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i JZU Bolnice „Sveti Vračevi" Bijeljina, 2024.

Zaštita srca i krvnih sudova – svetski rezultati u regionalnom okruženju - uspeh HISPA programa

u organizaciji

Udruženja centara za hipertenziju, prevenciju infarkta i šloga (HISPA)
JZU Bolnice „Sveti vračevi" Bijeljina, RS

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- Postkovid sindrom i sindrom hroničnog umora – Lice i naličje epidemije koja traje
- Personalizovana prevencija infarkta miokarda i šloga – uspeh HISPA programa
- Prevencija i Intervencija. Šta je starije, kokoška ili jaje?
- Hipertenzija – ubica mekog srca, maksimalna redukcija za optimalni kardiovaskularni rizik!
- „Sleep apnea" – stari igrač u savremenom okruženju kardiovaskularnog rizika!
- Dijabetes melitus i pušenje – Sinergija za kraći život!
- Familijarna hiperholesterolemija – savremena rešenja za dijagnostiku i lečenje!
- Prevencija šloga i lečenje atrijalne fibrilacije: regionalni izazovi savremena rešenja
- Hrana, stress, fizička aktivnost, pušenje – bosanski lonac faktora rizika!

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Iz uredništva

Izazovi i napredak u zdravlju kardiovaskularnog sistema

Kardiovaskularne bolesti (KVB) predstavljaju globalni zdravstveni problem, koji svake godine oduzima milione života. Iako je postignut značajan napredak u dijagnostici, liječenju i prevenciji, izazovi vezani za kardiovaskularne bolesti i dalje opterećuju zdravstvene sisteme širom svijeta.

Starenje stanovništva

Starenje stanovništva donosi niz izazova, posebno u smislu zdravlja kardiovaskularnog sistema. Povećanje očekivane životne starosti dovodi do veće prevalencije kardiovaskularnih bolesti, jer starenje uzrokuje promjene u strukturi i funkciji srca i krvnih sudova. Jedna od glavnih promjena je smanjenje elastičnosti arterija, što vodi ka povišenom krvnom pritisku i dodatnom opterećenju srca.

Ateroskleroza, proces nakupljanja plaka u zidovima arterija, značajno doprinosi riziku od srčanih udara i moždanih udara kod starije populacije. Pored toga, srčani mišić može oslabiti, smanjujući njegovu sposobnost da efikasno pumpa krv, čime se povećava rizik od srčane insuficijencije.

Preventivne mjere, kao što su zdrava ishrana, redovna fizička aktivnost, smanjen unos soli i kontrola tjelesne težine, ključne su za smanjenje rizika od kardiovaskularnih bolesti kod starijih osoba. Pravovremeno praćenje zdravlja i preventivni pregledi kod ljekara takođe mogu igrati značajnu ulogu u očuvanju zdravlja, omogućavajući starijoj populaciji da živi duže i zdravije.

Editorial

Challenges and advancements in cardiovascular health

Cardiovascular diseases (CVDs) represent a global health problem, claiming millions of lives each year. Although significant progress has been made in diagnosis, treatment, and prevention, the challenges of cardiovascular diseases continue to burden healthcare systems worldwide.

Aging population

Aging populations present a number of challenges, particularly in terms of cardiovascular health. Increased life expectancy leads to a higher prevalence of cardiovascular diseases, as aging causes changes in the structure and function of the heart and blood vessels. One of the main changes is a decrease in arterial elasticity, leading to high blood pressure and additional strain on the heart.

Atherosclerosis, the process of plaque buildup within artery walls, significantly contributes to the risk of heart attacks and strokes in the elderly population. Additionally, the heart muscle can weaken, reducing its ability to pump blood effectively, increasing the risk of heart failure.

Preventive measures, such as a healthy diet, regular physical activity, reduced salt intake, and weight control are keys to reducing the risk of cardiovascular disease in the elderly. Timely health monitoring and preventive visits to the doctor can also play an important role in maintaining health, allowing the elderly population to live longer and healthier lives.

Lični stil života kao faktor rizika

Lični stil života jedan je od glavnih faktora rizika za razvoj kardiovaskularnih bolesti. Nezdrava ishrana, bogata zasićenim mastima, šećerima i soli, doprinosi gojaznosti i povišenim nivoima holesterola, što direktno povećava rizik od ateroskleroze i povišenog krvnog pritiska. S druge strane, fizička neaktivnost oslabljuje srčani mišić i negativno utiče na krvotok, dok redovna fizička aktivnost pomaže u jačanju srca i očuvanju zdravih krvnih sudova.

Pušenje je još jedan faktor rizika jer oštećuje arterije, povećavajući vjerovatnoću srčanih udara i moždanih udara. Prekomjerna konzumacija alkohola dodatno pogoršava hipertenziju i oštećuje srčani mišić.

Kontrola ovih faktora kroz promjene u načinu života može značajno smanjiti rizik od kardiovaskularnih bolesti. Zdrava ishrana, redovno vježbanje, izbjegavanje pušenja i ograničavanje unosa alkohola ključne su preventivne mjere koje pomažu u očuvanju zdravlja kardiovaskularnog sistema. Ove promjene ne samo da doprinose dužem životu, već i poboljšavaju kvalitet života, omogućavajući ljudima da ostanu aktivni i zdravi duže.

Stres kao faktor rizika

Psihosocijalni stres ozbiljan je, ali često zanemaren faktor rizika za zdravlje kardiovaskularnog sistema. Kada je osoba izložena hroničnom stresu, tijelo reaguje otpuštanjem hormona stresa poput kortizola i adrenalina. Ovi hormoni izazivaju povišen krvni pritisak, ubrzan rad srca i povećanje nivoa šećera u krvi, što može oštetiti krvne sudove i srčani mišić. Pored fizioloških promjena, stres utiče i na ponašanje i stil života. Osobe pod stresom često pribjegavaju nezdravim načinima nošenja sa stresom kao što su pušenje, konzumacija alkohola, prejedanje ili izbjegavanje fizičke aktivnosti. Ove navike dodatno pogoršavaju zdravlje kardiovaskularnog sistema i povećavaju rizik od srčanih udara i moždanih udara.

Upravljanje stresom kroz tehnike opuštanja, redovnu fizičku aktivnost, pravilnu

Lifestyle as a risk factor

Lifestyle is one of the main risk factors for developing cardiovascular disease. First, an unhealthy diet, high in saturated fats, sugars, and salt, contributes to obesity and high cholesterol levels, which directly increase the risk of atherosclerosis and high blood pressure. On the other hand, physical inactivity weakens the heart muscle and negatively affects blood circulation, while regular physical activity helps strengthen the heart and maintain healthy blood vessels.

Smoking is another risk factor as it damages arteries, increasing the likelihood of heart attacks and strokes. Excessive alcohol consumption further exacerbates hypertension and damages the heart muscle.

Controlling these factors through lifestyle changes can significantly reduce the risk of cardiovascular disease. The healthy diet, regular exercise, avoiding smoking, and limiting alcohol consumption are key preventive measures helping to maintain cardiovascular health. These changes not only contribute to a longer life but also improve quality of life, allowing people to stay active and healthy for longer.

Stress as a risk factor

Psychosocial stress is a serious but often overlooked risk factor for cardiovascular health. When a person is exposed to chronic stress, the body responds by releasing stress hormones such as cortisol and adrenaline. These hormones lead to increased blood pressure, accelerated heart rate, and increased blood sugar levels, which can damage blood vessels and the heart muscle. In addition to physiological changes, stress also affects behavior and lifestyle. Stressed people often resort to unhealthy coping mechanisms such as smoking, alcohol consumption, overeating, or avoiding physical activity. These habits further exacerbate cardiovascular health and increase the risk of heart attacks and strokes.

Managing stress through relaxation techniques, regular physical activity, proper diet,

ishranu i adekvatan san ključno je za očuvanje zdravog srca. Podrška prijatelja, porodice i profesionalaca može pomoći ljudima da se bolje nose sa stresom, što doprinosi dugoročnom zdravlju kardiovaskularnog sistema.

Napredak u dijagnostici i terapiji

Napredak u dijagnostici i liječenju kardiovaskularnih bolesti značajno je poboljšao sposobnost da se ove bolesti prepoznaju, prate i liječe u ranoj fazi. Savremeni dijagnostički alati, poput ehokardiografije, koronarne angiografije, CT koronarne angiografije i magnetne rezonance srca (MRI) pružaju ljekarima detaljan uvid u strukturu i funkciju srca i krvnih sudova. Ove procedure pomažu u ranom otkrivanju problema sa kardiovaskularnim sistemom, čime se povećava šansa za uspješno liječenje.

U terapiji, farmakoterapija nudi niz novih lijekova uključujući one za kontrolu krvnog pritiska, smanjenje holesterola i sprečavanje zgrušavanja krvi. Ovi lijekovi smanjuju rizik od srčanih udara i moždanih udara pomažući pacijentima da održavaju stabilno zdravlje kardiovaskularnog sistema. Intervencijska kardiologija omogućava minimalno invazivne procedure, kao što je angioplastika sa ugradnjom stenta, koje otvaraju sužene arterije. Hirurške procedure, kao što je koronarna arterijska bypass operacija (CABG) i transplantacija srca, nude dugoročno liječenje za najteže oblike kardiovaskularnih bolesti. Ova kombinacija inovativnih dijagnostičkih metoda i napredne terapije čini osnovu u borbi protiv kardiovaskularnih bolesti, značajno poboljšavajući prognozu pacijenata i kvalitet života.

Telemedicina

Telemedicina je revolucionarni pristup u pružanju zdravstvene zaštite, koji omogućava pacijentima, posebno onima u ruralnim i udaljenim područjima, pristup kvalitetnoj medicinskoj njezi. Ova tehnologija smanjuje fizičke barijere s kojima se pacijenti često susreću, omogućavajući im da se posavjetuju sa specijalistima, poput kardiologa, iz udobnosti svojih domova. Kroz video pozive i mobilne

and adequate sleep is crucial for maintaining a healthy heart. Support from friends, family, and professionals can help people cope with stress better, contributing to long-term cardiovascular health.

Advances in diagnosis and therapy

Advances in the diagnosis and treatment of cardiovascular disease have significantly improved the ability to detect, monitor, and treat these conditions early. Modern diagnostic tools, such as echocardiography, coronary angiography, CT coronary angiography, and cardiac MRI, provide doctors with a detailed view of the structure and function of the heart and blood vessels. These procedures help in the early identification of cardiovascular problems, increasing the chances of successful treatment.

In treatment, pharmacotherapy provides a range of new drugs, including those for controlling blood pressure, lowering cholesterol, and preventing blood clotting. These drugs reduce the risk of heart attacks and strokes, helping patients maintain stable cardiovascular health. Interventional cardiology enables minimally invasive procedures, such as angioplasty with stenting, which open up narrowed arteries. Surgical procedures, such as coronary artery bypass grafting (CABG) and heart transplantation, provide long-term treatment for the most severe forms of cardiovascular disease. This combination of innovative diagnostics and advanced treatment is the foundation for combating cardiovascular disease, significantly improving patient prognosis and quality of life.

Telemedicine

Telemedicine is a revolutionary approach to providing healthcare, allowing patients, especially those in rural and remote areas, access to quality medical care. This technology reduces the physical barriers that patients often face, allowing them to consult with specialists, such as cardiologists, from the comfort of their

aplikacije, pacijenti mogu dobiti savjete, dijagnoze i preporuke bez potrebe da putuju, što je posebno važno za starije osobe ili one sa smanjenom pokretljivošću.

Telemonitoring, koji podrazumijeva praćenje vitalnih znakova kao što su krvni pritisak, puls i nivo šećera u krvi, dodatno poboljšava upravljanje kardiovaskularnim bolestima. Ova praksa omogućava ljekarima da prate zdravlje pacijenata u stvarnom vremenu i brzo reaguju na bilo kakve promjene ili komplikacije. Redovno praćenje može takođe pomoći u optimizaciji terapije i prilagođavanju lijekova u skladu sa individualnim potrebama pacijenta.

Kombinacija telemedicinskih konsultacija i praćenja omogućava rano otkrivanje potencijalnih problema, smanjuje potrebu za hitnim intervencijama i poboljšava kvalitet života pacijenata čineći zdravstvenu zaštitu pristupačnijom i efikasnijom.

Uloga vještačke inteligencije

Vještačka inteligencija (AI) nudi inovativna rješenja koja mogu transformisati način na koji se kardiovaskularne bolesti dijagnostikuju, liječe i prate. Algoritmi mašinskog učenja mogu analizirati ogromne količine podataka iz različitih izvora, uključujući medicinske istorije, rezultate laboratorijskih testova i slike dobijene dijagnostičkim alatima. Ova analiza omogućava precizno predviđanje rizika od kardiovaskularnih bolesti, što može značajno poboljšati ranu dijagnozu i prevenciju.

Jedna od ključnih prednosti AI je njena sposobnost da identifikuje obrasce koje ljudski stručnjaci možda neće primijetiti, čime se povećava tačnost dijagnoze. Na primjer, algoritmi mogu pomoći u identifikaciji faktora rizika kod pacijenata sa hipertenzijom ili dislipidemijom, omogućavajući pravovremene intervencije. Pored toga, AI može poboljšati terapiju kroz personalizovane preporuke, uzimajući u obzir individualne karakteristike pacijenata.

Vještačka inteligencija takođe poboljšava rezultate liječenja kroz kontinuirano praćenje

own homes. Through video calls and mobile applications, patients can receive advice, diagnoses, and recommendations without the need to travel, which is especially important for the elderly or those with reduced mobility.

Telemonitoring, which involves monitoring vital signs such as blood pressure, pulse, and blood sugar levels, further improves the management of cardiovascular diseases. This practice allows doctors to monitor patients' health in real time and respond quickly to any changes or complications. Regular monitoring can also help optimize therapy and adjust medications according to individual patient needs.

The combination of telemedicine consultations and monitoring enables the early detection of potential problems, reduces the need for emergency interventions, and improves the quality of life for patients by making healthcare more accessible and efficient.

The role of artificial intelligence

Artificial intelligence (AI) offers innovative solutions that can transform the way cardiovascular diseases are diagnosed, treated, and monitored. Machine learning algorithms can analyze vast amounts of data from various sources, including medical histories, laboratory test results, and images obtained from diagnostic tools. This analysis enables accurate prediction of the risk of cardiovascular disease, which can significantly improve early diagnosis and prevention.

One of the key advantages of AI is its ability to identify patterns that human experts may not notice, increasing diagnostic accuracy. For example, algorithms can help identify risk factors in patients with hypertension or dyslipidemia, enabling timely interventions. In addition, AI can optimize therapy through personalized recommendations, taking into account individual patient characteristics such as genetic profile, age, and existing health conditions.

AI also improves treatment outcomes through continuous patient monitoring. Using

pacijenata. Korišćenjem telemetrijskih uređaja i aplikacija za praćenje, vještačka inteligencija može analizirati vitalne znakove u realnom vremenu, identifikovati anomalije i omogućiti ljekarima da brzo reaguju na promjene u zdravlju pacijenata. Uvođenjem vještačke inteligencije u svakodnevnu praksu, kardiovaskularna medicina može postati preciznija, efikasnija i prilagođena potrebama svakog pacijenta, što vodi ka boljim zdravstvenim ishodima i kvalitetu života.

Programi prevencije kardiovaskularnih bolesti

Kardiovaskularne bolesti (KVB) predstavljaju jedan od vodećih uzroka smrti širom svijeta, a njihova prevencija postaje prioritet u javnom zdravlju. Programi prevencije KVB imaju za cilj smanjenje incidencije ovih bolesti kroz različite pristupe koji uključuju edukaciju, promjenu životnih navika, praćenje faktora rizika i upotrebu savremenih tehnologija.

Edukativni programi igraju ključnu ulogu u podizanju svijesti o kardiovaskularnim bolestima. Radionice, seminari i distribucija informativnih materijala pomažu pojedincima da razumiju važnost prevencije i kako mogu poboljšati svoje zdravlje. Takođe, programi promjene životnih navika, kao što su programi mršavljenja i promocije zdrave ishrane, omogućavaju ljudima da usvoje zdravije navike koje smanjuju rizik od KVB. Uloga uravnotežene ishrane bogate voćem, povrćem i zdravim mastima, uz smanjenje unosa soli i šećera, ne može se pretjerano naglasiti.

Praćenje i skrining su još jedan važan aspekt prevencije KVB. Redovni pregledi za mjerenje krvnog pritiska, nivoa holesterola i šećera u krvi omogućavaju rano otkrivanje faktora rizika, dok kardiovaskularni skrining koristi savremene dijagnostičke alate za detekciju bolesti srca prije nego što postane ozbiljna.

Savremena telemedicina i digitalni alati takođe doprinose prevenciji KVB. Mobilne aplikacije koje omogućavaju praćenje vitalnih znakova, nivoa fizičke aktivnosti i ishrane, kao

telemetry devices and tracking applications, AI can analyze vital signs in real time, identify anomalies, and enable doctors to respond quickly to changes in patients' health. By integrating AI into everyday practice, cardiovascular medicine can become more precise, efficient, and tailored to the needs of each patient, leading to better health outcomes and quality of life.

Cardiovascular disease prevention programs

Cardiovascular diseases (CVDs) are one of the leading causes of death worldwide, and their prevention is becoming a priority in public health. CVDs prevention programs aim to reduce the incidence of these diseases through various approaches including education, lifestyle modification, monitoring of risk factors, and the use of modern technologies.

Educational programs play a key role in raising awareness of cardiovascular diseases. Workshops, seminars, and distribution of information materials help individuals understand the importance of prevention and how they can improve their health. In addition, lifestyle modification programs, such as weight loss programs and healthy eating promotion programs, enable people to adopt healthier habits that reduce the risk of CVDs. The role of a balanced diet rich in fruits, vegetables, and healthy fats, with reduced salt and sugar intake, cannot be overemphasized.

Monitoring and screening are another important aspect of CVDs prevention. Regular check-ups to measure blood pressure, cholesterol levels, and blood sugar levels enable early detection of risk factors, while cardiovascular screening uses modern diagnostic tools to detect heart disease before it becomes serious.

Modern telemedicine and digital tools also contribute to CVDs prevention. Mobile applications that enable tracking of vital signs, physical activity levels, and diet, as well as online consultations with doctors, help in implementing prevention programs.

i online konsultacije sa ljekarima, pomažu u sprovođenju programa prevencije.

Fizička aktivnost je još jedna ključna komponenta prevencije. Organizovanje grupnih treninga i individualnih planova vježbi podstiče ljude da redovno vježbaju, čime smanjuju rizik od gojaznosti i povezanih zdravstvenih problema.

Psihološka podrška, kao što su programi upravljanja stresom i podrška prestanku pušenja, takođe igraju važnu ulogu. Tehnike kao što su meditacija i joga mogu pomoći u smanjenju stresa, što je ključno za održavanje kardiovaskularnog zdravlja.

Na kraju, zajedničke inicijative koje uključuju partnerstva sa lokalnim organizacijama i javno informisanje o KVB doprinose stvaranju zdravijeg okruženja.

Uzimajući u obzir sve ove aspekte, jasno je da su programi prevencije kardiovaskularnih bolesti ključni za smanjenje rizika i očuvanje zdravlja populacije. Investiranje u prevenciju nije samo korisno, već i neophodno za postizanje zdravijeg društva i smanjenje opterećenja zdravstvenih sistema.

Budućnost kardiovaskularne medicine

Budućnost kardiovaskularne medicine obećava značajne napretke koji bi mogli korjenito da promijene dijagnozu, liječenje i prevenciju kardiovaskularnih bolesti.

Regenerativna medicina se fokusira na popravljanje oštećenih tkiva i organa. U liječenju kardiovaskularnih bolesti, ovaj istraživački pravac koristi matične ćelije koje imaju potencijal da se diferenciraju u različite vrste srčanih ćelija. Klinička ispitivanja su pokazala da infuzija matičnih ćelija nakon srčanog udara može poboljšati funkciju srčanog mišića, smanjiti ožiljke i poboljšati oporavak pacijenata. Ovaj pristup može značajno promijeniti način liječenja srčanih bolesti, pružajući pacijentima priliku za bolji kvalitet života nakon ozbiljnih srčanih događaja.

Genetski inženjering je još jedan ključni aspekt budućnosti kardiovaskularne medicine.

Physical activity is another key component of prevention. Organizing group training and individual exercise plans encourages people to exercise regularly, reducing the risk of obesity and related health problems.

Psychological support, such as stress management programs and smoking cessation support, also plays the important role. Techniques such as meditation and yoga can help reduce stress, which is crucial for maintaining cardiovascular health.

Finally, joint initiatives involving partnerships with local organizations and public awareness campaigns about CVDs contribute to creating a healthier environment.

Considering all of the above aspects, it is clear that cardiovascular disease prevention programs are essential for reducing risk and maintaining population health. Investing in prevention is not only beneficial, but also necessary to achieve a healthier society and reduce the burden on healthcare systems.

The future of cardiovascular medicine

The future of cardiovascular medicine promises significant advances that could revolutionize the diagnosis, treatment, and prevention of cardiovascular disease.

Regenerative medicine focuses on repairing damaged tissues and organs. In the treatment of cardiovascular disease, this area of research uses stem cells that have the potential to differentiate into various types of heart cells. Clinical trials have shown that infusing stem cells after a heart attack can improve heart muscle function, reduce scarring, and improve patient recovery. This approach can significantly change the way heart disease is treated, giving patients the opportunity for a better quality of life after serious cardiac events.

Genetic engineering is another key aspect of the future of cardiovascular medicine. Advances in technologies such as CRISPR/Cas9 enable precise genome editing, which can be used to correct genetic mutations contributing

Napredak u tehnologijama kao što je CRISPR/Cas9 omogućava precizno uređivanje genoma, što se može koristiti za ispravljanje genetskih mutacija koje doprinose razvoju kardiovaskularnih bolesti. Na primjer, pacijenti sa nasljednim oblicima hiperholesterolemije mogli bi da imaju koristi od genetskih terapija koje bi mogle smanjiti nivoe holesterola u krvi, čime bi se smanjio rizik od ateroskleroze i srčanih bolesti. Ovaj pristup može omogućiti personalizovanu medicinu u kojoj se tretmani prilagođavaju specifičnim genetskim predispozicijama pacijenata.

Nanotehnologija se takođe pojavljuje kao ključna komponenta budućnosti kardiovaskularne medicine. Upotreba materijala nanotehnologije može omogućiti precizno dostavljanje lijekova direktno na mjesto djelovanja. Nanopartikuli se mogu dizajnirati da oslobode lijekove u tačno određeno vrijeme, maksimalizujući efikasnost terapije i minimizirajući nuspojave. Takođe, upotreba nanotehnologije u dijagnostici omogućava razvoj sofisticiranih biosenzora koji mogu otkriti biomarkere u krvi, što omogućava ranu dijagnozu kardiovaskularnih bolesti i potencijalno spasavanje života.

Zaključak

Ovaj specijalni broj časopisa pruža sveobuhvatan pregled najnovijih dostignuća i izazova u oblasti kardiovaskularnog zdravlja. S obzirom na to da kardiovaskularne bolesti često zahtijevaju multidisciplinaran pristup, važno je uključiti kardiologe, istraživače, inženjere, epidemiologe i pacijente u razvoj novih terapija i tehnologija. Kroz zajedničke napore i inovacije, možemo značajno smanjiti globalni teret kardiovaskularnih bolesti.

Razumijevanjem rizika, implementacijom preventivnih mjera i pružanjem pravovremenog liječenja možemo stvoriti budućnost u kojoj će kardiovaskularne bolesti biti značajno smanjene, a kvalitet života pacijenata u velikoj mjeri poboljšan. Ova vizija zahtijeva ulaganje u istraživanje i razvoj, kao i uključivanje novih tehnologija u svakodnevnu praksu, što može

to the development of cardiovascular disease. For example, patients with hereditary forms of hypercholesterolemia could benefit from genetic therapies that could reduce blood cholesterol levels, thereby reducing the risk of atherosclerosis and heart disease. This approach can provide personalized medicine, where treatments are tailored to the specific genetic predispositions of patients.

Nanotechnology also emerges as a key component of the future of cardiovascular medicine. The use of nanotechnology materials can enable precise drug delivery directly to the site of action. Nanoparticles can be designed to release drugs at specific times, maximizing the effectiveness of therapy and minimizing side effects. Additionally, the use of nanotechnology in diagnostics enables the development of sophisticated biosensors that can detect biomarkers in the blood, allowing for early diagnosis of cardiovascular disease and potentially saving lives.

Conclusion

This special issue of the journal provides a comprehensive overview of the latest advancements and challenges in cardiovascular health. Given that cardiovascular diseases often require a multidisciplinary approach, it is important to involve cardiologists, researchers, engineers, epidemiologists, and patients in the development of new therapies and technologies. Through collaborative efforts and innovation, we can significantly reduce the global burden of cardiovascular diseases.

By understanding the risks, implementing preventive measures, and providing timely treatment, we can create a future where cardiovascular diseases are significantly reduced and the quality of life of patients is greatly improved. This vision requires investment in research and development, as well as the integration of new technologies into everyday practice, which can enable not only more effective treatment, but also long-term prevention of cardiovascular diseases. Working

omogućiti ne samo efikasnije liječenje, već i dugoročnu prevenciju kardiovaskularnih bolesti. Zajedničkim radom ka zdravijoj budućnosti, možemo se nadati smanjenju stope smrtnosti i obolijevanja od kardiovaskularnih bolesti, omogućavajući milionima ljudi širom svijeta da vode aktivan i zdrav život.

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together towards a healthier future, we can hope to reduce the mortality and morbidity rates of cardiovascular diseases, allowing millions of people worldwide to lead active and healthy lives.

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Original article

Relationship between perceived stress and levels of blood pressure: single center study

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Summary

Introduction. High blood pressure (HBP) is a significant cardiovascular risk factor, with hypertension recognized as a leading cause of global mortality. This study aims to investigate the correlation between perceived stress and blood pressure levels among patients diagnosed with hypertension.

Methods. A cross-sectional study was conducted involving 80 hypertensive patients at the Institute for Cardiovascular Diseases "Dedinje". Comprehensive clinical examinations, including 24-hour ambulatory blood pressure monitoring (ABPM) and Perceived Stress Scale (PSS) assessments were performed.

Results. The results revealed a significant positive correlation between PSS scores and blood pressure levels ($r = 0.65$, $p < 0.001$), indicating that higher perceived stress is associated with elevated blood pressure. Furthermore, no statistically significant difference was found between stress levels and sex or smoking status.

Conclusion. These findings underscore the importance of stress management interventions in hypertension treatment, suggesting that addressing perceived stress could enhance therapeutic outcomes for patients.

Keywords: high blood pressure, perceived stress, ambulatory blood pressure monitoring, cardiovascular health

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Introduction

High blood pressure (HBP) is an important cardiovascular risk factor, with hypertension experts still debating threshold at which the specific BP should be deemed abnormal. Currently, it is widely accepted, based on extensive epidemiological and intervention studies, that blood pressure levels of ≥140/90mmHg are indicative of hypertension [1]. Ambulatory blood pressure monitoring (ABPM) is recognized as the gold standard for diagnosing hypertension [2]. According to the European Society of Hypertension practice guidelines, hypertension is diagnosed when a 24-hour ABP exceeds 130/80 mmHg, awake ABP surpasses 135/85 mmHg, and/or sleep ABP exceeds 120/70 mmHg. For ABPM to be considered valid, it must include at least 70% valid measurements or encompass 20 valid daytime readings alongside seven valid nighttime readings [3].

Arterial hypertension is responsible for approximately 10 million deaths worldwide annually, and is widely considered to be a leading factor contributing to the overall global disease burden of disease [4]. In the modern era, psychological stress has garnered increasing recognition as a significant risk factor for the onset and exacerbation of various diseases, including hypertension. Lifestyle modifications are universally recommended for individuals with elevated blood pressure levels [5]. Among the recommended non-pharmacological interventions, stress reduction is considered to be one of the most important factors in the management of hypertension [6].

Chronic medical conditions are often associated with the relatively high prevalence of anxiety, mood disorders, and other mental illnesses, highlighting the overall impact of psychological stress on cardiovascular diseases. The perceived level of stress reflects an individual's response to stressors, encompassing various life aspects such as work, family dynamics, financial concerns, interpersonal relationships, and daily responsibilities. Researches indicate that both stress and lifestyle choices are significant risk factors for the development and exacerbation of hypertension. The "fight or flight" response is an automatic physiological reaction to an event that is perceived as stressful or frightening and it makes heart rate and blood pressure levels increase. Indirectly, stress can influence blood pressure through unhealthy behaviors, including poor diet, physical inactivity, and substance abuse.

The World Health Organization (WHO) defines an individual's quality of life as the perception of their position within society, considering the cultural and value systems they live in, and how this relates to their goals [7]. This broad perspective highlights how quality of life intricately influences physical and mental health, personal beliefs, and social interactions. Therefore, understanding the intricate relationship between perceived stress and blood pressure levels is pivotal for the development of more effective preventive and interventional strategies [7, 8].

The primary aim of this study is to investigate the correlation between perceived stress and blood pressure levels.

Methods

Our cross-sectional study enrolled 80 consecutive patients diagnosed with hypertension who sought care at Institute for Cardiovascular Diseases "Dedinje", Center for Hypertension, from October 1st 2023 to February 1st 2024. Demographic data including sex, age, and smoking status were recorded for all patient who also subsequently underwent a comprehensive clinical examination featuring 24-hour ambulatory blood pressure monitoring, recognized as the premier clinical tool for blood pressure measurement. Additionally, all patients were given a Perceived Stress Scale (PSS) questionnaire* to complete during their appointment. The study was performed

in accordance to the ethical principles outlined in the Declaration of Helsinki.

The PSS is a widely utilized questionnaire designed to evaluate an individual's perception of stress in recent times. The inception of the PSS in 1983 marked its significance in understanding the impact of various situations on emotions and stress perception. This questionnaire inquires about the patients' feelings and thoughts over the preceding month and their frequency. PSS scores ranging from 0 to 13 denote a low stress level; scores from 14 to 26 suggest a moderate stress level, while scores from 27 to 40 indicate a high exposure to stress (Questionnaire*).

Statistical Analysis

Results are presented as count (%), mean ± standard deviation depending on data type. Data Analysis included student's t-test and one-way ANOVA to analyze differences in means between groups, Pearson's chi-squared test was used to analyze the differences of distribution of discrete variables, and Spearman's rank correlation coefficient for correlations between continuous variables. All p-values less than 0.05 were considered significant. All data were analyzed using SPSS 29.0.

***Questionnaire**

Perceived stress scale (PSS)

For each question choose from the following alternatives:

0 - never, 1 - almost never, 2 - sometimes, 3 - fairly often, 4 - very often

_____ 1. In the last month, how often have you been upset because of something that happened unexpectedly?
_____ 2. In the last month, how often have you felt that you were unable to control the important things in your life?
_____ 3. In the last month, how often have you felt nervous and stressed?
_____ 4. In the last month, how often have you felt confident about your ability to handle your personal problems?
_____ 5. In the last month, how often have you felt that things were going your way?
_____ 6. In the last month, how often have you found that you could not cope with all the things that you had to do?
_____ 7. In the last month, how often have you been able to control irritations in your life
_____ 8. In the last month, how often have you felt that you were on top of things?
_____ 9. In the last month, how often have you been angered because of things that happened that were outside of your control?
_____ 10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?

*For answers under serial number 4, 5, 7 and 8 score values 0=4; 1=3; 2=2; 3=1; 4=0. The PSS score is based on the individual's self-assessment.

Results

Our study included, 45 females and 35 males with an average age of 59.2±7.5 and 56.4±6.4, respectively. Within the male cohort there were 19 smokers and 16 non-smokers, while in the female cohort there were 23 smokers and 22 non smokers (Table 1).

Table 1. General demographic characteristics of study cohort

Age	57.6±12.2
Smoking (yes)	41 (51.2%)
PSS Score	23.8±7.5
Systolic BP (mmHg)	125.9±12.9
Diastolic BP (mmHg)	75.9±14.1

All values presented as n (%) or mean ± SD depending on variable.

The average PSS score in our study cohort was 23.78, which was indicative of moderate stress levels. Further analysis, revealed no statistically significant correlation between PSS scores and age (p=0.7), suggesting that stress perception was not age-dependent in this study population. Notably, we observed a significant positive correlation between PSS scores and blood pressure levels ($r = 0.65$, $p < 0.001$), indicating that higher stress perceptions were associated with elevated blood pressure. Additionally, when stratifying the cohort by stress levels as indicated by their PSS score, we observed the statistically significant difference in systolic blood pressure between the groups ($p<0.001$). Conversely, there was no the statistically significant difference observed between sex and stress levels (p=0.22). Similarly, analysis showed that there was also no the statistically significant difference in PSS scores between smokers and non-smokers (p=0.15), suggesting that smoking status alone did not influence perceived stress.

Discussion

In today's dynamic world, stress has become an ubiquitous component of daily life, elevating the significance of its impact on blood pressure [9]. While stress is not a direct cause of hypertension, it can influence its onset and further progression. Hypertension, in 95% of cases, is classified as "essential," where the exact cause is unknown, highlighting the importance of identifying contributing factors. Stress may exacerbate hypertension through repeated elevations in blood pressure and by stimulating the nervous system to produce vasoconstrictors, which in turn raise blood pressure. Moreover, when one risk factor is coupled with other stress-producing factors, the effect on blood pressure is multiplied [10, 11, 12]. Previous studies have shown that stress is not only associated with hypertension, but also with a broader spectrum of cardiovascular diseases [13, 14].

The pathophysiological mechanisms of stress involve a complex interplay between the brain, autonomic nervous system, and endocrine system, leading to metabolic, inflammatory, and hemostatic abnormalities. The brain plays a pivotal role in mediating stress responses, interpreting external stimuli, and determining what constitutes a stressor [15]. Current evidence suggests that sensitivity and response to stress are modulated by a variety of genetic and epigenetic factors. However, it still remains unclear whether perceived stress is associated with hypertension.

Interestingly, in our study we observed a marginally lower stress level in smokers compared to non-smokers. While this difference was not statistically significant, it is suggestive of a potential trend worthy of further investigation.

In our study of 80 patients we found a positive correlation between PSS scores and blood pressure indicating that higher perceived stress levels were associated with an increased blood pressure levels in patients with hypertension. Similarly, Palagini et al also found a positive

correlation between hypertension and PSS scores [16]. Contrary to our findings, studies by Li et al and Hassoun et al showed that there was inverse relationship between perceived stress and blood pressure [17, 18]. Moreover, in a large cohort study conducted by Wiernik et al, it was concluded that perceived stress was associated with higher BP, but only when occupational status was excluded [19]. Furthermore, a study by Schneider et al suggested that non-pharmacologic reduction of stress could be associated with long-term decreases in mortality in older populations having high blood pressure [20].

Interestingly, our study observed a marginally lower stress level in smokers compared to non-smokers, though this difference was not statistically significant, suggesting a potential trend worthy of further investigation.

Conclusion

Our findings highlight a significant link between perceived stress and hypertension, indicating that heightened stress levels may contribute to increased blood pressure. This further supports the advantages for incorporating stress management interventions into both the prevention and treatment of hypertension. The integration of psychotherapeutic approaches could potentially enhance the efficacy of conventional medical therapies in hypertensive patients. By targeting stress as a modifiable risk factor, healthcare practitioners have the opportunity to improve cardiovascular health outcomes in individuals with hypertension.

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Ethical approval. The Ethics Committee of the Institute for Cardiovascular Diseases "Dedinje"approved the study and informed consent was obtained from all individual respondents. The research was conducted according to the Declaration of Helsinki.

Conflicts of interest. The authors declare no conflict of interest.

References:

1. Gupta R. Hypertension in India--definition, prevalence and evaluation. J Indian Med Assoc 1999;97(3):74–80.
2. Krakoff LR. Cost-effectiveness of ambulatory blood pressure: a reanalysis. Hypertension 2006;47(1):29–34.
3. Yusuf S, Hawken S, Ôunpuu S, Dans T, Avezum A, Lanas F, et al. Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries (the INTERHEART study): case-control study. Lancet 2004;364(9438):937–52.
4. Hengel FE, Sommer C, Wenzel U. Arterial hypertension. Dtsch Med Wochenschr 2022;147(7):414–28.
5. Elliott WJ. Systemic hypertension. Curr Probl Cardiol 2007;32(4):201–59.
6. Mahmood S, Shah KU, Khan TM, Nawaz S, Rashid H, Baqar SW, et al. Non-pharmacological management of hypertension: in the light of current research. Ir J Med Sci 2019;188(2):437–52.
7. Achangwa C, Lee TJ, Park J, Lee MS. Quality of life and associated factors of international students in South Korea: A cross-sectional study using the WHOQOL-BREF instrument. Healthcare Basel 2022;10(7):1262.
8. Cantín M. World Medical Association Declaration of Helsinki: ethical principles for medical research involving human subjects. Reviewing the latest version. Int J Med Surg Sci 2014;1(4):339–46.

9. de la Sierra A. Ambulatory blood pressure monitoring is a useful tool for all patients. Hipertens Riesgo Vasc 2017;34(1):45–9.

10. Harris KM, Gaffey AE, Schwartz JE, Krantz DS, Burg MM. The Perceived Stress Scale as a measure of stress: decomposing score variance in longitudinal behavioral medicine studies. Ann Behav Med 2023;57(10):846–54.

11. Naik GS, Gaur GS, Pal GK. Effect of modified slow breathing exercise on perceived stress and basal cardiovascular parameters. Int J Yoga 2018;11(1):53–8.

12. Kulkarni S, O'Farrell I, Erasi M, Kochar MS. Stress and hypertension. WMJ 1998;97(11):34–8.

13. Valenzuela PL, Carrera-Bastos P, Gálvez BG, Ruiz-Hurtado G, Ordovas JM, Ruilope LM, et al. Lifestyle interventions for the prevention and treatment of hypertension. Nat Rev Cardiol 2021;18(4):251–75.

14. Gao Y, Rong H, Zhang Y, Yuan M, Xu Y, Ma J. Perceived stress in Chinese patients with coronary heart disease: a cross-sectional study. BMJ Open 2022;12(3):e051419.

15. McEwen BS, Gianaros PJ. Central role of the brain in stress and adaptation: links to socioeconomic status, health, and disease. Ann N Y Acad Sci 2010;1186:190–222.

16. Palagini L, Bruno RM, Cheng P, Mauri M, Taddei S, Ghiadoni L, et al. Relationship between insomnia symptoms, perceived stress and coping strategies in subjects with arterial hypertension: psychological factors may play a modulating role. Sleep Med 2016;19:108–15.

17. Hassoun L, Herrmann-Lingen C, Hapke U, Neuhauser H, Scheidt-Nave C, Meyer T. Association between chronic stress and blood pressure: findings from the German Health Interview and Examination Survey for Adults 2008–2011. Psychosom Med 2015;77(5):575–82.

18. Li D, Rong C, Kang Q. Association between perceived stress and hypertension in Chinese adults: a population-based survey. J Hum Hypertens 2023;37(4):321–6.

19. Wiernik E, Pannier B, Czernichow S, Nabi H, Hanon O, Simon T, et al. Occupational status moderates the association between current perceived stress and high blood pressure: evidence from the IPC cohort study. Hypertension 2013;61(3):571–7.

20. Schneider RH, Alexander CN, Staggers F, Rainforth M, Salerno JW, Hartz A, et al. Long-term effects of stress reduction on mortality in persons≥ 55 years of age with systemic hypertension. Am J Cardiol 2005;95(9):1060–4.

Odnos između uočenog stresa i nivoa krvnog pritiska: studija centra

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Uvod. Visok krvni pritisak (VKP) je značajan kardiovaskularni faktor rizika, pri čemu se hipertenzija prepoznaje kao vodeći uzrok globalnog mortaliteta. Cilj ove studije je istražiti povezanost između percipiranog stresa i nivoa krvnog pritiska kod pacijenata kojima je dijagnostikovana hipertenzija.

Metode. Sprovedena je studija preseka koja je obuhvatila 80 hipertenzivnih pacijenata u Institutu za kardiovaskularne bolesti „Dedinje." Izvršeni su sveobuhvatni klinički pregledi, uključujući 24-časovno ambulantno praćenje krvnog pritiska (ABPM) i procenu "Perceived Stress Scale" (PSS).

Rezultati. Rezultati su pokazali značajnu pozitivnu korelaciju između PSS skora i nivoa krvnog pritiska ($r = 0,65$, $p < 0,001$), što ukazuje da je veći percipirani stres povezan sa povišenim krvnim pritiskom. Takođe, nije pronađena statistički značajna razlika između nivoa stresa i pola ili statusa pušenja.

Zaključak. Ovi nalazi naglašavaju važnost intervencija za upravljanje stresom u lečenju hipertenzije, sugerišući da bi adresiranje percipiranog stresa moglo poboljšati terapijske rezultate kod pacijenata.

Ključne reči: visok krvni pritisak, percipirani stres, ambulantno praćenje krvnog pritiska, kardiovaskularno zdravlje

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Review

The transformative power of AI and wearables in the global prevention of cardiovascular disease

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Summary

The integration of Artificial Intelligence (AI) and wearable technologies in healthcare is revolutionizing preventive medicine, particularly in cardiovascular disease (CVD) prevention. With CVD being the leading cause of global mortality, these innovations offer transformative potential in addressing the disease through a multi-level prevention strategy. Capabilities of AI, supported by wearables, enhance data collection and analysis, allowing for tailored, patient-specific interventions. Primary prevention focuses on mitigating risk factors, while secondary prevention enables early detection through real-time monitoring, and tertiary prevention optimizes management of existing conditions to improve quality of life. This review explores the roles of AI and wearables in each level of prevention, highlighting advancements in predictive analytics, patient-centered care, and personalized treatment planning. Ethical considerations surrounding data privacy and security are also discussed, as well as the importance of accessible technology to reduce health disparities, particularly in low- and middle-income countries. As AI algorithms and wearable data improve, they will become increasingly effective in proactive health management, marking a shift from reactive treatment to preventive care. The successful implementation of these technologies depends on robust ethical frameworks and interdisciplinary collaboration, fostering a future in which preventive healthcare is more personalized, accessible, and impactful.

Key words: prevention, cardiovascular diseases, artificial intelligence, wearable technologies, predictive analytics

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Introduction

In medicine, prevention refers to the comprehensive range of activities and interventions aimed at reducing the risk of developing diseases, health-related complications, or injuries. Prevention is marked by the proactive approach that patients take to improve their health, often with their physician's guidance. This approach not only aims to prevent diseases before they occur, but also aims to manage and reduce the impact of any existing conditions, ultimately enhancing overall health and quality of life. Prevention can be broken down into three levels: primary, secondary, and tertiary [1].

Primary prevention is focused on preventing diseases or injuries before their occurrence. This includes vaccination, lifestyle modifications, and environmental modifications which will in turn reduce the risk of developing an adverse health outcome. Secondary prevention aims at early detection of disease, thus enabling early intervention to prevent further progression of the disease. Strategies include screening programs and early interventions. Tertiary prevention involves reducing the impact of already existing conditions by minimizing their impact on the patient's overall health and quality of life. Together, these levels of prevention combined form a comprehensive healthcare strategy to address a wide spectrum of health-related issues.

Data science is a field of study concerned with analyzing vast volumes of data and employing a wide range of advanced tools and techniques to uncover hidden patterns, derive meaningful insights, and aid in decision-making [2]. It is widely recognized as a driving force behind the evolution of artificial intelligence (AI). In recent years, data science has also made significant inroads into healthcare, facilitated by the introduction of wearable technologies and advanced AI algorithms capable of analyzing massive datasets at unprecedented speed. Moreover, the extensive information collected by wearables, thanks to their continuous monitoring capabilities, enables the continuous improvement of these algorithms. This enhancement over time makes them increasingly accurate in predicting adverse health outcomes and advising patients to seek guidance from their physicians.

In healthcare, wearables and AI have the potential to facilitate early diagnosis, identify irregularities in medical imaging that might otherwise be missed, enhance efficiency, and support decision-making processes [2]. Through their application, we can enhance patient safety, quality of care, and outcomes by leveraging AI as an additional resource within evidence-based medicine. This approach not only aids in refining decision-making but also utilizes the continuous stream of collected data to refresh guidelines and elevate patient care outcomes.

AI and Wearables in the Prevention of Cardiovascular Diseases

Globally, cardiovascular diseases (CVD) are the leading cause of death, with a significant portion taking place in low and middle-income countries [3]. In decreasing the global burden and prevalence of CVD worldwide, prevention at all three levels is the key. Notably, we can make a significant impact through education, screening, and controlling for risk factors. With the synergy of AI and wearables we can take this a step further to identify patients at risk through predictive algorithms and even use the vast amount of data collected from the wearables to be analyzed further and aid in delivering a patient-tailored approach to mitigating further risk.

Capability of AI to assimilate and interpret health data from wearables paves the way for the customization of treatment paradigms [4–7]. By evaluating patient-specific data, AI algorithms can recommend treatment plans that are tailored to the individual's health profile, enhancing the efficacy of chronic condition management, including hypertension and diabetes, which are precursors to cardiovascular

diseases. This personalized approach promises enhanced patient adherence, improved health outcomes, and an elevated standard of living. Thus, the approach of integrating wearables and AI is applicable in all three levels of prevention.

As we stand on the cusp of a new era in preventive healthcare, propelled by the integration of AI and wearables, the future holds boundless potential for transforming the ways we predict, prevent, and manage diseases, particularly CVD. The trajectory of this integration is not linear but rather an evolving journey promising to redefine the paradigms of health and wellness. As we navigate through this promising future, several key directions emerge, poised to shape the landscape of preventive medicine.

The future will see a significant leap in the predictive capabilities of AI algorithms, driven by advancements in machine learning and deep learning techniques [7]. These enhanced analytics will be capable of processing complex, multi-dimensional data from wearable devices in real-time, offering more accurate and timely predictions of health risks. The evolution of predictive analytics will enable earlier interventions, potentially before diseases manifest clinically, thereby shifting the focus firmly towards primary prevention.

Personalization will be at the heart of future preventive strategies, with AI playing a pivotal role in tailoring health interventions to the unique genetic, physiological, and lifestyle profiles of each individual. This bespoke approach will not only enhance the efficacy of preventive measures, but also could improve patient engagement and adherence.

Importantly, to decrease the global burden, we must address how such technologies could be beneficial in regions where the impact of CVD is most significant, particularly in low- and middle-income countries. In these countries, key factors include access to healthcare and cost. As we continue to witness advances in AI and wearables, costs are expected to decrease, thereby increasing accessibility and ensuring that a larger portion of the population has access. Additionally, as technology and society advance, we can further improve access to healthcare through telemedicine and other modalities, reaching a broader patient population. Above all, with increased access to healthcare and technologies, we can work to further improve algorithms since we will have more data collected, aiding us in enhancing treatments and guidelines. This will ultimately play a crucial role in reducing health disparities and achieving equitable health outcomes across various socio-economic and demographic groups.

Despite all, it is also important to consider the challenges we may face along the way as we utilize these powerful technologies and algorithms. Notably, we must address ethical considerations, particularly regarding data privacy and security. The future will necessitate the development of robust ethical frameworks and regulatory guidelines safeguarding individual privacy while ensuring the responsible use of AI in healthcare [2, 4]. Transparent and ethical AI models, coupled with secure data practices, will be essential in maintaining trust and confidence among users, which is critical for the widespread adoption of wearable technology in preventive medicine. Furthermore, it is also important to recognize that these technologies should be used as an aid to synthesize this mass information, but any decision should ultimately be made by the physician.

Discussion

Predictive analytics represents a transformative shift in the approach to healthcare, particularly in the prevention and management of CVD. This technology leverages AI, ML, and the vast arrays of health data to aid in forecasting potential health events. The core of predictive analytics lies in its ability to process and analyze historical health data,

lifestyle information, and real-time health metrics to identify patterns and risk factors associated with cardiovascular diseases; all of which wearables are able to do easily and non-invasively. At the heart of predictive analytics are advanced machine learning algorithms capable of sifting through complex and voluminous datasets to identify those at risk of developing CVD. Notably, deep learning can uncover subtle patterns in the data that may not be immediately apparent to human analysts. These patterns can include correlations between lifestyle choices, genetic predispositions, and the likelihood of developing heart disease. As more data becomes available, these algorithms self-improve, increasing their predictive accuracy over time.

The efficacy of predictive analytics in CVD prevention can be significantly enhanced through the integration of any additional data sources. Electronic Health Records, for example, can provide a comprehensive history of a patient's health, including past illnesses, treatments, and outcomes. When combined with real-time data from wearable devices, such as heart rate and activity levels, predictive models gain a nuanced understanding of a patient's health status and risk factors. This integration allows for the early identification of individuals at risk, facilitating timely interventions. The generated predictive insights can transform the landscape of CVD prevention. For high-risk individuals, personalized intervention plans can be developed, combining lifestyle modifications, medication, and monitoring to mitigate the risk. Predictive analytics also plays a crucial role in identifying asymptomatic individuals who may benefit from early treatment interventions, effectively shifting the healthcare model from reactive to proactive.

While predictive analytics may offer several significant benefits, several challenges must be addressed. The accuracy of predictions heavily depends on the quality and completeness of the data. Inaccuracies in data or biases within algorithms can lead to false positives or negatives, potentially impacting patient care. Ethical considerations around privacy and consent are paramount, as predictive analytics involves handling sensitive personal health information. Patients must be assured of the security of their data and the ethical use of predictive models. Thus, the further evolution of AI and wearables in medicine calls for updates in policy regarding patient data and handling of such information.

Additionally, it is crucial to consider the advantages and disadvantages associated with different types of databases: open, shared, or closed. Each type presents unique implications for patient privacy and data security. An open database is publicly accessible and may foster greater innovation and collaboration yet poses significant risks to patient confidentiality. A shared database restricts access to a group of authorized users, offering a balance between collaboration and privacy, but still requires stringent data protection measures. A closed database, with its strict access controls, provides the highest level of privacy and security, though it may limit the potential for external insights and improvements. The challenge lies in finding an optimal balance that safeguards patient data while still leveraging these databases effectively to advance CVD prevention efforts. This calls for extensive decision making with regard to the most appropriate database model that will maximize patients' benefits without compromising their privacy and security.

The future of predictive analytics in CVD prevention is poised for growth, driven by technological advancements and increased data availability. Next-generation wearables will provide more detailed health metrics, enhancing the data pool for predictive analysis. Furthermore, the integration of genomics into predictive models could offer even more personalized risk assessments and treatment plans. To take advantage of the full potential of predictive analytics, we must promote collaboration across discipline to combine expertise, data science, and ethical considerations.

Overall, predictive analytics is promising avenue in transforming the prevention and management of cardiovascular diseases. By harnessing the power of data and AI, healthcare can move towards more personalized, proactive, and preventative care models. However, the successful implementation of this technology requires careful consideration of ethical standards, data privacy, and the continuous improvement of predictive algorithms to ensure they serve the best interest of patients.

Conclusion

As we venture into this future, the integration of AI and wearable technology in preventive medicine offers a beacon of hope for a healthier, more proactive society. The path ahead is paved with challenges, but the potential rewards–a world where preventive healthcare is personalized, accessible, and effective–make this journey not only worthwhile, but imperative.

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References:

1. Gordon Jr RS. An operational classification of disease prevention. Public Health Rep 1983;98(2):107–9.
2. Babic S, Petrovic M, Lozuk B, Bojic M. Data Science in Modern Healthcare. HealthManagement.org The Journal 2022;22(4):200–2.
3. World Health Organization. Cardiovascular diseases (CVDs) [Internet]. [cited 2024 April 3]. Available from: https://www.who.int/news-room/fact-sheets/detail/cardiovascular-diseases-(cvds)
4. Huang JD, Wang J, Ramsey E, Leavey G, Chico TJA, Condell J. Applying Artificial Intelligence to Wearable Sensor Data to Diagnose and Predict Cardiovascular Disease: A Review. Sensors (Basel) 2022;22(20):8002.
5. Raj MM, Riyaz NUS, Reddy M, Yalcin HC, Ouakad HM, Bahadur I, et al. A review of smart sensors coupled with Internet of Things and Artificial Intelligence approach for heart failure monitoring. Med Biol Eng Comput 2021;59(11-12):2185–203.
6. Pevnick MJ, Birkeland K, Zimmer R, Elad Y, Kedan I. Wearable technology for cardiology: An update and framework for the future. Trends Cardiovasc Med 2018;28(2):144–50.
7. Phillips SP, Spithoff S, Simpson A. Artificial intelligence and predictive algorithms in medicine: Promise and problems. Can Fam Physician 2022;68(8):570–2.
8. Leclercq C, Witt H, Hindricks G, Katra RP, Albert D, Belliger A, et al. Wearables, telemedicine, and artificial intelligence in arrhythmias and heart failure: Proceedings of the European Society of Cardiology Cardiovascular Round Table. Europace 2022;24(9):1372–83.

Transformaciona moć veštačke inteligencije i nosivih uređaja u globalnoj prevenciji kardiovaskularnih bolesti

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Sjedinjavanje veštačke inteligencije (AI) i nosivih tehnologija u zdravstvenoj zaštiti unapređuje preventivnu medicinu, posebno u prevenciji kardiovaskularnih bolesti (KVB). Sa KVB kao vodećim uzrokom globalnog mortaliteta, ove inovacije pružaju transformativni potencijal u rešavanju problema bolesti kroz višeslojnu strategiju prevencije. AI, uz podršku nosivih uređaja, unapređuje prikupljanje i analizu podataka, omogućavajući prilagođene, specifične intervencije za svakog pacijenta. Primarna prevencija usmerena je na smanjenje faktora rizika, dok sekundarna prevencija omogućava rano otkrivanje putem praćenja u realnom vremenu, a tercijarna prevencija optimizuje upravljanje postojećim stanjima kako bi se poboljšao kvalitet života. Ovaj pregled istražuje uloge AI i nosivih uređaja na svakom nivou prevencije, ističući napredak u prediktivnoj analitici, nezi usmerenoj na pacijenta i planiranju personalizovanog tretmana. Diskutuju se i etički aspekti koji se odnose na privatnost i bezbednost podataka, kao i važnost pristupačne tehnologije u smanjenju zdravstvenih nejednakosti, naročito u zemljama sa niskim i srednjim prihodima. Kako AI algoritmi i podaci iz nosivih uređaja napreduju, oni će postajati sve efikasniji u proaktivnom upravljanju zdravljem, označavajući prelaz sa reaktivnog lečenja na preventivnu negu. Uspešna implementacija ovih tehnologija zavisi od snažnih etičkih okvira i interdisciplinarne saradnje, čime se podstiče budućnost u kojoj je preventivna zdravstvena zaštita personalizovanija, pristupačnija i efikasnija.

Ključne reči: prevencija, kardiovaskularne bolesti, veštačka inteligencija, nosive tehnologije, prediktivna analitika

SAŽECI/ABSTRACTS

Specialized education in healthcare from the perspective of healthcare institutions in Republic of Srpska

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Summary

Introduction. A specialist nurse is an advanced expert in nursing care, trained beyond the general education level. Continuous learning and training are essential for advancing the nursing profession amid ongoing changes.

Method. To assess the needs of specialist nurse technicians, the Ministry of Health and Social Welfare of Republic of Srpska, with the support of Fami Foundation, conducted research to clarify the requirements of public health institutions. A cross-sectional study involved 58 healthcare institutions in Republic of Srpska, including seven hospitals, three specialized hospitals, one university hospital, one clinical center, and 46 primary health care centers. A questionnaire collected basic information about employed nurses/technicians and assessed the need for specialist nurses. Data processing was performed using SPSS version 23, employing descriptive statistics and the $\chi 2$ test for analysis.

Results. Of the 58 participating institutions, 46 (79.3%) were primary level and 12 (20.7%) were secondary level. Among 57 responding institutions, 55.2% identified a need for specialist nurses, while 43.1% did not. Adding the proposed 11 additional specialist nurses to the 208 identified need, in total 219 specialist nurses have been required in Republic of Srpska. Only 44.8% of institutions were prepared to submit requests to initiate specializations for nurses.

Conclusion. To advance the nursing profession in Republic of Srpska, developing specializations is essential, supported by examples of successful practices in other countries.

Keywords: specialization, nurse, education, health care

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The impact of oncology therapy on cognitive functions in patients with breast cancer

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Summary

Introduction. Breast cancer diagnosis has significant physical and psychological effects on patients, highlighting the importance of a multidisciplinary approach. Health-related quality of life in oncology encompasses patients' subjective experiences regarding the positive and negative impacts of the disease on their physical, emotional, social, and cognitive functions, as well as the frequency of symptoms and treatment side effects. Patients undergoing oncology treatment often face cognitive disorders, including memory loss, difficulty concentrating, and slowed psychomotor activities. The role of the nurse-technician is crucial in detecting cognitive issues and educating both patients and families. Cognitive difficulties reflect the underlying illness rather than the patient's personality. The objective of this study is to examine the impact of oncology therapy on cognitive functions in breast cancer patients during treatment, hypothesizing that patients treated with immunotherapy (Herceptin) would demonstrate better-preserved cognitive functions than those undergoing classical chemotherapy.

Method. The study involved 120 breast cancer patients at the Oncology Clinic of the University Clinical Hospital Mostar. Patients were divided into a study group receiving immunotherapy (Herceptin) and a control group undergoing classical chemotherapy. The Functional Assessment of Cancer Therapy-Cognitive (FACT-Cog) scale, consisting of 37 items, was employed to assess perceived cognitive impairments and their impact on quality of life.

Results. No statistically significant differences in perceived cognitive impairment were observed between the two groups. However, patients receiving classical chemotherapy reported greater cognitive disability than those treated with Herceptin, although these differences were not statistically significant.

Conclusion. The hypothesis was not confirmed; the use of the "smart drug" did not significantly affect cognitive function preservation compared to classical chemotherapy.

Key words: breast cancer, cognitive impairment, chemotherapy, immunotherapy, Herceptin, nursing care

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Proprioceptive neuromuscular facilitation and its effect on blood pressure: our experience

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Summary

Introduction. Proprioceptive neuromuscular facilitation (PNF) is a treatment method based on the idea that everyone, including individuals with disabilities, possesses untapped psychophysical potential. PNF aims to enhance strength, coordination, movement control, balance, stabilization, and endurance by stimulating proprioceptors through neuromuscular mechanisms such as facilitation, inhibition, muscle resistance, and reflexes. This study aims to examine the effects of specific PNF techniques on blood pressure (BP) and ankle-brachial index (ABI) in patients with type 2 diabetes (T2DM) and newly diagnosed mild hypertension.

Methods. Conducted between October 2021 and April 2023, the study analyzed 30 patients aged 40 to 60 with controlled T2DM and newly diagnosed mild hypertension (systolic blood pressure [SBP] 140–159 mmHg and/or diastolic blood pressure [DBP] 90-99 mmHg). Participants engaged in two sets of PNF exercises for one hour, three days a week for three months, incorporating diagonal 1 (D1) and diagonal 2 (D2) patterns.

Results. A significant reduction in SBP was observed after one, two, and three months of PNF training. Initially, 28 patients (93%) had SBP >140 mmHg; this decreased to 21 (70%) after one month, 15 (50%) after two months, and 5 (16%) after three months. Similarly, DBP showed significant improvement, with 21 patients (70%) initially having DBP >90 mmHg, dropping to 11 (36%) after one month, 2 (6%) after two months, and none after three months.

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Conclusion. PNF exercises significantly aid in blood pressure control for T2DM patients with newly diagnosed mild hypertension, emphasizing the need for increased patient awareness of the benefits of exercise in managing diabetes complications.

Key words: proprioceptive neuromuscular facilitation, type 2 diabetes, hypertension blood pressure, ankle-brachial index

Polypharmacy in elderly patients

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Summary

Introduction. Polypharmacy, defined as the concurrent use of more than five medications, increases the risk of side effects, drug interactions, reduced quality of life, and higher healthcare costs. Common causes include multiple healthcare providers, insufficient prescribing knowledge among doctors, cultural factors, and lack of regular medication reviews. In 1997, Dr. Mark Beers established criteria to guide medication prescribing in elderly patients, focusing on medications to avoid, those requiring limited dosages, and those suitable for short-term use. This research aims to assess the prevalence of polypharmacy in elderly patients at our clinic.

Methods. Data were collected by reviewing electronic health records via the "IZIS" program and conducting direct interviews with patients. The study involved 151 patients over 65 from the Branjevo field clinic, Zvornik Health Centre, from January 1 to December 31, 2023.

Results. Better medication management was observed in patients living with family and those with higher education levels. Patients with multiple chronic diseases tended to use more medications daily, showing a higher prevalence of polypharmacy. Dementia patients exhibited poorer cooperation and higher medication use. Individuals with limitations in daily activities and those with a BMI < 20 also showed less adherence and increased polypharmacy. Over half of the respondents used more than five medications, with women reporting more adverse drug reactions than men.

Conclusion. Analysis of Beers' criteria drugs, particularly bromazepam, revealed that 31.13% of patients used this medication. Utilizing single-tablet formulations may improve adherence and reduce the total number of medications taken daily.

Key words: polypharmacy, Beers' criteria, medication review, single-pill

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Disease prevention at the primary level of health care

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Summary

Introduction. Cardiovascular diseases (CVDs) are a major global health concern, significantly influenced by changes in diet, physical inactivity, and increased smoking due to industrialization and urbanization. At the start of the 20th century, CVDs caused less than 10% of deaths; by the end of the century, this figure rose to approximately 50% in developed countries and 25% in developing nations. The Framingham Study introduced the term "risk factors" linked to disease occurrence. Key risk factors for CVDs include hypertension, hypercholesterolemia, diabetes, and smoking, while obesity, low physical activity, poor diet, and heredity also contribute. Women face unique risk factors, including hormonal changes and pregnancy complications. In developed countries, the decline in standardized mortality rates from CVDs has been attributed to primary prevention through risk factor reduction and secondary prevention via early detection and treatment.

Methods. From September 21 to 29, 2023, the Center for Health Promotion and Disease Prevention in Banja Luka, in collaboration with local health services, conducted preventive examinations at the "Bema" shoe factory, assessing 391 workers (350 women and 41 men) with no prior chronic non-communicable diseases. Measurements included blood pressure, blood sugar levels, anthropometric data, smoking status, physical activity, and alcohol consumption. Data on hypertension and diabetes during pregnancy were also collected.

Results. Among the 391 workers, 319 (81.58%) had one or more of risk factors. Notably, 36.57% had hypertension, 36.82% had elevated blood sugar, and 38.36% were smokers. Among women, 7.42% experienced hypertension during pregnancy, and 5.37% had diabetes. The findings indicate a significant proportion of workers at high risk for CVDs, warranting further diagnostic evaluations to prevent serious health complications.

Conclusion. Strengthening preventive measures can reduce the overall disease burden in society, aiming for a 3–5% reduction in disease burden by 2025.

Key words: risk factors, disease prevention, primary protection level

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Polisomnografy in nursing practice

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Summary

Sleep breathing disorders, primarily snoring and sleep apnea, manifest through a range of nighttime and daytime symptoms. Polysomnography (PSG) is a comprehensive overnight assessment of various physiological parameters, serving as one of the most accurate diagnostic methods for identifying sleep disorders. The primary objective of PSG is to measure critical components that aid in diagnosing sleep-related breathing disorders, with patients monitored under video surveillance throughout the night. Following the recording, a physician reviews the collected data to diagnose any disorders experienced during sleep.

Prior to the PSG, patients have been advised to refrain from afternoon naps, caffeinated beverages, and sleep medications. The procedure has been explained to the patient, detailing what measurements would be taken and the reasons for them. Instructions on sensor placement and patient behavior during the study have boon also provided. In the lab, nurses apply the necessary sensors to the patient and verify the quality of the signals and the complete setup. Once prepared, the patient is positioned in bed to facilitate sleep. During the recording, nurses monitor the patient and observe the measured parameters on a screen, intervening as needed to address any artifacts. In the morning, the patient is escorted back to their room, and the recording equipment is collected.

Treatment for sleep apnea includes weight loss, maintaining sleep hygiene, avoiding sedatives and alcohol before bed, ensuring nasal patency, and preventing back sleeping. Continuous Positive Airway Pressure (CPAP) devices, which deliver pressurized air to keep airways open, are commonly used. Surgical interventions may also be considered to correct anatomical abnormalities in the upper respiratory tract.

Key words: sleep apnea, polysomnography, CPAP, sleep hygiene

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The importance of defined procedures and psychological support in overcoming stress during and after the COVID-19 pandemic - review of medical technicians, UCC of Republic of Srpska

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Summary

Introduction. The COVID-19 pandemic posed a significant global health threat, resulting in increased workloads and emotional trauma for nurse-technicians caring for affected patients. This research aimed to explore the experiences of medical technicians at the University Clinical Center of Republic of Srpska (UCC RS) during the pandemic, with a focus on the importance of established procedures and the availability of psychological support.

Methods. Data were collected using a questionnaire approved by the UCC RS Ethics Committee, surveying 76 nurse-technicians from various organizational units within the institution.

Results. The questionnaire assessed nurse-technicians' perceptions of their readiness to face challenges, training, colleague support, equipment availability, and work organization. Most respondents (67.1%) were females, primarily young (47.4% aged 19–29) and with secondary education (68.4%). During the pandemic, 78.9% worked in settings directly treating COVID-19 patients, with 46.1% in intensive care units and over half working for more than 20 months in these roles. Emotional and professional exhaustion was reported by 55.3%, mainly due to the short timeframe for acclimatization. Factors helping to reduce exhaustion included timely information (69.7%) and defined procedures (69.7%). Only 22.4% participated in the psychological support program of the institution.

Conclusion. The findings indicate that the rapid adaptation to new work environments led to significant emotional and professional strain, which could be mitigated by defined procedures and timely communication. The low participation in psychological support service highlights a need for improved coping strategies and therapeutic interventions to better support nurse-technicians in future crises.

Keywords: COVID-19 pandemic, medical technician, procedures, psychological support

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Risk factors for the occurence of malignant diseases

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Summary

Cancer is the second leading cause of death globally, resulting in 9.6 million deaths each year, a figure projected to rise to 13.2 million by 2030. The World Health Organization (WHO) reports that 30–50% of cancers can be prevented, emphasizing that prevention is the most effective long-term strategy for cancer control. Major risk factors contributing to cancer and other diseases include tobacco use, poor diet, physical inactivity, and obesity.

Tobacco smoke contains over 7,500 chemical compounds, including 250 toxic and 40 carcinogenic substances. Nicotine addiction accelerates heart rate and increases blood pressure, while carcinogens in tobacco are responsible for 90% of lung cancer cases. Even passive smoking poses significant risks. Obesity, defined as a Body Mass Index (BMI) over 30 kg/m^2, increases cancer risk by 10%, as fat cells can promote inflammation that leads to precancerous lesions. Physical activity, encompassing all forms of movement, lowers the risk of malignancies, cardiovascular diseases, and diabetes. Proper nutrition, involving a balanced intake of fruits, vegetables, and grains, is crucial, as certain dietary factors are linked to cancer development. Alcohol consumption, which produces carcinogenic ethanol and acetaldehyde, can lead to various malignancies and increases the risk of developing hepatocellular carcinoma and other diseases.

Given the rise in malignant diseases due to modern lifestyles, prevention is vital. Key prevention strategies include avoiding tobacco use, maintaining a healthy weight, increasing physical activity, consuming a balanced diet rich in fruits and vegetables, and limiting alcohol intake.

Key words: cancer prevention, risk factors, tobacco use, obesity, nutrition

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Modern management of diabetes mellitus type 2 in prevention of cardiovascular disease

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Summary

According to the 2023 European Society of Cardiology (ESC) guidelines, GLP-1 RA agonists and SGLT-2 inhibitors are recommended as the primary agents to reduce cardiovascular (CV) risk in patients with type 2 diabetes, independent of glucose control. Patients with type 2 diabetes are categorized into four cardiovascular risk levels: very high risk, high risk, moderate risk, and low risk. The recommended LDL cholesterol targets vary by risk level: for very high-risk patients, the goal is <1.4 mmol/L; for high-risk patients, <1.8 mmol/L; and for moderate-risk patients, <2.6 mmol/L.

According to the American Diabetes Association (ADA) 2024 standards of care, GLP-1 RA agonists and/or SGLT-2 inhibitors are recommended for managing type 2 diabetes in patients with atherosclerotic cardiovascular disease (ASCVD) or high CV risk. For patients with heart failure, SGLT-2 inhibitors are prioritized, and for those with chronic kidney disease, SGLT-2 inhibitors are also recommended. When greater efficacy in glucose lowering is necessary, GLP-1 RA, insulin, or a combination of injectable agents (GLP-1 RA and insulin) may be used. To achieve and maintain weight management goals, GLP-1 RA is advised.

The target blood pressure for diabetic patients is <130/80 mmHg if safely attainable. For lipid management, the ADA recommends statin therapy as a primary prevention strategy for individuals with diabetes aged 40-75 without ASCVD. For those in the same age group at higher CV risk, including those with one or more ASCVD risk factors, high-intensity statin therapy is recommended. For those with multiple ASCVD risk factors and LDL cholesterol >1.8 mmol/L, adding ezetimibe or a PCSK9 inhibitor to maximally tolerated statin therapy may be reasonable. Recommendations for managing triglycerides include evaluating secondary causes of hypertriglyceridemia in individuals with elevated triglycerides (>5.7 mmol/L) and considering medical therapy to reduce the risk of pancreatitis. In patients with ASCVD or other CV risk factors on statin therapy with controlled LDL cholesterol, but elevated triglycerides (1.5–5.6 mmol/L), adding icosapent ethyl may be considered to

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reduce CV risk. Regarding antiplatelet therapy, aspirin (75–162 mg/day) is recommended as a secondary prevention strategy for patients with diabetes and a history of ASCVD. Aspirin may also be considered as a primary prevention strategy for diabetic patients at increased CV risk.

Key words: type 2 diabetes, cardiovascular disease, obesity, guidelines, GLP-1 receptor agonists, risk factors

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Diseases as a consequence of the influence of risk factors

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Summary

In recent years, we have witnessed an alarming increase in the prevalence of risk factors posing significant threats to global health, positioning them as the foremost health issue of our time. These risk factors, including elevated body mass index (BMI), smoking, high cholesterol levels, insulin resistance, physical inactivity, and poor dietary habits, are intricately linked to a wide range of chronic diseases. As a result, we find ourselves facing an epidemic of non-communicable diseases, such as cardiovascular diseases, diabetes, and certain cancers, which can be traced back to these modifiable risk factors.

The rise in BMI, particularly in the context of obesity, has reached epidemic proportions, contributing to metabolic disorders and exacerbating the risk of developing cardiovascular conditions. Smoking remains a leading cause of preventable diseases, contributing to respiratory disorders and malignancies. Elevated cholesterol levels, driven by unhealthy lifestyles and dietary choices, further complicate the landscape, leading to atherosclerosis and heart disease. Additionally, insulin resistance, often linked to obesity and sedentary behavior, is a precursor to type 2 diabetes, a condition posing significant morbidity and mortality risk.

Addressing these risk factors is crucial not only for the individual health of population, but also for reducing the overall burden on healthcare systems. By implementing comprehensive public health strategies aimed at risk factor reduction, we can significantly decrease the prevalence of associated diseases. Such interventions may include promoting healthier lifestyle choices, improving access to nutritious food, increasing physical activity, and implementing smoking cessation programs.

Moreover, reducing the prevalence of these risk factors would lead to substantial economic benefits, including decreased healthcare costs and improved productivity. The healthcare system would experience relief from the increasing demand for chronic disease management and treatment, allowing for better allocation of resources to other pressing health issues.

In summary, the management of risk factors is a critical public health priority that warrants urgent attention. By prioritizing the reduction of

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risk factors through effective interventions, we can combat the ongoing pandemic of non-communicable diseases, improve population health outcomes, and create a more resilient healthcare system.

Key words: risk factors, body mass index, smoking, insulin resistance, chronic diseases, public health strategies

Post-COVID syndrome and chronic fatigue syndrome

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Summary

Introduction. According to the definition of WHO, postcovid syndrome occurs in patients with history of a probable or confirmed infection with SARS-Cov-2, usually three months from a start of COVID-19 symptomps lasting at least two months and without the possibility to be explained by an alternative diagnosis. Common symptoms are fatigue, short breath, cognitive dysfunction and a lot of other symptomps influencing everyday functioning and quality of life of diseased people. Purpose of this project is to exemine frequency of postcovid symptomps as well as influence of age, sex, and the way of treatment of acute COVID-19 and comorbidities on appearence of postcovid.

Methods. Exeminees were filling up a survey made for need of research that among fundamental information about exeminees contained questions about acute COVID-19, eventual postcovid symptomology as well as effects on quality of life of diseased.

Results. A total of 133 patients that already had covid-19 filled up the survey from which 63.2% were women and 36.8% were men. Average age of patients amounts to 57.6 years. From 133 people that filled up the survey 70.70% stated that after 12 weeks of confirmed SARS-Cov-2 infection they had symptomps similar to COVID-19. The most common symptomps that respondents prompted were: fatigue (67%), myalgia (35.1%), ankle pain (34%), dyspnoea (31.9%), anosmia (30.9%), agenusia (29.8%), concetration disorder (27.7%), and prolonged cough (25.5%). The average duration of symptomps was 170 days. Listed symptomps had an effect on quality of life for 96.7% of respondents.

Conclusion. Frequancy of syptomology of postcovid, complexity and long lasting effects have a huge influence on diseased and it resambles a new challange in front of medical workers.

Key words: post-COVID syndrome, symptoms, quality of life, comorbidities, acute COVID-19 treatment

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The role of a nurse in treating patients with atrial fibrillation

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Summary

Atrial fibrillation is a non-infectious epidemic of the twenty first century. It represents a cardiac rhythm disorder occuring in the atria. It is the most common cardiac arrhythmia associated with an increased risk of stroke and reduced quality of life for patients. The aim of the study is to highlight the crucial role of nurses alongside physicians in the treatment of patients with atrial fibrillation.

Through a multidisciplinary approach, nurses play a role in preparation, diagnosis, as well as education and information dissemination about the disease to improve the quality of life of patients. It is important to emphasize the significance of anticoagulant therapy in stroke prevention, as well as lifestyle and dietary changes. Regular monitoring of blood pressure and blood glucose levels in individuals with diabetes is also of great importance. Communication skills are also essential in this process.

Taking into account the significant role of nurses in the treatment of patients with atrial fibrillation, there is a need for continuous education and training in new trends in technology and treatment to provide high-quality healthcare services.

The nurse is an indispensable part of the team in treating patients with atrial fibrillation. Their presence and role greatly influence the quality of life of patients.

Key words: atrial fibrillation, stroke prevention, lifestyle, diabetes, blood pressure, nursing intervention

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Nurses' awareness in the PHI Hospital "Sveti Vračevi" about their role in the prevention of cardiovascular diseases

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Summary

Introduction. Cardiovascular diseases (CVDs) are the leading cause of death globally, accounting for 32% of all deaths. Many CVDs can be prevented by addressing risk factors. Without improvements in healthy lifestyle behaviors and healthcare services, the prevalence of non-communicable diseases (NCDs) will rise significantly. Nurses, as the largest healthcare workforce, play a crucial role in providing high-quality care, making it essential to improve their knowledge of NCD risk factors to enhance CVDs prevention. This study aims to assess the knowledge and attitudes of nurses at PHI Hospital 'Sveti Vračevi' regarding their role in preventing CVDs.

Methods. We conducted a survey among 50 nurses at PHI Hospital 'Sveti Vračevi' using a questionnaire to explore their health behaviors and attitudes toward CVDs prevention. Statistical analysis was performed using SPSS 26.0.

Results. Nurses knowledgeable about CVDs prevention were more likely to believe they influence patients' lifestyle changes ($p < 0.05$). Those who attended recent CVDs prevention education were more likely to counsel patients effectively and influence lifestyle changes ($p < 0.05$). Despite a low proportion of nurses suffering from CVDs, there was a high prevalence of unhealthy lifestyle behaviors among them. No significant differences were found among nurses regarding working hours, lifestyle behaviors, and CVDs prevalence, indicating the need for further research with larger samples. Previous studies also noted high rates of unhealthy lifestyle behaviors among nurses. Factors such as limited time for patient care, low pay, and a perceived lack of patient awareness likely hinder their ability to manage risk factors effectively.

Conclusion. Nurses must serve as role models for healthy behaviors, recognizing the importance of their health in providing quality patient care, especially given their increased risk for NCDs.

Key words: CVDs, health promotion, disease prevention, nursing, education

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The application of artificial intelligence in PHI Hospital „Sveti Vračevi" Bijeljina

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Summary

The digital transformation of healthcare has been evolving for years, significantly accelerated by new technologies such as artificial intelligence (AI). This transformation offers the potential to enhance healthcare delivery and improve treatment outcomes.

AI stands as a milestone in this transformation, enabling healthcare professionals to enhance patient well-being by analyzing vast amounts of data to identify patterns and predict outcomes. AI is already making strides in various fields, including radiology, cardiology, and neurology, as well as personalized medicine, disease prediction, and patient monitoring. For instance, AI algorithms can assess genetic information to identify disease risks and enable preventive strategies. They can also facilitate real-time patient monitoring, alerting healthcare providers to potential health issues before they escalate. Furthermore, AI can analyze medical images such as X-rays, CT scans, and MRIs to detect early disease signs, resulting in faster, more accurate diagnoses and potentially saving lives. Despite concerns about AI replacing healthcare professionals, it is vital to emphasize that AI should augment human expertise, not replace it. The implementation of AI can improve treatment outcomes, reduce costs, and enhance efficiency, although challenges related to data protection, system integration, ethical considerations, and regulatory standards remain.

Recognizing the importance of AI, Bijeljina Hospital has actively utilized it in its operations since September 2023. We organized the international conference ''FUTURE vs. PRESENT IN MEDICINE, DIGITALIZATION - ARTIFICIAL INTELLIGENCE", which led to the establishment of the Center for Artificial Intelligence at PHI ''Sveti Vračevi". The AI applications focus on degenerative bone diseases, trauma, and spinal disorders, processing over 3,000 radiographic images to date. This integration of AI in radiology has significantly enhanced diagnostic processes and enriched medical data, valuable for research and developing new diagnostic

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algorithms and therapeutic strategies. Health organizations in Republic of Srpska must prepare for a future where healthcare professionals will increasingly rely on computer technologies. The implementation of AI at Bijeljina Hospital positions us as a leader in the region, ultimately benefiting our patients.

Key words: artificial intelligence, health system, transformation, radiology

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Challenges in the management of health institutions in the 21st century

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Summary

Healthcare systems worldwide are undergoing rapid and radical changes, necessitating an innovative approach and a workforce equipped with the necessary knowledge and skills to support this transformation. Organizations must address major social challenges, as highlighted by the COVID-19 pandemic. This paper explores the management challenges faced by healthcare institutions in the 21st century, drawing on lessons learned and experiences gained during the pandemic while focusing on preserving institutional missions despite obstacles.

The COVID-19 pandemic posed a global humanitarian challenge, resulting in millions of infections, countless lives lost, and significant economic repercussions. This crisis demanded swift and bold changes in healthcare management. We identified four key changes during the pandemic: fostering bolder visions, aligning the pace of change with needs, enhancing community trust in healthcare workers, and leveraging capacities from other organizations. If these changes become permanent, they could fundamentally improve work organization and engage key stakeholders. Healthcare managers must possess the competencies to navigate rapid changes and digital transformation for effective operations. It is essential to reconsider the role of the organization and business model, especially in light of new questions surrounding the speed and extent of necessary changes. The pandemic demonstrated the potential to achieve previously unattainable goals, but it is crucial to prioritize employee well-being and avoid long-term burnout.

In conclusion, significant changes in healthcare are imperative, particularly through digitalization and artificial intelligence, to enhance efficiency, medical quality, patient safety, and sustainable economic success. Learning from past mistakes and embracing flexibility will be crucial in addressing future challenges.

Key words: management, digital transformation, change management, COVID-19

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Association between COVID-19 and heart rhythm disorders

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Summary

Introduction. COVID-19 infection is associated with various disease manifestations across multiple organ systems, extending beyond its well-known pulmonary effects. Acute cardiovascular complications of COVID-19 can include myocarditis, pericarditis, acute coronary syndrome, heart failure, pulmonary hypertension, right ventricular dysfunction, and arrhythmias. Long-term follow-up studies have revealed an increased incidence of arrhythmias, heart failure, acute coronary syndrome, right ventricular dysfunction, myocardial fibrosis, hypertension, and diabetes mellitus. This study aims to investigate the association between COVID-19 and heart rhythm disorders.

Methods. A retrospective cohort study was conducted among patients hospitalized in the Cardiology department of the Public Health Institution Hospital „Sveti Vračevi" in Bijeljina during the pre-pandemic year of 2019 and the pandemic year of 2020. Statistical analysis was performed using SPSS version 26.0. Descriptive statistics and statistical significance analyses of the frequency of arrhythmias among patient cohorts from 2019 and 2020 were conducted, alongside univariate logistic regression.

Results. In 2019, there was a significant decrease in hospitalizations in the Cardiology department, alongside a rise in hospital mortality by 1.1 per 100 hospitalized patients. The age distribution between patients hospitalized in 2019 and 2020 showed no significant difference. In 2019, 29.9% of hospitalized patients experienced cardiac arrhythmias, while this figure rose to 40.3% in 2020, indicating a statistically significant increase ($p<0.05$). Univariate regression analysis revealed that pandemic-year patients were more likely to develop rhythm disorders (RR=1.583; $p<0.05$; CI=1.289–1.943). Moreover, patients with COVID-19 before hospitalization exhibited a higher frequency of arrhythmias compared to those diagnosed after admission ($p<0.05$).

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Conclusion. The pandemic year of 2020 showed increased hospital mortality and a significant rise in rhythm disorders among hospitalized patients compared to 2019. Patients who had COVID-19 prior to hospitalization had a higher incidence of rhythm disorders. Further research is warranted to include cohorts from the pandemic years 2021 and 2022.

Key words: COVID-19, heart rhythm disorders, hospital mortality

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Association of resistant hypertension and other cardiovascular risk factors in development of the heart failure with preserved ejection fraction

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Summary

Heart failure with preserved ejection fraction (HFpEF) is a complex clinical syndrome characterized by heart failure symptoms despite a preserved left ventricular ejection fraction (LVEF). This condition presents significant challenges in diagnosis, management, and prognosis due to its heterogeneous nature and varied etiologies. Hypertension (HTA), a common cardiovascular risk factor, is strongly linked to the development of HFpEF. This abstract provides an overview of the relationship between HTA and HFpEF, emphasizing pathophysiological mechanisms, clinical implications, and therapeutic considerations.

HTA contributes to the pathogenesis of HFpEF through various interconnected mechanisms, leading to structural, functional, and neurohormonal changes in the heart and vasculature. Chronic pressure overload causes left ventricular hypertrophy, diastolic dysfunction, and impaired relaxation, increasing the risk of HFpEF. Additionally, HTA induces endothelial dysfunction, oxidative stress, inflammation, and fibrosis, which exacerbate myocardial stiffness and impair ventricular-vascular coupling. Clinically, HTA-related HFpEF typically presents with a distinct phenotype characterized by older age, female predominance, obesity, diabetes mellitus, and multiple comorbidities, often showing diastolic dysfunction and left atrial enlargement.

Despite advances in diagnostic modalities, diagnosing HFpEF remains challenging and requires comprehensive clinical assessment, including history, physical examination, imaging, and biomarkers. Management strategies focus on aggressive blood pressure control, optimizing volume status, and addressing comorbidities such as obesity and diabetes. While pharmacological interventions targeting neurohormonal activation and myocardial relaxation show promise in preclinical studies, their efficacy in clinical trials remains uncertain, highlighting the need for further research.

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HTA significantly contributes to the development and progression of HFpEF, underscoring the importance of early detection, aggressive risk factor modification, and targeted therapies to improve outcomes. A multidisciplinary approach involving cardiologists, internists, and primary care physicians is essential for the comprehensive management of patients with HTA-related HFpEF.

Key words: heart failur, hypertension, diastolic dysfunction, management strategies

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Local complications after saphenous vein harvest using different surgical techniques

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Summary

Introduction. The saphenous vein graft remains the most commonly used conduit in coronary artery bypass grafting (CABG), despite its inferior patency compared to arterial grafts. Various factors influence the patency of saphenous vein grafts, including vein diameter, position, manipulation during harvesting, patient comorbidities, and target vessel diameter. Different surgical harvesting techniques can minimize wound complications and damage to the vein wall by reducing manipulation. This study aims to compare early and late postoperative complications among three surgical techniques: classical, "no touch," and endoscopic vein harvesting.

Methods. This study involved patients who underwent CABG at the Institute of Cardiovascular Diseases "Dedinje" from June 2019 to December 2020. A total of 83 patients were randomized into three groups based on the surgical technique employed: classical (27 patients, 32.5%), "no touch" (31 patients, 37.4%), and endoscopic (25 patients, 30.1%). Exclusion criteria included redo or urgent procedures, patients receiving multiple arterial conduits, and those with severe peripheral vascular disease. Data were collected preoperatively, during the early postoperative period, and more than one year post-operation.

Results. The groups were homogeneous concerning age (67.6±5.6 vs. 66.5±7.4 vs. 66.0±5.5 years; p=0.617) and sex (men: 48.1% vs. 74.2% vs. 72.0%; p=0.079). The length of harvested veins and hospital stay did not significantly differ among groups. Early postoperative complications included wound infections, which occurred in the classical and "no touch" groups, with none in the endoscopic group (p=0.269). Notably, leg pain, edema, and numbness were significantly lower in the endoscopic group compared to the other techniques.

Consclusion. Endoscopic vein harvesting resulted in the fewest local postoperative complications, suggesting it as a preferable option for saphenous vein graft harvesting in CABG.

Key words: saphenous vein graft, coronary artery bypass grafting, surgical techniques, postoperative complications, endoscopic harvesting

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Hypertension complications

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Summary

Hypertension, defined as consistently elevated blood pressure exceeding 140/90 mmHg, is a prevalent chronic condition often referred to as the "silent killer" due to its asymptomatic nature. This progressive disease poses significant risks to cardiovascular health, contributing to severe complications such as heart attacks, strokes, and kidney damage. The rise of hypertension in modern society is largely attributed to sedentary lifestyles, unhealthy dietary practices, and increased stress levels.

Effective management of hypertension is crucial for preventing associated cardiovascular diseases. Treatment strategies encompass both non-pharmacological and pharmacological approaches. Non-pharmacological interventions include weight reduction, regular physical activity, reduced sodium intake, smoking cessation, and stress management. These lifestyle changes can significantly lower blood pressure and improve overall health. For patients with severe hypertension or inadequate response to lifestyle modifications, pharmacological therapy is essential. Various antihypertensive medications, including diuretics, ACE inhibitors, and calcium channel blockers, are available to control blood pressure effectively.

In summary, hypertension requires a comprehensive management strategy to mitigate its health risks. Increased awareness, regular monitoring, and a combination of lifestyle changes and pharmacotherapy are vital for reducing the burden of this chronic condition and preventing its serious complications.

Key words: hypertension, cardiovascular health, treatment, lifestyle modification, pharmacotherapy

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Big data and artificial intelligence in medicine - ethical aspects

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Summary

Big data technology has changed the way patients communicate with healthcare professionals. Big data technology is the technique involved in analyzing large data sets to provide useful knowledge and insight, and to determine trends and make predictions.

Artificial intelligence (AI) is the process of embedding human intelligence in machines so that these machines apply logic and reasoning to analyze input and perform cognitive function. AI provides the ability to enable computers to solve complex problems independently, and to understand, act and learn in a human-like manner. Technologies, however, represent a double-edged sword because they provide unparalleled opportunities to improve the efficiency and quality of health care delivery, but at the same time introduce ethical dilemmas that must be resolved. The main concern is whether the large amount of patient data collected for computers and AI models is securely protected. There is an absolute need to address and manage ethical risks. Data security, data privacy and data management strategies must be established. Policies must be sufficiently in place to ensure that all patients have full control over their own data. Investments are needed in solutions that provide security measures to protect patient data, patient privacy and health information in general. Policies must be adopted allowing personal data to be used only for the purposes requested.

AI cannot replace a physician's judgment, but rather AI should support the clinician's decisions. Lines of responsibility must be drawn to articulate who must be held responsible when a patient is harmed or injured as a result of errors caused by the use of technologies.

Key words: big data, artificial intelligence, data security, ethics, patient privacy

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Prevention of mass non-communicable diseases in the age group 40 to 65 in the Municipality of Teslić

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Summary

Introduction. During the SARS-CoV-2 pandemic, essential disease prevention activities were not fully implemented in the Municipality of Teslić, highlighting the need for increased efforts in disease prevention.

Methods. The project focused on health promotion and the prevention of chronic mass non-communicable diseases (CMND). A total of 1,075 residents aged 40 to 65 in the Municipality of Teslić were examined. Medical professionals assessed blood pressure (BP), performed anthropometric measurements (including body mass index - BMI), and recorded smoking status. They identified individuals with arterial hypertension (HTA) and diabetes (DM) and provided guidance on healthy lifestyle habits. Laboratory tests measured glycemia (Glu), total cholesterol (TC), and prostate-specific antigen (PSA) in men. Participants were invited via phone by the Family Medicine Service at the "Sveti Sava" Health Center. The project also promoted healthy lifestyle habits through meetings with local community representatives and public forums emphasizing the significance of preventive examinations. The overarching goal was to create a risk factor map to target interventions and develop a plan for preventive control examinations.

Results. The risk factor map for the 1,075 examined individuals revealed that 538 were women and 537 were men. Of those surveyed, 263 respondents (24.46%) were smokers. Elevated systolic BP was observed in 19.25% of subjects without HTA, while 20.09% showed elevated diastolic BP. Pre-obesity and obesity rates were 39.8% and 39.62%, respectively. Glycemic values above 7.1mmol/l were found in 123 subjects, with 42 previously undiagnosed cases confirmed as diabetes. Elevated TC values above 5.2 mmol/l were noted in 64.65% of respondents, and PSA levels above 4 ng/ml were recorded in 30 men, with two cases of prostate cancer identified.

Consclusion. The project provided significant benefits to individuals and the community. The results indicate that CMND prevention should be approached as a collaborative campaign involving civil society organizations, businesses, and local communities to effectively promote health and prevent disease.

Key words: SARS-CoV-2, chronic non-communicable diseases, hypertension, diabetes mellitus, health promotion

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Harnessing artificial intelligence for improved hypertension management: a review and future prespectives

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Summary

Despite advancements in medications and lifestyle changes, achieving effective blood pressure control remains difficult. Recently, the rise of Artificial Intelligence (AI) has generated excitement about transforming healthcare delivery, particularly in hypertension management.

AI algorithms, especially machine learning and deep learning models, show great promise in improving the accuracy of hypertension diagnosis, risk stratification, and personalized treatment strategies. These models utilize extensive patient data, including electronic health records, genetic information, and data from wearable devices to create predictive analytics and identify patterns often missed by traditional methods.

AI can significantly enhance early detection and diagnosis of hypertension by analyzing diverse datasets to pinpoint subtle patterns and risk factors. This proactive identification allows clinicians to intervene earlier, potentially preventing disease progression. Additionally, AI-driven risk prediction models can highlight high-risk individuals who would benefit from timely interventions, thereby reducing morbidity and mortality.

AI-powered decision support systems provide valuable insights for clinicians by analyzing patient-specific data such as medication adherence and treatment response to create personalized treatment recommendations. By integrating real-time data with clinical guidelines, these systems enable healthcare providers to offer tailored interventions that enhance treatment efficacy.

Moreover, AI-driven remote monitoring solutions enhance hypertension management beyond conventional healthcare settings. Wearable

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devices equipped with AI can continuously track blood pressure and heart rate, offering real-time feedback and facilitating early detection of hypertension exacerbations.

Despite the promising applications of AI in hypertension management, challenges remain, including ensuring data privacy, addressing algorithmic bias, and integrating AI technologies into existing healthcare systems. Collaborative efforts among clinicians, data scientists, and policymakers are crucial to validate AI algorithms and effectively translate research into clinical practice.

AI presents a transformative opportunity in hypertension management by enabling early detection, personalized care, and remote monitoring. As AI technologies advance, they could significantly improve healthcare delivery and patient outcomes while alleviating the global burden of hypertension and its complications. However, addressing existing challenges and ensuring responsible AI integration into clinical practice are essential for maximizing its benefits.

Key words: hypertension, artificial intelligence, diagnosis, personalized treatment, remote monitoring

BIOMEDICINSKA ISTRAŽIVANJA
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Renal denervation

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Summary

Hypertension is considered the leading risk factor for cardiovascular diseases (CVD). According to statistics, 30–45% of the population in Europe suffer from CVD, and in Serbia, according to official data, 46.8% of the population suffers from CVD. Due to possible complications, special attention is paid to patients with resistant hypertension (blood pressure ≥140, introduced three antihypertensive drugs in an adequate dose, one of which is a diuretic). The most common failure in the treatment of hypertension is considered to be irregular therapy, but in 10% of patients, hyperactivity of the sympathetic nervous system can be a consequence of hypertension.

Renal denervation is a minimally invasive method of treating resistant hypertension, which reduces the overall tone of the sympathetic nervous system by selective ablation of afferent and efferent sympathetic fibers located in the adventitia of the renal arteries. Studies have shown that it is a safe and effective procedure. This procedure leads to a significant reduction in blood pressure by an average of 30/15mmHg. Periprocedural complications are minimal, and long-term follow-up of patients does not result in complications related to the morphology of the renal arteries.

Research indicates the possibility that renal denervation can have a favorable effect on functional capacity, reduction of left ventricular hypertrophy, reduction of insulin resistance and better regulation of insulin in people suffering from diabetes, as well as a lower impact of sleep apnea on hypertension.

Key words: renal denervation, resistant hypertension, sympathetic nervous system, blood pressure reduction, minimal invasive procedure, hypertension manageme

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The main predictors of severe forms of obstructive sleep apnea

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Summary

Introduction. Obstructive sleep apnea is one of the sleep related disorders that is characterized by repeated episodes of breathing interruptions caused by obstruction of the upper airways. If not treated, it can leave consequences in the whole organism. Negative effects on the cardiovascular system are reflected in the appearance of resistant hypertension, rhythm disorders, ischemic heart disease, and heart failure. The most common factors contributing to the appearance of this disease are obesity, age, sex, craniofacial abnormalities, smoking, use of alcohol and sedatives. The goal of our research is the evaluation of factors associated with a moderate or severe form of the disease in patients treated since November 2023 until February 2024 at the Institute for Cardiovascular Diseases Dedinje.

Methods. We analyzed data of the patients, their characteristics and comorbidities and compared the obtained data with the severity of obstructive sleep apnea measured with the value of the AHI index (apnea-hypopnea index).

Results. An analysis of the data of 30 patients showed that obesity was a factor associated with the occurrence of sleep apnea in ¾ of the patients; precisely 76.7% of obese patients had a medium or severe form of sleep apnea. Also, in our research, more severe forms of sleep apnea were present significantly more often in men, but the percentage of obese people was also significantly higher in men. All examined patients had hypertension, while one patient with resistant hypertension had severe form of sleep apnea (33.3%).

Conclusion. Sleep apnea is a disease with a high frequency which often remains unrecognized and can have numerous negative consequences in the body. Hypertension is a comorbidity that is most often associated

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with sleep apnea, but obesity is associated with more frequent occurrence of more severe forms of the disease.

Key words: sleep apnea, obesity, hypertension

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Lipid lowering combination therapy

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Summary

Statins contributed to the prevention of numerous atherosclerotic cardiovascular (CV) events and cardiovascular deaths in the past three decades.

Lipid lowering manageneny the benefit of statins is mainly mediated by the lowering of LDLc. According to scientific evidence, the current international guidelines recommend very low LDLc goals in patients at high/very high cardiovascular risk because they are associated with fewer CV events and improvements in atherosclerotic plaques. However, these goals often cannot be obtained with statins alone. Recent RCTs have demonstrated that these CV benefits can also be obtained with nonstatin LDLc-lowering drugs such as PCSK9 inhibitors (alirocumab and evolocumab), ezetimibe and bempedoic acid, while evidence with inclisiran is upcoming. Icosapent ethyl, a lipid metabolism modifier, has also shown an effect on event reduction. Physicians should take advantage of the currently available lipid-lowering therapies, choosing the drug or combination of drugs that is most appropriate for each patient according to his or her CV risk and baseline LDLc concentration. Strategies implementing combination therapies from early stages or even from the outset may increase the number of patients attaining LDLc goals, thereby preventing new CV episodes and improving existing atherosclerotic lesions.

Key words: lipid-lowering management, cardiovascular risk, cardiovascular events reduction, combination therapies, atherosclerosis management

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Perindopril for the treatment of hypertension

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Summary

Effective management of hypertension is crucial for preventing cardiovascular events and reducing mortality. This review highlights the specific advantages of the angiotensin-converting enzyme (ACE) inhibitor perindopril in treating hypertension.

Perindopril erbumine is a once-daily ACE inhibitor that lowers both systolic and diastolic blood pressures (BP) in patients with mild to moderate hypertension. The prodrug perindopril is converted into its active form, perindoprilat, which is rapidly distributed, particularly to tissues with high ACE activity. Perindopril BP-lowering efficacy is comparable to or exceeds that of other antihypertensives, with a trough-to-peak ratio of 75% to 100%, ensuring consistent 24-hour effectiveness per dose.

Dosing perindopril at 4 to 8 mg daily has been shown to significantly decrease carotid-femoral aortic pulse wave velocity (PWV), improve arterial compliance, and reduce left ventricular mass index. In patients with recent cerebral ischemia or stroke, perindopril maintains cerebral blood flow while effectively lowering SBP and DBP. Notably, first-dose hypotension is less common with perindopril than with other ACE inhibitors, making it safer for volume-contracted patients.

Clinical studies have shown that perindopril can effectively improve the distensibility and compliance of large and small arteries, potentially inducing vascular remodeling independent of BP reduction. It is generally well tolerated, particularly in the elderly, and shows enhanced efficacy when combined with diuretics or amlodipine, significantly reducing total and cardiovascular mortality compared to atenolol/diuretic regimens.

Perindopril is a well-tolerated ACE inhibitor surpassing other antihypertensive agents in managing hypertension. It appears to reverse vascular abnormalities linked to hypertension, such as arterial stiffness and left ventricular hypertrophy. While further research is needed to validate its

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impact on cardiovascular morbidity and mortality, perindopril remains an effective treatment option for patients with mild to moderate essential hypertension.

Keywords: cardiovascular disease, hypertension, perindopril, ACE inhibitors

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