Pregledni članak / Review article

Aritmologija i elektrostimulacija — pregled stanja u Hrvatskoj

Arrhythmology and cardiac pacing — an overview of the situation in Croatia

Sandro Brusich[1]*, Hrvoje Vražić[2]

[1]Klinički bolnički centar Rijeka, Rijeka, Hrvatska

[1]University Hospital Centre Rijeka, Rijeka, Croatia

[2]Klinička bolnica Dubrava, Zagreb, Hrvatska

[2]University Hospital Dubrava, Zagreb, Croatia

SAŽETAK: Unazad nekoliko godina prisutan je značajan napredak u zbrinjavanju bolesnika s poremećajima srčanog ritma, kako u svijetu, tako i u Republici Hrvatskoj. Ovaj pregledni članak prikazuje postojeće stanje u području aritmologije i elektrostimulacije u Republici Hrvatskoj. Najveći napredak vidljiv je u području elektrofiziologije značajnim povećanjem broja učinjenih kateterskih ablacija aritmija, a osobito ablacije fibrilacije atrija. Prisutni su i znatni pomaci u novim spoznajama u području elektrostimulacije, daljnji porast u brojnu centara gdje se takvi postupci provode, kao i u broju učinjenih postupaka, pri čemu edukacija prati nove spoznaje i trendove, sve s ciljem kako bi našim bolesnicima omogućili dulje preživljenje i bolju kvalitetu života. Međutim, glavni izazovi koji ostaju pred nama nisu se bitno promijenili u odnosu na prijašnje godine, a osnovno je pronalazak dodatnih sredstava koji bi osigurali bolju prevenciju nagle srčane smrti neophodnim povećanjem broja ugradnje implantabilnih kardioverter defibrilatora i uređaja za resinkronizacijsku terapiju. Prostor za poboljšanje je znatan, pri čemu se ne može dovoljno naglasiti važnost ustrajne aktivnosti stručnog društva u ovom području.

KLJUČNE RIJEČI: aritmologija, elektrofiziologija, elektrostimulacija srca, fibrilacija atrija.

SUMMARY: In the past few years there has been a significant progress in the management of patients with heart rhythm disorders both in the world and in Croatia. This review article summarizes the current situation in the area of arrhythmology and cardiac pacing in the Republic of Croatia. The greatest improvement is seen in the field of electrophysiology due to a significant increase in the number of performed electrophysiological procedures, particularly catheter ablation of atrial fibrillation. There are also significant advancements in new insights in the field of electrical stimulation, a further increase in a number of centers where such procedures are performed, as well as in the number of performed procedures where education follows new insights and trends, all with an aim to enable our patients to have prolonged survival and a better quality of life. However, some major challenges we are facing have not significantly changed compared to the previous year, and the basic one is finding additional resources to ensure better prevention of sudden cardiac death by necessary increasing the implantation rate of implantable cardioverter defibrillators and cardiac resynchronization therapy devices. The room for improvement is great, whereas we can not sufficiently emphasize the importance of persistent activities of the professional society in this area.

KEYWORDS: arrhythmology, electrophysiology, cardiac pacing, atrial fibrillation.

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Uvod

Aritmologija se ubraja među najkompleksnije i najzahtjevnije dijelove ne samo kardiologije, nego i cijele kliničke medicine. Sve boljim razumijevanjem patofizioloških mehanizama aritmija i primjenom novih tehnoloških dostignuća značajno su se unaprijedile mogućnosti liječenja bolesnika s poremećajima srčanog ritma.

Unatoč brojnim problemima, a zahvaljujući velikom trudu i entuzijazmu liječnika koji se bave ritmologijom u Republici Hrvatskoj, u zadnjih godina prati se značajan napredak u

Introduction

Arrhythmology is among the most complex and most demanding parts not only of cardiology, but also the entire clinical medicine. All the better understanding of the pathophysiological mechanisms of arrhythmias and the use of new technological advancements have significantly improved the treatment options for patients with heart rhythm disorders.

Despite many problems, and owing to great efforts and enthusiasm of physicians who deal with rhythmology in the Republic of Croatia, we have seen a significant advancement

području srčane elektrofiziologije i elektrostimulacije (u daljnjem tekstu elektrofiziologija i elektrostimulacija). Sukladno članku koji prati ovaj pregledni rad[1], prikazat ćemo trenutno stanje ritmologije i elektrostimulacije u Republici Hrvatskoj bazirajući se prvenstveno na službenim podacima objavljenim u EHRA White Book od 2011. do 2013. godine (izvješće European Heart Rhythm Association) te na još neslužbenim podacima prikupljenih iz osobne komunikacije za 2013. godinu[2,3].

Elektrofiziologija

Elektrofiziologija je dio ritmološkog portfolija u kojemu je došlo do najvećeg napretka u zadnjih nekoliko godina, a koji se manifestirao značajnim porastom broja obavljenih elektrofizioloških zahvata u čitavoj Republici Hrvatskoj, čime se djelomično smanjio veliki nesrazmjer u usporedbi s ostalim zemljama u regiji[4].

in the field of cardiac electrophysiology (hereinafter electrophysiology) and cardiac pacing in recent years. In accordance with the article that accompanies this review article[1], we shall show the current state of rhythmology and electrostimulation in the Republic of Croatia, primarily based on official data published in the EHRA White Book from 2011 to 2013 (the Report European Heart Rhythm Association) and the still unofficial data collected from personal communications in 2013[2,3].

Electrophysiology

Electrophysiology is a part of rhytmological portfolio which has seen the greatest progress in the last few years, being reflected in a significant increase in the number of performed electrophysiological procedures throughout the Republic of Croatia, resulting in a partial reduction of the huge disproportion in comparison with other countries in the region[4].

Table 1. *Overview of interventional electrophysiology in Croatia from 2010 to 2013.*

	2010	2011	2012	2013*
Number of ablation centers	4	5	5	5
Number of ablations performed	NA	455	593	700
Mean number of ablations perfrmed	NA	91	100	140
Number of atrial fibrillation ablations	NA	46	79	200

*unofficial framework data; NA = not available

U **Tablici 1** prikazani su relevantni podaci elektrofizioloških zahvata u Republici Hrvatskoj od 2010. do 2013. Trenutno postoje pet elektrofizioloških laboratorija od čega četiri na zagrebačkom području i jedan u Zadru. Svake godine vidljiv je značajan porast broja obavljenih zahvata te se procjenjuje da je tijekom 2013. godine obavljeno oko 700 elektrofizioloških zahvata. Najznačajniji je porast kompleksnijih zahvata uz uporabu trodimenzionalnih (3D) navigacijskih sustava, a osobito broja ablacija fibrilacije atrija (FA), što je u skladu sa svjetskim trendovima.

Osnovni problemi koji sprječavaju dodatni razvoj ove grane medicine jesu nedostatak adekvatnih financijskih sredstava za nabavku potrošnog materijala, osobito skupljih katetera za kompleksnije zahvate koji koriste navigacijske sustave te nedostatak adekvatne Dijagnostičko-terapijske skupine (DTS) u hrvatskom bolničkom sustavu kojima bi se moglo na pravilan način obračunati i vrednovati učinjeni bolnički rad.

Dodatni problem je još uvijek nedovoljno razvijena svijest o ovoj mogućnosti liječenja među bolesnicima, liječnicima obiteljske medicine te određenog broja liječnika specijalista što dovodi do nedovoljnog upućivanja bolesnika u specijalizirane ustanove. Na taj način, zbog nepridržavanja smjernicama Europskog kardiološkog društva (ESC), uskraćuje se bolesnicima efikasna metoda koja u brojnim slučajevima može dovesti do potpunog izlječenja, izlaže ih se dugotrajnom uzimanju antiaritmika sa svojim potencijalnim nuspojavama te nepotrebno opterećuje čitavi zdravstveni sustav.

Fibrilacija atrija

FA je najčešća postojana srčana aritmija koja se javlja u oko 1-2% opće populacije. Sukladno navedenim podacima u

Table 1 presents the relevant data of electrophysiological procedures in the Republic of Croatia from 2010 to 2013. Currently there are five electrophysiological laboratories, out of which four in the region of Zagreb and one in Zadar. Every year we can see a substantial increase in the number of procedures performed and it is estimated that during the year 2013 some 700 electrophysiological procedures were performed. The increase in complex procedures using three-dimensional (3D) navigation systems, in particular in the number of atrial fibrillation (AF) catheter ablations is significant, which is in line with global trends.

The main problems preventing further development of this branch of medicine are the lack of required financial resources for the purchase of supplies, particularly more expensive catheters for more complex procedures using navigation systems and the lack of adequate diagnosis-related group (DRG) in the Croatian hospital system, which would be used for calculation and valuation of the performed clinical work in a proper way.

An additional problem is still a lack of awareness about this treatment option among the patients, family physicians and a certain number of medical specialists leading to a lack of sufficient referrals of patients to specialized institutions. In this way, due to non-compliance with the guidelines of the European Society of Cardiology (ESC), the patients are denied an efficient method which in many cases can lead to a complete cure, they are exposed to long-term antiarrhythmic therapy with their potential side-effects and the entire health system is unnecessarily burdened.

Atrial fibrillation

AF is the most common persistent cardiac arrhythmia, which occurs in about 1-2% of the general population. In accor-

Hrvatskoj vjerojatno više od 60.000 bolesnika boluje od FA. Prisustvo FA uzrokuje dvostruki porast smrtnosti i peterostruki porast rizika za moždani udar, a jedan od pet svih moždanih udara povezan je s ovom aritmijom. Ishemijski moždani udar povezan s FA je često fatalan, a u bolesnika koji prežive zaostaje teži stupanj invalidnosti i imaju veću sklonost recidiva nego bolesnici s drugom etiologijom moždanog udara. Zbog svega navedenog osnovna i jedina terapija koja dokazano smanjuje mortalitet u bolesnika s FA je prevencija moždanog udara primjenom antikoagulantne terapije[5,6].

Drugi veliki napredak uz kateterske ablaciju u liječenju bolesnika s FA koji je prisutan u zadnjih nekoliko godina na našim prostorima je dostupnost novih oralnih antikoagulansa (NOAK)[6,7]. U Hrvatskoj su trenutno dostupna dva NOAK-a: dabigatran i rivaroxaban, a ove godine očekuje se i registracija apixabana. NOAK dijelimo u dvije skupine: direktne inhibitore trombina (dabigatran), koji je od lipnja 2013. god na dopunskoj listi Hrvatskog zavoda za zdravstveno osiguranje i na inhibitore aktiviranog faktora X (rivaroxaban i apixaban). Za razliku od antagonista vitamina K koji djeluju na više faktora koagulacijske kaskade, NOAK djeluju specifičnije na samo jedan koagulacijski faktor. Velike randomizirane studije i metaanalize pokazale su neinferiornost NOAK u usporedbi s inhibitorima vitamina K u redukciji tromboembolijskih incidenata te bolji profil sigurnosti u vidu smanjenja učestalosti krvarenja, osobito intrakranijskog krvarenja. Osnovni problemi koji još uvijek ograničavaju veću penetraciju NOAK među bolesnicima s FA jesu viša cijena nego antagonista vitamina K, nepokrivanje odnosno djelomično pokrivanje troškova od strane zdravstvenog osiguranja u Republici Hrvatskoj i još uvijek nedovoljna edukacija liječnika i bolesnika o efikasnosti i sigurnosti ove vrste antikoagulantne terapije.

S obzirom na spomenute napretke u liječenju FA, dostupnosti novih europskih smjernica, pojavila se potreba za sustavno sakupljanje suvremenih podataka o postupanju i liječenju bolesnika s FA u zemljama članicama ESC. Zbog navedenog ESC je pokrenuo program izrade registra bolesnika s FA s ciljem dobivanja suvremenih podataka kako bi se ustanovilo da li su dijagnostički i terapijski postupci u bolesnika s FA u skladu sa suvremenim smjernicama, procijenilo upotrebu strategije kontrole ritma kao što su kateterska ablacija FA, simptome, kvalitetu života, morbiditet i mortalitet u bolesnika s FA.

U skladu s ESC, Radna skupina za aritmije i elektrostimulaciju Hrvatskoga kardiološkog društva (HKD) pokrenula je također projekt izrade Hrvatskog registra bolesnika s FA kako bi se dobili adekvatni podaci o incidenciji, prevalenciji, morbiditetu i mortalitetu bolesnika s FA, trendovima liječenja, farmakoekonomici, a sve u cilju razvoja bolje strategije liječenja bolesnika s FA u Republici Hrvatskoj.

Elektrostimulacija srca

Napredak u području elektrostimulacije očituje se ne samo u smanjenju cijena uređaja za elektroterapiju, već i dostupnošću sve kvalitetnijih podataka iz velikih randomiziranih kliničkih studija koje sve bolje pokazuju koji bolesnici od navedene terapije mogu imati koristi nasuprot onim skupinama bolesnika kod kojih nije izgledno da će od takve terapije imati znatne koristi (dok štetne posljedice mogu biti značajne). Pri tome, nekoč relativno rijetke metode liječenja poput ugradnje uređaja za srčanu resinkronizaciju (CRT) i uređaja za sprečavanje nagle srčane smrti (ICD) postale su sveprisutne u Republici Hrvatskoj, pri čemu je najznačajnija

dance with these data, probably more than 60,000 patients suffer from AF in Croatia. AF confers a double increase in mortality and fivefold increase in the risk of stroke, and one in five of all strokes is attributed to this arrhythmia. Ischemic stroke associated with AF is often fatal, and those patients who survive are left more disabled by their stroke and more likely to suffer a recurrence than patients with other causes of stroke. Due to the foregoing, the basic and the only therapy that has proven to reduce mortality in patients with AF is the stroke prevention by using anticoagulant therapy[5,6].

Another great advancement with catheter ablation in the treatment of patients with AF which has been present in the last few years in our region is the availability of new oral anticoagulants (NOAC)[6,7]. In Croatia, two NOACs are currently available: dabigatran and rivaroxaban, and this year the registration of apixaban is expected. NOACs are divided into two groups: direct thrombin inhibitors (dabigatran), which has been added to the supplemental list of Croatian Health Insurance Fund since June 2013 and inhibitors of activated factor X (rivaroxaban and apixaban). Unlike vitamin K antagonists (VKA) which have an effect on a number of factors of the coagulation cascade, NOACs block the activity of one single step in coagulation. Large randomized trials and meta-analyses have demonstrated non-inferiority of NOACs compared with VKA in reducing thromboembolic events and a better safety profile in terms of reducing the incidence of bleeding, especially intracranial bleeding. The main problems that still limit a greater penetration of NOACs among patients with AF are a higher price than the price of VKA, non-coverage or partial coverage of the costs by health insurance in the Republic of Croatia and still insufficient education of physicians and patients in respect to the efficacy and safety of this type of anticoagulant therapy.

Given the aforementioned advancements in the treatment of AF, the availability of new European guidelines, the need has arisen for systematic collection of contemporary data on the treatment and management of patients with AF in ESC member countries. For this reason, ESC has launched a program of creating a AF registry in order to collect contemporary data as to determine whether the diagnostic and therapeutic procedures in patients with AF are in compliance with contemporary guidelines, to evaluate the use of rhythm control strategies such as catheter ablation AF, symptoms, quality of life, morbidity and mortality in patients with AF.

As well as the ESC, the Working Group on Arrhytmias and Cardiac Pacing of the Croatian Cardiac Society has launched a project of a national AF registry in order to obtain suitable data on incidence, prevalence, morbidity and mortality of patients with AF, treatment trends, pharmacoeconomics, all in order to develop better treatment strategies in patients with AF in the Republic of Croatia.

Cardiac pacing

Progress in the field of electrostimulation is reflected not only in reducing the cost of devices for electrotherapy, but also the availability of more quality data from large randomized clinical trials that better show what patients can benefit from the above therapy compared to the groups of patients who are not likely to have much benefit from such a therapy (while harmful consequences can be significant). In that respect, once relatively rare treatment methods such as cardiac resynchronization therapy (CRT) devices and implantable cardioverter defibrillators (ICD) have become ubiquitous in the Republic of Croatia, where the most significant difference compared to most European countries re-

razlika u odnosu na većinu europskih zemalja i dalje relativno nedostatan broj ugrađenih uređaja u odnosu na stvarne potrebe naše populacije. Glavni ograničavajući čimbenik, nažalost, i dalje predstavljaju nedostatna financijska sredstva koja su dostupna za primjenu ovog načina liječenja. Olakotni čimbenici, poput entuzijazma i interesa kolegica i kolega, stalno prisutnu edukaciju i rastući broj centara gdje je navedene postupke moguće provesti, imali su samo ograničeni učinak na broj ovih postupaka (podaci o najčešćim tipičnim postupcima u elektroterapiji su pregledno prikazani u **Tablici 2**). Nadalje, kako bi se postojeće stanje u Republici Hrvatskoj moglo usporediti sa stanjem od prije nekoliko godina, skrećemo pozornost čitatelja na članak objavljen u *Cardiologia Croatica* 2011. godine, čime će steći potpuni uvid u trenutno stanje, ali i trendove[4].

mains relatively insufficient number of implanted devices compared to the real needs of our population. The main limiting factor, unfortunately, is still a lack of financial resources available for the use of this treatment option. Mitigating factors, such as the enthusiasm and interest of colleagues, constantly present education and a growing number of centers where these procedures can be performed, had only a limited effect on the number of these procedures (data on the most typical procedures in electrotherapy are detailed in **Table 2**). Furthermore, in order to be able to compare the existing situation in the Republic of Croatia with the situation we faced a few years ago, we draw the reader's attention to an article published in *Cardiologia Croatica* in 2011, which will give you a complete insight into the current situation and trends as well[4].

Table 2. *Overview of cardiac pacing in Croatia from 2011 to 2012.*

Procedure	2011	2012
Pacemaker units implanted	**2,532**	**2,515**
New implants	2,147	2,191
Replacement	385	324
Implanting centers	16	17
CRT units implanted	**54**	**58**
CRT-P	35	37
CRT-D	19	21
Implanting centers	8	10
ICD units implanted	**84**	**118**
Implanting centers	12	12
Loop recorder units implanted	**15**	**7**
Lead extraction	**7**	**7**
Perfoming centers	1	3

Iz prikazanih podataka razvidno je da je došlo do određenog platoa u broju ugrađenih elektrostimulatora, pri čemu bi se, s obzirom na evoluciju nekih dijagnostičkih metoda, ipak očekivao daljnji porast. Međutim, zbog gore navedenih razloga, do tog porasta nije došlo. Određen porast prisutan je u ugradnji CRT i ICD uređaja, no nažalost taj porast je još uvijek nedostatan u odnosu na većinu zemalja u regiji, što je također zabilježeno i 2011. godine[2,3].

Svakako je najznačajnija novost u području elektrostimulacije objava dugo očekivanih novih Smjernica za elektrostimulaciju i srčanu resinkronizacijsku terapiju ESC koje su objavljene tijekom Europace kongresa u lipnju 2013. godine[8]. S obzirom na to da su prijašnje Smjernice objavljene još 2007. (uz dodatno osvježenje u području liječenja CRT uređajima 2010. godine), jasno je zašto je dobrodošlo novo izdanje[9,10].

Glavne novosti u tim Smjernicama rezultat su brojnih istraživanja u području primjene srčane resinkronizacijske terapije kod bolesnika sa zatajivanjem srca. Nakon objave rezultata nekoliko velikih randomiziranih kontroliranih kliničkih studija u kojima je pokazano da primjena CRT uređaja donosi znatnu korist bolesnicima s ozbiljnim zatajivanjem srca — u smislu boljeg preživljenja, ali i poboljšanja simptoma — uslijedio je niz studija u kojima je naglasak stavljen na definiranje varijabli koje određuju pobliže podskupine bolesnika za koje je

The presented data shows that a certain maximum in the number of implanted pacemakers has been achieved, whereas we still expect a further increase considering the evolution of some diagnostic methods. However, this increase has not occurred for the above reasons. There is a certain increase in the implantation of CRT and ICD devices, but unfortunately, this increase is still insufficient compared to the most of countries in the region, which was also recorded in 2011[2,3].

Certainly the most significant innovation in the field of cardiac pacing is publishing of long awaited ESC Guidelines for pacing and cardiac resynchronization therapy published during Europace Congress in June 2013[8]. Considering the fact that the previous Guidelines were published in 2007 (with additional update in the field of treatment by using CRT devices in 2010), it is clear why the new edition is welcome[9,10].

The main novelty in these Guidelines is the result of numerous studies in the field of applying cardiac resynchronization therapy in patients with heart failure. The publication of the results of several large randomized controlled clinical studies which showed that the use of CRT devices brings substantial benefit to patients with severe heart failure — in terms of better survival, but also improvement of symptoms — was followed by a series of studies in which emphasis was placed on defining the variables that closely determine

najveća vjerojatnost da će imati koristi od navedene terapije. Navedeno se ponajviše odnosi na prikladan odabir bolesnika kod kojih se razmatra liječenje CRT uređajem, kao i na određivanje kliničkih karakteristika koje vode k povoljnom odgovoru na takvo liječenje. Nova saznanja iz tih studija ugrađena su u nove Smjernice, a odnose se ponajviše na varijable za odabir bolesnika koji imaju najveću vjerojatnost koristi od primjene CRT uređaja i predviđanje odgovora na primjenu CRT.

Sve više pažnje posvećuje se i infekcijama sustava za elektrostimulaciju, budući da je broj takvih infekcija u znatnom porastu. S obzirom na sve veći broj bolesnika koji su nositelji takvih sustava, navedeno ne predstavlja iznenađenje, međutim ima znatne implikacije na zdravstveni sustav, budući da su takve infekcije značajan uzrok morbiditeta, mortaliteta i znatnog povećanja troškova liječenja. Također, s obzirom na sve veći broj bolesnika koji će trebati zamjenu postojećeg sustava za elektrostimulaciju (ponajprije zbog iscrpljenja generatora, ali i zbog revizija elektroda), za očekivati je i sve veći broj takvih infekcija. Prema podacima pokazanim u **Tablici 2** postupci ekstrakcije sustava za elektrostimulaciju počeli su se provoditi i u Republici Hrvatskoj.

U novim smjernicama za ugradnju CRT uređaja, po prvi puta donesene su jasne preporuke za perioperativno postupanje u bolesnika s antitrombocitnom i/ili antikoagulantnom terapijom. Hematomi su česta komplikacija, javljaju se u oko 2,9-9,5% slučajeva, a najčešće se liječe konzervativno. Evakuacija je potrebna u oko 0,3-2% slučajeva i 15 puta povisuje rizik za nastanak infekcije. Većina hematoma i krvarenje može se izbjeći pravilnom preoperativnom pripremom bolesnika i adekvatnom regulacijom antitrombocitne i antikoagulantne terapije. Nove smjernice preporučuju da se u većine bolesnika na antitrombocitnoj terapiji može perioperativno obustaviti terapija u trajanju od 5 do 7 dana, osobito ako su navedeni lijekovi uvedeni radi primarne prevencije. U bolesnika višeg rizika s dvostrukom antitrombocitnom terapijom, preporuča se ukidanje klopidogrela u trajanju od 4 dana prije implantacije. U bolesnika niskog tromboembolijskog rizika na antikoagulantnoj terapiji preporučuje se smanjenje doze uz postizanje INR-a 1,5 do 2 ili obustavljanje antikoagulantne terapije 3 do 5 dana prije implantacije. U bolesnika visokog tromboembolijskog rizika preporučuje se ugradnja uređaja uz INR između 2 do 2,5. Uporaba heparina perioperativno kao “most” za antikoagulantnu terapiju se više ne preporučuje zbog značajnog povišenja rizika za razvoj hematoma lože (učestalost 15-20%)[8].

Nagla srčana smrt

Iako je priprema novih Smjernica iz područja liječenja ventrikulskih aritmija i sprječavanja nagle srčane smrti u tijeku (s očekivanom objavom istih tijekom 2015. godine), važno je napomenuti da su i u tom području prisutne brojne nove spoznaje, koje su dobrim dijelom ugrađene u ove Smjernice za elektrostimulaciju i srčanu resinkronizacijsku terapiju, budući da su prijašnje Smjernice iz ovog područja objavljene još 2006. godine[11]. Jedna od znatnih novosti je i dodatni prikaz uloge pretrage MR srca, koja se u nekoliko centara može učiniti i u Republici Hrvatskoj. Nove spoznaje iz ovog područja odnose se na bolje razumijevanje pojavnosti i uzroka ventrikulskih aritmija i nagle srčane smrti, kao i odabir bolesnika koji bi trebali imati najviše koristi od ugradnje ICD uređaja.

subgroups of patients which are most likely to benefit from this therapy. The foregoing primarily applies to the appropriate selection of patients who are considered to undergo the treatment by a CRT device as well as to determination of clinical characteristics that lead to a favorable response to such a treatment. New insights from these studies are incorporated in the new Guidelines, which primarily relate to the variables for the selection of patients who are most likely to benefit from the use of CRT devices and predicting the response to CRT application.

Ever greater attention is paid to the infection of electrical stimulation system, since the number of such infections is constantly in rise. Considering the increasing number of patients who are the carriers of such systems, the foregoing is not surprising; however, it has significant implications for the healthcare system, since such infections are a significant cause of morbidity, mortality and a significant increase in medical costs. Also, considering an increasing number of patients who will need a replacement of the existing pacemaker (primarily due to the generator depletion, but also due to inspection of electrodes), we can expect an increasing number of such infections. According to the data shown in **Table 2**, the methods of extraction of the pacing systems started to be implemented in the Republic of Croatia.

The new guidelines for the implantation of a CRT device include for the first time the clear recommendations for the perioperative treatment of patients with antiplatelet and/or anticoagulant therapy. Pocket hematomas are a common complication, occurring in about 2.9% to 9.5% of cases and are usually treated conservatively. Evacuation is required in about 0.3% to 2% of cases and increases risk for occurrence of infection by 15 times. Most of the hematoma and bleeding can be avoided by proper preoperative patient preparation and adequate regulation of antiplatelet and anticoagulant therapy. The new guidelines recommend that in the majority of patients on antiplatelet therapy, the therapy may be discontinued perioperatively for a period of 5-7 days, especially if these drugs were introduced for primary prevention. In higher-risk patients with dual antiplatelet therapy, discontinuation of clopidogrel in a length of 4 days prior to implantation is recommended. Dose reduction of VKA is recommended in patients on anticoagulant therapy with low thromboembolic risk, achieving an INR of 1.5-2 or discontinuation of anticoaganticoagulant therapy for 3-5 days prior to implantation. In high thromboembolic risk patients implantation of devices with an INR between 2-2.5 is recommended. The use of heparin perioperatively as a "bridge" for anticoagulant therapy is no longer recommended due to a significant increase in the risk for the development of hamstring hematoma (incidence 15-20%)[8].

Sudden cardiac death

Although the preparation of the new Guidelines in the area of treatment of ventricular arrhythmias and prevention of sudden cardiac death (SCD) is in progress (where the publishing of these guidelines is expected in 2015), it is important to note that a number of new insights are present in this area, which are mostly incorporated in the Guidelines for cardiac pacing and cardiac resynchronization therapy, since the previous guidelines in this area were published in 2006.[11]. One of the significant novelties is an additional presentation of the role of heart MRI scan, which can be performed in a few centers in the Republic of Croatia. New insights in this area are related to a better understanding of the incidence and causes of ventricular arrhythmias and SCD, as well as the selection of patients that are benefit the most from ICD therapy.

Na kraju, valja spomenuti i pomake vezane uz postupke kardiopulmonalne reanimacije. U Republici Hrvatskoj se niz godina provodi više vrsti tečajeva iz kardiopulmonalne reanimacije sukladno Smjernicama Europskog društva za resuscitaciju (ALS, ILS, EPLS, AED; zadnje Smjernice su iz 2010. godine), a u organizaciji Hrvatskog društva za reanimatologiju Hrvatskog liječničkog zbora[12]. Tijekom 2013. godine učinjeni su znatni pomaci u dostupnosti defibrilatora na javnim mjestima, kako u Gradu Zagrebu, tako i diljem Republike Hrvatske; sve s ciljem kako bi se što većem broju laika omogućilo uspješno provođenje postupka reanimacije i, u slučaju potrebe, vanjske defibrilacije primjenom AED uređaja. Pri tome se mora naglasiti uloga Hrvatskoga kardiološkog društva i Zaklade Hrvatska kuća srca. Glavni izazov u ovom području svakako predstavlja potreba za kontinuiranom i sveobuhvatnom edukacijom što većeg broja laika, ali i zdravstvenog osoblja.

Genetsko testiranje

Nasljedne aritmogene bolesti srca predstavljaju važan uzrok malignih poremećaja srčanog ritma. Javljaju se pretežito u mlađe populacije, a manifestiraju se najčešće u vidu palpitacija, omaglica i sinkopa te u najgorem slučaju, naglom srčanom smrti (NSS). Karakterizirane su povećanom učestalošću supraventrikulskih i ventrikulskih poremećaja srčanog ritma te se smatraju najčešćim uzrokom NSS u mladih sportaša.

U skupinu nasljednih aritmogenih bolesti ubrajamo sindrom dugog (LQTS) i kratkog QT intervala (SQTS), Brugadin sindrom (BrS), kateholaminergičnu polimorfnu ventrikulsku tahikardiju (CPVT), aritmogenu kardiomiopatiju desne klijetke (ARVC) te hipertrofijsku kardiomiopatiju (HCM) (vidi **Slike 1-4**). Nasljeđuju se pretežito autosomno dominantno, a bliži su srodnici pod povišenim rizikom za obolijevanje od istih bolesti[13,14].

Finally, we should mention the breakthroughs made in regard to the cardiopulmonary resuscitation procedures. Several types of cardiopulmonary resuscitation courses have taken place in the last few years in the Republic of Croatia in accordance with the Guidelines of the European Society for Resuscitation (ALS, ILS, EPLS, AED; the latest guidelines date back to 2010), organized by the Croatian Society of Resuscitation of the Croatian Medical Association[12]. During the year 2013, major breakthroughs have been made in the availability of defibrillators in public places, not only in the City of Zagreb, but also throughout the Republic of Croatia; with an aim to help as many lay persons to successfully perform resuscitation and, if necessary, external defibrillation using the AED devices. The role of the Croatian Cardiac Society and the Croatian Heart House foundation is to be emphasized. The main challenge in this area is certainly the need for continuous and comprehensive education of as many lay persons as possible, but also the medical staff.

Genetic testing

Inherited arrhythmogenic heart diseases are an important cause of malignant cardiac arrhythmias. They often occur in young people, and usually manifest in the form of palpitations, syncopes, and at worst, SCD. They are characterized by an increased incidence of supraventricular and ventricular cardiac rhythm disorders and are considered the most common cause of SCD in young athletes.

The group of congenital arrhythmogenic diseases include long QT syndrome (LQTS) and short QT syndrome (SQTS), the Brugada syndrome (BrS), catecholaminergic Polymorphic Ventricular Tachycardia (CPVT), arrhythmogenic right ventricular cardiomyopathy (ARVC) and hypertrophic cardiomyopathy (HCM) (**Figures 1-4**). They are inherited predominantly autosomally, while closer relatives are at increased risk of developing the same disease[13,14].

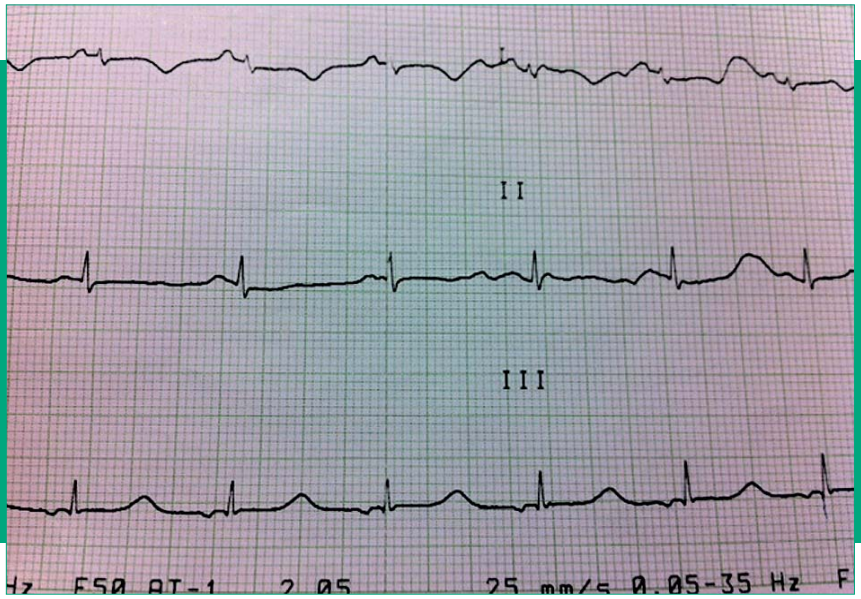

Figure 1. *ECG of a 33 year old female patient with LQTS after resuscitation because of ventricular fibrillation. See the characteristic QT prolongation in lead III.*

U Republici Hrvatskoj trenutno ne postoji mogućnost sustavnog genetskog testiranja nasljednih aritmogenih bolesti srca. U lipnju 2012. godine u sklopu zajedničkog projekta započeta je suradnja između Zavoda za kardiovaskularne bolesti KBC Rijeka i Statens Serum Instituta (Kopenhagen, Danska) u cilju sustavnog istraživanja svih bolesnika s kli-

At the moment, there is no possibility of a systematic genetic testing of congenital arrhythmogenic heart disease in the Republic of Croatia. In June 2012, the cooperation was established between the Institute for Cardiovascular Diseases University Hospital Centre Rijeka and Statens Serum Serum Institute (Copenhagen, Denmark) as part of the joint project

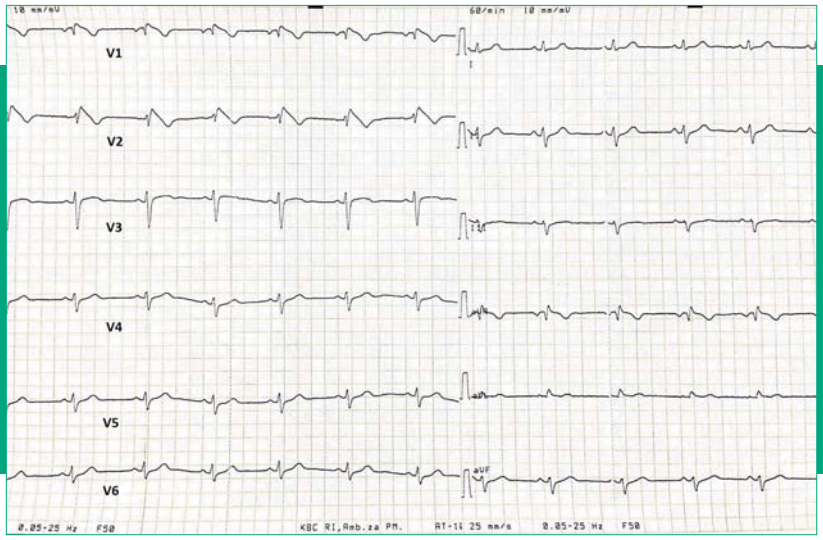

Figure 2. *ECG of a 23 year old male patient with Brugada syndrome. See the characteristic coved ST elevation i lead V1 and V2.*

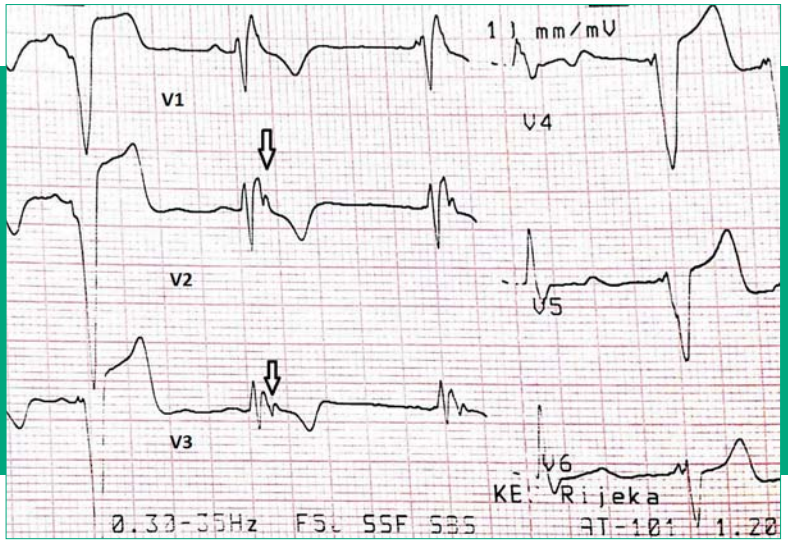

Figure 3. *ECG of a 47 year old patient with fully expressed ARVC. See the characteristic Epsilon wave and negative T-waves in lead V2 and V3 (arrow) and ventricular extrasystoles.*

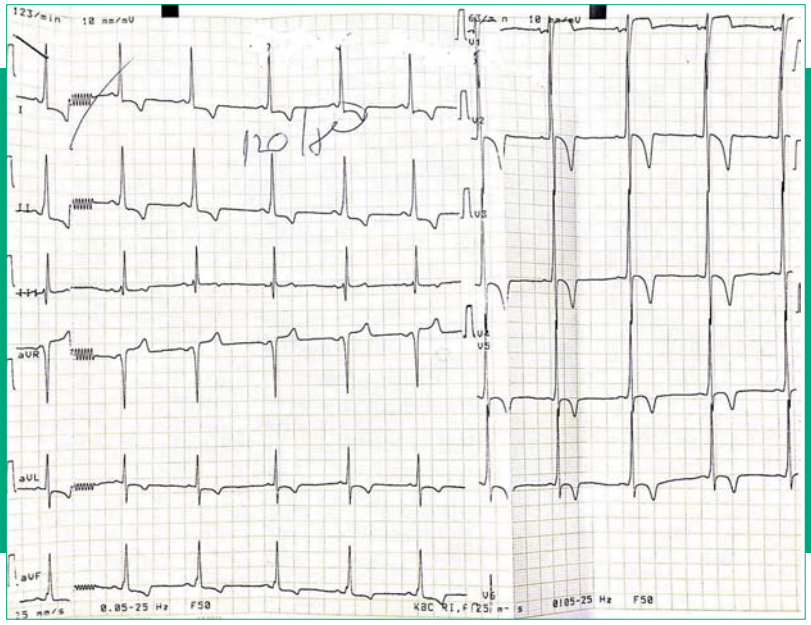

Figure 4. *ECG of a 17 year old patient with HCM. See the characteristic left ventricular hypertrophy with diffuse negative T wave.*

nički postavljenom dijagnozom nasljedne aritmogene bolesti i njihovih bližih srodnika[15,16]. Cilj ovog istraživanja bilo je sustavno genetski analizirati bolesnike s nasljednim aritmogenim bolestima i njihovih bližih srodnika, kako bi se po prvi puta na našim prostorima dobila genetska karakterizacija

in order to conduct a systematic trial of all the patients with a clinical diagnosis of congenital arrhythmogenic diseases and their close relatives[15,16]. The aim of this trial was to conduct a systematic genetic analysis of patients with congenital arrhythmogenic diseases and their close relatives, in

populacije te pokušalo identificirati bolesnike pod povećanim rizikom za NSS i omogućilo njihovo pravovremeno savjetovanje i liječenje.

Genetski je analizirano 85 bolesnika i njihovih srodnika, a genetska mutacija je ustanovljena 35 bolesnika (41%). Kontrolna skupina bila je sačinjena od 200 zdravih hrvatskih dobrovoljaca, čiji će genetski materijal ostati pohranjen kako bi se i ubuduće mogao koristiti za daljnja istraživanja te isključile eventualne karakteristične i učestale mutacije za našu populaciju.

order to obtain genetic characterization of populations for the first time in our region, to attempt to identify patients at an increased risk for SCD and providing them with prompt advice and treatment.

85 patients and their relatives were genetically analyzed, and genetic mutation was detected in 35 patients (41%). The control group was composed of 200 healthy Croatian volunteers whose genetic material will be deposited, so that it could be used for further trials in the future and to exclude any characteristic and frequent mutations in our population.

Table 3. *Population charachteristics of genetic inhereted disease in Croatia.*

	ARVC	HCM	BrS	LQTS	Total No (%)
No. of individuals	8	19	5	3	35
No. of new mutations	5	10	2	0	17 (48%)
Sex male / female	4/4	11/8	3/2	1/2	19/16
Mean age at diagnosis	46	38	55	41	30

ARVC = arrhythmogenic right ventricular cardiomyopathy; HCM = hypertrophic cardiomyopathy; BrS = Brugada syndrome; LQTS = long QT syndrome.

U **Tablici 3** prikazane su karakteristike bolesnika u kojih je ustanovljena genetska mutacija. Najzanimljiviji rezultat je 17 dosad novo opisanih mutacija (48%), što je i za očekivati s obzirom na dosad vrlo slabo genetski karakteriziranu populaciju[17,18].

Genetsko istraživanje aritmoloških bolesnika i otkrivanje novih mutacija važan je doprinos za bolje razumijevanje raznolikosti aritmija te nam omogućuje raniju dijagnostiku, kvalitetnije liječenje i preventivno djelovanje. Osnovne problemi su visoke cijene ovih pretraga, nemogućnost obavljanja navedenih testiranju u Hrvatskoj, nemogućnost refundacije troškova od zdravstvenog osiguranja i nedostatak educiranosti iz područja genetskog savjetovanja.

Zaključak

Zaključno, može se reći da se najveći napredak u području aritmologije u Republici Hrvatskoj u zadnjih nekoliko godina desio u području elektrofiziologije i kateterske ablacije FA prvenstveno zahvaljujući velikom entuzijazmu liječnika koji se bave ovim područjem medicine. Prisutni su i znatni pomaci u novim spoznajama u području elektrostimulacije, u Republici Hrvatskoj prisutan je daljnji porast u brojnu centara gdje se takvi postupci provode, kao i u broju učinjenih postupaka, pri čemu edukacija u tom području prati nove spoznaje i trendove, sve s ciljem kako bi našim bolesnicima omogućili dulje preživljenje i bolju kvalitetu života. Međutim, glavni izazovi koji ostaju pred nama nisu se bitno promijenili u odnosu na prijašnje godine, a osnovno je pronalazak dodatnih sredstava koji bi osigurali bolju prevenciju nagle srčani smrti neophodnim povećanjem broja ugradnje implantabilnih kardioverter defibrilatora i uređaja za resinhronizacijsku terapiju. Prostor za poboljšanje je znatan, pri čemu se ne može dovoljno naglasiti važnost ustrajne aktivnosti stručnog društva u ovom području.

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*Address for correspondence: Klinički bolnički centar Rijeka, Tome Strižića 3, HR-51000 Rijeka, Croatia.
Phone: +385-51-407-149
E-mail: sandro.brusich@gmail.com

Table 3 shows the characteristics of patients with established genetic mutation. The most interesting result is 17 new mutations described so far (48%), which is to be expected taking into account the population that has been so poorly genetically characterized in the past[17,18].

Genetic trial of arrhythmologic patients and discovery of new mutations is an important contribution necessary for a better understanding of the diversity of arrhythmia, and allows us earlier diagnosis, better quality treatment and preventive action. The basic problems are high prices of these tests, the inability to perform the above tests in Croatia, the inability to refund the costs from the health insurance and lack of education in the field of genetic counseling.

Conclusion

To conclude, we can say that the greatest advancement in the area of arrhythmology has been made in the field of electrophysiology and AF catheter ablation in the Republic of Croatia in recent years, primarily due to the great enthusiasm of physicians that engage in this area of medicine. There are also significant advancements in new insights in the field of electrical stimulation. A further increase in a number of centers where such procedures are performed has been recorded in the Republic of Croatia, and there is also an increasing number of performed procedures where education keeps up with new insights and trends, all with an aim to enable our patients prolonged survival and a better quality of life. However, some major challenges we are facing have not significantly changed compared to the previous years, and the basic one is finding additional resources to ensure better prevention of SCD by a necessary increase in the number of ICD and CRT implantats. The room for improvement is great, whereas we can not sufficiently emphasize the importance of persistent activities of the professional society in this area.

Literature

1. Liew R. Almanac 2013: cardiac arrhythmias and pacing. Cardiol Croat. 2014;9(1-2):12-27.

2. Auricchio A, Kuck KH, Hatala P, Arribas F. The current status of cardiac electrophysiology in ESC member countries. EHRA White book 2012: fifth edition.

3. Auricchio A, Kuck KH, Hatala P, Arribas F. The current status of cardiac electrophysiology in ESC member countries. EHRA White book 2013: sixt edition.

4. Bernat R. Arrhythmology in the Republic of Croatia. Cardiol Croat. 2011;6(12):393-6.

5. European Heart Rhythm Association; European Association for Cardio-Thoracic Surgery, Camm AJ, Kirchhof P, Lip GY, et al. Guidelines for the management of atrial fibrillation: the Task Force for the Management of Atrial Fibrillation of the European Society of Cardiology (ESC). Eur Heart J. 2010;31(19):2369-429.

6. Camm AJ, Lip GY, De Caterina R, et al. 2012 focused update of the ESC Guidelines for the management of atrial fibrillation: an update of the 2010 ESC Guidelines for the management of atrial fibrillation. Developed with the special contribution of the European Heart Rhythm Association. Eur Heart J. 2012;33(21):2719-47.

7. Heidbuchel H, Verhamme P, Alings M, et al. EHRA practical guide on the use of new oral anticoagulants in patients with non-valvular atrial fibrillation: executive summary. Eur Heart J. 2013;34(27):2094-106.

8. European Society of Cardiology (ESC); European Heart Rhythm Association (EHRA), Brignole M, Auricchio A, Baron-Esquivias G, et al. 2013 ESC guidelines on cardiac pacing and cardiac resynchronization therapy: the task force on cardiac pacing and resynchronization therapy of the European Society of Cardiology (ESC). Developed in collaboration with the European Heart Rhythm Association (EHRA). Europace. 2013;15(8):1070-118.

9. Vardas PE, Auricchio A, Blanc JJ, et al. Guidelines for cardiac pacing and cardiac resynchronization therapy. The Task Force for Cardiac Pacingand Cardiac Resynchronization Therapy of the European Society of Cardiology. Developed in collaboration with the European Heart Rhythm Association. Europace. 2007;9(10):959-8.

10. Dickstein K, Vardas PE, Auricchio A, et al. 2010 Focused Updateof ESC Guidelines on device therapy in heart failure: an update of the 2008 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure and the 2007 ESC guidelines for cardiac and resynchronization therapy. Eur Heart J. 2010;31(21):2677-87.

11. Zipes DP, Camm AJ, Borggrefe M, et al. ACC/AHA/ESC 2006 guidelines for management of patients with ventricular arrhythmias and the prevention of sudden cardiac death: a report of the American College of Cardiology/American Heart Association Task Force and the European Society of Cardiology Committee for Practice Guidelines (Writing Committee to Develop guidelines for management of patients with ventricular arrhythmias and the prevention of sudden cardiac death) developed in collaboration with the European Heart Rhythm Association and the Heart Rhythm Society. Europace. 2006;8(9):746-837.

12. Nolan JP, Soar J, Zideman DA, et al. European Resuscitation Council Guidelines for Resuscitation 2010 Section 1. Executive summary. Resuscitation. 2010;81(10):1219-76.

13. Behr ER, Dalageorgou C, Christiansen M, et al. Sudden arrhythmic death syndrome: familial evaluation identifies inheritable heart disease in the majority of families. Eur Heart J. 2008;29(13):1670-80.

14. Ranthe MF, Carstensen L, Oyen N, et al. Family history of premature death and risk of early onset cardiovascular disease. J Am Coll Cardiol. 2012;60(9):814-21.

15. Brusich S, Dembić M, Hedley P, et al. Genetic analysis of hereditary heart diseases: the Danish - Croatian collaboration. Cardiol Croat. 2012;7(Suppl 1):24.

16. Dembić M, Brusich S, Hedley P, Čubranić Z, Zaputović L, Christiansen M. Genetic testing, incidence and prevention of sudden cardiac death in Croatia. Cardiol Croat. 2012;7(Suppl 1):96-7.

17. Dembić M, Brusich S, Hedley P, et al. Novel arrhythmia-related mutations in Croatian arrhythmia patients. Europace. 2013;15(suppl 2):ii119-ii121.

18. Brusich S, Dembić M, Ćubranić Z. First results of genetic testing in Croatian arrhythmia patients. Cardiol Croat. 2013;8(9):297.