FREE PAPER SESSION 3

Canary II Room, 08:15h, 6th April 2019

08:15 – 08:25 **Pulmonary Arterial Hypertension and Pregnancy - A Systematic Review of Pregnancy Outcomes in a Contemporary Cohort**

Laureen Wang*[1] ; Ting Ting Low[1] ; Nita Guron[2] ; Candice Silversides[2]
[1]Cardiology/ National University Hospital/ Singapore, [2]Cardiology/ Toronto General Hospital/ Canada

08:25 – 08:35 **Balloon Pulmonary Angioplasty for Chronic Thromboembolic Pulmonary Hypertension: A Local Experience**

Kien Hong Kevin Quah*[1] ; Jonathan Yap[1] ; Wen Ruan[1] ; Ju Le Tan[1] ; Soo Teik Lim[1]
[1]Cardiology/ National Heart Centre Singapore/ Singapore

08:35 – 08:45 **Pulmonary Endarterectomy in Patients with Chronic Thromboembolic Pulmonary Hypertension: The Singapore Experience**

Alicia Chia*[1] ; Jonathan Yap[2] ; Wen Ruan[2] ; Ju Le Tan[2] ; Kenny Loh[3] ; Ming Huat Goh[3] ; Narayan Lath[4] ; Foong Koon Cheah[4] ; Ghee Chee Phua[5] ; Duu Wen Sewa[5] ; Aileen Ang[6] ; Lai Heng Lee[6] ; Mee Yong Loi[1] ; Tanee Chan[1] ; Kelvin Quah[2] ; Adila Binte Ismail[2] ; Soo Teik Lim[2] ; David Jenkins[7] ; Victor Chao[1]
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08:45 – 08:55 **Comparison of Pulmonary Flow Measurements Between Four-Dimensional Whole-Heart and Two-Dimensional Phase-Contrast MRI**

Xiaodan Zhao*[1] ; Jun-Mei Zhang[1 2] ; Ru San Tan[3 2] ; Shuo Zhang[4] ; Rob van der Geest[5] ; Ju Le Tan[3 2] ; Ping Chai[6 7] ; Lynette Teo[8 7] ; Marielle V Fortier[2 9] ; Teng Hong Tan[2 9] ; Shuang Leng[1] ; Wen Ruan[3] ; Jennifer Ann Bryant[1] ; Jonathan Yap[3] ; Ching Ching Ong[8] ; Devinder Singh[6 7] ; Soo Teik Lim[3 2] ; James W. Yip[6 7] ; Liang Zhong[1 2]
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08:55 – 09:05 **Risk-Benefit Ratio May Not Justify a Further Decrease in Threshold for Pulmonary Valve Replacement Late after Tetralogy of Fallot Repair: An Experience with 2579 Patients**

Perryn Ng*[1] ; Ting Ting Low[1] ; Susan L Roche[2] ; Edward J Hickey[2]
[1]National University Heart Centre, Singapore/ National University Health System/ Singapore, [2]Cardiology/ Toronto General Hospital/ Canada

09:05 – 09:15 **Can We Predict Pulmonary Vascular Obstructive Disease (PVOD) in Patients with Secundum Atrial Septal Defect (ASD) Just From 12-Lead Electrocardiogram?**

Jimmy Oi Santoso*[1] ; Radityo Prakoso[1] ; Ronaldo Simamora[1] ; Bambang Budi Siswanto[1]; [1]Cardiology/ Universitas Indonesia/National Cardiovascular center Harapan Kita/ Indonesia

09:15 – 09:30 **Help Seeking Patterns and Funding Strategies in Patients with Pulmonary Arterial Hypertension on PDE 5 Inhibitors: An Orphan Disease with Effective but High Cost of Treatment**

Justin Jang*[1] ; Yinghao Lim[1] ; Ting Ting Low[1] ; Tingwei Teo[1] ; Siti Munawarah Bte Maaroof [1] ; Ivandito KUNTJORO[1] ; James Yip[1] ; Edgar Tay[1]
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Topic: Non-Invasive Cardiac Imaging, Echocardiography, Nuclear Cardiology / Adult Congenital Heart Disease / Cardiac Surgery
Abstract No: 10370

Pulmonary Arterial Hypertension and Pregnancy - A Systematic Review of Pregnancy Outcomes in a Contemporary Cohort

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Objective(s)
To perform a systematic review of adverse pregnancy outcomes in pregnant women with PAH in the last decade.

Material and Method
We searched Medline, Embase and Cochrane database for articles describing outcomes in pregnancy published in 2008-2018. We excluded case reports with less than 8 cases, and studies that did not report PAH specific treatment. We reviewed 3663 titles and extracted data from 10 publications. Pooled incidences and percentages of maternal and perinatal outcomes were calculated.

Result(s)
There were 224 pregnancies in 213 women with PAH. In 8 studies (n=186 pregnancies) with early pregnancy outcomes, 25% had therapeutic abortions and 4% spontaneous miscarriages. 174 pregnancies continued beyond 20 weeks of gestation. In studies with functional class, 79% were class I or II pre-pregnancy and the mean PASP was 75±30 mmHg. The most common diagnosis was PAH associated with congenital heart disease (69%), followed by idiopathic (18%). With regards to PAH therapy; 21% were on a prostacyclin analogue, 23% on PDE-5 inhibitors, 8% on calcium channel blockers and combination therapy in 12%. The mean gestation age at delivery was 33 ± 5 weeks. Most women had Caesarean deliveries (77%); and 36% of pregnancies had general anesthesia. Overall maternal mortality rate beyond 20 weeks gestation was 11%; 6 maternal deaths occurred in 33 pregnancies with idiopathic PAH and 13 deaths in 124 pregnancies with congenital heart disease. There were no maternal deaths in PAH from other etiologies. Causes of death included pulmonary hypertension crisis, heart failure and shock. Premature births occurred in more than half of the pregnancies. Stillbirth occurred in 3% and neonatal mortality rate was 1%.

Conclusion
In this systematic review of a contemporary cohort of pregnant women with PAH, maternal mortality continues to be a significant risk. Continued prospective studies are needed to improve outcomes and to better understand the role of PAH therapy.

Keywords: pulmonary arterial hypertension; congenital heart disease; pregnancy

Topic: Invasive Diagnostic & Interventional Cardiology
Abstract No: 10363

Balloon Pulmonary Angioplasty for Chronic Thromboembolic Pulmonary Hypertension: A Local Experience

Kien Hong Kevin Quah*[1] ; Jonathan Yap[1] ; Wen Ruan[1] ; Ju Le Tan[1] ; Soo Teik Lim[1]
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Objective(s)

In patients with chronic thromboembolic pulmonary hypertension (CTEPH) who are ineligible for pulmonary endarterectomy (PEA) or have persistent pulmonary hypertension after surgery, balloon pulmonary angioplasty (BPA) has emerged as a viable treatment option. Data from South-east Asia (SEA) is lacking. We aim to share one of the first experiences with this treatment modality from the region.

Material and Method

All consecutive CTEPH patients who underwent BPA at our single tertiary cardiac institution from Jan 2016 were included. Baseline clinical characteristics and investigations as well as procedure details were collected. Efficacy outcomes included changes in functional class and pulmonary hemodynamics. Safety outcomes studied included peri-procedural complications and mortality.

Result(s)

A total of 32 BPA sessions were performed for 8 patients (mean age 59.3±18.6 years; 3 males; average 4 BPA sessions per patient (range 2 to 7)). The average number of pulmonary segments treated per session was 7.1±3.0. There were 5 CTEPH patients who completed BPA, 1 patient with ongoing treatment and 2 patients who had BPA for persistent pulmonary hypertension after PEA (See Table 1). The procedural success rate was 100%. There were 2 (6%) cases of haemoptysis from distal wire perforation that required gel foam distal embolization. These cases were stable after overnight monitoring in the high dependency. No other complications were noted - there were no mortalities, intubations or requirements for advanced cardiac life support systems. There was significant improvement in New York Heart Association (NYHA) functional class at 3 to 6 months (p=0.012), and this improvement persisted at 1 to 2 years of follow-up (p=0.026). There was also significant reduction in pulmonary vascular resistance from 6.8±2.6 Woods pre-treatment to 3.9±2.6 Woods (p=0.040) post-treatment and a trend towards reduction in mean pulmonary artery pressure from 42±10mmHg to 33±11mmHg post-treatment (p=0.102).

Conclusion

In suitable CTEPH patients ineligible for PEA, BPA is a safe and efficacious treatment modality.

Keywords: chronic thomboembolic hypertension; pulmonary embolism; balloon pulmonary angioplasty; pulmonary hypertension

Topic: Non-Invasive Cardiac Imaging, Echocardiography, Nuclear Cardiology / Adult Congenital Heart Disease / Cardiac Surgery
Abstract No: 10367

Pulmonary Endarterectomy in Patients with Chronic Thromboembolic Pulmonary Hypertension: The Singapore Experience

Alicia Chia[*1] ; Jonathan Yap [2] ; Wen Ruan[2] ; Ju Le Tan[2] ; Kenny Loh[3] ; Ming Huat Goh[3] ; Narayan Lath[4] ; Foong Koon Cheah[4] ; Ghee Chee Phua[5] ; Duu Wen Sewa[5] ; Aileen Ang[6] ; Lai Heng Lee[6] ; Mee Yong Loi[1] ; Tanee Chan[1] ; Kelvin Quah[2] ; Adila Binte Ismail[2] ; Soo Teik Lim [2] ; David Jenkins[7] ; Victor Chao[1]
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Objective(s)

Chronic thromboembolic pulmonary hypertension (CTEPH) is a debilitating condition that portends significant mortality and morbidity. Pulmonary endarterectomy (PEA) has been shown to be an efficacious treatment of this chronic disease. We aim to describe our local experience with this treatment modality.

Material and Method

All consecutive CTEPH patients who underwent PEA at our single tertiary cardiac institution from Jun 2015 to Dec 2018 were included. Baseline clinical characteristics and procedure details were collected. Efficacy outcomes studied included reduction in pulmonary pressures and resistance and improvements in functional status. Safety outcomes studied included peri-operative complications and mortality.

Result(s)

A total of 16 patients (mean age 54.8 ± 9.9 years; 6 males) underwent PEA. 2 of the 4 patients (25%) from the initial series passed away in-hospital after the PEA due to right heart failure. The NHCS CTEPH team subsequently went for a team HMDP at the Royal Papworth Hospital in UK. There were no subsequent mortalities in the last consecutive 12 patients. One patient required temporary ECMO support for reperfusion lung injury but was successfully weaned off. Seven incidental cases of SDH were noted on routine CT Brain scan post PEA (1 required burrhole drainage, the rest were conservatively treated). In the remaining 14 patients, NYHA functional class improved in all to NYHA I-II at 3 to 6 months ($p=0.003$), and this improvement was sustained in the majority at 1 to 2 years of follow-up ($p=0.011$). There was significant reduction in pulmonary vascular resistance from 11.68±5.38 Woods pre-treatment to 4.06±3.68 Woods ($p<0.001$) post-treatment, as well as in mean pulmonary artery pressure from 49.2±7.07mmHg to 30.5±16.9mmHg post-treatment ($p<0.001$).

Conclusion

PEA is a complex surgery that requires both good surgical technique as well as a comprehensive multi-disciplinary team care approach. Beyond the initial learning curve and with greater experience, the team has since achieved consistently improved outcomes.

Keywords: Chronic Thromboembolic Pulmonary Hypertension; CTEPH; Pulmonary Endarterectomy; PEA

Topic: Basic Science
Abstract No: 10359

Comparison of Pulmonary Flow Measurements between Four-Dimensional Whole-Heart and Two-Dimensional Phase-Contrast MRI

Xiaodan Zhao*[1] ; Jun-Mei Zhang[1 2] ; Ru San Tan[3 2] ; Shuo Zhang[4] ; Rob van der Geest[5] ; Ju Le Tan[3 2] ; Ping Chai[6 7] ; Lynette Teo[8 7] ; Marielle V Fortier[2 9] ; Teng Hong Tan[2 9] ; Shuang Leng[1] ; Wen Ruan[3] ; Jennifer Ann Bryant[1] ; Jonathan Yap[3] ; Ching Ching Ong[8] ; Devinder Singh[6 7] ; Soo Teik Lim[3 2] ; James W. Yip[6 7] ; Liang Zhong[1 2]

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Objective(s)

4D whole-heart phase-contrast magnetic resonance imaging (PC-MRI) simultaneously quantifies intracardiac flow velocities and directions in any arbitrary orientations within the imaging volume that can later be reconstituted in any desired plane. We aimed to compare main pulmonary artery (PA) flow by using conventional 2D PC-MRI at a pre-subscribed plane with 4D PC-MRI in healthy volunteers and patients with heart disease.

Material and Method

21 healthy volunteers, 7 patients with repaired tetralogy of Fallot and 4 with pulmonary hypertension were recruited. All subjects underwent standard 2D-PC MRI (typical frame rate 30/heart beat) acquisition at a plane transecting the mid PA. 4D PC-MRI was performed using gradient-echo echo-planar imaging (EPI) with velocity encoding in three orthogonal directions (same number of cardiac phases) covering the heart from apex to aortic arch with subject freely breathing without respiratory navigation. 2D and 4D PA flow measurements were compared using intra-class correlation coefficients (ICC) and Bland-Altman analyses.

Result(s)

PA flows and pulmonary regurgitation fractions (PRF) from 4D and 2D PC-MRI demonstrated good correlation (net forward flow 64.1 ± 16.1 vs. 62.7 ± 14.8mL, ICC 0.951; backward flow 8.6 ± 17.9 vs. 7.8 ± 15.5mL, ICC 0.990; PRF 9.1 ± 16.9 vs. 8.5 ± 14.8%, ICC 0.988) and agreement (means ± standard deviations of the differences in PA net forward flow, backward flow and PRF were 1.44 ± 6.67 mL, 0.8 ± 3.31 mL and 0.62 ± 3.45%, respectively).

Conclusion

4D whole-heart PC-MRI has excellent agreement with the standard 2D approach for PA flow quantitation. Compared to standard 2D-PC MRI, 4D-PC MRI encompasses more abundant information that may allow quantitation of downstream pulmonary artery wall shear stress, pulmonary vascular remodelling and assessment of disease progression and therapeutic response.

Keywords: 4D whole-heart phase-contrast magnetic resonance imaging; 2D phase-contrast magnetic resonance imaging; pulmonary artery flow quantitation; repaired tetralogy of Fallot; pulmonary hypertension

Topic: Non-Invasive Cardiac Imaging, Echocardiography, Nuclear Cardiology / Adult Congenital Heart Disease / Cardiac Surgery
Abstract No: 10378

Risk-Benefit Ratio May Not Justify a Further Decrease in Threshold for Pulmonary Valve Replacement Late After Tetralogy of Fallot Repair: An Experience with 2579 Patients

Perryn Ng*[1] ; Ting Ting Low[1] ; Susan L Roche[2] ; Edward J Hickey[2]
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Objective(s)

Recommended thresholds for pulmonary valve replacement (PVR) in asymptomatic patients after tetralogy of Fallot (TOF) repair are continually decreasing. We studied the natural history versus outcomes after PVR in various categories of indexed right ventricular end-diastolic volume (RVEDVi).

Material and Method

Acquisition of all repeated measure datapoints and cross-sectional review in 2579 patients (born 1924 - 2011), including 7553 echos, 2579 MRI scans and all interventional data. Analysis was via parametric competing risks techniques and time-related regressions adjusted for repeated measures.

Result(s)

Survival was 95%, 81% and 73% at age 20, 40 and 60 years respectively. Freedom from PVR (N=516, mean age 25 years) was 87%, 66% and 45% at 20, 40 and 60 years. Overall, survival after PVR was 98%, 95% and 87% at 1, 10 and 20 years. PVR-free survival in all 345 patients with MRI RVEDVi > 150 was 95% at 15 years. Comparative survival showed no survival advantage with PVR versus natural history for RVEDVi 150-160, 160-170, 170-180; these categories had excellent PVR-free survival approaching 100% at 10 years. Patients with RVEDVi > 200 had late survival decrements with PVR or without. PVR resulted in a large and significant reduction in RVEDVi (mean 40 ml/m2, P<.0001), after which RVEDVi remained stable (P=.10). Patients with RVEDVi 150-160, 160-170 or 170-180 had similar reductions in RVEDVi after PVR to comparable levels. 35% of children transitioning to adult care had RVEDVi > 150 ml/m2

Conclusion

Lowering the RVEDVi threshold for PVR does not appear to offer a clear survival advantage and offers small differences (if any) to RV geometry, potential procedure-related morbidity and endocarditis risk and would mean intervening on many teenagers with repaired TOF who could otherwise anticipate intervention in later life.

Keywords: Tetralogy-of-Fallot; Pulmonary valve replacement

Topic: Non-Invasive Cardiac Imaging, Echocardiography, Nuclear Cardiology / Adult Congenital Heart Disease / Cardiac Surgery
Abstract No: 10507

Can We Predict Pulmonary Vascular Obstructive Disease (PVOD) in Patients with Secundum Atrial Septal Defect (ASD) Just From 12-Lead Electrocardiogram?

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Objective(s)
To develop a diagnostic criteria of PH and predictor of PVOD from 12-lead ECG to help a cardiologist in the limited area.

Material and Method
This is cross-sectional study of 62 patients (age>18) with secundum ASD without other congenital heart defect undergo RHC in National Cardiovascular Center Harapan Kita. ECG obtained 24-h prior to RHC with a standard measurement. Predictor for PVOD developed from analysis in Pulmonary Hypertension group in secundum ASD

Result(s)
We analyzed the ECG and RHC from 32 subjects diagnosed with PH and 30 subjects without PH. We obtained that R in V1+S in V6> 12,5 mm, right axis deviation (RAD), and RV strain has an Area Under of Curve (AUC) of 80,8%, 70,5%, and 85,6% respectively to predict PH. We developed a scoring system and a score of >5 have a sensitivity of 90%, specificity of 84,4%. We also developed predictor for PVOD that predicted by R in V6+S in V6 > 27,5 mm that have sensitivity of 63,6% and specificity of 85,7%.

Conclusion
12-lead ECG can be used to predict PH and PVOD in secundum ASD. It may help cardiologists or general practitioners in rural and isolated area to manage patients with secundum ASD.

Keywords: Secundum ASD, Pulmonary Hypertension, 12-lead ECG, Right heart catheterization, pulmonary obstructuve vascular disease

Topic: Non-Invasive Cardiac Imaging, Echocardiography, Nuclear Cardiology / Adult Congenital Heart Disease / Cardiac Surgery
Abstract No: 10392

Help Seeking Patterns and Funding Strategies in Patients with Pulmonary Arterial Hypertension on PDE 5 Inhibitors: An Orphan Disease with Effective But High Cost of Treatment

Justin Jang*[1] ; Yinghao Lim[1] ; Ting Ting Low[1] ; Tingwei Teo[1] ; Siti Munawarah Bte Maaroof [1] ; Ivandito KUNTJORO [1] ; James Yip[1] ; Edgar Tay[1]
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Objective(s)

Pulmonary arterial hypertension (PAH) is associated with high medical and pharmacy costs. Phosphodiesterase Type 5 (PDE5) inhibitors have been found to be beneficial but costly. They are not subsidised in Singapore except via the Medication Assistance Fund Plus scheme. In this study, we describe the help-seeking behaviour of patients and funding strategies for Singaporean patients on PDE5 inhibitors in our registry.

Material and Method

We consecutively recruited all patients with PAH when they presented to our pulmonary hypertension specialty centre between 01 January 2003 and 29 December 2016. Singaporean patients on PDE5 inhibitors were included. Data recorded and analysed for this study included baseline demographics, whether the patients received MAF plus funding, percentage of funding, as well as any additional source of subsidies.

Result(s)

114 of 148 patients (77.0%) in the registry are Singapore citizens on PDE5 inhibitors. 75 of these 114 patients (65.8%) have been seen by a medical social worker, of which 16 are on MAF Plus funding. 14 of the remaining 59 patients were subsidised by Medifund whereas the remainder were self-paying. 30 patients in total (26.3%) were on any form of subsidy. 28 patients (24.6%) were on combination therapy. Of this group, 9 were on MAF Plus subsidies.

Conclusion

We identified fewer than expected patients on drug subsidy for PAH. This is contributed to by insufficient referrals and lack of requests for financial assistance. Patients on combination therapy have greater financial challenges. This study should spur us on to further study gaps in funding and address them.

Keywords: Pulmonary Hypertension; Asia; Healthcare Financing; Phosphodiesterase 5 Inhibitors