INTERNATIONAL CONFERENCE ON PULMONARY CIRCULATION

Prague, Czech Republic, June 2–5, 2010

Abstracts

DOES GENDER AFFECT THE RESULTS OF EXERCISE STRESS ECHOCARDIOGRAPHY FOR THE STUDY OF THE PULMONARY CIRCULATION?

ARGIENTO P[1], MULÈ M[2], CHESLER N[3], D'ALTO M[1], RUSSO MG[1], UNGER P[4], CALABRÓ R[1], BOSSONE E[5], NAEIJE R[4]

[1] *Second University of Naples, Via Leonardo Bianchi, Napoli, Italy,*
[2] *University of Catania, Italy, Catania, Italy,*
[3] *Department of Biomedical Engineering, University of Wisconsin-Madison, Wisconsin-Madison, USA,*
[4] *Free University of Brussels, Brussels, Belgium,*
[5] *University of Milano, Milano, Italy*

Objective: We tested the hypothesis that gender may affect the results of exercise stress Doppler echocardiography for the diagnosis of latent PH.
Methods: The study included 60 healthy subjects, 30 men aged 40.8 ± 14.1 yrs, mean ± SD and 30 women aged 40.1 ± 12.8 yrs. Mean pulmonary pressure (mPpa) was estimated from the maximum velocity of tricuspid regurgitation (TR) and calculated as 0.6 x sPpa + 2 mmHg. Cardiac output (CO) was calculated from the aortic velocity-time integral and cardiac index (CI) from CO/BSA (body surface area). The measurements were performed at baseline, at each level of workload increased by 20 W/2 min. Slopes of multipoint mPpa vs CI were calculated. Individual mPpa-CI relationships were tested for linearity and possible patterns.
Results: Resting CO was lower in women, and estimated pulmonary vascular resistance (PVR, mPpa/CO) accordingly higher. However, no significant differences were found between men and women regarding resting mPpa, CI and slope of multipoint mPpa-CI. Men reached higher maximal workload, mPpa and CI. The multipoint mPpa-CI relationships were best described by a linear approximation with no discernable pattern.
Conclusions: Exercise in men vs women is associated with higher maximal workload, cardiac output and mPpa, but no different incremental PVR corrected for body size. Results of exercise stress echocardiography for the detection of latent PH are gender-independent and best presented as body dimension-corrected multipoint pulmonary vascular pressure-flow relationships.

Variables	Men (N = 30)	Women (N = 30)	*P*-value
Resting mPpa (mmHg)	14.8 ± 3	15 ± 3	p = 0.98
Resting CI (l/min · m²)	2.6 ± 0.4	2.6 ± 0.5	p = 0.49
Resting CO (l/min · m²)	5.2 ± 1	4.4 ± 0.8	p = 0.0005
Maximum workload (watt)	200 ± 57	157 ± 39	p = 0.001
Peak exercise mPpa (mmHg)	36 ± 6	32 ± 8	p = 0.06
Peak exercise CI (l/min · m²)	10.5 ± 2.1	9.5 ± 1.7	p = 0.047
Peak exercise CO (l/min· m²)	16.2 ± 2.9	20.6 ± 3.8	p = 0.00003
Slope of mPpa-CI (mmHg/L/min · m²)	2.8 ± 0.9	2.6 ± 1	p = 0.42

ACUTE HEMODYNAMIC RESPONSE TO ORAL SILDENAFIL IN "OUT OF PROPORTION" PULMONARY HYPERTENSION

BARRIOS GARRIDO-LESTACHE E, GÓMEZ SÁNCHEZ MA, DE LA CRUZ BÉRTOLO J, ALBARRAN GONZALEZ-TREVILLA A, VELAZQUEZ MARTÍN MT, CARMJIMENEZ LOPEZ-GÜARCH C, DELGADO JIMENEZ JF, RUIZ CANO MJ

Hospital 12 de Octubre, Av. Andalucia s/n, Madrid, Spain

Background: The presence of pulmonary hypertension (PH) in patients with chronic heart failure referred for heart transplant (HT) assessment is a relatively common situation. Patients with "out of proportion" PH (mean transpulmonary gradient (TG) > 12 mmHg), exhibits increased morbidity and mortality at time of transplantation. In recent years, an improvement in heart failure treatment and the development of protocols with new vasodilator drugs have allowed the identification of patients in whom the PH stage is still reversible.
Methods: The aim is to include all patients undergoing a pre-transplant heart study with TG > 12 mmHg and who have also undergone systematically acute vasodilator testing with sildenafil. Hemodynamic data were obtained at basal state and then 15, 30 and 45 minutes after administration of 100 mg of oral sildenafil.
Results: We included 39 patients, 36 men, aged 54 ± 10.6 years and with severe left systolic ventricular dysfunction secondary to coronary heart disease and idiopathic dilated cardiomyopathy, all with a stable and optimized medical treatment and a basal TG > 12 mmHg. After 45 minutes, 22 of the 39 patients achieved TG < 12 mmHg. Other values also changed significantly: systolic pulmonary artery pressure from 66 mmHg (56–80) to 50 mmHg (36–59), mean pulmonary arterial pressure from 44 mmHg (37–51) to 29 mmHg (22–37), TG from 19 mmHg (17–22) to 12 mmHg (9–14), pulmonary vascular resistance from 5.5 WU (4.5–6,9) to 2.5 WU (2.1–3.5), venous oxygen saturation from 57.5% (51–66) to 62% (55–71) and cardiac output from 3.6 l/m (2.9–4.6) to 4.3 l/m (3.6–5.3). Sildenafil was well-tolerated, with only a slight tendency to asymptomatic hypotension, facial flushing in 4 patients, and mild headache in 2 patients.
Conclusion: In patients with "out of proportion" PH due to advanced heart failure, acute vasodilator test with sildenafil has proven effective and safety in indentifying patients with pulmonary hypertension still being reversible.

DOES ACUTE VASODILATOR RESPONSE TO SILDENAFIL PREDICT SURVIVAL IN HEART TRANSPLANTS?

BARRIOS GARRIDO-LESTACHE E, GÓMEZ SÁNCHEZ MA, DE LA CRUZ BÉRTOLO J, VELAZQUEZ MARTÍN MT, RENES E, JIMENEZ LOPEZ-GÜARCH C, RUIZ CANO MJ, DELGADO JIMENEZ J

Hospital 12 de Octubre, Av. Andalucía s/n, Madrid, Spain

Background: The presence of pulmonary hypertension (PH) in patients with chronic heart failure referred for heart transplant assessment is a relatively common situation, and has functional, prognostic and therapeutic implications. Following heart transplant, there is an increase in the amount of heart complications and early mortality, due to right ventricle failure.
Methods: The aim is to include all patients undergoing a pre-transplant heart study with PH associated with advanced heart failure and who have also undergone acute vasodilator testing with sildenafil. Out of these patients, only those who undergo transplant with an acute positive vasodilator response will be involved in a follow-up. Following the heart transplants of this patient group, mortality, and morbidity will be compared to those who did not have PH over the same time period.
Results: We included 39 patients with a severe PH due to advanced heart failure who underwent acute vasodilator testing and chronic treatment with sildenafil. Of these 39 patients, 35 could be included on the waiting list for heart transplantation. Out of these 2 died and 28 were transplanted. In its subsequent evolution and compared with the group of transplant patients without prior PH in the same period was observed, there were no significant differences in total mortality (25% vs 17.7%), intra-hospital mortality (10.7% vs 9.7%), extra-hospital mortality (14% vs 8.1%), days of stay in ICU (3–6 d vs 2–6 d), need for vasoactive drugs (1–3 d vs 1–4 d), need for intra-aortic balloon pump (52% vs 62%) or need for hemofiltration (8% vs 4.8%).
Conclusions: A positive response to acute vasodilator testing and after chronic treatment with sildenafil in patients with severe PH due to severe heart failure, allows the inclusion on the waiting list for heart transplantation in a high percentage and it is associated with no differences in terms of morbidity and mortality to cardiac transplant patients in the absence of PH.

PULMONARY ARTERY PRESSURES AFTER HEART TRANSPLANTATION IN PATIENTS WHO WERE TREATED WITH SILDENAFIL

BARRIOS GARRIDO-LESTACHE E, GÓMEZ SÁNCHEZ MA, DE LA CRUZ BÉRTOLO J, ALBARRAN GONZALEZ-TREVILLA A, VELAZQUEZ MARTÍN MT, HERNANDEZ HERNANDEZ F, GARCIA TEJADA J, ESCRIBANO SUBIAS P

Hospital 12 de Octubre, Av. Andalucía s/n, Madrid, Spain

Background: The presence of pulmonary hypertension (PH) in patients with chronic heart failure referred for heart transplant assessment is a relatively common situation, and has functional, prognostic and therapeutic implications. However, in recent years an improvement in heart failure treatment and, above all, the development of protocols with new vasodilator drugs have allowed the identification of patients in whom the PH stage is still reversible. Therefore they can be included from heart transplant waiting lists, since it has been proved that, following transplant, they can reach normal pulmonary pressures.

Methods: Hemodynamic data were collected at 15 days and 1, 3, 6, and 12 months after heart transplantation, in patients with a pre-transplant heart study with PH associated with advanced heart failure with a positive vasodilator response and chronic treatment with sildenafil.

Results: Between September 2001 and April 2009 39 patients were included with severe PH due to advanced heart failure who underwent acute vasodilator testing and chronic treatment with sildenafil. Of these 39 patients, 35 could be included on the waiting list for heart transplantation. Of these 2 died and 28 were listed and transplanted. At 15–30 days of heart transplantation most of hemodynamic values were normal or almost normal, with a systolic pulmonary artery pressure of 40 mmHg (34–46), mean pulmonary arterial pressure of 24 mmHg (20–29), mean transpulmonary gradient 11 mmHg (9–14), pulmonary vascular resistance 2 Wood Units (1.5–2.7), pulmonary capillary wedge pressures of 13 mmHg (10–15) and cardiac output of 5.5 l/min (4,6–5.8). There was no significant change in measurements during the follow-up period.

Conclusions: A positive response to acute vasodilator testing and after chronic treatment with sildenafil in patients with severe PH due to severe heart failure predicts that, following transplant, they can reach normal pulmonary pressures.

CARDIAC AUTONOMIC DYSFUNCTION IS ASSOCIATED WITH PULMONARY HYPERTENSION IN SYSTEMIC SCLEROSIS

BIENIAS P[1], CIURZYŃSKI M[1], GLIŃSKA-WIELOCHOWSKA M[2], IRZYK K[1], KORCZAK D[1], KALIŃSKA-BIENIAS A[2], GLIŃSKI W[2], PRUSZCZYK P[1]

[1] Department of Internal Medicine and Cardiology, The Medical University of Warsaw, Lindleya Street 4, Warsaw, Poland,
[2]Department of Dermatology, The Medical University of Warsaw, Koszykowa 82A, Warsaw, Poland

Background: Pulmonary hypertension (PH) and cardiac autonomic nervous system (cANS) dysfunction may occur in systemic sclerosis (SSc). Heart rate turbulence (HRT) is a biphasic reaction of the sinus node to ventricular extrasystole and reflects cANS function and baroreflex sensitivity. In post-myocardial infarction patients HRT impairment is one of the strongest electrocardiographic risk predictor of a subsequent death. The aim of the study was to identify the most significant factors influencing HRT in SSc.

Methods: Out of 68 consecutive SSc patients, 45 subjects (40 women) aged 54.6 ± 14.7 yrs were examined (mean disease duration 11.4 yrs). Control group consisted of 30 healthy subjects. After clinical evaluation, echocardiography and serum NT-proBNP measure, 24-h Holter monitoring for HRT was performed.

Results: Abnormal HRT, e.g. turbulence onset (TO) ≥ 0.0% and/or turbulence slope (TS) ≤ 2.5 ms/RR was found in 42% patients and in no member of controls. PH was diagnosed when tricuspid regurgitation pressure gradient (TRPG) was > 31 mmHg. HRT was abnormal in 78% of 9 patients with SSc and PH while in only 33% of 36 patients without PH ($p = 0.02$). The significant correlation between TRPG and TO ($r = 0.364$, $p = 0.02$) was revealed. Serum NT-proBNP exceeded the reference value in 62% of SSc patients. The mean serum NT-proBNP concentration in SSc patients with abnormal HRT was 287 ± 224 pg/ml, while in patients with normal values of TO and TS was 167 ± 114, $p = 0.04$. Univariate analysis revealed that older age, supraventricular arrhythmias, and PH influenced abnormal HRT occurrence. In multivariate analysis, abnormal HRT was associated with older age (OR 1.8, 1.1–3.5, $p = 0.03$) and PH (OR 6.1, 1.1–48.6, $p = 0.049$) only. PH significantly predicted TO increase both in univariate and multivariate analysis.

Conclusions: Patients with SSc are characterized by significant impairment of HRT indicating cANS dysfunction. Older age, and especially PH in SSc are independent predictors of HRT impairment.

THREE-MONTH FOLLOW-UP IN PATIENTS WITH HEMODYNAMIC STABLE ACUTE PULMONARY EMBOLISM WITH SYNCOPE AS THE PRESENTING SYMPTOM

BŁASZCZYK D[1], LEWCZUK J[2], KONIECZNY A[3], ROMASZKIEWICZ R[1], NOWAK M[1], PISZKO P[1]

[1] Dpt of Cardiology, Regional Specialist Hospital, Research and Development Centre, Kamieńskiego 73a, Wrocław, Poland,
[2] Medical University, Wrocław, Pasteura 1, Wrocław, Poland,
[3] Dpt of Nephrology Regional Specialist Hospital, Research and Development Centre, Kamieńskiego 73a, Wrocław, Poland

Background: Syncope (S) occurs in approximately 10% patients with acute pulmonary embolism (APE) and is commonly ascribed to the massive, hemodynamic instable APE.

The aim of the study: 1) To assess the occurrence of S in 50 consecutive patients (30 females, 20 males; aging from 31–88 years, mean age of 70 years) with hemodynamic stable APE in whom other reasons for S could be excluded and 2) to assess potential impact of S on 3-month clinical course of the disease.

Results: We found S in 11 (22%) of patients. Patients with APE-S, compared to patients with APE without S were older (78.5 vs. 68.2 yrs, $p < 0,05$), however, both groups did not statistically differ with baseline vital signs, angiographic, hemodynamic, echocardiographic parameters or with results of gaseometry, BNP, D-dimer and CRP. After starting anticoagulation all patients survived and no APE recurrences were found. There were alsono differences in echocardiographic and laboratory parameters between APE-S and APE without S groups after 3-month follow-up.

Conclusions: It is concluded, that S signals hemodynamic stable APE more frequently than is quoted. APE-S patients could not be clearly discriminated from APE patients without S on the basis of the parameters studied and S did not impact a 3-month course of hemodynamic stable APE.

SUPEROXIDE-NO INTERACTION PLAYS IMPORTANT ROLE IN THE DEVELOPMENT OF HYPOXIC PULMONARY HYPERTENSION

CHOVANEC M[1], HERGET J[1]

[1] Department of Physiology, 2nd Medical School, Charles University; Cardiovascular Research Centre, Plzenska 130/221, Prague, Czech Republic
[2] Department of Cardiology, Na Homolce Hospital, Roentgenova 2, Prague, Czech Republic

Chronic hypoxia-induced production of superoxide and nitric oxide (NO) plays important role at the onset of pulmonary hypertension (HPH). We tested whether superoxide dismutase mimetic Tempol (dose 80 mg · kg^{-1} per day in drinking water) and hypercapnia ($F_{iO2} = 0.045$) by its antioxidant activity influence the development of HPH.

In the first experiment, rats were exposed to normobaric hypoxia ($F_{iO2} = 0.1$) for 3 weeks and treated with Tempol (group TH) for first week of exposure or exposed to hypoxia with hypercapnia (group H^+ CO_2) for 3 weeks had significantly lower PAP (29.8, $p < 0.05$; 22.9, $p < 0.01$; respectively) compared to hypoxic controls (39.0 mmHg).

In the second experiment, rats were exposed to hypoxia for 4 days and treated (by Tempol or hypercapnia) for whole period of hypoxic exposure ($F_{iO2} = 0.1$). Then we measured the exhaled amount of NO in awake rats and the plasma concentration of NOx by the chemiluminescent method. The amount of exhaled NO was significantly decreased in group H^+ CO_2 (689.3 pg · min^{-1}, $p < 0.05$) but not in group TH (856.1 pg · min^{-1}) compared to hypoxic controls (905.8 pg · min^{-1}). The concentration of NO_x in plasma was significantly decreased in group H^+ CO_2 (57.4 μM, $p < 0.01$) but not in group TH (139.8 μM) compared to hypoxic controls (97.2 μM).

Tempol and hypercapnia applied at the beginning of hypoxic exposure prevent partially the development of HPH. Hypercapnia but not Tempol does influence the NO production.

Supported by Cardiovascular Research Centre MSMT 1M 0510, Grants: GACR 305/05/0672 and GAUK 78007.

EXERCISE DOPPLER ECHOCARDIOGRAPHY IDENTIFIES PRECLINIC PULMONARY HYPERTENSION IN SYSTEMIC SCLEROSIS

CIURZYŃSKI M[1], BIENIAS P[1], IRZYK K[1], RYMARCZYK Z[1], KOSTRUBIEC M[1], LICHODZIEJEWSKA B[1], GLIŃSKA-WIELOCHOWSKA M[2], SZEWCZYK A[2], KURZYNA M[3], PRUSZCZYK P[1]

[1] Dept. of Internal Medicine and Cardiology, Medical University of Warsaw, Lindleya 4, Warsaw, Poland,
[2] Dept. of Dermatology, Medical University of Warsaw, Lindleya 4, Warsaw, Poland,
[3] Dept. of Chest Medicine, National Institute of Tuberculosis and Lung Diseases, Płocka, Warsaw, Poland

Background: Pulmonary hypertension (PH) is a common cause of scleroderma (SSc) related deaths. Right-heart catheterization (RHC) is a diagnostic standard, while application of echo Doppler (TTE) and exercise Doppler echocardiography (EDE) in the identification of PH are still uncertain. We tried to assess if EDE could be useful for identifying PH in SSs pts.
Methods: This study involved 67 pts (64 F, 3 M, mean age 56.9 ± 17.1) with SSc. TTE followed by EDE were performed. The EDE protocol included the standard treadmill Bruce exercise with measurement of the tricuspid regurgitation peak gradient (TRPG) within one minute after the exercise. A positive exercise test was defined as an increase by at least 20 mmHg in the TRPG. An RHC with exercise was performed in patients echocardiographically suspected PH (resting TRPG > 31 mmHg and/or a positive EDE)
Results: At rest TRPG was detected in 65 (97%) of pts. The mean resting TRPG was 26.9 ± 7.6 mmHg. Resting TRPG > 31 mmHg was detected in 14 (21%) SSc pts. Mean TRPG increase during exercise was 12.9 ± 8.5 mmHg, with mean peak TRPG of 39.8 ± 14.1 mmHg. TRPG increase > 20 mmHg was recorded in 11 (16%), and was observed not only in subjects with resting TRPG > 31 mmHg (4 pts), but also in 7 of SSc pts with normal resting TRPG. SSc pts with echo suspected PH (21 pts) were referred to an RHC. Finally, RHC was done in 16 (25%) of pts (4 pts refused this procedure, 1 died during the waiting period). Out of 16 pts in whom RHC was carried out 4 (25%) were qualified due to positive EDE. In all 16 catheterized pts PH was confirmed. However, only in 4 subjects PAH was diagnosed (2 patients resting PAH, 2 pts exercise PAH). In the remaining 12 subjects venous origin of PH was found (1 pts resting venous PH, 11 pts exercise venous PH).
Conclusions: Exercise-induced PH is a common finding in SSc patients. An EDE is a useful test for detecting this condition. However, such patients require further diagnostic evaluation in order to differentiate its mechanisms.

ACCURACY OF ECHOCARDIOGRAPHY IN THE HEMODYNAMIC ASSESSMENT OF PH IN PATIENTS WITH SYSTEMIC SCLEROSIS

CIURZYŃSKI M[1], BIENIAS P[1], IRZYK K[1], RYMARCZYK Z[1], KOSTRUBIEC M[1], LICHODZIEJEWSKA B[1], GLIŃSKA-WIELOCHOWSKA M[2], SZEWCZYK A[2], KURZYNA M[3], PRUSZCZYK P[1]

[1] Dept. of Internal Medicine and Cardiology, Medical University of Warsaw, Lindleya 4, Warsaw, Poland,
[2] Dept. of Dermatology, Medical University of Warsaw, Lindleya 4, Warsaw, Poland,
[3] Dept. of Chest Medicine, National Institute of Tuberculosis and Lung Diseases, Płocka, Warsaw, Poland

Background: Pulmonary hypertension (PH) is a complication in patients with systemic sclerosis (SSc) and echocardiography (TTE) is a screening tool for its detection. We compared non-invasive Doppler assessment of pulmonary hemodynamic at rest and exercise with data obtained from right-heart catheterization (RHC).
Methods: This study involved 67 pts (64 F, 3 M, mean age 56.9 ± 17.1) with SSc. TTE followed by exercise Doppler-echocardiography (EDE) were performed. The EDE protocol included the standard treadmill Bruce exercise with measurement of the tricuspid regurgitation peak gradient (TRPG) within one minute after the exercise. A positive exercise test was defined as TRPG increase of at least 20 mmHg. An RHC with exercise was performed in patients with echocardiographically suspected PH (resting TRPG > 31 mmHg and/or a positive EDE). The pulmonary artery systolic pressure (PASP) was calculated according to the modified Bernoulli equation and the estimated RAP: PASp = TRPG + RAP. Mean PAP was derived according the formula: mPAp = 0.61 · PASP + 2 mmHg. The PVR in Wood units (WU) was calculated using the equation: $10 \cdot TRV/TVI_{RVOT}$.

Results:

Parameter	Echocardiography Mean value ± SD	Catheterization Mean value ± SD	Correlation 95% CI, P	Bland-Altman analysis Mean difference ± SD [median (range)]
sPAP, mmHg	39.3 ± 6.7	33.1 ± 6.7	0.57 (0.10–0.83) p = 0.02	−5.31 ± 5.42 [−5.5 (−16.0–8.0)]
mPAP, mmHg	25.7 ± 3.9	21.2 ± 4.3	0.69 (0.30–0.89) p = 0.005	−4.06 ± 13.13 [−5.00 (−8.00–3.00)]
Ex sPAP, mmHg	59.2 ± 8.8	61.5 ± 20.2	0.62 (0.18–0.85) p = 0.01	1.63 ± 16.15 [0.00 (−22.00–50.00)]
Ex mPAP, mmHg	37.9 ± 5.5	44.2 ± 13.8	0.60 (0.15–0.84) p = 0.01	5.63 ±11.38 [4.00 (−8.00–41.00)]
PVR, WU	1.58 ± 0.27	2.02 ± 0.99	0.45 (−0.06–0.77) p = 0.08	0.42 ± 0.88 [0.15 (−0.50–2.70)]

Conclusions: TTE and EDE may provide a reliable, non-invasive method to determine resting and exercise systolic and mean PAP in SSc pts although it may frequently be inaccurate in estimating PVR.

SEVERE HYPOXIA IN EISENMENGER'S SYNDROME DOES NOT PRECLUDE SAFE PERFORMANCE OF THE SIX-MINUTE WALK TEST

DAVIS R, HALL K, SEALE H, HARRIS J, RADFORD D, KERMEEN F

The Prince Charles Hospital, Rode Road, Brisbane, Australia

Background: Guidelines for the performance of six-minute walk tests (6MWT) list oxygen saturations ≤ 88% as a contraindication. Patients with Eisenmenger' syndrome (ES) experience significant hypoxia at rest and are considered high risk for assessment of exercise capacity. **Aim:** To report the safety and outcome of 6MWT in ES cohort prescribed specific pulmonary arterial hypertension (PAH) therapies.
Methods: Retrospective review of all 6MWT on ES patients referred to a tertiary PAH referral centre from 2003 to 2009. 6MWTs were performed by experienced physiotherapists on a 30 meter circuit with continuous oximetry and heart rate (HR) monitoring. Adverse events were defined as per ATS guidelines, with syncope or pre-syncopal episodes also recorded. Outcome measures of six-minute walk distance (6MWD), resting saturation (SpO_2), nadir exercise-induced desaturation (EID) and heart rate (HR) response to 6MWT were analyzed. Data was analyzed using descriptive statistics and non-parametric tests.
Results: Fifty three patients with ES (33 females, 14 Trisomy 21) of mean age 34 ± 12 years and mean duration of PAH therapy 15 ± 13 months had 300 6MWTs performed. Prior to beginning PAH therapy, 3 patients were NYHA-Functional Class II, n = 40 class III and n = 11 class IV with a mean 6 MWD of 345 ± 131 m. Baseline SpO_2 was 85 ± 8% with EID decreasing to 66 ± 15%. Thirteen minor adverse events (8 cardiac related symptoms, 4 pre-syncope, 1 leg pain) were identified (incidence 4.3%) with a lower EID a significant predictor to an adverse event during a 6MWT (p = 0.049). 6 MWD, functional class, Trisomy 21, and abnormal HR response to exercise were not related to reported adverse events.
Conclusion: The prescription of PAH specific therapy mandates some assessment of exercise capacity of the patient. 6MWT may be performed safely in ES despite the presence of severe hypoxia.

ROUTINE DESCRIPTION OF CT PULMONARY ANGIOGRAPHY IN PATIENTS WITH PULMONARY EMBOLISM DOES NOT CONTRIBUTE TO RISK STRATIFICATION

DYTRYCH V, KAVAN J, MASEK M, BELOHLAVEK J, KRAL A, LINHART A

II[nd] Dept. of Cardiology and Angiology, General Teaching Hospital, U Nemocnice 2, Prague, Czech Republic

Background: To analyze the role of current routine CT pulmonary angiography reports in risk stratification of pulmonary embolism (PE).
Methods: A retrospective observational study of all consecutive patients with verified PE, admitted to our department from January 2003 to October 2008 was performed. A total of 209 PE patients were identified. Eighty-two of these subjects underwent CT scans at our institution within 24 hours after admission, and these patients were included in the study.

Original pulmonary artery clot burden descriptions were reevaluated independently by two board-certified radiologists blinded to the clinical history. We analyzed agreement between the radiologists' observations using Kappa test and correlation between the clot burden and clinical severity of PE with Kruskal-Wallis ANOVA test.

Results: The overall observed agreement between the respective semiquantitative clot burden analyses was 77% ($\kappa = 0{,}61$), in high-risk PE in 93% ($\kappa = 0{,}82$), in intermediate-risk in 72% ($\kappa = 0{,}44$) and in low-risk PE in 77% ($\kappa = 0{,}64$). Correlation between the clot burden in pulmonary arteries and the clinical severity showed only a non-significant difference between the high-risk PE and the intermediate-risk PE ($p = 1.0$), while there was a significant difference between the high-risk versus low-risk PE ($p = 0.000001$), and the intermediate-risk versus low-risk PE ($p = 0.0005$).

Conclusion: There was only a moderate interexaminer agreement in the assessment of intermediate-risk PE. Correlation between the clot burden and the clinical severity showed no statistically significant difference between the high-risk and the intermediate-risk PE that significantly differ in a short-term mortality rate.

PULMONARY ARTERY PRESSURE IN POSTMENOPAUSAL WOMEN

GEGENAVA T, GEGENAVA M, KAVTARADZE G, UCHANEISHVILI Z
Tbilisi State Medical University, Vaja Pshavela 29, Tbilisi, Georgia

Background: Some studies have reported that in female patients, the risk of pulmonary hypertension (PH) development is increased during the postmenopausal period, when the protective effects of estrogens on the endothelium decrease. Endothelial injury, coupled with excessive release of vasoactive mediators locally, promotes a procoagulant state that leads to further vascular obstruction. Aim of our study was to determine frequency of PH in postmenopausal women.

Methods: The research was performed in 85 postmenopausal women (mean age, 54 ± 3 yrs). Determination of pulmonary artery pressure (PAP) was possible by 2D transthoracic Doppler-echocardiography (TTE). TTE estimates pulmonary artery systolic pressure (PASP). (Data of pulmonary hypertension in postmenopausal women were compared with control group data which includes non-postmenopausal women, $n = 85$).

Results: Results show that increased level of pulmonary artery pressure was majority discovered in postmenopausal women $n = 58$ (68.2%), ($p < 0.001$). Mean PASPs in these patients were 49.3 ± 10. They had no chronic obstructive pulmonary disease, cardiovascular disease with significant heart failure, valvular heart disease, history of diabetes. 30% of postmenopausal women with secondary severe PH were obese. By the means of transthoracic echocardiography tricuspidal regurgitation (TR), right atrial (RA) and right ventricular (RV) dilatation was showed in every patient with important degree of PH. Electrocardiography more frequently showed right axis deviation and right ventricular hypertrophy with secondary T wave changes.

Conclusions: The results have indicated, that PH is increased during the postmenopausal period, when the protective effects of estrogens on the endothelium decrease. The problem is real and it requires particular attention. Early diagnostic and treatment give the possibility to control disease and avoid complications.

ENDOTHELIUM FUNCTION AND PULMONARY HYPERTENSION IN PATIENTS WITH CONNECTIVE TISSUE DISEASES

GIESZCZYK K[1], MIZIA-STEC K[1], MIZIA M[1], HABERKA M[1], LASOTA B[1], GĄSIOR Z[1], BRZEZIŃSKA-WCISŁO L[2], KRAUZE E[2]
[1] 2nd Department of Cardiology, Ziołowa 45/47, Katowice, Poland,
[2] Department of Dermatology, Francuska 20/24, Katowice, Poland

Background: Blood vessels abnormalities are a common finding in patients suffering from connective tissue diseases (CTDs). Pulmonary hypertension (PH) associated with CTDs is the second most prevalent type of PH. Flow-mediated dilatation (FMD) and NO-mediated dilatation (NMD) are non-invasive techniques used to evaluate endothelial function of systemic arteries. The aim of the study was to assess relationship between FMD and echocardiographic parameters of right ventricular (RV) function in patients with CTDs: systemic sclerodermia (SSc) and systemic lupus erythematosus (SLE).

Methods: Thirty-one patients hospitalized in Department of Cardiology of Medical University of Silesia in Katowice were enrolled into the study. Pulmonary fibrosis and extra systemic causes of PH were excluded in all patients. Clinical data, echocardiographic parameters: tricuspid regurgitation velocity (TRV), pulmonary arterial pressure (PAP), right ventricular systolic pressure (RVSP), FMD and NMD were assessed in all subjects. Patients were divided into two groups depending on FMD: presenting with (FMD < 7%) and without (FMD ≥ 7%) dysfunction of endothelium ($n = 10$ vs 21; age: 52 ± 13 vs 56.5 ± 8 years; M/F: 1/9 vs 3/18, respectively).

Results: The following parameters were not significantly different in patients with and without endothelial dysfunction: TRV (2.7 ± 1.6 vs 2.6 ± 0.8 m/s; $p = 0.9$), RVSP (29 ± 8 vs 38 ± 19 mmHg; $p = 0.1$), AcT (104 ± 19 vs 107 ± 30 ms; $p = 0.8$), MPAP (32 ± 8 vs 31 ± 13 mmHg; $p = 0.8$), PA (20 ± 4 vs 20 ± 3 mm; $p = 1$), RV (24 ± 5 vs 24 ± 5 mm; $p = 1$) and RA area (11 ± 8 vs 13 ± 6 cm^2; $p = 0.7$). Depending on the values of TVR, PAP, RVSP and additional echocardiographic variables suggestive of PH, in the group without endothelial dysfunction 7 patients were unlikely, 11 possible and 3 likely to have PH, while in the group with endothelial dysfunction: 2, 8 and 0 ($p = 0.26$). There were no correlations between FMD and RV, RVSP or AcT.

Conclusions: Endothelial dysfunction defined as impaired brachial artery vasodilatation is not connected with RV dysfunction and PH in patients with CTDs.

ONE YEAR FOLLOW-UP OF PATIENTS WITH PULMONARY HYPERTENSION RECEIVING VASODILATOR TREATMENT

GIUSCA S, JURCUT R, COMAN IM, GHIORGHIU I, IORGOVEANU D, TICULESCU R, POPESCU BA, GINGHINA C
"C.C.Iliescu" Institute for Cardiovascular Diseases, Fundeni, Bucharest, Romania

Aims: To evaluate the response to vasodilator therapy in patients (pts) with pulmonary arterial hypertension (PAH) using functional status, echocardiography parameters of the right ventricle (RV), and biomarkers.

Material and methods: Twenty pts, aged 33 ± 15, with PAH (5 idiopathic, 2 with connective tissue disease, 1 with hereditary hemorrhagic telangiectasia and 12 with Eisenmenger's syndrome) were enrolled consecutively and received vasodilator therapy (sildenafil, bosentan or both). They were evaluated before treatment and at every 3 months thereafter for up to 1 year using the following: 6-minute walking distance (6MWD), echo-derived systolic pulmonary artery pressure (sPAP), tricuspid annular plane systolic excursion (TAPSE), RV fractional area change (RVFAC), RV myocardial performance index (TeiRV), peak systolic velocity of the tricuspid ring (St), peak systolic strain of the RV free wall (StrainRV) and BNP levels.

Results: One patient died during the follow-up (idiopathic PAH). The 6MWD increased significantly at 6 months and remained stable thereafter, sPAP did not change following vasodilator therapy. None of the echocardiographic parameters nor BNP levels showed any significant improvement during follow-up ($p = NS$). The baseline characteristics and evolution of all parameters under vasodilator therapy were similar in pts with congenital heart disease compared to pts with other etiologies of PAH.

Conclusions: Vasodilator therapy determined clinical improvement in pts with PAH. However, the treatment had no effect on the level of pulmonary systolic pressure, echo-derived RV functional parameters and BNP levels.

	Baseline	3 months	6 months	9 months	1 year
6MWD (m)	308 ± 141	424 ± 122	538 ± 203*	594 ± 195*	558 ± 127*
sPAP (mmHg)	90 ± 22	101 ± 16	105 ± 19	100 ± 15	102 ± 23
TAPSE (mm)	16.5 ± 5	16 ± 4	18 ± 4	18 ± 5	15 ± 4
RVFAC (%)	25 ± 9	26 ± 9	27 ± 9	32 ± 9	31 ± 10
TeiRV	0.76 ± 0.27	0.8 ± 0.15	0.7 ± 0.2	0.7 ± 0.2	0.71 ± 0.2
St (cm/s)	9 ± 2	11 ± 4	10 ± 3	10 ± 3	10 ± 4
StrainRV (%)	−16.5 ± 7	−15 ± 6	−16 ± 7	−17 ± 6	−14 ± 7
BNP (pg/ml)	206 (68–824)	180 (75–452)	230 (73–375)	113 (83–193)	146 (50–696)

$p < 0.05$

ADDITION OF SILDENAFIL AFTER BOSENTAN MONOTHERAPY FOR PAH. A PROSPECTIVE STUDY

GRIGNOLA JC, RUIZ MJ, ESCRIBANO P, JIMENEZ C, DELGADO JF, FLOX A, PINDADO C, GÓMEZ MA
Hospital Doce de Octubre. Cardiology Department, Crta. Andalucía, Madrid, Spain

Background: Bosentan (Bos) and sildenafil (Sild) therapies have shown clinical efficacy in pulmonary arterial hypertension (PAH). However, at present there is little experience on

combination therapy of both drugs. This study assesses the efficacy and safety of combination therapy in 12 patients with PAH.
Methods: A prospective, uncontrolled hospital study was conducted in patients with PAH. Patients started with Bos, and Sild was added when clinical deterioration was observed. Treatment efficacy was assessed by means of symptoms, NYHA Functional Class (FC), 6-minute walk distance test (6MWD) and echocardiographic assessments during follow-up.
Results: Twelve patients were included in the study. Nine females; mean age: 44.7 years. Compared to baseline, the 6MWD significantly improved after 4–6 months Bos monotherapy (median: 411 versus 452 m, respectively; $p = 0.008$), especially due to improvement of FCIII patients: 6MWD from baseline (median) 320 to 400 m after Bos. When Sild was added patients achieved a stabilization of 6MWD (median 413 m) in the median evolution 12-months follow-up.
Regarding NYHA-FC, 66% of patients (pts) were in FCIII at baseline (3 pts were in FCII, 8 pts FCIII and 1 pt FCIV). After Bos monotherapy 41% pts were in FCIII (5 pts FCII, 5 pts FCIII and 1 pt FCIV). When Sild was added after clinical deterioration a trend towards an improved NYHA-FC was observed ($p = 0.05$) (1 pts FCI, 6 pts FCII and 4 pts FCIII).
When compared with baseline no statistically significant changes on right ventricular (RV) function parameters were obtained, neither in monotherapy nor in combination.
No cases of liver toxicity and no deaths were registered at follow-up.
Conclusions: Addition of Sild after Bos monotherapy when clinical deterioration had been detected was associated with an improvement in clinical parameters (NYHA-FC) and a stabilization of RV function. Additional clinical studies are needed to assess the efficacy of Bos and Sild combination in patients with PAH to identify an optimal therapeutic strategy.

STROKE VOLUME INDEX AS PROGNOSTIC RISK FACTOR IN PULMONARY ARTERIAL HYPERTENSION PATIENTS

JACHEĆ W, WOJCIECHOWSKA C, TOMASIK A, FOREMNY A, NOWALANY KOZIELSKA E

II. Department of Cardiology, Silesian Medical University, Sklodowska 10, Zabrze, Poland

Patients who meet criteria of acute positive response in vasoreactivity hemodynamic assessment by use of for example nitric oxide inhalation (called responders) have better prognosis. The stroke volume index (SVI) is secondary measure and is calculated from cardiac output index and heart rate.
The aim of the study was to assess the prognostic value of right-heart catheterization (RHC) parameters measured at baseline and during nitric oxide inhalation.
Material and methods: Thirty consecutive patients (3 men) in whom RHC with vasoreactivity test with nitric oxide inhalation were performed were enrolled into the study. Patients were divided into two groups: A – patients who did not survive 5 years after the onset of symptoms ($n = 16$, 3 men, mean age 34.3 ± 16 years); B – patients who survived longer than 5 years ($n = 14$, mean age 31.8 ± 12 years). RHC procedure was performed accordingly to guidelines. The following parameters: mean pulmonary artery pressure (mPAP), right atrial pressure (RAP), pulmonary vascular resistance (PVR), and stroke volume index (SVI) were chosen for further evaluation. Statistic: univariable Cox hazard regression, Wilcoxon test, Whitney-Mann "U" test and log-rank test were used for statistical analysis of data.
Results: From all, only one patient from group B met currently obligatory responder criteria. Study groups did not differ either in all examined parameters at baseline or in vasoreactivity test. Univariable Cox hazard regression showed significant survival impact of SVI (baseline measurement): $p = 0.028$. Log-rank analysis showed that SVI above 33 ml/m^2 indicate significantly better survival in 5 years follow-up; log-rank $p = 0.016$, OR = 5.78, 95% CI [1.12 to 29.84].
Conclusion: Stroke volume may be a hemodynamic parameter that enables risk stratification. The other hemodynamic parameters in observed patients are of no full prognostic value in this analysis.

USEFULNESS OF COMBINED SILDENAFIL NITRIC OXIDE PULMONARY ARTERIAL HYPERTENSION REVERSIBILITY TEST AS A PROGNOSTIC FACTOR IN PAH PATIENTS

JACHEĆ W, WOJCIECHOWSKA C, TOMASIK A, FOREMNY A, NOWALANY KOZIELSKA E

II. Department of Cardiology, Silesian Medical University, Sklodowska 10, Zabrze, Poland

Among pulmonary arterial hypertension (PAH) patients, potentially good prognosis have patients with a fall of mean pulmonary artery pressure (mPAP) of at least 10 mmHg (to below 40 mmHg) without a decrease of cardiac output.
Aim of study: To determine the usefulness of combined sildenafil (SIL) nitric oxide (NO) PAH reversibility test as a prognostic factor in PAH patients.
Material and methods: 28 PAH patients, 2 males, mean age 41.7 ± 15.4 years (PAH: 20 idiopathic, 3 due to CTD, 2 due to HIV infections and 2 persistent after CHD) with mPAP: 50.5 ± 18.1 mmHg and PVRI: 1518 ± 814 dyn · s · cm^{-5}. Reversibility test: After initial measurement, hemodynamic data were collected during NO inhalation (20–120 ppm), 45 minutes after oral administration of 50 mg of sildenafil (SIL) and during another NO inhalation. Patients were divided into responders and nonresponders. Primary study endpoint was death. Follow up period was up to 3081 days (mean 1153 days). Therapy: 12 pts received sildenafil, 3 pts inhaled iloprost, 1 pt sitaxentan, 5 pts sildenafil and iloprost, 7 pts calcium channel blockers only or other treatment.
Results: During NO inhalation 4 pts and during sildenafil/NO administration 11 pts were classified as responders, respectively. During follow-up 11 deaths occurred, including 2 SIL/NO responders. None NO responder died. Responders and nonresponders did not differ in hemodynamic measurements and the treatment was comparable. Univariable Cox regression showed survival impact of mPAP ($p = 0.035$), PVRI ($p = 0.001$), RAP ($p = 0.022$) and SVI ($p = 0.012$, in multivariable Cox regression; $p = 0.013$). Only PVRI value predicted results of NOSIL test (univariable logistic regression $p = 0.019$, Chi^2 $p = 0.033$, 1 vs 3 tertile). Log-rank analysis shows that responders either to SIL/NO or to NO have significantly better survival (log-rank SIL/NO $p = 0.042$, log-rank NO $p = 0.092$).
Conclusion: SIL/NO reversibility test identifies more PAH patients with reversible form of pulmonary hypertension and better prognosis than NO inhalation only.

ONE YEAR OF EXPERIENCE IN A STARTING PAH CENTRE

JARVEKULG S, ANTON L, PÄRSIK E

North-Estonia Medical Centre Foundation, Sütiste St. 19, Tallinn, Estonia

Background: PAH, term used for various conditions that produce elevation in pulmonary arterial pressure, is associated with poor outcome, if left untreated.
Methods: Clinical information of patients who underwent RHC for PAH diagnosis during 2008.
Results: PH was diagnosed in 10 out of 13 cases, VRT was positive in 1 case. VRT was done with adenosine in 7, with sildenafil in 3 patients. Three were repeat procedures. One patient was male. Ages 23 to 71. Seven patients were referred by rheumatologists, 4 by cardiologists, 2 by pulmonologists. Significant arterial hypoxemia was found in 5. No intracardial shunts were found. Signs of RV failure were found in 2 baseline and in 1 repeat procedure. PAWP was elevated in 3 patients: due to left ventricular diastolic dysfunction in 2 and diffuse fibrotic changes in lung tissue in 1 patient. Results of RHC correlated well with previous echocardiography. Systemic sclerodermia was diagnosed in 4 out of 7 cases referred by rheumatologists, lupus erythematosus, mixed syndrome and antisynthetase syndrome in 1 patient each. On CT 2 patients were diagnosed with pneumofibrosis. One patient had IPAH. In 3 patients PH was associated with lung disease, in one patient CTEPH was diagnosed additionally to severe bronchial asthma. PAH specific treatment was started in 7: bosentan in 5 and sildenafil in 3 patients. Side effects to bosentan occurred in IPAH and sildenafil was prescribed. Sildenafil was administered in 2 cases of LV or pulmonary disease associated PH. Clinical course: improvement in 1, stable in 6 cases and 3 patients died. Time of death from diagnosis was 3, 2 and 0.5 years respectively.
Discussion: PAH has poor prognosis when diagnosed late but stabilization, even improvement is possible with a specific treatment. Routine screening of patients at risk with echocardiography is a reliable tool. Similar changes in tests to lung fibrosis in CT may result in different changes in pulmonary artery pressures. LV and lung disease associated PH and CTEPH and their combinations are a frequent problem in everyday practice.

ADAPTATION OF THE RIGHT VENTRICLE TO INCREASED PRESSURE AFTERLOAD – COMPARISON BETWEEN PULMONARY HYPERTENSION

JURCUT R[1], TICULESCU R[2], GIUSCA S[2], FLOARES E[2], IORGOVEANU D[2], GHIORGHIU I[2], COMAN IM[2], GINGHINA C[1]

[1] *University of Medicine and Pharmacy "Carol Davila", Dionisie Lupu 37, Bucharest, Romania,*
[2] *Institute of Cardiovascular Diseases "Prof. dr. C. C. Iliescu", Fundeni 258, Bucharest, Romania*

Purpose: In order to better characterize right ventricle (RV) remodeling as a response to increased afterload, we compared RV parameters in patients with pulmonary stenosis (PS)

vs patients with arterial pulmonary hypertension (PH) using conventional echocardiography and speckle tracking myocardial imaging.
Methods: We involved 36 age- and gender-matched patients (pts): group A (10 pts, 32.0 ± 18.3 yrs) with valvular PS; group B (13 pts, 39.1 ± 15.8 yrs) with arterial PH; group C (13 controls, 38.1 ± 14.7 yrs). All pts had standard echocardiography with measurements of RV fractional area change (RV-FAC), TAPSE, eccentricity index. Tricuspid regurgitation (TR) severity was graded from 0–4. Myocardial velocities (V) and longitudinal strain (S) were obtained by 2D-strain imaging from the RV free wall. BNP levels were measured in groups A and B.
Results: RV systolic pressure was 81 ± 41 mmHg in group A, 96 ± 38 mmHg in group B ($p = 0.37$ vs group A), 22 ± 4 mmHg in group C ($p < 0.01$ vs groups A and B). RV structure and function parameters are presented in the Table.

Parameters	Group A Pulmonary valve stenosis	Group B Pulmonary hypertension	Group C Controls	P ANOVA
RV end-diastolic diameter (mm)	30.6 ± 5.8	47.5 ± 9.5*	28.6 ± 5.6	< 0.001
RV free wall thickness (mm)	9.7 ± 3.5*	8.6 ± 1.5*	3.9 ± 1.0	< 0.001
RV-FAC (%)	56.2 ± 13.1	24.8 ± 12.3*	50 ± 11.5	< 0.001
TAPSE (mm)	19.6 ± 4.2	17.5 ± 7.6*	23.5 ± 1.9	0.02
RV-MPI	0.25 ± 0.12	0.85 ± 0.25*	0.15 ± 0.08	< 0.001
Tricuspid regurgitation	1.6 ± 0.7*	2.9 ± 0.9*,#	0.8 ± 0.4	< 0.001
RV wall global longitudinal sysV (cm/s)	7.8 ± 2.6*	8.1 ± 2.4*	10.4 ± 1.3	0.01
RV wall global longitudinal sysS (%)	−17.5 ± 4.2	−14.0 ± 7.4*	−22.3 ± 4.1	0.003
BNP (pg/ml)	199.4 ± 168.9	424.6 ± 440.1#	–	

Posthoc analysis: * $p < 0.05$ vs controls, # $p < 0.05$ vs group A

Conclusions: At a similar degree of pressure afterload and RV hypertrophy, pts with arterial PH have more severe systolic and diastolic RV dysfunction than pts with valvular PS. These changes could be related to differences in impedance related to obstacle location, as well as to more severe TR in pts with PH.

HOW REALLY GOOD OR BAD ARE PATIENTS WITH EISENMENGER'S SYNDROME?

KALDARAROVA M[1], SIMKOVA I[2]
[1] *National Institute of Cardiovascular Diseases, Pod Krasnou Horkou 1, Bratislava, Slovak Republic,*
[2] *Slovak Medical University and National Institute of Cardiovascular Diseases, Pod Krasnou Horkou 1, Bratislava, Slovak Republic*

Background: Eisenmenger's syndrome (ES) – irreversible pulmonary vascular changes due to congenital heart defect – represents a specific form of pulmonary arterial hypertension (PAH), with an ongoing relatively stable clinical status and good right ventricular (RV) function. However, not only as a result of PAH but also due to cyanosis these patients regularly develop severe symptoms, often lethal.
Methods: Twenty-five patients (pts) with ES (18F/7M, mean age 45 years) were observed. Pre-tricuspid defect (pre-TD) was present in 8 (32%) and post-tricuspid (post-TD) in 17 pts (68%). Differences in pre-TD and post -TD groups were established and correlations to clinical and functional status (according to 6-minute walking distance, 6MWD) were analyzed.
Results: Cyanosis was observed in 16 pts (64%), with mean oxygen saturation 80%. Severe clinical symptoms (dyspnea, syncope, hemoptoe) were present in 15 pts (60%).
Echocardiographic comparison of pre-TD vs post-TD groups showed significant: right ventricular (RV) dilatation (mm) – 50 vs 29 ($p = 0.004$) and RV EF (%) difference – 46 vs 60 ($p = 0.03$). Invasively measured mean pulmonary artery pressure (mPAP) (mmHg) was 57.5 vs 80 ($p = 0.006$), suprasystemic PAP was found in 13 (52%) of all pts.
Correlation between 6MWD < 360 m and presence of severe clinical symptoms were found ($p = 0.05$), especially syncope ($p = 0.03$) and resting dyspnea ($p = 0.03$). Although different, no statistical significance was achieved in pre-TD vs post-TD (372 vs 418, $p = 0.6$) or comparing 6MWD (m) in pts w/o or w: cyanosis – 450 vs 382 ($p = 0.2$), RV dilatation – 436 vs 385 ($p = 0.6$), RV dysfunction – 410 vs 398 ($p = 0.9$) or mPAP – 372 vs 389 ($p = 0.6$).
Conclusions: Type of the defect plays a significant role in hemodynamic picture of ES patients. Not PAP but RV function is crucial to their long-term survival. On the other hand, although ES has a generally better prognosis compared to other groups of PAH, severe symptoms may decrease patient's functional status or may lead to premature death.

DIAGNOSIS OF DEEP VEIN THROMBOSIS IN 2010

KARETOVA D
II[nd] Dept. of Cardiology and Angiology, General Teaching Hospital, U Nemocnice 2, Prague, Czech Republic

Venous thromboembolism – VTE (deep vein thrombosis – DVT and pulmonary embolism – PE) is still the third cause of mortality by cardiovascular disease after CHD and stroke. Late consequences may produce postthrombotic syndrome and chronic pulmonary hypertension. During the past two decades non-invasive diagnostic procedures such as venous compression ultrasonography, D-dimer estimation and spiral (or helical) computed tomography have become widely accessible. The index of suspicion of the thrombembolism has increased so before providing the above mentioned diagnostic tests the scores for clinical probability assessment could be evaluated in hemodynamically stable patients. In diagnosis of DVT duplex ultrasound remains the primary confirmatory test, computed tomography and magnetic resonance imaging are used only in selected patient populations when ultrasound results are equivocal or in patients suspected of central venous DVT or as a part of combined protocol for diagnosis of pulmonary embolism. The usefulness of D-dimer measurement (usually with a cut-off value 500 µg/l) has been shown to be highly sensitive in acute DVT or PE especially in younger patients in out-patient setting; age and hospitalization reduce the clinical value of the test. Still D-dimer level is the simple determinant for further evaluation (compression ultrasonography or multislice helical computed tomography) in low or intermediate level of suspicion according to score systems.
Progress in the treatment of VTE has been made as well. In most cases low molecular weight heparins (LMWH) or fondaparinux are overlapped with vitamin K antagonists given from the first day, cancer patients might benefit from a prolonged treatment with LMWH. In proximal DVT the best results of thrombus dissolution are obtained with catheter directed local thrombolysis, in concurrent hemodynamically significant pulmonary embolism systemically given thrombolysis is the treatment of choice. Several new oral anticoagulants are under clinical evaluation in phase III of clinical trials. They directly inhibit factor Xa (rivaroxaban, apixaban) or thrombin (dabigatran) and they seem to have the potential for replacing VKA or heparins in the future.

ENDOTHELIN RECEPTOR ANTAGONISTS ARE AN EFFECTIVE LONG TERM TREATMENT IN PAH-CHD

KERMEEN F, FRANKS C, O'BRIEN K, SEALE H, HALL K, MCNEIL K, RADFORD D
The Prince Charles Hospital, Rode Road, Brisbane, Australia

Introduction: Traditionally, treatment options for patients with pulmonary arterial hypertension associated with congenital heart disease (PAH-CHD) are limited. Bosentan has been shown to improve pulmonary hemodynamics and exercise tolerance short term but long term clinical studies are lacking.
Aim: To report long term efficacy and safety data with endothelin receptor antagonists (ERA) in patients with PAH associated CHD.
Methods: Prospective, open label, uncontrolled, single-centre study of 53 patients (33 females, 17 Trisomy 21, mean age 34 ± 12 years) prescribed ERA (48 bosentan, 5 sitaxentan) from 2003 to August 2009. Outcome measurements of oxygen saturation (SaO_2), WHO functional class, 6-minute walk test distance (6MWD), echocardiographic parameters, brain natriuretic peptide (BNP) and adverse events were analyzed.
Results: Mean duration of therapy was 15 ± 13 months in 36 simple CHD and 17 complex CHD (single ventricle physiology). Four patients failed ERA, seven died (5 progressive RHF) and one delisted from transplantation. No abnormal liver transaminases occurred on bosentan, with one case on sitaxentan. In the whole group, after 3,6,12,18 and 24 months of treatment a significant improvement was seen in WHO functional class (mean 3.15 vs 2.8 vs 2.5 vs 2.5 vs 2.4 vs 2.4; $p < 0.01$) and 6MWD (344 ± 18 vs 392 ± 17 vs 411 ±17 vs 420 ± 17 vs 442 ± 18 vs 417±23: $p < 0.0005$, $p < 0.01$) compared with baseline. Sub-analysis of the Trisomy 21 and complex CHD also showed a significant improvement in 6MWD at six and 12 months (263 ± 24 vs 348 ± 29 vs 360 ± 32, $p < 0.01$, $p < 0.05$; 297 ± 26 vs 360 ± 25 vs 360 ± 29, $p < 0.01$, $p < 0.05$) respectively. No changes in SaO_2, BNP, RV or LV function were demonstrated during follow-up.

Conclusion: This large single-centre study demonstrates that endothelin receptor antagonism is an effective and safe treatment in PAH associated CHD with or without Trisomy 21. The improvements in exercise tolerance are similar to reported benefits in other forms of PAH.

PLATELET ACTIVATION ASSESSED AS MPV PREDICTS EARLY DEATH IN ACUTE PULMONARY EMBOLISM

KOSTRUBIEC M[1], LABYK A[1], PEDOWSKA-WLOSZEK J[1], PACHO S[1], JANKOWSKI K[1], OSTROWSKI L[2], PRUSZCZYK P[1]

[1] Department of Internal Medicine and Cardiology, The Medical University of Warsaw, Lindleya 4, Warsaw, Poland

[2] Department of Radiology, The Medical University of Warsaw, Lindleya 4, Warsaw, Poland

Aims: Platelets play an important role in the pathogenesis of atherothrombosis. It has been shown that platelet size, measured by mean platelet volume (MPV), correlates with their reactivity. Increased values of MPV have been recognized as an independent risk factor for myocardial infarction and stroke. Increasing levels of MPV were identified as a predictor for venous thromboembolism (VTE). We hypothesized that in acute pulmonary embolism (APE) MPV is elevated and may predict mortality.
Methods and results: The study included consecutive 192 patients with APE (79 M/113 F, 64 ± 18 yrs) and 100 controls matched for age, sex and concomitant diseases. On admission blood samples were collected for MPV and troponin measurements. Although MPV did not differ between APE and controls (10.0 ± 1.2 vs 10.1 ± 0.8 fl), it differed between low and intermediate or high risk APE (9.4 ± 1.2 fl, 10.3 ± 1.1 fl, 10.3 ± 1.8 fl; respectively, $p < 0.0001$). Eighteen (9%) APE patients died during 30-day observation. MPV was higher in non-survivors than survivors (10.7 ± 1.4 fl vs 9.9 ± 1.2 fl, $p < 0.01$). The areas under ROC curves of MPV were 0.658 (95% CI: 0.587–0.725) for predicting 30-day mortality, and 0.712 (95% CI: 0.642–0.775) for 7-day mortality. MPV > 10.9 fl, showed sensitivity, specificity, PPV and NPV for death within 30 days (39%, 81%, 18%, 93%, respectively) and for 7-day mortality (54%, 82%, 18%, 96%). Multivariable analysis revealed MPV was the independent mortality predictor for 7- and 30-day all-cause mortality (HR 2.0 [CI 95%: 1.3–3.0, $p < 0.001$] and 1.7 [CI 95%: 1.2–2.5, $p < 0.01$], respectively). MPV were higher in patients with myocardial injury than in those without troponin elevation (10.2 ± 1.1 fl vs 9.8 ± 1.2 fl; $p = 0.02$). There were correlations between MPV and right ventricle (RV) diameter and RV dysfunction ($r = 0.28$, $p < 0.01$ and $r = 0.19$, $p < 0.02$, respectively).
Conclusion: MPV is an independent predictor of early death in APE. Moreover, MPV in APE is associated with right ventricular dysfunction and myocardial injury.

ASSESSMENT OF RENAL DYSFUNCTION IN SHORT-TERM PROGNOSIS IN ACUTE SYMPTOMATIC PULMONARY EMBOLISM

KOSTRUBIEC M[1], PEDOWSKA-WLOSZEK J[1], LABYK A[1], PACHO S[1], OSTROWSKI L[2], CIURZYNSKI M[1], PRUSZCZYK P[1]

[1] Department of Internal Medicine and Cardiology, The Medical University of Warsaw, Lindleya Street 4, Warsaw, Poland,

[2] Department of Radiology, The Medical University of Warsaw, Lindleya Street 4, Warsaw, Poland

Objective: Risk stratification in acute pulmonary embolism (APE) is based on the assessment of hemodynamic stability and evaluation of right ventricular (RV) function. Decreased cardiac output, hypoxemia and elevated central venous pressure can result in renal dysfunction. We hypothesized that renal dysfunction is an independent marker of early mortality in APE.
Material and methods: In a prospective cohort study we observed 220 consecutive patients (86 M/134 F, 64 ± 18 years) with APE proven by spiral CT. On admission, echocardiography was performed and blood samples were collected for troponin and creatinine assays.
Results: The calculated glomerular filtration rate (GFR) differed significantly between 81 pts with low-, 131 pts with moderate- and 8 pts with high-risk APE [71 (19–181) vs 55 (9–153) vs 41 (14–68) ml/min; respectively $p < 0.0001$]. Twenty-three patients died during 30-day observation. Importantly, GFR was lower in non-survivors than in survivors [35 (9–92) vs 63 (14–181) ml/min, $p < 0.0001$]. The AUC of the GFR ROC curve for predicting mortality was 0.760 (95% CI: 0.698–0.815). In multivariable analysis, independent mortality predictors were GFR, troponin, heart rate, and history of chronic heart failure. In normotensive patients, the GFR and cTn ROC curves for prediction of mortality showed no difference (AUC 0.789 and 0.781, respectively). However, Kaplan-Meier analysis showed an additive prognostic value of renal dysfunction. Thus troponin-positive patients with GFR ≤ 35 ml/mn showed 48 % 30-day mortality, while troponin-positive patients with GFR > 35 ml/mn had 11% mortality, and troponin-negative patients with GFR > 35 ml/mn had good prognosis, $p < 0.0001$.
Conclusion: Impaired kidney function, present in 47% APE patients, is related to all-cause mortality. In initially normotensive patients, GFR < 35 ml/min predicts 30-day mortality. Moreover, GFR assessment can improve troponin-based risk stratification of APE.

SIGNS OF MYOCARDIAL ISCHEMIA ON ECG CORRELATE WITH ELEVATED PLASMA CARDIAC TROPONIN AND RIGHT VENTRICLE

KOSTRUBIEC M, LABYK A, PEDOWSKA-WLOSZEK J, JANKOWSKI K, PRUSZCZYK P

Department of Internal Medicine and Cardiology, Lindleya 4, Warsaw, Poland

Objective: Plasma cardiac troponins (cTn) are frequently elevated in acute pulmonary embolism (APE), also ST-segment abnormalities on electrocardiography are commonly observed in APE patients. However, it has not been defined which ventricle is a potential source of cTn release. We assessed potential relationship between electrocardiographic signs of myocardial ischemia, systolic dysfunction of both ventricles at echocardiography and cTn levels in APE. On admission blood samples were collected for cTnI or cTnT and standard 12 lead ECG were performed. Following signs of myocardial ischemia were analyzed: T-wave inversion [T(-)] and ST-depression or elevation (≥ 1 mV, at ≥ 2 leads). The assessment of systolic function of both ventricles was performed by echocardiography.
Material and methods: We evaluated consecutive 94 pts (42 M, 52 F, aged 63).
Results: In 33 (35%) pts cTn exceeded the upper reference limit of our laboratory. The history of coronary artery disease (27% vs 31%) and previous myocardial infarction (12% vs 10%) did not differ in pts with elevated cTn[cTn(+)] and non-elevated cTn[cTn(-)]. In cTn(+) group T(-) or ST-depression were observed more frequently than in cTn(-) [32 (97%) vs 46 (75%), $p < 0.01$). However, both groups presented similar frequency of ST-elevation [7 (21%) vs 11 (18%), $p = NS$]. Interestingly, cTn levels correlated with the number of leads with T(-) or ST-depression (R 0,30; $p < 0,01$). Moreover, in cTn(+) group RV systolic dysfunction was more frequent [15 (54%) vs 4 (7%), $p = 0.0001$], while LV contractility abnormalities occurred similarly in both groups [3 (11%) vs 8 (15%), $p = NS$].
Conclusion: Signs of myocardial ischemia (ST-segment changes) on ECG in APE correlate with an elevated cTn and with the impairment of right but not left ventricle systolic function at echocardiography.

ENDOTHELIN IS NOT ELEVATED IN ACUTE PULMONARY EMBOLISM

KOSTRUBIEC M, PEDOWSKA-WLOSZEK J, CIURZYNSKI M, BIENIAS P, PRUSZCZYK P

Department of Internal Medicine and Cardiology, Lindleya 4, Warsaw, Poland

Introduction: In acute pulmonary embolism (APE) the increase of pulmonary vascular resistance depends on the thromboli load and potentially on the pulmonary bed contraction caused by neurohormonal reaction. Plasma levels of endothelin were reported to be elevated in pulmonary arterial hypertension. However, there are only few studies assessing endothelin in patients with APE.
Material and methods: Therefore in our study we evaluated endothelin concentration in 55 patients (29 M, 26 F, age 57 ± 19 yrs) with confirmed APE for potential value in risk stratification. Patients were compared with 24 healthy volunteers at similar age. On admission blood samples were collected for plasma endothelin concentration. The quantitative assessment of right ventricular (RV) function was performed by echocardiography.
Results: Endothelin concentrations were similar in APE patients and in control group [1.41 (0.22–9.68) pg/mL vs 1.62 (0.27–8.92) pg/mL; $p = NS$]. There were no differences in endothelin levels between APE patients with and without RV dysfunction [1.46 (0.38–4.54) pg/mL vs 1.41 (0.22–9.68) pg/mL; $p = NS$]. Endothelin concentration did not differ between patients with serious adverse events and APE group with event-free clinical course [3.19 (0.38–4.27) pg/mL vs 1.38 (0.22–9.68) pg/mL; $p = NS$]. There was no significant correlation between endothelin levels and blood saturation, time from the first symptoms, heart rate, blood pressure, tricuspid valve regurgitation pressure gradient and other echocardiographic parameters.
Conclusions: We concluded that plasma endothelin concentrations assessed on admission are not elevated in patients with APE and it does not play as important role in acute phase of increase of pressure in pulmonary arteries as in chronic pulmonary hypertension.

PULMONARY EMBOLISM IMPAIRS PHYSICAL CAPACITY DESPITE PROPER 6-MONTH ANTICOAGULATION

KOSTRUBIEC M[1], SADOWSKA K[2], KUCH M[2], LABYK A[1], BRAKSATOR W[2], PEDOWSKA-WLOSZEK J[1], PACHO S[1], DLUZNIEWSKI M[2], PRUSZCZYK P[1]

[1] Department of Internal Medicine and Cardiology, The Medical University of Warsaw, Lindleya 4, Warsaw, Poland,

[2] Department of Cardiology, Hypertension and Internal Medicine, The Medical University of Warsaw, Kondratowicza 8, Warsaw, Poland

Objective: Pulmonary embolism (PE) can cause myocardial injury in the acute phase and in some patients residual pulmonary thrombi can persist even despite the proper and adequate long-term anticoagulation. However clinical significance of these phenomena remains still to be determined.
Material and method: We evaluated 15 young pts (< 50 years of age) without any co-morbidities (8 M, 7 F, aged 42 ± 10 years) at cardiopulmonary exercise test (CPET) with GE CASE T2100 system 6–12 months after the first episode of PE. Control group consisted of 14 healthy age- and sex-matched volunteers (6 M, 8 F, aged 41 ± 11 years).
Results: Both groups were similar in age, height (172 vs 171 cm), and BMI (28 vs 24 kg/m^2, $p = 0.07$). Patients and controls did not differ significantly in regards of anaerobic threshold (AT) (23 ± 6 vs 26 ± 6 l/min, $p = 0.26$) and ventilatory equivalent for CO_2 (VE/VCO_2) (31 ± 4 vs 31 ± 6, $p = 0.72$). However, PE pts achieved lower maximal heart rate during exercise (160 ± 21 vs 183 ± 13 beats/min; $p = 0.002$) and their exercise time was lower (16 ± 4 vs 21 ± 3 min, $p < 0.001$). Importantly subjects after PE had also lower maximal oxygen uptake (peak VO_2) (30 ± 7 vs 36 ± 10 l/min, $p = 0.06$) and percentage of predicted peak VO_2 (87 ± 22 vs 101 ± 21%, $p = 0.09$) in comparison with the controls.
Conclusion: Maximal exercise capacity lower in pts 6–12 months after episode of PE than in healthy controls suggests persistent cardiopulmonary limitation.

THE PROGRESSION OF EARLY PULMONARY VASCULOPATHY IN SCLERODERMA IS ATTENUATED BY BOSENTAN

KOVACS G[1], MAIER R[1], ABERER E[1], BRODMANN M[1], TROESTER N[1], SCHEIDL S[1], RUBIN L[2], OLSCHEWSKI H[1]

[1] Medical University of Graz, Auenbruggerplatz 20, Graz, Austria,

[2] University of California, San Diego Medical Center, San Diego, La Jolla, USA

Background: A large increase of pulmonary arterial pressure (PAP) during exercise in patients without a manifest pulmonary arterial hypertension (PAH) may be an early sign of pulmonary vasculopathy in systemic sclerosis (SSc). In this explorative pilot study, we hypothesized that treatment with the endothelin-receptor antagonist bosentan might attenuate the progression towards manifest PAH in such patients.
Methods: SSc patients without manifest PAH (resting mean PAp < 25 mmHg) but a large exercise-induced PAP increase (mean PAp > 30 mmHg during exercise) were enrolled and underwent right-heart catheterization (RHC) at rest and during exercise at baseline, after a 12-month observation period and after a 6-month therapy with bosentan. Primary endpoint was the change of mean PAP at 50W during the observation vs. treatment period. Secondary end points were the changes of resting and exercise pulmonary vascular resistance (PVR) and peak VO_2 during the observation vs. the treatment period.
Results: 10 patients were enrolled. Mean PAP at 50W increased during the observation period (+4 ± 2.9 mmHg; $p = 0.002$) and decreased during the treatment period (−1.5 ± 4.5mmHg, NS). The changes between the treatment and observation period were statistically different ($p = 0.01$). Changes in resting PVR (+8 ± 25 vs −45 ± 22 dyn · s · cm^{-5}; $p < 0.001$) and in PVR during maximal exercise (+12 ± 31vs −37 ± 34 dyn · s · cm^{-5}; $p = 0.01$) between the observation and treatment periods were also statistically different. Peak VO_2 trended to improve during the treatment period (+0.5 ± 1.2 ml/min · kg) as compared to the observation period (−1.0 ± 2.0 ml/min · kg; $p = 0.08$).
Conclusion: In SSc patients without manifest PAH, but a large PAP increase during exercise, progression towards PAH is detectable within one year and this can be attenuated by bosentan, representing a potential new treatment indication.

PULMONARY HYPERTENSION IN HEART TRANSPLANTATION CANDIDATES – ONLY A MARGINAL PROBLEM?

KREJCI J, HUDE P, POLOCZKOVA H, OZABALOVA E, SPINAROVA L, VITOVEC J

St. Anna's University Hospital, Pekarska 53, Brno, Czech Republic

Background: In severe heart failure patients who are considered as candidates for heart transplantation (HTx) mixed (or reactive) form of pulmonary hypertension (PH) is frequently present. HTx is contraindicated when transpulmonary pressure gradient (TPG) is higher than 15 mmHg and/or pulmonary vascular resistance (PVR) more than 3.5 Wood units (WU). In such cases it is necessary to test reversibility of the pre-capillary component of PH.
Aim: Evaluation of the need of pre-capillary component testing in HTx candidates and of the effect of intravenous alprostadil on the right-heart catheterization (RHC) parameters in this patients' group.
Patients: Between January 2007 and November 2009, 664 RHCs were performed. There was a necessity of the reversibility testing of the PH pre-capillary component in 44 cases (in 30 patients). This group consists of 8 women and 22 men, mean age was 53 ± 9 years, functional class NYHA 3.1 ± 0.3. Cardiac output (CO) was 3.3 ± 0.7 L/min, mean pulmonary artery pressure (PAP) 48 ± 8 mmHg, pulmonary wedge pressure (PWP) 29 ± 7 mmHg, TPG 19 ± 6 mmHg and PVR 5.8 ± 1.8 WU
Results: Mean dose of administrated alprostadil was 116 ± 43 ng/kg/min, PAP dropped to 37 ± 10 mmHg and PWP to 24 ± 9 mmHg. Conversely CO increased to 4.5 ± 1.1 L/min. That led to reduction of PVR to 3.1 ± 1.1 WU TPG decreased to 13 ± 5 mmHg (all $p < 0.01$; except PWP change with $p < 0.05$). In 8 RHCs (in 5 patients) our effort to reach cut-off values of PVR and TPG failed.
Conclusion: „Fixed" pre-capillary component of PH is rare even in patients with a severe heart failure. In our patients' cohort it appeared in only 1.2% of all consecutive RHCs. This represents less than 1% of patients who were contraindicated for HTx only a few years ago. Today they have a new chance because of modern therapeutic possibilities – first of all left ventricular assist device (LVAD) therapy, and hopefully also from specific PH therapy in the days to come.

PSYCHIATRIC COMORBIDITY IN PATIENTS WITH PULMONARY ARTERIAL HYPERTENSION

KUTUZOVA A[1, 2], MOISEEVA OM[1], GONCHAROVA NS[1], PETROVA NN[3], LUCHANINOVA IS[1]

[1] State Almazov's Heart, Blood and Endocrinology Center, St. Petersburg, Russia,

[2] Pavlov's Medical University, St. Petersburg, Russia,

[3] State St. Petersburg University, St. Petersburg, Russia

Background: Pulmonary artery hypertension (PAH), a life-threatening illness with a poor outcome, could be considered as an independent extra-stressor, and an additional reason of negative impact on patient's psycho-emotional well-being. Due to the significant incidence of comorbid psychiatric conditions, our aim was to assess affective disorders, the ability to adapt, quality of life (QOL) in PAH patients. Data were available for 18 patients (16 female, 2 male, age, 46 ± 4.1 years) with PAH (WHO II–II functional class, idiopathic and related to collagen vascular disease as 70% : 30% cases).
Methods: Echocardiogram, right-heart catheterization and 6-minute walk test (6WT) were performed. Depression, anxiety and alexithymia were assessed using Zung's, Spielberger and Toronto Alexithymia self-rating scales. QOL, coping skills and life with PAH managing styles were examined using SF-36, Heim's and LSI questionnaires.
Results: The pulmonary artery and mean right atrial pressure, cardiac output were 100/37 ± 6/3 mmHg, 8 ± 2 mmHg, 3.9 ± 0.2 L/min, respectively; 6WT was 364 ± 21 m. The dominant PAH patient's personal characteristics were minimal alexithymia and evident anxiety (high-level in 62.5%, moderate in 31.3% cases). The absence of depression in this population could possibly be associated with the self-rating of depressive symptoms. The cumulative impact of somatic and anxiety disorders was revealed in PAH patient's prevailing of inefficient psycho-behavioral security style (distress"negation"strategy mean score 71 ± 8,2‰ (56% cases) and inadequate dominant emotional coping model ("optimism", 56% cases). QOL was low in SF-36 physical and emotional domains and was significantly associated with 6WT distance ($r = 0.61$; $p < 0.01$).
Conclusions: Anxiety for pulmonary artery hypertension patients is an important comorbidity. This psychiatric comorbidity is evident in patient's quality of life impairment and negative consequences for their stress-managing strategies and active coping process.

ACUTE PULMONARY EMBOLISM (APE) – MANAGEMENT AND SHORT-TERM OUTCOME. ANALYSIS OF CONSECUTIVE 353 CASES IN 3-YEAR SINGLE-CENTER EXPERIENCE

LABYK A[1], PEDOWSKA-WLOSZEK J[1], PACHO S[1], PALCZEWSKI P[2], DUL P[2], CIURZYNSKI M[1], RZEWUSKA E[1], KOCZAJ-BREMER M[1], KURNICKA K[1], JANKOWSKI K[1], KOSTRUBIEC M[1], PRUSZCZYK P[1]

[1] Department of Internal Medicine and Cardiology, The Medical University of Warsaw, Lindleya 4, Warsaw, Poland,

[2] 1st Institute of Clinical Radiology, The Medical University of Warsaw, Lindleya 4, Warsaw, Poland

Background: Analysis of clinical characteristics, management and short-term outcome of patients with acute pulmonary embolism (APE), diagnosed and treated in one center.

Methods: Analysis of 353 clinical course of consecutive patients (pts), 141 M, 212 F, (mean age 64.7 ± 18.12 yrs) with APE confirmed by contrast enhanced multidetector computed tomography, diagnosed and treated in a referral hospital between 2007 and 2010.
Results: High (HR), intermediate (IR) and low (LR) APE early mortality risk groups were defined according to recent ESC guidelines. HR, IR and LR groups included: 23 pts (10 M, 13 F, aged 70.13 + 16.95 yrs), 146 pts (61 M, 85 F, aged 65.77 ± 17.74 yrs), and 184 pts (70 M, 114 F, aged 63.17 ± 18.45 yrs), respectively. Majority of pts (91.8%) were anticoagulated only with UHF or LMWH, thrombolysis was used in 24 pts: 39.1% of HR group, 8.9% of IR and 1% of LR pts. However, 5 IR pts (3.42%) were enrolled in PEITHO study and randomly received tenecteplase or UFH. Overall in-hospital mortality rate was 7% (with APE related 5.4%), and in HR 65.2% (43.5%), IR 6.2% (4.1%), LR 2.2% (1.3%) respectively. However, 4 of 9 HR thrombolyzed pts died (mortality rate of HR thrombolyzed was 44.4%), while in non-thrombolyzed HR pts mortality reached 55.5%. Strong prognostic factors of overall in-hospital mortality were: age [OR 1.07 (95% CI 1.02–1.12)], heart rate [OR 1.04 (95% CI 1.02–1.06)] and creatinine concentration [OR 3.65 (95% CI 1.62–8.27)] that was also a significant mortality prognostic factor in LR group [OR 3,9 (95% CI 1,6–9,8)]. NT-proBNP and troponin I plasma concentration were significantly higher in patients who died.
Conclusions: Not only advanced age and hemodynamic status, but also creatinine, NT-proBNP, and troponin I levels are strong prognostic factors of early in-hospital mortality of patients with APE. Due to a high mortality rate in non-thrombolyzed high risk patients, their therapy should be more aggressive, and contraindication for such fibrinolysis should be less restrictive.

IMPEDANCE CARDIOGRAPHY IS INACCURATE IN THE ASSESSMENT OF CARDIAC OUTPUT IN PAH PATIENTS

LESNY P, LISKA B, LUKNAR M, GONCALVESOVA E
National Institute of Cardiovascular Diseases, Pod Krasnou Horkou 1, Bratislava, Slovak Republic

Background: Cardiac output (CO) is the best predictor of prognosis in patients with pulmonary arterial hypertension (PAH). There is a need of accurate noninvasive assessment of CO in PAH patients (pts). The role of ICG in PAH pts has not been clarified yet.
Aim: To compare the measurement of CO using ICG (COI) and thermodilution methods (COT) in pts with PAH and in pts with left-sided heart failure and pulmonary venous hypertension (PVH).
Patients and methods: Two groups of pts were evaluated. The heart failure (HF) group consisted of 30 pts with left-sided heart failure and pulmonary venous hypertension. The PAH group involved 35 pts with pulmonary arterial hypertension. PAH pts had higher pulmonary pressures than HF pts (79/35/52 mmHg vs 51/29/38 mmHg for systolic/diastolic/mean, $p < 0.05$). All patients were examined by COI and COT in one session. Correlation of ICG with standard thermodilution method was assessed by Bland-Altman statistical analysis for evaluation of agreement of two methods. Acceptable error of COI was defined as less than 15% deviation from the average difference in COT and COI.
Results: In pts with HF, the average CO as assessed by thermodilution and by ICG was 3.1 ± 1.1 L/min and 3.3 ± 1.4 L/min, resp., and in PAH pts 4.7 ± 1.4 L/min and 3.9 ± 1.0 L/min, resp. There was a substantially better correlation of COI with COT in HF than in PAH ($r = 0.86$, $p < 0.001$, vs $r = 0.50$, $p = 0.003$, resp.). At the accepted COI deviation threshold of 15% from the average difference COI and COT, 77% of measurements in HF pts were accurate in comparison with only 36% accurate measurements for PAH pts.
Conclusion: In contrast to HF, ICG is not accurate enough for CO assessment in PAH. Causes of this finding are not clear. Speculations can be made regarding the impact of pulmonary artery branches dilation or small pulmonary arterioles obliteration in pts with advanced PAH which can affect the thoracic impedance.

ABLATION OF ARRHYTHMIA SUBSTRATE IN PULMONARY HYPERTENSIVE PATIENTS – IS ACUTE SUCCESS NECESSARY FOR LONG-TERM BENEFIT?

LODZINSKI P[1], ZYLKOWSKA J[2], KOZLUK E[1], KURZYNA M[2], KILISZEK M[1], PIATKOWSKA A[1], FIJALKOWSKA A[2], TORBICKI A[2], OPOLSKI G[1]
[1] *Medical University of Warsaw, Banacha 1a, Warsaw, Poland,*
[2] *National Tuberculosis and Lung Diseases Research Institute, Plocka 26, Warsaw, Poland*

Pulmonary hypertension (PH) may be caused by different pathologies, however undoubtedly leads to significant changes in right-heart anatomy and function. Thus it may result in increased incidence of supraventricular arrhythmia which may worsen patients' clinical status. The aim of the study was to present results of ablation of arrhythmia substrate in PH patients.
Eleven consecutive patients (2 men, aged 42.6 ± 14) with PH were qualified to radiofrequency ablation (ARF) due to recurrent symptomatic arrhythmia: atrial tachycardia (AT) – 3 pts, AVNRT – 3 pts, typical AFl – 2 pts, AT coexistent with AFl – 3 pts. Before ablation 1 pt presented symptoms of NYHA class II, 9 pts NYHA class III and one NYHA class IV.
Except for AVNRT cases, electroanatomical mapping system was used to perform ARF. Transseptal puncture was abandoned due to a high risk of refractory hypoxemia in the course of uncontrolled right to left shunt. Six patients underwent ARF of all arrhythmias inducible in EP-study [successful RF group – all AVNRT, one AFl, one AFl and AT, one AT ablation (right atrial roof)]. In one patient with AT concealed accessory pathway (right posterior) was successfully ablated despite of AT ablation failure. In 2 AFl patients at least one of arrhythmia variants was not isthmus dependent and right-sided mapping of AFl circuit failed. In 2 of AT patients only slow pathway modification was performed due to inability of ablation in left atrium.
In 8 of 11 patients (5 with successful ARF and 3 with ARF failure) clinical status improved after ARF. In others NYHA class did not change. Despite the suboptimal acute effect of ARF in two patients, no arrhythmia recurrence was observed during 12-month follow-up. In one AT patient with not complete ARF, there was only a single recurrence of arrhythmia and the reduction NYHA class – from class III to II persisted.
Conclusion: RF ablation of arrhythmia substrate in pulmonary hypertensive patients is eligible and seems to be beneficial even without complete ablation of all arrhythmias induced during EP-study.

PULMONARY ARTERIAL VS VENOUS HYPERTENSION – ECG COULD HELP

LUKNAR M, LESNY P, KUCEROVA D, GONCALVESOVA E
National Institute for Cardiovascular Disease, Pod Krasnou Horkou 1, Bratislava, Slovak Republic

Background: One of essential diagnostic steps in pulmonary hypertension (PH) is to distinguish pulmonary arterial (PAH) from venous (PVH) hypertension due to left ventricular (LV) diastolic dysfunction. It can be accomplished through right-heart catheterization (RHC) that is not feasible for all pts. Noninvasive tools reducing the need for RHC are needed.
Aim: To determine if ECG at the initial examination in pts with a suspicion on PH can distinguish between PAH and PVH.
Patients and methods: Pts with clinical and echo suspicion on PH were retrospectively evaluated. Pts (n = 17.1 male) with PVH established by RHC were compared to their PAH counterparts (n = 17.4 male). Age, WHO class, mean pulmonary arterial pressure (38 ± 8.1 vs 41 ± 6.8 mm Hg), and LV ejection fraction were similar in the groups. ECG criteria for PH were identified and frequency of positive findings was compared using Student's t-test or Fisher's exact test.
Results: In PAH group, there was a higher prevalence of the following: $R/S > 1$ in V1 (52.9 vs. 0.0%, $p < 0.01$, positive (PPV) and negative (NPV) predictive values 100.0 and 68.0%, resp.), R in V1 + S amplitude in V5 or V6 > 1.05 mV (41.2 vs. 0.0%, $p < 0.05$), prolonged intrinsicoid deflection (35.3 vs 0.0%, $p = 0.03$), and RV strain (70.6 vs. 0.0%, $p = 0.002$, PPV and NPV 100.0 and 77.3%, resp.). In PAH, there was a significant rightward shift of the QRS electrical axis relative to PVH group (81.8 ± 66.4° vs 15.4 ± 45.2°, $p = 0.002$). There was no difference in P characteristics, presence of R in V1 ≥ 0.7 mV, qR in V1, R/S in V5 or V6 ≤ 1, rSr' in V1 with R' ≥ 1.0 mV, and a combined parameter of RV hypertrophy between the groups. Prevalence of at least one of the signs was higher in PAH group (88.2 vs 23.5%, $p < 0.05$).
Conclusion: In this specific population, presence of ECG criteria of PH can raise suspicion on PAH and shift clinical decision towards RHC. Absence of the abnormalities seems to indicate PVH. Exact assessment of diagnostic accuracy in this setting requires further evaluation.

EFFICACY AND SAFETY OF SILDENAFIL TREATMENT OF PULMONARY HYPERTENSION IN HEART TRANSPLANT RECIPIENTS – A SINGLE-CENTER, CASE-CONTROL STUDY

MARUSZEWSKI M, ZAKLICZYNSKI M, SWIERAD M, ZEMBALA M
Silesian Center for Heart Diseases, Szpitalna 2, Zabrze, Poland

Background: Heart transplantation is the best treatment option for patients with end-stage heart failure. Elevated left ventricular end-diastolic and atrial pressures may cause pulmonary venous hypertension, increased resistance and pulmonary pressures. Anesthesia and transplant procedure pose significant risk for patients with pulmonary hypertension (PH) and require optimal donor/recipient matching and extensive treatment. Otherwise, right ventricular failure may result in primary graft and early transplant failure. Novel vasodilators have opened new avenues in the management of PH.

Methods: This is a retrospective analysis of transplant outcomes in PH recipients treated perioperatively with oral sildenafil (n-37, A), compared to transplant recipients with PH (n-37, B) who have undergone transplantation without sildenafil treatment in a single center between 2005–2009. The groups were matched for gender, age, incidence of chronic obstructive pulmonary disease, and left ventricle ejection fraction. Early results of heart transplantation were evaluated to assess the efficacy and safety of sildenafil treatment of heart transplant recipients with PH.
Results: There were no significant differences between the groups (A vs B, respectively) in: mean ischemic time (204 ± 68 vs 185 ± 58 min), operative technique, duration of surgery (428 ± 96 vs 456 ± 210 min), and the rate of acute rejection (38 vs 27%), mechanical circulatory support, and transplanted heart bradycardia. Duration of ventilation, intensive care unit, and hospital stay was significantly longer in group A ($p < 0,05$). None of the patients treated perioperatively with sildenafil died of right ventricular failure vs 4 from group B patients. The mortality rate in group A was 8% vs 19% in group B (p – NS).
Conclusions: Perioperative sildenafil treatment in patients with PH may improve short-term results of orthotopic heart transplantation by minimizing the risk of post-transplant right ventricular failure in this group of patients.

PH IN ADVANCED HEART FAILURE AND IN HEART TRANSPLANT CANDIDATES

MELENOVSKY V, AL HITI H, MALEK I, KETTNER J, KAUTZNER J
Institute for Clinical and Experimental Medicine – IKEM, Videnska 1958/9, Prague, Czech Republic

Pulmonary hypertension (PH) occurs in up to 70% of patients with a moderate to advanced heart failure (HF), affecting adversely right ventricular function, exercise capacity, survival and choices of therapeutic options. Pulmonary hypertension in HF is often post-capillary – i.e. due to transmission of elevated LV filling pressure into pulmonary circulation. However, up to a third of patients develop prominent elevation of pulmonary vascular resistance (PVR). Why PVR increases only in some HF patients remains poorly understood. Structural remodeling of pulmonary vasculature or increased vascular tone due to enhanced endothelin or diminished nitric oxide effects were implicated. Recent data from our group also pointed to a critical role of diminished transpulmonary cGMP release. Elevated PVR is one of the strongest predictors of adverse peritransplant outcome due to a high risk of right-heart failure of the graft, suddenly exposed to high-resistance pulmonary vascular tree. There is a growing evidence that even "fixed" PVR elevation in many HF patients is eventually reversible after a prolonged left ventricular unloading or with a specific pharmacotherapy. Recent introduction of PDE5A inhibitors and left ventricular assist devices at our institution has changed the management of high-PVR heart transplant candidates and allowed successful transplantation even in those who used to be refused due to unacceptable PVR values.

PULMONARY ENDARTERECTOMY FOR CHRONIC THROMBOEMBOLIC PULMONARY HYPERTENSION: A SINGLE-CENTER 16-YEAR EXPERIENCE

MORSOLINI M[1], NICOLARDI S[1], MATTIUCCI G[2], BERWICK D[2], SILVAGGIO G[2], D'ARMINI AM[2], VIGANÒ M[2]
[1] Foundation I. R. C. C. S. "San Matteo" Hospital, University of Pavia, Department of Surgery, Piazzale Golgi, 2, Pavia, Italy,
[2] Foundation I. R. C. C. S. "San Matteo" Hospital, University of Pavia, Division of Cardiac Surgery, Piazzale Golgi, 2, Pavia, Italy

Background: Chronic thromboembolic pulmonary hypertension (CTEPH) is a progressive and potentially lethal disease due to the incomplete resolution of organized pulmonary emboli, leading to progressive right-heart failure. Pulmonary endarterectomy (PEA) has been largely recognized as the treatment of choice. We hereby describe our 16-year experience with PEA.
Methods: From April 1994 to March 2010, 283 PEAs were performed at our center. As our referral increased substantially over years, we became more confident of the procedure. Thus the operability rate rose from 74% (year 2004) to 89% (year 2009). The mean age at PEA was 56 ± 16 (11–84), and 26.1% of patients were older than 70 years. Patients were preoperatively in WHO functional class II (6.0%), III (45.9%) or IV (48.1%), and 60.1% presented with severe right-heart failure despite full medical therapy.
Results: Early postoperative results were all significant ($p < 0.001$): pulmonary vascular resistance drop (301 ± 194 vs 1 051 ± 505 dyn · s · cm^{-5}), cardiac output improvement (5.1 ± 1.3 vs 3.5 ± 1.2 L/min), severe tricuspid regurgitation reduction (16.4% vs 70.8% of patients) and arterial oxygen pressure increase (78 ± 11 vs 65 ± 11 mmHg). Hemodynamic results were excellent in both younger and older than 70-year-old patients. Overall operative mortality was 8.5%. Operative mortality of WHO II, III and IV patients was 0%, 3.9% and 13.9% respectively. Overall survival after PEA was 89%, 87%, 86%, 83%, 79% and 79% at 1, 3, 5, 7, 10 and 15 years respectively.
Conclusions: As shown by our results, PEA is a highly effective procedure. Hemodynamic and respiratory results are remarkable and durable. Mortality rate after the first postoperative year is comparable with that of the age-matched general population. Patients diagnosed with CTEPH, even if older than 70 years or in WHO functional class II, should be referred early to centers experienced in PEA to achieve best results.

CARDIOPULMONARY BYPASS STRATEGY AND CEREBRAL PROTECTION MANAGEMENT DURING PULMONARY ENDARTERECTOMY: A SINGLE-CENTRE 16-YEAR EXPERIENCE

MORSOLINI M[1], NICOLARDI S[1], MATTIUCCI G[2], BERWICK D[2], SILVAGGIO G[2], D'ARMINI AM[2], VIGANÒ M[2]
[1] Foundation I. R. C. C. S. "San Matteo" Hospital, University of Pavia, Department of Surgery, Piazzale Golgi, 2, Pavia, Italy,
[2] Foundation I. R. C. C. S. "San Matteo" Hospital, University of Pavia, Division of Cardiac Surgery, Piazzale Golgi, 2, Pavia, Italy

Background: In CTEPH, to achieve a true pulmonary endarterectomy (PEA) with the complete removal of all thrombotic materials, a bloodless surgical field is mandatory. The original technique uses a single deep hypothermic circulatory arrest (HCA) for each side, combined with aortic cross clamping. However, during our 16-year experience, we adopted alternative strategies.
Methods: From April 1994 to March 2010, 283 patients underwent PEA. We started according to the original technique (Group A 83 patients), except to leave unclamped the aorta. Since 2003 we began to perform shorter (10–15 min) periods of intermittent deep HCA followed by short periods of reperfusion (Group B 70 patients). Then we combined intermittent periods of HCA with moderate instead of deep hypothermia (Group C 91 patients). Finally, we modified again performing shorter periods of HCA (7 min) to reduce the neurological invasiveness further (Group D 39 patients). In this study we analyzed postoperative outcomes according to these different strategies.
Results: Patients characteristics changed during the study period as they became older (52 ± 15, 56 ± 16, 60 ± 15 and 62 ± 16 years old for Group A, B, C and D respectively), while preoperative hemodynamic impairment was the same in the 4 Groups. Operative parameters analysis reflected the changes in our strategy. Number of periods of HCA increased significantly during the study period (2 ± 1.4 ± 1.9 ± 4 and 13 ± 5) as did also the total HCA time (26 ± 15, 51 ± 29, 86 ± 36 and 86 ± 40 min). Despite age and longer total HCA time, patients of Group C and D had a better outcome in terms of time of mechanical ventilation, need for tracheostomy, incidence of infections, multi-organ failure, neurological events and operative mortality.
Conclusions: Short periods of intermittent HCA during moderate hypothermia seem to guarantee a better combination of surgical accuracy and cerebral protection, thus allowing for favorable postoperative outcomes. Therefore we support such strategy as a technique of choice during PEA.

CHRONIC THROMBOEMBOLIC PULMONARY HYPERTENSION: ASSESSING PULMONARY ENDARTERECTOMY OUTCOMES WITH MRI

NG B[1], McNEIL K[1], CHAMBERS D[1], SLAUGHTER R[1], DUNNING J[2], HOPKINS P[1], KERMEEN F[1]
[1] The Prince Charles Hospital, Rode Road, Brisbane, Australia,
[2] Papworth Hospital, Everard, Cambridge, U.K.

Magnetic resonance imaging (MRI) is a useful modality for assessing chronic thromboembolic pulmonary hypertension (CTEPH) before pulmonary endarterectomy (PEA). Cardiac MRI provides more accurate right ventricular (RV) data than echocardiography. MR angiography demonstrates vascular changes reliably to a segmental level and MR perfusion shows disease distribution.
Aim: To examine the relationship between changes in MRI parameters with clinical and hemodynamic outcomes post-PEA.

Methods: RV end-diastolic volume (RVEDV), RV ejection fraction (RVEF), vessel abnormalities and lobar perfusion defects were determined with MRI before and after PEAs performed during 2004–2007. Changes in New York Heart Association (NYHA) functional class, six-minute walk distance (6MWD), mean pulmonary artery pressure (mPAP) and cardiac output (CO) were collected retrospectively from patient charts.
Results: Nineteen patients assessed pre-PEA were of mean ± SD age 57 ± 12 years, NYHA class 2.8 ± 0.7, 6MWD 414 ± 103 m and mPAP 42 ± 10 mmHg. Immediately post-PEA, mPAP fell by 13 ± 7 mmHg which was related to changes in RVEDV of 26 ± 15% ($r^2 = 0.38$, $p = 0.006$). At 6–12 months post-PEA, 6MWD improvement (115 ± 99 m) was related to changes in RVEF of 28 ± 49% ($r^2 = 0.40$, $p = 0.007$) but angiographic changes had a weak relationship with NYHA class shift ($r^2 = 0.22$, $p = 0.034$). Perfusion generally improved after PEA relating weakly with RVEDV ($r^2 = 0.3$, $p = 0.032$) but not clinical outcomes.
Conclusions: This study shows that improvements in MRI parameters (RV data more than angiographic findings) after PEA correspond to clinical and hemodynamic outcomes. We have demonstrated a useful imaging test for monitoring patients post-PEA with no radiation exposure.

ACUTE PULMONARY HYPERTENSIVE CRISIS IN A PATIENT RECENTLY DIAGNOSED WITH BREAST ADENOCARCINOMA

NG B[1], SIVAKAMARAN P[2], KERMEEN F[1]
[1] *The Prince Charles Hospital, Rode Road, Brisbane, Australia,*
[2] *Gold Coast Hospital, Nerang Street, Gold Coast, Australia*

Case: We report the case of a 48 year old woman who presented with a two week history of rapidly progressive dyspnea associated with a dry cough. The patient was diagnosed with a right breast adenocarcinoma only ten days prior to her emergency department presentation and was awaiting staging CT scans. A CT pulmonary angiogram (CTPA) was performed in view of the patient's profound hypoxia and New York Heart Association Class IV functional class symptoms. Anticoagulation was commenced after multiple bilateral filling defects were demonstrated at the sub-segmental arterial level only. Unfortunately, the patient continued to deteriorate with worsening hypoxia, wedged shaped opacities on imaging and right ventricular failure. Echocardiogram confirmed severe pulmonary hypertension with severe right ventricular dysfunction and a right ventricular systolic pressure greater than 75 mmHg that was incongruous with her working diagnosis of small peripheral thrombotic pulmonary emboli. Treatment for her acute pulmonary hypertensive crisis was attempted with intravenous epoprostenol but hemodynamic compromise persisted leading to eventual death. Limited autopsy revealed extensive tumour microemboli in small pulmonary arteries as well as involvement in the cardiac microvasculature.
Discussion: Ante-mortem diagnosis of tumour microemboli is notoriously difficult as illustrated in this case. CTPA does not distinguish thrombotic from non-thrombotic pulmonary emboli reliably. Tumour microemboli are a rare cause of an acute pulmonary hypertensive crisis.

PULMONARY ENDARTERECTOMY IN UNILATERAL PULMONARY ARTERY OCCLUSION: A SINGLE-CENTER EXPERIENCE

NIERLICH P[1], HODA MA[1], AUGUSTIN V[1], GHANIM B[1], LANG I[2], AIGNER C[1], LANG G[1], JAKSCH P[1], TAGHAVI S[1], KLEPETKO W[1]
[1] *Department of Surgery, Division of Thoracic Surgery, Medical University Vienna, Währinger Gürtel 18-20, Vienna, Austria,*
[2] *Department of Internal Medicine, Division of Cardiology, Medical University Vienna, Währinger Gürtel 18-20, Vienna, Austria*

Background: Unilateral total pulmonary artery (PA) occlusion is a rare finding. Its etiology includes chronic thromboembolic (CTEPH), tumorous and systemic inflammatory diseases. This retrospective study aims to analyze incidence and clinical course of this entity in an institutional cohort of patients referred for pulmonary endarterectomy (PEA).
Methods: Nine patients (6 women and 3 men, mean age 36.4 ± 12.1 – range 20 to 56) with a unilateral total PA occlusion were identified among 162 patients referred for PEA between 1992 and 2008 (incidence 6.2 %). All occlusions were on the right side. Etiology was CTEPH in 6 patients, angiosarcoma of the PA in 2 and Takayasu's arteritis in 1 patient.
PEA was performed in 6 patients (including rePEA in one patient) and was accompanied by lobectomy in 1 patient with aspergilloma. Two of the remaining patients underwent angiosarcoma resection and a biopsy was taken in one patient.
Results: Seven patients are alive with a mean follow-up of 49.8 ± 40.1 months (11 to 109, median 42). Five patients with primary PEA had an excellent hemodynamic improvement; the patient with rePEA had partial reopening of the PA and died on the lung transplant waiting list. The 2 patients with angiosarcoma had complete reopening of the PA, underwent adjuvant chemoradiotherapy, one of them died 24 months after operation. The patient with Takayasu's arteritis was treated with immunosuppressive therapy.
Conclusions: Unilateral total PA occlusion is a rare finding which needs a thorough preoperative workup. Operative therapy is warranted due to good long-term results.

SURGICAL MANAGEMENT AND OUTCOMES OF PATIENTS WITH CTEPH: A SINGLE-CENTER EXPERIENCE WITH 160 PEAs

NIERLICH P[1], HODA MA[1], AUGUSTIN V[1], GHANIM B[1], LANG I[2], SKORO-SAJER N[2], TAGHAVI S[1], KLEPETKO W[1]
[1] *Department of Surgery, Division of Thoracic Surgery, Medical University Vienna, Währinger Gürtel 18-20, Vienna, Austria,*
[2] *Department of Internal Medicine, Division of Cardiology, Medical University Vienna, Währinger Gürtel 18-20, Vienna, Austria*

Background: Pulmonary endarterectomy (PEA) is established as a standard surgical treatment improving outcome in patients with chronic thromboembolic pulmonary hypertension (CTEPH). The aim of this retrospective study was to present a single-center record, where growing experience led to improved survival.
Methods: Between 1992 and 2009, a total of 160 patients (80 female and 80 male, mean age 52.61 ± 14.87 years, range 13–84 years) underwent pulmonary endarterectomy at our institution. Of those, 57 patients (51.9%) underwent PEA between 1992–2000 (the early group) and 103 patients (48.1%) were operated between 2001–2009 (the recent group). All patients had a history of dyspnea or respiratory distress.
Results: Patient's age, circulatory arrest time and ICU stay were comparable in both groups. A mean follow-up time was 2 315 days ± 1 658 days. Preoperative pulmonary vascular resistance was significantly higher in the early group (984.44 ± 452 vs 668.21 ± 294 dyn · s · cm^{-5}, $p = 0{,}003$). A postoperative improvement of hemodynamic parameters compared to preoperative values was achieved in all operated patients. Overall perioperative mortality rate decreased from the initial 15.8% to the recent 3.9%. One-year survival increased from 75% (1993–2000) to 89.8% (2002–2008). The main causes of death were right-heart failure ($n = 6$) and bleeding ($n = 2$) in the early group and multi-organ failure ($n = 2$) in the recent group.
Conclusions: Growing experience, preoperatively better candidate selection, improved preoperative drug treatment and pre- and postoperative bridging possibilities resulted in improved outcome in patients undergoing PEA at our institution. For this reason, this demanding procedure should be performed in experienced centres.

FORMATION OF PLEXIFORM LESIONS IN EXPERIMENTAL SEVERE PULMONARY ARTERIAL HYPERTENSION

OKA M[1], ABE K[1], ALZOUBI A[1], TOBA M[1], ITO M[1], FAGAN KA[2], COOL CD[2], VOELKEL NF[3], MCMURTRY IF[1]
[1] *University of South Alabama, 3158 MSB, Mobile, USA,*
[2] *University of Colorado, 12631 East 17th Avenue, Aurora, USA,*
[3] *Virginia Commonwealth University, 2529 Professional Road, Richmond, USA*

The plexiform lesion is the hallmark of severe pulmonary arterial hypertension (PAH). However, its genesis and hemodynamic effects are largely unknown due to limited availability of samples from PAH patients and lack of appropriate animal models. We investigated whether rats with severe progressive PAH developed plexiform lesions. After a single subcutaneous injection of the VEGF receptor blocker, SU5416, rats were exposed to hypoxia for 3 wks. They were then returned to normoxia for additional 10 wks. Hemodynamic and histological examinations were performed at 0 (control), 5, 8, and 13 wks after the SU5416 injection. All but control rats developed severe PAH. Right ventricular systolic pressure value reached its maximum (~100 mmHg) at 5 wks after SU5416 injection and stayed at about the same high level thereafter. However, cardiac index decreased over time, thus calculated total pulmonary vascular resistance tended to increase at 13 wks after SU5416 compared to the 5-wk time point, indicating the pulmonary vascular disease was still progressing. Over time**,** the SU5416/hypoxia/normoxia-exposed severe PAH rats sequentially showed various types of histological changes in the pulmonary arteries that follow the Heath-Edwards classification (Grades 1-4), including plexiform-like complex lesions. There were two patterns of

complex lesion formation: a lesion forming within the vessel lumen (stalk-like) and another that projected outside the vessel (aneurysm-like). Immunohistochemical analyses showed these structures had cellular and molecular features closely resembling human plexiform lesions. In conclusion, severe, sustained pulmonary hypertension in a very late stage of the SU5416/hypoxia/normoxia-exposed rat is accompanied by formation of lesions that are indistinguishable from the pulmonary arteriopathy of human PAH. This unique model provides a new and rigorous approach for investigating the genesis, hemodynamic effects, and reversibility of plexiform and other occlusive lesions in PAH.

SIX-MONTH ECHOCARDIOGRAPHIC AND TOMOGRAPHIC EVALUATION AFTER ACUTE PULMONARY EMBOLISM

PACHO S, PEDOWSKA-WŁOSZEK J, ŁABYK A, LICHODZIEJEWSKA B, ILNICKA E, DUL P, WOJCIECHOWSKI A, CIURZYŃSKI M, KURNICKA K, KOSTRUBIEC M, JANKOWSKI K, PRUSZCZYK P

Medical University of Warsaw, Lindleya 4, Warsaw, Poland

Objectives: Assessment of incidence of pulmonary hypertension (PH) assessed by echocardiography in patients six months after acute pulmonary embolism (APE) and comparison with thromboembolic resolution evaluated by contrast enhanced multi-slice computed tomography imagining (MSCT).

Methods: Retrospective analysis of echocardiographic outcome of 75 patients (45 females, 30 males aged 58.33 ± 19.9) after APE treated in our department in the years 2007–2009 and comparison to results of MSCT exams performed 6 months after the onset of pulmonary embolism.

Results: We observed a group of 75 patients diagnosed with APE for a period of six months of controlled anticoagulation. MSCT exams were performed with 64 row Toshiba Aquilion scanner and for echocardiographic exams Philips IE 33 was used. After six months of anticoagulation 9 patients had shortened acceleration time (AcT < 80 ms), 18 patients had tricuspid regurgitation peak gradient (TRPG) exceeding 31 mmHg, suggesting pulmonary hypertension. Interestingly, shortened AcT was found in 3 patients with normal AcT at acute phase APE. Both AcT < 80 ms and TRPG ≥ 31 mmHg were observed in 5 patients. Echocardiographic signs of pulmonary hypertension did not correspond with MSCT imagining results – patients with echocardiographic signs of PH had no remnant pulmonary artery thrombi, while 4 patients with residual thrombi in pulmonary arteries presented no signs of right ventricle overload and PAH.

Conclusions: In six-month observation of patients after APE it is suggested to perform echocardiographic and CT imagining in order to fully assess the results of therapy.

DIFFERENCES IN THE CLINICAL MANIFESTATION OF PULMONARY EMBOLISM ACCORDING TO THE AGE OF PATIENTS

PEDOWSKA-WŁOSZEK J[1], ŁABYK A[1], PACHO S[1], ILNICKA E[2], WOJCIECHOWSKI A[2], CIURZYŃSKI M[1], RZEWUSKA E[1], JANKOWSKI K[1], KOSTRUBIEC M[1], PRUSZCZYK P[1]

[1] Department of Internal Medicine and Cardiology, The Medical University of Warsaw, Lindleya 4, Warsaw, Poland

[2] 1st Department of Clinical Radiology, The Medical University of Warsaw, Lindleya 4, Warsaw, Poland

Background: Acute pulmonary embolism (APE) may cause various, often not characteristic clinical symptoms. The most frequent ones are dyspnea and chest pain. In many cardiovascular diseases the clinical picture depends on the age of patients. However, there are only a few studies assessing differences in the clinical manifestations of APE in respect to the age of APE pts.

Aim: The aim of our study was to assess potential differences in the clinical manifestation of APE according to the age of pts.

Material and methods: We evaluated 358 consecutive pts with APE confirmed by sCT, treated in a single institution between 2007–2009, 145 males, 213 females. Patients were divided into four age groups. Group A consisted of pts at the age < 40, n = 49 (F – 18, M – 31), group B pts aged between 41–60, n = 71(F – 32, M – 39), group C pts aged between 61–80, n = 172 (F – 116, M – 56) and group D pts > 80, n = 66 (F – 47, M – 19). We studied clinical symptoms on admission: especially chest pain, character of pain, dyspnea, syncope, hemoptysis and fever. Moreover, we assessed the presence of parenchymal consolidations in sCT.

Results: Pts from A group vs D group more frequently had chest pain ($p = 0{,}007$), especially pleuritic pain ($p = 0.025$) (Table). Moreover, pts from A group vs C frequently had dyspnea ($p = 0.034$) and hemoptysis ($p = 0.021$). Pts from A group vs C more often had parenchymal consolidations in sCT ($p = 0.026$). There was no difference in presence of syncope, anginal pain and fever.

	Signs				
Age group	**A (≤ 40; n = 49)**	**B (41–60; n = 71)**	**C (61–80; n = 172)**	**D (≥ 81; n = 66)**	***P***
Dyspnea	73%	83%	88%	84%	A vs C $p = 0{,}034$
Chest pain	58%	49%	39%	29%	A vs D $p = 0{,}007$
Anginal pain	6%	6%	20%	12%	NS
Pleuritic pain	43%	34%	21%	19%	Avs D $p = 0{,}025$
Syncopa	27%	20%	26%	28%	NS
Fever	13%	11%	7%	12%	NS
Hemoptysis	16%	7%	4%	6%	A vs C $p = 0{,}021$
Computed tomography					
Parenchymal consolidations	61%	38%	30%	40%	A vs C $p = 0{,}026$

Conclusion: Clinical manifestation of APE may depend on the age of a patient. Younger as compared with older pts more frequently had symptoms of lung disorders (pleuritic pain, hemoptysis and parenchymal consolidations). Thus pulmonary embolism should be taken into account especially among younger pts with a clinical suspicion of pneumonia.

PULMONARY ENDARTERECTOMY FOR PROXIMAL CTEPH NOT IN EVERY CASE

PISZKO P[1], LEWCZUK J[2], ROMASZKIEWICZ R[1], JAGAS J[1], MAZIJ M[1], KONIECZNY A[1], LENARTOWSKA L[1], NOWAK M[1], CISOWSKA M[1], BŁASZCZYK D[1]

[1] Cardiology Dpt, County Hospital, Research and Development Center, Kamienskiego 73a, Wroclaw, Poland,

[2] Faculty of Health Science, Pasteura 4, Wroclaw, Poland

Background: Pulmonary endarterectomy is a treatment of choice for proximal CTEPH, however, patients with mean pulmonary artery pressure (MPAP) < 30 mmHg are probably not candidates for surgery and some others with MPAP > 30 mmHg improve functionally and refuse operation during the first 6 months of anticoagulation. The distant results of functional status, pulmonary hemodynamics and echocardiography in these patients are not well-known.

Material and methods: Functional NYHA class, pulmonary hemodynamics (PASP, MPAP, RVED, MRAP) and echocardiography (AcT, Doppler dPASP, RVED) were assessed before and after mean 5.1 (1–10) years of anticoagulation in 7 proximal CTEPH patients (3 males, 4 females) aged 42–70 years with MPAP 26 to 38 mmHg.

Results:

	PASP, mmHg	**MPAP, mmHg**	**MRAP, mmHg**	**PADP, mmHg**	**dPASP, mmHg**	**RVED, mm**	**AcT, ms**	**NYHA class**
Before	53.6	31.1	10.5	18.0	49.4	29.4	76.8	II–III
After	25.6	16.7	5.8	11.1	25.0	22.7	109.3	I
P value	0.0008	0.001	0.004	0.4	0.0001	0.005	0.0007	0.0088

Summary: Patients with proximal CTEPH with MPAP < 30 mmHg and with MPAP > 30 mmHg who improved their functional status during the first 6 months of anticoagulation seem not to require pulmonary endarterectomy.

LONG TERM CLINICAL COURSE OF CTEPH NOT PRECEDED BY THROMBOEMBOLIC EPISODE(S)

PISZKO P[1], ROMASZKIEWICZ R[1], LEWCZUK J[2], LENARTOWSKA L[1], JAGAS J[1], MAZIJ M[1], BŁASZCZYK D[1], CISOWSKA M[1], NOWAK M[1]

[1] Cardiology Dpt, County Hospital, Research and Development Center, Kamienskiego 73a, Wroclaw, Poland,

[2] Faculty of Health Science, Medical University, Pasteura 4, Wroclaw, Poland

Background: Long term clinical course of chronic thromboembolic pulmonary hypertension (CTEPH) with no history of thromboembolism is not well-known.

Material and methods: Clinical, echocardiographic and hemodynamical assessment of a 50-year-old male with 3-year history of dyspnea on exertion. Pulmonary angiography: proximal bilateral (lobar and segmental) CTEPH.
Results: NYHA class at baseline = II, after 11 years = I. Results of echocardiographic study during a follow-up and pulmonary hemodynamics at baseline and after 11 years are shown in Tables.

Hemodynamics	PASP, mmHg	PADP, mmHg	MPAP, mmHg	MRAP, mmHg	PCWP, mmHg	CO, l/min	CI, l/min	PVR, r.u	SVR, r.u.
At baseline	53	12	32	6	10	4.0	2.1	5.5	22.3
After 11 years	22	15	19	6	13	5.1	2.4	1.2	19.6

Echocardiography	At baseline	After 1 year	After 4 years	After 7 years	After 10 years
d-PASP, mmHg	42	26	23	25	34
RVED, mm	34	30	29	27	28
AcT, ms	95	95	100	118	102

Summary: Patients with CTEPH not preceded by thromboembolic event(s) with moderate pulmonary hypertension and with NYHA class II might be successfully treated with anticoagulation alone.

PULMONARY HYPERTENSION WITH EISENMENGER'S SYNDROME BASED ON UNCORRECTED CONGENITAL HEART DISEASE

POHLUDKOVÁ L, ZEMAN K

Hospital in Frýdek-Místek, El. Krásnohorské 321, Frýdek-Místek, Czech Republic

Background: Pulmonary hypertension (PH) is a group of diseases characterized by increased mean pulmonary artery pressure. One of the causes of PH could be congenital heart disease and it is associated with Eisenmenger's syndrome.
Case report: We would like to present a case of a 54-year-old man with uncorrected congenital heart disease – dextrocardia, atrial septal defect and hypoplasia of the right lung. At the age of nine a heart surgery operation had been planned, but it was not executed because of a technical reason. Since his childhood he has been feeling the dyspnea of exertion and close tolerance of physical effort. During his life the difficulties have gradually worsened, they have occurred in a very low physical effort (NYHA III–IV). Repeatedly the man has been treated for respiratory infections related to acute decompensation of right-sided heart failure. He was sent to the Pulmonary hypertension centre in Prague because of serious pulmonary hypertension with PASP 105 mmHg by echocardiography (right-heart catheterization was not successful). Bronchiectasis and large thrombosis in pulmonary bloodstream were detected in accordance with CT. A chronic anticoagulation therapy with warfarin was associated with hemoptysis so that the LMWH could be applied in a reduced dose in a long term. In March 2007 a peroral therapy by bosentan was started and since then stabilization of patient's dyspnea (NYHA III) has been observed. Temporarily the advantage of psychological support has been used. As in recent two years there has been a progressive loss of weight, a nutritional specialist was consulted and nutritional support was started.
Conclusion: The therapy of pulmonary hypertension is centralized into special centres. It is often essential as the interdisciplinary cooperation can ensure a complex care for chronic patients. Nowadays the occurrence of Eisenmenger's syndrome has been decreasing thanks to a well-timed diagnostics and surgical treatment of congenital heart disease.

PULMONARY HYPERTENSION IN ADULTS WITH CONGENITAL HEART DISEASE – OUR EXPERIENCE

POPELOVA J[1,2], CERNY S[1,2], GEBAUER R[1,2], PAVEL P[1], JEHLIČKA P[1], PLASIL P[1], DOUBEK D[1], SKOVRANEK J[2]

[1] *Dept. of Cardiac Surgery, Hospital Na Homolce, Roentgenova 2, Prague, Czech Republic*
[2] *Pediatric Cardiocentre, University Hospital Motol, V Úvalu 84, Praha, Czech Republic*

Our database contains 2423 adult patients with congenital heart disease (CHD) whom we have been following for 15 years. We have found pulmonary hypertension in 180 of these patients (7,4%). Eisenmenger's syndrome was present in only 1,5% of the entire adult CHD group and 21% of the PH group. The 15-year mortality rate in the whole group of CHD patients was 4,5%. The group with PH suffered froma mortality rate of 15,6% and in the group with Eisenmenger's syndrome the mortality rate was 29%. Specific vasodilating therapy was applied to 37% of Eisenmenger patients still living and to 9% of those who died. To date, we have operated on 52 patients with PH, which comprises 30% of patients with CHD and PH. The post-operative 30-days mortality rate was 5,1%, the long-term post-operative mortality rate was 14%.
Conclusion: The care of adults with CHD must be centralized. Many PH patients are suitable candidates for corrective surgery even at an adult age, with acceptable mortality rates. The surgical correction should be complex. The mortality of patients with PH has been 3,5times higher than the mortality in the entire CHD group, while the highest mortality rate was in the group with Eisenmenger's syndrome. Pulmonary vasodilating therapy may be beneficial to some patients with inoperable Eisenmenger's syndrome.

Supported by grant MZOFNM2005.

PULMONARY ARTERY CIRCULATION AFTER TRANSJUGULAR PORTOSYSTEMIC SHUNTING

PUDIL R[1], HULEK P[2], FEJFAR T[2], SAFKA V[2]

[1] *1st Dept. of Medicine, Charles University Prague, University Hospital, Sokolska 585, Hradec Kralove, Czech Republic,*
[2] *2nd Dept. of Medicine, Charles University Prague, University Hospital, Sokolska 585, Hradec Kralove, Czech Republic*

Background: Liver cirrhosis and hepatopulmonary syndrome is associated with structural and functional changes of pulmonary circulation. However, little is known about the changes of lung circulation after transjugular portosystemic shunt (TIPS).
Methods: A prospective study of 56 patients (37 males, 19 females, 54.2 $\pm$ 0.5 yrs) with liver cirrhosis undergoing transjugular portosystemic shunting. Hemodynamic assessment with Swan-Ganz catheter was performed before and 24 h after the TIPS procedure. Echocardiography was performed before, 24 h, 7 days, 1 month and 6 month later.
Results: Twenty-four h after the TIPS procedure, we observed an increase in systolic and diastolic pressure in the pulmonary artery (sAP: 21 $\pm$ 5.6 vs 25 $\pm$ 6.2 mmHg, $p < 0.05$, dAP: 12 $\pm$ 3.8 vs 15 $\pm$ 4 mmHg, $p < 0.05$, mAP: 16 $\pm$ 4.3 mmHg vs 20 $\pm$ 4.7 mmHg, $p < 0.05$), pulmonary artery wedge pressure (9 $\pm$ 3.3 mmHg vs. 11 $\pm$ 3.7 mmHg, $p < 0.05$). Also cardiac output and cardiac index increased (7.2 $\pm$ 1.8 L/min vs. 9.5 $\pm$ 1.9 L/min, $p < 0.05$, resp. 3.9 $\pm$ 1 L/min/m^2 vs 5.0 $\pm$ 1 L/min/m^2, $p < 0.05$). During a 6-month follow-up, we found significant increase of right ventricle diameter (27.1 $\pm$ 3.0 vs 29.7 $\pm$ 3 mm, $p < 0.05$), inferior vena cava diameter (17.4 $\pm$ 1.9 vs 19.6 $\pm$ 1,8 mm, $p < 0.01$). Tricuspid regurgitation progressed (TR grade: 1.2 $\pm$ 0.5 vs 1.7 $\pm$ 0.3, $p < 0.05$), peak tricuspid regurgitation gradient increased (17.1 $\pm$ 8.2 vs 24.3 $\pm$ 4.3 mmHg, $p < 0.01$).
Conclusions: This study showed: (1) TIPS procedure is accompanied with significant changes in pulmonary artery circulation, (2) the changes of pulmonary artery circulation persist for a long time and are increasing within time, and (3) these changes can be detected by echocardiography.

This study was supported by the research grants: No. MSM0021620817 and MZO 00179906.

REVELATION OF RIGHT VENTRICULAR DIASTOLIC RESERVE IN HYPOXIC COR PULMONALE

SABIROV IS, MARIPOV AM, AKUNOV AC, HAN TV, YUSUPOV SA, SARYBAEV ASH.

National Centre of Cardiology and Internal Medicine, Bishkek, Kyrgyzstan

The aim of the study was to investigate right ventricular (RV) diastolic reserve in COPD patients complicated with hypoxic pulmonary hypertension (PH) and cor pulmonale (CP) at rest and inhaling hypoxic gas mixture. Systolic and diastolic RV functions and pulmonary hemodynamics were assessed using Doppler-echocardiography in 45 COPD patients with PH and CP at remission.
Control group consisted of 15 healthy age-matched men. RV ejection fraction was determined by Gibson (1985) and Levine (1984). COPD patients demonstrated two types of RV diastolic dysfunctions: hypertrophic and pseudonormal.
Control group showed no considerable changes of RV diastolic function in response to hypoxic test.
COPD patients at the 1st group having only PH and COPD patients having PH and CP with hypertrophic RV diastolic dysfunction (2A) preserved their diastolic reserve in response to

hypoxic test. COPD patients with PH, CP and pseudonormal RV diastolic dysfunction had restricted diastolic reserve which was revealed using hypoxic test.

Influence of acute hypoxia on right ventricular diastolic function in healthy persons and COPD patients

Indices		Control (n = 16)	1st group (n = 21)	2nd group	
				Subgroup 2H (n = 15)	Subgroup 2P (n = 9)
E/A	B	1.45 ± 0.04	0.92 ± 0.03	0.72 ± 0.03	1.5 ±0.04
	HT	1.12 ± 0.03	0.84 ± 0.03	0.62 ± 0.02	2.15 ± 0.05
	p <	0.001	NS	0.011	0.001
Ei/Ai	B	3.25 ± 0.11	1.95 ± 0.08	1.45 ± 0.05	3.51 ± 0.08
	HT	2.37 ± 0.09	1.82 ± 0.08	1.23 ± 0.05	4.82 ± 0.16
	p <	0.001	NS	0.005	0.001
FAF %	B	24.0 ± 0.7	34.5 ± 1.0	41.0 ± 0.9	22.3 ± 0.4
	HT	30.0 ± 0.8	36.0 ± 1.1	45.2 ± 1.1	17.3 ± 0.5
	p <	0.001	NS	0.007	0.001
IVRT, ms	B	56.4 ± 1.5	93.5±1.0	102.0 ± 1.1	58.6 ± 1.2
	HT	81.2 ± 2.3	98.0 ± 0.9	106.4 ± 1.1	41.0 ± 1.2
	p <	0.001	0.002	0.009	0.001
RT, ms	B	180.3 ± 4.3	218.1 ± 1.6	224.0 ± 1.5	179.2 ± 2.4
	HT	184.6 ± 4.4	224.1 ± 1.1	231.1 ± 1.4	147.3 ±1.1
	p <	NS	0.004	0.002	0.001

Legend: B – baseline, HT – hypoxic test, P – compared with baseline data, E/A – early tricuspid velocity to late peak velocity ratio, Ei/Ai – integrated early tricuspid velocity to late peak velocity ratio, FAF % – fraction of atrial filling, IVRT – isovolumic relaxation time, RT – retardation time.
Thus using of hypoxic test in COPD patients with PH and CP helps to reveal diastolic reserve of right ventricle.

LEFT VENTRICULAR DIASTOLIC FUNCTION IN PATIENTS WITH HIGH ALTITUDE-INDUCED PULMONARY HYPERTENSION

SABIROV IS, SYDYKOV AS, MARIPOV AM, KOJONAZAROV BK, DJUMABAEV MN, KASYMOV MM, SARYBAEV AS

National Centre of Cardiology and Internal Medicine, Bishkek, Kyrgyzstan

Abnormal left ventricular (LV) diastolic function (DF) has frequently been reported in patients with chronic pulmonary disease. Several factors including tachycardia, hypoxemia, medications and decreased LV preload may play a role in causing the changes in LV filling profile. In order to investigate LV DF in high altitude pulmonary hypertension (HAPH) we studied 36 highlanders (HL) with HAPH aged 21 to 68 yrs, residing at altitudes of 2900–3600 m. Pulmonary hemodynamics and LV diastolic function were evaluated with 2-dimensional and Doppler echocardiography. According to echocardiographic evidence of right ventricular hypertrophy (RVH) [right ventricular dimension (RVD) > 2.5 cm and anterior wall thickness (RVAWT) > 0,5 cm] they were divided into 2 groups: 16 HL with high altitude cor pulmonale (HACP) and 20 HL without RVH (HAPH). Eighteen age-matched apparently healthy HL without HAPH served as a control. Results are presented in the Table.

Variables	Control	HAPH	HACP
MPAP, mmHg	19.0 ± 0.3	28.2 ± 0.2***	32.4 ± 0.8***
RVD, cm	1.84 ± 0.06	1.95 ± 0.05	2.73 ± 0.07***
RVAWT, sm	0.34 ± 0.01	0.37 ± 0.01*	0.49 ± 0.02***
E/A	1.62 ± 0.07	1.54 ± 0.06	1.22 ± 0.12**
FAF, %	23.0 ± 1.0	25.4 ± 1.1	31.4 ± 1.9***

Legend. *, **, *** – $p < 0.05$, $p < 0.01$, $p < 0.001$ accordingly for comparison with control group; MPAP – mean pulmonary arterial pressure; E/A – peak E velocity to peak A velocity ratio; FAF – fraction of atrial filling.

Thus our study confirmed that changes occur in LV filling in HL with HAPH and RVH. The interventricular interdependence may play a role in the causing of alterations of LV diastolic function.

DOES ANTICOAGULATION IN EISENMENGER'S SYNDROME ALTER LONG-TERM SURVIVAL?

SANDOVAL J

National Institute of Cardiology of Mexico, Juan Badiano 1, Mexico City, Mexico

Strong arguments can be made both for and against anticoagulation in Eisenmenger's syndrome. These complex patients with pulmonary arterial hypertension due to long-standing left-to-right shunt develop irreversible pulmonary vascular disease, bidirectional shunting and cyanosis. The competing presence of both pulmonary arterial hypertension (PAH) and cyanosis both add weight to discussions regarding the appropriateness of anticoagulation, creating a therapeutic dilemma.
Clinically, patients with Eisenmenger's syndrome are often approached with the same therapeutic objectives as acyanotic patients with other forms of PAH. Based on non-randomized observational data, anticoagulation therapy is recommended in the treatment of idiopathic PAH, although there are no randomized studies proving efficacy. However, patients with Eisenmenger's snydrome differ significantly from other forms of PAH in several key ways. Firstly, they have a higher incidence of pulmonary artery thrombosis, roughly 20% based on several series. Secondly, they have a high incidence of hemoptysis which can be life-threatening. Thirdly, cyanosis contributes to coagulation abnormalities and thrombocytopenia all of which affect risks from anticoagulation, and mandates careful titration of International Normalized Ratio (INR) from experienced laboratories. Deaths from warfarin in Eisenmenger's syndrome have been described. Because of these competing sequelae, extrapolation of recommendations for idiopathic PAH is not justifiable. This important question must be addressed by data specific to the population with Eisenmenger's syndrome. To date, no published studies, to our knowledge, have investigated the issue of anticoagulation in these patients.
The aim of the present study was to analyze the impact of long-term anticoagulation therapy on the survival of patients with Eisenmenger's syndrome. Therefore we retrospectively reviewed anticoagulation use in our patients to look for differences in survival between those taking and not taking anticoagulants.
From a large pool of referred patients with PAH associated to congenital heart disease and with detailed baseline clinical information, we identified 92 patients with Eisenmenger's physiology ($PAP_{mean} = 73 \pm 19$ mmHg, oxygen saturation 82 ± 9%, PaO_2 48 ± 8 mmHg, hemoglobin 18.6 ± 4 g/dL) who either were anticoagulated (n = 48) or not anticoagulated (n = 44). All underwent a thorough initial evaluation including detailed history, laboratory, echocardiographic and catheterization data. Patients receiving anticoagulants were started on anticoagulant therapy within 12 months of initial presentation and followed for at least 2 years, and were compared with non-anticoagulated patients. The majority of patients did not have a clinical indication for anticoagulation, which was largely recommended based on physician's preference. Baseline variables were compared between groups, and between survivors and non-survivors. Analyses of prognostic factors and survival were done using Cox and Kaplan-Meier methods, respectively. A p value < 0.05 was considered significant.
There were more ASD patients in the anticoagulation group, but otherwise no baseline differences in clinical, functional, or hemodynamic data. After mean follow-up of 7 ± 5.4 years (range 1–31), 11 patients died in the AC and 10 in the Non-AC group. There was no survival difference between groups (log-rank test = 1.78; p = NS). For the entire cohort, mortality was significantly associated with NYHA class 3–4 (HR = 4.2), evidence of right-heart failure (HR = 13.6), and a mean corpuscular volume < 80 μ^3 (HR = 3.8). Use of anticoagulation did not impact survival. Bleeding complications occurred in 7 (16%) of anticoagulated patients, including two fatalities.
Conclusion: In this retrospective, non-randomized, long-term follow-up study of Eisenmenger's syndrome patients with simple congenital defects living at moderate altitude, survival was associated with poor functional class and clinical signs of heart failure. Anticoagulation had no demonstrable impact on survival and complications were not trivial. This data may be useful in considering future studies addressing this question, although based on the event rates presented here, addressing this question prospectively may be infeasible.

INSIGHTS INTO THE PATHOBIOLOGY OF PULMONARY HYPERTENSION IN MITRAL STENOSIS

SANDOVAL J[1], CARRILLO A[1], MASSO F[1], SOTO V[1], BARRAGAN R[1], PULIDO T[1], SANTOS E[1], VOELKEL N[2]

[1] *National Institute of Cardiology, Mexico, Juan Badiano 1, Mexico City, Mexico,*
[2] *Virginia Commonwealth University, 1111 Westbroad St, Richmond, VA, USA*

Background: Pulmonary hypertension (PH) in mitral stenosis (MS) is a limiting factor of success after treatment. Details of the pathobiology of pulmonary vascular disease (PVD) and PH in MS are largely unknown.
Objectives: We sought to begin to investigate which vascular effectors are important in MS, and how they influence the pathobiology and reversibility of the disease.

Methods: We studied 11 patients with MS and PH who underwent surgical mitral valve replacement. All patients had undergone plasma level measurements of endothelin-1 (ET-1), prostacyclin, thromboxane, serotonin (SER), and angiotensin II (ANG), at baseline heart catheterization (HC) and these measurements were repeated one year after at follow-up HC. All patients had a lung biopsy at the time of surgery. The tissue was used for vascular morphometry and for tissue measurements of TGFβ-1, ANG, SER, and ET-1.
Results: All patients had significant ($p < 0.001$) clinical improvement. NYHA functional class improved from a mean of 2.33 to class 1, and six-minute walk test increased from 148 $\pm$ 43 to 392 $\pm$ 57 m. Hemodynamic variables also improved, however, PH (as defined by a mean PAP > 25 mmHg), did not regress in 6 out of the 11 patients (54.5%). Patients with persistent PH had a higher PCWP (18 $\pm$ 5 vs 9 $\pm$ 3 mmHg; $p < 0.011$). The tissue TGFß protein was higher in patients with persistent PH. Vascular fibrosis was more prominent in the venules and correlated with the mean PAP at one year ($r = 0.63$; $p < 0.05$). ET-1 staining was also more prominent in the venules. The arterial-venous difference of ET-1 at one year correlated with mean PAP ($r = 0.62$; $p < 0.04$).
Conclusions: PH after correction of MS is associated with the persistence of pulmonary vascular fibrosis, mainly at the pulmonary venules. Our findings suggest the participation of endothelin in the pathogenesis of PVD in MS.

ARRHYTHMIAS IN PAH – EPIDEMIOLOGY AND MANAGEMENT

SEDLACEK K, AL-HITI H, MELENOVSKY V, KAUTZNER J
IKEM, Clinic of Cardiology, Videnska 1958/9, Prague, Czech Republic

Pulmonary arterial hypertension in its advanced stage is a serious disease associated with poor prognosis despite significant progress in diagnosis and therapeutic strategies. As in any other condition associated with heart failure, patients with pulmonary hypertension may suffer from cardiac arrhythmias. Very few systematic reviews and dedicated research projects are available dealing with cardiac arrhythmia in this patient group. With exception of few isolated series or case reports, incidence and prevalence of cardiac arrhythmias in pulmonary arterial hypertension and their relevance to the course of the disease and therapy are largely unknown. Furthermore, syncope is a serious complicating event in the course of the disease and about 10% of patients with advanced disease may die suddenly. Analogically to left heart disease, syncope may be a surrogate of sudden cardiac death. Although a detailed pathophysiology of syncope in pulmonary arterial hypertension was first described almost sixty years ago, mechanisms of sudden cardiac death are not known. Unlike in other conditions such as coronary artery disease, there are currently no strategies for risk stratification and primary prevention of sudden cardiac death in patients with pulmonary arterial hypertension.

EFFECT OF RESVERATROL ON HYPOXIC PULMONARY VASOCONSTRICTION IN THE ISOLATED PULMONARY VESSELS

SILAN C[1], KUŞÇUOĞLU E[2], UZUN Ö[2], BALBAY Ö[3]
[1]*Çanakkale Onsekiz Mart University, School of Medicine, Department of Pharmacology, Kepez, Çanakkale, Turkey,*
[2] *Abant İzzet Baysal University, School of Medicine, Department of Pharmacology, Gölköy, Bolu, Turkey,*
[3] *Düzce University, School of Medicine, Department of Chest Disease, Konuralp, Düzce, Turkey*

Background: Endothelial dysfunction, oxidative stress, proliferation of pulmonary arterial smooth muscle cells, inflammation and hypoxia-induced vasoconstriction promote the development of pulmonary hypertension. Thus most of works have focused on pulmonary vasodilator agents. Among these agents, resveratrol exerts antioxidant, anti-inflammatory and vasodilatory effects in the systemic circulation. Its effects pulmonary vessels, however, remain poorly defined. In the present study we aimed to investigate the effect of resveratrol on hypoxia-induced vasoconstriction in lamb isolated pulmonary arteries and veins.
Methods: Isolated pulmonary vessels were suspended in an organ bath filled with Krebs-Heinseleit solution. The solution was aerated with room air or a gas mixture containing 95% N_2 to 5% CO_2. Isometric contractions were recorded continuously with a computerized polygraph system. 5-HT and U46619, a thromboxane analogue, were used as precontractile agents.
Conclusion: Our results showed that 5HT induced contraction were not changed in the presence of resveratrol in pulmonary arteries. But resveratrol significantly decreased contractile response of U46619 in pulmonary veins. In addition to these data, in the presence of resveratrol (20 µM), hypoxia-induced pulmonary vasoconstriction decreased in pulmonary veins precontracted with U46619, but not in pulmonary arteries precontracted with 5-HT.

CONGENITAL ABSENCE OF PORTAL VEIN AS A RARE CAUSE OF SEVERE PULMONARY HYPERTENSION, IMPROVEMENT WITH DISEASE-SPECIFIC THERAPY

SIMKOVA I, TAVACOVA M, KALDARAROVA M, PACAK J
Dept.of Cardiology, National Institute of Cardiovascular Diseases, Pod Krasnou Horkou 1, Bratislava, Slovak Republic

Congenital absence of the portal vein (CAPV) is an extremely rare condition that results from aberrant venous development in early embryonic life. The mesenteric and splenic venous drainage bypasses the liver and drains directly into the systemic circulation. We describe a case of CAPV with congenital porto-systemic shunting presenting as portopulmonary hypertension (PPHT).
Case report: A 31-year-old man with a diagnosis of pulmonary hypertension since age 5 developed abdominal symptoms. Chest X-ray, echocardiogram, cardiac catheterization and pulmonary angiography confirmed severe precapillary pulmonary hypertension (mean PAP 85 mmHg, PVR 12 WU) with severe right ventricular overload, enlargement of pulmonary arteries > 55 mm with peripheral tapering. Abdominal ultrasonography and computerized tomography demonstrated liver congestion and fibrosis, and established the diagnosis of CAPV with portosystemic shunting to the inferior caval vein. Hepatic aminotransferases and bilirubin values were borderline. Cardiopulmonary performance was just mildly reduced (6MWD 520 m). The patient became hoarse due to the pressure of the dilated pulmonary artery on the recurrens nerve. The diagnosis of severe PPHT due to portosystemic shunting was established. After 3 months of sildenafil treatment the hoarse disappeared, functional class improved, after 9 months 6MWD elongated significantly (+120 m) and PAP_{mean} decreased (72 mmHg).
Conclusion: Portopulmonary hypertension is a well-known but relatively rare severe complication of portal hypertension in chronic liver diseases. The key role in the pathophysiology of PPHT rather than portal hypertension per se seems to be the portosystemic shunting like in our patient without any significant liver disease. Only few cases of CAPV have been presented, usually in association with cardiac, skeletal, and visceral malformations. This is the first reported case of congenital porto-systemic shunt associated with PPHT.

UTILITY OF TRANSTHORACIC ECHOCARDIOGRAPHY IN PULMONARY ARTERIAL HYPERTENSION DIAGNOSIS IN CHRONIC OBSTRUCTIVE PULMONARY DISEASE EXACERBATION

SKOCZYNSKI S[1], MIZIA-STEC K[2], SOZANSKA E[1], SEMIK-ORZECH A[1], GASIOR Z[2], PIERZCHALA W[1]
[1] *Department of Pulmonology, Medical University of Silesia, Medykow 14, Katowice, Poland,*
[2] *II Department of Cardiology, Upper-Silesian Medical Center in Katowice, Medical University of Silesia, Ziołowa 47, Katowice-Ochojec, Poland*

Background: Transthoracic echocardiography (TTE) has been accepted as a screening tool for secondary pulmonary arterial hypertension (PAH). This method is useful in stable chronic obstructive pulmonary disease (COPD), but has not been widely used as a diagnostic tool in patients with COPD exacerbation. The aim of the study was to compare utility of TTE in secondary PAH diagnosis in patients with COPD exacerbation before and after treatment.
Methods: Forty consecutive patients hospitalized in Pneumonology Department of the Medical University of Silesia due to COPD exacerbation were enrolled into the study. TTE was performed at baseline and after successful treatment. PAH was defined as right ventricular systolic pressure (RVSP) > 35 [mmHg], and/or pulmonary artery mean pressure (PAPmean) $\geq$ 25 [mmHg].
Results: Out of 40 patients we were able to perform TTE in 17 (42.5%) subjects at admission and in 26 (65%) at discharge. PAH was present in 88.2% patients prior to, and 80.8% after treatment when assessed with PAP_{mean}, and in 35.3% before and 52.9% after treatment when presented with RVSP. It was possible to obtain accurate PAP_{mean} results in 94.12% patients at admission, and in 96.15% at discharge, whereas RVSP could be measured in 58.82% patients at admission, and in 65.38% at discharge. Significant reduction of PAP_{mean} [mmHg] (pre-treatment: 41.2 $\pm$ 11.2; post-treatment: 39.1 $\pm$ 12.1; $p = 0.029$) was observed in the follow-up. There was a trend for reduction of RVSP [mmHg] (pre-treatment: 44.5 $\pm$ 12.9; post-treatment: 36.3 $\pm$ 14.3; $p = 0.068$). Post-treatment RVSP values were higher in patients with obstructive sleep apnea syndrome ($p < 0.05$) and night desaturations ($p < 0.05$).
Conclusions: When performed in experienced centers, TTE represents a non-invasive tool in PAH assessment in some patients with COPD exacerbation and it allows monitoring of a therapy-induced reduction of pulmonary artery pressure. TTE feasibility in COPD patients increases after clinical improvement however it remains relatively low.

CHRONIC OBSTRUCTIVE PULMONARY DISEASE EXACERBATION IN CONTEXT OF CARDIAC HEMODYNAMICS

SKOCZYNSKI S[1], MIZIA-STEC K[2], SOZANSKA E[1], SEMIK-ORZECH A[1], GASIOR Z[2], PIERZCHALA W[1]

[1] Department of Pulmonology, Medical University of Silesia, Medyków 14, Katowice, Poland,
[2] II. Department of Cardiology, Upper-Silesian Medical Center in Katowice, Medical University of Silesia, Ziołowa 47, Katowice-Ochojec, Poland

Introduction: Cardiovascular diseases and chronic obstructive pulmonary disease (COPD) are leading causes of mortality worldwide. However, changes of right and left heart hemodynamic during COPD exacerbation have not been well established yet.
Methods: Forty consecutive patients hospitalized in Pneumonology Department of the Medical University of Silesia due to COPD exacerbation entered the study. Transthoracic echocardiography (TTE) was performed at baseline and after successful treatment. Pulmonary arterial hypertension PAH was defined as right ventricular systolic pressure (RVSP) > 35 mmHg and/or pulmonary artery mean pressure (PAP_{mean}) ≥ 25 mmHg in TTE. Endothelin-1(ET-1) and NT-proBNP blood concentrations were obtained at the baseline and after treatment.
Results: There was a significant reduction of PAP mean [mmHg] (pre-treatment: 41.2 ± 11.2; post-treatment: 39.1 ± 12.1; p = 0.029), and a trend for reduction of RVSP [mmHg] (pre-treatment: 44.5 ± 12.9; post-treatment: 36.3 ± 14.3; p = 0.068). Right ventricle diastolic diameter [mm] was also significantly reduced (pre-treatment: 28.6 ± 5.0; post-treatment: 26.95 ± 4,0; p = 0.035), and there was a trend for the reduction of inferior vena cava diameter [mm] (pre-treatment: 20.74 ± 3.9; post-treatment: 19.98 ± 4.7; p = 0.083). There was also a trend for the improvement of RVFAC (systolic change of right ventricle area) [%] (pre-treatment: 55.3 ± 13.3; post-treatment: 56.2 ± 4.0; p = 0.056), but no changes in LVEF (left ventricle ejection fraction) [%] were noticed: (pre-treatment: 53.2 ± 9.9; post-treatment: 55.0 ± 10.2; p = 0.733). No changes in E/A ratio of mitral flow were observed. Treatment was also associated with the trend for reduction of ET-1 [fmol/ml] (pre-treatment: 1.72 ± 2.8; post-treatment: 1.32 ± 1.9; p = 0.076), but no changes in NT-proBNP levels [fmol/ml] were noticed (pre-treatment: 17.5 ± 38.9; post-treatment: 12.8 ± 18.6; p = 0.3).
Conclusions: COPD exacerbation probably deteriorates right, but not left ventricle hemodynamic.

RELAXANT EFFECT OF RESVERATROL ON ISOLATED PULMONARY VESSELS: ROLE OF NO AND PROSTANOIDS

UZUN Ö, KUŞÇUOĞLU E

Abant İzzet Baysal University, School of Medicine, Department of Pharmacology, Gölköy, Bolu, Turkey

Background: Although there is a variety of drugs used, no current treatment approach to pulmonary hypertension provides a cure. Preferably, treatment targets are to reduce pulmonary vascular resistance. Thus, we aimed to investigate the effect of resveratrol on precontracted pulmonary vessels and to assess the role of NO and PG's by using specific NOS and cyclooxygenase inhibitors, Nw-nitro-L-arginine methyl ester (L-NAME) and indometacin, respectively.
Methods: Lungs of freshly slaughtered sheep were obtained from an abattoir in this study. Isolated pulmonary arteries and veins were suspended in an organ bath filled with Krebs-Henseleit solution. Isometric contractions were recorded continuously with a data acquisition system. 5-HT and U46619, a thromboxane analogue, were used as pre-contractile agents.
Conclusion: Our results suggest that resveratrol concentration-dependently relaxed precontracted pulmonary artery and vein rings. The IC_{50} value of resveratrol was 33.6 ± 3.7 mM in artery rings and 33.0 ± 1.6 mM in vein rings. The relaxation induced by resveratrol was unaffected by the L-NAME and cyclooxygenase inhibitor indomethacin.

Rho KINASE ACTIVATION BY ACUTE HYPOXIA

WARD JPT, KNOCK G, SNETKOV V, AARONSON PI

King's College London, Henriette Raphael House, London, U.K.

Hypoxic pulmonary vasoconstriction (HPV) is an intrinsic property of the smooth muscle of intrapulmonary arteries. It is now recognized that HPV involves not only elevation of intracellular calcium but also increased calcium sensitivity. This is believed to be due to activation of Rho kinase, which inhibits myosin phosphatase, and thus increases myosin light chain (MLC) phosphorylation and thus force. Rho kinase-mediated calcium sensitization also plays an important role in pulmonary hypertension. Whilst there is a consensus that mitochondria act as the oxygen sensor in HPV, the mechanisms linking them to activation of Rho kinase has remained unclear, although many believe that the key signal in HPV is increased generation of reactive oxygen species (ROS). We have shown that hypoxia causes phosphorylation of the myosin phosphatase targeting sub-unit (MYPT1), the target of Rho kinase, and sub-cellular translocation of Rho kinase itself, both indicating activation of Rho kinase. We have also shown that exogenous superoxide constricts pulmonary artery by increasing calcium sensitivity in a Rho kinase-dependent manner, with similar effects on MYPT1 phosphorylation and Rho kinase translocation as hypoxia, and that this is associated with activation of the small GTPase RhoA, the activator of Rho kinase. We now have evidence that oxidant sensitive src family kinases are intimately involved in the response to both ROS and hypoxia, as inhibition of these kinases or use of siRNA knockdown strongly suppresses HPV, the response to ROS, and the associated activation of Rho kinase as reflected by MYPT1 phosphorylation and Rho kinase translocation. We therefore propose that src kinase plays a key role in HPV and possibly pulmonary hypertension, and maybe a useful therapeutic target.

Supported by the Wellcome Trust and British Heart Foundation.

DIFFERENCES IN OUTCOME OF MEDICALLY AND SURGICALLY TREATED PATIENTS WITH CTEPH: ONE CENTER EXPERIENCE

WIETESKA M[1], BIEDERMAN A[2], KURZYNA M[1], DYK W[2], FIJALKOWSKA A[1], SZTURMOWICZ M[1], WAWRZYNSKA L[1], BURAKOWSKI J[1], HAJDUK B[1], TORBICKI A[1]

[1] Institute of Tuberculosis and Lung Diseases, Plocka 26, Warsaw, Poland,
[2] Institute of Cardiology, Alpeska 42, Warsaw, Poland

Background: Chronic thromboembolic pulmonary hypertension (CTEPH) may lead to fatal right-heart failure. Most patients (pts) are treated by pulmonary endarterectomy (PEA), some for various reasons remain on medical therapy (MT) alone.
Objectives: To assess clinical outcome in pts who underwent PEA or received MT alone.
Methods: One hundred twelve CTEPH pts (75 male, aged 53.9 ± 14.7 years) diagnosed between 1998 and 2008 were followed for a mean of 3.6 ± 3.0 years after diagnosis. Majority (59%) underwent PEA, 46 pts remained on MT alone because of distal lesions (n = 29), high operative risk (n = 10) or patient's refusal. Targeted treatment (TT) was used in 20/46 MT pts (sildenafil, bosentan or prostanoids in 8, 9 and 3 pts, respectively). No differences between PEA and MT in baseline hemodynamics (PAP 49.9 ± 8.8 vs 51.6 ± 10.8 mmHg, PVR 9.4 ± 3 vs 9.4 ± 4 WU, CI 2.4 ± 0.5 vs 2.5 ± 0.6 l/min/m^2, SVO_2 57 ± 10 vs 56 ± 10 %, respectively, all p > 0.05) distance covered during 6MWT and key echocardiographic indices were found. Non-invasive evaluation was repeated after 6–12 months.
Results: Three-year mortality was 12.7% and 34.8%, p < 0.003 after PEA and in MT pts, respectively. There was a trend for lower mortality among MT patients on TT compared to those on conventional therapy alone (25.0% vs 42.3%). Significant clinical improvement was noted as a result of PEA, but not in MT pts**.**
Conclusions: Despite similar baseline disease severity CTEPH pts treated by PEA have better three-year survival when compared to MT, and show sustained clinical improvement. The potential impact of TT in non-operable pts remains to be evaluated. All efforts should be undertaken to perform PEA in all operable CTEPH patients.

CPR FOR MASSIVE PULMONARY EMBOLISM – ECHOCARDIOGRAPHIC CASE STUDY

ZAJICEK P[1], HRABOVSKY M[1], HEJDUSEK P[2], PRODELAL P[1]

[1] Hospital Valašské Meziříčí, U Nemocnice 980, Valašské Meziříčí, Czech Republic,
[2] Rescue Service of Zlin Region, U Nemocnice 1511, Valašské Meziříčí, Czech Republic

Resuscitation for acute pulmonary embolism has had a very bad prognosis with a mortality rate of nearly 100%. A quick and accurate diagnosis partially improves this bad condition even in obvious signs of clinical death. The authors present an echo-case story of 67-year-old woman successfully resuscitated for highly suspicious massive pulmonary embolism with repeated IV bolus administration of thrombolytics (alteplasum). This case study also demonstrates the value of echocardiography in visualizing and evaluating some life-threatening situations such as breathlessness, chest pain, hypotension, syncope and emphasizes how important it is to follow responses to applied treatment.

DOPPLER ECHOCARDIOGRAPHY IN MEAN PULMONARY ARTERY PRESSURE MEASUREMENT IN PATIENTS WITH COPD

ZATEYSHCHIKOVA A[2], ALEKHIN M[1], DUKOVA N[1], SHAVRIN I[2], KISELEV D[1], VTORUSHIN D[2], SIDORENKO B[1], ZATEYSHCHIKOV D[1]

[1] Federal State Institution "Educational Scientific Medical Center" of the General MD of President RF, Timoshenko 21, Moscow, Russia,
[2] City Clinical Hospital 51, Aliabieva, 7/33, Moscow, Russia

These days numerous methods of pulmonary artery pressure (PAP) calculations with aid of Doppler echocardiography (DE) are in use. The purpose of the study was to find the most accurate and executable method of mean PAP (MPAP) measurement in patients (pts) with chronic obstructive pulmonary disease (COPD).

Materials and methods: Twenty pts with COPD aged 71 ± 12 years were involved. Invasive MPAP (iMPAP) was calculated from systolic and diastolic PAP, measured directly during right-heart catheterization. Non-invasive MPAP (niMPAP) was calculated on the basis of maximal gradient of pulmonary regurgitation (PR) and time intervals of flow in right ventricular outflow tract (RVOT) and pulmonary artery (PA) using A. Kitabatake's et al. (1983) and G. Mahan's et al. (1983) and A. Dabestani's et al. (1987) formulas. Both right-heart catheterization and DE were performed within 72 hours.

Results: Spectrogram of RVOT and PA flow in pulse Doppler mode were available in all the pts, so MPAP could be calculated using the above mentioned formulas. PR was registered in 18 pts, but measurement of its maximal velocity in early diastole (necessary for MPAP calculation) was possible only in 11 of them (55%). iMPAP was significantly associated with niMPAP, worked out on the basis of PR ($r = 0.68$; $p < 0.05$), and according to Kitabatake's formula for RVOT flow ($r = 0.62$; $p < 0.05$). There was no correlation of iMPAP and MPAP calculated according to the formulas for PA flow. The average difference between niMPAP and iMPAP was 7.8 mmHg for MPAP calculated on the basis of PR gradient, and 8.6 mmHg – on the basis of RVOT flow. For both methods association of that difference with iMPAP magnitude was revealed ($r = 0.60$; $p < 0.05$ and $r = 0.74$; $p < 0.01$, respectively).

Thus DE methods of MPAP calculation based on estimation of PA flow are not quite accurate and should not be used in COPD pts. Instead DE measurement of PR and RVOT flow are to be used, although overestimation is expected, especially in cases of enhanced MPAP.

ERYTHROPOIETIN LEVEL IS ASSOCIATED WITH PULMONARY HYPERTENSION IN PATIENTS WITH COPD

ZATEYSHCHIKOVA A[1], SHAVRIN I[1], KISELEV D[3], REZNICHENKO N[2], BARINOV V[3], PRIVALOV D[1], ZATEYSHCHIKOV D[3]

[1] City Clinical Hospital 51, Aliabieva, 7/33, Moscow, Russia,
[2] City Clinical Hospital 17, Volynskaya, 7, Moscow, Russia,
[3] Federal State Institution, "Educational Scientific Medical Centre" of the General MD of President RF, Timoshenko 21, Moscow, Russia

Hypoxic pulmonary hypertension (PH) is reported to develop in 5–30% of chronic obstructive pulmonary disease (COPD) patients (pts) worsening their prognosis. There is some evidence that elevated serum erythropoietin (EPO) level could be not only a sign of hypoxemia but also be involved in pathologic pathway of PH.

The aim of the study was to reveal the association between EPO serum level and parameters of central hemodynamics.

Materials and methods: We examined 23 stable COPD pts (70.6 ± 2.30 y.o) without signs of decompensated right-heart failure. Most of them (21–91%) were current or former smokers, COPD duration came to 17.7 ± 3.56 years. All of them had moderate or severe bronchial obstruction (average forced expiratory volume in 1 second was 4.7%). During right-heart catheterization standard hemodynamic parameters including pulmonary artery systolic (SPAP), diastolic (DPAP) and mean (MPAP) pressure were obtained. Continuous monitoring of cardiac output (CO) and indexed right ventricular stroke volume (IRVSV) were performed with Vigilance II (EDWARDS). EPO level was measured with Biomerica EPO ELISA, normal ranges 4.0–32.0 mIU/ml.

Results: The average MPAP was estimated at 18.9 ± 1.37 mmHg, 5 pts (21.7%) had PH (MPAp > 25 mmHg). Hemoglobin (Hb) level was 126.8 ± 4.23 g/l in average (91–165 g/l), mean EPO level was 14.7 ± 2.58 mIU/ml, only 3 pts had EPO beyond normal ranges: 1 – less than 4 mIU/ml, 2 – more than the upper limit. EPO level was associated with Hb and hematocrit ($r = -0.645$, $p < 0.01$ and $r = -0.476$, $p < 0.05$, respectively). No association between EPO and characteristics of COPD and hypoxia severity was detected. Otherwise, EPO occurred to be associated with right ventricular dysfunction parameters (inferior vena cava diameter, $r = 0.500$, $p < 0.05$), SPAP ($r = 0.812$, $p < 0.05$) and IRVSV ($r = -0.582$, $p < 0.01$). So our data correspond with the hypothesis that EPO might participate in PH development in COPD pts. Further studies are needed to confirm this assumption.

RIGHT VENTRICLE FUNCTION AND PULMONARY CIRCULATION IN CONGENITAL HEART DISEASE IN CHILDREN

ZAVADOVSKIY KW, KRIVONOGOV NG, LISHMANOV YU. B

Institute of Cardiology, Kievskaya 111A, Tomks, Russia

Aim: To investigate the right ventricle function and regional lung perfusion in children with congenital heart disease (CHD) and pulmonary hypertension.

Material and methods: We examined 45 patients with septal defect (aged 5–17) with mean pulmonary artery pressure (PAP) 68.7 ± 33.5 mmHg. The first-pass radionuclide angiography (FPRA) was performed with 99mTc-DTPA 0.5–1.0 MBq/kg. We performed FPRA thrice: at rest; 3 min after sublingual administration of 10 mg nifedipine; one hour after i.v. administration of enalaprilate (Enap 1.25 mg in drops). The time of radionuclide bolus transit throughout arterial (TAM) and venous (TVM) sections of pulmonary hemodynamics, and the right ventricle half-evacuation time (T1/2RV) were assessed. All patients underwent also perfusion lung scintigraphy.

Results: We have shown that TAM and T1/2RV were raised proportionally to an increase in pulmonary artery pressure, with correlation coefficient 0.48 and 0.50 correspondingly. In answer to administration of pharmacological agents we discovered both increasing and decreasing of TAM and T1/2RV. In postoperative period pulmonary hemodynamic normalization occurred in patients with TAM and T1/2RV pharmacological test (FT) increasing. In patients with TVM and T1/2RV FT decreasing residual pulmonary hypertension was diagnosed. In inoperable patients (due to a high risk of postoperative acute right ventricle failure) TAM and T1/2RV FT decreasing predominated. In inoperable patients and in children with residual pulmonary hypertension we discovered mottled lung perfusion pattern.

Conclusion: The performing of perfusion lung scintigraphy and first pass radionuclide angiography with vasodilators assess to estimate right ventricle function and pulmonary microcirculation. It allows predicting postoperative right ventricle function and pulmonary artery pressure normalization.

RADIONUCLIDE ASSESSMENT OF PULMONARY CIRCULATION AND RIGHT VENTRICLE FUNCTION IN PULMONARY EMBOLISM

ZAVADOVSKIY KW, PANKOVA AN, GULYAEV VM, LISHMANOV YUB

Institute of Cardiology, Kievskaya, Tomsk, Russia

Aim: To investigate the condition of pulmonary microcirculation and right ventricle (RV) hemodynamics in patients with pulmonary embolism**.**

Materials and methods: Seventy-two patients were examined in the course of investigation. Among them – 15 patients (average age 59 ± 9) suffering from coronary heart disease (NYHA I–III); 57 patients (average age 62 ± 11) with suspicion of pulmonary embolism (PE). Radionuclide evaluation included realization of quantitative blood pool single photon emission computer tomography (QBS) and lung perfusion scintigraphy (LPS). The following indices were evaluated: ejection fraction (EF), right ventricle end systolic and diastolic volume (ESV and EDV), peak ejection and filling rates (PER and PFR), mean filling rate for the first third of cardiac cycle (MFR/3).

Results: Values of ejection fraction of right ventricle were found to be significantly low in the group of patients with PE. The values of ESV volume were significantly greater in patients with PE. End-diastolic volume value between the groups did not differentiate significantly. It was found that patients with PE had significantly lower values of RV stroke volume. Main differences between the groups were found according to rate indexes – PER, PFR and MFR/3. Pulmonary blood filling in patient without PE equally increased from base of lungs to apical parts. In patients with signs of PE, signs of pulmonary blood flow redistribution were observed. In the areas of the lungs corresponding with pool of embolized pulmonary artery the blood flow was authentically low in comparison with conventionally intact area. We do not find any correlation between extent of PE and right ventricle dysfunction indices. In patients with PE extent less than 50% the normal right ventricle can be interpreted as the sign of acute PE. On the other hand, right ventricle dysfunction is typical for chronic thromboembolic pulmonary hypertension.

Conclusion: Development of pulmonary embolism is accompanied by significant lowering of diastolic RV function. QBS allows to define pulmonary blood flow and to estimate pulmonary embolism intensity semiquantitatively. Right ventricle dysfunction in case of pulmonary embolism extent less than 50% is typical of chronic thromboembolic pulmonary hypertension.

PULMONARY ENDARTERECTOMY IN PATIENTS WITH CHRONIC THROMBOEMBOLIC PULMONARY HYPERTENSION, IN-HOSPITAL RESULTS

ZEMBALA M, PRZYBYLSKI R, SKOCZYLAS I, NOWOWIEJSKA-WIEWIÓRA A, SITKO A, ZĘBIK T, POLOŃSKI L

Silesian Centre for Heart Diseases, Szpitalna 2, Zabrze, Poland

Introduction: Chronic thromboembolic pulmonary hypertension (CTEPH) inflicts almost 1–5% patients after acute pulmonary embolism. It is probably connected with remodeling clot in proximal parts of pulmonary arteries as well as distal vasculopathy. A pulmonary endarterectomy (PEA) is a surgical treatment that decreases pressure in the pulmonary artery and enhances functional outcome in patients with severe thromboembolic hypertension.

Material and methods: The inclusion criteria were class III or IV according to the New York Heart Association (NYHA), pulmonary vascular resistance (PVR) > 200 dyn · s · cm^{-5}, proximal changes in pulmonary arteries without any history of fatal illness such as cancer or irreversible changes in lungs. Thirty-seven patients with CTEPH fulfilled these criteria, were protected with the use of vena cava filter prior to the operation and finally underwent PEA. Two of them died in the first 24 hours after the surgery.

Results: The echocardiographical (right ventricular ejection fraction – RVEF %, right ventricular diameter – RV diameter mm, tricuspid regurgitation – TVR) and hemodynamical measurements (mean pulmonary artery pressure – mPAP mmHg, PVR dyn · s · cm^{-5}) as well as NYHA classification are presented in Table 1. They were estimated before and after PEA. In all of them differences were significant ($p < 0.05$).

Conclusion: The PEA not only enhanced patients' outcome but also improved assessed parameters significantly. The surgical treatment in CTEPH is beneficial especially in selected patients with the proximal arterial clot-vasculopathy.

Table 1

	Before	After	*p*
RVEF (%)	27.0 ± 6.3	36.3 ± 5.5	< 0,0001
RV diameter (mm)	38.6 ± 6.4	31.4 ± 5.4	< 0,0001
mPAP (mmHg)	55.3 ± 9.4	31.1 ± 8.6	< 0,0001
PVR (dyn · s · cm^{-5})	965 ± 256	219 ± 70.4	< 0,001
NYHA			< 0,001
1	–	20	
2	1	16	
3	15	1	
4	21	-	
TVR	2.8 ± 0.9	0.8 ± 0.6	< 0,001

SILDENAFIL IN INFANTS WITH PH AFTER SURGICAL CLOSURE OF CONGENITAL SYSTEMIC-TO-PULMONARY SHUNT

ZUK M, KOWALCZYK M, BRODZIKOWSKA-PYTEL A, MIRECKA-ROLA A, TURSKA-KMIEC A, ZUBRZYCKA M, KAWALEC W

Children's Memorial Health Institute, Al. Dzieci Polskich, Warsaw, Poland

Background: Persistent pulmonary hypertension (PH) and heart failure (HF) resistant to conventional therapy can be serious postoperative complications in infants after correction of congenital heart defect with systemic-to-pulmonary shunt. Treatment with vasodilators seems to be an interesting promising option in such cases. The aim of the study was to evaluate the efficacy of sildenafil in infants with PH after shunt closure.

Methods: Echo, chest X-ray and NTproBNP level were performed every 3–6 months in consecutive patients, who started sildenafil because of PH in early or mid-term postoperative period after shunt closure performed from June 2007 to January 2009. During a follow-up patients with no signs of PH on echo and normal NTproBNP level were catheterized. In patients with normal PA pressure sildenafil was discontinued. Echo and NTproBNP level were performed 1 week and every 3 months after discontinuation.

Results: Six infants with persistent PH after cardiac surgery: 3 AVSD (all with Down syndrome), 1 multiVSD, 2 ASD (1 with Down syndrome) were involved in the study. The age of correction was 6.2–13.1 months (8.8 ± 2.6). Sildenafil was started because of PH recognized on echo – confirmed by cardiac cath in 4 pts, in 2 without cardiac cath. In 4 pts sildenafil was introduced in the early postoperative period as a continuation of NO, in 2 pts treatment was started 6 weeks and 6 months after surgery. At the 1st check NT-proBNP ranged from 1170 to > 3000 pg/ml. A follow-up on sildenafil was 3–12 months. All patients are in good general condition, without HF. In 4 cases (all with Down syndrome) sildenafil was withdrawn after cardiac cath. After follow-up period from 3 to 13 months echo and NT-proBNP are normal. Two pts are still on sildenafil1 year after surgery, without HF. No adverse events of sildenafil were observed.

Conclusions: In the study group sildenafil was effective and well tolerated medication in therapy of postoperative PH. Echo examination and NT-proBNP level were good methods for evaluation of treatment.