



“Bundle branch reentrant” ventrikulska tahikardija — Ventrikulska tahikardija koja kruži preko grana — Prikaz dva slučaja

Bundle branch reentrant ventricular tachycardia — Ventricular tachycardia circulating through the branches — Two case studies

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SAŽETAK: “Bundle branch reentrant” ventrikulska tahikardija (BBRVT) je rjeđi oblik dugotrajne monomorfne ventrikulske tahikardije (VT) koja se dominantno javlja u bolesnika s teškom, prvenstveno dilatativnom kardiomiopatijom. Budući se radi o VT brze frekvencije koja rezultira hemodinamskom nestabilnošću, presinkopa i sinkopa česti su prezentirajući simptomi. U bazičnom EKG zapisu u bolesnika s ovom aritmijom nalazimo intraventrikulske smetnje provođenja po tipu bloka lijeve grane (LBBB), a često i PQ prolongaciju. Isto tako, VT je najčešće LBBB morfologije, frekvencije preko 200/min, a morfologija QRS-a se ne razlikuje značajno u sinusnom ritmu i samoj aritmiji. Navedene karakteristike bolesnika i same tahikardije trebaju nas navesti da pomislimo na ovu posebnu vrstu tahikardije. Definitivna dijagnoza postavlja se elektrofiziološkim ispitivanjem kojim dokazujemo da kružni mehanizam tahikardije koristi Hisov snop te lijevu i desnu granu provodnog sustava srca. Produžen HV interval kao marker usporenog provođenja kroz Hisov snop i distalne dijelove provodnog sustava jedna je od glavnih karakteristika navedene tahikardije. Ablacija desne grane je u ovoj aritmiji kurativna. Najčešća komplikacija ablacije je totalni AV blok koji se javlja u 10-30% slučajeva što zahtjeva implantaciju trajnog elektrostimulatora srca. Zbog osnovne bolesti srca i mogućnosti i drugih tipova VT ovi bolesnici imaju i nakon uspješne ablacije indicaciju za implantaciju kardioverter-defibrilatora u svrhu primarne prevencije nagle srčane smrti. Ovdje prikazujemo dva recentna slučaja BBRVT.

KLJUČNE RIJEČI: ventrikulska tahikardija, blok lijeve grane, elektrofiziološko ispitivanje.

SUMMARY: Bundle branch reentrant ventricular tachycardia (BBRVT) is a rare form of sustained monomorphic ventricular tachycardia (VT), which predominantly occurs in patients with severe, primary dilated cardiomyopathy. Since this is a fast frequency VT resulting in hemodynamic instability, presyncope and syncope are common presenting symptoms. In the basic ECG in patients with this arrhythmia we find intraventricular disorders of conduction in type left bundle branch block (LBBB) and often PQ prolongation. Also, VT is usually of LBBB morphology, with heart rate over 200/min, while QRS morphology does not significantly differ in sinus rhythm and the arrhythmia itself. These characteristics of the patients and the tachycardia should make us consider of this special type of tachycardia. Definitive diagnosis is made by electrophysiological study to prove that a circular mechanism of tachycardia uses bundle of His and the left and right branch of the conducting system of the heart. Prolonged HV interval as a marker of slowed conduction through the bundle of His and more distal parts of the conducting system is one of the main characteristics of this tachycardia. The ablation of right bundle branch is curative in this arrhythmia. The most common complication of ablation is a total AV block that occurs in 10-30% of cases, which requires the implantation of permanent heart electrostimulator. Due to the basic disease of the heart and the possibility of other types of VTs, these patients show after successful ablation the indication for implantation of cardioverter-defibrillator for primary prevention of sudden cardiac death. Here we present two recent cases of BBRVT.

KEYWORDS: ventricular tachycardia, left bundle branch block, electrophysiological study.

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“Bundle branch reentrant” ventrikulska tahikardija (BBRVT) je poseban oblik dugotrajne monomorfne ventrikulske tahikardije (VT) koju ne susrećemo često u kliničkoj praksi. Ova činjenica ju ne čini manje važnom ukoliko znamo da se radi o vrlo opasnoj aritmiji koju je važno prepoznati, tim više što je moguće jednostavno liječenje kateeterskom ablacijom.

SLUČAJ 1

Muškarac u dobi od 56 godina koji, osim anamneze dugogodišnje, neadekvatno liječene arterijske hipertenzije

Bundle branch reentrant ventricular tachycardia (BBRVT) is a special form of sustained monomorphic ventricular tachycardia (VT), which is not often encountered in clinical practice. This fact does not make it less important if we know that this is a very dangerous arrhythmia that is important to recognize because you can easily treat it by catheter ablation.

CASE 1

A male patient aged 56 who, apart from a long history and inadequately treated hypertension had no other signif-



nije imao drugih značajnijih bolesti. Prvi simptomi zatajivanja srca javili su se 2008. godine kada je učinjena inicijalna obrada u regionalnom centru. Ehokardiografski je verificirana teška kardiomiopatija s dilatiranom lijevom klijetkom i teško reduciranom sistoličkom i dijastoličkom funkcijom, uz EF oko 25% te prisutnu tek blagu mitralnu insuficijenciju. Kako je koronarografija bila uredna, postavljena je dijagnoza dilatativne kardiomiopatije (moguće "izgorjela" hipertenzivna bolest srca). Već tada se u holterskim zapisima prate učestale VES i paroksizmi kratkotrajne VT (nsVT). Liječenje je započeto optimalnom medikamentoznom terapijom (ACE inhibitor, beta blokator, antagonist aldosterona, diuretik Henleove petlje) uz dodatak amiodarona. Početkom 2011. godine dolazi do kliničkog pogoršanja bolesnika te je u nekoliko navrata bilo potrebno hospitalno liječenje zbog kongestivnog srčanog zatajivanja. Pacijent je tada bio u funkcijskom stupnju III./IV. prema NYHA ljestvici uz nove simptome u vidu presinkopa i u jednom navratu prave kardiogene sinkope. Kako su bile iscrpljene sve dijagnostičke i terapijske mogućnosti u regionalnom centru pacijent je referiran u tercijarnu ustanovu kao potencijalni kandidat za transplantaciju srca. Nakon opsežne predtransplantacijske obrade bolesnik je stavljen na elektivnu listu za transplantaciju srca.

Tijekom kasnijeg praćenja dolazi do daljnjeg kliničkog pogoršanja te se bolesnik u kolovozu 2011. ponovno zaprima u tercijarni cetar sa simptomima niskog minutnog volumena, sada u IV. funkcijskom stupnju prema NYHA. Tijekom hospitalizacije u tri navrata dolazi do razvoja brze monomorfne VT sa slikom bloka lijeve grane frekvencije 220/min, koja je zbog gubitka svijesti morala biti električki kardiovertirana (**Slika 1**). U EKG zapisu u sinusnom ritmu prisutna je bila PQ prolongacija te intraventrikulske smetnje provođenja, dominantno po tipu nekompletnog bloka lijeve grane (**Slika 2**). Na temelju navedenoga postavljena je sumnja da se radi o "bundle branch reentrant" ventrikulskoj tahikardiji te je pacijent upućen na elektrofiziološko ispitivanje. Učinjena je standardna EP studija s

icant diseases. The first symptoms of heart failure were reported in 2008 when the initial workup was made in the regional center. Echocardiography verified severe cardiomyopathy with dilated left ventricle and severely reduced systolic and diastolic function with EF of around 25% with present only mild mitral insufficiency. As the coronarography was normal, the diagnosis of dilated cardiomyopathy was made (possibly burned out hypertensive heart disease). Even then the frequent VES and paroxysm of non-sustained VT (nsVT) were monitored by using Holter ECG. The treatment started by optimal medicamentous therapy (ACE inhibitor, beta blocker, aldosterone antagonists, loop diuretics) with the addition of amiodarone. At the beginning of 2011 the patient's clinical condition aggravated, and on several occasions the hospital treatment was required for congestive heart failure. The patient belonged then to NYHA III-IV functional class with new symptoms in the form of presyncope and on one occasion in the form of actual cardiogenic syncope. Since all diagnostic and therapeutic options in the regional center were exhausted, the patient was referenced to tertiary institution as a potential candidate for heart transplantation. After extensive pre-transplantation workup, the patient was placed on the elective list for heart transplantation.

In the later follow-up, further clinical aggravation occurred and the patient was in August 2011 re-admitted with symptoms of low minute volume, now being in IV functional class. During hospitalization, the patient developed fast monomorphic VT with left bundle branch block with frequency of 220 bpm for three times, which due to loss of consciousness had to be electrically cardioverted (**Figure 1**). The ECG in sinus rhythm showed PQ prolongation and intraventricular conduction problems, dominantly by type of incomplete left bundle branch block (**Figure 2**). Based on the above bundle branch reentrant ventricular tachycardia was suspected and the patient was referred for electrophysiological (EP) study. Standard EP study with 3+1 catheter (**Figure 3**) was conducted. The basic intracardiac re-

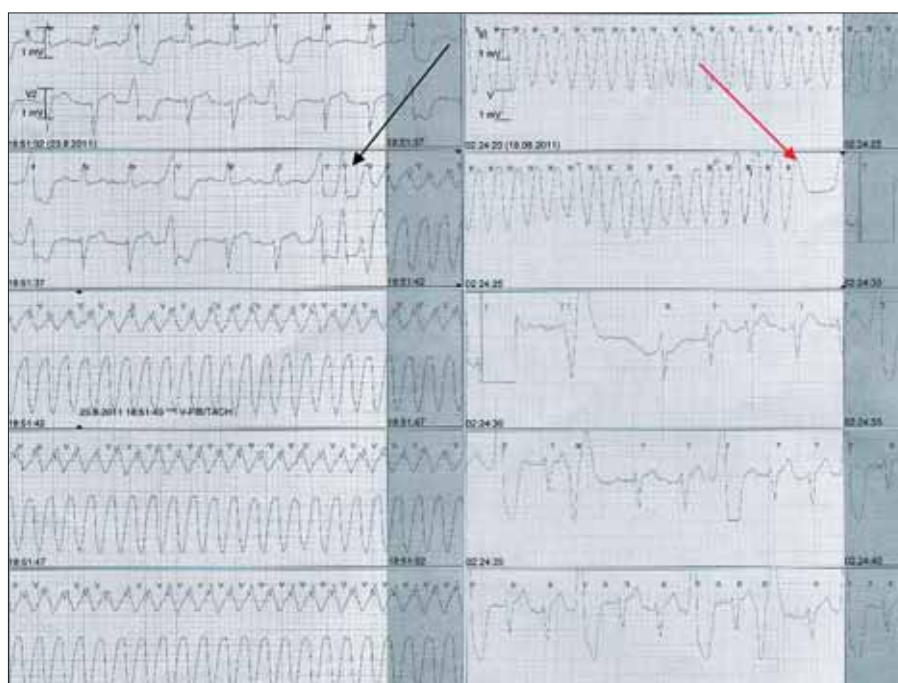


Figure 1. Tracing of ventricular tachycardia with ECG monitor. It is evident that the patient is in the sinus rhythm which is interrupted by frequent premature ventricular contractions (PVC). Two such PVC initiate rapid monomorphic ventricular tachycardia, which the left bundle branch block morphology (black arrow). Since arrhythmia causes hemodynamic instability, electrocardioversion was necessary to restore sinus rhythm (red arrow). It is important to note that the axis and the tachycardia morphology are similar to the QRS in the sinus rhythm.

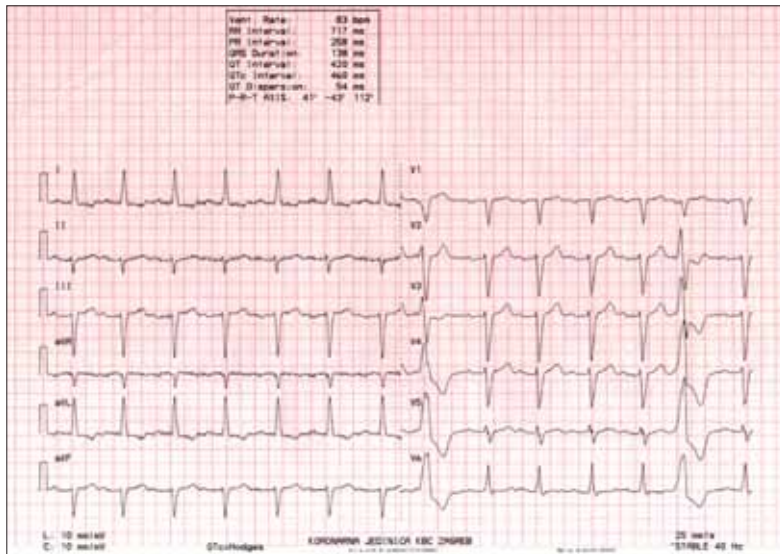


Figure 2. 12-lead ECG of patients in sinus rhythm. There is a PQ prolongation and intraventricular conduction delay resembling incomplete left bundle branch block.

Figure 3. Diascopic image of the initial position of electrophysiology catheters — RAO 30. High right atrium — black arrow, the recording position of bundle of His — red arrow, the tip of the right ventricle — yellow arrow, position of recording of the right branch — blue arrow.

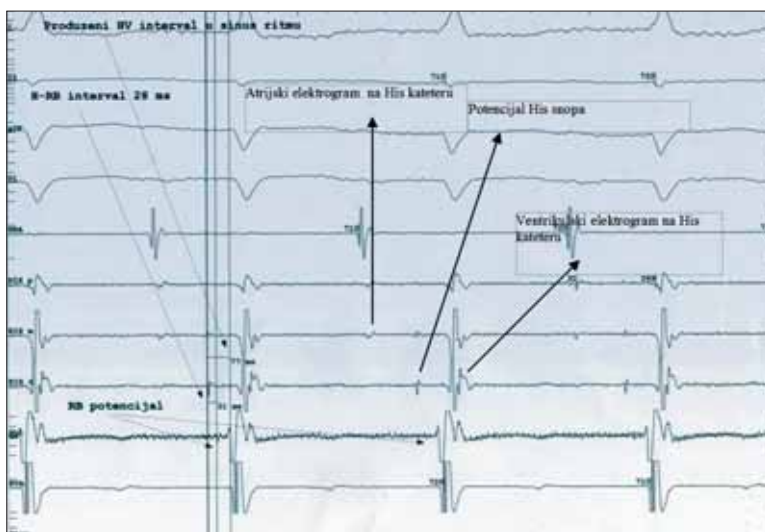
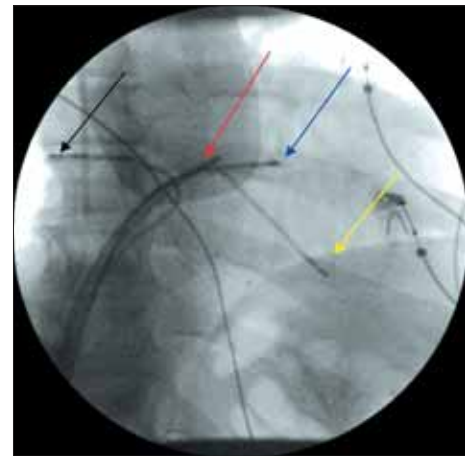


Figure 4. Intracardiac measurements in sinus rhythm. Significantly prolonged HV interval 77 ms (normal up to 55 ms) is visible. The potential of the right branch (RB) can be seen on the ablation catheter — the interval between the His deflection and right branch (H-RB interval) should be longer than 15 ms (28 ms here).

3+1 kateterom (Slika 3). U bazičnim intrakardijalnim zapisima verificirana je HV prolongacija (Slika 4). Uvođenjem katetera u lijevi ventrikul zabilježen je potencijal lijeve grane koji prethodi svakom QRS kompleksu te je tako dokazano da je provodljivost kroz lijevu granu donekle očuvana te da se u slučaju ablacije desne grane neće izazvati totalni AV blok (Slika 5). Nakon toga učinjen je protokol stimulacije desnog ventrikla po Wellensu u svrhu izazivanja kliničke aritmije. Zbog prijašnje ekstenzivne intravenske terapije amiodaronom izazvana je samo kratkotrajna VT sa slikom bloka lijeve grane (Slika 6). U intrakardijalnim elektrogramima jasno se vidi AV disocijacija što potvrđuje dijagnozu VT, a na His-kateteru se nazire da sva-

cards verified the HV prolongation (Figure 4). The introduction of a catheter into the left ventricle recorded the potential of the left branch that precedes each QRS complex and thus it was proved that the conductivity through the left branch was to some extent preserved, and that the case of right bundle branch ablation would not cause total AV block (Figure 5). Following that, the right ventricular stimulation protocol according to Wellens's protocol was performed for the purpose of causing clinical arrhythmia. Because of previous extensive intravenous amiodarone therapy only sustained VT with left bundle branch morphology was induced (Figure 6). Intracardiac electrogram clearly shows AV dissociation which confirms the diagnosis of VT,



Figure 5. Diascopic image of the position of the catheter in the left ventricle (AP) — recording of the potential the left bundle branch — a black arrow, ablation catheter — red arrow.

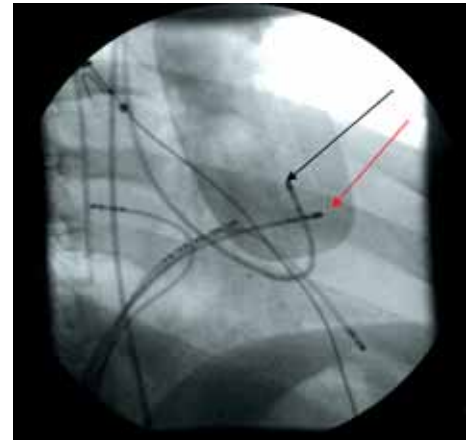
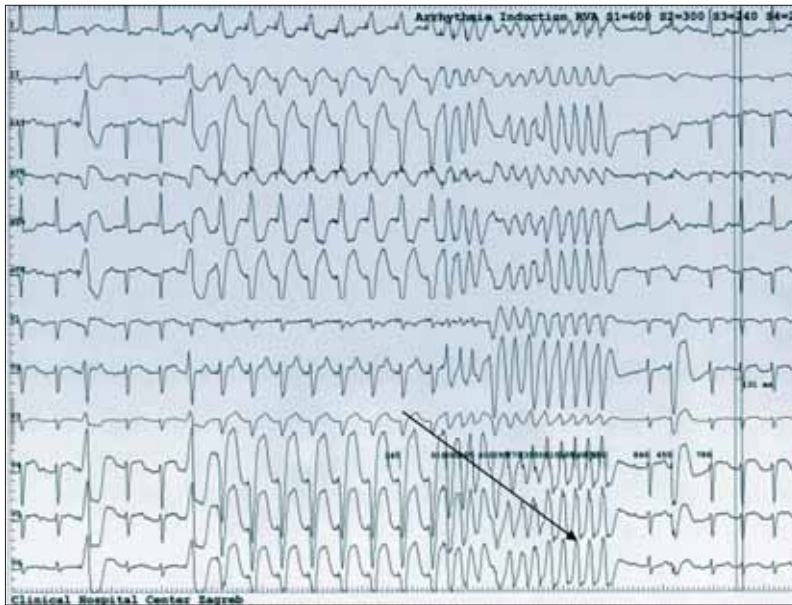


Figure 6. Induction of ventricular tachycardia (VT). After 8 uniform stimulus and 3 extrastimulus, short VT with the left bundle branch block morphology is induced. As the patient received large quantities of amiodarone during the days prior to the study, sustained tachycardia could not be induced by standard stimulation. Recorded electrograms revealed the tachycardia mechanism, which is the reason why we did not apply isoproterenol and insisted on induction of sustained tachycardia.

kom ventrikulskom kompleksu predstoji His elektrogram s još dužim HV intervalom što su glavne značajke BBRVT (**Slika 7**). Ovime smo dokazali da kružni mehanizam tahikardije uključuje Hisov snop i obje grane provodnog sustava te smo pristupili ablaciji desne grane. Već s drugom aplikacijom RF energije postize se trajan blok desne grane (**Slika 8 i 9**). Pozicija ablacijskog katetera vidi se na **Slici 3. i 5.** Komplikacije procedure u smislu totalnog AV bloka nije bilo. Nakon ablacije više nije bilo moguće izazvati ni kratkotrajnu VT, a u daljnjem praćenju nije zabilježeno nikakvih malignih aritmija, čak niti spontanih nsVT koje su bile vrlo česte prije ablacije. S obzirom na ozbiljno kliničko stanje bolesnika smatramo da je transplantacija srca optimalno rješenje za njegovo dugoročnije zbrinjavanje. Kako je pacijent još uvijek u IV. stupnju prema NYHA, a očekivano trajanje života mu je manje od godine dana nije implantiran kardioverter-defibrilator (ICD).

SLUČAJ 2

73-godišnji bolesnik primljen je u bolnicu zbog povraćanja, proljeva, osjećaja slabosti te znakova bubrežne i jetrene lezije. U anamnezi nije bilo značajnijih podataka osim što je dva tjedna pred prijem pri vožnji automobila osjetio tahikardiju. Nakon zaustavljanja i izlaska iz automobila nastupila je sinkopa u trajanju desetak minuta. Nakon toga pet dana nije bilo nikakvih tegoba, a onda počinju navedene gastrointestinalne tegobe. Zbog graničnih vrijednosti troponina učinjena je koronarografija koja je po-

and the His-catheter shows that each ventricular complex is preceded by His electrogram with even longer HV interval which are the main features of BBRVT (**Figure 7**). Hereby, we have shown that a circular mechanism of tachycardia includes bundle of His and the both branches of the conductive system, so we started right bundle branch ablation. Already with the second application of RF energy, permanent right bundle branch block (**Figure 8 and 9**) is achieved. The position of the ablation catheter is seen in **Figure 3 and 5**. There was no complication of the procedure in respect of total AV block. After the ablation it was no longer possible to induce nsVT, and further follow-up did not indicate any malignant arrhythmias, even spontaneous nsVT which were very frequent prior to ablation. Considering the serious clinical condition of the patient, we believe that the heart transplantation is the optimal solution for its long-term management. Since he is still in IV NYHA class, and his life expectancy is less than a year, the patient was not implanted cardioverter-defibrillator (ICD).

CASE 2

73-year-old patient was admitted to hospital because of vomiting, diarrhea, weakness and signs of renal and liver lesions. The patient had no history of any significant symptoms except that 2 weeks ago felt tachycardia while driving the car. After stopping the car and stepping out of the car, there occurred syncope lasting for ten minutes. After

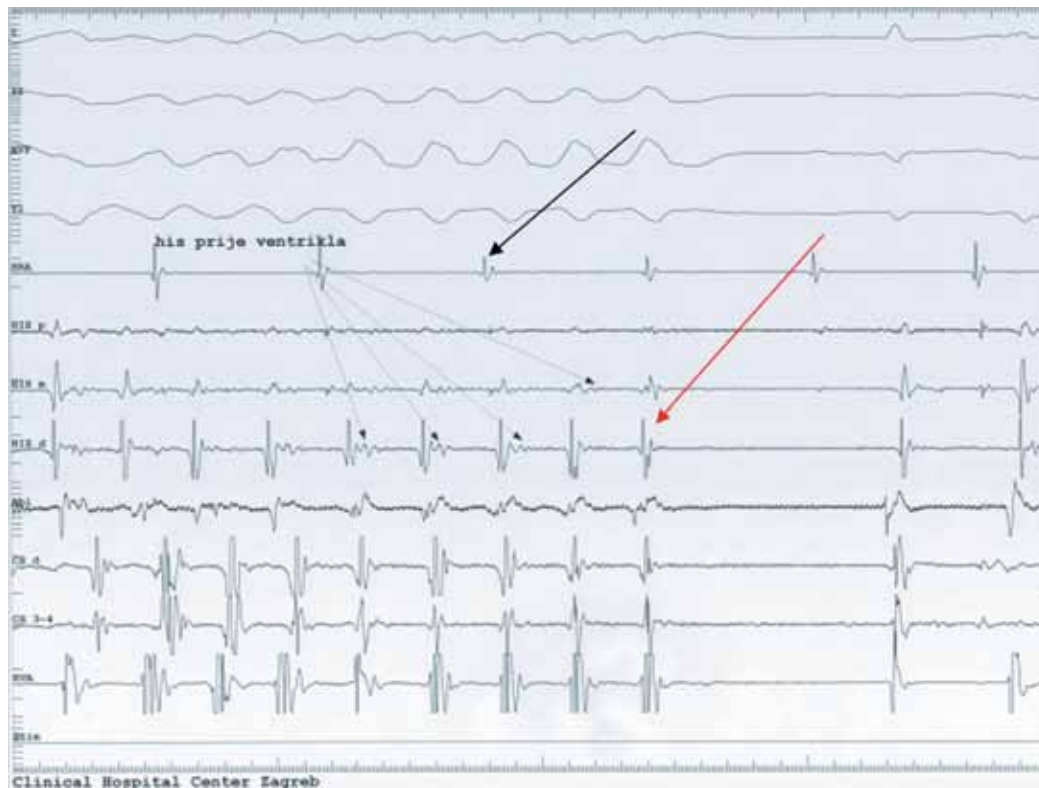


Figure 7. Intracardiac electrograms during the ventricular tachycardia. Clear AV dissociation was shown. Each ventricular electrogram is preceded by His electrogram which verifies the diagnosis of BBRVT (a catheter is not stable, so the His potential is occasionally lost). In addition to that, HV interval is even longer than in sinus rhythm, which is also the characteristic of this tachycardia. Atrial electrograms — black arrow. Ventricular electrograms — red arrow.

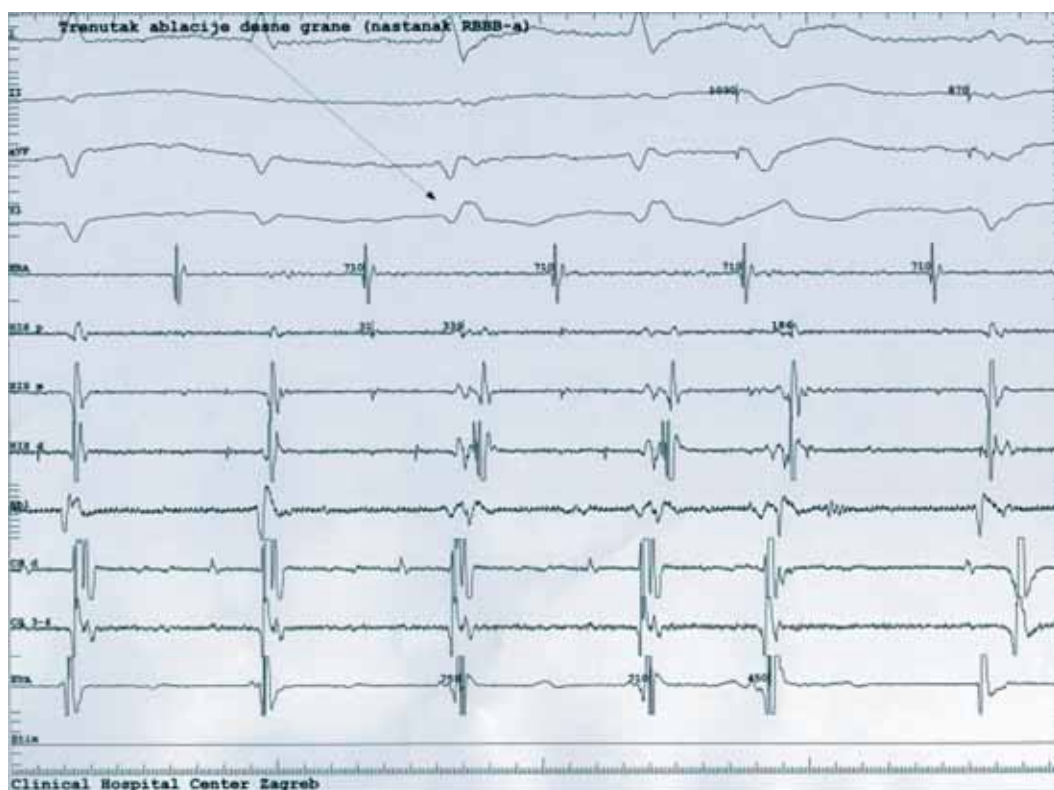


Figure 8. Ablation of the right bundle branch. Permanent right bundle branch block is induced with the second application of RF energy which is clearly seen in the position of V1 lead.

kazala uredan nalaz te UZV srca gdje je uz normalnu funkciju obje klijetke nađena bikuspidna aortna valvula i aneurizma ascendentne aorte. Tijekom obrade hepatorenalne lezije registrirano je nekoliko kraćih i jedna dugotrajna VT koja se u sinus konvertirala amiodaronom. Nakon što su renalna i jetrena funkcija normalizirane (jasni uzrok nije nađen) bolesnik je ponovno premješten u kliniku. EKG je

that, he had no problems for five days only to be followed by gastrointestinal problems. Due to the borderline values of troponine, the patient underwent coronarography, which showed normal findings and echocardiography which besides the normal function of both ventricles showed bicuspid aortic valve and ascending aortic aneurysm. During the treatment of hepatorenal lesion there occurred

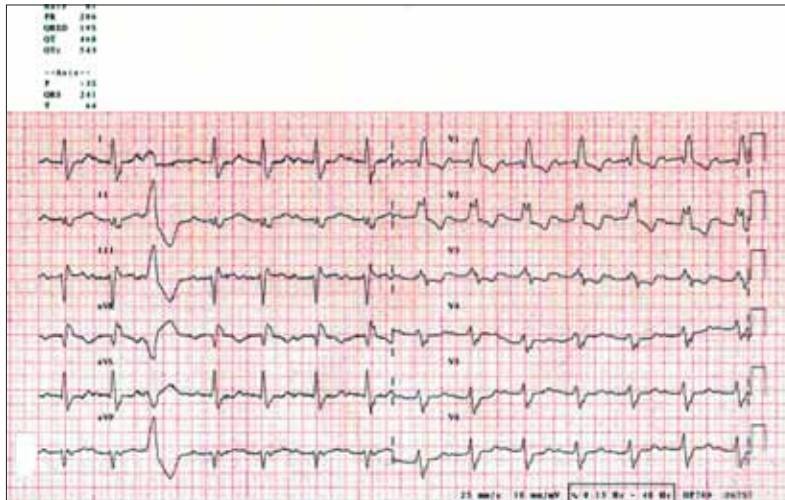
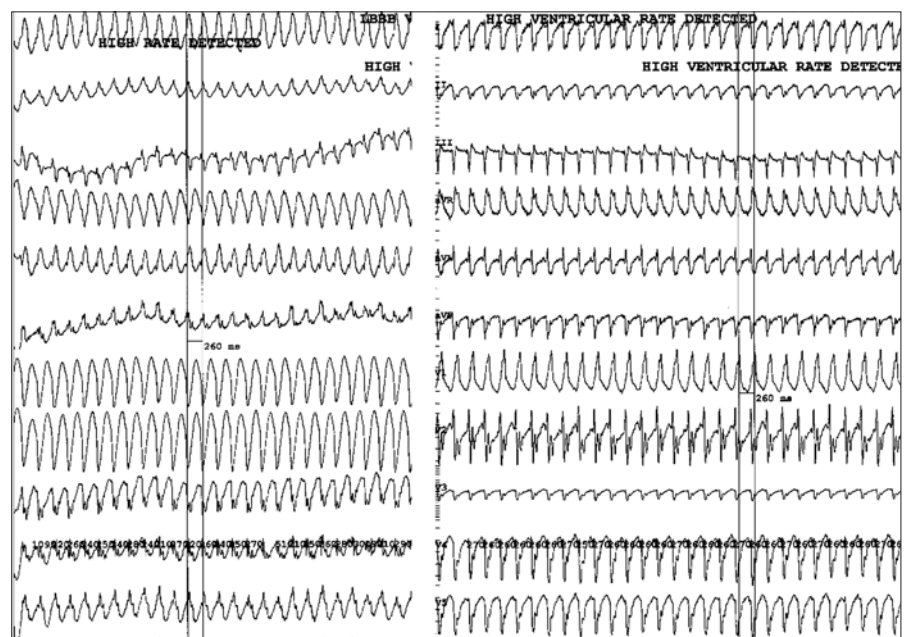


Figure 9. Post-procedural ECG. A clear right bundle branch block with maintained sinus rhythm and PQ prolongation.

pokazao sinusni ritam uz PQ prolongaciju te alterirajući nekompletni i kompletni blok desne grane. U EKG zapisu tijekom aritmije verificirana je tahikardija širokih QRS kompleksa izgleda bloka desne grane i frekvencije 250/min. Elektrofiziološkom studijom s istom konfiguracijom katetera kao u slučaju 1 nađen je produženi HV interval (78 ms). Tahikardija se standardnim protokolom nije uspjela izazvati, ali nakon primjene isoproterenola lako se inducirala VT izgleda bloka lijeve grane i frekvencije 250/min. Tahikardija je konvertirana "overdrive" elektrostimulacijom ventrikla. Tokom manipulacije kateterima radi stabilnije pozicije na Hisovu snopu inducira se ponovno VT potpuno iste frekvencije (250/min), ali ovaj put izgleda bloka desne grane (klinička aritmija) (Slika 10). U nastavku je učinjena potpuna ablacija desne grane (prethodno je kompletni blok desne grane bio intermitentan). Po ablaciji tahikardija se više ni uz primjenu isoproterenola nije mogla izazvati. Za razliku od slučaja 1, ovaj bolesnik nije imao značajnije strukturne bolesti srca, a radilo se o poremećaju provođenja Hisova snopa i dominantno desne gra-

several non-sustained and one sustained VT, which converted to sinus rhythm by amiodarone. After renal and liver function normalized (clear cause was not found) the patient was again transferred to our Clinic. ECG showed sinus rhythm with a PQ prolongation and alternating incomplete and complete right bundle branch block. The ECG during the arrhythmia verified tachycardia of wide QRS complexes with appearance of the right bundle branch block and frequency of 250 bpm. The EP study with the same catheter configuration as in the case 1 showed prolonged HV interval (78 ms). Tachycardia was not induced by standard protocol, but after applying isoproterenol, VT was easily induced with appearance of the left branch block and frequency of 250 bpm. Tachycardia is converted by "overdrive" electrostimulation of ventricle. During manipulation by catheters for the purpose of more stable position on the bundle of His, VT was again induced with exactly the same frequency (250 bpm), but this time with appearance of right bundle branch block (clinical arrhythmia) (Figure 10). A complete ablation of the right bundle branch was performed (previously the complete right bundle branch block

Figure 10. Ventricular tachycardia with the left branch block morphology and ventricular tachycardia with the right bundle branch block morphology with completely same frequency (interval 260 ms).





ne zbog čega je klinička tahikardija imala rjeđi oblik bloka desne grane.

RASPRAVA I ZAKLJUČAK

Mehanizam BBRVT vrlo je zanimljiv jer uključuje normalne provodne srčane strukture (lijevu i desnu granu te Hisov snop). Neophodan preduvjet za nastanak ove tahikardije je poremećaj provođenja Hisova snopa i distalnijih dijelova provodnog sustava, obično lijeve grane (**Slika 2**)^{1,2}. Intrakardijalnim mjerenjima u sinusnom ritmu ovaj poremećaj provodljivosti manifestira se produženim HV intervalom (normala do 55 ms) (**Slika 4**). U manjini slučajeva HV interval je normalan³. Sama tahikardija obično započinje ventrikulskom ekstrasistolom (VES) koja se širi prema obje grane provodnog sustava ventrikula. Ako je VES pravodobno tempirana, zatiče desnu granu refrakternu od zadnje normalne sinusne kontrakcije te je u njoj depolarizacija blokirana (desna grana u odnosu na lijevu obično ima dužu refrakternost). Retrogradni val depolarizacije širi se tako lijevom granom sve do Hisovog snopa. Za to vrijeme desna grana izlazi iz faze refrakternosti što omogućuje da se sada val depolarizacije proširi anterogradno u desni ventrikul. Ako je provođenje bilo dostatno sporo lijeva grana u međuvremenu izlazi iz refrakternosti te dobivamo sve uvjete za potpuni repetitivni kružni mehanizam tahikardije (**Slika 11**) koji u zapisu EKG ima sliku bloka lijeve grane (impuls se anterogradno širi desnom granom) (**Slika 1**). U mnogo rjeđim slučajevima kružni mehanizam obrnutog je smjera te tahikardija ima izgled bloka desne grane (RBBB).

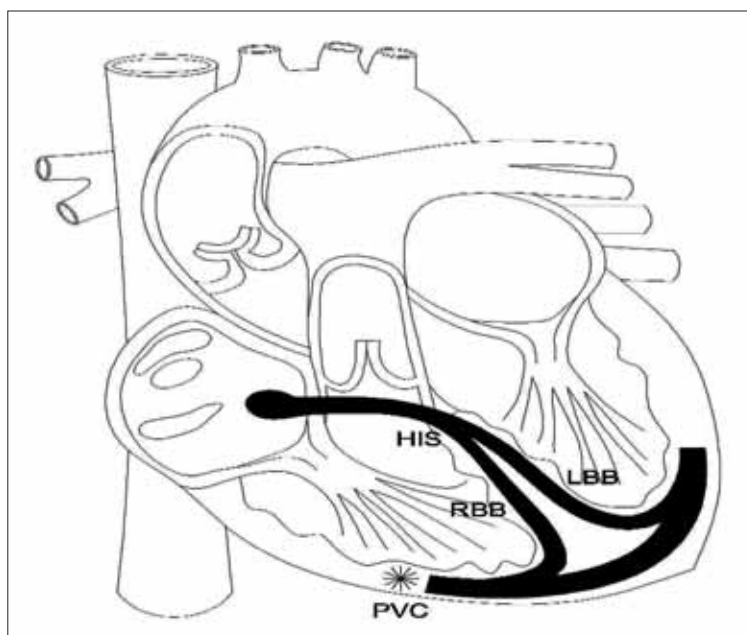
Klinički, radi se o tahikardiji visoke frekvencije (>200/min) koja uglavnom dovodi do hemodinamske ugroženosti, a odatle i do (pre)sinkopalnih epizoda te moguće nagle srčane smrti⁴. Važno je za napomenuti da je ova aritmija refraktorna na standardnu antiaritmijsku terapiju lijekovima. Tahikardija se dominantno nalazi kod bolesnika s dilatativnom kardiomiopatijom (mehanizam VT kod 30% bolesnika), rjeđe kod ishemijske kardiomiopatije, a rijetko i kod bolesnika bez strukturne bolesti srca (bolest samo

was intermittent). Following the ablation, tachycardia could not be caused even by the use of isoproterenol. Unlike the case 1, this patient had no significant structural heart diseases, and it was a disorder of conduction of the bundle of His and dominant right bundle branch which is the reason why the clinical tachycardia had less common form of right bundle branch block.

DISCUSSION AND CONCLUSION

BBRVT mechanism is very interesting because it includes the normal conductive cardiac structures (left and right bundle branch and bundle of His). The necessary precondition for the occurrence of this tachycardia is a disorder of the conduction of the bundle of His and more distal parts of the conductive system, usually of the left bundle branch (**Figure 2**)^{1,2}. By intracardiac measurements in sinus rhythm, this disorder of conduction is manifested by prolonged HV interval (normal up to 55 ms) (**Figure 4**). In a small number of cases, the HV interval was normal³. The tachycardia itself begins with premature ventricular contraction (PVC) that extends to the both branches of the conductive system of the ventricles. If PVC is properly timed, it finds the right branch refractory from the last normal sinus contraction and the depolarization is blocked in it (the right branch compared to the left branch usually has longer refractoriness). Retrograde wave of depolarisation spreads through the left bundle branch up to the bundle of His. During this time, the right bundle branch leaves the phase of refractoriness which now allows for the depolarization wave to expand anterogradely to the right ventricle. If the conduction was sufficiently slow, left bundle branch leaves in the meanwhile the refractoriness and we get all the conditions for complete repetitive circular mechanism of tachycardia (**Figure 11**) that the ECG has the image of the left bundle branch block (the impulse is anterogradely expanded through the right branch) (**Figure 1**). In much rarer cases, the circular mechanism shows the reversal direction, and tachycardia has the appearance of the right bundle branch block.

Figure 11. Tachycardia usually begins with premature ventricular contractions, which is blocked in the right bundle branch (RBB), the depolarization wave travels slowly retrogradely through the left bundle branch (LBB) to the bundle of His. In the meantime, the RBB went out of the refractoriness and the impulse is conducted anterogradely back to ventricle through the RBBB.





provodnog sustava). Stoga ako imamo bolesnika s dilatativnom kardiomiopatijom, nekompletnim ili kompletnim blokom grane pogotovo uz PQ prolongaciju te atakama dugotrajne, brze, hemodinamski nestabilne VT čija je morfologija slična bloku grane u sinusnom ritmu, vjerojatno se radi o bolesniku s BBRVT^{1,5}. Međutim za definitivnu dijagnozu uvijek je potrebno elektrofiziološko (EP) ispitivanje, koje može biti i terapijsko ako se dokaže navedeni mehanizam aritmije.

Nakon što se EP studijom utvrdi mehanizam tahikardije pristupa se radiofrekventnoj (RF) ablaciji jedne od grana provodnog sustava. Uglavnom se pristupa ablaciji desne grane jer je ona lakše dostupna te nosi manje periproceduralnih komplikacija. Stopa uspješnosti ove metode referirana je u studijama čak do 100%, no postoji 10-30% mogućnost indukcije kompletnog AV bloka (preegzistentni kompletni blok lijeve grane) što zahtjeva implantaciju permanentnog elektrostimulatora srca, a prema novim smjernicama za elektrostimulaciju, ugradnju CRT uređaja — ne smijemo zaboraviti da se ova aritmija javlja u bolesnika s teškom simptomatskom kardiomiopatijom. Zbog sveg navedenog, smjernice europskog i američkih kardioloških društava (ESC, ACC, AHA) iz 2006. godine navode da je ablacija terapija izbora za prevenciju nagle srčane smrti u pacijenata s BBRVT⁶.

Iako se nakon ablacije ova VT više ne može izazvati, bolesnici su zbog prirode svoje bolesti i dalje pod značajnim rizikom za razvoj drugih vrsta malignih aritmija. Dakle, ovim bolesnicima ostaje indikacija za implantaciju ICD, kao primarne prevencije nagle srčane smrti prema važećim smjernicama⁷.

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