Primjena integriranog algoritma u dijagnostici i liječenju periferne arterijske bolesti u bolesnika s dijabetesom

Application of an Integrated Algorithm in the Diagnosis and Treatment of Peripheral Artery Disease in Patients with Diabetes

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SAŽETAK: Šećerna bolest sa svojim komplikacijama uzrokuje 9 % ukupne smrtnosti diljem svijeta. Periferna arterijska bolest, uz kardiovaskularne bolesti, najčešća je komplikacija šećerne bolesti, čija prevalencija raste s dobi i duljinom trajanja dijabetesa. Specifičnost periferne arterijske bolesti u dijabetičara jest difuzno zahvaćanje arterijskog sustava, poglavito potkoljeničnih arterija. Posljedično tomu, dijabetes je i dalje glavni uzrok malih i velikih amputacija ekstremiteta, što, uz smanjenje kvalitete života, znatno utječe i na preživljenje bolesnika. Budući da razvijena aterosklerotska bolest uključuje niz komplikacija iz stručne domene različitih užih specijalnosti, poput dijabetičkog stopala, u dijagnostici i liječenju nužno je organizirati multidisciplinarne timove. U tu svrhu u Općoj bolnici „Dr. Josip Benčević" u Slavonskom Brodu organiziran je multidisciplinarni tim sa svrhom ranog prepoznavanja periferne arterijske bolesti te pravodobnog liječenja. Dosadašnje iskustvo iz svakodnevne kliničke prakse pokazuje da je za pravilno funkcioniranje tima nužno imati precizan dijagnostičko-terapijski algoritam kako bi se izbjegle duge liste čekanja za slikovnu obradu koja uključuje dupleks ultrazvuk i višeslojnu kompjutoriziranu tomografiju. Dijagnostički algoritam temeljio se na vrijednostima gležanjskog indeksa, a njegova vrijednost i klinička slika usmjeruju i određuju stupanj hitnosti i tip slikovne obrade. Integriranjem algoritma u *on-line* registar baze podataka dobili smo mogućnost lakšeg praćenja stope učestalosti, uspješnosti liječenja i ovisnosti o unesenim varijablama. Nadamo se da će takav način rada rezultirati ranijim otkrivanjem simptomatske bolesti, a time i znatnim smanjenjem amputacija donjih ekstremiteta te naposljetku i smrtnosti.

SUMMARY: Diabetes and its complications causes up to 9% of total mortality worldwide. Peripheral arterial disease is, in addition to cardiovascular diseases, the most common complication of diabetes with a prevalence that increases with age and the duration of diabetes. The specificity of peripheral artery disease in diabetics is the diffuse involvement of the arterial system, especially the popliteal arteries. Consequently, diabetes is still the main cause of small and large limb amputations, which, in addition to a reduction in the quality of life, significantly affects the survival of patients. Since the developed of atherosclerotic disease involves a number of complications from the professional domain of various subspecialties, such as diabetic foot, it is necessary to organize multidisciplinary teams for the diagnostic and therapeutic purposes. For this purpose, the General Hospital "Dr. Josip Benčević" in Slavonski Brod organized a multidisciplinary team with the goal of early recognition of peripheral artery disease and application of timely treatment. Experience from everyday clinical practice indicates that proper functioning of the team requires an accurate diagnostic and therapeutic algorithm to avoid long waiting lists for imaging, which includes Color Doppler and multislice computed tomography. The diagnostic algorithm was based on the ankle-brachial index, and its value and clinical picture guided and determined the degree of urgency and the type of image processing. By integrating the algorithm into the online database registry, we were able to more easily monitor the incidence rate, treatment success, and dependence on the entered variables. We hope that this approach will result in earlier detection of symptomatic disease and thus a significant reduction in lower limb amputations and, ultimately, mortality.

KLJUČNE RIJEČI: algoritam, multidisciplinarni tim, periferna arterijska bolest, registar, šećerna bolest.

KEYWORDS: algorithm, multidisciplinary team, peripheral arterial disease, register, diabetes.

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Uvod

Periferna arterijska bolest (PAB) aterosklerotska je okluzivna bolest donjih ekstremiteta. Šećerna bolest i pušenje glavni su čimbenici rizika za nastanak PAB-a. Životna dob, duljina trajanja dijabetesa te periferna neuropatija usko su povezani s rizikom od pojave PAB-a. U bolesnika s dijabetesom u dobi >40 godina života prevalencija PAB-a iznosi 20 %, dok je u bolesnika u dobi >50 godina života prevalencija 30%[1]. Klinički se očituje kao asimptomatska bolest ili simptomatska bolest po tipu intermitentnih klaudikacija ili kronične kritične ishemije (CLI), kao i u posebnom entitetu kao što je dijabetičko stopalo. Nažalost, velik broj bolesnika javlja se liječniku u fazi uznapredovale bolesti, s ireverzibilnim ishemijskim oštećenjima, što dovodi do velikog broja malih i velikih amputacija donjih ekstremiteta. Učestalost amputacija donjih ekstremiteta u dijabetičkoj populaciji kretala se u rasponu od 78 do 704 na 100 000 osoba godišnje, a relativni rizici između dijabetičara i nedijabetičara varirali su između 7,4 i 41,3[2]. Od ukupnoga broja bolesnika s amputacijom u zapadnoj Europi, 66 % su dijabetičari s vrlo visokom jednogodišnjom stopom smrtnosti koja, prema nekim istraživanjima, raste i do 50 %[3,4].

Specifičnost PAB-a u bolesnika s dijabetesom jest difuznost aterosklerotske bolesti, s izraženijim zahvaćanjem tibijalnih arterija te odsutnost simptoma čak i u stadiju kritične ishemije zbog neuropatskih oštećenja karakterističnih za dijabetičko stopalo. To u konačnici rezultira smanjenom uspješnošću revaskularizacijskog liječenja i još uvijek velikom stopom amputacija[5].

Rano prepoznavanje prisutnosti PAB-a te pravodobna dijagnostika može znatno smanjiti broj amputacija te ukupnu smrtnost. S obzirom na to da liječenje ovakvih bolesnika provodi više užih specijalista, nužno je organizirati multidisciplinarne timove.

Amputacije

Nakon postavljanja dijagnoze PAB-a, smjernice preporučuju uvođenje medikamentne terapije (antitrombocitni lijekovi, statini), vježbanje i kontrolu čimbenika rizika. Unatoč mjerama, velik broj bolesnika ostaje simptomatičan, što zahtijeva neki oblik revaskularizacijskog liječenja (kirurško ili endovaskularno). Kao krajnja mjera liječenja preostaje amputacija donjih ekstremiteta, rezervirana za slučajeve kada ne postoji mogućnost revaskularizacije, u slučaju znatnog gubitka tkiva te kada revaskularizacija i optimalna medikamentna terapija ne daju pozitivne rezultate. Amputacija donjih ekstremiteta smatra se posljednjim terapijskim izborom zbog povećane smrtnosti i troškova liječenja. Amputacije donjih ekstremiteta, s obzirom na lokalizaciju, mogu se podijeliti na velike i male amputacije, u skladu s preporukama nadležnih društava: NICE (*The National Institute for Health and Clinical Excellence*) i PARC (*The Peripheral Academic Research Consortium*)[6,7]. Velike ili visoke amputacije mogu se definirati kao amputacije na razini ili iznad razine gležnja, a, s obzirom na koljeni zglob, mogu biti natkoljenične (transfemoralne) ili potkoljenične (transtibijalne) amputacije. Male ili niske amputacije odnose se na amputacije ispod razine gležnja, uključujući stopalo te jedan ili više nožnih prstiju. Statistički podatci bolesnika podvrgnutih velikim amputacijama upućuju na gotovo dvostruko povećanu stopu smrtnosti u usporedbi s pacijentima u kojih amputacija nije izvedena (13 % : 6,9 %)[8].

Introduction

Peripheral artery disease (PAD) is an atherosclerotic occlusive disease of the lower extremities. Diabetes and smoking are the main (strong) risk factors for developing PAD. Age, duration of diabetes, and peripheral neuropathy are closely related to the risk of PAD. The prevalence of PAD is 20% in patients with diabetes over 40 years of age, while the prevalence is around 30% in patients over 50 years of age[1]. Clinically, it manifests as an asymptomatic disease or symptomatic disease by type of intermittent claudication or chronic limb ischemia (CLI), as well as particular entities such as the diabetic foot. Unfortunately, a large number of patients presents in the advanced stage of the disease, with irreversible ischemic damage leading to a large number of small and large amputations of the lower extremities. The frequency of lower limb amputations in the diabetic population ranges from 78 to 704 per 100,000 individuals per year, and the relative risk between diabetics and non-diabetics ranges between 7.4 and 41.3[2]. Of the total number of amputated patients in Western Europe, 66% are diabetics with a very high one-year mortality rate, which, according to some studies, has risen up to 50%[3-4].

The specificity of PAD in patients with diabetes is the diffuse involvement of atherosclerotic disease, with more pronounced involvement of the tibial arteries and the absence of symptoms even in the stage of critical ischemia due to neuropathic damage characteristic for diabetic foot. This also results in reduced success of revascularization treatment and a rate of amputations that is still high[5].

Early detection of the presence of PAD and timely diagnosis can significantly contribute to a reduction in the number of amputations and overall mortality. Since the treatment of these patients is carried out under the domains of multiple subspecialties, it is necessary to organize multidisciplinary teams.

Amputations

Once PAD is diagnosed, the guidelines recommend the introduction of drug therapy (antiplatelet drugs, statins), exercise, and control of risk factors. Despite the measures, a large number of patients remain symptomatic, requiring some form of revascularization treatment (surgical or endovascular). As a final treatment measure, amputations of the lower extremities is reserved for cases when there is no possibility of revascularization, in case of significant tissue loss, and when revascularization and optimal drug therapy do not give positive results. Lower limb amputations are considered the last therapeutic choice due to increased mortality and treatment costs. Amputations of the lower extremities, with, can be divided into large and small amputations regard to localization and in accordance with the recommendations of the relevant societies; NICE (The National Institute for Health and Clinical Excellence) and PARC (The Peripheral Academic Research Consortium)[6-7]. Large or high amputations can be defined as amputations at or above the level of the ankle, and depending on the knee joint they can be above-knee (transfemoral) or below-knee (transtibial) amputations. Small or low amputations refer to amputations below the level of the ankle, including the foot and one or more toes. Statistics of patients undergoing major amputations indicate an almost twofold increase in the mortality rate compared with patients in whom amputa-

Porazni statistički podatci upozoravaju na potrebu bolje prevencije razvoja PAB-a te standardizacije algoritma dijagnoze i liječenja te bolesti i njezinih komplikacija.

Ukupno među bolesnicima s potrebom amputacije donjih ekstremiteta, 81,8 % bolesnika čine dijabetičari, a 75,6 % bolesnici s dijabetesom i PAB-om[9]. Statistički podatci pojedinih nacionalnih istraživanja pokazuju smanjenje ukupne stope amputacija s 27,5 na 25/10 000 bolesnika s dijabetesom, no bez značajne razlike u kretanju velikih i malih amputacija (male amputacije 15,7 – 14,9, velike amputacije 11,8 – 10,2, p = 0,66 i p = 0,29)[10]. Broj hospitalizacija radi netraumatske amputacije donjih ekstremiteta u dijabetičara znatno se smanjio posljednjih nekoliko desetljeća, s 11,2 na 3,9/1000 bolesnika (p < 0,01). Unatoč ohrabrujućim podatcima, učestalost hospitalizacija radi netraumatske amputacije i dalje disproporcionalno raste u dijabetičara >75 godina života[11].

Multidisciplinarnim pristupom, prema podatcima *World Health Organization* (WHO) i *International Diabetes Federation,* broj amputacija povezanih s dijabetesom može se smanjiti za 85 %[12].

MULTIDISCIPLINARNI KONCEPT

Organiziranje multidisciplinarnih timova više specijalnosti nužno je radi same multifaktorijelne naravi perifernih arterijskih komplikacija kod šećerne bolesti. Iako je vaskularna – aterosklerotska bolest glavni uzrok ireverzibilnih oštećenja i komplikacija u 82 % bolesnika s dijabetesom, periferna neuropatija, ulceracije i sekundarne infekcije također su česta komplikacija osobito pri dijabetičkom stopalu[13]. U Općoj bolnici „Dr. Josip Benčević" u Slavonskom Brodu organiziran je multidisciplinarni tim u veljači 2018. godine koji se sastojao od liječnika dijabetologa, radiologa, vaskularnih kirurga te kardiologa. Osnovni je zadatak bio zajedničkim dijagnostičkim algoritmom ubrzati dijagnostiku u simptomatskih bolesnika te unaprijediti revaskularizacijsko liječenje i na taj način smanjiti broj amputacija. Središnju koordinacijsku ulogu imali su dijabetolozi koji su regrutirali bolesnike i trijažirali ih u daljnji dijagnostičko-terapijski postupak.

Bolesnici i metode

Dijagnostički se algoritam temeljio na polaznoj vrijednosti gležanjskog indeksa (ABI) i kliničkim simptomima. Prema kliničkim simptomima i stupnju ishemije prema ABI-ju, rađena je stratifikacija dijagnostičke obrade. Tako se u bolesnika sa simptomima kronične kritične ishemije preskakala nepotrebna doplerska obrada te je provođena hitna višeslojna kompjutorizirana tomografija (MSCT) i/ili invazivna angiografija unutar 2 dana, nakon čega bi intervencijski tim procijenio mogućnosti revaskularizacijskog liječenja. Poseban je naglasak bio usmjeren na simptomatske bolesnike s hodnom prugom manjom od 100 metara, za koje je predviđena obrada putem dnevne bolnice na vaskularnom kirurškom odjelu unutar 7 dana ako su vrijednosti ABI-ja <0,5 te unutar 21 dana ako bi ABI bio između 0,5 i 0,9. Ujedno se posebna pozornost u algoritmu davala bolesnicima s visokim ABI-jem zbog velike pojavnosti rigidne i značajne aterosklerotske bolesti u ovakvih bolesnika kako bi se i u njih provela adekvatna i pravodobna obrada (**slika 1**).

Sa svrhom upisa i praćenja bolesnika koji, uz šećernu bolest, imaju i PAB, u siječnju 2019. osnovan je Registar bolesnika s PAB-om. Zamišljen je kao baza podataka koja će uz svoju

tion was not performed (13% vs. 6.9%)[8]. Current statistics indicate the need for better prevention of PAD development and standardization of the algorithm for its diagnosis and treatment and its complications.

Overall, among patients requiring lower limb amputation, 81.8% of patients are diabetics, while 75.6% are patients with diabetes and PAD[9]. Statistical data in some national studies have shown a decrease in the overall rate of amputations from 27.5 to 25.0 / 10,000 in patients with diabetes, but without a significant change for large and small amputations (small amputations 15.7-14.9, large amputations 11.8-10.2, p=0.66 and p=0.29)[10]. The number of hospitalizations for non-traumatic lower limb amputation in diabetics has decreased significantly in the last few decades, from 11.2 to 3.9 / 1000 patients (p<0.01). Despite encouraging data, the incidence rate of hospitalizations for non-traumatic amputation continues to rise disproportionately in diabetics over 75 years of age[11].

A multidisciplinary approach, according to the World Health Organization (WHO) and the International Diabetes Federation, can reduce the number of diabetes-related amputations by 85%[12].

MULTIDISCIPLINARY CONCEPT

Organizing multidisciplinary teams of more specialties is necessary to address the very multifactorial nature of peripheral arterial complications in diabetes. Although vascular-atherosclerotic disease is the leading cause of irreversible damage and complications in 82% of patients with diabetes, peripheral neuropathy, ulceration, and secondary infections are also common complications, especially in diabetic foot[13]. In the General Hospital "Dr. Josip Benčević" in Slavonski Brod, a multidisciplinary team was organized in February 2018 consisting of diabetologists, radiologists, vascular surgeons, and cardiologists. The main task was to speed up the diagnosis of symptomatic patients with a common diagnostic algorithm and to improve revascularization treatment, thus reducing the number of amputations. The central coordinating role was played by diabetologists who recruited patients and triaged them for further diagnostic-therapeutic procedures.

Patients and Methods

The diagnostic algorithm was based on the baseline ankle brachial index (ABI) and clinical symptoms. Stratification of diagnostic processing was performed based on clinical symptoms and the degree of ischemia according to ABI. Thus, unnecessary Doppler processing was skipped in patients with symptoms of chronic limb ischemia and emergency multislice computed tomography (MSCT) and / or invasive angiography were performed within 2 days, after which the intervention team would assess the options for revascularization treatment. Particular emphasis was placed on symptomatic patients with a walking distance of less than 100 meters, who were scheduled for treatment through a day hospital in the vascular surgical department within 7 days if ABI values were < 0.5 and within 21 days if ABI were between 0.5 and 0.9. At the same time, special attention in the algorithm was given to patients with high ABI due to the high incidence of rigid and significant atherosclerotic disease in these patients in order to administer adequate and timely treatment (**Figure 1**).

In order to enroll and monitor patients who have PAD in addition to diabetes, the Register of Patients with PAD was es-

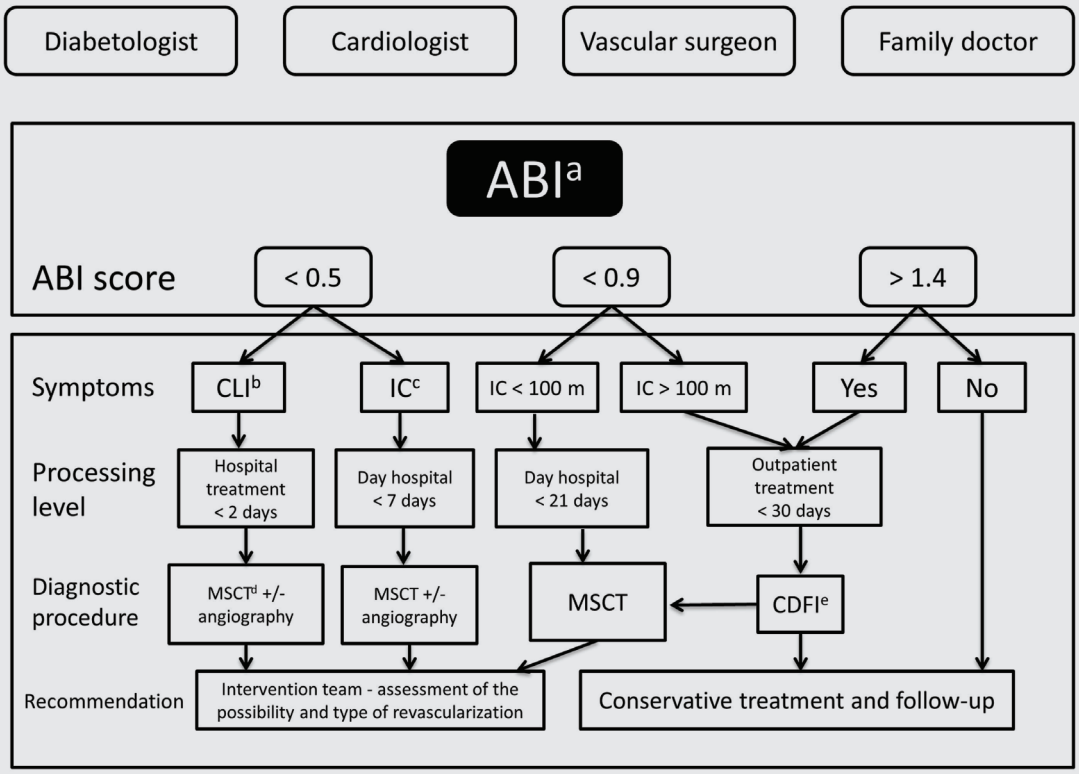

FIGURE 1. The diagnostic and therapeutic algorithm based on ankle-brachial index values and clinical features. Chronic critical limb ischemia was defined by the occurrence of pain at rest, the appearance of ulcers, or gangrene on the lower extremity in patients with proven peripheral arterial disease.

[a]ankle-brachial index; [b]chronic critical limb ischemia; [c]intermittent claudication; [d]multslice computed tomography; [e]duplex ultrasound.

osnovnu svrhu, a to je klinička dobrobit za bolesnika, služiti i u istraživanju ove bolesti. Prva verzija Registra postavljena je na Googleov poslužitelj u siječnju 2019. godine. U njega su se unosili rezultati bolesnika kojima je kroz dnevnu dijabetološku bolnicu rađen ABI. Osim varijabli dobivenih mjerenjem ABI-ja, unosili su se osnovni demografski podatci, komorbiditeti, lijekovi te laboratorijske vrijednosti (HbA1c i lipidogram) koji su zapravo dio redovitih dijabetoloških pregleda.

Budući da je registar na udaljenom poslužitelju, može mu se pristupiti s bilo kojeg radilišta, što omogućuje multidisciplinarni unos velikoga broja varijabli.

Osnovna uloga Registra u kliničkoj primjeni jest detektiranje bolesnika sa sniženim ABI-jem te pravodobno usmjerivanje prema dodatnoj ciljanoj dijagnostičkoj obradi i liječenju.

Rezultati

U razdoblju od siječnja 2019. do ožujka 2020. ukupno je obrađeno 310 bolesnika. Varijable primijenjene u registru prikazane su u **tablici 1**.

Broj bolesnika s dijagnozom šećerne bolesti iznosio je 265, od kojih je 196 oboljelih imalo pridruženu arterijsku hipertenziju, a 61 je bio pušač. Prosječna vrijednost HbA1c iznosila je 8 %, dok je prosječni LDL iznosio 3,3 mmol/L. Snižen ABI <0,9 te

tablished in January 2019. It is designed as a database that, in addition to its basic purpose which is achieving clinical benefit for patients, will also facilitate research on this disease. The first version of the Registry was uploaded to Google's server in January 2019. Patients who underwent ABI at a day diabetic hospital were admitted. In addition to the variables obtained by measuring ABI, basic demographic data, comorbidities, drugs, and laboratory values (HbA1c and lipid panel) were entered, which are a part of regular diabetological examinations.

Because the Registry is on a remote server, it can be accessed from any site, allowing multidisciplinary input of a large number of variables.

The main role of the Registry in clinical application is the detection of patients with reduced ABI and timely referral to additional targeted diagnostic processing and treatment.

Results

A total of 310 patients were enrolled in the period from January 2019 to March 2020. The variables used in the Registry are shown in **Table 1**.

The number of patients diagnosed with diabetes was 265, of whom 196 had associated arterial hypertension, while 61

TABLE 1. Variables used in the Registry.

Patient's personal and demographic data	Name and surname Date of birth Sex Height Weight BMI
Comorbidity data	Arterial hypertension Dyslipidemia Coronary artery disease Atherosclerotic carotid disease
Current check-in / arrival details	Examination date Method of referral Doctor from the team Nurse from the team
Data from current status and anamnesis	ABI Smoking and cigarette quantity Diabetes therapy HbA1c Lipid profile Renal function*

BMI = body mass index (based on the ratio of body weight to square of a person's height); ABI = ankle-brachial index; HbA1c = glycated hemoglobin.
*assessment of renal function based on creatinine clearance (value obtained using the Cockcroft-Gault formula).

viši >1,4 verificiran je u 58 bolesnika koji su prema algoritmu dodatno obrađeni i upućeni na procjenu mogućnosti revaskularizacije. U 26 bolesnika izvedena je perkutana transluminalna angioplastika (PTA), dok je 17 bolesnika liječeno kirurškom revaskularizacijom. U 15 bolesnika nije bilo moguće revaskularizacijsko liječenje pa su oni nastavili konzervativno liječenje. U navedenoj grupi bolesnika s patološkim ABI in-

were smokers. The mean HbA1c was 8%, while the average LDL was 3.3 mmol/L. Decreased ABI <0.9 and >1.4 were verified in 58 patients who were further processed according to the algorithm and referred for assessment of revascularization options. Percutaneous transluminal angioplasty (PTA) was performed in 26 patients, while 17 patients were treated with surgical revascularization. Revascularization treatment

TABLE 2. Cross-sectional indicators of selected variables from the Registry for the total number of diabetic patients vs. abnormal ankle-brachial index.

	Total number of diabetic patients	ABI <0.9 and ABI >1.4
Number of patients	265	58
The ration of women to men %	48 : 52	49:51
Average BMI	32	31
Average HbA1c	8.0%	8.3%
Average LDL (mmol/L)	3.3	3.3
Proportion of smokers	23%	19%
Proportion of patients with arterial hypertension	74%	62%
Proportion of patients with coronary heart disease	5.0%	6.3%
Proportion of patients on insulin therapy	41%	38%

ABI = ankle-brachial index; BMI = body mass index (based on the ratio of body weight to the square of a person's height); HbA1c = glycated hemoglobin; LDL = low-density lipoprotein.

deksom, 62 % njih imalo je hipertenziju, a 19 % su bili i pušači. Prosječni HbA1c u navedenoj grupi bolesnika iznosio je 8,3 %, dok je prosječni LDL bio 3,4 mmol/L (**tablica 2**).

Rasprava

Dijagnoza PAB-a temelji se na slikovnim metodama dupleks ultrazvuka i MSCT-a. Međutim, izrazito duga lista čekanja na ove pretrage sprječava pravodobnu dijagnostiku i odgađa potreban revaskularizacijski postupak. Potencijal ABI-ja u procjeni PAB-a, kao i ukupnoga kardiovaskularnog rizika, i dalje je ostao neiskorišten[14]. Zbog toga smo osmislili dijagnostički algoritam temeljen na ABI indeksu, a njegova vrijednost i klinička slika usmjeruju i određuju stupanj hitnosti te tip slikovne obrade. Integriranjem algoritma u registar baze podataka dobili smo podatke o prevalenciji i utjecaju čimbenika rizika u ispitivanoj grupi bolesnika. U 22 % ispitanika (n = 58) zabilježen je ABI <0,9 te >1,4, što odgovara procijenjenoj prevalenciji PAB-a koja iznosi 20 – 30 %. Naime, još 1992. godine Walters *i sur.* ustanovili su prevalenciju PAB-a u bolesnika s dijabetesom od 23,5 %, dok su Elhad *i sur.* u svojem istraživanju imali prevalenciju od oko 33 %[15-16]. U skladu s preporukama u 74 % (n = 43) bolesnika proveden je jedan od oblika revaskularizacijskog liječenja[17].

Među uključenim ispitanicima, glavni komorbiditet, uz šećernu bolest (od čega 41 % bolesnika bio na inzulinskoj terapiji), bila je arterijska hipertenzija (u 74 % bolesnika), dok su pušači činili bili 24 % ispitanika. U podanalizi bolesnika s ABI-jem <0,9 i >1,4 (n = 58) nije nađena značajnija razlika u komorbiditetima uz verificiran nešto manji udio hipertenzije (62 %) i pušenja (19 %). Prosječna vrijednost LDL kolesterola u podgrupi s patološkim ABI-jem nije bila značajno različita 3,4 : 3,3 mmol/L, dok je HbA1c bio viši 8,3 : 8,0 %. U sukladu s dobivenim podatcima, očekivano, neregulirana šećerna bolest glavni je uzrok razvoja PAB-a, dok je arterijska hipertenzija u dijabetičkih bolesnika s PAB-om „jači" dodatni čimbenik u usporedbi s pušenjem.

U samo 6,3 % bolesnika s ABI-jem <0,9 verificirana je i pridružena koronarna bolest srca. Naime, poznata je činjenica kako je ABI neovisni čimbenik rizika za kardiovaskularni i cerebrovaskularni morbiditet i mortalitet te, prema podacima Weitz *i sur.*, u 20 % bolesnika s PAB-om razvije se nefatalni koronarni incident u petogodišnjem razdoblju[18-20].

Glavno tehničko ograničenje sadašnje verzije registra jest u tome što nije relacijski povezan s registrom koronarnih bolesnika koji se također vodi u istoj ustanovi. Stoga je za buduću verziju registra jedan od glavnih ciljeva stvoriti jedinstvenu relacijsku bazu podataka za PAB i koronarnu bolest srca, što će omogućiti objektivnije podatke o povezanosti PAB-a i koronarne bolesti srca.

Zaključak

Multidisciplinarni timovi znatno pridonose poboljšanju dijagnostike i liječenja dijabetoloških bolesnika s perifernom arterijskom bolesti. No za pravilno funkcioniranje tima potrebno je izraditi jasne dijagnostičko-terapijske algoritme. Dijagnostički algoritam temeljen na ABI indeksu omogućuje pravodobnu dijagnostiku PAB-a određujući stupanj hitnosti i tip slikovne obrade. Integriranjem algoritma u *on-line* registar postiže se bolje praćenje dijagnostičko-terapijskog protokola za svakoga pojedinog bolesnika s mogućnošću praćenja

was not possible in 15 patients, who continued conservative treatment. In the group of patients with a pathological ABI index, 62% had hypertension while 19% were also smokers. The average HbA1c in this group of patients was 8.3%, while the average LDL was 3.4 mmol/L (**Table 2**).

Discussion

The diagnosis of PAD is based on duplex ultrasound and MSCT imaging methods. However, the extremely long waiting list for these tests prevents timely diagnosis and delays the required revascularization procedure. The potential of ABI in the assessment of PAD, as well as the overall cardiovascular risk, remained untapped[14]. For the same reason, we devised a diagnostic algorithm based on ABI, and its value as well as the clinical picture are used to guide and determine the degree of urgency and the type of image processing. By integrating the algorithm into the database registry, we obtained data on the prevalence and influence of risk factors in the examined group of patients. ABI <0.9 and >1.4 were recorded in 22% of subjects (n = 58), which corresponds to an estimated prevalence of PAD of 20-30%. Namely, back in 1992, Walters et al. found the prevalence of PAD in diabetic patients to be 23.5%, while Elhad et al. reported a prevalence of 33%[15-16]. According to the recommendations, 74% (n = 43) of patients underwent one of the forms of revascularization treatment[17].

Among the included subjects, the main comorbidity with diabetes (of which 41% of patients were on insulin therapy) was arterial hypertension (in 74% of patients), while 24% of the subjects were smokers. In the subanalysis of patients with ABI <0.9 and >1.4 (n = 58), no significant difference was found in comorbidities, with a verified slightly smaller comorbidity prevalence (hypertension 62%, smoking 19%). The mean value of LDL cholesterol in the subgroup with pathological ABI was not significantly different, 3.4 vs. 3.3 mmol/L, while HbA1c was slightly higher, 8.3 vs. 8.0%. According to the obtained data, as expected, unregulated diabetes was the main cause of the development of PAD, while arterial hypertension in patients with diabetes and PAD is a "stronger" additional factor compared with smoking.

Associated coronary artery disease was found in only 6.3% of patients with ABI <0.9. Namely, it is a known fact that ABI is an independent risk factor for cardiovascular and cerebrovascular morbidity and mortality, and, according to Weitz et al., 20% of patients with PAD develop a non-fatal coronary incident over a 5-year period[18-20].

The main technical limitation of the current version of the Registry is that it is not relationally related to the Coronary Patient Registry, which is also kept in the same institution. Therefore, one of the main goals for a future version of the Registry is to create a unique relational database for PAD and coronary artery disease which will allow more objective data on the association between these two diseases.

Conclusion

Multidisciplinary teams can significantly contribute to the improvement of diagnosis and treatment of patients with diabetes and peripheral artery disease. However, proper functioning of the team requires development of clear diagnostic-therapeutic algorithms. The diagnostic algorithm based on ABI enables timely diagnosis of PAD by determining the

i bolje kontrole glikemije te ostalih rizičnih faktora. Pristup registru s udaljenog poslužitelja omogućuje interaktivno sudjelovanje svih članova multidisciplinarnog tima kako u dijagnostičkom, tako i terapijskom postupku. Ono ujedno omogućuje retrospektivnu i prospektivnu analizu svih potrebnih podataka, što može uvelike pridonijeti poboljšanju liječenja i smanjenju negativnih ishoda bolesti, što se prije svega odnosi na smanjenje stope amputacija.

degree of urgency and the type of image processing that should be applied. By integrating the algorithm into the online Registry, better monitoring of the diagnostic and therapeutic protocol is achieved for each individual patient with the possibility of monitoring and better control of glycemia and other risk factors. Access to the Registry from a remote server enables interactive participation of all members of the multidisciplinary team in both diagnostic and therapeutic procedures. It also enables retrospective and prospective analysis of all necessary data, which can greatly contribute to improving treatment and reducing the negative outcomes of the disease, which primarily refers to reducing the rate of amputations.

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