Second Croatian Symposium of Echocardiography

with international participation

Cardiovascular Ultrasound:
from Imaging to Knowledge in the Practice of Clinical Cardiology

October, 11-13, 2007
Hotel Adriatic, Opatija, Croatia

THALASSOTHERAPIA
OPATIJA
1957.- 2007.

KARDIO LIST

HRVATSKO KARDIOLOŠKO DRUŠTVO

Suppl 2 - God. 2 - 2007.

Uredništvo *Kardio lista* prima sljedeće priloge iz područja kardiologije: kratka znanstvena i stručna priopćenja, osvrte, pisma uredništvu, vijesti, zanimljivosti, najave i izvješća sa skupova. Regularna duljina teksta napisanog prema uputama International Committee of Medical Journal Editors (http://www.icmje.org) je najviše do 3.500 znakova s razmacima. Uredništvo ima pravo kraćenja tekstova. Svi objavljeni članci predstavljaju stavove i mišljenje njihovih autora koji preuzimaju punu odgovornost za sve što je iznešeno u radu, bez obzira na recenziju.

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Official languages
hrvatski engleski

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Location and Date
Congress Centre of the Hotel Adriatic
Opatija
Croatia
11-13 October 2007

Organizer
Thalassotherapia Opatija
Special Hospital for Rehabilitation of the Heart, Lung and Rheumatologic Diseases
Refferal Center for health tourism and medically programmed vacation of the Republic of Croatia
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Croatian Society of Cardiology

Dear Colleagues,

On behalf of the Organizing Committee, it is my great pleasure to welcome you to Opatija and to the Second Croatian Symposium of Echocardiography: Cardiovascular ultrasound – from imaging to knowledge in the practice of Clinical Cardiology.

Our main concentration is on the scientific program. We are giving you a brief glimpse of the scientific program, which will cater to all level of echocardiographer and clinicians.

The Symposium has been designed to provide a comprehensive overview of the latest developments in echocardiography, primarily in the areas of Valvular Heart Diseases, Haemodynamic Heart Evaluation, Echo Techniques and Therapeutic Modalities and Stress Echocardiography in Coronary Artery Disease.

A highly reputed International & National faculty is taking part in this Congress. The various faculty members are master teachers in the field of echocardiography. Papers will be presented in the form of plenary sessions, scientific sessions and posters.

We would like to express our thanks to the pharmaceutical and manufacturing industries for their generous support, to Target Conferences for their excellent arrangements in all aspects, to our colleagues, friends and families for their untiring help, support and advice in planning and arranging this meeting.

We hope that you will enjoy the Symposium and that your interaction with your colleagues from many different countries will stimulate a creative exchange of ideas and will be personally rewarding. We also hope and trust that you will enjoy your visit to the very beautiful and exciting city of Opatija in October 11. 2007.

Yours sincerely,

Viktor Peršić

President of the Organizing Commitee

Scientific program

Echocardiographic Workshop for Beginners

Wednesday, October 10,2007
Thursday, October 11,2007

Thursday, October 11, 2007

15.00 - 18.00 REGISTRATION
18.00 OPENING CEREMONY

Friday, October 12, 2007

09.00 - 10.30 **Plenary session I**
Chairpersons: N. Nanda (Birmingham), I. Sokol (Zagreb), Ž. Mavrić (Rijeka)

09.00 - 09.10 **Wellcome and Announcement**
V. Peršić (Opatija)
D. Miličić (Zagreb)

09.10 - 09.30 **Echocardiography today: State of the Art**
N. Nanda (Birmingham)

09.30 - 09.50 **Echocardiography in Cardiac Resynchronization Therapy: State of the Art and Future Directions**
J. Gorcsan (Pitsburgh)

09.50 - 10.10 **The Role of Echo in the Assessment of LV Filling Pressures**
F.J. Pinto (Lisbon)

10.10 - 10.30 Refreshment Break

Scientific session #1

10.30 - 13.00 **Valvular Heart Diseases**
Chairpersons: F.J. Pinto (Lisbon), V. Peršić (Opatija), J. Vincelj (Zagreb)

10.30 - 10.50 **Comprehensive Evaluation of Aortic Stenosis**
V. Peršić (Opatija)

10.50 - 11.10 **Aortic Regurgitation: Moderate or Severe - How Can I Be Sure?**
J. Gorcsan (Pitsburgh)

11.10 - 11.30 **Prognostic Value of Echocardiography in Assessing Mitral Regurgitation**
F.J. Pinto (Lisbon)

11.30 - 11.50 **Stentless versus Superstentless Aortic Bioprostheses in Terms of Survival Advantage**
I. Sokol (Zagreb)

11.50 - 12.10 **Ehocardiography in Tricuspid Valve Disease**
D. Planinc (Zagreb)

11.50 - 12.10 Refreshment Break

12.30 - 12.50 **Echocardiography in Valvular Endocarditis**
J. Vincelj (Zagreb)

13.00 - 15.00 Lunch

Scientific session #2

15.00 - 16.20 **Left and Right Ventricular Function**
Chairpersons: I.Vlasseros (Athens), V. Nikolić-Heitzler (Zagreb), L. Zaputović (Rijeka)

15.00 - 15.20 **Echocardiographic Assessment of Left Ventricular Long Axis Function**
G. Bajraktari (Prishtina)

15.20 - 15.40 **2D and 3D Transthoracic Echo Diagnosis and Assessment of Left Ventricle - non compaction**
N. Nanda (Birmingham)

15.40 - 16.00 **The Diagnosis of Right Ventricular Failure by Echocardiography**
I. Vlasseros (Athens)

16.00 - 16.20 **Echocardiography in Pulmonary Embolism**
V. Nikolić - Heitzler (Zagreb)

16.20 - 16.40 Refreshment Break

Scientific session #3

16.40 - 17.40 **Stress Echo in ishemic Heart Disease**
Chairpersons: E. Picano (Pisa), D. Planinc (Zagreb), D. Žagar (Rijeka)

16.40 - 17.00 **Stress Echo and Sustainability of Cardiovascular Imaging**
E. Picano (Pisa)

17.00 - 17.20 **Role of Stress Echo in Patient Management**
G. Miličević (Zagreb)

17.20 - 17.40 **ECHO ASSESSMENT OF CARDIAC MASSES**
Cardiac Tumors
D. Žagar (Rijeka)

Saturday, October 13, 2007

08.30 - 09.10 **Plenary sesion II**
Chairpersons: D. Miličić (Zagreb), J. Gorcsan (Pitsburgh), A. Matana (Rijeka)

08.30 - 08.50 **Incremental Value of 3D Echo over 2D Echo/Doppler in the Assessment of Valvular Regurgitation**
N. Nanda (Birmingham)

08.50 - 09.10 **Clinical Uses of Tissue Doppler**
J. Gorcsan (Pitsburgh)

Scientific session #4

09.10 - 10.30 **Aortic Disease and Dissection, Heart Failure**
Chairpersons: D. Miličić (Zagreb), J. Gorcsan (Pitsburgh), A. Matana (Rijeka)

09.10 - 09.30 **Echocardiography in the Assessment of Aortic Dissection**
D. Milićić (Zagreb)

09.30 - 09.50 **Aneurysm of Sinus Valsalva**
A. Matana (Rijeka)

09.50 - 10.10 **Extravascular Lung Water by Chest Sonography in Heart Failure Patients**
E. Picano (Pisa)

10.10 - 10.30 **Echo - Doppler Prognosis in Heart Failure**
J. Gorcsan (Pitsburgh)

10.30 - 10.40 Refreshment Break

Scientific session #5

10.40 - 12.00 **Echo Techniques and Therapeutic Modalities**
Chairpersons: J. Šeparović (Zagreb), J. Mirat (Zagreb), R. Bernat (Krapinske Toplice)

10.40 - 11.00 **Echo Techniques for CRT Patient Selection and Device Optimization**
J. Šeparović (Zagreb)

11.00 - 11.20 **Monitoring of Patients with Implanted Devices**
J. Mirat (Zagreb)

11.20 - 11.40 **Echo-Based Non Invasive Cardiac Angiogenesis Therapy**
I. Vlaseros (Athens)

11.40 - 12.00 **Percutaneous Closure of Patent Foramen Ovale and Atrial Septal Defect - the Role of Transesophageal Echocardiography**
R.Bernat (Krapinske Toplice)

12.00 Lunch
Closing ceremony

Lecture Abstracts

Echocardiography Today: State of the Art

N.C. Nanda
Professor of Medicine and Director, Heart Station/Echocardiography Laboratories, University of Alabama at Birmingham, Birmingham, Alabama USA

Echocardiography has today become the most widely used technique in the noninvasive assessment of cardiac disease entities. It has practically replaced cardiac catheterization in the hemodynamic evaluation of valvar lesions. Reliable assessment of valvar stenosis and regurgitation are routinely done by echocardiographic techniques. Prosthetic valves are also best assessed by echo/Doppler methods. It is also the technique of choice for evaluating intracardiac lesions such as tumors, thrombi and other masses as well as for the detection of infective vegetations on cardiac valves. Aortic disorders such as dissection and aneurysm are also diagnosed by echocardiography although other techniques such as CT scan and magnetic resonance imaging have advantages over echocardiography in some scenarios. Pericardial fluid collections are reliably delineated by echocardiography. Estimation of left ventricular systolic and diastolic function is one of the most common indications of echocardiography in clinical adult practice of cardiology. Tissue Doppler imaging may further help in the assessment of systolic and diastolic function by delineating longitudinal deformation of the ventricular walls and permitting calculation of strain and strain rate. Echocardiography is also a cornerstone for the diagnosis of both pediatric and adult congenital heart conditions. Stress echocardiography, both exercise (immediate post-treadmill or bicycle) and pharmacologic (Dobutamine or Dipyridamole) is also being used extensively in the assessment of coronary artery disease, risk assessment following acute myocardial infarction and myocardial viability. In this context, stress echocardiography provides a stiff competition to radionuclide techniques.Transesophageal echocardiography has proved to be a great boon in the assessment of infective vegetations, cardiac sources of embolism and aortic dissection as well as intraoperative monitoring of cardiac function and assessment of valve repair. The feasibility of examining aortic arch branches and the carotid arteries using upper esophageal and transpharyngeal approaches has also been shown. Some progress has also been made in the direct visualization of coronary arteries and assessment of degree of coronary stenosis using both transthoracic and transesophageal modalities. Using contrast echocardiography it is possible to perform noninvasive left and right ventricular Aangiograms@. More importantly, myocardial perfusion can be assessed in real-time although this technology has not yet been perfected and is not ready for prime time. Substantial progress has been made in the development of three- and four-dimensional echocardiography. The reconstruction time has been markedly reduced and the quality of images considerably improved. The feasibility and clinical utility of real-time three-dimensional transthoracic echocardiography as well as more recently live/real time three-dimensional transesophageal echocardiography have also been demonstrated. Another important advance is the development of small, hand-held echocardiographic machines which can be used for focused examinations and for screening purposes.

The major problem with echocardiography is still the size of the acoustic window. The air filled lungs and bones present an impenetrable barrier to the ultrasound waves and this limits a complete transthoracic evaluation of cardiac structures and the great vessels. This is not a problem with magnetic resonance imaging which has begun to compete with echocardiography in the noninvasive evaluation of cardiac lesions. However, it is much more expensive and the equipment is cumbersome and not portable; these limitations pose a hurdle to the widespread applicability of magnetic resonance imaging. Comprehensive delineation of coronary arteries for assessment of stenotic lesions and reliable assessment of myocardial perfusion both at rest and during stress currently represent the Alast frontiers@ of echocardiography.

Echocardiography in Cardiac Resynchronization Therapy: State of the Art and Future Directions

J.Gorcsan
University of Pittsburgh
Pittsburgh, USA

Cardiac resynchronization therapy (CRT) has made a major impact to the management of patients with severe symptomatic heart failure, wide QRS duration, and depressed left ventricular (LV) ejection fraction. Although the widened QRS is a surrogate for delayed mechanical activation, known as dyssynchrony, echo-Doppler techniques have identified a subset of patients with widened QRS who do not have dyssynchrony and accordingly do not respond to CRT. Many echocardiographic techniques have emerged to quantify regional dyssynchrony, in hopes of improving patient selection and response rate to CRT. Principal routine methods include: M-mode septal to posterior wall motion delay > 130 ms, pulsed Doppler measures of LV ejection in relation to right ventricular ejection, interventricular mechanical delay > 40-45 ms, and diastolic filling time from the mitral inflow velocity as a ratio of cycle length < 40%. The majority of published manuscripts have been on tissue Doppler imaging (TDI) to measure longitudinal velocities from apical windows. Popular methods have been the intraventricular opposing wall delay (septal-lateral wall delay > 65 ms) or 12-site standard deviation (Yu Index > 32 ms) dispersion of time to peak velocities. The color-coded TDI is preferred to pulsed-Doppler TDI because the often-complicated analysis may be done off-line, when the patient is discharged from the echo lab. A new technique of speckle tracking may be applied to the routine black-and-white images to calculate strain, which is independent on Doppler angle of incidence, like TDI. Using speckle-tracking radial strain from mid-LV short-axis imagine, the septal-posterior wall delay > 130 ms was predictive of ejection fraction response following CRT. Other emerging methods are three-dimensional echocardiography that examines the timing of segmental blood displacement, and velocity vector imaging, that determines timing of regional wall motion. The PROSPECT trial is a recent observational multi-center trial that tried to determine which echo-Doppler method of the above would be most predictive. Preliminary results were recently presented at the European Society of Cardiology Meeting and the Heart Failure Society of America Meetings. In the multi-center setting, M-mode had high variability whereas the pulsed Doppler interventricular mechanical delay and filling time/RR had low variability and high yield. The TDI methods had intermediate yield and variability. The results were not as predictive as those published by highly specialized single-center studies. Accordingly, there appears to be a need for training and expertise for TDI approaches that are technically much more complex, in particular. Future clinical trials are underway to determine echo-Doppler selection of patients with narrow QRS < 120 ms. These patients may be potential candidates for CRT, however, we need clinical trials to prove this indication, and currently CRT in narrow QRS patients in not approved. The clinically approved guidelines: NYHA functional class III-IV, QRS > 120 ms, and ejection fraction < 35% are still advocated for patient selection, and these patients should not be denied therapy. This field continues to evolve and further data are needed to precisely define the appropriate role of echocardiographic dyssynchrony information in patient selection for CRT.

Comprehensive Evaluation of Aortic Stenosis

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Special hospital for rehabilitation of heart, lung and rheumatic diseases
Referal center of the Ministry of Health of the Republic of Croatia
Thalassotherapia Opatija

Doppler echocardiography provides accurate hemodynamic information for establishing the diagnosis, assessment and follow-up of patients with aortic stenosis (AS). Echocardiography should focus on: morphologic assessment, determining the severity of stenosis, identifying other valvular or nonvalvular conditions and assessing the left ventricular response to the pressure overload. Before the clinical application of color-doppler imaging echocardiography was limited to providing morphological description of aortic valve by 2D echocardiography which is helpful in identifying the underlying cause of valvular stenosis (bicuspid aortic valve, rheumatic valve disease, degenerative aortic valve). Doppler echocardiography is used to measure peak and mean transvalvular gradients across the aortic valve and to identity associated lesions. Patient with the peak jet velocity ≥ 4.5 m/s had a critical aortic stenosis, and those with a peak jet velocity < 3.0 m/s had mild aortic stenosis. In practice, the mean pressure gradient has an excellent correlation with cardiac catheterization measured mean gradients. Aortic valve area can be calculated by the continuity equation. On the basis of variety of hemodinamic and natural history data we graded the degree of aortic stenosis as severe (area ≤ 1.0 cm2), moderate (area >1.0 to 1.5 cm2) and mild (area > 1, 5 cm2) (1). Color flow imaging helps in determination the direction of the jet of flow and facilitates aligning the continuous-wave Doppler parallel to the direction of velocity jet. Concomitant valvular lesion can be evaluated (mitral regurgitation, aortic insufficiency). Because of enhanced resolution and unobstructed visualization, transesophageal echocardiography (TEE) provides further detail that often is not obvious on transthoracic echocardiography. TEE can be used to measure aortic valve area by planimetry (2). 3D aortic valve planimetry is a novel non-invasive technique, which provides an accurate and reliable quantitative assessment of AS (3). Patients with left ventricular systolic dysfunction and low-flow, low-gradient aortic stenosis represent an especially challenging subset of aortic stenosis patients to manage and determine the appropriateness of aortic valve replacement. Patients with aortic stenosis, LV dysfunction, and relatively low gradients have better outcomes when management decisions are based on the results of dobutamine echocardiograms; those patients identified as having severe aortic stenosis and preserved contractile reserve by dobutamine echocardiography should undergo surgery, while patients identified as having non-severe aortic stenosis can be managed conservatively (4). The authors have described the utility of the dobutamine echocardiography to identify patients most likely to benefit from surgery. (5)

The comprehensive echocardiographic and Doppler hemodynamic evaluation of aortic stenosis is discussed in the presentation.

Aortic Regurgitation – Moderate or Severe, How Can I Be Sure?

J.Gorcsan
University of Pittsburgh
Pittsburgh, USA

Clinical evaluation of aortic regurgitation (AR) is an important task for the echocardiography laboratory. Although color Doppler jet size has historically been used as a rapid estimation for AR severity, other factors may influence the jet area and interfere with the confidence of one's assessment of AR severity. Accordingly, more recent guidelines have advocated focus on the jet origin, to assess the vena contract width and the proximal isovelocity surface area (PISA) method. A vena contracta width of < 0.3 cm is consistent with mild AR, a width > 0.6 cm is consistent with severe AR, and 0.3-0.6 is consistent with moderate degrees of AR. The vena contracta width can be rapid applied, and when done properly have a high supplemental predictive value. The PISA method is more complicated, but has been supported by several papers in the literature. It is important to image from multiple planes to define the regurgitant orifice, which may be difficult in the setting of bicuspid aortic valve. An assessment of aortic root diameter is also important in patients with bicuspid aortic valves, since there is an association of ascending aorta aneurysm and bicuspid aortic valves. Imaging is critically important, since these may be asymptomatic. Other echo-Doppler methods, such as continuous wave Doppler may be used as a supplement, and the deceleration time, described as pressure half-time can indicate severe regurgitation. It should be noted that a steep slope is usually indicative of severe regurgitation in the setting of acute severe AR with rapid equalization of aortic and LV diastolic pressures. Chronic AR may have a flatter slope despite having a large regurgitant volume because of adaptive mechanism of the LV and periphery. A clinically consistent and important measure is pulsed-Doppler in the descending thoracic aorta. This can be done from the supra-sternal notch or subcostal window, and it is important to position the sample volume in the center of the aorta to obtain a good signal. Color Doppler guidance is often helpful. Holodiastolic flow reversal is a consistent sign of moderately-severe or severe AR that is usually an indication for surgery in symptomatic AR. It is important to follow patients carefully with asymptomatic AR to monitor for echo signs of insidious LV dysfunction. Classic signs would be an ejection fraction (EF) < 50% or an left ventricular (LV) end-systolic diameter > 50 mm. These would be criteria to advocate aortic valve surgery in patients who may be otherwise asymptomatic. Accordingly, meticulous attention to EF and LV diameter are important aspects of the evaluation of the patient with AR.

Stentless versus Superstentless Aortic Bioprostheses In Terms Of Survival Advantage

I.Sokol[1], Ž.Sutlić[2], B.Biočina[2], S.Sokol[1]
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Aortic valve replacement (AVR) is definitive intervention in severe aortic stenosis and regurgitation and 15% of cardiac operations belong to AVR. Ten years survival after AVR is 40-70%, average 50% and it is realised by mechanical or bioprosthetic valves. Mechanical prosthetic valves are inherent with thromboembolism, attendant hazzards of permanent anticoagulation therapy and neglibile

structural valve deterioration, but bioprosthetic valves have been developed primarily to overcome the risk of thromboembolism and permanent anticoagulation. Improving their inherent disadvantage of structural deterioration, they should be medical treatment of choice in the therapy of aortic valve disease. First bioprosthetic valves were autografts 1962 (pulmonary and pericardial valve), homografts (donor hearts), and heterografts (porcine valvular or bovine pericardial tissue), with stents 1965 (Hancock, Carpentier-Edwards, Medtronic-Intact), stentless 1987 (Medtronic Freestyle, Prima-Edwards, Toronto SPV) and superstentless 1995 (Shelhigh). The most frequent causes of deaths after AVR only valve related were in 29% cases such as thromboembolism, reoperation, bleeding and prosthetic valve endocarditis. Structural deterioration of bioprosthetic aortic valves is dependent of valvular consistency, its tissue preservation, bioacceptability and internal diameter as determinant of postoperative gradients predicting later hemodynamics. Bioprosthetic stentless and superstentless porcine aortic valves offer several advantages over traditional bioprosthetic valves. Among them are stentless Toronto SPV (TSPV) and Superstentless Shelhigh Valves (SSSV) with superior hemodynamics with laminar flow patterns accompanied with lower gradients, rare and only trivial aortic valve regurgitations, reduction of LV mass and increase of EF. TSPV bioprosthesis requires two sutture lines to be implanted. The first row of sutures is between the LVOT and inflow of the valve and the second between the aortic sinuses and the valve. The subcoronary technic of the implantation is intraannular with aortic root as a stent. The diameter of sinotubular junction during systole is crucial for valve competence and when it exceeds the diameter of aortic annulus by more than 10%, the root is dilated and bioprosthesis should not be used. At the completion of the implantation, the sinotubular junction should not exceed the diameter of the valve. On the contrary, SSSV bioprosthesis require one suture line and no sutures are needed in the vicinity of the coronary arteries. A composite valve mounted on superfexible ring has 3 separate cusps, which allow the best hemodynamic characteristics. The valve implantation is easy with mini or total root replacement with possibility to oversize the valve conduit by one to three sizes. Whether these established hemodynamic benefits can translate into improved survival should be considered in our clinical examination. Echo/Doppler diagnostics at baseline values and follow-up included estimation of peak velocity, peak “instantenous”and mean transvalvular gradients, effective orifice area (EOA) and index (EOAI), valvular structure and function in short and long axis (TTE, TEE), valvular regurgitation with color Doppler, LV systolic and diastolic function, and LV mass index - LVMI (g/m²). Between 1999 and 2007, 41 patients underwent isolated AVR with TSPV and 49 with SSSV bioprostheses with main indication aortic stenosis in more than 80% and aortic regurgitation and mixed aortic valve diseases in other 20%. Mean age was 66 years. Preoperatively bioprosthesis/BSA ratio was normal and LVEF near normal. Two thirds have been male gender and different ranges of stentless and superstentless valves have been used, but mean valve size was for stentless and for superstentless of relative great range of 26.2/24.3mm. Average months after AVR were for TSPV mean 27.1 months and for SSSV 22.4 months. On hospital discharge peak and mean gradients were inherently stenotic and similar for both groups, but on late outcome control significantly decrease of transvalvular gradients in TSPV and slightly less in SSSV group with adequate increase in EOA and EOAI, but without significantly differences between two groups. LV remodeling with reduction of LV mass and increase of EF have been registered in both groups, again without significantly differences. Acturial survival was 94 % during 8 years follow-up. Cardiac deaths were not valve related. TSPV and SSSV bioprostheses offer an aortic valve substitute with excellent postoperative and short-term hemodynamics resulting in significant early LV mass regression. Considering the limitations of this selected elderly population, the clinical outcome and survival up to long-term is encouraging with only a few observed valve-related events. Owing to maintenance of the normal aortic physiology and flexibility of the aortic root, it is felt that these valves could last 15 years and longer. They will probable provide in the future a useful alternative to aortic homografts.

Ehodoplerkardiografija u bolestima trikuspidne valvule

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Anatomski trikuspidna valvula (TV) je najsloženija od 4 srčane valvule: sastoji se od prstena, tri listića (septalni, prednji i stražnji) te tri papilarna mišića. Prednji listić je najveći, korde spajaju svaki listić s jednim ili više papilarnih mišića, a ušće ima oblik trokuta. Metode izbora u evaluaciji TV su dvodimenzijska ehokardiografija, pulzirajući, kontinuirani te obojeni dopler. Bitni su dvodimenzijski prikaz anatomije i dinamike te primjena doplera za mjerenje anterogradnih brzina kroz stenotičku valvulu kao i obojenog doplera za prikaz regurgitacije. Budući da su anatomija i pokreti TV kompleksni, jednodimenzijska ehokardiografija ima malu ulogu u otkrivanju patologije valvule. TV se može prikazati iz više transtorakalnih ehokardiografskih presjeka: parasternalno iz prikaza ulaznog dijela desnog ventrikula vrlo dobro se vide stražnji i prednji listić. U parasternalnoj kratkoj osi i subkostalno dobro se prikazuju septalni i prednji listić, u apikalnoj poziciji 4 šupljine također septalni i prednji listić ali i odnos s mitralnom valvulom.TV se može također dobro prikazati u različitim presjecima transezofagijskom ehokardiografijom, ali općenito njen doprinos razumijevanju patologije trikuspidnog ušća je manji nego mitralnog.

Patologija TV može biti primarna ili sekundarna. Primarni patološki procesi dovode do stenoze i/ili regurgitacije, a sekundarni gotovo isključivo do regurgitacije.

Trikuspidna stenoza je rijetka, obično je uzrokovana reumatskom vrućicom (uvijek je zahvaćena i mitralna valvula), a vrlo rijetko prirođenim abnormalnostima, karcinoidom, Fabrijevom bolešću, tumorom atrija ili same valvule, aneurizmom sinusa Valsalve, oštećenjem elektrodom elektrostimulatora ili opstrikcijom proteze. Listići budu zadebljani posebice na vršcima, ograničenih su pokreta, korde također.Evaluacija trikuspidne stenoze doplerom slična je evaluaciji mitralne stenoze. Stenoza se smatra teškom kada je srednji dijastolički gradijent veći od 7 mmHg, a T1/2 duže od 190ms. Mjerenje površine ušća u dvodimenzijskom prikazu rijetko je moguće.

Za razliku od trikuspidne stenoze, trikuspidna regurgitacija (TR) je vrlo česta i može biti uzrokovana primarnom bolešću valvule ili nastaje sekundarno zbog dilatacije trikuspidnog prstena. Zbog složenog načina zatvaranja minimalna do blaga TR nalazi se obično u ranoj sistoli u oko 50-60% zdravih osoba. Iako nije hemodinamski značajna njena detekcija doplerom omogućuje proračun intrakardijalnih tlakova. Sekundarna (funkcijska) TR značajno je češća; TV je morfološki uredna , ali je prsten dilatiran zbog čega je koaptacija nepotpuna. Razlikovanje primarne valvulne abnormalnosti od sekundarne disfunkcije zbog plućne hipertenzije bitni je korak u evaluaciji bolesnika s bolešću TV. Etiologija primarne TR uključuje reumatsku vrućicu,reumatoidni artritis, miksomatoznu degeneraciju, karcinoidni sindrom, endokarditis, Ebsteinovu anomaliju, endokardnu fibroelastozu i fibrozu, prolaps, traumu i jatrogena štećenja. Sekundarna TR uzrokovana je najčešće plućnom hipertenzijom bilo kojeg uzroka. Ostali uzroci uključuju infarkt desnog ventrikula, ishemijsku disfunkciju papilarnog mišića, kardiomiopatiju i L-D spoj s dilatacijom desnog ventrikula.

Klinički se TR procjenjuje uglavnom kvalitativno kao minimalna (unutar normalnih granica), blaga, umjerena i jaka (teška) regurgitacija. Pomoću obojenog doplera gradira se skalom 1-4+ ovisno o proširenosti sistoličkog protoka u desni atrij, analogno procjeni mitralne regurgitacije. Na tešku TR upućuju slijedeći kriteriji: 1. površina mlaza obojenim doplerom veća od 30% površine desnog atrija, 2. gusti signal kontinuiranim doplerom, 3. dilatacija prstena ≥4cm ili nepotpuna koaptacija kuspisa, 4. konkavna kasnosistolička konfiguracija signala kontinuiranog doplera, 5. brzina utoka krvi ≥1m/s, 6. dilatacija desnog atrija i ventrikula, i 7. sistolički reverzni protok u donju šuplju i hepatalne vene.

Na značajno volumsko opterećenje desnog ventrikula ukazuje dijastoličko izravnjanje interventrikulskog septuma, najjače izraženo na kraju dijastole, vidljivo u kratkoj parasternalnoj osi. Stupanj TR može se također dobro procijeniti primjenom kontrastne ehokardiografije. Općenito, u procjeni TR uvijek je potreban integralni pristup.

Procjena pulmonalnog tlaka bitna je komponenta u ispitivanju bolesnika s bolešću valvula desnog srca. Brzina regurgitirajućeg mlaza kroz određeno ušće u direktnom je odnosu sa smanjenjem tlaka kroz valvulu i stoga se koristi u određivanju intrakardijalnih tlakova Npr. brzina mlaza TR odražava sistoličku razliku tlaka između desnog ventrikula i atrija pa se stoga sistolički tlak u desnom ventrikulu može izračunati dodajući očekivani tlak u atriju. Ako je brzina mlaza TR 4,0 m/sec, gradijent kroz trikuspidno ušće u sistoli je 4 x 4 x 4 = 64 mmHg(modificirana Bernoullijeva jednadžba). Ako je očekivani tlak u desnom atriju 10 mmHg, sistolički tlak u desnom ventrikulu iznosi 74 mmHg. U odsutnosti opstrukcije izlaznog trakta desnog ventrikula sistolički tlak u plućnoj arteriji odgovara sistoličkom tlaku desnog ventrikula. Brzine protoka krvi u izlaznom traktu desne klijetke i u trunkusu arterije pulmonalis moraju se izmjeriti u svih bolesnika s povećanom brzinom trikuspidne regurgitacije kako bi bili sigurni da nema opstrukcije. Dp/dt desne klijetke (pokazetelj kontraktilne funkcije) može se odrediti iz spektra krivulje mlaza TR dobivenoga kontinuiranim doplerom. Za vrijeme izovolumetrijske kontrakcije nema značajnijih promjena tlaka u desnom atriju i stoga promjene brzine TR u tom razdoblju odražavaju dp/dt. Uobičajeno se mjeri vremenski interval između brzina 1 i 2m/sec. na spektru mlaza TR.

Dvodimenzijska ehodoplerkardiografija predstavlja danas referetni standard za patomorfološku i funkcijsku dijagnostiku i evaluaciju trikuspidne valvule odnosno ušća. Posljednih nekoliko godina sve se više, posebice u velikim kardikirurškim centrima, u evaluaciji trikuspidne valvule primjenjuje i 3-D ehokardiografija.

Echocardiography in Valvular Endocarditis

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Clinical presentation of valvular endocarditis is variable and dependent on a combination of intracardiac pathology, evolution of the infection, and possible extra cardiac involvement.

The role of echocardiography in diagnosis of valvular endocarditis continues to evalue as a result of both changes in epidemiology and advances in technology. The valvular endocarditis an important cause of cardiovascular morbidity and mortality and is still a challenging diagnosis. Although risk factors exist for the development of valvular endocarditis between 10% and 60% of patients who develop valvular endocarditis have no history of prior cardiac disease. The important risk factors include congenital heart disease, rheumatic heart disease, mitral valve prolapse, prior cardiac surgery, and intravenous drug abuse. The critical role of echocardiography in this condition is underscored by the fact that the single best prognosis sign in valvular endocarditis is an early diagnosis.

Echocardiography plays several important role in patients with known or suspected valvular endocarditis. It is useful to identify predisposing heart disease, plays a pivotal role in diagnosis, is often used to detect complications, can asses the hemodynamic effects including degree of regurgitation, the size and function of cardiac chambers, and in evaluating the intracardiac and pulmonary pressure, and provide useful prognostic information among patients with valvular endocarditis. Echocardiographic criteria for valvular endocarditis include vegetations, abscesses, valve tissue disruption or destruction, valvular regurgitation, prosthetic valve dehiscence and pericardial effusion. Among these, the hallmark finding is the presence of vegetation. By ehocardiographic criteria, vegetation may be defined as an echogenic, mobile mass usually attached to the valve on the upstream side. It is usually shaggy, irregular and amorphous mass. It displays motion that is independent of the valve and is often described as oscillating. Associated tissue deformity and/or destruction may occur though this often depends on the type of microorganism involved.

Echocardiography has to be performed in all cause

of suspected infective endocarditis. Transthoracic echocardiography (TTE) must be performed first, and has a sensitivity of about 75% for the diagnosis of vegetation. Transesophageal echocardiography (TEE) is mandatory in cases of doubtful transthoracic examination, in prosthetic and pacemaker infective endocarditis, and when abscess is suspected. TEE enhances the sensitivity of TTE to about 90% to 100% for the diagnosis of vegetations, and the additive value of TEE is even more important for the diagnosis of abscesses, and more generally, perivalvular extension, including false aneurysms, perforations, and fistulas. The superiority of TEE was related to the improved image quality in patients with suboptimal transthoracic echocardiograms as well as the improved ability to detect smaller vegetations. Negative echocardiography findings may be observed in about 15% of cases of infective endocarditis. The most frequent explanations for negative echocardiography are very small or absent vegetations and difficulties in identifying vegetations in the presence of prior severe lesions e.g. mitral valve prolapse, degenerative lesions, prosthetic valves.

Echocardiography plays an important role in predicting embolic events. Several echocardiographic findings have been associated with an increased risk of embolism, including the size and mobility of vegetations, the localization of the vegetation on the mitral valve, the increasing or decreasing size of the vegetation under antibiotic treatment, some microorganisms (Staphylococcus aureus, Streptococcus bovis, Candida species), and biological markers. The vegetations longer than 10 mm have a higher risk of embolism, and this risk is particularly high in patients with very large (> 15 mm) and mobile vegetations.

In conclusion, echocardiography plays a key role in the management of valvular endocarditis: for diagnosis, detection of complications, follow up, and prognostic assessment of patients.

Echocardiographic Assessment of Left Ventricular Long Axis Function

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Left ventricular contraction is a complex phenomenon because of the complex arrangement of the myocardial fibers. Sub-endocardial and subepicardial fibers are arranged longitudinally and spirally around the left ventricular cavity, with the epicardial fibers tightening clockwise and the epicardial fibers tightening anti-clockwise. Based on this contraction of the myocardium there are three components of ventricular contraction: radial contraction, longitudinal shortening and rotation. The left ventricle changes its shape by reducing its long axis by 10-12% and its short axis by about 25%. Mitral annular plane systolic excursion (MAPSE) contributes to ventricular ejection and now is widely accepted that a significant reduction in systolic excursion towards the apex correspond to a considerable decrease in systolic function. This decrease has a good correlation with the survival of patients with heart failure. The longitudinal left ventricular systolic function can be quantified more easily by pulsed wave tissue Doppler (PW-TD). Both M-mode and PW-TD have shown that LV longitudinal shortening is dyshomogenous even in normal subjects; is greater displacement and velocities inferiorly and laterally than at septal and anterior level. A reduction in the amplitude of myocardial systolic velocity (Sm) can precede the reduction of LV ejection fraction. Values of Sm <5cm/s indicate severely impaired LV global systolic function. Sm is markedly reduced in dilated and hypertophic cardiomyopathies.

The strain rate imaging (SRI) is the most advanced “off-line” ultrasound tool capable of quantifying regional myocardial velocities and is used for measuring the deformation of a given myocardial wall. SR seems to be less load dependent, and can therefore be considered a stronger index of myocardial contractility.

Two and Three Dimensional Transthoracic Echo Diagnosis and Assessment of Left Ventricular Noncompaction

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Live Three-Dimensional Transthoracic Echocardiographic Assessment of Ventricular Non-Compaction

Bodiwala K et al: Echocardiography 2005;22:611-620

We present eight adult patients with non-compaction (four with isolated left ventricular non-compaction and four with combined left and right ventricular non-compaction) in whom live three-dimensional transthoracic echocardiography (3D TTE) demonstrated multiple, prominent myocardial trabeculations, deep intertrabecular recesses communicating with the ventricular cavity, and a typical honeycombing appearance. In the four patients with combined right and left ventricular non-compaction, very extensive trabeculations in the right ventricle were identified, much more than in normal or hypertrophied right ventricles. Five of the eight patients were not definitively identified to have non-compaction on two-dimensional (2D) TTE, but the diagnosis was made with 3D TTE. These cases demonstrate the potential usefulness of 3D TTE as a supplement to 2D TTE in the assessment of non-compaction.

Comparison of Two- and Three-Dimensional Transthoracic Echocardiography in the Assessment of Trabeculations and Trabecular Mass in Left Ventricular Non-compaction

Rajdev S et al: Echocardiography 2007;24:760-767

Twenty-one patients (mean age 47.5 years, 9 females) with left ventricular non-compaction (LVNC) diagnosed by both two-dimensional transthoracic echocardiography (2DTTE) and live / real time three-dimensional transthoracic echocardiography (3DTTE) were included in the study. Left ventricular (LV) mass was calculated with epicardial and endocardial border tracings first including the LV trabeculations and then excluding them. LV trabecular mass was then derived as the difference between the two measurements. This was done by 2DTTE using the modified biplane Simpson's method and by live / real time 3DTTE using the Tom Tec imaging system. The number of trabeculations arising from each segment of LV walls as well as the segmental distribution of trabeculations was also assessed by both 2DTTE and 3DTTE. The calculated LV trabecular mass by 3DTTE (mean 11.8 + 5.5 grams) was significantly greater than 2DTTE (mean 7.3 + 4.3 grams, $p=0.005$). The total number of trabeculations assessed by 3DTTE (mean 11.2 + 3.3) was also significantly greater than 2DTTE (mean 3.76 + 1.2, $p<0.0001$). The values for inter- and intra-observer variability were lower for 3DTTE than 2DTTE. In conclusion, both LV trabecular mass as well as the total number of trabeculations in patients with LVNC were significantly underestimated by 2DTTE as compared to 3DTTE.

Ehokardiografija u plućnoj emboliji

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Prilikom sumnje na plućnu emboliju ehokardiografija nije metoda izbora. Dijagnostika se temelji na zbiru kliničkih pokazatelja, povećanoj vrijednosti D-dimera u krvi i patološkom nalazu spiralnog CT-a. Ehokardiografija se međutim, preporuča kao metoda stupnjevanja rizika budući da da neki bolesnici koji

su u početku urednih vrijednosti tlaka postupno razvijaju sliku šoka. U jedinicama intenzivnog liječenja radi se svakako o nezaobilaznoj proceduri jer je neinvazivna i dostupna uz krevet bolesnika, a posebice onih koji su hemodinamski nestabilni i nepodobni za transport. Preko 80% bolesnika s plućnom embolijom i šokom ehokardiografski pokazuju znakove dilatacije i disfunkcije desnog ventrikula. Nalaz hipokinezije desnog ventrikula je vrlo nepovoljan prognostički pokazatelj i povezan je s visokom smrtnosti već u ranoj fazi bolesti i kod bolesnika s vrijednostima sistemskog arterijskog tlaka preko 90 mm Hg , te navodi na razmatranje primjene fibrinolitičke terapije ili embolektomije. Plućnu emboliju osim akutne dilatacije desnog ventrikula bez hipertrofije stijenki, hipokinezije do akinezije primarno srednjeg segmenta slobodne stijenke desnog ventrikula, karakteriziraju i paradoksalni pomaci interventrikulskog septuma kao i dopplerski pokazatelji plućne hipertenzije. Za razliku od toga, bolesnici s dijagnozom plućne embolije i urednim vrijednostima sistemskog arterijskog tlaka, ako nemaju ehokardiografske znakove disfunkcije desnog ventrikula u pravilu imaju dobru kratkoročnu prognozu i nemaju indikaciju za fibrinolitičku trapiju.

Role of Stress Echo in Patient Management

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The intention of this presentation is to raise interest on pharmacological stress echocardiography among cardiologist and other clinicians. The technique is time consuming, but it resolves diagnostic doubts on existence and extent of coronary artery disease and doubts related to residual myocardial viability after myocardial infarction, all in a very elegant manner.

Echo Assessment of Cardiac Masses: Primary Cardiac Tumors

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A cardiac mass is defined as an abnormal structure within or immedicitaly adjacent to the heart. There are three types of cardiac masses: tumor, vegetation and thrombus.Primary tumors of the heart are rare, with an incidence of approximately 0, 02 percent. Metastases are the most frequent tumors of the heart. Most primary cardiac tumors are benign the main benign tumor being myxoma (50-75%). The main primary malignant tumor is the angiosarcoma. Symptoms are very variable and can be the result of either local or systemic effects. Presentation may range from cardiac failure to valve obstruction or embolization, arrhythmias and sudden death. Imaging with echocardiography and magnetic resonance plays an important role in diagnosis. Histology is important in determining tumor type. Surgery is successful for benign tumors if resectable. Even benign tumors can result in death if they are large and unresectable. The role of chemotherapy and radiotherapy to be established in cardiac sarcomas and lymphomas bat their role in the treatment of other malignant tumors depends on the tumor type. Surgery combined with chemotherapy and radiotherapy may offer better long-term outcome.

Incremental Value of Three-Dimensional Echo over Two-Dimensional Echo/Doppler in the Assessment of Valvular Regurgitation

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Quantification of Mitral Regurgitation by Live Three-Dimensional Transthoracic Echocardiographic Measurements of Vena Contracta Area

Khanna D et al: Echocardiography 2004;21:737-743

We evaluated 44 consecutive patients who underwent standard two-dimensional (2D) and live three-dimensional (3D) transthoracic echocardiography (TTE), as well as left heart catheterization with left ventriculography. Mitral regurgitant vena contracta area (VCA) was obtained by 3D TTE by systematic and sequential cropping of the acquired 3D TTE data set. Assessment of mitral regurgitation (MR) by ventriculography were compared to measurements of VCA by 3D TTE and to 2D TTE measurements of MR jet area to left atrial area (RJA/LAA), RJA alone, vena contracta width (VCW), and calculated VCA. VCA from 3D TTE closely correlated with angiographic grading (rs=0.88) with very little overlap. VCA of <0.2 cm2 correlated with mild MR, 0.2 – 0.4 cm2 with moderate MR, and >0.4 cm2 with severe MR by angiography. Ventriculographic grading also correlated well with 2D TTE measurements of RJA/LAA (rs=0.79) and RJA alone (rs=0.76) but with more overlap. Assessment of VCW and calculated VCA by 2D TTE agreed least with ventriculography (rs=0.51 and rs=0.55, respectively). Live 3D TTE color Doppler measurements of VCA can be used for quantitative assessment of MR and is comparable to assessment by ventriculography.

Assessment of Aortic Regurgitation by Live Three-Dimensional Transthoracic Echocardiographic Measurements of Vena Contracta Area: Usefulness and Validation

Fang L et al: Echocardiography 2005;22:775-781

In this report, we evaluate 56 consecutive adult patients who underwent standard two-dimensional (2D) and live three-dimensional transthoracic echocardiography (3D TTE), as well as left heart catheterization with aortography (45 patients) or cardiac surgery (11 patients), for evaluation of aortic insufficiency. Similar to the method we previously described for mitral insufficiency, aortic regurgitant vena contracta area (VCA) was obtained by 3D TTE by systematic and sequential cropping of the acquired 3D TTE data set. Assessments of aortic regurgitation by aortography and surgery are compared to measurements of VCA by 3D TTE and to 2D TTE measurements of vena contracta width (VCW). Aortographic or surgical grading correlated well with 2D TTE measurements of VCW (r=0.92), but correlated better with 3D TTE measurements of VCA (r=0.95), with improved dispersion between angiographic grades demonstrated by the 3D TTE technique. Live 3D TTE color Doppler measurements of VCA can be used for accurate assessment of aortic regurgitation and are comparable to assessment by aortography.

Quantification of Tricuspid Regurgitation by Live Three-Dimensional Transthoracic Echocardiographic Measurements of Vena Contracta Area

Velayudhan DE et al 2006;23:793-800

We evaluated tricuspid regurgitation (TR) by multiple echocardiographic techniques in 93 consecutive patients who underwent standard two-dimensional (2D) and live three-dimensional (3D) transthoracic echocardiography (TTE). TR vena contracta (VC) area was obtained by 3D TTE by systematic and sequential cropping of the acquired 3D TTE data set. Assessment of VC area by 3D TTE was compared to 2D TTE measurements of the ratio of TR regurgitant jet area to right atrial area (RJA/RAA), RJA alone, VC width, and calculated VC area. VC area from 3D TTE closely correlated with RJA/RAA and RJA alone as determined from 2D TTE measurements. Live 3D TTE color Doppler measurements of VC area can be used for quantitative assessment of TR and offers incremental value for quantification of particularly severe regurgitant lesions.

Clinical Uses of Tissue Doppler

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Tissue Doppler imaging (TDI) has emerged in routine clinical practice for specific applications. Although the concept of TDI has been introduced over 13 years ago, most applications have focused on research topics. A few specific applications have gained widespread clinical acceptance, and can be translated into daily patient care. The first is the measurement of the mitral annular velocity as a marker of diastolic function as a means to estimate left ventricular (LV) filling pressures. This is applied using pulsed-TDI where the region of interest is usually applied to the lateral mitral annular site using the apical 4-chamber view. This peak mitral annular velocity in early diastole is usually referred to as the E' velocity. The mitral inflow velocity or E velocity is measured from the apical 4-chamber view at the tips of the mitral leaflets. The simple ratio of E/E' is then used as an estimate of LV filling, with E/E' > 10 indicating an abnormally high LV diastolic filling pressure > 15 mmHg. Variations in the E/E' ratio has been used including the septal site, and the average of septal and lateral wall sites. Situations in which the E/E' may not be useful include acute volume depletion, prosthetic mitral valves, mitral stenosis, and constrictive pericarditis. In general, this reproducible non-invasive estimation of LV filling pressures may have an impact of the clinical care of patients in daily practice. The second application is to aide in the differentiation of constrictive pericarditis from restrictive cardiomyopathy. Mitral inflow Doppler data are very useful, with respiratory variation typically observed with constriction and a restrictive pattern, characterized by a short E deceleration time < 150 ms, typically seen in restrictive cardiomyopathy, such as amyloidosis. Hepatic vein patterns with respiratory variation also support constrictive pericarditis. However, these routine Doppler data may be confusing or ambiguous in certain clinical situations. A mitral annular velocity < 8 cm /sec by pulsed TDI is supportive of restrictive cardiomyopathy. A normal mitral annular velocity is usually > 10 cm/sec, and it may be exaggerated further by pericardial constriction. A third application of TDI is in evaluating an athlete prior to competitive athletics. It is potentially dangerous to allow persons with hypertrophic cardiomyopathy to engage in competitive athletics, but trained athletes have structural alterations in their heart that may be thought to represent disease. Accordingly TDI may be useful in differentiating the athletic heart from hypertrophic cardiomyopathy. A pulsed Doppler recording of the athlete's heart is usually > 10 cm/sec, whereas, those with forms of hypertrophic cardiomyopathy have diminished E' velocities, usually < 10 cm/sec. These specific applications of TDI have a favorable impact on patient care.

Aneurizma Sinusa Valsalve

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Aneurizma sinusa Valsalve (ASV) je rijetka anomalija. Čini 0,1-3,5% svih prirođenih anomalija srca i opisuje se u 0,09% obdukcijskih nalaza. To je mobilna filamentozna struktura koja široko komunicira sa sinusom Valsalve. Može biti prirođena i stečena. Prirođena je uzrokovana defektnom aortalnom medijom, što dovodi do odvajanja medije od fibroznoga prstena aorte. Rijetko je prisutna pri rođenju, a tijekom vremena dolazi do progresivne dilatacije oslabljene areje pa se ASV najčešće dijagnosticira u trećoj ili četvrtoj deceniji života. Ruptura prije dvadesete godine je rijetka. Anomalija je 3-4 puta češća u muškaraca. Uzroci stečene ASV su ateroskleroza, sifilis, cistična nekroza medije, endokarditis, trauma toraksa i raniji kirurški zahvat.

Prirođena ASV najčešće zahvaća desni koronarni sinus (65-85%), znatno rjeđe nekoronarni (10-30%) i vrlo rijetko lijevi koronarni sinus (manje od 5% slučajeva). Često je udružena s drugim anomalijama (defekt ventrikularnog septuma, bikuspidalna aortalna valvula, aortalna insuficijencija, pulmonalna stenoza, koarktacija aorte, defekt atrijalnog septuma).

Prirođena ASV obično ostaje godinama klinički nijema. Simptomi se najčešće javljaju zbog rupture u susjedne šupljine s nastankom aorto-kardijalne komunikacije, a rjeđe zbog kompresije susjednih struktura. Pri rupturi u 35% bolesnika postoji iznenadna prekordijalna bol uz dispneju (masivna ruptura), 45% ih ima postupni nastup dispneje s progresijom simptoma, a 20% bolesnika nema tegoba i tek pojava novoga kontinuiranog šuma upućuje na nastale promjene. ASV može rupturirati u sve strukture u susjedstvu korijena aorte, najčešće u desnu klijetku (60-90% slučajeva), znatno rjeđe u desnu pretklijetku (oko 10% slučajeva), a ruptura u šupljine lijevoga srca je još rjeđa. Aneurizma desnoga koronarnog sinusa rupturira u desnu klijetku ili desnu pretklijetku, aneurizma nekoronarnoga sinusa u desnu pretklijetku, a rijetka aneurizma lijevoga koronarnog sinusa u lijevu pretklijetku, lijevu klijetku, interventrikularni septum ili u perikardijalni prostor. Ruptura u šupljine desnoga srca uzrokuje lijevo-desnu komunikaciju, a ruptura u perikardijalni prostor tamponadu srca. Nerupturirana ASV se može utisnuti u izlazni trakt desne klijetke ili u plućnu arteriju i uzrokovati zatajivanje desnoga srca. Zbog kompresije koronarne arterije mogu se javiti anginozne tegobe, a atrio-ventrikularni blok i sinkope zbog kompresije provodnoga sustava. Cerebralne ili periferne embolije uzrokovane mobilizacijom tromba iz ASV su rijetke. Ehokardiografija je osnovna metoda u dijagnostici ASV. Za postavljanje dijagnoze je u većini slučajeva dovoljna transtorakalna pretraga, a preoperativno se (zbog mogućnosti pružanja podrobnijih informacija) obično učini i transezofagealna pretraga. Metoda omogućava postavljanje dijagnoze ASV, procjenu njezinog odnosa sa susjednim strukturama, dokaz rupture i komunikacije sa susjednim šupljinama srca. Također je moguće procijeniti i hemodinamske posljedice rupture (veličina šupljina, kontraktilnost klijetki, brzina protoka na ušćima). Vegetacije infektivnog endokarditisa mogu se naći na rubovima aneurizme ili na stijenci desnoga srca (zbog traumatiziranja mlazom krvi). Premda rijetko, ponekad je moguće uočiti trombotične mase u ASV, koje mogu biti uzrokom cerebralnih ili perifernih embolija. Ehokardiografija također služi i u otkrivanju već spomenutih pridruženih grješaka.

Nerupturirane ASV operiraju se elektivno, a rupturirane zahtijevaju urgentan kirurški zahvat. Pritom je u većini slučajeva potreban bar još jedan zahvat radi korekcije pridruženih anomalija. Postoperativna ehokardiografska kontrola omogućava procjenu učinka operacije i dijagnostiku komplikacija. Stoga je ehokardiografija osnovna tehnika u dijagnostici ASV, njezinih komplikacija i u postoperativnom praćenju.

Echo – Doppler Diagnosis and Prognosis in Heart Failure

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Technological advances in echocardiography have made great contributions to clinical care by improving more objective quantification of global and regional cardiac function. A major impact has been in the care of patients with heart failure. Ejection fraction (EF) remains the most commonly used means to determine overall systolic function, and many clinical trials for both pharmacological and device therapy use EF as a patient selection criterion for therapy. The American Society of Echocardiography recommends tracing end-diastolic and end-systolic frames using Simpson's rule or method of disks for a biplane EF. Digital image acquisition has become of extreme importance to facilitate the calculation of ejection fraction. The use of microbubble contrast agents that opacify the LV can also be used in selected patients with poor image quality. Newer echocardiographic techniques include: Auto EF, which incorporates artificial intelligence learned pattern recognition and a database trained on >10,000 human EF tracings to automatically locate and track the LV endocardium from routine gray scale digital cineloops and calculate EF in 15 sec. Auto EF results favorably compared with manually traced biplane Simpson's rule, visual EF, and magnetic resonance imaging (MRI) in a subset. Measures of right ventricular (RV) function appear to have additive value to LV EF. Patients with severe heart failure who have severe biventricular dysfunction, appear to have a worse prognosis than patients with severe LV dysfunction, but preserved RV function. Routine pulsed-Doppler measures of mitral inflow velocity can be used to identify a restrictive pattern. This is done by measuring from the peak of the inflow E velocity to the zero baseline. A time < 150 ms has been defined as a restrictive pattern, and is indicative of high left atrial pressure and impaired LV diastolic function. Worse prognosis in heart failure has been associated with shorter the deceleration times. Tissue Doppler is a relatively new method for quantitative analysis in heart failure patients. Pulsed-Doppler measures of the mitral annulus have been used to quantify the height of the early diastolic E' velocity and the systolic S wave as well. Diminished systolic and early diastolic velocities have been associated with a poor prognosis in heart failure. These tissue Doppler measures of mitral annular velocity may also be combined with blood test markers of BNP as a noninvasive evaluation of prognosis in heart failure. In summary, a contemporary echo-Doppler evaluation of prognosis in heart failure includes measuring: LV EF, RV function, mitral inflow deceleration time, and tissue Doppler measures of mitral annular S wave and E' waves.

Monitoring of Patients with Implanted Devices

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In Croatia 11 centers were involved in pacemaker implantation. Since modern technology offers a different types of pacing modes and mirrhiad of programmable options, we need various diagnostic tools to help us in good tuning of their functions. Among different diagnostic techniques cardiac echocardiography is of greatest importance. During implantation it can be useful in some settings, but its crucial role is represented by follow-up of these patients. Synchronization and in some rare cases dessinchronization may optimize cardiac function. Different echocardiographic parameters offer findings of crucial importance for decision making among vast programmability options. Physicians involved in monitoring and programming of pacemakers should be familiar with all these echocardiographyc parameters. Pacemaker syndrome is the most common clinical problem caused by improper programmability mode or atrioventricular synchronization. Dual chamber pacemakers are the most often implanted devices nowadays in most developed countries as well as in Croatia. We stress the importance of implementation of all programmable possibilities during the follow up as well as making use of all available echocardiographic parameters for optimal functioning of pacemaker devices.

Echo-Based Non Invasive Cardiac Angiogenesis Therapy

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Management of patients with advanced coronary artery disease (CAD) is a major challenge for the cardiologist and cardiac surgeon. Patients with advanced CAD frequently have limited symptoms with recurrent angina, angina at low work thresholds, breathlessness, and other debilitating conditions. These patients have often been through several “re-do” coronary bypass procedures and multiple percutaneous coronary interventions.

Surgical and interventional options for these patients typically have been exhausted or will result in only partial revascularization. Therefore, therapy remains limited to the use of multiple anti-anginal medications, reduced activity, exertion, and stress level, and significant alteration and limitation of lifestyle.

The field of therapeutic angiogenesis offers hope for these patients. The goal of this emerging approach is to induce therapeutically the growth and development of new vasculature in zones of severe ischemia in the myocardium, with the hope that new capillaries and arterioles generated will connect to remnant existing vasculature. These neovessels are viewed to act as collaterals, perfusing ischemic territories unapproachable by macro procedures such as angioplasty and bypass surgery.

Several strategies are being pursued for therapeutic angiogenesis. Local injection of naked DNA or viral vectors coding for various angiogenic growth factors (eg, VEGF and FGF) have been examined in animals and humans, as have local injections of actual growth factor proteins such as VEGF, FGF, and IGF. In addition, local delivery of endothelial cells and bone marrow-derived precursor stem cells are being studied.

While these approaches will ultimately provide in-

sight into many basic mechanisms involved in myocardial angiogenesis, significant limitations exist with many of these as far as rapid translation into clinically useable therapies in the near term. Another strategy that has been examined for several years now, is that of injury-induced angiogenesis. While not referred to directly in the literature by this term, many studies have emerged over the years using variants of this approach. However, long term effect has not demonstrated.

A new Non-Invasive Cardiac Angiogenesis Therapy (NI-CATh) was developed recently which couples the ability of low intensity shock waves to induce angiogenesis to the therapy of angina and is becoming a new alternative in the treatment of these patients. Reversible ischemic regions, no longer approachable or treatable by exiting invasive methods are being targeted and treated with NI-CATh. Short and long term results have shown the ability of this new therapy to increase local perfusion, reduce symptoms and improve overall quality of life of patients.

The system which realizes this therapy is a cardiac shock wave generator (Medispec, Germantown, USA) modified from lithotripsy to cardiac needs, energy flux density could be adjusted between 0.03 and 0.2 mj/mm2 and focus size was 6 x 6 X 40 mm. The system includes a shock wave generator with the therapeutic head, an external ultrasound system, and an ECG-trigger. Patients are positioned on the device patient table and ECG stickers are placed on the thorax.

The using SPECT data could be identify the ischemic zone to treat with shock waves. This area was localized using ultrasound mainly using parasternal view. The area was marked and the distance from the transducer was measured. When the area was found the therapeutic head of the SW generator was mounted to the transducer. The therapeutic head was fixed at the previous measured distance to ensure that focused shock waves meet the treatment zone. Then, the silicon couching of the therapeutic head was inflated to get the best possible contact to the skin and ultrasound gel was used as an adjunctive.

The SW focus is marked on the ultrasound screen enabling the operator to see the treated zone during the whole treatment. Treatment consisted of 100 impulses, R wave triggered, administered to three different myocardial border zones of the previously identified reversible ischemic zone. The treatment schedule was repeated 3 times in one week and was again repeated after 3 weeks and again after another 3 weeks. Overall 9 single treatment days conclude a complete treatment session with an overall 2700 shocks in the whole treatment. Energy level of 0.09mJ/mm2 was used according to previous animal studies for optimize effect.

To ensure safety of the procedure 3-lead ECG, oxygen saturation, blood pressure and ultrasound are used during the procedure. To test for myocardial tissue damage, Troponine I, CK, and myoglobine levels in patient's serum, is measured before and after each procedure (1 and 6 hours). In addition is included a 12-lead ECG which was recorded before and after the procedure. Holter ECG was performed before and after each treatment. In addition transthoracic echocardiography was performed before and after each procedure, as well as after the 3 months follow-up in order to assess left ventricle function according to the recommendation of the ASE.

To assess the exercise tolerance of the patients, is performed treadmill exercise testing before and at 3 months follow-up after therapy. The diagnosis of ischemia and the criteria for interruption of exercise were established according to the AHA/ACC guidelines.

he results of this therapy proven clinically are the increase of time to angina during exercise test, of exercise tolerance, of AP CCS class, of settle angina questionnaire, of maximal oxygen uptake, of local myocardial contractility and significant SPECT perfusion improvement.

In conclusion the NI-CAth is safe, efficient and feasible. More clinical studies and especially placebo controlled studies are needed to undermine the affectivity of the therapy in patients with myocardial ischemia.

Percutaneous Closure of Patent Foramen Ovale and Atrial Septal Defect – the Role of Transesophageal Echocardiography

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The atrial septal defect (ASD) represents one of the most common forms of congenital heart disease seen in adult population, carrying both the risk of paradoxical embolism and well known chronic hemodynamic consequences of left-to-right shunting. The patent foramen ovale (PFO) and atrial septal aneurysm have been identified as potential causative factors for recurrent cerebrovascular events. The latter is especially true in younger patients with no identifiable cause of a stroke (so-called cryptogenic stroke). PFO closure in treatment of migraine has been associated with reductions in headache frequency, but not complete symptom relief.

The transesophageal echocardiography (TEE) is the method of choice for diagnosis and determining the anatomic properties of both PFO and ASD. It is an essential part of a pre-procedural workup algorithm for establishing the feasibility and planning the percutaneous catheter-based interventional closure (device selection).

Some authors advocate the lack of need for TEE during the closure procedure; however, it is emphasized by others that periprocedural TEE guidance can actually be of essential importance, since it enables precise device placement, demonstrates reduction or disappearance of shunt and helps avoid possible complications, such as interference with neighboring heart structures and device dislodgment.

Both TTE and TEE are an integral part of the follow-up routine after PFO/ASD closure, which enable monitoring of closure success (shunt disappearance) and possible late complications (thrombus formation).

Examples from own series of 12 patients with percutaneous PFO/ASD closure are presented in order to highlight the above points.

Poster Abstracts

KARDIO LIST 2007;2 Suppl 2:27

Influence of the Type and Degree of LVH on the Prevalence of Ventricular Arrhythmias in Patients with Hypertensive Heart Disease

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We investigated the correlation between the type and degree of left ventricular hypertrophy (LVH) and the prevalence of ventricular arrhythmias (VA) in hypertensive patients with LVH.

A total of 192 patients (87 men and 105 women) without coronary disease were divided into three groups according to type of LVH (concentric, eccentric and asymmetric) and three subgroups in relation to the degree of hypertrophy (mild, moderate and severe). In all subjects blood pressure was measured, electrocardiographic and echocardiographic data obtained and the prevalence of VA determined by Holter monitoring and bicycle ergometry.

The most frequent LVH type was the concentric (63%), followed by eccentric (28%) and asymmetric (9%). Severe LVH was found in 10% of patients. Patients with eccentric LVH had a significantly higher left ventricular mass index then those with concentric LVH (p=0.011). Patients with asymmetric LVH presented no significant difference in relation to the concentric and eccentric. Complex VA during Holter monitoring was identified in over 40% of patients. There was no statistically significant difference between groups in frequency of simple (p=0.757) and complex (p=0.657, p=0.819, p=0.617, for polytopic, pairs and ventricular tachycardia, respectively) VA. Increased prevalence of VA was found for the moderate and severe degree in all types. In the concentric type the difference was statistically significant for simple VA (p=0.042). In conclusion, there was no correlation between type of LVH and prevalence of VA. The severity of hypertrophy slightly contributes to a greater prevalence of the same. Asymmetric hypertrophy carries no increased risk.

Imaju li pojedini Oblici Hipertrofije Lijeve Klijetke Utjecaj na Duljinu i Disperziju QT Intervala u hipertenzivnih Bolesnika?

J.Kunišek[1], L.Zaputović[2], M.Žuvić Butorac[3], L.Kunišek[4], K.Lukin-Eškinja[5], R.Karlavaris[5], I.Bruketa-Markić[5]

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Hipertrofična klijetka (LVH) može stvoriti uvjete za produljenje QT intervala i nehomogen oporavak podražljivosti što može povisiti aritmogeni rizik. Pokazano je da povećana QT disperzija može biti povezana s LVH u hipertoničara. Malo podataka je objavljeno u vezi QTc prolongacije i složenih ventrikulskih aritmija u hipertenzivnih bolesnika s LVH. Cilj ovog rada je bio istražiti koji tip i stupanj LVH izaziva najveće produljenje i disperziju QT intervala.

Od rujna 1998. do ožujka 2004. u kardiološkoj ambulanti je pregledano 7647 hipertenzivnih bolesnika. Sumnja na LVH u EKG je postavljena u 1606 bolesnika od kojih su 1414 odmah isključeni iz studije zbog neispunjavanja kriterija. Dijagnoza LVH u preostalih 192 bolesnika potvrđena je ehokardiografski, a nakon isključenja onih s atrijskom fibrilacijom, 158 bolesnika (70 muškaraca 88 žena, u dobi od 43 do 72 godine) je uključeno u studiju. Svi su imali esencijalnu hipertenziju. Svi lijekovi su ukinuti 48 sati prije ergometrijskog testiranja i Holter monitoriranja. Isključeni su bolesnici s drugim bolestima srca i kroničnim bolestima prema strogim kriterijima. Bolesnici su podijeljeni u tri skupine s obzirom na tip LVH: skupinu s koncentričnom (RWT>0.45 i IVS/LVPW<1.3), ekscentričnom (LVIDS>32mm i RWT<0.45) i asimetričnom LVH (IVS/LVPW>1.3). Svaka skupina podijeljena je na podskupine s obzirom na stupanj LVH: blagu (IVS ili LVPW:11-12mm), umjerenu (IVS ili LVPW 13-14mm) i tešku (IVS ili LVPW >15 mm). QT intervali su mjereni s preciznošću od 20 ms u šest odvoda, a zatim je izračunata srednja vrijednost QT intervala i QT disperzija. Normalnom vrijednošću QTc intervala smatrana je duljina do 420 ms za muškarce i do 430 ms za žene, a QT disperzije do 70 ms.

Faktorska analiza varijanci pokazala je prosječni QT i QTc interval pri gornjoj granici normale za cijelu skupinu ispitanika (380.6±47.3 odnosno 425.0±34.4ms). Ni prosječna QT disperzija nije prelazila normalne vrijednosti (34.5±19,1ms). QTc interval i QT disperzija većih su vrijednosti kod teške koncentrične i ekscentrične LVH, ne značajno (u muškaraca se duljina QTc intervala povećava sa stupnjem LVH, p=0.081)). Značajno je bila veća QT disperzija u muškaraca s teškom LVH (p=0.047). Duljina QT intervala značajno je bila veća u kategoriji složenih ventrikulskih aritmija (Lown III-V) nego u kategoriji jednostavnih ventrikulskih aritmija (p=0.037). QTc interval imao je samo istu tendenciju.

Dobiveni rezultati pokazuju tendenciju porasta duljine QT i QTc intervala te QT disperzije proporcionalno s masom LV u muških ispitanika. Odgovarajuće tome rasla je složenost ventrikulskih aritmija. Nije bilo značajne razlike u promatranim parametrima s obzirom na tip LVH.

Coarctation of Aorta

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48-year old male patient comes for internist examination with symptoms of non-regulated hypertension. He was non regularly medically treated for arterial hypertension whose values can be up to 230/120 mmHg. Ten days before examination he was completely asymptomatic. During examination he complains about night – choking and torpidity of the left hand. Examination registered TA 210/80 mmHg, rhythmical heart action with neat heart tones and systolic murmur on aorta and complete precordium with propagation on back where it is heard down whole back.
ECG showed hypertrophy of LV and loading of LV. Markers of heart necrosis were negative. UZ of heart was made because of doubt on dissection of aorta and we found aneurism of ascendent aorta (5 cm in diameter), hypertrophy of LV with preserved global and regional contractility and mild aortal regurgitation.
CT angiography of aorta showed dilatation of ascendent aorta, neat arcus of aorta with coarctation of aorta behind the beginning of arteria subclavia sinister in short segment. Coarctation of aorta was diagnosed and dissection was excluded.
Operation was recommended.

The Influence of Duration Arterial Hypertension on Occurrence Left Ventricular Diastolic Dysfunction

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Arterial hypertension and left ventricular hypertrophy /LVH/ are factors which disturb left ventricular diastolic function. LVH, especially when is very expressed / enormous/, is mayor risk factor and predictor of sudden death because of cardiovascular accidents.
Arterial hypertension weakens relaxation and left ventricular hypertrophy weakens compliance also in all diastolic phases .If duration of hypertension is longer, transformations will be more expressed .They always lead to the left ventricular diastolic dysfunction/DDLV/ .DDLV is defined like left ventricular disturbances of relaxation and compliance with normal EF - over 50%.
Doppler echocardiography enables precise and early DDLV diagnosis.
64 patients with essential hypertension were presented in this study. There were verified 57 patients with LVH from total number of patients. 42 patients have had DDLV. Seven patients didn't have verified LVH. Echocardiographic evaluation was undertaken for all patients.
For DDLV diagnose following parameters were used: isovolumic relaxation time/ IVRT/, peak early filling velocity/ E/, peak atrial filling velocity /A/, E/A ratio, deceleration time / DT/, left ventricular mass /LV mass/.
Conclusions: Patients with LVH and DDLV were older and they had higher LV mass than patients without LVH. /directly correlation/.
Patients with LVH and DDLV had higher systolic blood pressure and significant longer duration of hypertension /8 year/ than patients without DDLV /3 year/.
DDLV, average, was occurring after 5, 5 year of duration of hypertension.
It is necessary to tend, as early as possible, to detect DDLV for all patients with arterial hypertension and prevent it with better medical control of arterial hypertension.This is the right way to respite left ventricular diastolic dysfunction.

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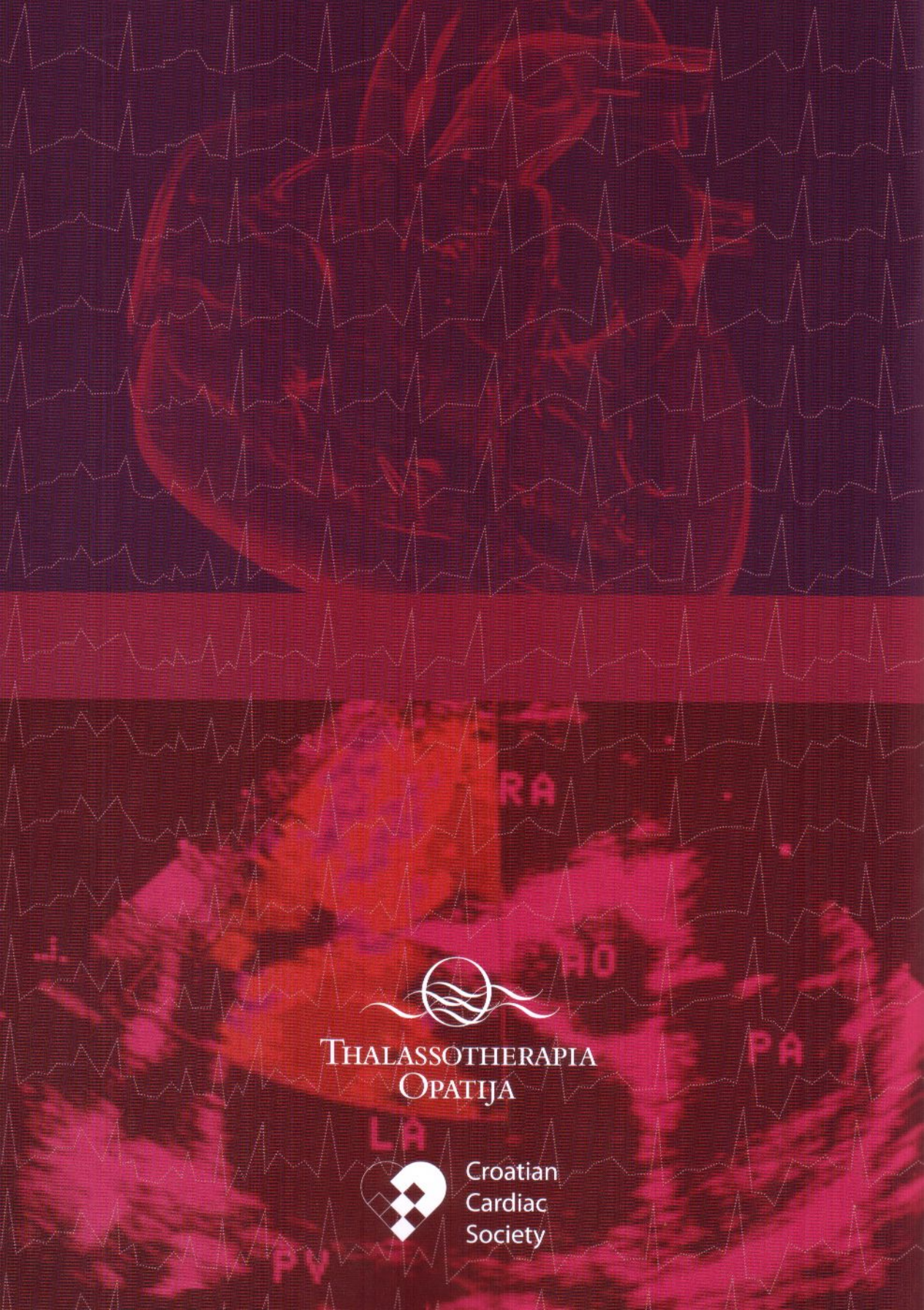
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