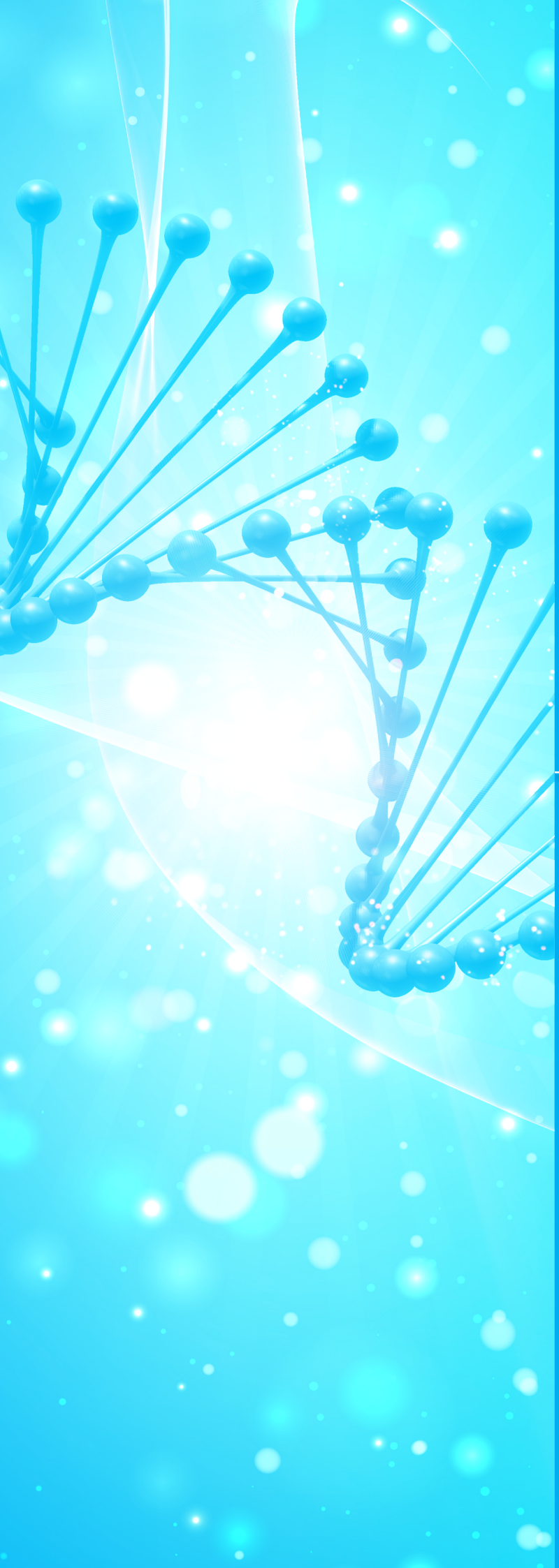

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SADRŽAJ

CONTENTS

ORIGINALNI RAD

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PRIHVATANJE KOVID-19 VAKCINA MEĐU STUDENTIMA MEDICINE PRETKLINIČKE I KLINIČKE NASTAVE

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SAŽETAK

Uvod/Cilj: Zdravstveni radnici i studenti medicine su imali važnu ulogu u pandemiji virusa KOVID-19, pa su njihova odgovornost, znanje i stavovi o vakcinaciji bili veoma značajni. Cilj ovog istraživanja bio je da ispita šta utiče na prihvatanje KOVID-19 vakcina među studentima medicine prema godini studija.
Metod: U ovoj studiji preseka učestvovalo je 730 studenata Medicinskog fakulteta Univerziteta u Beogradu, od kojih su 332 studenti na trećoj godini koji pohađaju nastavu na pretkliničkim predmetima (45,5%) i 398 (54,5%) studenti na šestoj godini koji pohađaju nastavu na kliničkim predmetima. Studija je sprovedena u periodu od 1. decembra 2022. godine do 31. januara 2023. godine. U istraživanju je korišćen posebno dizajniran upitnik koji su studenti popunjavali anonimno i na dobrovoljnoj bazi.
Rezultati: Najveći broj studenata se izjasnio da nikada nisu bili zaraženi KOVID-19 (63,0%). Studenti šeste godine su bili značajno više vakcinisani (94,5% vs 87,3%, p=0,001). Kao najčešći razlog za vakcinaciju studenti navode želju da zaštite ljude oko sebe (64% pretklinički i 71% klinički, p=0,594), dostupnost vakcine (27% pretklinički i 33% klinički, p=0,407) i preporuke zdravstvenih radnika (30% pretklinički i 27% klinički p=0,111). Najčešći razlog za odbijanje vakcine navode sumnju da vakcine nisu dovoljno ispitane (52% pretklinički i 59% klinički, p=0,792) i strah od neželjenih efekata vakcine (26% and 50%, p=0,059). Studenti koji su pohađali nastavu na kliničkim predmetima su značajno češće redovno pratili informacije o KOVID-19 vakcinama i informisali se putem interneta u odnosu na studente koji su pohađali nastavu na pretkliničim predmetima.
Zaključak: Dobijeni rezultati pokazuju visok obuhvat vakcinacijom među studentima obe ispitivane grupe. Pravovremeno i tačno informisanje putem medija i društvenih mreža može doprineti sprečavanju dezinformacija i i sprovođenju javnozdravstvenih kampanja.

Ključne reči: KOVID-19, studenti medicine, vakcine

Uvod

Nakon otkrivanja pneumonije nepoznate etiologije, Svetska zdravstvena organizacija (SZO) je 11. marta 2020. godine proglasila pandemiju Kovida-19 koja je postala ozbiljna pretnja javnom zdravlju, pre svega zbog visoke zaraznosti i virulencije virusa (1). Dramatičan porast slučajeva bolesti i smrti doveo je do zatvaranja škola, fakulteta i ograničenja slobode kretanja. Mere prevencije i zaštite poput dezinfekcije , socijalne distance i nošenja maski bile su jedini način da se uspori infekcija da bi se zaštitilo stanovništvo i sačuvao preopterećeni zdravstveni sistem (2). Sve ove promene predstavljale su novinu i otežavajući faktor u nastavi i za studente i za nastavno osoblje u mnogim zemljama (3).

Studenti predstavljaju visoko obrazovanu populaciju, koja je uz to veoma informisana i vrlo aktivna po pitanju kretanja, migracija i slično, što zasigurno doprinosi lakšem širenju virusa. Studije medicine na Medicinskom fakultetu u Beogradu su koncipirane tako da se tokom prve tri godine

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COVID-19 VACCINATION ACCEPTANCE AMONG PRECLINICAL AND CLINICAL MEDICAL STUDENTS

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SUMMARY

Introduction/Aim: Health workers and medical students played an important role in the COVID-19 pandemic, so their responsibility, knowledge and attitudes towards vaccination were very important in the pandemic. The aim of this study was to examine COVID-19 vaccination acceptance among medical students according to their year of study.
Methods: In this cross sectional study730 students of the Faculty of Medicine of the University of Belgrade participated, of which 332 were preclinical students (45.5%) and 398 (54.5%) clinical students. The study was conducted between December 1, 2022 and January 31, 2023 based on a specially designed questionnaire, which the students filled out anonymously and on a voluntary basis.
Results: The largest number of students declared that they have never been infected with COVID-19 (63.0%). Clinical students were significantly more vaccinated (94.5% vs 87.3%, p=0.001). As the most common reasons for vaccination, students state the desire to protect the people around them (64% preclinical and 71% clinical, p=0.594), availability of vaccine (27% preclinical and 33% clinical, p=0.407) and recommendation by healthcare workers (30% preclinical and 27% clinical, p=0.111). The most common reasons for not receiving the vaccine were the suspicion that the vaccines have not been tested enough (52% preclinical and 59% clinical, p=0.407) and the fear of side effects (26% and 50%, p=0.059). Clinical medical students significantly more often regularly followed information about COVID-19 vaccine and received information from the Internet in comparison with preclinical students.
Conclusion: The obtained results show a high coverage of vaccination among preclinical and clinical medical students. Timely and accurate information through the media and social networks can contribute to preventing misinformation and help the public health system in future challenges and campaigns.

Keywords: COVID-19, medical students, vaccine

Introduction

After the discovery of pneumonia of unknown etiology, the World Health Organization (WHO) declared a pandemic of COVID-19 on March 11, 2020 which has become a serious threat to public health, primarily due to the high contagiousness and virulence of the virus (1). The dramatic increase in illness and death cases led to the closing of schools, colleges, and restrictions on freedom of movement. Prevention and protection measures such as disinfection, social distancing and wearing masks were the only way to slow down the infection in order to protect the population and preserve the overburdened health system (2). All these changes were a novelty and a difficult teaching factor for both students and teaching staff in many countries (3).

Students represent a highly educated population that is, in addition, very informed and very active in terms of movement, migration, etc. which certainly contributes to the easier spread

studija stiču znanja iz osnovnih, pretkliničkih predmeta, a od četvrte godine studija studenti pohađaju nastavu na kliničkim predmetima, što uključuje obilaženje bolnica i rad sa pacijentima. Dosadašnje studije su uglavnom ispitivale obuhvat vakcinacijom, znanje i stavove studenata o vakcinama uopšte, dok je mali broj studija upoređivao studente u odnosu na godinu studija, naročito na Medicinskom fakultetu (4,5). Visoka učestalost i mortalitet zahtevali su uključivanje dodatnog medicinskog osoblja i studenata u zdravstveni sistem dok vakcina nije pronađena i isporučena. Čak i pre početka pandemije, SZO je odbijanje vakcinacije svrstala među deset najvažnijih problema javnog zdravlja (6).

Na početku vakcinacije u Srbiji odobrena je upotreba četiri vakcine: Fajzer Biontek, Oksford-AstraZeneka, Sputnjik V i Sinofarm. Vakcina proizvođača Moderna je uvedena kasnije, u novembru 2021. godine. Najveći broj studija bavio se proučavanjem faktora rizika koji dovode do bolesti i načina prenošenja, kao i kliničkim manifestacijama, odnosno povezanošću sa težinom bolesti (7,8), dok je manji broj studija u svetu pratio stavove i prihvatanje vakcine među studentima medicine i zdravstvenim radnicima uopšte.

Cilj ove studije bio je da se ispitaju faktori koji utiču na prihvatanje vakcinacije protiv Kovida-19 među studentima medicine prema godini studija.

Metode

Ovom studijom preseka obuhvaćeno je 730 studenata Medicinskog fakulteta Univerziteta u Beogradu, od kojih su 332 (45,5%) studenti koji su pohađali nastavu na pretkliničkim predmetima (treća godina studija), a 398 (54,5%) studenti koji su pohađali nastavu na kliničkim predmetima (šesta godina studija). Studija je sprovedena tokom decembra 2022. i januara 2023. godine.

U ovom istraživanju je korišćen posebno dizajniran upitnik koji su studenti popunjavali anonimno i na dobrovoljnoj bazi. Pre popunjavanja upitnika obavešteni su o svrsi istraživanja. Epidemiološki upitnik, kao instrument merenja, sadržao je 12 pitanja koja se odnose na stavove i ponašanje studenata medicine u vezi sa vakcinacijom protiv Kovida-19. Pored sociodemografskih pitanja vezanih za pol, starost i mesto stanovanja, upitnik je sadržao pitanja koja su se odnosila na vakcinalni status, razloge za/protiv vakcinacije, izbor vakcine, buduće planove vakcinacije, mišljenje o tome za koje stanovništvo vakcina protiv Kovida-19 treba da bude obavezna, da li su oboleli i kako su dobijali informacije o vakcinama protiv Kovida-19.

U statističkoj analizi podataka korišćen je hi kvadrat test. Vrednosti $p < 0,05$ smatrane su statistički značajnom razlikom. Svi podaci su analizirani uz pomoć programa SPSS, verzija 23.

Rezultati

Prosečna starost učesnika studije bila je 23,00+1,85 godine, a 502 (68,8%) su bile žene. Najveći broj studenata izjasnio se da nikada nisu bili zaraženi Kovidom-19 (63,0%) (Tabela 1). Otprilike polovina učesnika bili su studenti šeste godine medicine.

Studenti koji su pohađali nastavu na kliničkim predmetima bili su vakcinisani u značajno vecem

Tabela 1. Demografske karakteristike studenata medicine i njihov KOVID-19 status

Karakteristike	**N = 730** **x±SD / N (%)**
Godine (opseg 20-35) (x±SD)	23,00±1,85
Pol, N (%)	
Muški	228 (31,2)
Ženski	502 (68,8)
Trenutna godina, N (%)	
Preklinički	332 (45,5)
Klinički	398 (54,5)
Da li ste ikada bili zaraženi Kovid-19? N (%)	
Da	123 (37,0)
Ne	209 (63,0)

of the virus. Medical studies at the Faculty of Medicine in Belgrade are designed so that in the first three years, knowledge is acquired from basic, pre-clinical subjects, so that from the fourth year of study students attend clinical subjects that include circulating in hospitals and working with patients. Previous studies have mainly examined the vaccination rate, knowledge and attitudes of students about vaccines in general, while a small number of studies have compared students in relation to years of study, especially at the Faculty of Medicine (4,5). The high frequency and mortality required the inclusion of additional medical staff and students in the health system until a vaccine was found and delivered. Even before the start of the pandemic, the WHO classified vaccination refusal as one of the ten most important public health problems (6).

The use of four vaccines: Pfizer-BioNTech, Oxford-AstraZeneca, Sputnik V and Sinopharm were approved in Serbia at the beginning of the vaccine roll-out. Moderna vaccine was introduced later, in November 2021. The largest number of studies dealt with the study of risk factors that lead to the disease and ways of transmission as well as clinical manifestations, i.e. the relationship with the severity of the disease (7,8), while smaller number of studies in the world followed attitudes and vaccine acceptance among medical students and health workers in general.

The aim of this study was to examine factors impacting COVID-19 vaccination acceptance among medical students according to their year of study.

Methods

This cross sectional studyincluded 730 students of the Faculty of Medicine of the University of Belgrade, of which 332 (45.5%) were preclinical students (third year of study), and 398 (54.5%) clinical students (sixth year of study). The study was conducted during December 2022 and January 2023.

In the research, a specially designed questionnaire was used, which the students filled out anonymously and on a voluntary basis. Before filling in, they were informed about the purpose of the research. The epidemiological questionnaire, as a measurement instrument, contained 12 questions related to the attitudes and behavior of medical students regarding vaccination against COVID-19. In addition to sociodemographic questions related to gender, age and place of residence, the questionnaire also contained questions related to vaccination status, reasons for/against vaccination, choice of vaccine, future vaccination plans, opinion for which population COVID -19 vaccine was supposed to be mandatory, did they suffer from COVID-19 and how did they get information about COVID-19 vaccines.

Chi square test was used in data analysis. A statistically significant difference was considered at the $p < 0.05$ level. All data were analyzed using SPSS version 23.

Results

The average age of study participants was 23.00±1.85 years, and 502 (68.8%) were women. The largest number of students declared that they

Table 1. Demographic characteristic of medical students and their COVID-19 infection status

Karakteristike	N = 730 x±SD / N (%)
Age (range 20-35) (x±SD)	23.00±1.85
Gender, N (%)	
Male	228 (31.2)
Female	502 (68.8)
Current year, N (%)	
Preclinical	332 (45.5)
Clinical	398 (54.5)
Have you ever been infected with COVID-19? N (%)	
Yes	123 (37.0)
No	209 (63.0)

Tabela 2. Stavovi studenata medicine o vakcinaciji protiv KOVID-19 u odnosu na godinu studija

Karakteristike ispitanika	Preklinički N=332 N (%)	Klinički N=398 N (%)	P vrednost
Vakcinisani protiv Kovida-19:			
Nisam primio vakcinu	42 (12,7)	22 (5,5)	<0,001
Fajzer-Biontek	179 (53,9)	174 (46,3)	
Oksford-AstraZeneka	1 (0,3)	3 (0,8)	
Sputnik V	13 (3,9)	34 (9,0)	
Sinofarm	71 (21,4)	106 (28,2)	
Sinofarm+Fajzer Biontek	21 (6,3)	54 (14,4)	
Sputnik+Fajzer Biontek	5 (1,5)	5 (1,3)	
Verujem lekarima i drugim zdravstvenim radnicima kada preporučuju vakcinu protiv Kovida-19	185 (73,4)	286 (75,3)	0,641
Verujem Vladi i Ministarstvu zdravlja kada preporučuju vakcinu protiv KOVID-19	228 (68,7)	270 (67,8)	0,873
Verujem poznatim ličnostima kada preporučuju vakcinu protiv KOVID-19	38 (11,5)	44 (11,1)	0,906
Verujem profesorima na Medicinskom fakultetu kada preporučuju vakcinu protiv KOVID-19	281 (84,9)	326 (81,9)	0,319
Redovno pratim informacije o vakcinama protiv KOVID-19	110 (33,1)	161 (40,5)	0,046
Verujem da je vakcina najbolja mera prevencije za KOVID-19	246 (74,5)	278 (69,8)	0,185
Verujem da je vakcina protiv KOVID-19 sigurna	225 (68,4)	265 (66,6)	0,634
Verujem da nisam u opasnosti od teškog oblika KOVID-19	231 (69,6)	270 (70,1)	0,935
Mislim da vakcine protiv KOVID-19 nisu testirane dovoljno dugo vremena	105 (31,7)	153 (38,4)	0,062
Vakcinacija protiv KOVID-19 treba da bude obavezna za sve zdravstvene radnike	273 (82,7)	315 (80,2)	0,390
Vakcinacija protiv KOVID-19 treba da bude obavezna za studente medicine	238 (72,3)	291 (73,9)	0,674
Vakcina protiv KOVID-19 treba da bude obavezna za opštu populaciju	183 (56,0)	218 (55,3)	0,881

p vrednost za hi kvadrat test

procentu (94,5% vs 87,3%, p=0,001). Najveći broj studenata primio je vakcinu Fajzer/Biontek, od kojih je 53,9% bilo na trećoj godini studija, a 46,3% na šestoj godini studija. Studenti kliničke nastave su značajno češće pratili redovno informacije o vakcini protiv Kovida-19. Stavovi studenata u vezi sa vakcinacijom nisu se razlikovali u odnosu na godinu studija (Tabela 2).

Kao najčešći razlog za vakcinaciju, studenti su navodili nameru da zaštite ljude oko sebe (64% studenata pretkliničkih predmeta i 71% studenata kliničkih predmeta, p=0,594) (Grafikon 1). Najčešći razlog za neprimanje vakcine bila je sumnja da vakcine nisu dovoljno ispitane (52% studenata pretkliničke i 59% studenata kliničke nastave, p=0,792), kao i strah od neželjenih reakcija na vakcinu (26% i 50%, p=0,059) (Grafikon 2).

Studenti koji su pohađali nastavu na kliničkim predmetima su značajno češće dobijali informacijje sa Interneta u odnosu na studente pretkliničke nastave (59% vs 41%, p=0,001) (Grafikon 3).

Diskusija

Većina studenata je vakcinisana protiv Kovida-19 (87,3% pretkliničkih i 94,5% kliničkih). Najveći broj studenata je primio Fajzer/Biontek vakcinu. Moguće je da se većina studenata opredelila za ovu vakcinu da bi mogli da putuju u inostranstvo jer Sputnjik V i Sinofarm nisu dobili odobrenje Evropske agencije za lekove. Iako je obuhvat vakci-

Table 2. Attitudes of medical students regarding the COVID-19 vaccination in relation to the year of study

Karakteristike ispitanika	Preclinical N=332 N (%)	Clinical N=398 N (%)	P value
Vaccinated against COVID-19:			
I did not receive vaccine	42 (12.7)	22 (5.5)	<0.001
Pfizer/BioNTech	179 (53.9)	174 (46.3)	
Oxford-AstraZeneca	1 (0.3)	3 (0.8)	
Sputnik V	13 (3.9)	34 (9.0)	
Sinopharm	71 (21.4)	106 (28.2)	
Sinopharm+Phizer/BioNTech	21 (6.3)	54 (14.4)	
Sputnik+Pfizer/BioNTech	5 (1.5)	5 (1.3)	
I trust doctors and other healthcare workers when they recommend COVID-19 vaccine	185 (73.4)	286 (75.3)	0.641
I trust Government and Ministry of Health when they recommend COVID-19 vaccine	228 (68.7)	270 (67.8)	0.873
I trust celebrities when they recommend COVID-19 vaccine	38 (11.5)	44 (11.1)	0.906
I trust university teachers at the Faculty of Medicine when they recommend the COVID-19 vaccine	281 (84.9)	326 (81.9)	0.319
I regularly follow information about COVID-19 vaccine	110 (33.1)	161 (40.5)	0.046
I believe that the best preventive measure for COVID-19 is getting vaccinated	246 (74.5)	278 (69.8)	0.185
I believe that COVID-19 vaccines are safe	225 (68.4)	265 (66.6)	0.634
I believe that I am not at risk for severe COVID-19	231 (69.6)	270 (70.1)	0.935
I think that the COVID-19 vaccines were not tested for enough time	105 (31.7)	153 (38.4)	0.062
COVID-19 vaccination should be mandatory for all healthcare providers	273 (82.7)	315 (80.2)	0.390
COVID-19 vaccination should be mandatory for medical students	238 (72.3)	291 (73.9)	0.674
COVID-19 vaccination should be mandatory for the general population	183 (56.0)	218 (55.3)	0.881

p value for chi square test

have never been infected with COVID-19 (63.0%) (Table 1). About half of participants were sixth-year medical students.

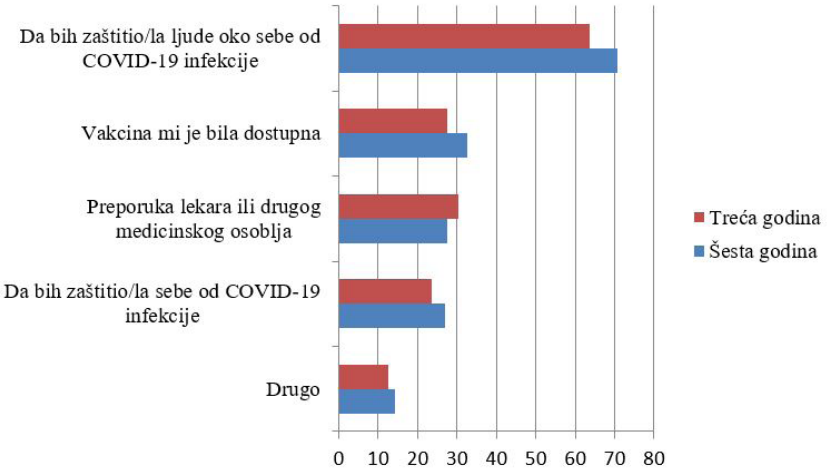
Clinical students were vaccinated at a significantly higher rate (94.5% vs. 87.3%, p= 0.001). The largest number of students received the Pfizer/BioNTech vaccine, of which 53.9% in the third-year and 46.3% in the sixth-year. Clinical studies students significantly more often followed regularly information about COVID-19 vaccine. The attitudes of students in relation to vaccination did not differ in relation to the year of study (Table 2).

As the most common reasons for vaccination, students state the intention to protect the people around them (64% preclinical and 71% clinical, p=0.594) (Figure 1). The most common reason for not receiving the vaccine were the suspicion that the vaccines have not been tested enough (52% preclinical and 59% clinical, p=0.792), and the fear of side effects of the vaccine (26% and 50%, p=0.059) (Figure 2).

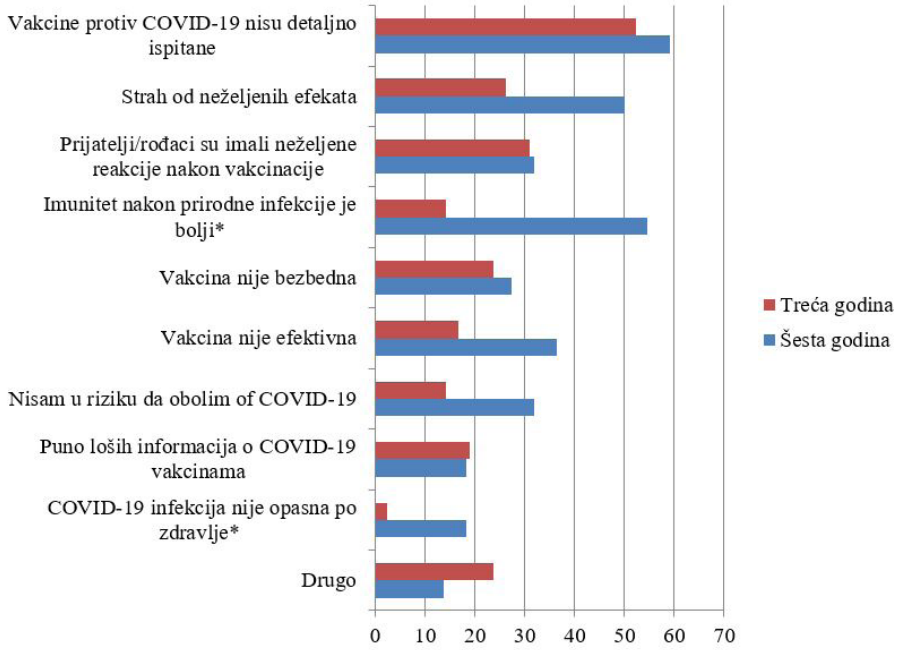
Clinical students significantly more often received information from the Internet in comparison with preclinical medical students (59% vs 41%, p=0.001) (Figure 3).

Discussion

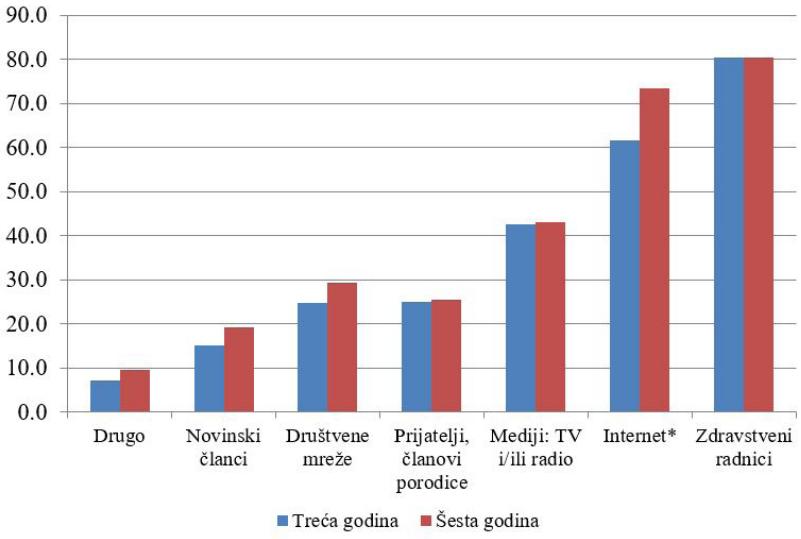
The majority of students were vaccinated against COVID-19 (87.3% preclinical and 94.5%



Grafikon 1. Razlozi za vakcinaciju protiv KOVID-19



Grafikon 2. Razlozi za nevakcinaciju protiv KOVID-19



Grafikon 3. Izvori informacija o KOVID-19

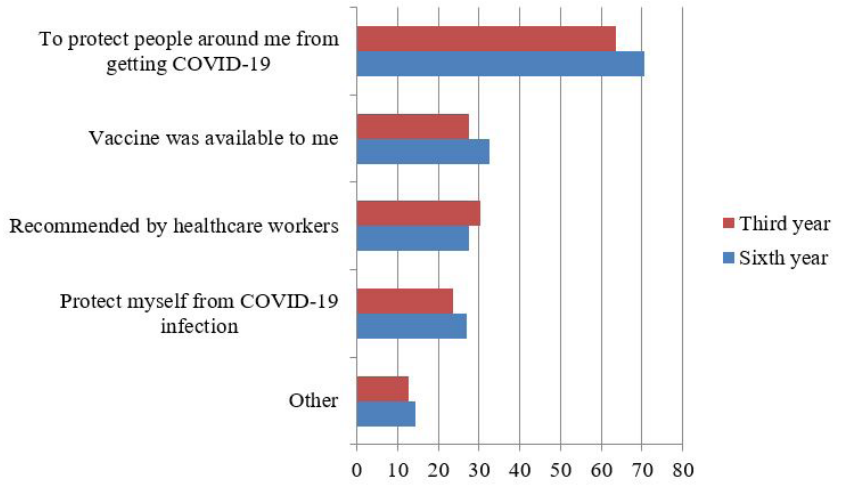


Figure 1. Self-reported reasons for vaccination against COVID-19

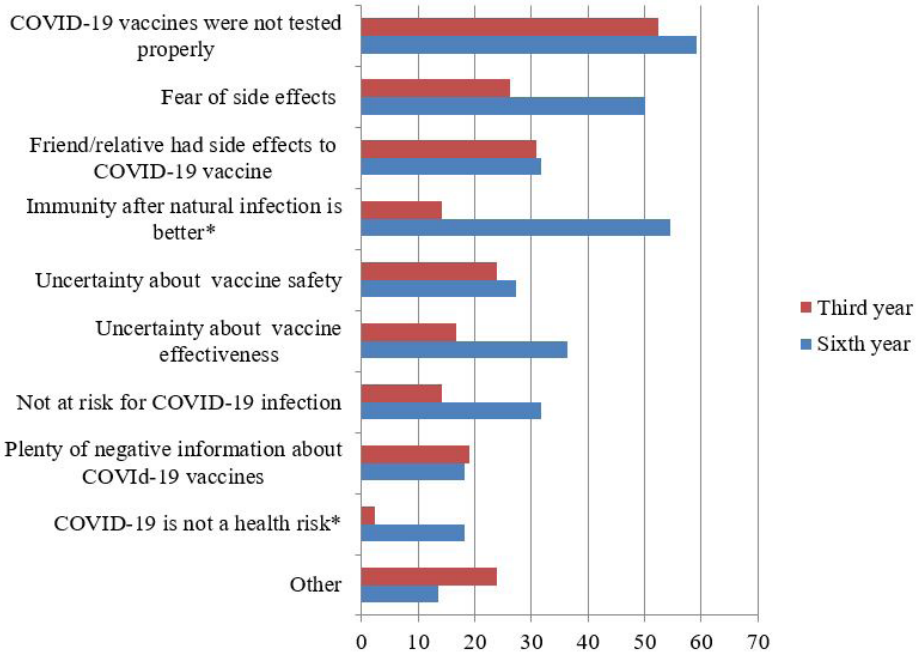


Figure 2. Self-reported reasons for non- vaccination against COVID-19

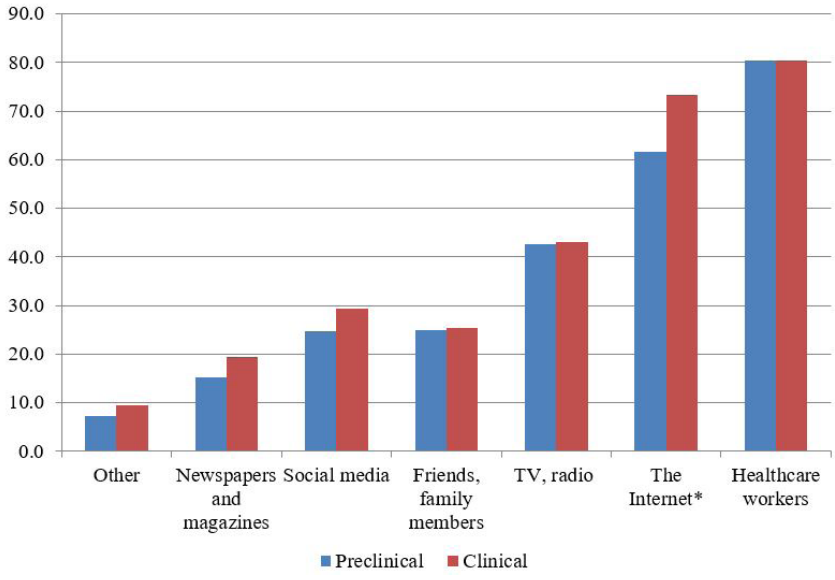


Figure 3. COVID-19 sources of information

nacijom bio visok u obe grupe, studenti kliničke nastave su bili značajno više vakcinisani. Studenti koji su pohađali nastavu na kliničkim predmetima imali su veću stopu vakcinacije zbog boljeg znanja i rada sa pacijentima. Prema SZO, neodlučnost po pitanju vakcinacije definiše se kao odlaganje da se prihvati ili odbije vakcinacija uprkos dostupnosti usluga vakcinacije (9). Stopa vakcinacije među studentima medicine je viša u poređenju sa opštom populacijom (10) i studentima koji ne studiraju medicinu (11). Mnoge studije su pokazale visok obuhvat vakcinacije u populaciji studenata medicine (12-16), što je veoma važno za zaštitu sopstvenog zdravlja i zdravlja pacijenata (17). Nekoliko studija je pokazalo da su stope neodlučnosti da se vakcinišu značajno više kod studenta koji su pohađali nastavu na pretkliničkim predmetima (58,3% do 90%) u poređenju sa studentima koji su pohađali nastavu na kliničkim predmetima (10% do 41,7%) (18,19).

Studenti kliničke nastave su značajno redovnije pratili informacije o vakcini protiv Kovida-19. Obe grupe studenata su verovale zdravstvenim radnicima i zdravstvenim vlastima kada su preporučivali vakcinu protiv Kovida-19 i druge mere. Iako su studenti kliničkih predmeta svojim nastavnim planom i programom bili obavezni da budu vakcinisani, odnosno da dostave potvrdu o prethodnim bolestima radi zaštite pacijenata sa kojima dolaze u kontakt, podaci o visokom stepenu poverenja u proverene i zvanične informacije ukazuju na visok stepen poverenja u zdravstveni sistem i odgovornost. U ovoj situaciji, pokazana je želja za humanošću i nastavkom obrazovanja studenata kliničke i pretkliničke nastave. U studiji Habiba i saradnika, kojom je obuhvaćeno 1445 studenata medicine, došlo se do zaključka da 22,6% studenata nije verovalo informacijama zdravstvenih vlasti o vakcini i da postoji razlika u poverenju u preporuke Ministarstva zdravlja u odnosu na godinu studija, odnosno da su studenti sa pretkliničkih predmeta imali manje poverenja u zdravstvene vlasti (20). Zdravstveni radnici su najvažniji faktor koji utiče na prihvatanje vakcinacije kod ostalih grupa (21).

Većina studenata veruje da je vakcina najbolja preventivna mera za Kovid-19 i da bi trebalo da bude obavezna za sve pružaoce zdravstvenih usluga. Nešto manji broj studenata smatra da bi vakcinacija trebalo da bude obavezna za studente medicine, dok su mišljenja podeljenja kada je u pitanju obavezna vakcinacija za opštu populaciju.

Iako je vakcinacija bila veća među studentima koji su pohađali nastavu na kliničkim predmetima, oni su izrazili veću bojazan da vakcina nije dovoljno dugo testirana pre upotrebe. Osim toga, studenti kliničkih studija su značajno češće navodili da je prirodno stečen imunitet bolji i da Kovid-19 ne predstavlja ozbiljni rizik po njihovo zdravlje. Ono što je bilo iznenađujuće, ali ne i neočekivano, Srbija je bila jedna od prvih zemalja koje su počele vakcinaciju stanovništva, a sasvim je izvesno da u to vreme nije bilo adekvatnih informacija o vakcinama, i postojala je mogućnost da studenti i celo stanovništvo budu izloženi pritisku i dezinformacijama. Strah od neželjenih efekata vakcinacije uočen je i kod studenata medicine i u opštoj populaciji (17). Rezultati o stavovima o obaveznoj vakcinaciji među zdravstvenim radnicima, studentima medicine i opštom populacijom su kontradiktorni. *Rodger* ovo tumači kao nepoverenje u farmaceutsku industriju i strah od mogućih neželjenih efekata vakcine (22). Sumnje i strahovi su porasli kada su mnoge zemlje odlučile da obustave korišćenje vakcina Oksford/AstraZeneka i Džonson i Džonson zbog niskog rizika od tromboze, dok su mRNK vakcine dovođene u vezu sa blagim slučajevima miokarditisa (23). Sa druge strane, oprezan stav lekara i studenata medicine prema obaveznoj vakcinaciji može da se tumači kao strah od ograničavanja ljudskih prava i sloboda (24). *Politis* i saradnici ukazuju da 50% zdravstvenih radnika ima pozitivan stav prema obaveznoj vakcinaciji opšte populacije, što korelira sa rezultatima naše studije (25). Dodatnu zabunu izazvao je nedostatak svesti o obaveznoj vakcinaciji zdravstvenih radnika u Evropi. Nekoliko evropskih zemalja (na primer, Italija, Nemačka, Grčka, Francuska i Poljska) primenile su obaveznu vakcinaciju protiv Kovida-19, dok druge zemlje (Češka Republika i Ujedinjeno Kraljevstvo) nisu primenile obaveznu vakcinaciju zdravstvenih radnika (26).

Uzimajući u obzir ukupnu situaciju i značaj buduće profesije, 73,8% studenata medicine navelo je kao najvažniji razlog vakcinisanja namera da zaštite ljude oko sebe. U ovoj studiji nisu prikupljani podaci o infekcijama rođaka ili bliskih prijatelja studenata obolelih od Kovida-19, ali je postojanje ovakvog razloga zasigurno doprinelo ovom stavu u vezi sa željom da se vakcinišu studenti medicine. Osim toga, obaveza pohađanja nastave za osobe koje su već narušenog zdravlja zbog mnogih bolesti, ili koje rade direktno u okruženju

clinical). The largest number of students received the Pfizer/BioNTech vaccine. It is possible that the majority of students chose this vaccine in order to be able to travel abroad, because Sputnik V and Sinopharm were not approved by the European Medicines Agency. Although vaccination coverage was high in both groups, clinical students were significantly more vaccinated. Clinical students showed a higher vaccination rate due to their better knowledge and conection with patients. According to the WHO, vaccine hesitancy is defined by delay in acceptance or refusal of vaccination despite availability of vaccination services (9). Vaccination rate among medical students is higher than in the general population (10) and non-medical students (11). Many studies showed high vaccination coverage in the population of medical students (12-16), which is very important for protection of their own health, and health of the patients (17). Several studies showed that rates of vaccine hesitancy were significantly higher in pre-clinical medical students (58.3% to 90%) compared to clinical students (10% to 41.7%) (18,19).

Clinical students were significantly more regularly following information about the COVID-19 vaccine. Both groups of students trusted healthcare workers and health authorities when they recommend COVID-19 vaccine and other measures. Although students in clinical courses were required by their curriculum to be vaccinated, or to present a certificate of past illnesses to protect the patients they come into contact with, the data on the high degree of trust in verified and official information indicates a high degree of trust in the health system and responsibility. In this situation, they are showing a desire for humanity and the continuation of the education of both students in clinical and pre-clinical subjects. In the study by Habib et al., which included 1445 medical students, it was concluded that 22.6% of students did not trust the information of the health authorities about the vaccine and that there is a difference in trust in the recommendations of the Ministry of Health in relation to the years of study, i.e. students of preclinical subjects had less trust in health authorities (20). Healthcare workers are the most important factors that influence the acceptance of vaccination among the others (21).

Most students believe that the vaccine is the best preventive measure for COVID-19, and should be mandatory for all healthcare providers. A slightly smaller number of students considered that vaccine should be mandatory for medical students, while opinions are divided about mandatory vaccination for the general population.

Although vaccination was higher among clinical students, they expressed a greater fear that the vaccine was not tested long enough before use. In addition, clinical students significantly more often stated that immunity after natural infection is better and that COVID-19 is not a severe health risk. That this data is surprising, but not unexpected, Serbia was one of the first countries to start vaccinating the population, and it is quite certain that there was no adequate information about vaccines at that time, and there was a possibility that students and the entire population were exposed to pressure and disinformation. Fear of vaccination side effects was found both in medical students and the general population (17). The results on the attitudes of mandatory vaccination among healthcare workers, medical students and the general population are contradictory. Rodger interprets this as distrust in the pharmaceutical industry and fear of possible vaccine side effects (22). Doubts and fears grew when many countries decided to suspend the Oxford/AstraZeneca and Johnson & Johnson vaccines because of the low risk of blood clots, while the mRNA vaccines were linked to mild cases of myocarditis (23). On the other hand, the cautious attitude of doctors and medical students towards mandatory vaccination can be interpreted as a fear of limiting human rights and freedoms (24). Politis et al. suggest that the attitude of health workers towards mandatory vaccination of the general population is 50%, which correlates with our results (25). Additional confusion was caused by the lack of awareness in Europe regarding the mandatory vaccination of healthcare workers. Several European countries (e.g. Italy, Germany, Greece, France and Poland) implemented mandatory vaccination against COVID-19, while others (e.g. the Czech Republic and United Kingdom) have not implemented compulsory vaccination for health workers (26).

Considering the overall situation and the importance of the future profession, 73.8% of medical students cited the intention to protect the people around them as the most important reason. This study did not collect data on the infections of relatives or close friends of students with COVID-19, but the existence of such a reason certainly

obolelih od Kovida-19, kao i zaštita prijatelja sigurno su doprineli ovom stavu i bile su motivišući faktor da se prihvati vakcinacija.

Studenti su kao najčešći razlog za odbijanje vakcinacije naveli sumnju da vakcine nisu dovoljno ispitane (52% studenata pretkliničkih i 59% studenata kliničkih studija), kao i strah od neželjenih reakcija na vakcinu (26% i 50%). S obzirom na dramatičnu situaciju povezanu sa pandemijom, koja je dovela do velikog broja žrtava i paralisala normalno funkcionisanje, uloženi su ogromni napori da se brzo pronađe vakcina. To je dovelo do usporavanja epidemije, ali je, s druge strane, dovelo do opreza, pa čak i sumnje u vakcinu kod određenog broja ljudi, pa čak i medicinskih radnika, posebno što neželjeni efekti nisu odmah uočeni. Kako su počeli da se beleže prvi neželjeni efekti, strah među ljudima i oklevanje postajali su sve češći razlozi za izbegavanje vakcinacije, odnosno revakcinacije (27). Oklevanje da se vakcinišu je takođe primećeno kod studenata medicine, posebno kod mlađih studenata na pretkliničkim predmetima, što se može objasniti nižim stepenom znanja u poređenju sa studentima koji su pohađali nastavu na kliničkim predmetima i manjom izloženošću Kovidu-19.

U odnosu na način informisanja, studenti koji su pohađali nastavu na kliničkim predmetima značajno češće su dobijali informacije sa Interneta. *Ngya* i saradnici (13) su izvestili da je većina studenata dobijala informacije of profesora i doktora (64,6%), zatim iz medija (59,9%) i od prijatelja (48,1%). U jednoj studiji koja je sprovedena u Indiji i kojom je obuhvaćeno 400 studenata medicine, mediji (49,75%) i novine (14,75%) su navedeni kao dominantan izvor informacija (28). Društvene mreže u modernom dobu zbog masovne upotrebe predstavljaju značajan izvor informacija, ali i izvor za širenje dezinformacija i lažnih vesti što može dovesti do nepoverenja u vakcinu.

Studija je imala određena ograničenja, pre svega zbog svog dizajna i samoprijavljenih odgovora koji imaju dozu pristrasnosti. Kao drugo ograničenje moramo pomenuti period anketiranja jer su se mišljenja i stavovi studenata menjali u zavisnosti od talasa pandemije, što je dovelo do straha, panike i brige za sebe i svoje najmilije.

Zaključak

Stavovi studenata medicine o vakcinaciji protiv Kovida-19 bili su pozitivni. Studenti koji su pohađali nastavu na kliničkim predmetima bili su značajno češće vakcinisani, ali su obe grupe studenata pokazale visok nivo društvene i moralne odgovornosti, kao i visok stepen poverenja u lekare i zdravstvene vlasti.

Dostupnost neproverenih informacija, kao i širenje lažnih informacija doprineli su postojanju straha i neodlučnosti kod manjeg broja studenata. Pravovremeno i tačno informisanje putem medija i društvenih mreža može doprineti sprečavanju širenja dezinformacija i pomoći javnom zdravstvenom sistemu u budućim izazovima i kampanjama.

Konflikt interesa

Autori su izjavili da nema konflikta interesa.

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contributed to this attitude regarding the desire to vaccinate medical students. Apart from that, obligation for attending classes for people who are already in poor health due to many diseases, or working directly in the environment of COVID-19 patients, as well as protecting friends, certainly contributed to this attitude and were a motivating factor to accept vaccination.

The students stated that the most common reason for not receiving the vaccine was the suspicion that the vaccines have not been tested enough (52% preclinical and 59% clinical) and the fear of side effects of the vaccine (26% and 50%). Given that the dramatic situation related to the pandemic, which led to a large number of victims and paralyzed normal functioning, enormous efforts were made to quickly find a vaccine. This led to the slowing down of the epidemic, but on the other hand, it led to caution and even suspicion of the vaccine among a certain number of people and even medical workers, especially since side effects were not immediately noted. As the first side effects began to be recorded, fear among people and hesitation became an increasingly common reason for avoiding or hesitating vaccination, or revaccination (27). Vaccine hesitance was also noted among medical students, especially among younger, preclinical students, which can be explained by a lower level of knowledge compared to clinical students, and less exposure to COVID-19.

In relation to the method of information, clinical students significantly more often received information from the Internet. Ngya et al. (13) reported that most of students received information from professors and doctors (64.6%), followed by the media (59.9%) and friends (48.1%). In a study that included 400 medical students in India, social media (49.75%) and newspapers (14.75%) were cited as the dominant source of information (28). Social networks in the modern age with mass use represent a significant source of information, but also for the spread of misinformation and fake news that can lead to mistrust of the vaccine.

The study had certain limitations primarily due to its design and self-reported answers that carry some forms of bias. As another limitation, we must mention is the period of the survey because the opinions and attitudes of the students changed depending on the waves of the pandemic, which led to fears, panic and concern for themselves and their loved ones.

Conclusion

Attitudes of medical students towards COVID-19 vaccination were positive. Clinical medical students were significantly more often vaccinated but both groups showed a high level of social and moral responsibility, as well as a high degree of trust in doctors and health authorities.

The availability of unverified information as well as the spread of false information contributed to the existence of fear and indecision among a smaller number of students. Timely and accurate information through the media and social networks can contribute to preventing misinformation and help the public health system in future challenges and campaigns.

Competing interests

The authors declared no competing interests.

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PREDIKTORI TEŽINE BOLESTI KOD BOLESNIKA SA COVID-19 BOLEŠĆU

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SAŽETAK

Uvod/Cilj: U kliničkoj slici COVID-19 dominira respiratorna simptomatologija, ali se u osnovi radi o multisistemskom poremećaju. Cilj ove studije je bio da se identifikuju prediktori teških oblika COVID-19 definisanih kao potreba za potpomognutom ventilacijom (neinvazivna ili invazivna mehanička ventilacija).
Metode: Sprovedena je retrospektivna kohortna studija u Opštoj bolnici „Laza K. Lazarević" u Šapcu u periodu od 1.4.2020. do 15.11.2020. godine. Odnos između demografskih i kliničkih parametara pacijenata i potrebe za asistiranom ventilacijom ispitan je logističkom regresionom analizom.
Rezultati: Studijom je obuhvaćeno 516 pacijenata, 334 ispitanika muškog pola (64,7%), starosti 60 i više godina (52,7%). Najčešći prijavljeni simptomi bili su groznica (89%) i generalizovana slabost (68,8%). Mehanička ventilacija je bila potrebna za 44 pacijenta, od kojih su većina bili muškarci (64,7%). Dominantni komorbiditeti u grupi sa mehaničkom ventilacijom bili su hipertenzija (63,6%) i dijabetes (22,7%). Prema multivarijantnoj analizi, nezavisni faktori rizika za potpomognutu ventilaciju bili su: febrilnost (p=0,022), trajanje bolesti više od sedam dana pre hospitalizacije (p=0,023), oksigena saturacija (sO_2) na prijemu <90% (p=0,002), aritmija (p=0,001), leukocitoza (p=0,034), i CRP>50 mg/l (p=0,002).
Zaključak: Rizik od potpomognute ventilacije je bio veći kod febrilnih pacijenata, sa oksigenom saturacijom manje od 90% na prijemu u bolnicu, trajanjem bolesti više od sedam dana pre hospitalizacije, aritmijama, leukocitozom, i CRP većim od 50 mg/l.

Ključne reči: COVID-19, komorbiditeti, faktori rzika, težina bolesti, potpomognuta ventilacija strategije, etički kodeks

Uvod

Korona virusi su jednolančani RNK virusi koji pogađaju ljude i mnoge životinjske vrste i poznati su od 1960. godine. Njihov potencijal otkriven je u novembru 2002. godine sa pojavom teškog akutnog respiratornog sindroma (engl. *Severe acute respiratory syndrome*, SARS). U međuvremenu, 2009. godine čovečanstvo je preživelo još jednu pandemiju gripa H1N1, a u junu 2012. godine ponovo je upozoreno na značaj korona virusa sa epidemijama bliskoistočnog respiratornog sindroma (engl. *Middle East Respiratory Syndrome*, MERS). Kompetentan, brz i odlučan odgovor nadležnih u slučaju SARS i MERS sindroma ograničio je broj obolelih i umrlih, ali je takođe ukazao na neke karakteristike koje će obeležiti pandemiju Koronavirusne bolesti 2019 (engl. *Coronavirus disease 2019* - COVID-19), poput visokog stepena straha od novih zaraznih bolesti među stanovništvom (SARS), potencijala za nozokomijalno širenje i čestih asimptomatskih slučajeva (MERS) (1).

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PREDICTORS OF DISEASE SEVERITY IN COVID-19 PATIENTS

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SUMMARY

Background/Aim: In the clinical picture of COVID-19 respiratory symptomatology dominates, but it is basically a multisystemic disorder. The aim of this study was to identify predictors of severe forms of COVID-19 defined as the need for assisted ventilation (non-invasive or invasive mechanical ventilation).
Methods: The research was conducted as a retrospective cohort study at the General hospital "Laza K. Lazarević" in Šabac for the period from1.4.2020. to 14.11.2020. The relationship between demographic and clinical parameters of patients and the need for assisted ventilation was examined by logistic regression analysis.
Results: The study included 516 patients, 334 male subjects (64.7%), with the age of60 and over (52.7%). The most commonly reported symptoms were fever (89%) and generalized weakness (68.8%). Mechanical ventilation was required by 44 patients, majority of whom were male (64.7%). The dominant comorbidities in mechanically ventilated group were hypertension (63.6%) and diabetes (22.7%). According to multivariate analysis independent risk factors for assisted ventilation were: fever (p=0.016), duration of illness more than seven days before hospitalization (p=0.023), oxygen saturation (sO2) <90% (p=0.002), arrhythmia(p=0.001), leukocytosis(p=0.034), and CRP≥50 mg/l (p=0.002).
Conclusion: The risk of assisted ventilation was higher in patients with fever, sO2<90% on admission to hospital, duration of illness more than seven days before hospitalization, arrhythmia, leukocytosis, lymphopenia<1.0x109 and CRP>50 mg/l.

Keywords: COVID-19, comorbidities, risk factors, disease severity, assisted ventilation

Introduction

Coronaviruses are single-stranded RNA viruses that affect humans and a wide variety of animal species and have been known since 1960. Their emerging potential was discovered in November 2002 with severe acute respiratory syndrome (SARS). Meanwhile, in 2009, humanity survived another pandemic of H1N1 influenza and in June 2012, it was again warned about the significance of the coronavirus with the Middle East Respiratory Syndrome (MERS) epidemics. The competent, rapid and decisive response of the authorities in SARS as well as in MERS limited the number of diseased and mortality, but also pointed out to some features that will mark the COVID-19 pandemic, such as high level of fear of new infectious diseases in population (SARS), potential for nosocomial spread and prevalent asymptomatic cases (MERS) (1).

At the end of 2019, a large number of patients with similar forms of acute pneumonias were

Krajem 2019. godine, otkriven je veliki broj pacijenata sa sličnim oblicima akutnih pneumonija u Vuhanu, u Kini. Do tada nepoznati korona virus SARS-CoV-2 ubrzo je identifikovan kao uzročnik uz pomoć molekularnih metoda, a bolest je nazvana COVID-19. Usledilo je brzo širenje SARS-CoV-2 infekcije u Kini, a potom i širom sveta. Svetska zdravstvena organizacija je 11. marta 2020. proglasila pandemiju COVID-19 bolesti. U ovoj trećoj epidemiji korona virusa dominirao je broj obolelih i umrlih i potpuno je razotkrivena globalna nespremnost za borbu protiv pandemije (1). Do 09.10.2024. COVID-19 bolest je dovela do preko 776 miliona dijagnostifikovanih slučajeva i više od sedam miliona smrtnih slučajeva širom sveta. Istog dana registrovano je 270.000 novih slučajeva COVID-19 bolesti širom sveta (2).

Kliničke manifestacije infekcije uzrokovane SARS-CoV-2 su različite, od blagih simptoma do akutne respiratorne insuficijencije i multiorganske disfunkcije. Kod većine obolelih od COVID-19 bolesti, prisutni su znaci blage respiratorne infekcije, ali bolest je zapravo multisistemski poremećaj i 14% pacijenata zahteva lečenje u jedinici intenzivne nege (3,4). Veća učestalost teških oblika bolesti i posledične hospitalizacije utvrđena je kod starijih osoba sa komorbiditetima – demencijom, dijabetesom tipa 2, hroničnom opstruktivnom bolešću pluća (HOBP), pneumonijom, depresijom, atrijalnom fibrilacijom, i hipertenzijom (5). Najteži oblici bolesti lečeni su u jedinicama intenzivne nege, a starije osobe, dijabetičari, osobe sa hiperholesterolemijom i HOBP bile su u većem riziku od smrtnog ishoda (6).

Rana identifikacija faktora rizika za teške oblike COVID-19 bolesti može biti od pomoći u upravljanju bolničkim prijemima. U ovom istraživanju identifikovani su prediktori teških oblika COVID-19 bolesti. Težak oblik COVID-19 je definisan kao potreba za asistiranom ventilacijom (neinvazivnom ili invazivnom mehaničkom ventilacijom).

Metode

U ovoj retrospektivnoj kohortnoj studiji podaci su prikupljeni iz elektronske dokumentacije Opšte bolnice „Laza K. Lazarević“ u Šapcu, Srbiji, u periodu od 1.4.2020. do 15.11.2020. Analiza je uključila sve obolele koji su potvrđeni metodom reverzne transkripcije lančane reakcije polimeraze (RT-PCR).

Istorije bolesti pacijenata sa COVID-19 oboljenjem su popunjavane nakon kliničkog pregleda. Pacijenti su davali informacije o trajanju i simptomima bolesti, komorbiditetima i istoriji pušenja. Uzimanje krvi za analizu i rendgensko snimanje grudnog koša rađeni su u roku od 24 sata od prijema u bolnicu, osim uzorkovanja d-dimera, koje je zbog organizacionih poteškoća urađeno u periodu od 72 sata od prijema. Lekar je procenjivao gojaznost tokom kliničkog pregleda.

Podaci o pacijentima su sadržali demografske karakteristike (pol, starost, mesto stanovanja), bihejvioralne rizike (gojaznost, pušački status), simptome i znake bolesti na prijemu (povišena temperatura, opšta slabost, kašalj i prisustvo sputuma, dijareja, hemoptiza, teškoće sa disanjem, mijalgija, vrtoglavica, sinkopa, gubitak svesti i trajanje bolesti od početka bolesti do prijema u bolnicu), rendgensi snimak grudnog koša i laboratorijske parametre (oksigena saturacija - sO_2, leukociti, limfociti, neutrofili, eritrociti i trombociti, hemoglobin, CRP, transaminaze u serumu - alanin i aspartat transaminase, ALT i AST, urea, kreatinin, bilirubin, laktat dehidrogenaza, LDH, d dimer), komorbiditete (hipertenzija, dijabetes, ishemijska bolest srca, vaskularna oboljenja, srčana insuficijencija, kardiomiopatija, hronični bronhitis, emfizem, astma, bubrežna insuficijencija, terapija zamene bubrežne funkcije – RRT tj. renalna dijaliza, prethodni moždani udar ili cerebralno krvarenje, demencija, Parkinsonova bolest, demijelinizirajuće bolesti nervnog sistema, maligne bolesti, epilepsija, autoimune bolesti, insuficijencija jetre, aritmije, sarkoidoza) i potreba za neinvazivnom ili invazivnom mehaničkom ventilacijom.

Da bi se identifikovali faktori povezani sa mehaničkom ventilacijom među pacijentima sa COVID-19 bolešću korišćena je logistička regresiona analiza. Izlazna varijabla bila je prijem u jedinicu intenzivnog lečenja koji je zahtevao neinvazivnu ili invazivnu mehaničku ventilaciju. Prediktorske varijable uključivale su demografske karakteristike, bihejvioralne rizike, simptome i znake bolesti na prijemu, laboratorijske parametre, radiološke nalaze grudnog koša i podatke o komorbiditetima. Varijable $p<0,10$, zasnovane na univarijantnoj logističkoj regresionoj analizi, uključene su u multivarijantnu logističku regresionu analizu. Efekat uree u serumu i vrednosti kreatinina procenjivani su u univarijantnoj i multivarijantnoj analizi samo kod ispitanika koji nisu bili zavisni od RRT.

Statistički paket za društvene nauke SPSS 20.0 korišćen je za obradu podataka.

detected in the Wuhan, China. The previously unknown corona virus SARS-CoV-2 was soon identified by molecular methods as a causative agent and the disease was named as Coronavirus disease 2019, abbreviated COVID-19. This was followed by rapid spread of SARS-CoV-2 in China and then worldwide. On March 11, 2020, the World Health Organization declared COVID-19 pandemic. This third coronavirus epidemic dominated with the number of patients and deaths and completely unmasked the global unpreparedness to fight the pandemic(1).As of 09.10.2024. COVID-19 has led to over 776 million diagnosed cases and more than seven million COVID-19 related deaths worldwide. On the same day 270,000 new cases were registered worldwide (2).

The clinical manifestations of COVID-19 infection are variable, ranging from mild symptoms to acute respiratory failure and multiorgan dysfunction. Majority of COVID-19 have signs of a mild respiratory infection, but disease is in fact a multisystem disorder and 14% of patients require treatment in intensive care unit (3, 4). A higher frequency of severe forms of the disease, and consequent hospitalization, has been observed in older people with comorbidities - dementia, type 2 diabetes, chronic obstructive pulmonary disease (COPD), pneumonia, depression, atrial fibrillation, hypertension (5). The most severe forms of the disease were treated in intensive care units, the elderly and diabetics, hypercholesterolemia, COPD were at higher risk of death (6).

Early identification of the risk factors for severe COVID-19 disease could be helpful in managing hospital admissions. In this research predictors of severe COVID19 disease were identified. The severe COVID-19 disease was defined as the need for assisted ventilation (non-invasive or invasive mechanical ventilation).

Methods

In this retrospective cohort study data were collected from electronic documentation at the General Hospital "Laza K. Lazarević" in Šabac, Serbia in period from 1.4.2020. to 15.11.2020. The analysis included allreverse transcriptasepolymerase chain reaction (RT–PCR) confirmed cases.

Case histories of COVID-19 patients were completed after the clinical examination. Patients provided information on the duration and symptoms of the disease, comorbidities, smoking history. Blood sampling and chest X-ray were performed within 24 hours of admission, except for the d-dimer sampling, which was performed within 72 hours of admission because of organizational difficulties. Obesity was assessed by the physician on clinical examination.

Patient data included demographic characteristics (sex, age, place of residence), behavioral risks (obesity, smoking status), symptoms and signs of the disease on admission (fever, generalized weakness, cough and sputum production, diarrhea, hemoptysis, breathing difficulty, musculoskeletal pain, dizziness, syncope, loss of consciousness and duration of illness from onset of disease to hospital admission), chest X-ray findings and laboratory parameters (oxygen saturation - sO_2, blood leukocytes, lymphocytes, neutrophils, erythrocyte and platelet count, hemoglobin, CRP, serum transaminases - alanine and aspartate transaminases, ALT and AST, urea, creatinine, bilirubin, lactate dehydrogenase - LDH, d dimer), comorbidities (hypertension, diabetes, ischemic heart disease, vascular disease, heart failure, cardiomyopathy, chronic bronchitis, emphysema, asthma, renal failure, renal replacement therapy – RRT or renal dialysis, previous stroke or cerebral hemorrhage, dementia, parkinsonism, demyelinating diseases of central nervous system, malignancy, epilepsy, autoimmune diseases, liver failure, arrhythmias, sarcoidosis) and demand for noninvasive or invasive mechanical ventilation.

Logistic regression analysis was performed to identify factors associated with mechanical ventilation among COVID-19 cases. The outcome variable was ICU admission requiring noninvasive or invasive mechanical ventilation. The predictor variables included demographic characteristics, behavioral risks, symptoms and signs of the disease on admission, laboratory parameters, chest X-ray findings and comorbidities data. Variables with $p \leq 0.10$, based on univariate logistical regression analysis were included in the multivariate logistic regression analysis. The effect of serum urea and creatinine levels in both univariate and multivariate analyses was assessed only in subjects who were not dependent on RRT.

The Statistical Package for Social Science, SPSS 20.0, was used in data processing.

Rezultati

U studiji je učestvovalo ukupno 516 pacijenata kod kojih je SARS-CoV-2 infekcija potvrđena uz pomoć RT-PCR testa. Srednja vrednost starosne dobi bila je 61 godina, dok je najveći procenat slučajeva bio kod osoba starih 60 i više godina (52,7%). Od ovih pacijenata, 334 su bili muškarci (64,7%), pretežno iz urbanih sredina (52,7%).

Najčešći simptomi su bili povišena telesna temperatura (89,0%) i opšta slabost (68,8%), samo 0,4% je imalo poremećaje svesti, a 1,4% hemoptizu. Srednja vrednost trajanja bolesti pre prijema u bolnicu bila je 7 dana. Radiološki nalazi bilateralne pneumonije bili su prisutni kod 313 pacijenata (65,6%). Najčešće prijavljivani komorbiditeti su bili hipertenzija (48,3%) i dijabetes (15,7%).

Od 516 hospitalizovanih pacijenata, bilo je 54 smrtna ishoda, dok je srednja vrednost starosne dobi iznosila 69,5 godina, a većina su bili muškarci (81,5%).

Mehanička ventilacija je bila neophodna kod 44 pacijenta (ukupno 27 intubiranih), a većina intubiranih pacijenata bili su muškarci (64,7%). Srednja vrednost trajanja bolesti od početka do prijema u jedinicu intenzivne nege (JIN) bila je 9 dana. Dominantni komorbiditeti u grupi pacijenata koji su bili na mehaničkoj ventilaciji bili su hipertenzija (63,3%) i dijabetes (22,7%). Ukupno 6 pacijenata je preživelo nakon neinvazivne ventilacije.

Univarijantna logistička regresiona analiza je pokazala da su pol, starost, gojaznost, istorija pušenja, visoka temperatura, kratak dah, trajanje bolesti pre prijema u bolnicu, sO_2, leukociti u krvi, limfociti, neutrofili, trombociti, urea, kreatinin, CRP, AST, LDH, hipertenzija, ishemijska bolest srca, periferna vaskularna bolest, bubrežna insuficijencija, RRT, epilepsija i aritmije značajni prediktori teških oblika COVID-19 bolesti, koji su uključeni u model multivarijantne logističke regresione analize (Tabele 1-3).

Rezultati multivarijantne logističke regresione analize su pokazali da je rizik od asistirane ventilacije značajno češći kod pacijenata koji su imali febrilnost na prijemu (p=0,016), duže trajanje bolesti pre hospitalizacije (p=0,023), sa oksigenom saturacijom <90% (p=0,002), leukocitozom (p=0,034), CRP>50 mg/l (p=0,002) i poremećajem srčanog ritma (p=0,001) (Tabela 4).

Diskusija

U ovoj studiji, prosečna starost pacijenata je bila slična starosti pacijenata u studijama sprovedenim u Lombardiji (63,9 godina) (7), Vuhanu (60 godina) (8) i Sjedinjenim Američkim Državama (61 i 63 godine) (9,10), ali niža u odnosu na studije sprovedene u Nemačkoj i Ujedinjenom Kraljevstvu (73 godine) (11,12). U svim navedenim studijama, učesnici su dominantno bili muškarci (50,9-70,7%).

Većina hospitalizovanih pacijenata imala je povišenu telesnu temperaturu, što je u skladu sa nalazima drugih studija, a to je bilo praćeno opštom slabošću (68,8%), i kašljem kao trećim najčešćim simptomom (66,7%). U većini drugih istraživanja kašalj je bio drugi najčešći simptom (8, 10-14), osim u studijama sprovedenim u Lombardiji i Mičigenu, u kojima je kašalj bio prvi simptom (77,8%) (7).

Kao i u drugim studijama, najčešći komorbiditeti su bili hipertenzija i dijabetes (8, 11-13). Hipertenzija i dijabetes tipa 2 su česti komorbiditeti u slučaju SARS i MERS infekcija, a ozbiljne forme bolesti se mogu povezati sa stanjem metaboličke inflamacije koja podstiče oslobađanje citokina u infekcijama (14,15).

Proporcija pacijenata koji su zahtevali intubaciju tokom hospitalizacije (5,2%) u Šapcu bila je niža nego za Sjedinjene Američke Države (12,2-15,3%) (9,10), Ujedinjeno Kraljevstvo (10%) (12) i Nemačku (14%) (11), a viša u poređenju sa podacima iz Kine (0,2-4,6%) (8,13) tokom 2020. godine. Takođe, uočene su razlike kada su u pitanju podaci o umiranju (ukupan mortalitet 10,5%; 86,4% kod pacijenata na mehaničkoj ventilaciji; 3,6% kod pacijenata bez asistirane ventilacije) u poređenju sa rezultatima studija iz SAD-a (ukupan mortalitet 21%; 81,1% za mehaničku ventilaciju) (10), Nemačke (16,6%; 33% za mehaničku ventilaciju) (11) i Kine (ukupan mortalitet 16,5%) (8), dok se podaci studija sprovedenih u Britaniji i Lombardiji ne mogu uporediti (nije bilo prijavljenih ishoda kod ovih pacijenata) (7,12). Ove razlike se mogu objasniti različitim kriterijumima za hospitalizaciju, preporukama za intubiranje pacijenata, kao i brojem dostupnih ležaja u jedinicama intenzivne nege i različitim nivoima opreme u JIN.

Starija životna dob i prateći komorbiditeti su prediktori teških ishoda kod većine virusnih infekcija (16). U studiji iz Nemačke, pacijenti stariji od 79 godina bili su u najvećem riziku od smrtnog

Results

A total of 516 patients with RT-PCR confirmed SARS-CoV-2 infection were enrolled. The median age of population was 61 years, and highest percent of cases were in people aged 60 and over (52.7%). Of these patients, 334 participants were male (64.7%), predominantly from urban areas (52.7%).

The most common symptoms were fever (89%) and generalized weakness (68.8%), only 0.4% had impaired consciousness and 1.4% had hemoptysis. The median duration of illness spreadmission was 7 days. X-ray findings of bilateral pneumonia were present in 313 patients (65.6%). The most commonly reported comorbidities were hypertension (48.3%) and diabetes (15.7%).

Of the 516 patients who were hospitalized 54 died, median age of deceased were 69.5 years and majority were male (81.5%).

Mechanical ventilation was required by 44 patients (a total of 27 was intubated), majority of patients were male (64.7%). The median duration of illness from onset to Intensive Care Unit (ICU) admission was 9 days. The dominant comorbidities in mechanically ventilated group were hypertension (63.6%) and diabetes (22.7%). In total 6 patients survived after non-invasive ventilation.

The univariate logistical regression analysis demonstrated that gender, age, obesity, smoking history, fever, shortness of breath, preadmission illness duration, sO_2, blood leukocytes, lymphocytes, neutrophils and platelets count, urea, creatinine, CRP, AST, LDH, hypertension, ischemic heart/peripheral vascular disease, renal failure, RRT, epilepsy and arrhythmias were significant predictor variables which were used for multivariate logistical regression analysis (Tables 1 -3).

The multivariate logistical regression analysis revealed that the risk for assisted ventilation was higher in patients who were febrile on admission (p=0.016), had longer preadmission illness duration (p=0.023), sO_2<90% (p=0.002), leukocytosis (p=0.034), CRP≥50 mg/l (p=0.002) and heart rhythm disorders (p=0.001) (Table 4).

Discussion

In this study median age of the patients was similar to the patients from the studies in Lombardy (63.9 years) (7), Wuhan (60 years) (8), USA (61 and 63 years) (9, 10) but lower than in German and UK studies (73 years) (11,12). In all mentioned researches participants were dominantly males (50.9-70.7%).

The majority of hospitalized patients had fever, which is consistent with findings of other studies, followed by generalized weakness (68.8%) while cough is the third (66.7%) and in most other researches the second most common symptom(8,10-14), except in the Lombard and Michigan studies where it was the first symptom (77.8%) (7).

As in other researches the most common comorbidities were hypertension and diabetes (8,11-13). Hypertension and type II diabetes are common comorbidities in both SARS and MERS infections and severe form of the disease may be related to a state of metabolic inflammation that potentiates the release of cytokines in infections (15).

The proportion of patients who required intubation during hospitalization (5.2%) in Šabac differed from US data (12.2-15.3%) (9, 10), UK (10%) (12) and Germany (14%)(11)but it was higher compared to China (0.2-4.6%) (8,13)during 2020. There were also differences in mortality (10.5%; 86.4% in patients with mechanical ventilation; 3.6% in patients without assisted ventilation) compared to results from the USA (21%; 81.1%for mechanical ventilation) (10), Germany (16.6%; 33% for mechanical ventilation)(11), China (total mortality 16.5%;) (8), while the data for the British and Lombard studies are not comparable (there were patients with no recorded outcome) (7,12). The differences could be explained with different hospitalization criteria, recommendations for intubation of patients as well as the number of ICU beds available and different ICU equipment levels.

Older age and underlying comorbidities are predictors of severe outcomes in most viral infections(16). In the German study patients older than 79 years were at highest risk of death but risk of mechanical ventilation was lower because of strict implementation of "do not intubate" recommendations (11).

Symptoms and signs of COVID-19 present on admission may predict a more severe course of the disease. The regression model showed that the odds of requiring noninvasive/invasive mechanical

Tabela 1. Demografske karakterteristike i prikaz simptoma kod pacijenata sa COVID-19

	Broj pacijenata		Neasistirana ventilacija		Asistirana ventilacija		
Varijabla	**n (516)**	**%**	**n (472)**	**%**	**n (44)**	**%**	**p**
Pol							
Muško	334	64,7	297	62,9	37	84,1	0,007
Žensko	182	35,3	175	37,1	7	15,9	
Starost (godine)							
<60	244	47,3	235	49,8	9	20,5	0,001
≥ 60	272	52,7	237	50,2	35	79,5	
Vrsta naselja							
Grad	272	52,7	250	53,0	22	50,0	0,706
Selo	244	47,3	222	47,0	22	50,0	
Gojaznost							
Da	125	24,2	108	22,9	17	38,6	0,022
Ne	391	75,8	364	77,1	27	61,4	
Istorija pušenja							
Pušač, bivši pušač	81	15,7	68	14,4	13	29,5	0,010
Nepušač	435	84,3	404	85,6	31	70,5	
Telesna temperatura (°C)							
≤ 38,5	351	68,0	331	70,1	20	45,5	0,001
> 38,5	165	32,0	141	29,9	24	54,5	
Opštaslabost							
Da	355	68,8	325	68,9	30	68,2	0,926
Ne	161	31,2	147	31,1	14	31,8	
Kašalj							
Da	344	66,7	317	67,2	27	6,4	0,436
Ne	172	33,3	155	32,8	17	3,6	
Prisustvo sputuma							
Da	65	12,6	57	12,1	8	18,2	0,247
Ne	451	87,4	415	87,9	36	81,8	
Hemoptiza							
Da	7	1,4	6	1,3	1	2,3	0,588
Ne	509	98,6	466	98,7	43	97,7	
Kratkoća daha							
Da	108	20,9	89	18,9	19	43,2	0,001
Ne	408	79,1	383	81,1	25	56,8	
Dijareja							
Da	94	18,2	86	18,2	8	18,2	0,995
Ne	422	81,8	386	81,8	36	81,8	
Mijalgija							
Da	173	33,5	162	34,3	11	25,0	0,213
Ne	343	66,5	310	65,7	33	75,0	
Sinkopa							
Da	16	3,1	13	2,8	3	6,8	0,151
Ne	500	96,9	459	97,2	41	93,2	
Trajanje bolesti (dani)							
≤ 7	211	40,9	202	42,8	9	20,5	0,006
> 7	305	59,1	270	57,2	35	79,5	
sO_2 (%)							
<90	80	15,5	55	11,7	25	5,8	0,001
≥90	436	84,5	417	88,3	19	43,2	

Table 1. Demographic characteristics and presenting symptomsof COVID-19 patients

	Number of patients		No assisted ventilation		Assisted ventilation		
Variable	**n (516)**	**%**	**n (472)**	**%**	**n (44)**	**%**	**p**
Gender							
Male	334	64.7	297	62.9	37	84.1	0.007
Female	182	35.3	175	37.1	7	15.9	
Age (years)							
<60	244	47.3	235	49.8	9	20.5	0.001
≥ 60	272	52.7	237	50.2	35	79.5	
Settlement type							
Urban	272	52.7	250	53.0	22	50.0	0.706
Rural	244	47.3	222	47.0	22	50.0	
Obesity							
Yes	125	24.2	108	22.9	17	38.6	0.022
No	391	75.8	364	77.1	27	61.4	
Smoking history							
Smoker, ex-smoker	81	15.7	68	14.4	13	29.5	0.010
Non-smoker	435	84.3	404	85.6	31	70.5	
Body temperature (°C)							
≤ 38,5	351	68.0	331	70.1	20	45.5	0.001
> 38,5	165	32.0	141	29.9	24	54.5	
Generalized weakness							
Yes	355	68.8	325	68.9	30	68.2	0.926
No	161	31.2	147	31.1	14	31.8	
Cough							
Yes	344	66.7	317	67.2	27	6.4	0.436
No	172	33.3	155	32.8	17	3.6	
Presence of sputum							
Yes	65	12.6	57	12.1	8	18.2	0.247
No	451	87.4	415	87.9	36	81.8	
Hemoptysis							
Yes	7	1.4	6	1.3	1	2.3	0.588
No	509	98.6	466	98.7	43	97.7	
Shortness of breath							
Yes	108	20.9	89	18.9	19	43.2	0.001
No	408	79.1	383	81.1	25	56.8	
Diarrhea							
Yes	94	18.2	86	18.2	8	18.2	0.995
No	422	81.8	386	81.8	36	81.8	
Myalgia							
Yes	173	33.5	162	34.3	11	25.0	0.213
No	343	66.5	310	65.7	33	75.0	
Syncope							
Yes	16	3.1	13	2.8	3	6.8	0.151
No	500	96.9	459	97.2	41	93.2	
Duration of illness (days)							
Yes	211	40.9	202	42.8	9	20.5	0.006
No	305	59.1	270	57.2	35	79.5	
sO_2 (%)							
Yes	80	15.5	55	11.7	25	5.8	0.001
No	436	84.5	417	88.3	19	43.2	

Tabela 2. Radiološki laboratorijski nalazi kod pacijenata sa COVID-19

	Broj pacijenata		Neasistirana ventilacija		Asistirana ventilacija		
Varijabla	**n**	**%**	**n**	**%**	**n**	**%**	**p**
Pneumonija	(473)		(430)		(43)		
Unilateralna	135	28,5	127	29,5	8	18,6	0,135
Bilateralna	338	71,5	303	70,5	35	8,4	
Pleuralni izliv	(473)		(430)		(43)		
Da	12	2,3	10	2,1	2	4,5	0,320
Ne	503	97,7	461	97,9	42	95,5	
Leukociti (10^9/l)	(516)		(472)		(44)		
≤ 9,7	456	88,4	425	90,0	31	70,5	0,001
> 9,7	60	11,6	47	10,0	13	29,5	
Limfociti (10^9/l)	(516)		(472)		(44)		
< 1,0	184	35,7	158	33,5	18	59,1	0,001
≥ 1,0	332	64,3	314	66,5	44	40,9	
Granulociti (10^9/l)	(516)		(472)		(44)		
≤ 6,5	428	82,9	402	85,2	26	59,1	0,001
>6,5	88	17,1	70	14,8	18	40,9	
Hemoglobin (g/l)	(516)		(472)		(44)		
< 100	25	4,8	21	4,4	4	9,1	0,180
≥ 100	491	95,2	451	95,6	40	90,9	
Trombociti (10^9/l)	(516)		(472)		(44)		
< 158	145	28,1	126	26,7	19	43,2	0,022
≥ 158	371	71,9	346	73,3	25	56,8	
CRP (mg/l)	(512)		(468)		(44)		
< 50,0	270	52,7	264	56,4	6	13,6	0,001
≥ 50,0	242	47,3	204	43,6	38	86,4	
ALT (U/l)	(460)		(420)		(40)		
≤ 55	344	74,8	314	74,8	30	75,0	0,974
> 55	116	25,2	106	25,2	10	25,0	
AST (U/l)	(459)		(419)		(40)		
≤ 34	189	41,2	181	43,2	8	20,0	0,006
> 34	270	58,8	238	56,8	32	80,0	
LDH (U/l)	(409)		(372)		(37)		
≤ 246	192	46,9	188	50,5	4	10,8	0,001
> 246	217	53,1	184	49,5	33	89,2	
Urea (mmol/l)	(507)		(464)		(43)		
≤ 8,2	425	87,4	401	89,7	24	61,5	0,001
> 8,2	61	12,6	46	10,3	15	38,5	
Kreatinin (umol/l)	(506)		(464)		(42)		
≤ 110,5	446	91,8	421	94,0	25	65,8	0,001
> 110,5	60	8,2	43	6,0	17	34,2	
D dimer (ug/ml)	(128)		(110)		(18)		
≤ 0,5	57	44,5	51	46,4	6	33,3	0,306
> 0,5	71	55,5	59	53,6	12	66,7	

p vrednost za χ^2 test

Table 2. Radiographic and laboratory findings of patients with COVID-19

	Number of patients		No assisted ventilation		Assisted ventilation		
Variable	**n**	**%**	**n**	**%**	**n**	**%**	**p**
Pneumonia	(473)		(430)		(43)		
Unilateral	135	28.5	127	29.5	8	18.6	0.135
Bilateral	338	71.5	303	70.5	35	8.4	
Pleuraln effusion	(473)		(430)		(43)		
Yes	12	2.3	10	2.1	2	4.5	0.320
No	503	97.7	461	97.9	42	95.5	
Leukocytes (10^9/l)	(516)		(472)		(44)		
≤ 9.7	456	88.4	425	90.0	31	70.5	0.001
> 9.7	60	11.6	47	10.0	13	29.5	
Lymphocytes (10^9/l)	(516)		(472)		(44)		
< 1.0	184	35.7	158	33.5	18	59.1	0.001
≥ 1.0	332	64.3	314	66.5	44	40.9	
Granulocytes (10^9/l)	(516)		(472)		(44)		
≤ 6.5	428	82.9	402	85.2	26	59.1	0.001
>6.5	88	17.1	70	14.8	18	40.9	
Hemoglobin (g/l)	(516)		(472)		(44)		
< 100	25	4.8	21	4.4	4	9.1	0.180
≥ 100	491	95.2	451	95.6	40	90.9	
Platelets (10^9/l)	(516)		(472)		(44)		
< 158	145	28.1	126	26.7	19	43.2	0.022
≥ 158	371	71.9	346	73.3	25	56.8	
CRP (mg/l)	(512)		(468)		(44)		
< 50.0	270	52.7	264	56.4	6	13.6	0.001
≥ 50.0	242	47.3	204	43.6	38	86.4	
ALT (U/l)	(460)		(420)		(40)		
≤ 55	344	74.8	314	74.8	30	75.0	0.974
> 55	116	25.2	106	25.2	10	25.0	
AST (U/l)	(459)		(419)		(40)		
≤ 34	189	41.2	181	43.2	8	20.0	0.006
> 34	270	58.8	238	56.8	32	80.0	
LDH (U/l)	(409)		(372)		(37)		
≤ 246	192	46.9	188	50.5	4	10.8	0.001
> 246	217	53.1	184	49.5	33	89.2	
Urea (mmol/l)	(507)		(464)		(43)		
≤ 8.2	425	87.4	401	89.7	24	61.5	0.001
> 8.2	61	12.6	46	10.3	15	38.5	
Creatinine (umol/l)	(506)		(464)		(42)		
≤ 110.5	446	91.8	421	94.0	25	65.8	0.001
> 110.5	60	8.2	43	6.0	17	34.2	
D dimer (ug/ml)	(128)		(110)		(18)		
≤ 0.5	57	44.5	51	46.4	6	33.3	0.306
> 0.5	71	55.5	59	53.6	12	66.7	

p value for χ^2 test

Tabela 3. Komorbiditeti pacijenata sa COVID-19

	Broj pacijenata		Neasistirana ventilacija		Asistirana ventilacija		
Varijabla	**n (516)**	**%**	**n (472)**	**%**	**n (44)**	**%**	**p**
Hipertenzija							
Da	249	48,3	221	46,8	28	63,6	
Ne	267	51,7	251	53,2	16	36,4	0,035
Šećerna bolest							
Da	81	15,7	71	15,0	10	22,7	
Ne	435	84,3	401	85,0	44	77,3	0,184
Ishemična srčana bolest							
Da	32	6,2	25	5,3	7	15,9	
Ne	484	93,8	447	94,7	37	84,1	0,008
Kardiomiopatija							
Da	16	3,1	14	3,0	2	4,5	
Ne	500	96,9	458	97,0	42	95,5	0,566
Hronični bronhitis							
Da	9	1,7	7	1,5	2	4,5	
Ne	507	98,3	465	98,5	42	95,5	0,159
Astma							
Da	39	7,6	37	7,8	2	4,5	
Ne	477	92,4	435	92,2	42	95,5	0,435
Bubrežna insuficijencija							
Da	29	5,6	22	4,7	7	15,9	
Ne	487	94,4	450	95,3	37	84,1	0,004
Dijaliza							
Da	21	4,1	17	3,6	4	9,1	
Ne	495	95,9	455	96,4	44	90,9	0,089
Cerebrovaskularna bolest							
Da	12	2,3	11	2,3	1	2,3	
Ne	504	97,7	461	97,7	43	97,7	0,981
Parkinsonova bolest							
Da	5	1,0	4	0,8	1	2,3	
Ne	511	99,0	468	99,2	43	97,7	0,375
Maligna oboljenja							
Da	23	4,5	22	4,7	1	2,3	
Ne	493	95,5	450	95,3	43	97,7	0,473
Epilepsija							
Da	2	0,4	1	0,2	1	2,3	
Ne	514	99,6	471	99,8	43	97,7	0,093
Aritmija							
Da	25	4,8	18	3,8	7	15,9	
Ne	491	95,2	454	96,2	37	84,1	0,001

p vrednost za χ^2 test

Table 3. Comorbidities of COVID-19 patients

	Number of patients		No assisted ventilation		Assisted ventilation		
Variable	**n (516)**	**%**	**n (472)**	**%**	**n (44)**	**%**	**p**
Hypertension							
Yes	249	48.3	221	46.8	28	63.6	
No	267	51.7	251	53.2	16	36.4	0.035
Diabetes							
Yes	81	15.7	71	15.0	10	22.7	
No	435	84.3	401	85.0	44	77.3	0.184
Ischemic heart disease							
Yes	32	6.2	25	5.3	7	15.9	
No	484	93.8	447	94.7	37	84.1	0.008
Cardiomyopathy							
Yes	16	3.1	14	3.0	2	4.5	
No	500	96.9	458	97.0	42	95.5	0.566
Chronic bronchitis							
Yes	9	1.7	7	1.5	2	4.5	
No	507	98.3	465	98.5	42	95.5	0.159
Asthma							
Yes	39	7.6	37	7.8	2	4.5	
No	477	92.4	435	92.2	42	95.5	0.435
Renal failure							
Yes	29	5.6	22	4.7	7	15.9	
No	487	94.4	450	95.3	37	84.1	0.004
Dialysis							
Yes	21	4.1	17	3.6	4	9.1	
No	495	95.9	455	96.4	44	90.9	0.089
Cerebrovascular disease							
Yes	12	2.3	11	2.3	1	2.3	
No	504	97.7	461	97.7	43	97.7	0.981
Parkinsonism							
Yes	5	1.0	4	0.8	1	2.3	
No	511	99.0	468	99.2	43	97.7	0.375
Malignancies							
Yes	23	4.5	22	4.7	1	2.3	
No	493	95.5	450	95.3	43	97.7	0.473
Epilepsy							
Yes	2	0.4	1	0.2	1	2.3	
No	514	99.6	471	99.8	43	97.7	0.093
Arrhythmia							
Yes	25	4.8	18	3.8	7	15.9	
No	491	95.2	454	96.2	37	84.1	0.001

p value for χ^2 test

Tabela 4. Faktori koji se odnose na potrebu za asistiranom ventilacijom prema rezultatima multivarijantne logističke regresione analize

Varijabla	RR	(95%IP)	p
Telesna temperatura >38,5°C	2,9	(1,2 – 7,1)	0,016
Trajanje bolesti >7 dana	3,1	(1,2– 8,3)	0,023
sO_2 <90%	4,0	(1,7 – 9,1)	0,002
Leukociti >9,7 10^9/l	2,9	(1,1 – 8,0)	0,034
CRP ≥ 50,0 mg/l	7,5	(2,1 – 26,9)	0,002
Aritmija	14,3	(3,6– 50,0)	0,001

RR-relativnirizik; IP-interval poverenja

ishoda, ali je rizik od mehaničke ventilacije bio manji zbog striktne primene preporuka da se ne intubiraju (11).

Simptomi i znaci COVID-19 bolesti na prijemu mogu predvideti teži tok bolesti. Regresioni model je pokazao da su šanse da će biti potrebna neinvazivna/invazivna mehanička ventilacija bile 2,9 puta veće za febrilne pacijente (telesna temperatura > 38,5°C). Podaci iz Nemačke (11) takođe ukazuju na vezu između povišene telesne temperature i potrebe za asistiranom mehaničkom ventilacijom, ali slična veza nije primećena u studijama iz Kine (8) ili Italije (7). Zanimljivo je da su u Nemačkoj ispitanici sa rinorejom bili pod većim rizikom od mehaničke ventilacije (11), što nije potvrđeno u istraživanju Imama i saradnika (9), dok u našoj studiji rinoreja nije registrovana kao simptom.

Naši nalazi sugerišu da je saturacija kiseonikom periferne krvi statistički visoko značajan prognostički parametar. Pacijenti koji su na prijemu imali sO_2<90% imali su značajnu veći rizik za upotrebu mehaničke ventilacije. Povezanost vrednosti sO_2 na prijemu i teških formi bolesti nije potvrđena u Vuhanu (8). Zanimljivo je da vrednosti parcijalnog pritiska kiseonika u krvi tokom hospitalizacije nisu imale prognostički značaj kod pacijenata u Italiji, dok je nizak odnos parcijalnog pritiska arterijskog kiseonika (engl. *Partial pressure of arterial oxygen*, PaO_2) i frakcije udahnutog kiseonika (engl. *Fractional inspired oxygen*, FiO_2) bio značajan indikator nastajanja akutne respiratorne insuficijencije prema definiciji akutnog respiratornog sindroma (7).

Pacijenti sa CRP > 50 mg/l su imali 7,5 puta veći rizik od mehaničke ventilacije, a rizik je takođe bio skoro utrostručen u prisustvu leukocitoze. Kod pacijenata u Kini, pored nivoa CRP, prediktori progresije u teške oblike COVID-19 bili su trombocitopenija i povišene transaminaze u serumu, ali nije bilo kontrole na konfaunding faktore (13). Značaj povišenih nivoa AST i trombocitopenije otkriven je u našem istraživanju u univarijantnoj logističkoj regresionoj analizi, ali nije potvrđen u modelu multivarijantne logističke regresione analize. U drugoj studiji iz Kine, u multivarijantnoj analizi, značajni prediktori su bili leukocitoza, povišeni nivoi LDH i d dimera > 1 mg/l (8). Povezanost nivoa d dimera i teških oblika COVID-19 je potvrđena u nekoliko istraživanja (17), ali naši rezultati nisu bili u skladu sa njihovim nalazima, što se može dovesti u vezu sa relativno malim brojem pacijenata sa dostupnim nalazom d dimera (128 pacijenata; 24,8%). Pored vrednosti CRP-a među ispitanicima u Lombardiji, značajan parametar za progresiju u teške forme bolesti bile su povišene vrednosti kreatinina u serumu (7).

Podaci iz više studija pokazuju da su odrasli sa teškim osnovnim zdravstvenim stanjima u većem riziku od bolesti i smrti usled teške forme COVID-19 bolesti (7,11,18). U našoj studiji, 34,3% pacijenata nije imalo pridružene bolesti, 35,9% je imalo jednu, 21,1% dve, 5,8% tri, 2,1% četiri, 0,4% pet, 0,2% (1 osoba) šest i 0,2% osam komorbiditeta. U multivarijantnoj analizi značajan prediktor mehaničke ventilacije je bio poremećaj srčanog ritma, što je u skladu sa rezultatima drugih studija (7,8,11). Među pacijentima u Lombardiji, prisustvo koronarne bolesti je identifikovan kao prediktor progresije SARS-CoV infekcije u teži oblik COVID-19 bolesti (7). Značaj kardiovaskularnih oboljenja i hroničnih bolesti donjeg respiratornog trakta za mehaničku ventilaciju potvrđen je u studiji sprovedenoj u Nemačkoj, u kojoj je dijabetes bio značajan prediktor mehaničke ventilacije (11) i kod pacijenata iz Vuhana hipertenzija je bila značajan faktor za razvoj invazivne ventilacije (8).

Table 4. Factors related to the requirement for the assisted ventilation according to the results of multivariate logistic regression analysis

Varijabla	HR	(95%IP)	p
Body temperature >38.5°C	2.9	(1.2 – 7.1)	0.016
Duration of illness >7 days	3.1	(1.2– 8.3)	0.023
sO_2 <90%	4.0	(1.7 – 9.1)	0.002
Leucocytes >9,7 10^9/l	2.9	(1.1 – 8.0)	0.034
CRP ≥ 50,0 mg/l	7.5	(2.1 – 26.9)	0.002
Arrhythmia	14.3	(3.6– 50.0)	0.001

HR-hazard ratio; CI-confidence interval

ventilation were 2.94 times higher for febrile patients (body temperature >38.5 °C). Data from Germany (11) also indicate an association between fever and the need for assisted ventilation, but a similar relationship was not observed in the Chinese (8) or Italian study (7). Interestingly, German subjects with rhinorrhea were at higher risk for mechanical ventilation (11), a fact that wasn't confirmed in Imam et al research (9) and in our subjects rhinorrhea wasn't registered as a symptom.

Our findings suggest that peripheral blood oxygen saturation a statistically highly significant prognostic parameter. Patients with admission sO_2<90% had a significantly higher risk of requiring assisted ventilation. The association of admission sO_2 and severe disease forms has not been confirmed in Wuhan (8). Interestingly the values of blood oxygen partial pressure during hospitalization had no prognostic significance in Italian patients and low PaO_2/ FiO_2 ratio was a significant indicator of emerging acute respiratory failure as per acute respiratory syndrome definition (7).

Patients with CRP≥50mg/l had 7.5 times higher risk for mechanical ventilation, the risk was also almost tripled in presence of leukocytosis. In patients in China, beside CRP levels, predictors of progression to severe COVID-19 forms were thrombocytopenia and elevated serum transaminases but there was no control of confounding factors (13). Significance of elevated AST levels and thrombocytopenia was detected in our research in univariate logistical regression analysis but wasn't confirmed in multivariate logistics. regression model. In another Chinese study in multivariate analysis, important predictors were leukocytosis, elevated LDH and d dimer levels > 1mg/l (8). Association of d dimer levels and severe forms of COVID-19 was confirmed in several researches (17) but our results were not consistent with their findings, fact that could be related with the relatively small number of patients with available d dimer result (128 patients; 24.8%). In addition to CRP in subjects in Lombardy, a significant parameter for progression to severe disease was serum creatinine (7).

Data from multiple studies indicate that adults with severe underlying health conditions are at higher risk for severe COVID-19-associated illness and death (7,11,18). In our research 34.3% patients had no associated diseases, 35.9% had one, 21.1% two, 5.8% three, 2.1% four, 0.4% five, 0, 2% (one person) six and 0.2% eight comorbidities. In the multivariate analysis of mechanical ventilation predictors, heart rhythm disorders were highly statistically significant risk factor, which is consistent with results of other studies (7,8,11). In patients in Lombardy, the presence of coronary heart disease was a predictor of progression to a more severe form of COVID-19 (7). The importance of cardiovascular diseases and chronic diseases of the lower respiratory tract for the mechanical ventilation was confirmed in a German study in which diabetes was an important predictor of mechanical ventilation (11)and in Wuhan patients in whom hypertension was associated with higher invasive ventilation risk (8).

Our research had some notable limitations. The number of cases requiring assisted ventilation was small (44 patients, 8.5%), the data were collected from single hospital in Serbia and may not represent the national population. Hospitalization criteria were variable and resource dependent.

Naše istraživanje je imalo neka značajna ograničenja. Broj slučajeva koji zahtevaju asistiranu ventilaciju je bio mali (44 pacijenta, 8,5%), podaci su prikupljeni iz jedne bolnice u Srbiji i ne odnose se na ukupno stanovništvo. Kriterijumi za hospitalizaciju su bili promenljivi i zavisili su od resursa.

Zaključak

Slučajevi COVID-19 sa temperaturom, dužim trajanjem bolesti pre prijema, sO_2<90%, leukocitozom, CRP≥50 mg/l i sa aritmijom imali su značajno veći rizik od razvoja teške forme bolesti, koja je zahtevala neinvazivnu/invazivnu mehaničku ventilaciju.

Konflikt interesa

Autori su izjavili da nema konflikta interesa.

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Conclusion

COVID-19 cases with fever, longer preadmission illness duration, sO_2<90%, leukocytosis, CRP≥50 mg/l and having arrhythmia had significantly higher risk of developing severe disease, which required non-invasive/invasive mechanical ventilation.

Competing interests

The author declared no competing interests.

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PROCENA ZDRAVSTVENE PISMENOSTI ODRASLIH KOJI SVOJU ZDRAVSTVENU ZAŠTITU OSTVARUJU U DOMU ZDRAVLJA PIROT I FAKTORI KOJI JE ODREĐUJU

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SAŽETAK

Uvod/Cilj: Zdravstvena pismenost je pojam koji sve više dobija na važnosti u oblasti javnog zdravlja i zdravstvene zaštite, iako se kao takav koristi još od sedamdesetih godina XX veka. Cilj ovog rada je da se proceni nivo zdravstvene pismenosti u populaciji odraslih pacijenata koji svoju zdravstvenu zaštitu ostvaruju u Domu zdravlja Pirot, kao i da se identifikuju faktori koji mogu biti povezani sa nivoom zdravstvene pismenosti.
Metode: Istraživanje je sprovedeno u vidu studije preseka u Domu zdravlja Pirot u periodu od 1.5.2024. do 1.6.2024.godine. U istraživanju je učestvovalo 400 ispitanika. Kao instrumenti istraživanja korišćeni su opšti upitnik i Evropski upitnik za procenu zdravstvene pismenosti (engl. *The European Health Literacy Questionnaire*, HLS-EU-Q-47). U statističkoj analizi podataka korišćen je hi kvadrat test.
Rezultati: Od 400 odraslih ispitanika doma zdravlja 10,2% je imalo neadekvatnu, 15,8% problematičnu, 33,5% dovoljnu, a 40,5% odličnu zdravstvenu pismenost. Dovoljna ili odlična zdravstvena pismenost je statistički značajno bila povezana sa polom, godinama starosti, mestom stanovanja, bračnog statusa i stepenom obrazovanja. Lica sa hroničnim bolestima, kao i lica koja su lično procenila da imaju loše i veoma loše zdravstveno stanje, su značajno češće imala neodgovarajuću/problematičnu zdravstvenu pismenost.
Zaključak: Nizak nivo zdravstvene pismenosti je ključna barijera za korišćenje odgovarajuće zdravstvene zaštite, zbog čega je neophodno kontinuirano raditi na identifikaciji grupa sa neadekvatnom zdravstvenom pismenošću i njihovoj edukaciji.

Ključne reči: zdravstvena pismenost, hronična bolest, faktori rizika, javno zdravlje

Uvod

Zdravstvena pismenost je pojam koji sve više dobija na značaju u oblasti javnog zdravlja i zdravstvene zaštite, iako se kao takav koristi od 1970-ih godina. Koncept zdravstvene pismenosti definiše ljudski potencijal da ispuni složene zahteve zdravlja u savremenom društvu (1). Zdravstvena pismenost, između ostalih determinanti socijalnog zdravlja, u velikoj meri utiče na poboljšanje opšteg zdravlja, a od ključne je važnosti da se unapredi zdravstvena pismenost na lokalnom, regionalnom, nacionalnom i međunarodnom nivou, jer se time poboljšava ukupno društveno zdravlje, omogućavajući pacijentima da preuzmu kontrolu nad svojim zdravljem (2).

Zdravstvena pismenost se definiše kao procena sopstvenog zdravlja, ali i zdravlja porodice i zajednice u smislu razumevanja faktora koji na njega utiču, kao i znanja za upravljanje njime (3). U potrazi za sveobuhvatnom definicijom, Evropski konzorcijum o zdravstvenoj pismenosti predložio je definiciju koja kaže da je „zdravstvena pismenost usko povezana sa pismenošću i podrazumeva znanje ljudi, motivaciju i kompetencije za pristup, razumevanje, ocenu i primenu informaci-

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ASSESSMENT OF HEALTH LITERACY OF ADULTS RECEIVING THEIR HEALTH CARE AT THE PIROT HEALTH CENTER AND THE FACTORS THAT DETERMINE IT

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SUMMARY

Introduction/Aim: Health literacy is a concept that has been gaining increasing importance in the field of public health and healthcare, even though it has been in use since the 1970s. The aim of this work is to assess the level of health literacy in the population of adult patients who receive their health care in the Pirot Health Center, as well as to identify factors that may be associated with the level of health literacy.
Methods: The research was conducted in the form of a cross-sectional study in the Pirot Health Center in the period from 1.5.2024. until 1.6. 2024. 400 respondents participated in the research. The general questionnaire and the European Health Literacy Questionnaire (HLS-EU-Q-47) were used as research instruments. The chi-square test was used in the statistical analysis of the data.
Results: Out of 400 adult health center respondents, 10.2% had inadequate, 15.8% problematic, 33.5% sufficient, and 40.5% excellent health literacy. Sufficient or excellent health literacy was statistically significantly associated with gender, age, place of residence, marital status and level of education. Persons with chronic diseases, as well as persons who personally assessed that they have poor and very poor health status, significantly more often had inadequate/problematic health literacy.
Conclusion: A low level of health literacy is a key barrier to the use of appropriate health care, which is why it is necessary to continuously work on the identification of groups with inadequate health literacy and their education.

Key words: health literacy, chronic disease, risk factors, public health

Introduction

Health literacy is a concept that has been recognized as one of the most important in the field of public health and health care, although it has been used as such since 1970s. The concept of health literacy defines the human potential to meet the complex demands of health in modern society (1). Health literacy, among other determinants of social health, influences the improvement of general health, to a large extent, and therefore, it is of key importance to improve health literacy at the local, regional, national and international levels, since this improves overall social health, enabling patients to take control over their health (2).

Health literacy is defined as the assessment of one's own health, but also the health of family and community in terms of understanding the factors that influence it, as well as knowledge to manage it (3). In search of a comprehensive definition, the European Health Literacy Consortium proposed the following definition: "health literacy is closely related to literacy and involves the knowledge, motivation and competences of persons to access, understand, appraise and apply health information in order to make decisions about health care, disease prevention and health promotion necessary for maintaining and improving the

ja za donošenje odluka u svakodnevnom životu koje se tiču zdravstvene zaštite, prevencije bolesti i promocije zdravlja, za održavanje i poboljšanje kvaliteta života tokom životnog puta" (4). Pregledom literature može se zaključiti da autori često naglašavaju potrebu za prevazilaženjem isključivo individualnog pristupa i insistiraju na tome da se zdravstvena pismenost posmatra kao rezultat usklađivanja kriterijuma koje postavlja zdravstveni sistem sa mogućnostima i kapacitetima pojedinca.

Zagovornici zdravstvene pismenosti stanovništva dodatno su proširili kontekst zdravstvene pismenosti kako bi uključili determinante koje prevazilaze lične veštine i čitav medicinski okvir zdravstvene pismenosti. Shodno tome, definisani su modeli zdravstvene pismenosti i to funkcionalna, interaktivna i kritička zdravstvena pismenost (5). Procena zdravstvene pismenosti razvijena je zajedno sa paradigmom zdravstvene pismenosti. Koristeći rezultate prethodnih istraživanja, u cilju procene zdravstvene pismenosti razvijena su dva koncepta (6). Prvi, govori o neophodnosti razvoja najkraćeg mogućeg instrumenta za testiranje sposobnosti čitanja i razumevanja zdravstvenih informacija. Alati koji se koriste u ovom konceptu uglavnom su u formi upitnika, nakon čega istraživač vodi intervju. Drugi, uključuje samotestiranje zdravstvene pismenosti. Ovaj koncept se uglavnom koristi samoinicijativno kada se pojedinac podvrgava popunjavanju testa, a najčešće zato što je ranije imao poteškoća u razumevanju zdravstvenih informacija. Veliki broj navedenih alata javno je dostupan istraživačima, a najčešće korišćeni su: Test za ispitivanje funkcionalne zdravstvene pismenosti kod odraslog stanovništva (engl. *The Test of Functional Health Literacy in Adults*, TOFHLA), Instrument za brzu procenu pismenosti kod odraslih u medicini (engl. *The Rapid Estimate of Adults Literacy in Medicine*, REALM), Test dostignuća širokog opsega (engl. *The Wide Range Achievement Test*; WRAT), Evropski upitnik za procenu zdravstvene pismenosti (engl. *The European Health Literacy Questionnaire*, HLS-EU-Q), Najnoviji vitalni znak (engl. *The Newest Vital Sign*; NVS), Alat za kratak skrining zdravstvene pismenosti (engl. *The Brief Health Literacy Screening Tool,* BRIEF), Skala svih aspekata zdravstvene pismenosti (engl. *All Aspects of Health Literacy Scale*, AAHLS), Demografska procena zdravstvene pismenosti (engl. *The Demographic Assessment of Health Literacy*, DAHL), Procena zdravstvene pismenosti za adolescente (engl. *The Health Literacy Measure for Adolescents*, HELMA) i Upitnik zdravstvene pismenosti (engl. *The Health Literacy Questionnaire*, HLQ). Takođe, pored navedenih alata, treba napomenuti da su alati za indirektnu procenu zdravstvene pismenosti dostupni i kada je zdravstvena pismenost povezana sa nekom drugom veštinom, kao npr. numeričke veštine ili veštine samoprocene.

Svetska zdravstvena organizacija (SZO) dala je definiciju zdravlja u kojoj kaže da je „zdravlje stanje potpunog fizičkog, mentalnog i socijalnog blagostanja, a ne samo odsustvo bolesti" (7). Glavne determinante zdravlja su promenljivi i nepromenljivi faktori. Nepromenljivi zdravstveni faktori su oni koji se ne mogu promeniti našim uticajem, kao što su genetska predispozicija, polna struktura i starost. Promenljivi faktori su oni na koje svojim delovanjem možemo uticati i smanjiti destruktivni uticaj navedenih faktora na zdravlje. SZO je izvela devet grupa zdravstvenih determinanti: lični prihod, obrazovanje, fizičko okruženje, zapošljavanje i uslovi rada, mreža socijalne podrške, genetski faktori, individualno zdravstveno ponašanje i odgovor na stres, zdravstveni sistem (pristupačnost, upotrebljivost, efikasnost u preventivi i lečenju).

Cilj ovog rada je da se proceni nivo zdravstvene pismenosti u populaciji odraslih pacijenata koji svoju zdravstvenu zaštitu ostvaruju u Domu zdravlja Pirot, kao i da se identifikuju faktori koji mogu biti povezani sa nivoom zdravstvene pismenosti.

Metode

Istraživanje je sprovedeno u vidu studije preseka, u periodu od 1. 5. 2024. do 1. 6. 2024. godine. U istraživanju je učestvovalo 400 ispitanika, koji su u navedenom periodu obratili izabranom lekaru. Studija je sprovedena po Helsinškoj deklaraciji, a etičko odobrenje je dobijeno od Etičkog odbora Doma zdravlja Pirot, u Pirotu (poziv na broj: 02-03-1/EO). Pre početka istraživanja ispitanici su bili upoznati sa ciljem i procedurom istraživanja. Svi ispitanici su pre početka istraživanja potpisali dobrovoljni informisani pristanak za učestvovanje u istraživanju, nakon čega je usledila procena podobnosti za uključenje u studiju. Procena podobnosti je vršena na osnovu kriterijuma za uključivanje i isključivanje. Kriterijumi za uključivanje u istraživanje podrazumevali su: da pacijenti imaju pravo na zdravstvenu zaštitu u Domu zdravlja „Pirot", da su stariji od 18 godina i da su dali pristanak da dobrovoljno popune upitnik. Kriterijumi za isključiva-

quality of life throughout life" (4). By reviewing the literature, it can be concluded that authors often emphasize the need to overcome an exclusively individual approach and insist that health literacy should be viewed as the result of coordinating the criteria set by the health system with the individual's capabilities and capacities.

The proponents of population health literacy have expanded the context of health literacy additionally in order to include the determinants that surmount personal skills and the whole medical framework of health literacy. Therefore, the models of health literacy have been defined, that is, functional, interactive and critical health literacy (5). The assessment of health literacy has been developed together with the paradigm of health literacy. By using the results of previous studies, aimed at the assessment of health literacy, two concepts have been developed (6). The first speaks about the necessity of developing the shortest possible instrument for testing the ability of reading and understanding health information. Tools that are used in this concept are mainly in the form of a questionnaire, and later the researcher conducts the interview. The second includes the self-test of health literacy. This concept is mainly based on self-initiative and the individual completes the test, most frequently because he previously had difficulty understanding health information. The majority of the mentioned tools is publicly available to researchers, while the following are the most often used: The Test of Functional Health Literacy in Adults (TOFHLA), The Rapid Estimate of Adults Literacy in Medicine (REALM), The Wide Range Achievement Test (WRAT), The European Health Literacy Questionnaire (HLS-EU-Q), The Newest Vital Sign (NVS), The Brief Health Literacy Screening Tool (BRIEF), All Aspects of Health Literacy Scale (AAHLS), The Demographic Assessment of Health Literacy (DAHL), The Health Literacy Measure for Adolescents (HELMA) and The Health Literacy Questionnaire (HLQ). Also, in addition to the mentioned tools, it should be mentioned that the tools for the indirect assessment of health literacy are available even when health literacy is associated with other skills, such as numerical skills or self-assessment skills.

The World Health Organization (WHO) defined health in the following way: "health is a state of complete physical, mental and social well-being and not merely the absence of disease" (7). The main determinants of health are modifiable and non-modifiable factors. The non-modifiable health factors are those that cannot be changed by our influence, such as genetic predisposition, gender structure and age. The modifiable factors are those that we can influence and thus reduce the destructive impact of the mentioned factors on health. The WHO derived nine groups of health determinants: personal income, education, physical environment, employment and working conditions, network of social support, genetic factors, individual health behavior and response to stress, health system (accessibility, usability, efficiency in prevention and treatment).

The aim of this study is to assess the level of health literacy in the population of adult patients who receive their health care in the Health Center Pirot, as well as to identify factors that may be associated with the level of health literacy.

Methods

The research was conducted in the form of a cross-sectional study from May 1st, 2024 to June 1st, 2024. The study included 400 participants, who consulted the chosen doctor in the mentioned period. The study was conducted according to the Declaration of Helsinki, while ethical approval was obtained by the Ethics Committee of the Health Center Pirot (reference number: 02-03-1/EO). The respondents were acquainted with the aim and procedure of the research prior to the start of the study. All respondents signed a voluntary informed consent to participate in the study prior to the start of the study, which was followed by the assessment of suitability for inclusion in the study. Eligibility was assessed based on inclusion and exclusion criteria. The inclusion criteria were the following: patients had the right to health care at the Health Center Pirot, they were older than 18 and they had given their consent to fill out the questionnaire voluntarily. The exclusion criteria were: they did not have the right to health care at the Health Center Pirot, they were younger than 18 and they refused to participate in the study.

The general questionnaire on demographic, social and economic characteristics and characteristics related to the use of health system services and attitudes, information and behavior of respondents in the field of health and the European Health Literacy Questionnaire (HLS-EU-Q-47), which

nje iz istraživanja su bili: da ne ostvaruju pravo na zdravstvenu zaštitu u Domu zdravlja „Pirot“, da su mlađi od 18 godina i da su odbili učestvovanje u istraživanju.

Kao instrumenti istraživanja korišćeni su opšti upitnik o demografskim, socijalnim i ekonomskim karakteristikama i karakteristikama koji se odnose na korišćenje usluga zdravstvenog sistema i stavovima, informisanosti i ponašanju ispitanika u oblasti zdravlja i Evropski upitnik za procenu zdravstvene pismenosti (engl. *The European Health Literacy Questionnaire*, HLS-EU-Q-47), standardizovan upitnik za testiranje zdravstvene pismenosti koji je javno dostupan (1). Evropski upitnik za procenu zdravstvene pismenosti je sveobuhvatan alat koji se koristi za procenu zdravstvene pismenosti u opštoj populaciji. Upitnik se sastoji od ukupno 47 stavki koje su podeljene u tri osnovna domena i to zdravstvena briga (engl. *Healthcare*), prevencija bolesti (eng. *Disease Prevention*) i promocija zdravlja (eng. *Health Promotion*).

Domen zdravstvene brige obuhvata 16 stavki koje procenjuju sposobnost pojedinca da pronalazi, razumeva, procenjuje i koristi informacije u vezi sa zdravstvenom zaštitom. Domen prevencija bolesti sadrži 15 stavki koje ispituju sposobnost pojedinca da pronalazi, razumeva, procenjuje i koristi informacije koje se odnose na prevenciju bolesti, dok se domen promocija zdravlja sastoji od 16 stavki koje procenjuju sposobnost pojedinca da pronalazi, razumeva, procenjuje i koristi informacije u cilju unapređenja i očuvanja zdravlja. Zdravstvena pismenost se procenjuje kroz odgovore na postavljena pitanja koja se odnose na gore navedene domene. Ispitanici odgovaraju na svaku stavku koristeći Likertovu skalu koja se kreće od 1 (vrlo teško) do 4 (vrlo lako), čime se meri koliko dobro mogu da pronađu, razumeju, procene i koriste zdravstvene informacije. Za ispitanike koji su validno odgovorili na najmanje 80% svih pitanja izračunat je sveobuhvatni opšti Indeks zdravstvene pismenosti (HLS-EU-Q Index) prema formuli: Index = (mean – 1)*(50/3), čije se vrednosti kreću od 0, što predstavlja „najmanji mogući”, do 50, što predstavlja „najbolji mogući“ rezultat zdravstvene pismenosti. Na osnovu opšteg Indeksa zdravstvene pismenosti ispitanici su klasifikovani u jednu od četiri grupe nivoa zdravstvene pismenosti: neadekvatna (0-25), problematična (>25-33), dovoljna (>33-42) i odlična (>42-50).

Za statističke proračune korišćen je komercijalni, standardni programski paket SPSS, verzija 20.0. (*The Statistical Package for Social Sciences software–SPSS Inc, version 20.0, Chicago, IL*). Za statističku analizu podataka korišćen je hi kvadrat test.

Rezultati

Od 400 odraslih ispitanika uključenih u ovo studiju preseka 10,2% je imalo neadekvatnu, 15,8% problematičnu, 33,5% dovoljnu, a 40,5% odličnu zdravstvenu pismenost (tabela 1).

Najviše ispitanika je bilo starosne dobi od 30 do 39 godina (37,0%), a najmanje je imalo 50 i više godina (13,5%). Ispitanika 40-49 godina je bilo 23,5%, a 20-29 godina 26,0% (tabela 2, grafikon 1). Većinu ispitanika u ovom istraživanju činile su žene (62,0%) (tabela 2, grafikon 2), osobe u braku ili vanbračnoj zajednici (57,5%) (tabela 2, grafikon 3), kao i osobe koje živele u urbanim sredinama (57,5%) (tabela 2, grafikon 4). U odnosu na stepen obrazovanja, najveći procenat ispitanika je bio sa srednjoškolskim obrazovanjem (78,0%), a najmanji sa nepotpunom ili završenom osnovnom školom (2,7%). Što se tiče radnog statusa, među ispitanicima je najviše bilo onih koji su zaposleni (79,5%), a najmanje penzionera (12,0%). Najveći procenat ispitanika je materijalno stanje svojeg domaćinstva definisao kao dobro (56,0%), a najmanji kao veoma loše (2%). Prilikom procene sopstvenog zdravlja, 36% ispitanika je navelo da ima dobro zdravstveno stanje, a 4,5% kao veoma loše (tabela 2, grafikon 5). Hroničnu bolest je imalo 18,5%,

Tabela 1. Nivo zdravstvene pismenosti prema Indeksu zdravstvene pismenosti odraslih koji svoju zdravstvenu zaštitu ostvaruju u Domu zdravlja Pirot

Nivo zdravstvene pismenosti	N	%
Neadekvatna zdravstvena pismenost	40	10,2
Problematična zdravstvena pismenost	63	15,8
Dovoljna zdravstvena pismenost	135	33,5
Odlična zdravstvena pismenost	162	40,5

is a standardized health literacy test that is publicly available, were used as research instruments (1). The European questionnaire for the assessment of health literacy is a comprehensive tool used to assess health literacy in the general population. The questionnaire consists of 47 items that are divided into three basic domains, namely healthcare, disease prevention and health promotion.

The health care domain includes 16 items that assess the ability of an individual to find, understand, evaluate and use information related to health care. The domain of disease prevention contains 15 items that examine the ability of an individual to find, understand, evaluate and use information related to disease prevention, while the domain of health promotion consists of 16 items that assess the ability of an individual to find, understand, evaluate and use information in order to improve and preserve health. Health literacy is assessed through answers to raised questions related to the above mentioned domains. The respondents answer questions using a Likert scale ranging from 1 (very difficult) to 4 (very easy), which measures how well they can find, understand, evaluate and use health information. For respondents who validly answered at least 80% of all questions, a comprehensive general health literacy index (HLS-EU-Q Index) was calculated according to the formula: Index = (mean – 1)*(50/3), whose values range from 0, which is the "lowest possible", to 50, which is the "best possible" health literacy score. Based on the general health literacy index, respondents were classified into one of four groups of health literacy levels: inadequate (0-25), problematic (>25-33), sufficient (>33-42) and excellent (>42-50).

The commercial, standard software package SPSS, version 20.0 (The Statistical Package for Social Sciences software – SPSS Inc, version 20.0, Chicago, IL). Chi-square test was used for the statistical analysis of data.

Results

Of 400 adult respondents, who were included in this cross-sectional study, 10.2% had inadequate, 15.8% problematic, 33.5% sufficient, and 40.5% excellent health literacy (Table 1).

The majority of respondents were in the age group 30 to 39 years (37.0%), while the fewest respondents were 50 and older (13.5%). 23.5% of respondents were in the age group 40-49 years, while 26.0% were in the age group 20-29 years (Table 2, Figure 1). The majority of respondents in this study were women (62.0%) (Table 2, Figure 2), married persons or persons who were cohabiting (57.5%) (Table 2, Figure 3), as well as persons who lived in urban areas (57.5%) (Table 2, Figure 4). According to the level of education, the highest percentage of respondents had a high school diploma (78.0%), while the lowest percentage of respondents was among persons who did not complete or who completed primary school (2.7%). In relation to the work status, the majority of respondents were employed (79.5%), while the fewest respondents were retired (12.0%). The highest percentage of respondents defined the financial condition of their household as good (56.0%), while the smallest percentage of them defined this condition as bad (2%). When assessing their own health, 36% of respondents stated that they had a good state of health, while 4.5% stated that it was very bad (Table 2, Graph 5). 18.5% of respondents had a chronic disease, and 81.5% had no chronic diseases (Table 2, Figure 6). Adequate or excellent health literacy was statistically significantly more often present in women than in men, in those under the age of 40 than in those older than 40, in the urban population than in people living in the suburbs and in rural areas, in married persons or persons who were cohabiting than in single or divorced/widowed persons, in persons with university or college diplomas in comparison to lower

Table 1. The level of health literacy according to the Health Literacy Index of adults who receive their health care at the Pirot Health Center

Level of health literacy	N	%
Inadequate health literacy	40	10.2
Problematic health literacy	63	15.8
Sufficient health literacy	135	33.5
Excellent health literacy	162	40.5

Tabela 2. Sociodemografske karakteristike odraslih koji svoju zdravstvenu zaštitu ostvaruju u Domu zdravlja Pirot u odnosu na stepen zdravstvene pismenosti

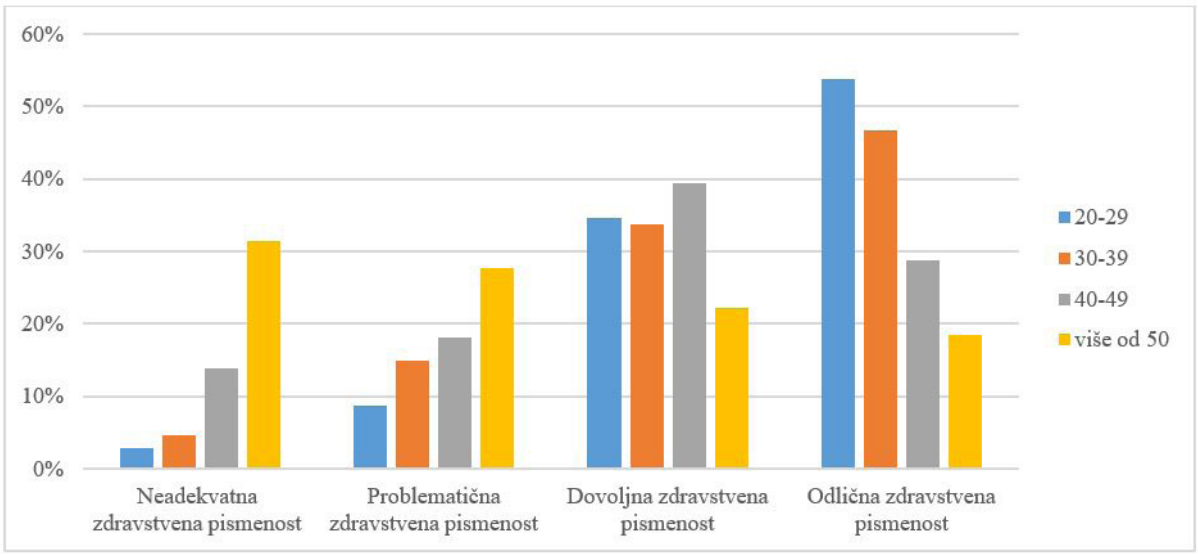
Karakteristike ispitanika	Neadekvatna zdravstvena pismenost N (%)	Problematična zdravstvena pismenost N (%)	Dovoljna zdravstvena pismenost N (%)	Odlična zdravstvena pismenost N (%)	p vrednost
Pol					
Muški	16 (10,5)	38 (25,0)	54 (35,5)	44 (28,9)	
Ženski	24 (9,7)	25 (10.1)	81 (32,7)	118 (47,6)	<0,001
Starosna dob (godine)					
20-29*	3 (2,9)	9 (8,6)	36 (34,6)	56 (53,8)	
30-39*	7 (4,7)	22 (14,9)	50 (33,8)	69 (46,6)	
40-49	13 (13,8)	17 (18,1)	37 (39,4)	27 (28,7)	
više od 50	17 (31,5)	15 (27,8)	12 (22,2)	10 (18,5)	<0,001
Sredina iz koje potiču					
Gradska	11 (4,8)	28 (12,2)	97 (42,2)	94 (40,9)	
Prigradska*	11 (11,5)	27 (28,1)	26 (27,1)	32 (33,3)	
Seoska*	18 (24,3)	8 (10,8)	12 (16,2)	36 (48.6)	<0,001
Bračni status					
Neoženjen/neudata	17 (11,6)	19 (13,0)	35 (24,0)	75 (51.4)	
U braku/ vanbračnoj zajednici	18 (7,8)	36 (15,6)	93 (40,4)	83 (36,9)	
Udovica/udovac*	3 (21,4)	5 (35,7)	2 (14,3)	4 (28,6)	
Razveden/na*	2 (20,0)	3 (30,0)	5 (50,0)	0 (0,0)	<0,001
Stepen obrazovanja					
Osnovna škola i niže*	3 (27,3)	3 (27,3)	5 (45,5)	0 (0,0)	
Srednja škola*	30 (9,6)	48 (15,4)	115 (36,9)	119 (38,1)	
Viša/Visoka škola	7 (9,1)	12 (15,6)	15 (19,5)	43 (55,8)	0,009
Radni status					
Zaposlen/na	15 (4,7)	43 (13,5)	112 (35,2)	148 (46,5)	
Nezaposlen/na	13 (27,1)	10 (20,8)	14 (29,2)	11 (22,9)	
U penziji	12 (35,3)	10 (29,4)	9 (26,5)	3 (8,8)	<0,001
Socio-ekonomsko stanje					
Vrlo loše*	6 (75,0)	2 (25,0)	0 (0,0)	0 (0,0)	
Loše*	1 (4,2)	3 (12.5)	9 (37,5)	11 (45,8)	
Prosečno	5 (10,4)	12 (25,0)	16 (33,3)	15 (31,2)	
Dobro	22 (9,8)	18 (8,0)	86 (38,4)	98 (43,7)	
Vrlo dobro	6 (6,2)	28 (29,2)	24 (25,0)	38 (39,6)	0,125
Subjektivna procena zdravstvenog stanja					
Veoma dobro*	2 (2,6)	19 (25,0)	29 (38,2)	26 (34,2)	
Dobro*	4 (2,7)	10 (6,8)	47 (32,2)	85 (58,2)	
Prosečno	11 (10,6)	12 (11,5)	43 (41,3)	38 (36,5)	
Loše	11 (19,6)	19 (33,9)	14 (25,0)	12 (21,4)	
Veoma loše	12 (66,7)	3 (16,7)	2 (11,1)	1 (5.5)	<0,001
Postojanje hronične bolesti					
Da	13 (17,6)	23 (31,1)	19 (25,7)	19 (25,7)	
Ne	27 (8,3)	40 (12,3)	116 (35,6)	143 (43,9)	<0,001

*spojene kategorije pri izračunavanju p vrednosti korišćenjem hi kvadrat testa

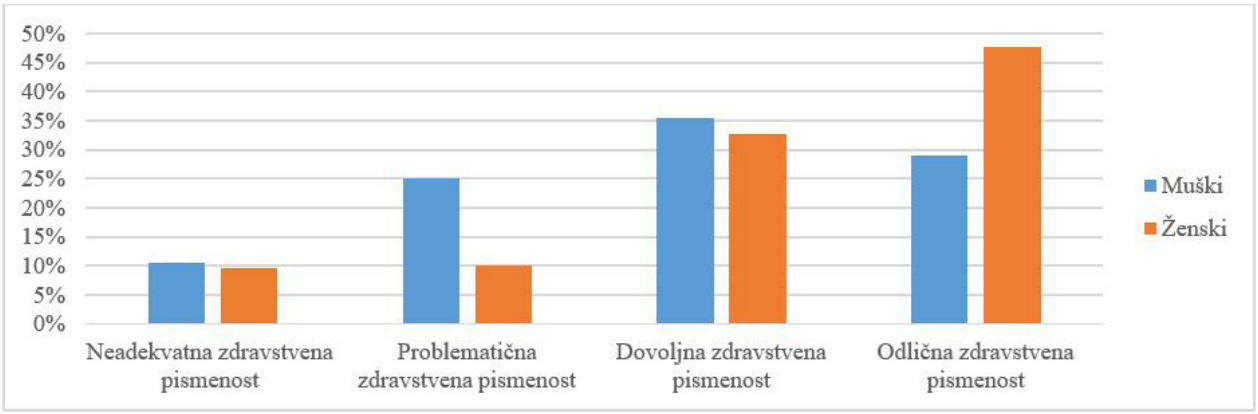
Table 2. Socio-demographic characteristics of adults who receive their health care at the Pirot Health Center in relation to the level of health literacy

Characteristics of respondents	Inadequate health literacy N (%)	Problematic health literacy N (%)	Sufficient health literacy N (%)	Excellent health literacy N (%)	p value
Gender					
Male	16 (10.5)	38 (25.0)	54 (35.5)	44 (28.9)	
Female	24 (9.7)	25 (10.1)	81 (32.7)	118 (47.6)	<0.001
Age (years)					
20-29*	3 (2.9)	9 (8.6)	36 (34.6)	56 (53.8)	
30-39*	7 (4.7)	22 (14.9)	50 (33.8)	69 (46.6)	
40-49	13 (13.8)	17 (18.1)	37 (39.4)	27 (28.7)	
Older than 50	17 (31.5)	15 (27.8)	12 (22.2)	10 (18.5)	<0.001
Environment in which they live					
City	11 (4.8)	28 (12.2)	97 (42.2)	94 (40.9)	
Suburban*	11 (11.5)	27 (28.1)	26 (27.1)	32 (33.3)	
Rural*	18 (24.3)	8 (10.8)	12 (16.2)	36 (48.6)	<0.001
Marital status					
Single	17 (11.6)	19 (13.0)	35 (24.0)	75 (51.4)	
Married/in cohabitation	18 (7.8)	36 (15.6)	93 (40.4)	83 (36.9)	
Widow/widower*	3 (21.4)	5 (35.7)	2 (14.3)	4 (28.6)	
Divorced*	2 (20.0)	3 (30.0)	5 (50.0)	0 (0.0)	<0.001
Level of education					
Primary school and lower*	3 (27.3)	3 (27.3)	5 (45.5)	0 (0.0)	
Secondary school*	30 (9.6)	48 (15.4)	115 (36.9)	119 (38.1)	
College/Faculty	7 (9.1)	12 (15.6)	15 (19.5)	43 (55.8)	0.009
Working status					
Employed	15 (4.7)	43 (13.5)	112 (35.2)	148 (46.5)	
Unemployed	13 (27.1)	10 (20.8)	14 (29.2)	11 (22.9)	
Retired	12 (35.3)	10 (29.4)	9 (26.5)	3 (8.8)	<0.001
Socio-economic state					
Very bad*	6 (75.0)	2 (25.0)	0 (0.0)	0 (0.0)	
Bad*	1 (4.2)	3 (12.5)	9 (37.5)	11 (45.8)	
Average	5 (10.4)	12 (25.0)	16 (33.3)	15 (31.2)	
Good	22 (9.8)	18 (8.0)	86 (38.4)	98 (43.7)	
Very good	6 (6.2)	28 (29.2)	24 (25.0)	38 (39.6)	0.125
Subjective assessment of health condition					
Very good*	2 (2.6)	19 (25.0)	29 (38.2)	26 (34.2)	
Good*	4 (2.7)	10 (6.8)	47 (32.2)	85 (58.2)	
Average	11 (10.6)	12 (11.5)	43 (41.3)	38 (36.5)	
Poor	11 (19.6)	19 (33.9)	14 (25.0)	12 (21.4)	
Very poor	12 (66.7)	3 (16.7)	2 (11.1)	1 (5.5)	<0.001
Existence of chronic disease					
Yes	13 (17.6)	23 (31.1)	19 (25.7)	19 (25.7)	
No	27 (8.3)	40 (12.3)	116 (35.6)	143 (43.9)	<0.001

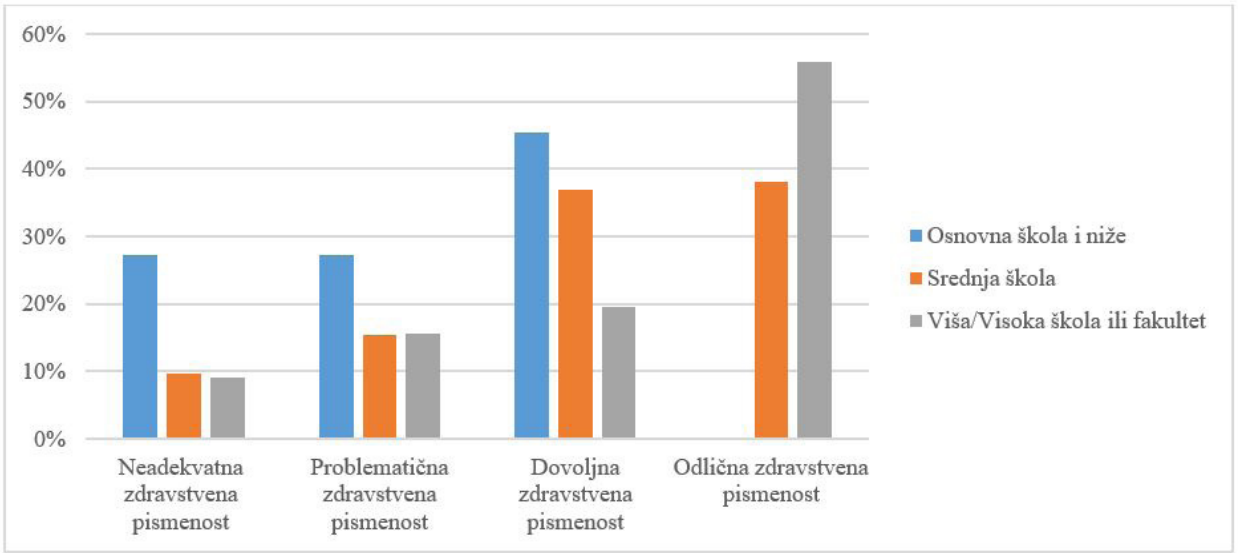
*joint categories when calculating p value using chi-square test



Grafikon 1. Distribucija ispitanika u populaciji odraslih pacijenata (n=400) koji svoju zdravstvenu zaštitu ostvaruju u Domu zdravlja Pirot prema nivoou zdravstvene pismenosti u odnosu na starosnu dob



Grafikon 2. Distribucija ispitanika u populaciji odraslih pacijenata (n=400) koji svoju zdravstvenu zaštitu ostvaruju u Domu zdravlja Pirot prema nivou zdravstvene pismenosti u odnosu na pol



Grafikon 3. Distribucija ispitanika u populaciji odraslih pacijenata (n=400) koji svoju zdravstvenu zaštitu ostvaruju u Domu zdravlja Pirot prema nivoou zdravstvene pismenosti i u odnosu na obrazovni status

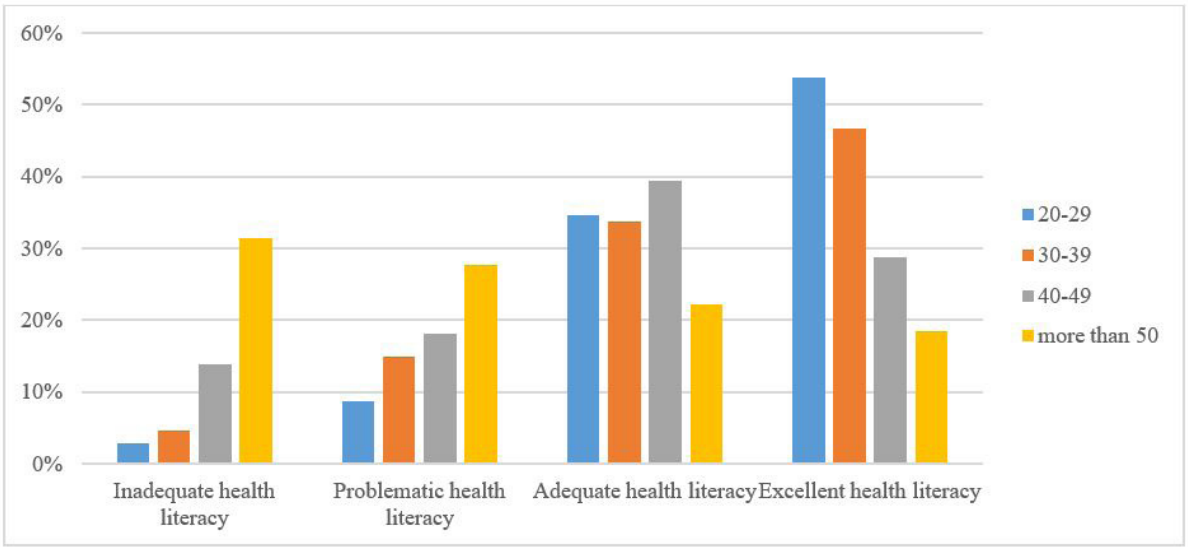


Figure 1. Distribution of respondents in a population of adult patients (n=400) who receive their health-care at the Health Center Pirot according to the level of health literacy in relation to age

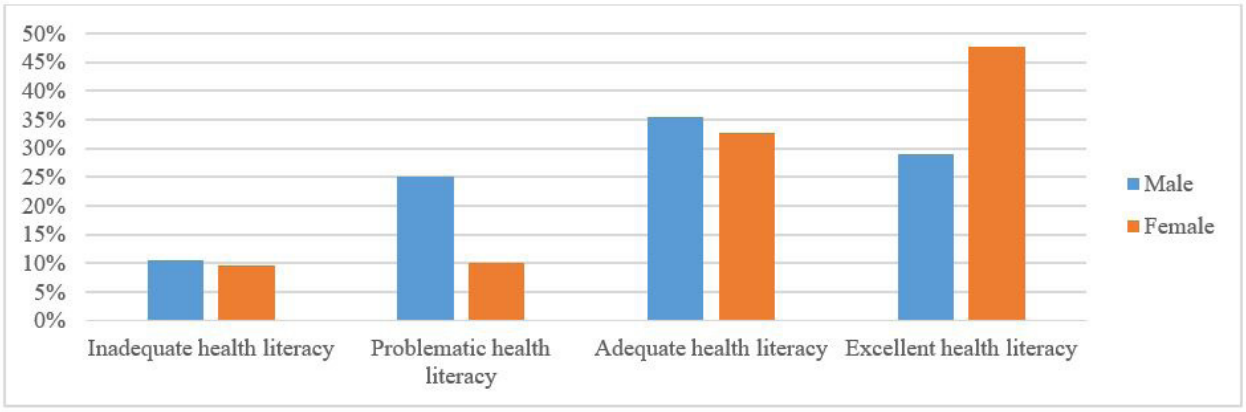


Figure 2. Distribution of respondents in a population of adult patients (n=400) who receive their health-care at the Health Center Pirot according to the level of health literacy in relation to gender

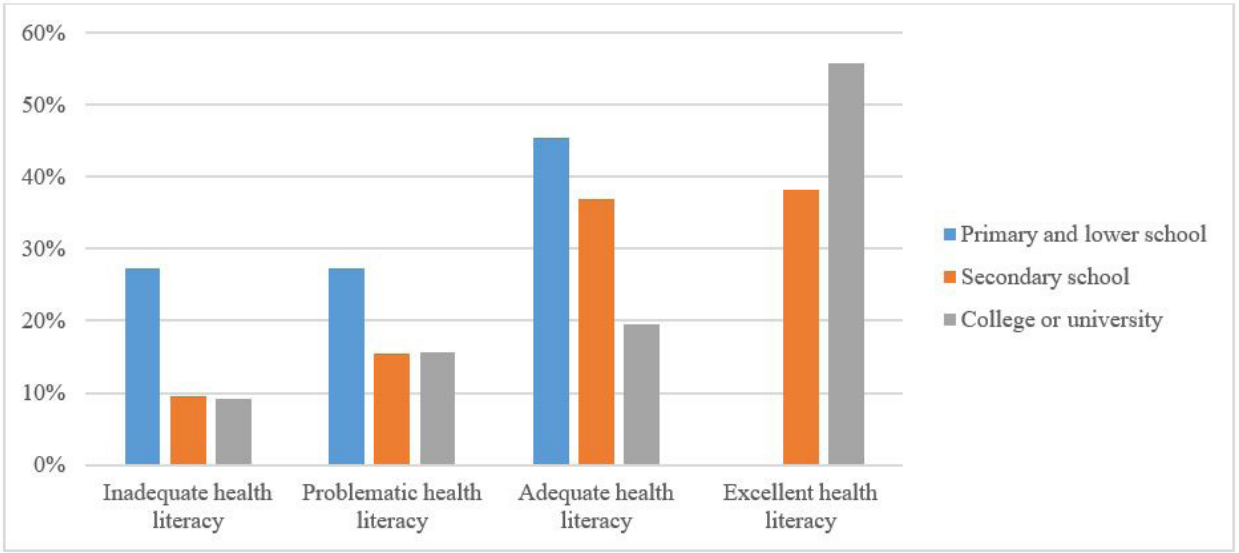
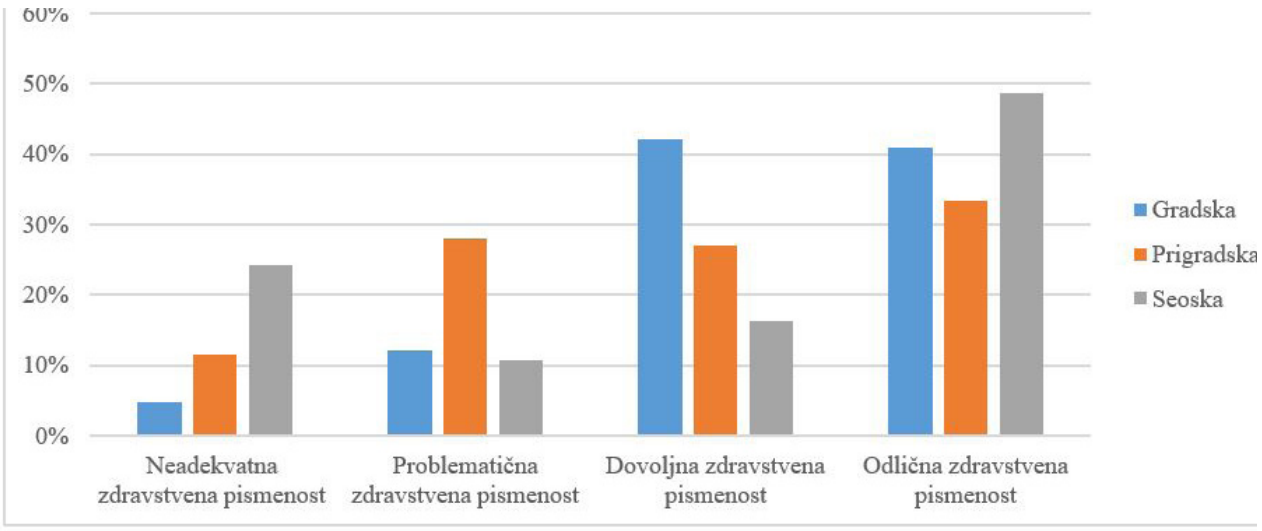
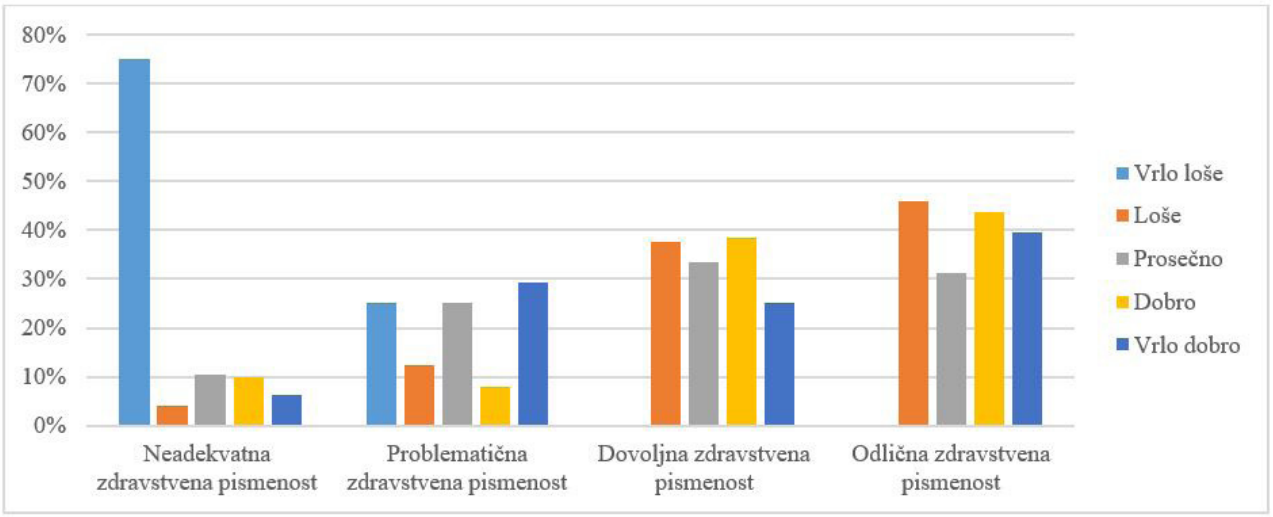


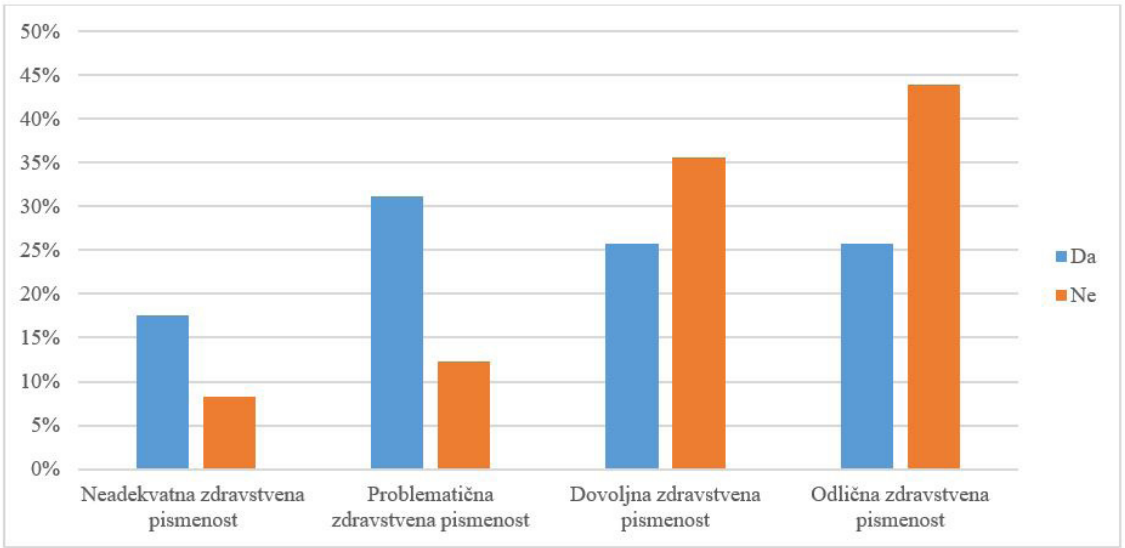
Figure 3. Distribution of respondents in a population of adult patients (n=400) who receive their health-care at the Health Center Pirot according to the level of health literacy and educational status.



Grafikon 4. Distribucija ispitanika u populaciji odraslih pacijenata (n=400) koji svoju zdravstvenu zaštitu ostvaruju u Domu zdravlja Pirot prema nivoou zdravstvene pismenosti i u odnosu na sredinu u kojoj žive



Grafikon 5. Distribucija ispitanika u populaciji odraslih pacijenata (n=400) koji svoju zdravstvenu zaštitu ostvaruju u Domu zdravlja Pirot prema nivoou zdravstvene pismenosti i u odnosu na ličnu procenu zdravlja



Grafikon 6. Distribucija ispitanika u populaciji odraslih pacijenata (n=400) koji svoju zdravstvenu zaštitu ostvaruju u Domu zdravlja Pirot prema nivoou zdravstvene pismenosti i u odnosu na prisustvo hronične bolesti

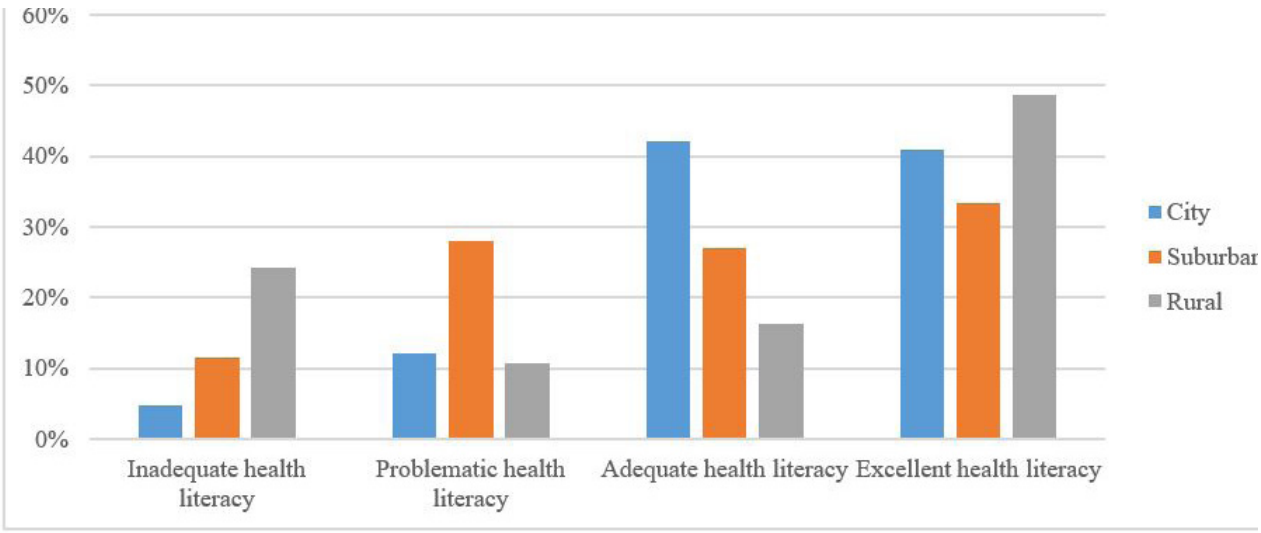


Figure 4. Distribution of respondents in a population of adult patients (n=400) who receive their health-care at the Health Center Pirot according to the level of health literacy and in relation to the environment in which they live

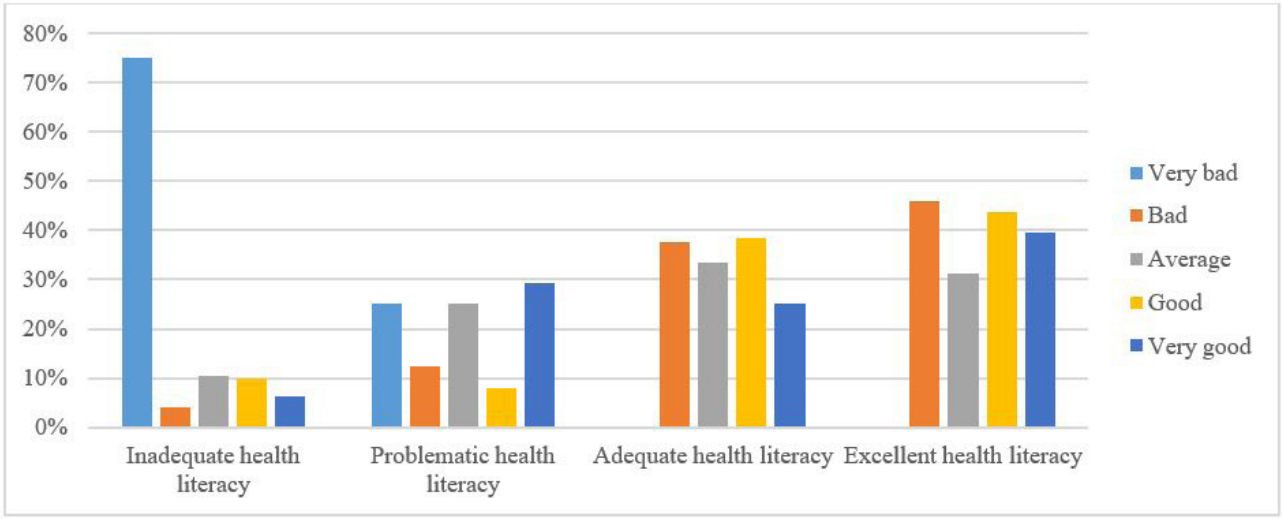


Figure 5. Distribution of respondents in a population of adult patients (n=400) who receive their healthcare at the Health Center Pirot according to the level of health literacy and health assessment

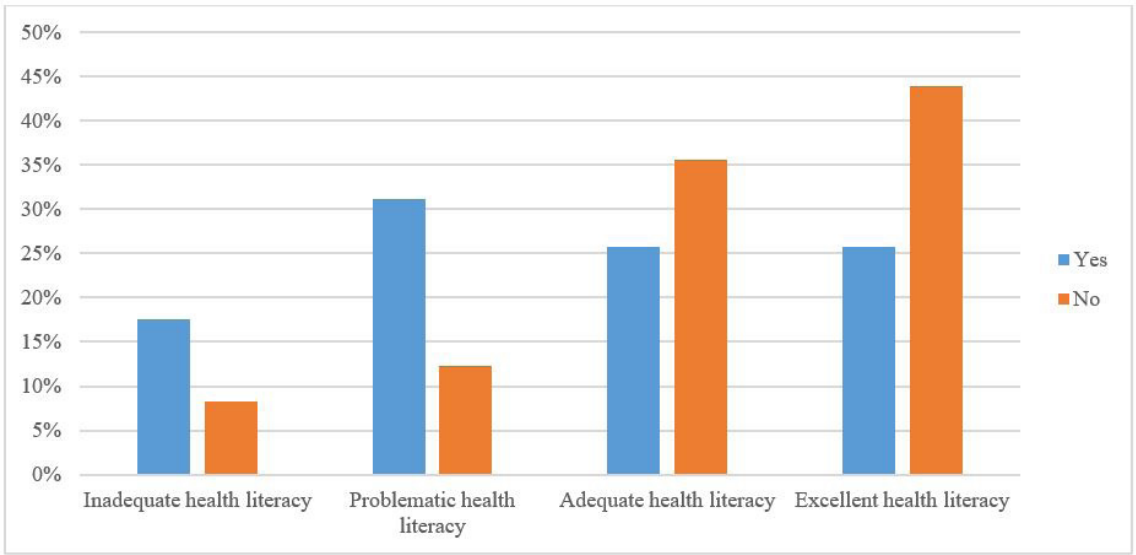


Figure 6. Distribution of respondents in the population of adult patients (n=400) who receive their health care at the Pirot Health Center according to the level of health literacy and in relation to the presence of a chronic disease

ispitanika, a 81,5% je bilo bez hroničnih oboljenja (tabela 2, grafikon 6). Dovoljna ili odlična zdravstvena pismenost je statistički značajno češće bila prisutna kod žena nego muškaraca, kod mlađih od 40 godina nego starijih od 40 godina, kod gradskog stanovništva nego lica koja žive u prigradskim i seoskim sredinama, kod lica u braku ili vanbračnoj zajednici nego kod neoženjenih/neudatih i udovaca/razvedenih, kod lica sa višom/viskom školom ili fakultetom u odnosu na niži stepen obrazovanja i kod zaposlenih nego kod nezaposlenih/penzionera. Nije uočena statitički značajna razlika u stepenu zdravstvene pismenosti u odnosu na socio-ekonomsko stanje koje su sami procenjivali ispitanici. Lica sa hroničnim bolestima, kao i lica sa subjektivnom procenom da imaju loše i veoma loše zdravstveno stanje, su značajno češće imala neodgovarajuću/problematičnu zdravstvenu pismenost nego lica sa dovoljnom/odličnom zdravstvenom pismenošću.

Diskusija

Naše istraživanje je identifikovalo socio-demografske faktore koji statistički značajno utiču na dovoljnu/odličnu zdravstvenu pismenost, poput starosti (mlađi od 40 godina), pola (žene), stepena obrazovanja (viša/visoka škola ili fakultet), mesta stanovanja (gradska sredina), bračnog statusa (život u braku/vanbračnoj zajednici) i zaposlenost (nezaposleni/penzioneri). Takođe, uočena je veza između materijalnog stanja ispitanika i njihove zdravstvene pismenosti (tj. osobe sa boljim socio-ekonomskim stanjem imale su viši nivo zdravstvene pismenosti), ali ona nije bila statistički značajna. Ovi rezultati podržavaju prethodna istraživanja i ukazuju na potrebu za ciljanim edukativnim intervencijama i zdravstvenim politikama koje će unaprediti zdravstvenu pismenost baš u identifikovanim grupama (8,9). Brojne studije, kao i naša, su ukazale da starije osobe, niže obrazovanje i loši socio-ekonomski uslovi su ključni faktori loše zdravstvene pismenosti (10-13). Međutim, neki istraživači ukazuju da lica sa istim stepenom obrazovanja mogu da pokazuju različit nivo znanja i veština, tako da ovaj indikator nije uvek dosledan pri proceni njegovog uticaja na stepen pismenosti (10,11). U mnogim istraživanjima, kao i u našem, žene imaju viši nivo zdravstvene pismenosti nego muškarci (12), što može da bude posledica činjenice da žene veću važnost pridaju zdravlju kao majke, negovateljice, učesnice različitih preventivnih programa itd. (13). Parker i saradnici (14) su ustanovili da je neadekvatna zdravstvena pismenost češće zastupljena kod stanovništva koje živi u ruralnoj sredini. Sa druge strane, neka druga istraživanja su pokazala da je niži nivo zdravstvene pismenosti prisutan kod ispitanika iz gradske sredine (1). Analizirajući Američku nacionalnu studiju, baziranu na reprezentativnom uzorku, uočava se da ne postoji značajna razlika u zdravstvenoj pismenosti ispitanika ruralnih i urbanih naselja (4). Takođe, uočava se u brojnim studijama da se zdravstvena pismenost povećava sa poboljšanjem materijalnog statusa ispitanika (4-6).

U našem istraživanju ispitanici sa nekim hroničnim oboljenjem su značajno češće imali niži nivo zdravstvene pismenosti u odnosu na one koji ga nisu imali. Takođe, ispitanici koji su svoje zdravlje samoprocenili kao veoma dobro ili odlično imali su odličan nivo zdravstvene pismenosti, a oni koji su ga procenili kao loše ili veoma loše, skoro dve trećine, imalo je neadekvatnu zdravstvenu pismenost. Istraživanje u Australiji, koje je koristilo isti merni instrument kao u našem istraživanju, je pokazalo da ispitanici koji koriste usluge državnog zdravstvenog sistema imaju daleko niži nivo zdravstvene pismenosti u odnosu na ispitanike koji su koristili usluge privatnog zdravstvenog sistema (5,15). *Jessup* i saradnici (16), objašnjavaju da je prisustvo hroničnih bolesti u korelaciji sa povećanim rizikom od različitih mentalnih poremećaja, poput pojave anksioznosti i depresije, što može doprineti smanjenu mogućnosti kontrole zdravlja i ostvarivanju lične zdravstvene zaštite (7,8,17).

Sve je veći broj istraživanja koja se bave zdravstvenom pismenošću, jer je utvrđena veza između niske učestalosti zdravstvene pismenosti i lošijeg zdravlja, neadekvatnog zdravstvenog ponašanja i sve većeg korišćenja zdravstvenih usluga (18). Takođe, sve češće se sprovode populaciona istraživanja za analizu i praćenje učestalosti javljanja nedovoljne zdravstvene pismenosti, što pomaže u kreiranju javnozdravstvenih politika i pristupanju izradi odgovarajućih strategija. Međutim, upoređivanje zdravstvene pismenosti između zemalja je otežana jer se koriste različite definicije i instrumenti za procenu zdravstvene pismenosti. Generalno, niska zdravstvena pismenost vodi da osoba ne razume svoju bolest, otežano donosi odluke, informiše se o bolesti iz nerelevatnih izvora informacija, ne može da razume kako može da unapredi svoje zdravlje itd (19,20). Brojne

levels of education, in employed persons than in unemployed/retired persons. No statistically significant difference was observed in the level of health literacy in relation to the socio-economic condition assessed by respondents themselves. Persons with chronic diseases, as well as persons with the subjective assessment of having poor or very poor health status, significantly more often had inadequate/problematic health literacy than persons with sufficient/excellent health literacy.

Discussion

Our study has identified socio-demographic factors that have a statistically significant influence on sufficient/excellent health literacy, such as age (under the age of 40), gender (female), level of education (college/faculty), place of residence (urban areas), marital status (living in marriage/cohabiting) and employment (unemployed/retired). Also, the relationship between the marital status of respondents and their health literacy was observed, but it was not statistically significant (i.e. persons with better socio-economic state had a higher level of health literacy). These results support previous research and indicate the need for targeted educational interventions and health policies that will improve health literacy in the identified groups (8,9). Numerous studies, as well as our study, indicate that older people, lower education and lower socio-economic status are key factors in poor health literacy (10-13). However, some researchers point out that persons with the same level of education can show a different level of knowledge and skills, so this indicator is not always consistent when assessing its impact on the level of literacy (10,11). In numerous studies, as well as in ours, women have a higher level of health literacy than men (12), which may be a consequence of the fact that women attach more significance to health as mothers, caregivers, participants in various preventive programs, etc. (13). Parker et al. (14) found that inadequate health literacy is more is common in the population living in rural areas. On the other hand, some other studies have shown that a lower level of health literacy is present in respondents from urban areas (1). By analyzing the American National Study, based on a representative sample, it has been observed that there is no significant difference in the health literacy of respondents from rural and urban areas (4). Also, it has been observed in numerous studies that health literacy increases with the improvement of the material status of respondents (4-6).

In our study, respondents with some chronic diseases had a lower level of health literacy significantly more often in comparison to those who did not have it. Also, respondents who self-assessed their health as very good or excellent had an excellent level of health literacy, while those who assessed it as poor or very poor, almost two-thirds, had inadequate health literacy. A study, which was conducted in Australia and in which the same measuring instrument was used as in our study, showed that respondents who used the services of the state health system had a much lower level of health literacy compared to respondents who used the services of the private health system (5,15). Jessup et al. (16) explain that the presence of chronic diseases is correlated with an increased risk of various mental disorders, such as anxiety and depression, which can contribute to a reduced ability to control health and achieve personal health care (7,8,17).

There is an increasing number of studies dealing with health literacy, because the relationship between low frequency of health literacy and poor health, inadequate health behavior and increasing use of health services has been established (18). Also, population studies are increasingly being conducted to analyze and monitor the frequency of occurrence of insufficient health literacy, which helps in creating public health policies and appropriate strategies. However, the comparison of health literacy between different countries is difficult because different definitions and instruments are used to assess health literacy. Generally, low health literacy means that a person does not understand his illness, has difficulty making decisions, gets information about the illness from irrelevant sources of information, cannot understand how he can improve his health, etc. (19,20). Numerous studies have shown that persons with chronic diseases have difficulties when coping with the disease, as well as that they use health services more often (21). Also, worse disease outcomes occur more often in them. The above mentioned is related to the lack of knowledge about the disease, about treatment and possibilities of self-care. It is necessary for health workers to identify persons with inadequate health literacy in order

studije su pokazale da lica sa hroničnim bolestima imaju teškoće u upravljanju bolešću, kao i da češće koriste zdravstvene usluge (21). Takođe, kod njih se češće javljaju lošiji ishodi bolesti. Sve navedeno se dovodi u vezu sa nedostatkom znanja osoba o samoj bolesti, lečenju i mogućnostima samozbrinjavanja. Neophodno je da zdravstveni radnici identifikuju lica sa neadekvatnom zdravstvenm pismenošću u cilju prilagođavanja komunikacije sa njima (npr. provera razumevanja datih uputstava, izbegavanje žargona i stručne terminologije itd.).

Upotreba validiranih instrumenata (alata) za procenu zdravstvene pismenosti daje dodatnu pouzdanost našim dobijenim rezultatima. Naše istraživanje ima nekoliko ograničenja. Prvo, uzorak ispitanika je pretežno obuhvatao osobe iz urbanih sredina, što može uticati na generalizaciju rezultata. Drugo, podaci o zdravstvenoj pismenosti su prikupljani putem samoprocene, što može dovesti do subjektivnih pristrasnosti. Konačno, istraživanje nije uzelo u obzir sve moguće faktore koji mogu uticati na zdravstvenu pismenost, poput kulturnih i jezičkih barijera. Dalja istraživanja u ovoj oblasti su neophodna, posebno longitudinalno praćenje zdravstvene pismenosti kako bi se bolje razumeo njen uticaj na dugoročne zdravstvene ishode. Potrebno je istražiti i efikasnost različitih intervencija usmerenih na poboljšanje zdravstvene pismenosti, posebno u grupama sa niskim socio-ekonomskim statusom i u ruralnim zajednicama.

Zaključak

Aktivnosti vezane za unapređenje zdravstvene pismenosti u Pirotu treba sprovoditi među starijima, osobama iz ruralnih sredina, koje žive same, imaju niži stepen obrazovanja i koji su nezaposleni/penzioneri. kao i među muškarcima, licima sa hroničnim bolestima i onima koji loše ili veoma loše procenjuju svoj zdravstveni status. Neophodno je kontinuirano praćenje nivoa zdravstvene pismenosti u populaciji odraslih pacijenata i ispitivati faktore koji su povezani sa zdravstvenom pismenošću, te dobijene rezultate koristiti kao osnovu za kreiranje i implementaciju aktivnosti u cilju povećanja nivoa zdravstvene pismenosti, što bi doprinelo unapređenu zdravlja.

Konflikt interesa

Autori su izjavili da nema konflikta interesa.

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to adapt communication with them (e.g. to check whether they understood given instructions, to avoid jargon and professional terminology, etc.).

The use of validated instruments (tools) for the assessment of health literacy gives additional reliability to our obtained results. Our study has several limitations. First, the sample of respondents included persons mainly from urban environments, which may affect the generalization of results. Second, data on health literacy were collected through self-assessment, which may lead to subjective bias. Finally, the study did not take into account all possible factors that may affect health literacy, such as cultural and language barriers. Further research in this field is necessary, especially longitudinal monitoring of health literacy in order to better understand its impact on long-term health outcomes. It is also necessary to investigate the efficiency of different interventions aimed at improving health literacy, especially in groups with low socio-economic status and in rural communities.

Conclusion

Activities related to the improvement of health literacy in Pirot should be carried out among the elderly, persons from rural areas, single persons, persons with lower levels of education, and among unemployed/retired, as well as among men, persons with chronic diseases and those who assess their health status as poor or very poor. It is necessary to continuously monitor the level of health literacy in the population of adult patients and examine factors related to health literacy, and use the obtained results as a basis for the creation and implementation of activities aimed at increasing the level of health literacy, which would contribute to the improvement of health.

Competing interests

The authors declared no competing interests.

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PRIMARNI ANGIOSARKOM DOJKE: PRIKAZ SLUČAJA

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SAŽETAK

Uvod/Cilj: Angiosarkom dojke je redak tumor porekla vaskularnog endotela, koji čini manje od 0,05% svih malignih tumora dojke. Cilj ovog prikaza slučaja je bio da ukaže na važnost ranog prepoznavanja i multidisciplinarnog pristupa u dijagnostici i lečenju ovog retkog entiteta.
Prikaz bolesnika: Žena životne dobi 44 godine, javila se na klinički pregled zbog tumora u desnoj dojci. Nakon mamografskog pregleda, na kom je verifikovana visoko suspektna lobulirana promena na spoju gornjih kvadranata desne dojke promera 86 × 98 mm, učinjena je biopsija širokom iglom, a potom i radikalna mastektomija. Patohistološki je verifikovan mezenhimalni tumor vaskularnog porekla. Imunohistohemijskom metodom bojenja tumor je pokazao imunoreaktivnost na Vimentin, CD31, CD34, Faktor VIII, dok su AE1/AE3, EMA, estrogen, progesteron i HER2 bili negativni. Postavljena je dijagnoza slabo diferentovanog primarnog angiosarkoma.
Zaključak: Primarni angiosarkom dojke predstavlja pravi dijagnostički izazov. Zbog izuzetne retkosti i agresivnosti tumora, od izuzetne važnosti je multidisciplinaran pristup pri dijagnostici i lečenju. S obzirom na to da su kliničke i radiološke karakteristike primarnog angiosarkoma nespecifične, a diferencijalne dijagnoze podrazumevaju spektar najčešće benignih, ali i malignih promena u dojci, histopatološka analiza je od ključnog značaja za postavljanje dijagnoze.

Ključne reči: angiosarkom dojke, imunohistohemija, mezenhimalni tumor, primarni angiosarkom

Uvod

Angiosarkom dojke je vrlo redak tumor porekla vaskularnog endotela, koji čini manje od 0,05% svih malignih tumora dojke (1,2). Na osnovu etiologije, može se klasifikovati na primarni i sekundarni angiosarkom. Primarni angiosarkom dojke javlja se sporadično, kod mlađih žena, dok su sekundarni najčešće udruženi sa radioterapijom, i javljaju se kod starijih pacijenata (3,4).

Cilj ovog prikaza slučaja je bio da ukaže na važnost ranog prepoznavanja i multidisciplinarnog pristupa u dijagnostici i lečenju ovog retkog entiteta.

Prikaz bolesnika

Pacijentkinja životne dobi 44 godine, javila se na klinički pregled zbog palpabilne mase u desnoj dojci. Dostupna medicinska dokumentacija pacijentkinje i anamnestički podaci ne upućuju na lečenje ili prisustvo maligniteta, niti naslednih oboljenja u porodici. Pre 7 godina bila je podvrgnuta eksciziji tumorske promene u levoj dojci, kada je histopatološki potvrđena dijagnoza fibroadenoma. Kliničkim pregledom nije utvrđeno prisustvo promena na koži, kao ni retrakcija bradavice i limfadenopatija.

Nakon mamografskog pregleda, na kom je na spoju gornjih kvadranata desne dojke verifikovana visoko suspektna tumorska promena lobulirane građe, promera 86 × 98 mm, učinjena je biopsija širokom iglom. Patohistološki izveštaj je na osnovu histomorfologije i imunohistohemijskog bojenja pokazao da se radi o mezenhimalnom tumoru vaskularnog porekla. Primenjena imunohistohemijska metoda pokazala je imunoreaktivnost na CD31,

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CASE REPORT

PRIMARY ANGIOSARCOMA OF THE BREAST: A CASE REPORT

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SUMMARY

Background/Aim: Breast angiosarcoma is a rare tumour of vascular endothelium origin, accounting for less than 0.05% of all breast malignancies. The aim of this case report was to point out the importance of early recognition and a multidisciplinary approach in the diagnosis and treatment of this rare entity.
Case report: A 44-year-old woman presented for a clinical examination due to a tumour in her right breast. After a mammographic examination, which verified a highly suspicious lobular change at the junction of the upper quadrant of the right breast with a diameter of 86 × 98 mm, a biopsy with a core needle was performed, followed by a radical mastectomy. Pathohistologically, a vascular mesenchymal tumor was verified. Using the immunohistochemical staining method, the tumor showed immunoreactivity to Vimentin, CD31, CD34, and Factor VIII, while AE1/AE3, EMA, estrogen, progesterone, and HER2 were negative, and the diagnosis of poorly differentiated primary angiosarcoma was made.
Conclusion: Primary breast angiosarcoma represents a real diagnostic challenge. Due to the tumor's rarity and aggressiveness, a multidisciplinary approach to diagnosis and treatment is essential. Because of the nonspecific clinical and radiographic features of primary angiosarcoma, differential diagnoses encompass both benign and malignant breast conditions. Therefore, histopathological analysis is crucial for accurate diagnosis.

Keywords: Breast angiosarcoma, Immunohistochemistry, Mesenchymal tumours, Primary angiosarcoma

Introduction

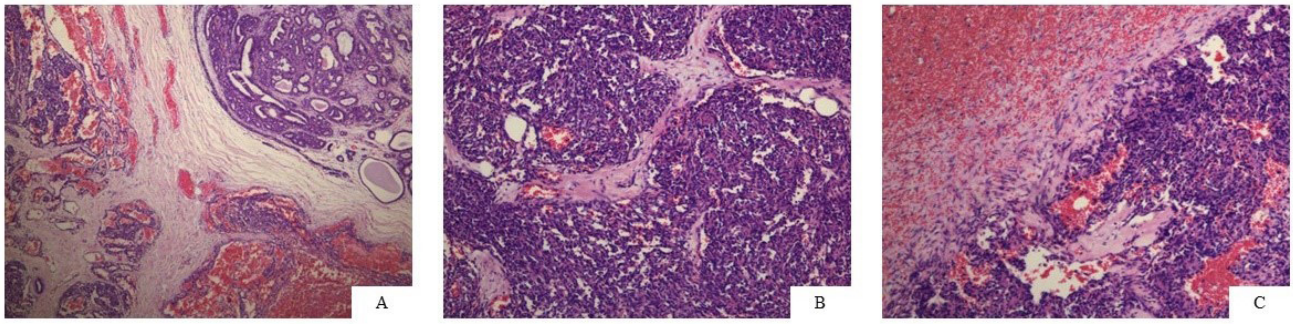
Breast angiosarcoma is a very rare tumor of vascular endothelium accounting for less than 0.05% of all breast malignancies (1,2). Based on its etiology, it can be classified into primary and secondary angiosarcoma. Primary breast angiosarcoma occurs sporadically, in younger women, while secondary is most often associated with radiation therapy, and it occurs in older patients (3,4).

The aim of this case report was to point out the importance of early recognition and a multidisciplinary approach in the diagnosis and treatment of this rare entity.

Case report

A 44-year-old female patient presented for a clinical examination due to a palpable mass in the right breast. The available medical documentation of the patient and anamnestic data did not indicate the treatment or presence of malignancies and hereditary diseases in the family. She underwent the excision of a tumor change in the left breast seven years ago, when the diagnosis of fibroadenoma was confirmed histopathologically. The clinical examination did not reveal the presence of skin changes or nipple retraction and lymphadenopathy.

After a mammographic examination, which verified a highly suspicious lobular tumor change with a diameter of 86 x 98 mm at the junction of upper quadrants of the right breast, a core needle biopsy was performed. The pathohistological report, based on histomorphology and immunohistochemical staining, showed that it was a vascular mesenchymal tumor. The



Slika 1. Mikrofotografije angiosarcoma u uklonjenom tkivu dojke:
A) U gorenjem desnom uglu slike prisutno tkivo dojke benignih karakteristika, dok se u preostalim delovima slike uočava tumorsko tkivo koga čine prošireni vaskularni kanali (bojenje hematoksilinom i eozinom, x40);
B) Prisutni solidni delovi tumora sa papilarnim formacijama endotelnih ćelija i izraženom atipijom (bojenje hematoksilinom i eozinom, x100);
C) Fokalno prisustvo solidnih delovi sa poljem krvarenja (bojenje hematoksilinom i eozinom, x400)

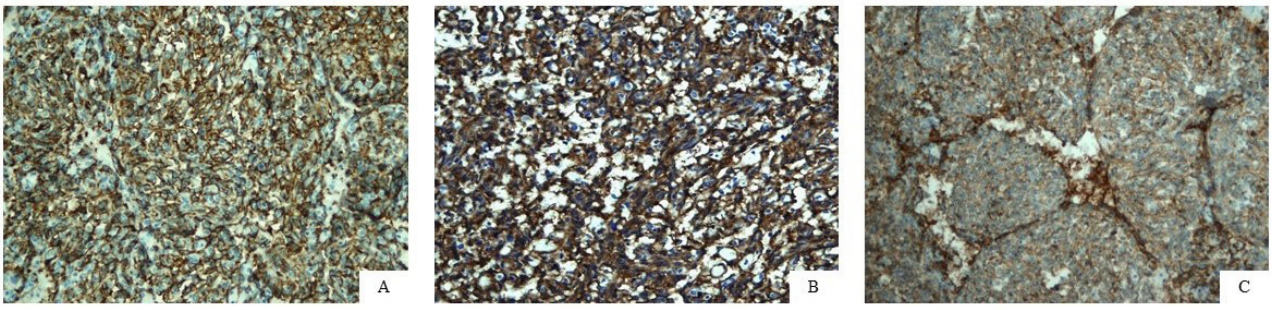
CD34, Faktor VIII, Vimentin, i fokalno Aktin, dok su CKAE/AE3, CK7, CK5/6, LCA, EMA, S100, p63, Calponin, CD10, estrogen, progesteron i HER2 bili negativni.

Urađena je radikalna mastektomija desne dojke. Na serijskim presecima, makroskopski, uočen je jasno ograničen tumor promera 120 × 70 × 45 mm, braonkaste boje, delom hemoragičan, mekše konzistencije. Patohistološki je verifikovan mezenhimalni tumor, koga čine prošireni vaskularni kanali, papilarne formacije endotelnih ćelija, sa izraženom atipijom i brojnim mitozama, uz fokalno prisustvo solidnih delova sa poljima nekroze i krvarenja (slika 1). Imunohistohemijskom metodom bojenja tumor je pokazao imunoreaktivnost na CD31, CD34, Faktor VIII i Vimentin, dok su AE1/AE3, EMA, estrogen, progesteron i HER2 bili negativni (slika 2). C-myc je pokazao nespecifično bojenje. Ekspresija ćelijskog proliferativnog indeksa, Ki67, je bila oko 25 %. Postavljena je dijagnoza umereno diferentovanog primarnog angiosarkoma visokog gradusa. Zahvaćenost limfnih čvorova nije bila prisutna.

Pacijentkinji je indikovana sistemska mono hemoterapija sa adriamicinom.

Diskusija

Angiosarkom je redak tumor, karakterističan po svom agresivnom ponašanju, lošoj prognozi i visokom malignom potencijalu (2). Može se javiti u svim organima, i čini oko 8% svih sarkoma koji nastaju u tkivu dojke (5). Dojka predstavlja jednu od češćih lokalizacija za primarni angiosarkom, koji se najčešće dijagnostikuje kod žena životne dobi od 30 do 40 godina (5,6). Dok se sekundarni angiosarkom češće javlja kod starijih pacijentkinja životne dobi preko 60 godina, koje su prethodno bile podvrgnute konzervativnoj terapiji praćenoj radioterapijom (7). *Yin* i saradnici su pokazali da se primarni angiosarkom dojke visokog gradusa znatno češće javlja u mlađem uzrastu, u odnosu na primarni angiosarkom srednjeg i niskog gradusa (3).



Slika 2. Mikrofotografije imunohistohemijske metode bojenje. Tumorske ćelije pokazuju:
A) CD31 pozitivnost (imunohistohemijsko bojenje, x200);
B) CD34 pozitivnost (imunohistohemijsko bojenje, x200);
C) Pozitivnost na FVIII, (imunohistohemijsko bojenje, x200).

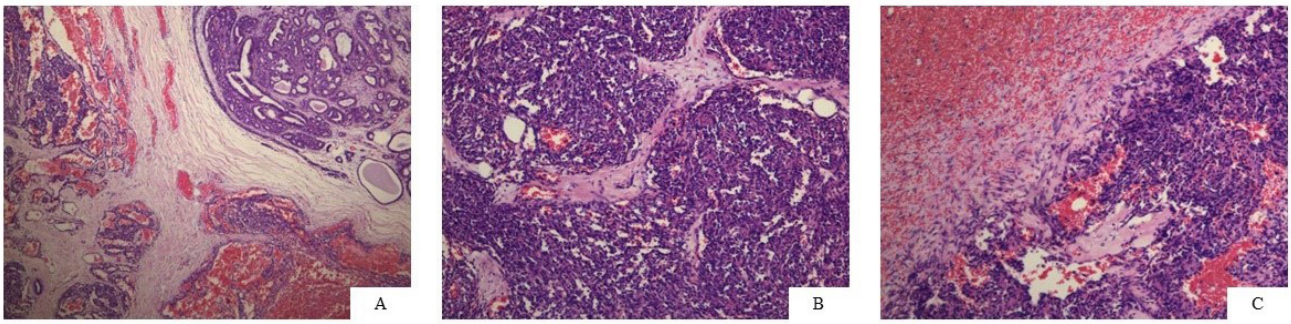


Figure 1. Microphotographs showing angiosarcoma in excised breast tissue.
A) Breast tissue with benign features is present in the top right corner of the picture. In contrast, cancer tissue consisting of dilated vascular channels is seen in the rest of the image (hematoxylin and eosin staining, x40);
B) Solid tumour portions with endothelial cell papillary forms and atypia (haematoxylin and eosin staining, x100);
C) Solid tumour parts with a lake of haemorrhage (haematoxylin and eosin staining, x400).

applied immunohistochemical method showed immunoreactivity to CD31, CD34, Factor VIII, Vimentin and focally Actin, while CKAE/AE3, CK7, CK 5/6, LCA, EMA, S100, p63, Calponin, CD10, estrogen, progesterone and HER2 were negative.

A radical mastectomy of the right breast was performed. In serial sections, macroscopically, a clearly demarcated tumor with a diameter of 120 x 70 x 45 mm, brownish in color, partly hemorrhagic, with softer consistency, was observed. Pathohistologically, a mesenchymal tumor was verified, consisting of dilated vascular channels, endothelial cell papillary forms, with pronounced atypia and numerous mitoses, with the focal presence of solid parts with a lake of necrosis and hemorrhage (Figure 1). Using the immunohistochemical staining method, the tumor showed immunoreactivity to CD31, CD34, Factor VIII and Vimentin, while AE1/AE3, estrogen, progesterone and HER2 were negative (Figure 2). C-myc showed non-specific staining. The expression of the cell proliferative index, Ki67, was around 25%. The diagnosis of poorly differentiated high-grade primary angiosarcoma was made. Lymph nodes were not involved.

Systemic mono chemotherapy with adriamycin was indicated for the patient.

Discussion

Angiosarcoma is a rare tumor, which is characterized by its aggressive behavior, poor prognosis and high malignant potential (2). It can occur in all organs, and it represents about 8% of all sarcomas that develop in the breast tissue (5). The breast is one of common localizations for primary angiosarcoma, which is most often diagnosed in women aged 30 to 40 years (5,6). However, secondary angiosarcoma occurs more often in patients older than 60 years, who were previously treated using conservative therapy followed by radiation therapy (7). Yin et al. showed that high-grade primary breast angiosarcoma

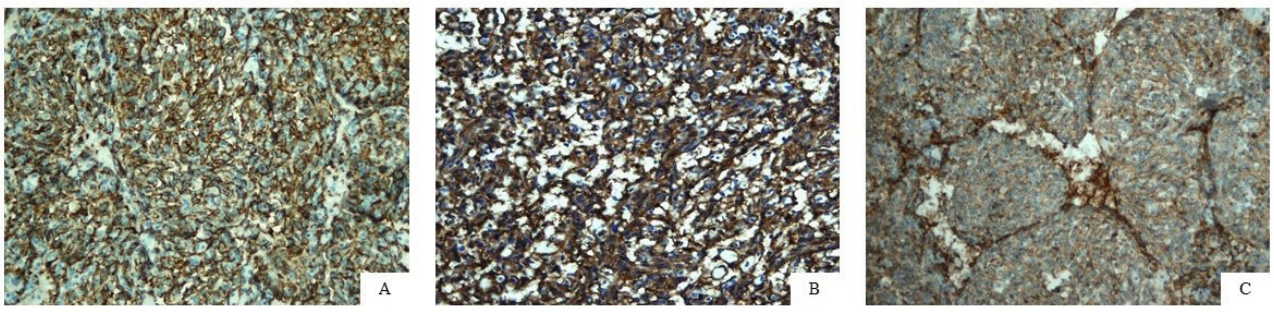


Figure 2. Microphotographs of immunohistochemical staining. Tumour cells show:
A) CD31 positivity (immunohistochemical staining, x200);
B) CD34 positivity (immunohistochemical staining, x200);
C) FVIII positivity, (immunohistochemical staining, x200).

Klinički se ispoljava kao bezbolna masa, koju karakteriše brz rast i retka povezanost sa plavičastom promenom boje kože (8). Retrakcija bradavice, kao i iscedak iz bradavice, obično izostaju (1). *Zellek* i saradnici pokazali su da je veličina tumora u korelaciji sa desetogodišnjom stopom preživljavanja bez recidiva, a da je prognoza posebno nepovoljna kada je dijametar tumora veći od 10 cm(6). Trombocitopenija i hemoragijske manifestacije, kao što je *Kazbah-Merit* sindrom, mogu se javiti kod velikih tumora (9). U studiji *Tian* i saradnika, pokazano je da se primarni angiosarkom dojke češće javlja u levoj dojci (10). Mamografski tumor pokazuje najčešće masu bez kalcifikacija ili fokalnu asimetriju, a sonografski može biti varijabilnih ehogenosti (5). Uprkos visokom malignitetu, zahvaćenost limfnih čvorova je veoma retka (11).

Prema histološkoj slici može se podeliti u tri tipa: angiosarkom niskog gradusa, sa definisanim vaskularnim kanalima, kod koga su papilarne endotelne ćelije i mitoze retke, srednjeg gradusa, sa papilarnim formacijama endotelnih ćelija i solidnim delovima, i visokog gradusa sa vretenastim ćelijama, fokusima nekroze i krvarenja i izraženim mitozama (12). Imunohistohemijska metoda bojenja igra važnu ulogu u postavljanju dijagnoze angiosarkoma dojke. Odsustvo imunoreaktivnosti citokeratinskih markera i pozitivna imunoreaktivnost endotelnih markera, kao što su CD31, CD34 i Faktor VIII, koji ukazuju na endotelno poreklo tumora, karakteristično je kod angiosarkoma, što je potvrđeno i kod naše pacijentkinje (13). CD34 predstavlja specifični marker endotelne diferencijacije, dok je CD31 senzitivniji, međutim oba markera takođe pokazuju pozitivnu imunoreaktivnost i u drugim lezijama (6). Angiosarkomi pokazuju invazivne karakteristike, sa visokom stopom mitoza i visokim indeksom ćelijskog proliferativnog indeksa, Ki67 (14). Prognostički faktori kao što su veličina tumora, stepen diferencijacije i stadijum bolesti od ključnog su značaja za određivanje ishoda (9).

Uprkos činjenici da je biopsija širokom iglom postala zlatni standard u dijagnostici tumora dojke, u slučajevima u kojima preko 90% tumora čine fokusi nekroze i krvarenja, ova metoda je ograničavajuća u dobijanju reprezentativnih uzoraka (3). Preoperativna dijagnoza angiosarkoma širokom iglom, takođe je otežana i nedovoljnom količinom adekvatnog uzorka. I pored toga dijagnoza primarnog angiosarkoma predstavlja izazov, s obzirom da diferencijalne dijagnoze podrazumevaju spektar najčešće benignih vaskularnih lezija, poput atipične vaskularne proliferacije, angiomatoze, angiolipoma ili hemangioma, ali i malignih promena u dojci (1).

Terapiju izbora predstavlja totalna mastektomija (2,4). Mnogi smatraju da konzervativna terapija nije dobar izbor za primarni angiosarkom dojke, jer je stopa recidiva nakon mastektomije 8%, a nakon široke ekscizije 23% (1). Iako je pronađena korelacija hemoterapije sa ukupnim preživljavanjem i preživljavanjem bez recidiva za slabodiferentovane angiosarkome, uloga radioterapije i hemoterapije i dalje ostaje kontroverzna (1,15). Imajući u vidu njegovu lošu prognozu, primarni angiosarkom dojke zahteva ranu dijagnozu i brzo lečenje. Stoga su preventivni pregledi u dijagnostici oboljenja dojki od izuzetnog značaja za njihovo rano otkrivanje, pravovremeno i efikasno lečenje.

Zaključak

Primarni angiosarkom dojke predstavlja pravi dijagnostički izazov. Zbog izuzetne retkosti i agresivnosti tumora od izuzetne važnosti je multidisciplinaran pristup dijagnostici i lečenju. S obzirom da su kliničke i radiološke karakteristike primarnog angiosarkoma nespecifične, histopatološka analiza je od ključnog značaja za postavljanje dijagnoze ovog retkog entiteta. Edukacija i podizanje svesti jedni su od ključnih događaja u ranijem otkrivanju bolesti i boljem ishodu lečenja.

Konflikt interesa

Autori su izjavili da nema konflikta interesa.

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occurs significantly more often at a younger age, in comparison to intermediate- and low-grade primary angiosarcoma (3).

Clinically, it manifests itself as a painless mass, characterized by rapid growth and rare association with bluish skin discoloration (8). Nipple retraction and nipple discharge are usually absent (1). Zellek et al. showed that the size of the tumor is correlated with the ten-year survival rate without recurrence, and that the prognosis is particularly unfavorable when the diameter of the tumor is greater than 10 cm (6). Thrombocytopenia and hemorrhagic manifestations, such as Kasabach-Merritt syndrome, can occur in large tumors (9). In a study by Tian et al, it was shown that primary breast angiosarcoma occurs more frequently in the left breast (10). Mammography usually shows a tumor mass without calcifications or focal asymmetry, while on ultrasonography it can have mixed echogenicity (5). Despite its high malignancy, the involvement of lymph nodes is very rare (11).

According to the histological picture, it can be divided into three types: low-grade angiosarcoma, with defined vascular channels, in which papillary endothelial cells and mitoses are rare, intermediate-grade angiosarcoma, with endothelial cell papillary forms and solid parts, and high-grade angiosarcoma, with spindle cells, foci of necrosis and hemorrhage and readily identifiable mitoses (12). The immunohistochemical staining method plays an important role in the diagnosis of breast angiosarcoma. The absence of immunoreactivity of cytokeratin markers and positive immunoreactivity of endothelial markers, such as CD31, CD34, Factor VIII, which indicate the endothelial origin of the tumor, is characteristic of angiosarcoma, which was also confirmed in our patient (13). CD34 is a specific marker of endothelial differentiation, while CD31 is more sensitive; however, both markers also show positive immunoreactivity in other lesions (6). Angiosarcomas show invasive characteristics, with a high mitotic rate and a high cell proliferative index, Ki67 (14). Prognostic factors such as the size of the tumor, degree of differentiation, and stage of the disease are of key importance in determining the outcome (9).

Despite the fact that a core needle biopsy has become the gold standard in the diagnosis of breast cancer, in cases where over 90% of the tumor consists of foci of necrosis and hemorrhage, this method has limitations in obtaining representative samples (3). The preoperative diagnosis of angiosarcoma with a wide needle is also difficult due to the insufficient amount of adequate sample. Besides this, the diagnosis of angiosarcoma represents a challenge because differential diagnoses most frequently include the spectrum of benign vascular lesions, such as atypical vascular proliferation, angiomatosis, angiolipoma or hemangioma, as well as malignant changes in the breast (1).

The radical mastectomy is the mainstay of treatment (2,4). Many believe that conservative therapy is not a good choice for primary breast angiosarcoma, because the recurrence rate after mastectomy is 8%, and after wide excision 23% (1). Although the correlation between chemotherapy and overall survival without recurrence has been found for poorly differentiated angiosarcomas, the role of radiation therapy and chemotherapy still remains controversial (1,15). Having in mind its poor prognosis, primary angiosarcoma requires early detection and prompt treatment. Therefore, preventive examinations in the diagnosis of breast diseases are extremely important for their early detection, timely and effective treatment.

Conclusion

Primary breast angiosarcoma represents a real diagnostic challenge. Due to its extreme rarity and aggressiveness, a multidisciplinary approach to diagnosis and treatment is extremely important. Considering that the clinical and radiological characteristics of primary angiosarcoma are non-specific, the histopathological analysis is of key importance for the diagnosis of this rare entity. Education and raising awareness are crucial for early disease detection and better treatment outcomes.

Competing interests

The author declared no competing interests.

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PREDNOSTI I NEDOSTACI RENDGENSKE DIJAGNOSTIKE ZA OBOLELE OD VELIKOG KAŠLJA

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SAŽETAK

Svetska zdravstvena organizacija opisuje veliki kašalj kao „izuzetno zaraznu bolest respiratornog trakta koju uzrokuje *Bordetella pertussis*“, mikroorganizam specifično patogen za ljude. Veliki kašalj pogađa sve uzraste, posebno decu, i jedan je od vodećih uzroka smrti kod dece mlađe od jedne godine. Inkubacija obično traje 7 do 10 dana, a klinička slika zavisi od uzrasta i vakcinalnog statusa. Dijagnoza velikog kašlja često predstavlja izazov zbog simptoma koji su slični onima kod drugih respiratornih infekcija. Kod odraslih obično bolest prolazi asimptomatski ili se javlja blaga simptomatska infekcija, posebno kod starijih koji su prethodno vakcinisani. Međutim, kod dece mlađe od 5 godina, posebno odojčadi, je teža klinička slika u vidu paroksizmalnog kašlja, koji može biti praćen karakterističnim vizingom ili inspiratornim hukom i izbacivanjem male količine lepljive sluzi, a može da dođe i do pojave dispneje, cijanoze i apneje. Komplikacija koja se najčešće javlja kod nevakcinisane dece je bronhopneumonija. U cilju dijagnostikovanja bolesti, pored specifične kliničke slike, najčešće se koristi bris ili aspirat nazofaringsa za PCR testiranje ili kultivaciju bakterije i krv za serološke analize. Rendgenski snimak pluća kod lica sa sumnjom na veliki kašalj može imati značajnu ulogu u proceni komplikacija i diferencijalnoj dijagnozi, a kod mlađih od četiri godine i za olakšavanje postavljanja dijagnoze. Međutim, nedostaci rendgenskog snimanja pluća su napadi kašlja prilikom snimanja, nemogućnost otkrivanja bolesti u ranom stadijumu, izlaganja pacijenta jonizujućem zračenju i greške u interpretaciji snimaka.

Ključne reči: dijagnoza, rendgen pluća, veliki kašalj, komplikacije, diferencijalna dijagnoza

Uvod

Pertusis, poznat i kao veliki kašalj ili „kašalj od 100 dana“, prvi put je opisan u pariskoj epidemiji 1578. Uzročnik, *Bordetella pertussis*, otkriven je 1908. godine, a prva vakcina je licencirana 1914. godine, ali bez rutinske upotrebe sve do 1949. godine (1). U našoj zemlji je od 1960. godine započeto sa sprovođenjem rutinske vakcinacije protiv pertusisa korpuskularnom vakcinom, a od 2015. godine acelularnom vakcinom. Bez mogućnosti vakcinacije, pertusis je bio glavni uzrok obolevanja i umiranja novorođenčadi (2).

Bordetella pertussis je gram negativan kokobacil koji se vezuje za cilijarne nastavke respiratornih epitelnih ćelija. Lokalne inflamatorne promene se javljaju u sluzokoži respiratornog trakta. Oslobađaju se toksini (pertusisni toksin, dermonekrotični toksin, adenilat ciklazni toksin i trahealni citotoksin) koji deluju lokalno i sistemski, iako sam uzročnik ne prodire potpuno u respiratorni trakt i gotovo nikada se ne nalazi u hemokulturi (3). Iako je veliki kašalj bolest za koju postoji vakcina, bolest se održava endemski u svim zemljama sveta, a epidemijski se javlja na svake dve do pet godina (3). Danas se ponovo susrećemo sa sve većim brojem obolelih. Nevakcinisani i nepravovremeno vakcinisani, kao i relativno kratko trajanje imuniteta posle vakcinacije, doprinose povećanju broja slučajeva velikog kašlja u populaciji (4).

Dijagnoza velikog kašlja često predstavlja izazov zbog simptoma koji su slični onima kod drugih respiratornih infekcija. Osim toga simptomi i znaci pertusisa se razlikuju u zavisnosti od

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ADVANTAGES AND DISADVANTAGES OF X-RAY DIAGNOSIS FOR WHOOPING COUGH PATIENTS

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SUMMARY

The World Health Organization describes whooping cough as "a highly contagious disease of the respiratory tract caused by *Bordetella pertussis*," a microorganism specifically pathogenic to humans. Whooping cough affects all ages, especially children, and is one of the leading causes of death in children under one year of age. Incubation usually lasts 7 to 10 days, and the clinical picture depends on age and vaccination status. Whooping cough is often a challenge because of symptoms that are similar to those of other respiratory infections. In adults, the disease is usually asymptomatic or mild symptomatic infection occurs, especially in the elderly who have been previously vaccinated. However, in children under 5 years of age, especially infants, the clinical picture is more severe. It is in the form of paroxysmal cough, which may be accompanied by characteristic wheezing or inspiratory whooping and vomiting or expelling a small amount of sticky mucus. Dyspnea, cyanosis and apnea can also occur, especially in infants. The most common complication in unvaccinated children is bronchopneumonia. In order to diagnose the disease, in addition to the specific clinical picture, a nasopharyngeal swab or aspirate is most often used for PCR testing or bacterial cultivation and blood for serological analyses. X-ray of the lungs in persons with suspicion of whooping cough can play a significant role in the assessment of complications and differential diagnosis, and in children under four years of age, also in establishing the diagnosis. However, during chest X-ray imaging, coughing attacks during imaging, inability to detect the disease in the early stages, exposure of the patient to ionizing radiation, and errors in the interpretation of images may occure.

Key words: diagnosis, lung X-ray, whooping cough, complications, differential diagnosis

Introduction

Pertussis, also known as whooping cough or “the cough of 100 days“, was first described in the Paris epidemic in 1578. The causative agent, *Bordetella pertussis*, was discovered in 1908 and the first vaccine was licensed in 1914, but it was not routinely used until 1949 (1). In our country, routine vaccination against pertussis began in 1960 with corpuscular vaccine, while the acellular vaccine has been used since 2015. Since there was no possibility of vaccination, pertussis was the main cause of infant morbidity and mortality (2).

Bordetella pertussis is a gram-negative coccobacillus that adheres to the ciliated respiratory epithelial cells. Local inflammatory changes occur in the mucosal lining of the respiratory tract. Released toxins (pertussis toxin, dermonecrotic toxin, adenylate cyclase toxin and tracheal cytotoxin) act locally and systemically, although the causative organism itself does not fully penetrate the respiratory tract and it is almost never found in blood culture (3). Although pertussis is a disease, for which there is a vaccine, the disease remains endemic in all countries of the world, and epidemics occur every two to five years (3). Today, we again encounter an increasing number of patients. Unvaccinated persons and persons that were not vaccinated in time, as well as the relatively short duration of immunity

uzrasta (5,6). Kod odraslih sa kašljem do osam nedelja dijagnoza pertusisa se postavlja na osnovu prisustva paroksizmalnog kašlja, koji se završava iskašljavanjem male količine lepljive sluzi. Takođe, može da se javikarakterističan inspiratorni huk ili vizing (engl. *wheezing*). Ukoliko odrasla osoba koja kašlje ima temperaturu ili ako nema paroksizmalan kašalj onda se ne može govoriti o velikom kašlju. Kod dece sa kašljem koji traje < 4 nedelje javlja se paroksizmalni kašalj, karakteristični vizing, kao i povraćanje posle kašlja, što ukazuje na veliki kašalj. Specifično je da su napadi kašlja (paroksizmi) češće noću. Oni su brzi, snažni i ponavljajući, traju 1-2 minuta, bez udisaja, a završavaju dugim visokotonskim, duboko uvučenim udahom (pisak/huk). Često može da dođe do apnoične epizode. Stanje se pogoršava kako bolest odmiče. Moguć je razvoj komplikacija bolesti što zavisi od uzrasta (češće kod dece), od vakcinalnog statusa obolelog, od brzine postavljanja dijagnoze i terapije. Bronhopneumonija je najčešća komplikacija, dok su konvulzije i encefalopatije znatno ređe.

Stoga, u cilju postavljanja dijagnoze, pored kliničkih simptoma i znakova, postoji nekoliko laboratorijskih metoda za potvrdu dijagnoze (kultura – specifičnost 100%, lančana reakcija polimeraze – PCR – 88-100%, serologija – 72-100%, testiranje oralne tečnosti – 91-99%) (6).

Najčešće se od pacijenata uzimaju nazofaringealni bris ili aspirat i/ili uzorak krvi. Kod svih lica sa kašljem koji traje do dve nedelje radi se kultura, do tri nedelje PCR, a od druge do osme nedelje, najduže do dvaneste nedelje, serološka analiza. Rendgen pluća pomaže u cilju otkrivanja komplikacija, najčešće pneumonije, ali promene nisu specifične za veliki kašalj (6). Zbog sve veće učestalosti respiratornih infekcija razmatra se uloga rendgena pluća za njihovo dijagnostikovanje, pa tako i za dijagnostikovanje pertusisa.

Cilj ovog preglednog rada je da analizira prednosti i nedostatke rendgenske dijagnostike kod obolelih od velikog kašlja.

Metode

U ovom preglednom radu pretražene su elektronske baze podataka *Google Scholar* napredne pretrage, Konzorcijuma biblioteka Srbije za objedinjenu nabavku – KoBSON i platforma *PubMed*. U pretrazi su korišćene sledeće ključne reči: rendgen pluća, dijagnoza, veliki kašalj, prednosti i nedostaci. Korišćene su publikacije objavljene u periodu od 2014. do 2024. godine, na srpskom ili engleskom jeziku. Rezultati studija sprovedenih na temu rendgenske dijagnostike u slučajevima velikog kašlja prikazani su u narativnom obliku.

Epidemiološke i kliničke karakteristike velikog kašlja

Svetska zdravstvena organizacija (SZO) opisuje veliki kašalj kao „izuzetno zaraznu bolest respiratornog trakta koju izaziva *Bordetella pertussis*", specijalno patogenimikroorganizam za ljude. Veliki kašalj pogađa sve uzraste, posebno decu i jedan je od vodećih uzroka smrti kod dece mlađe od jedne godine. Inkubacija obično traje 7 do 10 dana (od jedne do tri nedelje), a kliničke manifestacije su povezane sa uzrastom i vakcinalnim statusom (4). Kod dece se bolest karakteriše paroksizmalnim kašljem koji je praćen karakterističnim inspiratornim vizingom i povraćanjem nakon kašlja. Takođe, može da dođe do cijanoze, dispneje i apneje. Adolescenti i odrasli često imaju atipične simptome i mogu imati samo uporni kašalj. Ozbiljnost bolesti je obrnuto proporcionalna uzrastu pacijenta (7). Naime, pertusis ima predvidljiv tok kod nevakcinisane dece i može rezultirati kliničkim tokom praćenim komplikacijama. Prognoza je posebno loša tokom prve i druge godine života, kada je učestalost hospitalizacije i smrtnih ishoda najviša (0,2% u razvijenim i 4% u nerazvijenim zemljama) (8). Bolest može imati blag i atipičan tok kod vakcinisane dece, adolescenata i odraslih, zbog čega se retko otkriva kod ovih osoba. Naime, ovi pacijenti mogu biti značajan izvor infekcije za malu decu, posebno decu u prvoj godini života, kada imunološki sistem još uvek nije dovoljno razvijen (4). Nekoliko seroepidemioloških studija je pokazalo da je bolest veoma česta kod tinejdžera i odraslih (7,9), odnosno da su oni važni izvori infekcije za malu decu.

Infekcija pertusisom je pokazala imunomodulatorne efekte, sa nedavnim istraživanjima fokusiranim na ulogu adenilat ciklaznog toksina (CyaA) i proteinskih efektora sistema za sekreciju tipa III (TTSS) koji mogu uticati na patogenezu osnovnih hroničnih stanja/bolesti, posebno na hronične inflamatorne bolesti (10,11). Postoje dokazi da infekcija koju uzrokuje *Bordetella pertussis* može imati uticaj na astmatični napad (12), respiratorne bolesti (10) i druga atopijska stanja (13).

after vaccination contribute to the increase in the number of cases of pertussis in the population (4).

Diagnosis of pertussis is often challenging because of symptoms that are similar to the symptoms of other respiratory infections. In addition, the symptoms and signs of pertussis differ depending on age (5,6). In adults who cough for up to eight weeks, the diagnosis of pertussis is made based on the presence of paroxysmal cough, which ends with the coughing up of a small amount of sticky mucus. Also, the characteristic inspiratory whoop or wheezing can be heard. If an adult who coughs has a fever or if he does not have a paroxysmal cough, then it is not whooping cough. When cough lasts < 4 weeks in children, and when paroxysmal cough occurs, as well as wheezing and posttusive vomiting, it is whooping cough. It is specific that coughing fits (paroxysms) are more common at night. They are fast, forceful and repetitive, they last 1-2 minutes, without inhaled air, and they end in prolonged, high-pitched deeply indrawn breath (wheezing/whoop). An apneic episode can often occur. The condition worsens as the disease progresses. Complications are possible, and this depends on age (more common in children), on the vaccination status of the patient, on the timely diagnosis and therapy. Bronchopneumonia is the most common complication, while convulsions and encephalopathy are much less common.

Therefore, in order to establish the diagnosis, in addition to clinical symptoms and signs, there are several laboratory methods for confirming the diagnosis (culture – specificity 100%, polymerase chain reaction – PCR – 88-100%, serology – 72-100%, oral fluid testing – 91-99%) (6).

A nasopharyngeal swab or aspirate and/or blood sample are most often collected from patients. For all persons with a cough that lasts up to two weeks, a blood sample is collected, PCR testing for a cough lasting up to three weeks, and a serological analysis from the second to the eighth week, at most up to the twelfth week. A chest X-ray helps to detect complications, most often pneumonia, but changes are not specific for whooping cough (6). Due to the increasing frequency of respiratory infections, the role of the chest X-ray is considered for their diagnosis, including the diagnosis of pertussis.

The aim of this review article is to analyze the advantages and disadvantages of X-ray diagnostics in patients with whooping cough.

Methods

In this review article, the electronic databases were searched using Google Scholar advanced search, as well as the Serbian Library Consortium for Coordinated Acquisition – KoBSON and the PubMed platform. The following keywords were used: chest X-rays, diagnosis, whooping cough, advantages and disadvantages. Publications published from 2014 to 2024 in Serbian and English were used. The results of studies conducted on the topic of X-ray diagnostics in cases of whooping cough are presented in a narrative form.

Epidemiological and clinical characteristics of whooping cough

The World Health Organization (WHO) describes whooping cough as "a highly contagious disease of the respiratory tract caused by *Bordetella pertussis*", which is a particularly pathogenic microorganism for humans. Whooping cough affects people of all ages, especially children and it is one of the leading causes of death in children under one year of age. Incubation usually lasts 7 to 10 days (from one to three weeks), and clinical manifestations are related to age and vaccination status (4). In children, the disease is characterized by paroxysmal cough that is accompanied by characteristic inspiratory wheezing and posttusive vomiting. Also, cyanosis, dyspnea and apnea may occur. Adolescents and adults usually have atypical symptoms and may only have a persistent cough. The severity of disease is inversely proportional to the age of the patient (7). Namely, pertussis has a predictable course in unvaccinated children and can result in a clinical course followed by complications. The prognosis is particularly bad during the first and second year of life, when the frequency of hospitalization and deathly outcomes is the highest (0.2% in developed and 4% in underdeveloped countries) (8). The disease may have a mild and atypical course in vaccinated children, adolescents and adults, which is why it is rarely detected in these people. Namely, these patients can be a significant source of infection for young children, especially children in the first year of life, when the immune system is still not sufficiently developed (4). Several seroepidemiology studies have shown that the disease is very common in teenagers and adults (7,9), that is, that they are important sources of infection for young children.

Pertusis kod pacijenata sa hroničnim bolestima, kao što su astma ili hronična opstruktivna bolest pluća, može dovesti do komplikacija i povećanih troškova lečenja (14). Nedavna procena ukazuje da 60% starijih osoba u Evropi ima barem dve hronične bolesti (15), što ih uz nedostatak ili nepotpunu imunizaciju i slabiji imunitet čini osetljivijim na infektivne bolesti i povećava rizik od komplikacija. Osim toga, pertusis može biti neposredni uzročnik drugih bolesti.

Testiranje na pertusis korišćenjem PCR metode i/ili serologije, koje može dati laboratorijsku potvrdu, nije uvek dostupno u okviru primarne zdravstvene zaštite, kao ni u okviru pojedinih urgentnih službi. Takođe sporo rastuća *Bordetella* zahteva specijalizovane medije (hranjive podloge), a kulture obično nisu pozitivne 3 do 7 dana. Kod odraslih osoba, u trenutku kada se sumnja na dijagnozu, kulture su obično negativne (16). PCR ima veću senzitivnost i specifičnost od kulture, ali testiranje nije široko dostupno.

Diferencijalno dijagnostički, veliki kašalj treba uzeti u obzir kod pacijenata sa produženim kašljem, posebno ukoliko se javlja u paroksizmima ili uz „zvuk“ pri udahu ili povraćanje posle kašlja. Tokom rane paroksizmalne faze, leukocitoza (često 25.000 do 60.000 po mL) sa limfocitozom može povećati sumnju na pertusis (17). Nalazi radiografije pluća nisu specifični i mogu pokazati peribronhijalno zadebljanje (muf), naglašen retikularni crtež perihilarno, konsolidacije plućnog parenhima, atelektaze različitog stepena i limfadenopatiju.

SZO procenjuje da je širom sveta bilo 151.074 slučajeva velikog kašlja u 2018. godini, a u prethodnim godinama (2008) prijavljeno je do 89.000 smrtnih slučajeva. Trenutno je vakcinacija (korpuskularna i manje reaktogena acelularna) najbolja dostupna strategija za redukcuju broja obolelih od velikog kašlja (1,18). Međutim, i pored globalne vakcinacije ova bolest danas nije eliminisana, nego je ostala endemična u većini zemalja. Razlozi oživljavanja bolesti nisu jasni, a neki navode genetsku adaptaciju cirkušućih prouzrokovaća pertusisa na vakcinu, kratko trajanje imuniteta posle date acelularne vakcine, smanjen obuhvat vakcinacije dece, neuspeh vakcina da spreče nastajanje i prenos infekcije. U cilju rešavanja novnastale situacije predlaže se vakcinacija novorođenčadi, uvođenje buster doze vakcine za decu do 14. godine života, kao i vakcinisanje trudnica (19-21). Pravovremeno ordiniranje antibiotika doprinosi da osoba nije zarazna posle petog dana od uzimanja terapije, a bez antibiotske terapije zarazna je tri nedelje.

Prednosti rendgenske dijagnostike kod pacijenata sa velikim kašljem

Ministrstvo zdravlja Republike Srbije i dostupni protokoli za dijagnostiku velikog kašlja preporučuju da se rendgensko snimanje grudnog koša uradi kod pacijenata mlađih od četiri godine sa sumnjom na veliki kašalj, kako bi se olakšala dijagnoza i detektovale eventualne komplikacije. Glavni razlog za rendgen pluća dece sa sumnjom na veliki kašalj je olakšavanje dijagnoze kod dece mlađe od 4 godine, jer su simptomi nespecifični, a rendgenski snimak može pomoći u proceni stanja pluća i eliminaciji drugih uzroka respiratornih problema kao što su pneumonija i bronhitis, koji mogu biti posledica ili komplikacija velikog kašlja. Takođe, rendgen pluća se koristi za detekciju komplikacija velikog kašlja (pneumonija, atelektaza pluća, itd.). Kod postojanja serije neprestanih napada kašlja (paroksizmalnog kašlja) rendgenski snimak pluća omogućava sagledavanje težine stanja i prisutnih plućnih komplikacija. Takođe, kod mlađih pacijenata rendgenski snimak doprinosi isključivanju drugih respiratornih bolesti koje imaju slične simptome kao veliki kašalj (npr. bronhiolitis ili pneumonija).

Ipak, uprkos ovim preporukama, oko 20% pacijenata, uzrasta od 0-2 godine, uključenih u istraživanje Lime i saradnika (2022) nije imalo urađene rendgenske snimke pluća, što je možda posledica neinformisanosti zdravstvenih radnika o ovoj preporuci (22). Ipak, pomenuta studija takođe je indentifikovala promene kod 57,5% pacijenata sa rendgenskim snimcima pluća, pri čemu su se najčešće javljali peribronhijalno zadebljanje i naglašen perihilarni retikularni crtež. Naime, malo studija opisalo je promene na rendgenskim snimcima kod pacijenata sa sumnjom na veliki kašalj. Ipak, najčešći nalazi na rendgenskim snimcima pluća kod pacijenata sa akutnim respiratornim infekcijama su: peribronhijalno zadebljanje, naglašen retikularni crtež perihilarno i konsolidacije plućnog parenhima (23).

Zadebljanje peribronhijalnih struktura je često prisutno kod pacijenata sa velikim kašljem. Na rendgenskom snimku, zadebljani peribronhijalni prostor ili peribronhijalni muf će se najbolje prikazati kada je periferni bronh ortogonalno pogođen

Pertussis infection has shown immunomodulatory effects, with recent research focusing on the role of adenylate cyclase toxin (CyaA) and type III secretion system proteins (TTSS) that can influence the pathogenesis of underlying chronic conditions/diseases, especially chronic inflammatory diseases (10,11). There is evidence that infection caused by *Bordetella pertussis* can have an impact on asthma attack (12), respiratory diseases (10) and other atopic conditions (13).

Pertussis in patients with chronic diseases, such as asthma or chronic obstructive pulmonary disease, can lead to complications and increased treatment costs (14). A recent estimate indicates that 60% of the elderly in Europe have at least two chronic diseases (15), which together with the lack of immunization or incomplete immunization and weak immunity make them more susceptible to infectious diseases and increase the risk of complications. In addition, pertussis can be a direct cause of other diseases.

Testing for pertussis using the PCR method and/or serology, which can provide laboratory confirmation, is not always available within primary health care, as well as within certain emergency services. Also, slow-growing *Bordetella* requires specialized media (nutritious base), and cultures are typically not positive for 3 to 7 days. In adults, by the time the diagnosis is suspected, cultures are typically negative (16). PCR is more sensitive and specific than culture, but testing is not widely available.

In terms of differential diagnosis, whooping cough should be considered in patients with prolonged cough, especially if it occurs in paroxysms or with a "sound" while inhaling or post-tussive emesis. During the early paroxysmal phase, leukocytosis (often 25,000 to 60,000 per mL) with lymphocytosis may raise suspicion for pertussis (17). Chest X-ray findings are not specific and may show peribronchial thickening (cuffing), prominent reticular pattern in the perihilar area, consolidation of lung parenchyma, variable degrees of atelectasis and lymphadenopathy.

The WHO estimates that there were 151,074 cases of whooping cough worldwide in 2018, while in previous years (2008), up to 89,000 deaths were reported. Currently, vaccination (corpuscular and less reactogenic acellular) is the best available strategy to reduce the number of people who get whooping cough (1,18). However, despite global vaccination, this disease has not been eliminated so far, but has remained endemic in most countries. The reasons for the resurgence of the disease are not clear, and some cite the genetic adaptation of circulating pertussis agents to the vaccine, the short duration of immunity after the acellular vaccine, the reduced coverage of children with vaccine, the failure of vaccines to prevent the development and transmission of infection. In order to solve the new situation, the vaccination of newborns has been proposed, as well as the introduction of booster dose for children up to 14 years of age and the vaccination of pregnant women (19-21). The timely administration of antibiotics contributes to the fact that a person is not contagious after the fifth day of taking therapy, and without antibiotic therapy, he is contagious for three weeks.

The advantages of X-ray diagnostics in patients with whooping cough

The Ministry of Health of the Republic of Serbia and available protocols for the diagnosis of whooping cough recommend that chest X-rays should be performed in patients younger than four years with suspected whooping cough, in order to make diagnosis easier and detect possible complications. The main reasons for the chest X-ray of children with suspected whooping cough is to make the diagnosis easier in children under four years of age, because the symptoms are non-specific, and the X-ray can help assess the state of the lungs and eliminate other causes of respiratory problems – pneumonia, bronchitis, which may be the result or complication of whooping cough. Also, the chest X-ray is used to detect complications of whooping cough (pneumonia, lung atelectasis, etc.). In the presence of a series of continuous coughing fits (paroxysmal cough), a chest X-ray enables the evaluation of the severity of the condition and present pulmonary complications. Also, in younger patients, a chest X-ray helps to distinguish pertussis from other respiratory diseases that have similar symptoms as whooping cough (e.g. bronchiolotis or pneumonia).

However, despite these recommendations, about 20% of patients, aged 0-2 years, included in the study of Lima et al. (2022) did not have the chest X-ray done, which may be the consequence of the fact that healthcare workers were uninformed about these recommendations (22). However, the

X zrakom i to u vidu kružnog rasvetljenja sa zidom koji je veće debljine nego što je to uobičajeno i to zbog inflamacije i otoka okolnih tkiva (24). Ovaj nalaz može biti posledica direktnog prisustva infekcije u respiratornom sistemu pacijenta, ali može se javiti i zbog upale koja nastaje usled mehaničke iritacije zida bronha uzrokovane napadima kašlja tokom pertusisa. Pored zadebljanja peribronhijalnih struktura, moguće je da se na rendgenskim slikama vide i druge promene karakteristične za veliki kašalj.

Atelektaza (kolaps plućnih alveola) i alveolarna zasenčenja (nakupljanje tečnosti ili supstanci u plućnom parenhimu) takođe mogu biti prisutne na rendgenskom snimku pluća pacijenata obolelih od pertusisa. Atelektaza je česta komplikacija bolesti koja se javlja kao rezultat povećanog pritiska u alveolama tokom jakih i dugotrajnih napada kašlja, što rezultira njihovim kolapsom i ograničenom razmenom gasova u njima. Na rendgenskom snimku, atelektaza se manifestuje smanjenom transparentnošću parenhima koja zapravo predstavlja segment pluća bez vazduha (25). Atelektaza može biti segmentna, lobarna ili kompletna, u zavisnosti od toga koliko područje pluća je zahvaćeno (23). Segmentna i lobarna atelektaza se na radiografiji pluća prikazuju kao trouglasta mekotkivna zasenčenja čija se baza nalazi na periferiji, a vrh je usmeren ka hilusu. U težim slučajevima, može doći i do atelektaze celog plućnog krila, što se na snimcima prezentuje u vidu jednostrano tamnog pluća i snažnog privlačenja medijastinalnih struktura ka kolabiranom plućnom krilu. Ovakav nalaz ukazuje na ozbiljan poremećaj u plućnoj funkciji pacijenata obolelih od velikog kašlja (25). Posledično, atelektaza može dovesti do smanjenog protoka kiseonika u organizmu, što se manifestuje nedostatkom daha, umorom i slabošću.

Alveolarna zasenčenja su takođe česti nalazi na rendgenskom snimku pluća pacijenata obolelih od velikog kašlja (16). Ona predstavljaju nakupljanje tečnosti ili supstanci u plućnom parenhimu. Sama *Bordetella pertussis* može svojim toksinima i drugim metaboličkim produktima izazvati upalu i iritaciju bronha, što dovodi do povećane proizvodnje sluzi. Alveolarna zasenčenja kao forma razvijene bolesti na rendgenskom snimku se vide kao slivena, ređe pojedinačna mrljasta zasenčenja plućnog parenhima i znak su uznapredovaloginflamatornog procesa. Skenerom mogu da se vide razliličite atenuacije ili smanjenja transparencija plućnog parenhima od tipa mlečnog stakla pa do pravih konsolidativnih promena. Rendgenski se promene tipa mlečnog stakla mogu previdеti ukoliko zahvataju manju površinu parenhima. Zbog ograničenog protoka vazduha i neefikasne razmene gasova, alveolarne infiltracije se klinički manifestuju simptomima kao što su nedostatak daha, kašalj i otežano disanje.

Međutim, treba naglasiti da rendgenski snimak pluća nije specifičan test za dijagnozu velikog kašlja, ali u svim gore navedenim primerima može da pomogne da bi se pravovremeno postavila dijagnoza i započelo sa terapijom.

Nedostaci rendgenske dijagnostike kod pacijenata sa velikim kašljem

Jedan od glavnih problema prilikom rendgenskog snimanja pacijenata sa velikim kašljem je napad kašlja tokom samog postupka snimanja. Ovo može dovesti do artefakata koji otežavaju interpretaciju nalaza. Samim tim, zbog lošeg kvaliteta slike može postojati potreba za ponavljanjem snimanja, što može biti iscrpljujuće i neprijatno iskustvo za pacijenta koji ne može da kontroliše napad kašlja.

Najveći procenat pacijenata sa velikim kašljem čine deca mlađeg uzrasta kod kojih je nemoguće vizualizovati oko 22% plućnog parenhima zaklonjenog srčano-sudovnom senkom na rendgenskom snimku. Nedostatk saradnje pacijenta prilikom snimanja, u smislu odsustva maksimalnog inspirijuma prilikom ekspozicije, čini ovaj procenat još većim (23).

Još jedan nedostatak rendgenskog snimanja kod pacijenata sa velikim kašljem jeste i neefikasnost u otkrivanju bolesti u ranom stadijumu, iako može biti koristan za detekciju kasnijih komplikacija, kao što su upala pluća ili pneumotoraks. Naime, u ranom stadijumu bolesti, kašalj može biti blag ili sličan običnom kašlju kod prehlade. Ove početne faze mogu biti presudne za pravovremenu dijagnozu i započinjanje odgovarajućeg lečenja kako bi se sprečilo dalje širenje bolesti. Međutim, rendgensko snimanje obično nije dovoljno osetljivo da detektuje blage promene koje se javljaju tokom ovog perioda.

Kada je reč o rendgenskom snimanju, jedan od nedostataka je i izlaganje pacijenta jonizujućem zračenju koje ima potencijal da ošteti ćelije u telu. Preterana izloženost ovom zračenju može povećati rizik od razvoja karcinoma i drugih bolesti. U slučaju velikog kašlja, gde rendgensko snimanje

above mentioned study also identified changes in 57,5% of patients with the chest X-ray, where peribronchial thickening and prominent perihilar reticular pattern occurred most often. Namely, few studies described X-ray changes in patients with suspected whooping cough. However, the most common findings on chest X-ray in patients with acute respiratory infections are the following: peribronchial thickening, prominent reticular pattern in the perihilar area and consolidation of lung parenchyma (23).

Thickening of peribronchial structures is often present in patients with whooping cough. On the chest X-ray, thickened peribronchial space or peribronchial cuffing will be best shown when the peripheral bronchus is orthogonally affected by the X-ray, in the form of a ring-like illumination with a wall that is thicker than usual due to inflammation and swelling of the surrounding tissues (24). This finding may be a consequence of the direct presence of infection in the patient's respiratory tract, but it may also occur due to inflammation resulting from mechanical irritation of the bronchial wall caused by coughing fits during pertussis. In addition to the thickening of peribronchial structures, it is possible that other changes characteristic of whooping cough can be seen on X-ray images.

Atelectasis (collapse of lung alveoli) and alveolar opacities (accumulation of fluids or substances in the lung parenchyma) may also be present on chest X-rays in patients with pertussis. Atelectasis is a common complication of the disease that occurs as a result of increased pressure in alveoli during strong and prolonged coughing attacks, which results in their collapse and limited gas exchange in them. On the chest X-ray, atelectasis is manifested as reduced transparency of parenchyma, which is actually a segment of the lung without air (25). Atelectasis can be segmental, lobar or complete, depending on how much of the lung area is affected (23). Segmental and lobar atelectasis appears on chest radiography as wedge-shaped area of soft-tissue opacity, where the apex is at the hilum and base towards the pleura. In more severe cases, there may be atelectasis of the entire lung, which is presented on the X-ray images as a unilateral dark lung and a strong mediastinal shift toward the collapsed lung. This finding indicates a serious disorder in the lung function of patients suffering from whooping cough (25). As a result, atelectasis can lead to a reduced flow of oxygen in the body, which is manifested by shortness of breath, fatigue and weakness.

Alveolar opacities are also common findings on the chest X-ray of patients affected by whooping cough (16). It represents the accumulation of fluids or substances in the lung parenchyma. *Bordetella pertussis*, with its toxins and other metabolic products, can cause inflammation and irritation of bronchi, which causes the increased production of mucus. Alveolar opacities as a form of developed disease on the radiological image are seen as consolidative, less often individual patchy opacities of lung parenchyma and they are a sign of an advanced, inflammatory process. With the CT scan, different attenuations or reductions in the transparency of the lung parenchyma can be seen, from the ground glass opacity to true consolidative changes. Changes such as ground glass opacities can be overlooked on the chest X-ray if they affect a smaller surface of the parenchyma. Due to the limited air flow and less efficient gas exchange, alveolar infiltrations are clinically manifested as shortness of breath, cough or breathing difficulties.

However, it should be emphasized that the chest X-ray is not a specific test for the diagnosis of whooping cough, but in all the above mentioned examples, it can help to make a timely diagnosis and start therapy.

The disadvantages of X-ray diagnostics in patients with whooping cough

One of the main problems when the chest X-ray is done in patients with whooping cough is a coughing fit during the imaging procedure. This can lead to artifacts that make the interpretation of findings difficult. Therefore, due to poor image quality, it can happen that imaging has to be repeated, which can be a tiring and unpleasant experience for a patient who cannot control coughing fits.

The largest percentage of patients with whooping cough are young children, in whom it is impossible to visualize about 22% of the lung parenchyma, which is obscured by the cardiovascular shadow on the X-ray image. The lack of cooperation of patients during imaging procedure in terms of the absence of maximum inspiration during exposure makes this percentage even higher (23).

nije neophodno za dijagnozu u ranim stadijumima, izlaganje pacijenta ovj vrsti zračenja može biti neefikasno i nepotrebno.

Što se tiče interpretacije rendgenskog snimka grudnog koša u dijagnostici velikog kašlja, moguće su određene greške koje mogu uticati na tačnost dijagnoze. Neki od mogućih problema uključuju: nedovoljnu osetljivost, nespecifičnost nalaza, dijagnostičku konfuziju i variranje nalaza tokom bolesti.

Naime, radiografija pluća može biti manje osetljiva za detekciju blagih promena koje se javljaju u ranim stadijumima pertusisa. Ovo može dovesti do lažno negativnih rezultata, gde snimak ne pokazuje prisustvo infekcije i može dovesti do propusta u postavljanju tačne dijagnoze. Takođe, kod pacijenata sa velikim kašljem može pokazivati nespecifične promene, kao što su zadebljanje peribronhovaskularnog crteža ili manja alveolarna zasenčenja. Ove promene nisu specifične za veliki kašalj i mogu se videti i kod drugih respiratornih infekcija ili stanja. Ponekad se simptomi pertusisa mogu preklapati sa drugim respiratornim infekcijama ili bolestima koje imaju sličnu prezentaciju kao što su bronhitis ili astma, te mogu izazvati tzv. dijagnostičku konfuziju. Takođe, veliki kašalj prolazi kroz različite faze tokom vremena, tako da rendgenski nalazi mogu varirati zavisno od stadijuma bolesti. Na primer, početni stadijum bolesti može imati normalan rendgenski nalaz, dok kasnije može doći do konsolidacije. Kako bi se minimizirale greške prilikom interpretacije radiografije pluća kod sumnje na pertusis, važan je sveobuhvatni pristup koji uključuje kliničku istoriju pacijenta, laboratorijske testove i praćenje simptoma tokom vremena kako bi se postavila ispravna dijagnoza i započelo adekvatno lečenje.

Zaključak

Rendgenski snimak pluća kod lica sa sumnjom na veliki kašalj može imati značajnu ulogu u proceni komplikacija i diferencijalnoj dijagnozi. Kod dece mlađe od četiri godine sa sumnjom na veliki kašalj, može se koristi kao dodatni alat za potvrdu ili isključivanje bolesti, ali samo u kombinaciji sa kliničkim i laboratorijskim pristupom.

Konflikt interesa

Autori su izjavili da nema konflikta interesa.

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Another disadvantage of radiological imaging in patients with whooping cough is related to the ineffectiveness to detect the disease at an early stage, although it may be useful for detecting later complications, such as pneumonia or pneumothorax. Namely, in the early stage of the disease, the cough may be mild or similar to coughing which is the symptom of the common cold. These initial stages can be crucial for timely diagnosis and appropriate treatment to prevent further spreading of this disease. However, radiological imaging is usually not sensitive enough to detect mild changes that occur during this period.

When it comes to the radiological imaging, one of the disadvantages is exposing the patient to ionizing radiation that has the potential to damage cells in the body. Excessive exposure to this radiation can increase the risk of developing cancer and other diseases. In the case of whooping cough, where X-ray imaging is not necessary for diagnosis in early stages, exposing the patient to this type of radiation may be ineffective and unnecessary.

As for the interpretation of chest X-ray in the diagnosis of whooping cough, certain errors are possible that can affect the accuracy of the diagnosis. Some of the possible problems include: insufficient sensitivity, non-specificity of findings, diagnostic confusion and variation of findings during the course of the disease.

Namely, chest radiography may be less sensitive for detecting mild changes that occur in the early stages of pertussis. This can lead to false negative results, where the image does not show the presence of infection and can lead to a failure to establish an accurate diagnosis. Also, in patients with whooping cough, it may show non-specific changes, such as thickening of the peribronchovascular pattern or minor alveolar shadows. These changes are not specific for whooping cough and they can be seen in other respiratory infections or conditions. Sometimes the symptoms of pertussis can overlap with other respiratory infections or diseases that have a similar presentation such as bronchitis or asthma, and can cause the so-called diagnostic confusion. Also, whooping cough goes through different stages over time, so X-ray findings can vary depending on the stage of the disease. For example, the initial stage of the disease may have a normal X-ray finding, while later consolidation may occur. In order to minimize errors in the interpretation of chest radiography in patients with suspected pertussis, a comprehensive approach is necessary, which includes the patient's clinical history, laboratory tests and monitoring of symptoms over time in order to establish the correct diagnosis and start adequate treatment.

Conclusion

The chest X-ray in persons with suspected whooping cough can play a significant role in the evaluation of complications and differential diagnosis. In children younger than four years with suspected whooping cough, it can be used as an additional tool to confirm or exclude the disease, but only in combination with a clinical or laboratory approach.

Competing interests

The authors declared no competing interests.

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PREGLEDNI RAD

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DA LI JE ZNANJE O DIJABETES MELITUSU PREDUSLOV OPTIMALNE SAMONJEGE I KONTROLE OVE BOLESTI?

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SAŽETAK

Dijabetes melitus (engl. *Diabetes mellitus* - DM) predstavlja najčešću endokrinološku bolest savremenog doba pandemijskih razmjera. Osobe s DM imaju povećan rizik od prerane smrti uzrokvane kardiovaskularnim i ostalim bolestima u odnosu na opštu populaciju. Znanje oboljelih o DM uključuje niz uvjerenja o različitim aspektima bolesti koje su oboljeli prikupili tokom svog života, prije i poslije dijagnoze. Ovo znanje predstavlja značajan kognitivni faktor koji može uticati na prilagođavanje osobe na bolest, tok bolesti i njeno liječenje. U okviru ovog preglednog rada ispitano je da li je znanje o DM preduslov optimalne samonjege i kontrole ove bolesti. Pretraživanje literature sprovedeno je korištenjem sljedećih ključnih riječi: dijabetes melitus, samonjega, znanje i edukacija u okviru *PubMed*, *Emabase*, *Scopus*, *SCIndex* i Hrčak za razdoblje od 2001. do 2024. godine. Najveći broj istraživanja o znanju oboljelih o DM koristilo je Upitnik znanja o dijabetesu (engl. *Diabetes knowledge questionnaire* - DKQ) s 24 stavke. Kod oboljelih od DM tipa 1 i DM tipa 2, koji su učestvovali u ovim istraživanjima, uočeno je deficitarno znanje o DM koje autori dovode u vezu s suboptimalnim vrijednostima glukoze u krvi, visokim morbiditetom i mortalitetom. Porodična istorija DM, mlađa životna dob i fakultetsko obrazovanje su identifikovani kao nezavisni prediktori optimalnog znanja oboljelih od DM u većini istraživanja. Rutinska procjena nivoa znanja oboljelih o DM putem standardizovanih upitnika, prateća identifikacija vulnerabilnih grupa i njihova edukacija omogućila bi unapređenje znanja oboljelih od DM i usvajanje vještina neophodnih u aktivnostima samonjege.

Ključne riječi: Dijabetes melitus, samonjega, znanje, edukacija

Uvod

Učinkovito liječenje DM započinje s oboljelim koji imaju primjereno znanje o DM (1). Znanje oboljelih o DM uključuje niz uvjerenja (zasnovanih na informacijama) o različitim aspektima bolesti koje su oboljeli prikupili tokom svog života, prije i poslije dijagnoze. Uvjerenja se obično odnose na identifikaciju uzroka, simptoma, faktora progresije, dostupnih metoda liječenja i posljedica bolesti. Prikupljaju se iz različitih izvora, poput prethodnog ličnog iskustva, medicinskog osoblja, knjiga ili interneta. Istinitost uvjerenja može varirati, i neka od njih su zapravo lažna (2).

Znanje oboljelih o DM predstavlja značajan kognitivni faktor koji može uticati na prilagođavanje osobe na bolest, tok bolesti i njeno liječenje. Mehanizmi navedene interakcije nisu u potpunosti jasni. Vjeruje se da oboljele osobe s optimalnim znanjem o DM imaju snažniju ukupnu psihološku adaptaciju na bolest i kvalitetniju komplijansu. Nasuprot tome, nepotpuno ili netačno znanje o DM može predstavljati ograničavajući faktor u liječenju (2).

U okviru ovog preglednog rada ispitano je da li je znanje o DM preduslov optimalne samonjege i kontrole ove bolesti.

Metode

Pretraživanje literature je sprovedeno korišćenjem sljedećih ključnih riječi: dijabetes melitus, samonjega, znanje i edukacija. Realizacija pretraživanja je ostvarena korišćenjem sledećih baza

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REVIEW ARTICLE

IS KNOWLEDGE OF DIABETES MELLITUS A PREREQUISITE FOR OPTIMAL SELF-CARE AND CONTROL OF THIS DISEASE?

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SUMMARY

Diabetes mellitus (DM) is the most common endocrinological disease of the modern era of pandemic proportions. People with DM have an increased risk of premature death caused by cardiovascular and other diseases compared to the general population. Patients' knowledge about DM includes a series of beliefs about different aspects of the disease that patients have accumulated during their lifetime, before and after diagnosis. This knowledge represents a significant cognitive factor that can influence a person's adaptation to the disease, the course of the disease and its treatment. In this review, it was examined whether knowledge about DM is a prerequisite for optimal self-care and control of this disease. The literature search was conducted using the following key words: diabetes mellitus, self-management, knowledge and education in PubMed, Emabase, Scopus, SCIndex and Hrčak for the period from 2001 to 2024. The largest number of studies on DM patients' knowledge used the Diabetes Knowledge Questionnaire (DKQ) with 24 items. In patients with DM type 1 and DM type 2 who participated in these studies, ubiquitous, deficient knowledge about DM was observed, which the authors link to suboptimal blood glucose values, high morbidity and mortality of the patients. Family history of DM, younger age and college education were independent predictors of optimal knowledge of patients with DM in most studies. Routine assessment of the level of knowledge of patients with DM through standardized questionnaires, accompanying identification of vulnerable groups and their education would enable the improvement of the knowledge of patients and the acquisition of skills necessary for self-menagement.

Key words: Diabetes mellitus, self-menagement, knowledge, education

Introduction

The efficient treatment of DM begins with patients who have adequate knowledge about DM (1). Patients' knowledge about DM includes beliefs (based on information) about different aspects of this disease that patients have collected during their lifetime, before and after the diagnosis. These beliefs usually relate to the identification of causes, symptoms, factors of progression, available treatment methods and consequences of the disease. They are collected from various sources, such as previous personal experience, medical staff, books or the Internet. The validity of these beliefs may vary, while some of them are actually false (2).

Patients' knowledge about DM is a significant cognitive factor that can influence the person's adaptation to the disease, its course and treatment. The mechanisms of the above mentioned interaction have not been completely clarified. It is believed that patients with optimal knowledge about DM have stronger overall psychological adaptation to the disease and better compliance. In contrast, incomplete or incorrect knowledge about DM may represent a limiting factor in the treatment (2).

In this review article, it was investigated whether knowledge about DM is a prerequisite for optimal self-care and control of this disease.

Methods

The search of literature was conducted using the following key words: diabetes mellitus, self-

podataka: *PubMed* , *Emabase* , *Scopus* , *SCIndex* i *Hrčak*. Pretraživanje je sprovedeno za razdoblje od 2001. do 2024. godine.

Dijabetes melitus

Dijabetes melitus (engl. *Diabetes mellitus*, DM) je složena, multifaktorska i poligenska hronična metabolička bolest koju karakteriše poremećaj metabolizma ugljenih hidrata, masti i bjelančevina uzrokovan relativnim ili apsolutnim nedostatkom insulina, poremećajem djelovanja insulina ili kombinacijom ova dva mehanizma (3).

DM predstavlja najčešću endokrinološku bolest savremenog doba pandemijskih razmjera. Prema izvještaju Međunarodne federacije za dijabetes (engl. *International Diabetes Federation*, IDF), globalna prevalencija DM u osoba uzrasta od 20 do 79 godina, iznosi 463 miliona što predstavlja 9% svjetske populacije. Najveći broj oboljelih u okviru navedene starosne grupe utvrđen je u Kini, Indiji i Sjedinjenim Američkim Državama. Procijenjeni broj osoba uzrasta od 65 do 99 godina s DM iznosi 135,6 miliona (19,3%). U Evropi, DM je dijagnostifikovan u 59,3 miliona osoba uzrasta od 20 do 79 godina, odnosno 8,9% osoba navedene starosne grupe (4). U Srbiji je utvrđeno 770.000 oboljelih osoba, što odgovara komparativnoj prevaleniciji od 9,0% (5).

U odnosu na patofiziologiju, savremena etiološka klasifikacija razlikuje četiri kategorije DM:

1. Tip 1 DM uzrokovan razaranjem ß ćelija gušterače s posljedičnim apsolutnim nedostatkom insulina. Obuhvata dva podtipa: autoimuni (1A) i idiopatski (1B).
2. Tip 2 DM objedinjuje promjenjiv stepen rezistencije na insulin, progresivni defekt izlučivanja insulina i prekomjerno stvaranje glukoze u jetri.
3. Gestacijski DM predstavlja DM koji je nastao ili je prvi put dijagnostikovan tokom trudnoće.
4. Drugi specifični oblici DM-a uključujući monogenske sindrome DM, bolesti egzokrinog dijela pankreasa, endokrinopatije, DM uzrokovan lijekovima ili hemikalijama i druge specifične oblike DM (4).

DM tipa 2 je najučestaliji (više od 90% ukupnog DM). Slijede DM tipa 1 (oko 7% ukupnog DM), gestacijski DM i drugi specifični oblici DM (oko 2% ukupnog DM) (4).

DM tipa 1 i tipa 2 su heterogene bolesti u kojih se klinička prezentacija i progresija bolesti razlikuju. DM tipa 1 objedinjuje pretklinički DM, klinički DM, djelimičnu remisiju i ponovno intenziviranje bolesti s doživotnom ovisnošću o insulinu (1). Polidipsija i poliurija su najčešće prve manifestacije DM tipa 1 u djece i oko 50% djece javlja se dijabetesna ketoacidoza. Prezentacija u odraslih osoba je varijabilna i oni mogu imati privremenu remisiju bolesti, kada im insulin nije potreban. DM tip 1 uzrokuje niz akutnih komplikacija poput dijabetesne ketoacidoze, laktatne acidoze, dijabetesnog hiperosmolarnog neketogenog stanja i hipoglikemije (3,6).

DMT2 nerijetko ostaje nedijagnostikovan dugi niz godina, budući da se hiperglikemija većinom razvija postepeno i u ranijim fazama bolesti nije isuviše ozbiljna da uzrokuje klasične simptome DM. Uprkos tome, čak i oboljeli s nedijagnostikovanim DM imaju povećan rizik od razvoja hroničnih komplikacija bolesti uključujući mikrovaskularne (retinopatija, nefropatija i polineuropatija) i makrovaskularne (koronarna bolest, cerebrovaskularna bolest i periferna arterijska bolest) komplikacije (6).

Liječenje DM-a objedinjuje medikamentoznu (neinsulinski lijekovi i insulini) i nemedikamentoznu terapiju (medicinska nutritivna terapija, fizička aktivnost, edukacija i podrška u samostalnom upravljanju DM-om i psihosocijalna podrška). Troškovi liječenja oboljelih na globalnom nivou iznose 760 milijardi američkih dolara (engl. *United States Dollar*, USD) (6).

Osobe s DM imaju povećan rizik od prerane smrti uzrokvane kardiovaskularnim i ostalim bolestima u odnosu na opštu populaciju (7). Globalno, DM uzrokuje 11,3% smrtnih slučajeva među osobama uzrasta od 20 do 79 godina. Gotovo polovina smrtnih slučajeva utvrđena je u radno sposobnog stanovništva uzrasta ispod 60 godina (4). U Srbiji, DM predstavlja treći vodeći uzrok umiranja i ogovoran je za 3% svih smrtnih slučajeva (5).

U cilju optimalne regulacije vrijednosti glukoze u krvi osoba s DM neophodna je modifikacija zdravstvenog ponašanja, samodisciplina i sprovođenje aktivnosti samonjege. Osobe s DM u prosjeku tri sata godišnje provode sa ljekarom, dok preostalih 8.757 sati samostalno kontrolišu svoju bolest. Prema tome, svaka osoba s DM treba da posjeduje odgovarajuće znanje i samopouzdanje kako bi preuzela odgovornost za sopstveno zdravlje tokom čitavog života (8).

care, knowledge and education. The search was realized using the following databases: PubMed, Embase, Scopus, SCIndex and Hrčak. The search was conducted for the period 2001 to 2024.

Diabetes mellitus

Diabetes mellitus (DM) is a complex, multifactorial and polygenic chronic metabolic disease characterized by the disorder of carbohydrate, fat and protein metabolism caused by relative or absolute deficiency in insulin, impaired insulin action or combination of these two mechanisms (3).

DM is the most common endocrine disease of modern age, which has pandemic proportions. According to the report of the International Diabetes Federation (IDF), the global prevalence of DM in persons aged 20 to 79 is 463 million that represents 9% of the world's population. The largest number of patients within the mentioned age group was determined in China, India and the United States of America. The estimated number of persons aged 65 to 99 years with DM is 135.6 million (19.3%). In Europe, DM was diagnosed in 59.3 million persons aged 20 to 79 years, that is, 8.9% of persons in the mentioned age group (4). In Serbia, 770,000 persons affected by DM were identified, which corresponds to the comparative prevalence of 9.0% (5).

In relation to its pathophysiology, modern etiological classification distinguishes four categories of DM:

1. Type 1 DM results from destruction of pancreatic ß cells with the consequent absolute lack of insulin. It includes two subtypes: autoimmune (1A) and idiopathic (1B).

2. Type 2 DM combines variable degrees of insulin resistance, a progressive defect in insulin secretion and excessive production of glucose in the liver.

3. Gestational DM is DM that developed or was diagnosed for the first time during pregnancy.

4. Other specific forms of DM including monogenic syndromes of DM, diseases of the exocrine part of the pancreas, endocrinopathy, DM caused by drugs or chemicals and other specific forms of DM (4).

Type 2 DM is the most common form of DM (more than 90% of all cases of DM). This is followed by type 1 DM (about 7% of all cases of DM), gestational DM and other specific forms of DM (about 2% of all cases of DM) (4).

Type 1 and type 2 DM are heterogeneous diseases, in which clinical presentation and progression are different. Type 1 DM combines preclinical DM, clinical DM, partial remission and relapse of the disease with lifelong insulin dependence (1). Polydipsia and polyuria are the most common first manifestations of type 1 DM in children, while in about 50% of children, diabetic ketoacidosis occurs. The presentation in adults is variable and they may have a temporary remission of the disease, when they do not need insulin. Type 1 DM causes a number of acute complications such as diabetic ketoacidosis, lactate acidosis, diabetic hyperglycemic hypersmolar non-ketonic syndrome and hypoglycemia (3,6).

Type 2 DM often goes undiagnosed for many years because hyperglycemia usually develops gradually and in early stages of the disease it is not too severe to cause the classic symptoms of DM. Despite this, even patients with undiagnosed DM have an increased risk of developing chronic complications including microvascular (retinopathy, nephropathy and polyneuropathy) and macrovascular complications (coronary disease, cerebrovascular disease and peripheral arterial disease) (6).

The treatment of DM includes medicinal (non-insulin and insulin drugs) and non-medicinal treatment (medical nutritional therapy, physical activity, education and support in self-management of DM and psychosocial support). Globally, treatment costs amount to 760 billion US dollars (6).

Persons with DM have an increased risk of premature death caused by cardiovascular and other diseases in comparison to the general population (7). Globally, DM causes 11.3% of deaths among people aged 20-79 years. Almost half of deaths occur in the working age population under the age of 60 (4). In Serbia, DM is the third leading cause of death and it is responsible for 3% of all deaths (5).

In order to optimally regulate blood glucose levels in persons with DM, modification of health behavior is necessary, as well as self-discipline and self-care activities. Persons with DM spend on average three hours a year with a doctor, while the remaining 8,757 hours they control their disease independently. Therefore, each person with DM should have appropriate knowledge and

Uloga znanja oboljelih o dijabetes melitusu u menadžmentu dijabetes melitusa

Učinkovito liječenje DM-a zahtjeva primjereno znanje oboljelih o DM-u i modalitetima njegovog liječenja. Iako optimalan menadžment DM zahtjeva i druge kvalitete i kompetentnost oboljelih za samonjegu, posjedovanje znanja o DM-u je esencijalno. Naime, znanje oboljelih o DM-u predstavlja temelj informisane odluke o ishrani, fizičkoj aktivnosti, kontroli tjelesne težine, praćenju vrijednosti glukoze u krvi, upotrebi lijekova i redovnim pregledima ljekara (1,9,10).

Istraživanja povezuju znanje oboljelih o DM s optimalnom samonjegom i kvalitetom života (11-13). S druge strane, nedostatak znanja oboljelih poistovjećuje se sa suboptimalnom kontrolom DM (14,15). Na primjer, u istraživanju među osobama s DM tipa 2 u Tajvanu ustanovljeno je da značajan broj oboljelih odlaže upotrebu insulina, nerijetko do nastanka ireverzibilnih multiorganskih oštećenja, smatrajući da upotreba insulina narušava funkciju bubrega. Osim toga, uočeno je i značajno odsustvo samokontrole vrijednosti šećera u krvi u oboljelih koji vjeruju da uvijek osjećaju porast vrijednosti šećera u krvi (14). Nemali broj osoba s DM tipa 2 koji su učestvovali u istraživanju u Indiji smatrao je da nije u obavezi da koriguje ishranu ukoliko uzima lijekove budući da promjena životnog stila ne unapređuje kontrolu DM. Nadalje, određen broj učesnika u ovom istraživanju bilo je mišljenja da produžena upotreba oralne neinsulinske terapije uzrokuje ozbiljne nuspojave. Sve navedeno u značajnoj mjeri ograničava kvalitetnu samonjegu i optimalnu kontrolu DM (15).

Edukacija oboljelih o dijabetes melitusu

Prema aktuelnim standardima i smjernicama za uspješnu samonjegu i podršku osobama s DM, Američke asocijacije za dijabetes (engl. *American Diabetes Association*, ADA), neophodno je da sve osobe s DM učestvuju u strukturiranoj edukaciji u cilju sticanja znanja, vještina i sposobnosti neophodnih za kvalitetnu samonjegu, prilagođavanje svakodnevnom načinu života i efikasnu terapiju DM. Budući da DM tipa 2 čini više od 90% svih slučajeva DM, predominantno je riječ o edukaciji s ciljem modifikacije zdravstvenog ponašanja i adekvatne samokontrole DM. Strukturirana edukacija kod osoba s DM realizuje se u obliku individualnih obrazovnih intervencija, grupnih edukativnih programa ili njihove kombinacije. Oblik edukacije zavisi od uvjerenja, znanja i vještina oboljelih i članova njihovih porodica, raspoloživosti i profesionalne sklonosti edukatora i dostupnih zdravstvenih resursa (6).

Edukacija osoba s DM u okviru primarne zdravstvene zaštite u Srbiji je propisana je Uredbom o zdravstvenoj zaštiti stanovništva od šećerne bolesti (Sl. glasnik RS, br. 18/94) i Uredbom o nacionalnom programu prevencije i rane detekcije tipa 2 dijabetes melitusa (Sl. glasnik RS, br. 17/2009). Prema ovim Uredbama, osobama s T2DM neophodno je obezbjediti sedam edukativnih sesija u prvih 12 meseci od otkrivanja bolesti. Pružaoci edukacije mogu biti ljekari specijalisti interne medicine i posebno edukovani diplomirani medicinski tehničari. U edukativnom timu mogu biti prisutni i dijetetičari, farmakolozi i psiholozi (16).

Iako samo znanje oboljelih o DM nužno ne osigurava optimalnu samonjegu, procjena razine znanja o DM, kao i identifikovanje specifičnih nedostataka u znanju oboljelih, predstavlja važan korak u unapređenju zdravstvene zaštite oboljelih (11,12,15). Naime, identifikovanje vulnerabilnih skupina oboljelih i njima manje poznatih aspekata DM-a i samonjege oboljelih omogućava oblikovanje i implementaciju edukativnih programa s ciljem optimizacije vrijednosti glukoze u kvi i posljedičnog sniženja morbiditeta i mortaliteta (6).

Instrumenti za procjenu znanja o dijabetes melitusu

Ne postoji jedinstven, opšteprihvaćen instrument za procjenu znanja oboljelih o DM-u (15-17).

Upitnik osnovnog znanja o dijabetesu (engl. *Diabetes Basic Knowledge Tool*, DBKT) sačinila je grupa autora iz Sjedinjenih Američkih Država 1989. godine. Sadrži ukupno 49 stavki iz pet konceptualnih dimenzija znanja o DM-u: patolofiziologija, simptomi i menadžment DM-a, praćenje vrijednosti glukoze u krvi, farmakološka terapija DM-a, dijeta/ishrana, prevencija razvoja dijabetesnog stopala i komplikacije DM (17).

Upitnik za samoprocjenu znanja o dijabetesu (engl. *Diabetes self-report tool*, DSRT) izrađen je 1989. godine u cilju utvrđivanja samoprocjenjenog znanja o DM (16). Upitnik sadrži 15 stavki u šest domena: patofiziologija, simptomi i znaci, dijagnostifikovanje i komplikacije DM, samoupravljanje i ishrana. Ispitanicima su ponuđena četiri potenci-

confidence to take responsibility for their own health throughout life (8).

The role of patients' knowledge about diabetes mellitus in the management of diabetes mellitus

The efficient treatment of DM requires appropriate knowledge about DM and treatment modalities. Although the optimal management of DM requires other qualities and competence of patients regarding self-care, knowledge about DM is essential. Namely, patients' knowledge of DM is the basis of informed decisions about diet, physical activity, weight control, blood glucose monitoring, use of medications and regular medical examinations (1,9,10).

Patients' knowledge about DM is associated with the optimal self-care and quality of life in the studies (11-13). On the other hand, the lack of knowledge among patients is identified with the suboptimal control of DM (14,15). For example, in a study which was conducted among persons with type 2 DM in Taiwan, it was found that a significant number of patients postpone the use of insulin, often until the occurrence of irreversible multiorgan damage because they believe that the use of insulin impairs kidney function. In addition, a significant absence of self-control of blood sugar values was observed in patients who believe that they always feel an increase in blood sugar values (14). A significant number of persons with type 2 DM who participated in the study in India believed that they were not obliged to balance their diet if they were taking medicines because lifestyle change did not improve DM control. Furthermore, a certain number of participants in this study believed that the prolonged use of oral non-insulin therapy caused severe serious side effects. All of the above mentioned significantly limits good quality self-care and optimal control of DM (15).

Education of patients about diabetes mellitus

According to the current standards and guidelines of the American Diabetes Association for successful self-care and support for people with DM, it is necessary that all people with DM participate in the well-structured education aimed at acquiring knowledge, skills and abilities necessary for the good-quality self-care, adaptation to daily life and efficient treatment of DM. Considering that type 2 DM accounts for more than 90% of all cases of DM, this education is predominantly aimed at modifying the health behavior and adequate self-control of DM. Structured education in persons with DM is realized in the form of individual educational interventions, group educational programs or their combination. The type of education depends on beliefs, knowledge and skills of patients and their family members, the availability and professional inclinations of educators and available health resources (6).

The education of people with DM within primary health care in Serbia has been prescribed by the Regulation on the health protection of the population against diabetes (Official Gazette of RS, NO. 18/94) and the Regulation on the national program for the prevention and early detection of type 2 diabetes mellitus (Official Gazette of RS, NO. 17/2009). According to these Regulations, it is necessary to provide seven educational sessions to people with Type 2 DM during the first 12 months from diagnosis. Providers of education can be specialists in internal medicine and specially educated graduate medical technicians. Dietitians, pharmacologists and psychologists can also be present in the educational team (16).

Although patients' knowledge about DM does not necessarily ensure the optimal self-care, the assessment of the level of knowledge about DM, as well as the identification of specific gaps in patients' knowledge, is an important step in improving the patients' health care (11,12,15). Namely, the identification of vulnerable groups of patients and those aspects of DM and self-care that are less known to them enables the creation and implementation of educational programs aimed at optimizing blood glucose values and consequently reducing morbidity and mortality (6).

Instruments for assessing knowledge about diabetes mellitus

There is no single, generally accepted instrument for assessing patients' knowledge about DM (15-17).

Diabetes Basic Knowledge Tool (DBKT) was created by a group of authors from the United States in 1989. It contains a total of 49 items from five conceptual dimensions of knowledge about DM: pathophysiology, symptoms and

jalna odgovora: „Uopšte se ne slažem"; „Ne slažem se"; „Slažem se"; „Potpuno se slažem" (17).

Kratki test znanja o dijabetesu (engl. *Brief diabetes knowledge test*, DKT1) objavljen je 1998. godine. Sa ukupno 23 stavke omogućava procjenu opšteg znanja o dijabetesu i znanja o upotrebi insulina. Tokom 2011. godine pojednostavljen je u cilju prilagođavanja osobama sa ograničenom pismenošću (Pojednostavljen test znanja o dijabetesu, *Simplified diabetes knowledge scale*) (18).

Revidirani upitnik znanja o dijabetesu (engl. Diabetes knowledge test 2, DKT2) razvijen je ažuriranjem DKT1. Izmjenjeno je ukupno 13 stavki (2 pravopisne ispravke, 4 izmjene usljed prilagođavanja važećim nacionalnim standardima, 7 izmjena u cilju pojednostavljenja pitanja ili odgovora). Kao i DKT1, DKT2 sadrži 2 podtesta sa ukupno 23 stavke (17). Prvi podtest je opšti podtest znanja o dijabetesu (engl. *General knowledge part*, GKP), a drugi je podtest upotrebe insulina (engl. *Insulin use part*, IUP). Dijelovi upitnika se mogu koristiti pojedinačno (18,19).

Upitnik za samoprocjenu znanja o dijabetesu (engl. *Diabetes self-report tool*, DSRT) izrađen je 1989. godine u cilju utvrđivanja samoprocjenjenog znanja o DM-u (16). Upitnik sadrži 15 stavki u šest domena: patofiziologija, simptomi i znaci, dijagnostifikovanje i komplikacije DM, samoupravljanje i ishrana. Ispitanicima su ponuđena četiri potencijalna odgovora: „Uopšte se ne slažem"; „Ne slažem se"; „Slažem se"; „Potpuno se slažem" (17).

Upitnik znanja o dijabetesu (engl. *Diabetes knowledge questionnaire*, DKQ) od 24 stavke izveden je iz originalnog upitnika od 60 stavki koji se koristio u Studiji obrazovanja o DM-u među Amerikancima meksičkog porijekla oboljelim od DM-a i članovima njihovih porodica u okrugu *Starr* (od 1994 do 1998). DKQ-24 posjeduje 17 pozitivno formulisanih stavki i 7 negativno formulisanih stavki unutar tri domena: osnovna znanja o DM-u, kontrola vrijednosti glukoze u krvi i prevencija komplikacija DM-a. Ispitanicima su ponuđena tri potencijalna odgovora: da, ne i ne znam. Ukupan rezultat predstavlja zbir tačnih odgovora, sa višim ocjenama koje ukazuju na postojanje optimalnog znanja o DM-u (20-24).

Svi gore navedeni instrumenti za procjenu znanja oboljelih o DM-u imaju odgovarajuću pouzdanost i unutrašnju konzistentnost (15-24). Najveći broj istraživanja o znanju oboljelih o DM koristio je DKQ-24 upitnik. Naime, DKQ-24 upitnik je citiran preko 440 puta i preveden na više od 30 jezika (1).

Istraživanja o znanju o dijabetes melitusu

Značajan broj autora je istraživao znanje oboljelih o DM. Najveći broj istraživanja je obavljen uz pomoć DKQ upitnika među oboljelim od DM tipa 2. U svim ovim istraživanjima nije postojao adekvatan nivo znanja oboljelih o DM (25-27).

U istraživanju oboljelih od DM tipa 2 u Tajlandu pomoću DKQ upitnika čak 96,7% oboljelih imalo je manje od 50% tačnih odgovora (26). Na sveprisutno, suboptimalno znanje oboljelih o DM ukazala su i istraživanja oboljelih od DM-a tipa 2 u Meksiku i Peruu. Naime, u navedenim istraživanjima procenat oboljelih s adekvatnim znanjem o D iznosio je 7% u Meksiku i 17% u Peruu (27). Nešto viši nivo znanja oboljelih o DM, utvrđen je u Indiji, u kojoj je adekvatno znanje o DM ustanovljeno u 32% oboljelih s DM tipa 2 (28). Deficitarno znanje o DM-u je utvrđeno i u oboljelih u Grčkoj i Indoneziji (29,30). U sistematskom pregledu znanja oboljelih o DM u Jugoistočnoj Aziji (Vijetnam, Tajland, Kambodža, Laos, Mjanmar, Malezija, Singapur, Indonezija, Brunej, Filipini i Istočni Timor), koji je obuhvatio sedam studija (od ukupno pregledanih 6210 studija) i 17.489 osoba s DM tipa 2, razina znanja o DM je bila nezadovoljavajuća (15). Slični rezultati su nađeni u sistematskom pregledu literature o znanju o DM-u u Iranu, koji je obuhvatio 10 studija (od pregledanih 546 studija), odnosno 1556 ispitanika (oko 156 ispitanika u svakoj studiji) (31).

Pojedinačna istraživanja ukazuju na zabrinjavajuće nisku svijest oboljelih o patofiziologiji, kliničkim manifestacijama, komplikacijama i liječenju DM (28,30,32-34). U istraživanju autora iz Nepala, Etiopije i Hrvatske, s etiologijom DM bilo je upoznato manje od trećine oboljelih od DM tipa 2 (32-34). Najveći broj oboljelih od DM tipa 2 u Indoneziji je bio mišljenja da DM uzrokuje prekomjerno konzumiranje šećera i druge slatke hrane (30). Svega 12% oboljelih od DM tipa 2 u Indiji poznavalo je tipove DM (28). Čak 79,8% oboljelih od DM tipa 2 koji su učestvovali u istraživanju u Hrvatskoj vrijednost šećera u krvi natašte iznad 11 mmmol/L nisu smatrali previsokom (34). Istraživanja u Etiopiji, Nepalu, i Hrvatskoj otkrila su zabrinjavajuće nisku svijest oboljelih o komplikacijama DM (32-34). Niti jedan oboljeli od DM tipa 2 u istraživanju u Nepalu nije doveo DM u vezu s oštećenjem krvnih sudova (32). S komplikacija-

management of DM, blood glucose monitoring, pharmacological therapy of DM, diet/nutrition, prevention of diabetic foot development and complications of DM (17).

Diabetes self-report tool (DSRT) was created in 1989 with the aim of determining self-reported knowledge about DM (16). The questionnaire contains 15 items in six domains: pathophysiology, symptoms and signs, diagnosis and complications of DM, self-management and diet. The respondents are offered four potential answers: "I do not agree at all"; "I do not agree"; "I agree"; "I agree completely" (17).

Brief diabetes knowledge test (DKT1) was published in 1998. With a total of 23 items, it enables the assessment of general knowledge about diabetes and knowledge about the use of insulin. In 2011, it was simplified in order to adapt to people with limited literacy (Simplified diabetes knowledge scale) (18).

Diabetes knowledge test 2 (DKT2) was developed by updating DKT1. A total of 13 items were changed (2 spelling corrections, 4 changes due to adaptation to valid national standards, 7 changes aimed at simplifying questions or answers). Like DKT1, DKT2 contains 2 subtests with a total of 23 items (17). The first subtest is the general knowledge part (GKP), while the second is the insulin use part (IUP). The parts of the questionnaire can be used separately (18,19).

Diabetes self-report tool (DSRT) was developed in 1989 in order to determine self-reported knowledge about DM (16). The questionnaire contains 15 items in six domains: pathophysiology, symptoms and signs, diagnosis and complications of DM, self-management and nutrition. Respondents were offered four potential answers: "I do not agree at all"; "I do not agree"; "I agree"; "I completely agree" (17).

Diabetes knowledge questionnaire (DKQ) contains 24 items and it was adapted from the original questionnaire that contained 60 items and that was used in the Starr County Diabetes Education Study among Mexican Americans with DM and their family members (from 1994 to 1998). DKQ-24 has 17 positively formulated items and 7 negatively formulated items within three domains: basic knowledge about DM, blood glucose control and prevention of complications caused by DM. Respondents were offered three potential answers: yes, no and I do not know. The total score is the sum of correct answers, where higher scores indicate optimal knowledge of DM (20-24).

All of the above mentioned instruments for the assessment of patients' knowledge about DM have adequate reliability and internal consistency (15-24). The largest number of studies on patients' knowledge about DM used DKQ-24 questionnaire. Namely, DKQ-24 questionnaire has been cited more than 440 times and has been translated into more than 30 languages (1).

Research on knowledge about diabetes mellitus

A significant number of authors investigated patients' knowledge about DM. The largest number of studies was conducted with the help of DKQ questionnaire among patients affected by type 2 diabetes mellitus. In all these studies, there was no adequate level of knowledge among patients affected by DM (25-27).

In a study of patients affected by type 2 diabetes mellitus conducted in Thailand with the help of DKQ questionnaire, as many as 96.7% of patients had less than 50% of correct answers (26). Studies of patients affected by type 2 DM in Mexico and Peru pointed to the ubiquitous, suboptimal knowledge of patients about DM. Namely, in the above mentioned studies, the percentage of patients with adequate knowledge about DM was 7%, in Mexico and 17% in Peru (27). A slightly higher level of knowledge about DM was found in patients in India, where adequate knowledge about DM was found in 32% of patients with type 2 DM (28). Deficient knowledge about DM was found in patients in Greece and Indonesia (29,30). In a systematic review of knowledge about DM in patients in Southeast Asia (Vietnam, Thailand, Cambodia, Laos, Myanmar, Malaysia, Singapore, Indonesia, Brunei, the Philippines and Timor-Leste), which included seven studies (out of a total of 6210 studies reviewed) and 17,489 persons with type 2 DM, the level of knowledge about DM was unsatisfactory (15). Similar results were found in a systematic review of literature on knowledge about DM in Iran, which included 10 studies (out of 546 reviewed studies), that is, 1556 participants (about 156 participants in each study) (31).

Individual studies point to a worryingly low level of awareness among patients about pathophysiology, clinical manifestations, compli-

ma koje uzrokuje DM je bilo upoznato manje od trećine oboljelih u Etiopiji i Hrvatskoj (34,35).

U većini istraživanja, porodična istorija DM, mlađa životna dob i fakultetsko obrazovanje su predstavljali nezavisne prediktore optimalnog znanja oboljelih o DM (23,29,33,36). Član porodice sa DM može predstavljati važan izvor informacija o bolesti. Nadalje, bolje znanje o DM mlađih oboljelih osoba autori su doveli u vezu sa upotrebom interneta i komunikacijom sa drugim oboljelim (29). Takođe, osobe mlađe životni dobi s DM tipa 2 nerijetko uspješnije usvajaju aktivnosti samonjege u odnosu na starije osobe. U osoba starije životni dobi narušena kognitivna funkcija otežava sticanje optimalnog znanja o DM (32). Oboljeli s višim nivoom obrazovanja češće prisustvuju savjetovanju ili edukaciju o DM. Osim toga, informacije o DM prikupljaju putem različitih sredstava komunikacije (32). Istraživanje u Etiopiji identifikovalo je značajno bolje znanje o DM oboljelih osoba muškog pola, što je objašnjeno značajno nižom stopom pismenosti kod žena (33). U većine oboljelih s DM tipa 2 nivo znanja o DM je u velikoj meri određivao vrijednost glikoziliranog hemoglobina A1c (27,34-36).

U istraživanju autora iz Gane, mlade osobe s DM tipa 1 i njihovi staratelji su posjedovali ograničeno znanje o liječenju DM. Oboljeli i njihovi staratelji su upoznati s aktivnostima samonjege i terapijom hiperglikemije, ali je njihovo znanje o zbrajanju ugljenih hidrata, liječenju teške hipoglikemije i liječenju DM tipa 1 tokom specifičnih perioda, kao što je trudnoća, marginalno (31). U istraživanju u Grčkoj osobe s DM tipa 1 imali su signifikantno više znanje o DM u odnosu osobe s DM tipa 2 (37). Istraživanje u Jordanu ustanovilo je nisko znanje o DM među oboljelim. Nije postojala značajna razlika u znanju između oboljelih s DM tipa 1 i DM tipa 2 (38).

Zaključak

DM predstavlja veliki izazov za zdravstvene radnike i oboljele od DM. Znanje oboljelih o DM -u je temelj optimalnog upravljanja DM imajući u vidu da obezbjeđuje donošenje informisanih odluka i aktivnu ulogu oboljelih u procesu liječenja. Istraživanja u svim delovima svijeta ukazuju na sveprisutno deficitarno znanje oboljelih o DM. Nedostatak znanja o DM dovodi se u vezu s suboptimalnim vrijednostima glukoze u krvi, visokim morbiditetom i mortalitetom. Rutinska procjena nivoa znanja oboljelih o DM putem standardizovanih upitnika i prateća identifikacija vulnerabilnih grupa u ustanovama primarne zdravstvene zaštite rezultovala bi organizovanju edukacija koje bi doprinele unapređenju znanja oboljelih i usvajanju vještina neophodnih u aktivnostima samonjege i adekvatne kontrole ove bolesti.

Konflikt interesa

Autori su izjavili da nema konflikta interesa.

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cations and treatment of DM (28,30,32-34). In a study by authors from Nepal, Ethiopia and Croatia, less than a third of patients affected by type 2 DM were familiar with the etiology of DM (32-34). The largest number of patients with type 2 diabetes mellitus in Indonesia thought that DM is caused by excessive consumption of sugar and other sweet foods (30). Only 12% of patients with type 2 diabetes mellitus in India knew the types of DM (28). As many as 79.8% of patients with type 2 diabetes mellitus who participated in the research conducted in Croatia did not consider the value of fasting blood glucose above 11 mmol/L to be too high (34). Studies that were conducted in Ethiopia, Nepal and Croatia revealed a worryingly low level of awareness among patients about the complications of DM (32-34). None of the patients with type 2 DM in a study in Nepal associated DM with blood vessel damage (32). Less than a third of patients in Ethiopia and Croatia were familiar with the complications caused by DM (33,34).

In the majority of studies, family history of DM, younger age and university education were independent predictors of optimal knowledge of patients about DM (23,28,32,35). A family member with DM can be an important source of information about the disease. Furthermore, the authors associated better knowledge about DM in younger patients with the use of Internet and communication with other patients (28). Also, younger people with type 2 DM often adopt self-care activities more successfully than older people. In elderly people, impaired cognitive function makes it difficult to acquire optimal knowledge about DM (32). Patients with a higher level of education more often attend counseling or education about DM. In addition, information about DM is collected through various means of communication (32). A study conducted in Ethiopia identified a significantly higher level of knowledge about DM in male patients, which was explained by a significantly lower literacy rate in women (33). In the majority of patients with type 2 DM, the level of knowledge about DM determined, to a large extent, the value of glycated hemoglobin A1c (27,34-36).

In a study by authors in Ghana, younger persons with type 1 DM and their caregivers had limited knowledge about the treatment of DM. Patients and their caregivers were acquainted with the activities of self-care and the treatment of hyperglycemia, but their knowledge of carbohydrates counting, the treatment of severe hypoglycemia, and treatment of type 1 DM during specific periods, such as pregnancy, is marginal (31). In a study conducted in Greece, persons with type 1 DM had significantly more knowledge about DM than persons with type 2 DM (37). A study conducted in Jordan found low knowledge about DM among patients. There was no significant difference in knowledge between patients with type 1 DM and type 2 DM (38).

Conclusion

DM represents a great challenge for healthcare workers and patients affected by DM. Patients' knowledge about DM is the basis of optimal management of DM, having in mind that it ensures making informed decisions and the active role of patients in the treatment process. Studies in all parts of the world point to the ubiquitous lack of knowledge among patients affected by DM. The lack of knowledge about DM is associated with suboptimal blood glucose values, high morbidity and mortality. Routine assessment of the level of knowledge about DM among patients with the help of standardized questionnaires and the accompanying identification of vulnerable groups in primary health care institutions would result in the organization of educational sessions that would contribute to the improvement of knowledge among patients and the acquisition of skills necessary for self-care activities and adequate control of this disease.

Competing interests

The author declared no competing interests.

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PREDIKTORI ISHODA LEČENJA HIRURŠKIH PACIJENATA U JEDINICI INTENZIVNE NEGE: PREGLED LITERATURE

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SAŽETAK

Intenzivna nega podrazumeva negu životno ugroženih pacijenata, tj. negu kritično obolelih pacijenata, kojima je potreban intenzivan nadzor, lečenje i nega u cilju održavanja hemodinamske i respiratorne ravnoteže, kako bi se smanjio broj komplikacija i smrtnih ishoda. Starenje stanovništva, povećana složenost nege, kao i sve raznovrsnija patologija i simptomatologija određenih bolesti i stanja, utiču na povećanje potrebe za uslugama intenzivne nege u svim granama medicine, pre svega u hirurgiji. Cilj ovog preglednog rada jeste da se identifikuju prediktori ishoda lečenja hirurških pacijenata u jedinicama intenzivne nege (JIN). Podaci su prikupljeni pretraživanjem nekoliko baza podataka: *PubMed, Google Scholar, Web of Science* i *Embase*. Pretraživanje je sprovedeno za poslednjih dvadeset godina korišćenjem sledećih ključnih reči: jedinica intenzivne nege, hirurgija, prediktori i ishod lečenja. U našu analizu uključeni su radovi koji su analizirali kliničke ishode hirurških pacijenata koji su boravili u JIN. Uočava se da su prediktori ishoda lečenja hirurških pacijenata u JIN: težina kliničke slike pacijenta pre hospitalizacije, vrsta i obim operativnog zahvata, godine starosti, gojaznost, broj komorbiditeta, postoperativne komplikacije, ali i stepen organizovanosti zdravstvene službe i kompetentnost zdravstvenog osoblja. Stoga, na lokalnom, regionalnom i globalnom nivou treba razraditi kontinuirano praćenje i evaluaciju prediktora ishoda lečenja hirurških pacijenata u JIN, imajući u vidu da se hospitalizuju životno ugroženi pacijenti i da postoji visok rizik od komplikacija i smrtnog ishoda. Identifikovanje prediktora ishoda lečenja hirurških pacijenata u JIN, doprineće donošenju strategija za unapređenje lečenja ovih pacijenata.

Ključne reči: hirurgija, jedinica intenzivne nege, prediktori, lečenje, ishodi, komplikacije

Uvod

Hirurgija je grana medicine koja se bavi izučavanjem i lečenjem, pre svega hirurškim (operativnim) putem, različitih bolesti, povreda i deformiteta. Sa većim i bržim razvojem tehnologije i produžetkom životnog veka, povećava se i broj povreda i bolesti, pa samim tim i obim hirurškog tretmana povređenih i obolelih lica. Razvojem transplantacione hirurgije, kao i modaliteta lečenja onko-hirurških pacijenata, produžava se životni vek pacijenata za koje ranije nije bilo mogućnosti za izlečenje, ili se bar stavlja bolest pod kontrolu (1). Integralni deo hirurgije, kao i svih drugih medicinskih grana je zdravstvena nega, koja, kako u svetu, tako i kod nas, datira od najranijeg perioda. Njena specifičnost u navedenoj oblasti u odnosu na druge nege, jeste u tome što se prevashodno sprovodi u stacionarnim uslovima po principima progresivne nege i što obuhvata sve indikatore i

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ORIGINAL ARTICLE

PREDICTORS OF TREATMENT OUTCOME OF SURGICAL PATIENTS IN THE INTENSIVE CARE UNIT: LITERATURE REVIEW

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SUMMARY

Intensive care involves the care of life-threatening patients, i.e. care of critically ill patients who need intensive monitoring, treatment and care in order to maintain hemodynamic and respiratory balance, in order to reduce the number of complications and deaths. The aging of the population, the increased complexity of care, as well as the increasingly diverse pathology and symptomatology of certain diseases and conditions, influence the increase in the need for intensive care services in all branches of medicine, primarily in surgery. The aim of this review is to identify predictors of treatment outcomes for surgical patients in intensive care units (ICUs). Data were collected by searching several databases: PubMed, Google Scholar, Web of Science and Embase. A search was conducted for the past tventy years using the following keywords: intensive care unit, surgery, predictors, and treatment outcome. Included in our analysis were papers that analyzed the clinical outcomes of surgical patients who stayed in the ICU. It is observed that the predictors of the outcome of the treatment of surgical patients in ICU are: the severity of the patient's clinical picture before hospitalization, the type and scope of the operation, age, obesity, number of comorbidities, postoperative complications, but also the degree of organization of the health service and the competence of the health staff. Therefore, at the local, regional and global level, continuous monitoring and evaluation of predictors of treatment outcomes for surgical patients in the ICU should be developed, bearing in mind that life-threatening patients are hospitalized and that there is a high risk of complications and death. By identifying the predictors of the outcome of the treatment of surgical patients in the ICU, it will contribute to the adoption of strategies to improve the treatment of these patients.

Key words: surgery, intensive care unit, predictotrs, treatment, outcomes, complications

Introduction

Surgery is a branch of medicine that deals with the study and treatment of different diseases, injuries and deformities, primarily by means of surgical (operative) intervention. With the greater and faster development of technology and the extension of life expectancy, the number of injuries and diseases increases, and therefore, the scope of surgical treatment of injured and ill persons. With the development of transplant surgery, as well as of treatment modalities for onco-surgical patients, the life expectancy of patients for whom there was previously no possibility of treatment is extended, or at least the disease is brought under control (1). An integral part of surgery, as well as of all other medical branches is health care, which dates back to the earliest period both in the world and in our country. Its specificity in the mentioned field compared to other types of care is that it

standarde u preoperativnom, perioperativnom i postoperativnom periodu (1,2). Jedinica intenzivne nege (JIN) predstavlja zasebnu organizacionu i prostornu/geografsku celinu, koja funkcioniše u saradnji sa drugim odeljenjima u određenoj zdravstvenoj ustanovi (3). Pored dobro organizovanog prostora, JIN karakteriše kontinuirano prisustvo medicinskog osoblja i oprema za izvođenje različitih terapijskih i dijagnostičkih procedura, koja nije standardna na drugim/nižim nivoima progresivne nege (4).

U većini razvijenih zemalja, hirurški pacijenti čine najveći broj pacijenata hospitalizovanih u JIN. Određivanje težine stanja ovih pacijenata pre bilo koje hirurške intervencije i dalje predstavlja težak i odgovoran posao, jer komplikacije do kojih može doći imaju velikog značaja za krajnji ishod lečenja, i mogu značajno uticati na pojavu smrtnih ishoda (5). Značaj proučavanja prediktora u hiruirgiji je utoliko veći, što različita akutna stanja, bolesti i povrede koreliraju sa potrebom za hirurškim zbrinjavanjem, kako konzervativnim, tako i operativnim, koje se često sprovodi upravo u JIN. Cilj ovog preglednog rada je da se identifikuju prediktori ishoda lečenja hirurških pacijenata lečenih u JIN-u.

Metod

Podaci za ovaj pregledni rad su prikupljeni pretraživanjem nekoliko baza podataka: *PubMed*, *Google Scholar*, *Web of Science* i *Embase*. Pretraživanje je sprovedeno za poslednjih dvadeset godina korišćenjem sledećih ključnih reči: jedinica intenzivne nege, hirurgija, prediktori i ishod lečenja (komplikacije i mortalitet). U našu analizu uključeni su samo oni radovi koji su analizirali ishode lečenja (komplikacije i mortalitet) hirurških pacijenata koji su boravili u JIN.

Otvoren i zatvoren sistem intenzivne nege

Istraživanja na ovu temu vrše se u čitavom svetu, a u našem istraživanju akcenat smo stavili na pacijente koji se isključivo hirurški zbrinjavaju, iako to nije jedini kriterijum za smeštaj pacijenta u JIN. Polemika se u određenim studijama vodi, pre svega, oko načina organizovanja intenzivne nege hirurških pacijenata, gde se kao dva osnovna modela organizacije pominju tzv. otvoreni i zatvoreni sistem. U otvorenom sistemu intenzivne nege pacijenti se zbrinjavaju u prisustvu hirurga i/ili interniste, te se samo po potrebi konsultuje intenzivista. Nasuprot njemu, u zatvorenom sistemu, intenzivista preuzima stalnu i punu odgovornost za zbrinjavanje pacijenta i donosi sve odluke od njegovog prijema do otpusta (6). Iako se smatra da i jedan i drugi model imaju svoje prednosti, istraživanja u većini zemalja pokazuju da je zatvoreni sistem korisniji za pacijente, naročito one kritično obolele i sa multitraumama (7).

Preoperativni, perioperativni i postoperativni prediktori ishoda

Rezultati dosadašnjih studija potvrđuju, da je teško identifikovati koji pacijenti su pod većim rizikom od komplikacija i smrtnog ishoda nakon operativnog lečenja u odnosu na druge pacijente (8). Međutim, prediktori ishoda hirurških pacijenata dele se na one koji su poznati u preoperativnom periodu, one koji su direktno povezani sa hirurškom intervencijom, kao i na individualne faktore koji doprinose riziku nastanka komplikacija i vode smrtnom ishodu (5).

Preoperativno stanje pacijenta je značajan prediktor, tim pre što osobe koje nemaju komorbiditete, tačnije pridružene bolesti (dijabetes, hipertenziju, srčane bolesti itd.), i koje su mlađe i fizički zdravije imaju veću šansu da ne razviju neku od komplikacija. Procena fizičke kondicije pacijenata može pomoći u oporavku pacijenata, kao i bolji laboratorijski rezultati (npr. hemoglobin, elektroliti, kreatinin itd.) (8,9). Brojna istraživanja ukazuju da stres, anksioznost, depresivne reakcije i psihička destabilizacija mogu negativno uticati na imunološki sistem, dovesti ga u stanje imunosupresije, i time smanjiti sposobnost organizma da se oporavi posle hirurške intervencije (10). Istraživanja dalje pokazuju, da su dužina trajanja operativnog zahvata, složenost operacije, starije godine korisnika usluga, viši indeks telesne mase i hitnost postupka povezani sa lošijim ishodima (11-16). Perioperativni indikatori su oni koji utiču na ishod lečenja tokom samog hirurškog zahvata (npr. vrsta anestezije, dužina operacije, vrsta hirurške intervencije, monitoring vitalnih funkcija, pravovremeno reagovanje u slučaju komplikacija, itd.), a postoperativni na oporavak posle hirurške intervencije (kvalitet postoperativne nege, upravljanje bolom, prevencija infekcija, rehabilitacija, posttraumatski stres, depresija, itd.) (17,18). Ipak, za pouzdaniju procenu ishoda, treba uzeti u obzir i druge faktore, kao što su: sastav tima (hirurškog i anesteziološkog) koji će

is primarily carried out in inpatient conditions according to the principles of progressive care, which encompasses all indicators and standards in preoperative, perioperative and postoperative period (1,2). The intensive care unit (ICU) is a separate organizational and spatial/geographical unit, which functions in cooperation with other departments in the healthcare institution (3). In addition to a well-organized space, the ICU is characterized by the continuous presence of medical staff and equipment used for carrying out various therapeutic and diagnostic procedures, which is not standard at other/lower levels of progressive care (4).

In the majority of developed countries, surgical patients account for the largest number of patients hospitalized in ICUs. Determining the severity of condition of these patients before any surgical intervention is still a difficult and responsible task, because complications that may occur are of great importance for the final treatment outcome, and can significantly affect the occurrence of fatal outcomes (5). The significance of studying predictors in surgery is therefore greater, as various acute conditions, diseases and injuries correlate with the need for surgical treatment, both conservative and operative, which is often performed in the ICU. The aim of this review article is to identify treatment outcomes of surgical patients treated in the ICU.

Methods

Data for this review article were collected by searching a few databases: PubMed, Google Scholar, Web of Science and Embase. The search has been conducted for the last twenty years using the following key words: intensive care unit, surgery, predictors and treatment outcome (complications and mortality). Only those studies that analyzed treatment outcomes (complications and mortality) of surgical patients who stayed in ICUs were included in our analysis.

Open and closed system of intensive care

Research on this topic has been conducted all around the world, and in our study the research effort has focused on patients who are treated solely surgically, although this is not the only criterion for admitting a patient to the ICU. In certain studies, a debate is going on primarily about the way of organizing intensive care for surgical patients, where the so-called open and closed systems are mentioned as two main models of organization. In the open system of intensive care, patients are cared for in the presence of a surgeon and/or an internist, while an intensivist is consulted only if it is necessary. On the other hand, in the closed system, the intensivist takes on the continuous and full responsibility for the care of the patient and makes all decisions from his admission to discharge (6). Although it is considered that both models have advantages, research in most countries has shown that the closed system is more useful for patients, especially those who are critically ill and with multiple traumas (7).

Preoperative, perioperative and postoperative predictors of treatment outcomes

The results of previous studies confirm that it is difficult to identify which patients are at a higher risk of complications and death after operative treatment compared to other patients (8). However, the predictors of outcome of surgical patients are classified as those that are known in the preoperative period, those that are directly related to surgical intervention, as well as individual factors that contribute to the risk of complications and lead to death (5).

The preoperative condition of the patient is a significant predictor, especially because persons who do not have comorbidities (diabetes, hypertension, heart diseases, etc.), that is, associated diseases, and who are younger and physically healthier have a greater chance of not developing any of the complications. The assessment of patient's physical condition can help in patient's recovery, as well as better laboratory findings (e.g. hemoglobin, electrolytes, creatinine, etc.) (8,9). Numerous studies have shown that stress, anxiety, depressive reactions and psychological destabilization can negatively affect the immune system, lead to the state of immunosuppression, and thus reduce the body's ability to recover after surgical intervention (10). Moreover, research has shown that the duration of operative procedure, the complexity of the operation, older age of service users, higher body mass index and the urgency of the procedure are associated with worse outcomes (11-16).

vršiti zahvat, njihova sposobnost i veštine, lekovi, raspoloživa oprema, podatak da li je intervencija hitna ili elektivna, pa čak i doba godine, doba dana tj. dan u nedelji kada se vrši hirurška intervencija (npr. manji rizik je ukoliko je intervencija radnim danom u odnosu na vikend) i dr. (17,18).

Najpoznatiji sistem klasifikacije fizičkog statusa bolesnika, ali i koristan prediktor mogućeg operativnog i postoperativnih rizika, jeste dobro poznata ASA klasifikacija fizičkog stanja bolesnika (engl. *The American Society of Anesthesiologists* - ASA). Prema ASA - klasifikaciji, bolesnici za anesteziju se grupišu u jednu od šest grupa, pri čemu prva grupa podrazumeva da je bolesnik zdrav i da ima vrlo mali rizik za anesteziju, a grupa šest označava bolesnika sa dokazanom smrti mozga koji je kandidat za davanje organa.

Postoje indeksi koji su usko specifični za određene organske sisteme, koji u zavisnosti o kojem sistemu je reč obuhvataju analizu uticaja niza faktora na umiranje ili komorbiditete, kao npr. Čarlsonov indeks komorbiditeta (engl. *Charlson Comorbidity Index* - CCI) i revidirani indeks srčanog rizika (engl. R*evised Cardiac Risk Index* - RCRI) (19,20). Najčešće korišćeni indeksi/skorovi za predviđanje umiranja u JIN su: skor akutne fiziologije i hronične zdravstvene evaluacije (engl. *Acute Physiology and Chronic Health Evaluation* - APACHE) (21), model verovatnoće umiranja (engl. *Mortality Probability Models* - MPM) (22), skor pojednostavljene akutne fiziologije (engl. *Simplified Acute Physiology Score* - SAPS) (23), sekvencijalna procena zatajenja organa (engl. *Sequential Organ Failure Assessment* - SOFA) (24) i hirurški Apgar skor (engl. *Surgical Apgar Score* - SAS) (25).

Evropsko društvo za intenzivnu medicinu izdalo je smernice za smeštaj pacijenata u JIN, i to onih koji su nestabilnog zdravstvenog stanja ili u visokom riziku za razvoj komplikacija (26). Nešto kasnije, Amerčki koledž je objavio šire smernice za prijem pacijenata u JIN prema određivanju prioriteta, u rasponu od prioriteta 1 (gde se ubrajaju pacijenti koji će imati najviše koristi od prijema) do prioriteta 4 (u koji se ubrajaju oni za koje se smatra da neće imati nikakve koristi) (27).

Osnovni problemi hirurških pacijenata, pa samim tim i zdravstvene nege u JIN su: poremećaj svesti, krvarenje, bol, sva stanja koja iniciraju kontinuirano praćenje vitalnih parametara ili njihovo merenje na pola sata (invazivni i neinvazivni monitoring), politraumatizam, primena nekonvencionalne terapije i drugih terapijskih postupaka (oksigenoterapija, transfuzija pune krvi ili njenih derivata, stalna infuziona terapija, intubacija, mehanička ventilacija), strah od ishoda operativnog lečenja, mogućnost nastanka ranih postoperativnih komplikacija (povišena telesna temperatura, infekcija, povraćanje), stanje imunosupresije, ograničena pokretljivost ili nepokretnost pacijenata (što može usloviti oštećenje integriteta kože, poremećaj cirkulacije, opstipaciju i dr.), deficit u samozbrinjavanju (nemogućnost samostalnog hranjenja, obavljanja lične higijene) i dr. (1,2).

Određene studije ukazuju da preoperativna slabost može biti prediktor neželjenih postoperativnih ishoda (28). Pojedine smernice preporučuju preoperativnu terapiju intravenskim rastvorima, kao i hemodinamsku optpimizaciju radi usklađivanja potrošnje i isporuke kiseonika, što opet, kod visokorizičnih hirurških pacijenata, ima za cilj smanjenje postoperativnih komplikacija i umiranja (29). U prilog tome govore i rezultati studije koja je potvrdila da upotreba preoperativne hirurške sigurnosne kontrolne liste, koja obuhvata 19 stavki, u cilju osiguranja bezbednosti pacijenta, pre uvođenja u operacionu salu, kao i pre izlaska iz nje, dovodi do smanjenja komplikacija koje mogu rezultirati čak i smrtnim ishodom (30).

Stručnost i brojnost zdravstvenih radnika kao indikator ishoda

Pored faktora koji su vezani za samog pacijenta, doprinos u krajnjem ishodu ima osoblje koje je kompetentno i posebno obučeno za rad u JIN. Smatra se da edukovani i posvećeni intezivisti i medicinske sestre, koji poseduju usko specijalizovane veštine za realizaciju invazivnih i neinvazivnih dijagnostičko-terapijskih postupaka, mogu pružiti bolji tretman i negu od onih koji nisu prošli obuku (31,32). Istovremeno, osobe koje su radno angažovane u JIN treba da razviju i veštine kritičkog razmišljanja/mišljenja (33). Smatra se, da rano uočavanje određenih promena u stanju pacijenta predstavlja takođe prediktor preživljavanja, adekvatnog lečenja i što bržeg kućnog oporavka - rehabilitacije. Pored znanja i veština, potreban je dovoljan broj osoblja za pružanje ovako superiornog oblika praćenja, podrške i nege pacijenata, ali i potpuna prostorna opremljenost uz materijalne resurse (oprema, bolesnički kreveti, aparati, itd.). Radi sprečavanja komplikacija ležanja i ograničene pokretljivosti, članove tima čine i fizioterapeuti (34).

Perioperative indicators are those that affect the treatment outcome during the surgical procedure itself (e.g. type of anesthesia, length of operation, type of surgical intervention, monitoring of vital functions, timely response in case of complications, etc.), while postoperative indicators affect recovery after surgical intervention (quality of postoperative care, pain management, prevention of infections, rehabilitation, post-traumatic stress, depression, etc.) (17,18). However, for a more reliable assessment of the outcome, other factors should be considered, such as the following: team members (surgical and anesthesiological) that will perform the procedure, their ability and skills, medications, available equipment, information on whether the intervention is urgent or elective, and even the time of the year, the time of the day, that is, the day of the week when the surgical intervention is performed (e.g. the risk is lower when the intervention is performed on a weekday compared to the weekend), etc. (17,18).

The most well-known classification system of the patient's physical status, as well as a useful predictor of possible operative and postoperative risks is the well-known ASA classification of the patient's physical condition (ASA – The American Society of Anesthesiologists). According to the ASA classification, patients for anesthesia are grouped into one of six groups, where the first group means that the patient is healthy and has a very low risk for anesthesia, while the sixth group indicates a patient with the proven brain death who is a candidate for donation of organs.

There are indices that are narrowly specific for certain body systems, which depending on the given system include the analysis of numerous factors influencing mortality and comorbidities, such as Charlson Comorbidity Index (CCI) and Revised Cardiac Risk Index (RCRI) (19,20). The most commonly used indices/scores for predicting mortality in the ICU are: Acute Physiology and Chronic Health Evaluation (APACHE) (21), Mortality Probability Models (MPM) (22), Simplified Acute Physiology Score (SAPS) (23), Sequential Organ Failure Assessment (SOFA) (24) and Surgical Apgar Score (SAS) (25).

The European Society of Intensive Care Medicine (ESICM) published guidelines for the admission of patients to the ICU, namely those who are in an unstable state or at a high risk of developing complications (26). Later, the American College published broader guidelines for admitting patients to ICUs according to priorities, ranging from priority 1 (patients who will most benefit from the admission) to priority 4 (for patients who are thought to have no benefits) (27).

The main problems of surgical patients, and therefore, of health care in the ICU include the following: loss of consciousness, bleeding, pain, all conditions that require the continuous monitoring of vital parameters or their measurement every half hour (invasive and non-invasive monitoring), polytraumatism, administration of unconventional therapy and other therapeutic procedures (oxygen therapy, transfusion of whole blood or its products, continuous infusion therapy, intubation, mechanical ventilation), fear of the outcome of operative treatment, the possibility of early postoperative complications (elevated body temperature, infection, vomiting), the state of immunosuppression, limited mobility or immobility of patients (which can cause damage to skin integrity, circulatory disorders, constipation, etc.), deficit in self-care (inability to take food independently, perform personal hygiene) etc. (1,2).

Certain studies indicate that preoperative weakness may be a predictor of adverse postoperative outcomes (28). Certain guidelines recommend preoperative therapy with intravenous solutions, as well as hemodynamic optimization in order to harmonize oxygen consumption and delivery, which is aimed at reducing postoperative complications and mortality in high-risk surgical patients (29). This is supported by the results of the study, which confirmed that the use of the preoperative surgical safety checklist, including 19 items aimed at ensuring the patient's safety before entering the operating room, as well as before leaving it, led to a reduction in complications, which can even result in a deathly outcome (30).

Expertise and number of healthcare workers as an indicator of success

In addition to factors related to the patient himself, the contribution to the final outcome is made by staff who are competent and specially trained to work in the ICU. It is believed that educated, dedicated intensivists and nurses, who have highly specialized skills for the realization of invasive and non-invasive diagnostic-therapeutic procedures, can provide better treatment and care than those who did not undergo training (31,32).

Zbrinjavanje hirurških pacijenata sa različitim oboljenjima i povredama u JIN predstavlja veliki izazov za hirurga, koji osim bazičnih propedevtičkih metoda, koristi vrlo kompleksne i sofisticirane terapijske i operativne procedure u cilju stabilizacije stanja pacijenta. Medicinske sestre, pored učešća u zavisnim, međuzavisnim i nezavisnim sestrinskim intervencijama u JIN, pružaju usluge nege pacijenata i koriste u sestrinskoj praksi instrumente procene životne ugroženosti pacijenata (engl. *Early Warning Score*), skale za procenu bola (numeričke, verbalno-analogne, multidimenzionalni upitnik i dr.), skale za procenu stanja svesti (engl. *Glasgow Coma Score* i *AVPU Score*), skale za procenu stanja traumatizovanih pacijenata (engl. *Trauma Score*), skale za procenu rizika od nastanka tromboflebitisa (engl. *Jackson Scale*), dekubitusa (engl. *Norton, Braden i Knoll*) i rizika od pada (engl. *Morse Fall Scale*) (2).

Kolaboracija između hirurga, anesteziologa i medicinskih sestara neophodna je od trenutka prijema do momenta otpusta, u cilju blagovremene detekcije stanja pacijenta i brze intervencije.

Najčešće komplikacije hirurških pacijenata u JIN

Rezultati pojedinih istraživanja pokazuju, da su najčešće komplikacije kod hirurških pacijenata u JIN infekcije. Informacije o vrstama infekcija, njihovim uzročnicima i ishodima mogu doprineti razvoju strategije za prevenciju, blagovremenu dijagnostiku, lečenje i raspodelu postojećih resursa (35). Pandemija korona virusa pokrenula je mnogobrojna pitanja oko načina zbrinjavanja hirurških pacijenata, kako bi se smanjio negativan uticaj određenih prediktora i minimizirao rizik od nastanka infekcije. Predloženo je odlaganje elektivnih operacija, kao i obezbeđivanje ustanova u kojima se neće zbrinjavati kovid pozitivni pacijenti, ali i pravilna upotreba lične zaštitne opreme (36).

Zaključak

Starost pacijenta, njegovo zdravstveno stanje pre smeštanja u JIN, prisustvo drugih bolesti (komorbiditeta), složenost i tok operativnog zahvata, postoperativnih komplikacija i kompetetnost kadra su najznačajniji prediktori ishoda lečenja hirurških pacijenata u JIN. U cilju poboljšanja ishoda hirurških pacijenata lečenih u JIN usled različite etiologije, neophodno je pored optimizacije stanja pacijenata pre operacije, tokom operativnog zahvata i nakon istog, standardizovati sistem edukacije i sertifikacije osoblja za rad u JIN. Takođe, neophodno je kontinuirano izveštavati o ishodima lečenja pacijenata u JIN, kako bi se preduzele preventivne i korektivne mere u cilju sprečavanja komplikacija, zaštite zdravlja pacijenata i smanjivanja letalnih ishoda.

Konflikt interesa

Autori su izjavili da nema konflikta interesa.

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At the same time, persons who are employed in the ICU should also develop skills of critical thinking (33). It is believed that early detection of certain changes in the patient's condition is also a predictor of survival, adequate treatment and faster recovery at home - rehabilitation. In addition to knowledge and skills, a sufficient number of staff is needed to provide such a superior form of monitoring, support and patient care, as well as complete equipment of facilities with material resources (equipment, patient beds, devices, etc.). In order to prevent complications of lying down and limited mobility, team members are physiotherapists, as well (34).

Taking care of surgical patients with different diseases and injuries in the ICU is a big challenge for a surgeon, who, in addition to basic propaedeutic methods, uses very complex and sophisticated therapeutic and operative procedures in order to stabilize the patient's condition. Nurses, besides taking part in dependent, interdependent and independent nursing interventions in the ICU, provide patient care service and use instruments for assessing life threatening conditions in their nursing practice (Early Warning Score), scales for the assessment of pain (numerical, verbal-analogue, multidimensional questionnaire, etc.), scales for assessing the state of consciousness (Glasgow Coma Score and AVPU Score), scales for assessing the state of traumatized patients (Trauma Score), scales for assessing the risk of thrombophlebitis (Jackson Scale), pressure ulcers (Norton, Braden, Knoll) and the risk of fall (Morse Fall Scale) (2).

The collaboration between surgeons, anesthesiologists and nurses is necessary from the moment of admission to the moment of discharge, aimed at the timely detection of patient's condition and quick intervention.

The most common complications in surgical patients in the ICU

The results of certain studies have shown that the most common complications in surgical patients in the ICU are infections. The information about types of infections, their causes, and outcomes can contribute to the development of strategies for the prevention, timely diagnosis, treatment and distribution of existing resources (35). The corona virus pandemic has initiated numerous questions related to the way of taking care of surgical patients. In order to reduce the negative impact of certain predictors and minimize the risk of infections, it has been proposed to postpone elective surgeries, as well as to provide institutions, where covid positive patients would not be cared for, as well as the proper use of personal protective equipment (36).

Conclusion

The patients' age, his health condition before the admission to the ICU, the presence of other diseases (comorbidities), the complexity and course of the operation, the absence of postoperative complications and the competence of staff are the most important predictors of the outcome of the treatment of surgical patients in the ICU. In order to improve the outcome of surgical patients treated in the ICU due to various etiologies, it is necessary, in addition to optimizing the condition of patients before surgery, during and after surgery, to standardize the system of education and certification of staff for work in the ICU. Also, it is necessary to continuously report on the outcomes of treatment of patients in the ICU, in order to take preventive and corrective measures aimed at preventing complications, and therefore, better protection of patients' health and reduction in the number of deathly outcomes.

Competing interests

The authors declared no competing interests.

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