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**CARDIOLOGY**



Including Abstracts of  
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# Surgical Repair of Post Myocardial Infarction Ventricular Septal Rupture: Experience at a Tertiary Care Hospital

IMRAN KHAN, WASEEM RIAZ, TIPU KHAN, ZAFAR TUFAIL, ABDUL WAHEED

From Department of Cardiac Surgery, Punjab Institute of Cardiology, Lahore, Pakistan

**KHAN ET AL.:** *Surgical Repair of Post Myocardial Infarction Ventricular Septal Rupture: Experience at a Tertiary Care Hospital.* **Background:** Early surgery is indicated for ventricular septal rupture (VSR) that develops after myocardial infarction (MI). Surgical repair carries a high mortality. The purpose of this study was to find out the in hospital outcome of the surgical repair of this complication at a tertiary care high volume centre. **Methods and Results:** A retrospective descriptive study was done by checking the hospital record of all those patients who had undergone surgical repair of post myocardial infarction ventricular septal rupture from January 2008 to August 2014. The hospital ethical committee gave permission for the study. All the patients underwent identical surgical procedure for the repair of septal rupture. Perioperative variables were recorded and descriptive statistics obtained. A total of 40 such patients were identified including 24 (60%) male and 16 (40%) female patients with a mean age of  $55.4 \pm 10.7$  years. Intra-aortic balloon pump was used in 27 (62.5%) patients preoperatively. Nine out of 40 patients were operated within 2 weeks of the occurrence of VSR. While 23 (57.5%) were operated after the 3 weeks of VSR. Six out of 9 patients died who were operated within 2 weeks. One out of 23 patients died who presented after 3 weeks duration after post MI VSR. **Conclusion:** Still a large number of patients suffer from post MI VSR in our setup. Surgical treatment carries high mortality especially those operated within first week. Patch repair of the ventricular septal is an acceptable treatment strategy for both anterior and posterior located septal ruptures. (*J HK Coll Cardiol* 2015;23:1-5)

*Intraaortic Balloon pump, Outcomes, Post myocardial infarction ventricular septal rupture*

## 摘要

**背景：**心肌梗死伴發室中隔破裂（VSR）是早期手術治療的適應症。手術修補破裂室中隔具有很高的死亡率。本研究旨在探索在大型三級醫療中心中手術修補破裂室中隔的院內結果。**方法與結果：**一項回顧性研究調查了2008年1月至2014年8月間所有心肌梗死後室中隔破裂並進行手術修補室中隔患者的病歷資料。本次調研已通過醫院倫理委員會同意。所有患者進行同樣的室中隔破裂修補術。記錄術前的變數，並做統計描述。總共納入40名合格患者，其中男性24（60%）名，女性16（40%）名，平均年齡為 $55.4 \pm 10.7$ 歲。27（62.5%）名患者使用術中主動脈內球囊泵。9名患者在VSR 2周內進行手術治療，23（57.5%）在VSR 3周後進行手術治療。前9名患者中有6名術後死亡，後23名患者中則有一名手術後死亡。**結論：**目前我們中心仍有大量的的心肌梗死伴發室中隔破裂患者。手術治療伴隨著極高的死亡率，尤其是室中隔破裂 1 周內進行手術治療的患者。補片修補位於前段和後段的室中隔破裂是一種可進行的治療方案。

**關鍵詞：**主動脈內球囊泵、結果、心肌梗死後室中隔破裂

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## Introduction

Ventricular septal rupture is one of the mechanical complications of myocardial infarction. Acute myocardial infarction can lead to many mechanical complications like rupture of the free wall and pseudoaneurysm, rupture of the ventricular septum, acute mitral regurgitation, and tamponade.<sup>1</sup> Post myocardial infarction (MI) ventricular septal rupture (VSR) occurred in 1-3% patients in pre-thrombolytic era but with the advent of thrombolytic agents the incidence has reduced to 0.5-1%.<sup>2</sup> It carries a high surgical mortality and early intervention is warranted. Post MI VSR is either antero-apical or infero-posterior. Different surgical techniques are used for their repair. With advancement in perioperative management like the use of intra-aortic balloon pump and better surgical techniques, the operative mortality has decreased over the years.<sup>3</sup> But in spite of such developments, it still carries a high operative mortality in patients who present early. Those surviving the first 30 days postoperatively have a good long term survival.<sup>4</sup> This retrospective study describes the in hospital outcome of surgical treatment of post MI VSR in a high volume unit.

## Materials and Methods

This retrospective observational study was conducted at the Department of Cardiac Surgery, Punjab Institute of Cardiology, Lahore, Pakistan. It is a high volume centre where annually 2100 cardiac operations are performed on the average. Hospital record of all those patients operated for ventricular septal rupture after myocardial infarction from January 2008 to August 2014 was studied and various preoperative, intraoperative and postoperative variables were recorded. The time interval from the onset of symptoms to surgery was recorded. A 30 day follow up was obtained from the hospital record for all patients including telephonic information about those patients who had left the hospital before 30 days period. The outcome and in hospital mortality of all the patients were collected.

## Surgical Technique

Surgical technique was identical for all the patients. The VSR was approached from the left ventricle with incision in the infarcted myocardium. A patch reconstruction of the VSR with Dacron™ was performed in every patient. Pledgeted prolene sutures were used with pledgets on both the right ventricular and left ventricular side of the septum. The defect in the left ventricular wall was closed using Teflon™ felts and taking big enough bites in the myocardium to include the infarcted or aneurysmal myocardium. Concomitant coronary artery bypass grafting (CABG) was performed where needed. No additional procedure was needed in any patient.

## Data Analysis

The SPSS (version 16, SPSS Inc.) was used for the data analysis. Quantitative variable were presented as mean±standard deviation and the qualitative variables were presented as frequency and percentages.

## Results

A total of 40 patients were included in the study. Number of male patients was 24 (60%) and female patients were 16 (40%). Mean age was 55.4±10.7 years. The clinical and demographic characteristics of the patients are presented in Table 1. Intra-aortic balloon pump (IABP) was used in 27 (62.5%) patients preoperatively. The mean ejection fraction of all the patients was 42.33±10%. Nine out of 40 patients were operated within 2 weeks of the occurrence of VSR. Most of the patients (23 (57.5%)) were operated after the 3 weeks of VSR. Preoperative cardiac angiogram could not be obtained in 2 patients as they had to be operated quickly due to haemodynamic deterioration. Concomitant CABG was performed in 29 (72.5%) patients. Six out of 9 patients died who were operated within 2 weeks. Five of those 6 patients were operated in the first week after VSR diagnosis. Out of those five patients, 4 were in cardiogenic shock who received

IABP preoperatively. Three of these patients did not survive the procedure. Mortality was very low in those presenting late i.e., only one out of 23 patients died who presented after 3 weeks duration after post MI VSR (Table 2). Residual ventricular septal defect (VSD) was detected in 5 patients on postoperative echocardiogram. But none of these 5 patients died. Mortality was significantly low in patients in whom preoperative IABP was used. Three out of 4 patients with postero-inferior VSR died while mortality was significantly low in patients presenting with antero-apical VSR i.e. 5 out of 36.

### Discussion

To the best of our knowledge, this is the largest report on the outcomes of surgical repair of post myocardial infarction ventricular septal rupture in Pakistan. Over a period of five years, 40 patients were operated for post myocardial infarction which is a large number of patients compared to the international literature. The reason for this high number may be the huge population that is covered by our hospital and secondly, a large number of patients still do not have access to instant thrombolytic therapy in this part of the world. Reports in 70s and early 80s, when thrombolytic therapy wasn't common, showed a high incidence of post MI VSR. The GUSTO-I trial then mentioned an incidence of 0.20% and the reason they gave for the decreasing incidence was more and more availability of thrombolytic therapy.<sup>2</sup>

This mechanical complication of myocardial infarction carries very high in-hospital mortality. Report by George and colleagues described the surgical results of post MI VSR from the Society of Thoracic Surgeons database.<sup>5</sup> Mortality in their report is 42.9%. They have

mentioned time interval from MI to operation and then surgery. They showed that 54% of the patients operated within 7 days of MI had in-hospital mortality. Anders and colleagues similarly showed a mortality of 41%.<sup>6</sup> But mortality rates as low as 19% have also been reported.<sup>7</sup> Morality in our study was 20% which is evidently on the lower side compared to most of the international reports. This can be explained by the fact

**Table 1. Clinical characteristics of the patients**

Variable	Patients n=40
Age	55.4±10.7 years
Male/Female	24 (60%)/16 (40%)
Diabetes mellitus	13 (32.5%)
Hypertension	27 (65%)
History of smoking	10 (25%)
Preoperative IABP	27 (62.5%)
EF	42.33±10%
Cardiogenic shock	4 (10%)
Postero-inferior location of VSR	4 (10%)
Antero-apical location of VSR	36 (90%)
Concomitant CABG	29 (72.5%)
Mean CPB time	95.45±25.06 minutes
Mean cross clamp time	67.9±13.88 minutes
Length of stay in ICU	11±5 days
Residual VSD	5 (12.5%)
CVA	3 (7.5%)
Postoperative acute kidney injury	13 (32.5%)
Pleural effusion requiring tapping	6 (15%)
Postoperative RRT	4 (10%)

IABP: intra aortic balloon pump; EE: ejection fraction; VSR: ventricular septal rupture; CABG: coronary artery bypass grafting; CPB: cardiopulmonary bypass; ICU: intensive care unit; VSD: ventricular septal defect; CVA: cerebrovascular accident; RRT: renal replacement therapy

**Table 2. Relationship of time duration from diagnosis to surgery with early outcome**

Time duration from diagnosis to surgery	In-hospital outcome		Total No. of patients
	Survival	Mortality	
<2 weeks	3	6 (66.67%)	9 (22.5%)
2 weeks to 3 weeks	7	1 (12.5%)	8 (20%)
>3 weeks	22	1 (4.3%)	23 (57.5%)
<b>Total</b>	<b>32</b>	<b>8 (20%)</b>	<b>40</b>

the most of the patients presented late and 90% patients had antero-apical VSR. Both these factors have been proved to be predictors of survival in previous reports.<sup>5</sup> Cardiogenic shock is an important risk factor for mortality in these patients.<sup>5</sup> Only four of the patients in our study reached the hospital with cardiogenic shock. They were emergently operated and only one of those four patients survived showing the very high mortality rate in this subgroup of patients.

The time for intervention is very much decided by the haemodynamic status of the patient. Cardiogenic shock warrants immediate surgery. If the patient is haemodynamically stable, optimization with inotropes and mechanical cardiac support can be achieved and surgery performed after a delay of 3-4 weeks. If there is clinical deterioration, immediate surgery is indicated.<sup>8</sup> Patients operated within one week of occurrence of VSR carry a very high mortality.<sup>9</sup> On the other hand, patients operated after the 2 weeks period after VSR carried a very low mortality as evident from our study. The reason for high mortality in early operated patient may be the acute haemodynamically decompensated state of the patient and secondly the fresh, friable margins of the defect where necrotic process is still going on.<sup>10</sup> We cannot wait for that length of time and deny early surgery to patients on ethical grounds as we don't know which patient will survive the initial high mortality period. So every patient should be given a chance and operated early when the diagnosis is made.<sup>11</sup>

Intra-aortic balloon pump is an important addition to the management of post MI VSR. It was used in 62.5% of the patients in our study. The use of IABP in these patients significantly reduces mortality as shown by our report. IABP significantly reduces left to right shunt and afterload in these patients thus improving the haemodynamics.<sup>12</sup> The current guidelines for the management of post MI VSR recommends the routine preoperative use of IABP for every patient diagnosed with this problem.<sup>13</sup>

Whether to do concomitant CABG or not is a subject of debate. Coronary arteries have a varied pattern of disease in patients with post MI VSR. Cox and colleagues and Leavey and colleagues found single vessel disease to be more common in their patients.<sup>14,15</sup> Triple vessel disease was found in 48.2% of the patients and concomitant CABG was performed in 72.5% of the

patients in our study. Barkera and colleagues in their article found triple vessel disease to be more common in patients with post MI VSR.<sup>16</sup> The high number of patients with triple vessel disease in our study may be due to the extensive nature of coronary artery disease in this part of the world.<sup>17</sup>

Small residual VSD was observed in five patients postoperatively in our study. These patients did not suffer from any additional morbidity and they survived the immediate postoperative period. Yam and colleagues observed patients with residual VSD for 10 years and found excellent long term outcomes.<sup>18</sup> We cannot infer at present from these findings as to what should be the fate of small residual defects that does not cause any shunt. Transcatheter closure of these defects has been described in literature.<sup>19</sup>

Our study is a retrospective report of the repair of post MI VSR at a single centre, thus carries all the drawbacks of a retrospective study. The sample size is also not statistically powered so as to find out all the predictors of mortality accurately. It doesn't describe the medium or long term follow up of the patients described thus we don't know the usefulness of the patch repair procedure in the long term. But this descriptive study gives an idea about the diseases burden and its surgical outcome in a developing country. We hope that with better facilities of thrombolytic therapy the incidence of ventricular septal rupture in the settings of acute MI will decrease. Advancements in the perioperative care and the availability of ventricular assist devices in this part of the world will certainly improve the surgical outcome of the patients especially those who present early to the hospital and those with cardiogenic shock.

### **Conflict of Interest Statement**

None

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# Transcatheter Aortic Valve in Valve Implantation Through a Prosthesis Carotid Artery: First Case

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**BENHALLA AND SOREA: *Transcatheter Aortic Valve in Valve Implantation Through a Prosthesis Carotid Artery: First Case:*** In recent years, transcatheter aortic valve implantation has become an emerging alternative for high-risk patients with severe aortic stenosis. We report a case of transcatheter aortic valve implantation with the self-expanding Medtronic CoreValve bioprosthesis through a left common carotid artery. This 83-year-old male patient presented with heart failure due to a severe degenerative aortic bioprosthesis, with several comorbidities, resulting in a logistic EuroScore II of 36%. Consequently, he was rejected to undergo surgery and a transcatheter approach was planned. And due to severe peripheral vascular disease with iliofemoral lesions, significant calcifications of the innominate artery, we considered a left carotid access through a prosthesis carotid in Dacron. The procedure was successful without cardiac, cerebrovascular, or access complications. And it appears to be a valuable alternative access for patients with severe peripheral vascular disease. (*J HK Coll Cardiol* 2015;23:6-9)

*Carotid bioprosthesis, Percutaneous aortic valve, Valve in valve*

## 摘要

近年來，經導管主動脈瓣植入術，已經成為重度動脈瓣狹窄高危患者的緊急替代方法。我們報導一例通過左頸總動脈予置有美敦力公司自主擴張型生物假體的患者行經導管主動脈瓣植入術的案例。一名由於嚴重假體主動脈退化導致心功能衰竭的83歲男性患者，同時伴有多種伴發病，logistic EuroScore II評分既為36%，以至於他拒絕手術治療，而計畫採取經導管途徑的治療方式。又由於患者嚴重的周圍性血管疾病與髂股的病變、明顯的無名動脈鈣化，我們考慮通過聚酯纖維假體頸動脈到達左頸總動脈。手術成功完成，並且未發生心臟、腦血管或者手術操作併發症。通過頸總動脈假體經導管主動脈瓣植入術可能是治療伴有嚴重周圍性血管疾病患者的有效選擇方式。

關鍵詞：頸動脈生物假體、經皮主動脈瓣、瓣中瓣

## Introduction

The first percutaneous aortic valve replacement has been performed by Dr. A. Cribier in 2002, opening a new therapeutic approach to patients at high surgical risk for conventional operation by sternotomy.

Within a short time, there has been an improvement of the material and a simplification of the

procedure, the surgical approach used and the implantation technique. However patient selection remains crucial. We describe a percutaneous aortic valve implantation (a CoreValve bioprosthesis) in a degenerated bioprosthesis without an adequate vascular access, and which we decide to add prosthesis carotid in Dacron in per operative procedure.

## Case Report

An 83-year-old male, presented with heart failure due to a severe degenerative aortic bioprosthesis operated in 2009, with comorbidities included diabetes, hypertension, chronic pulmonary obstructive disease,

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## Discussion

as well as peripheral and coronary artery disease, resulting in a logistic EuroScore II of 36%. Preinterventional morphological patient screening included transthoracic as well as transesophageal echocardiography, confirmed a severely calcified aortic bioprosthesis with a mean transprosthesis gradient of 53 mmHg, valve area 0.8 cm<sup>2</sup>, and ejection fraction of 40%.

Computed tomographic illustrate showed a peripheral vascular disease with iliofemoral lesions, the diameter of the common iliac artery was of 5 mm and the subclavian arteries were about 5-6 mm with significant calcifications and unfavourable angulations of the innominate artery. Therefore, we considered a left carotid access, with a diameter of 6.5 mm, as the only solution with the use of a prosthesis carotid in Dacron to facilitate the procedure. The aortic annulus diameter, and the distance of the coronary ostia were also evaluated.

The carotid artery was first reopened under local anaesthesia and then after intubation and induction of general anaesthesia, endarterectomy of the left carotid artery was performed. Thereafter, an 8 mm Dacron prosthesis was connected to the left common carotid artery in an end-to-side fashion and a sheath was introduced into it. Via this approach, a self-expanding aortic valve prosthesis (CoreValve, Medtronic) was placed in typical position but 4 mm below (Figures 1 & 2). Importantly, the introducer sheath was not advanced into the carotid artery, so that antegrade blood flow was maintained during the entire TAVI procedure without further shunting. A localization 4 mm below the position is considered ideal for implantation. In this case (Figure 3) this may explain the immediate postoperative transaortic prosthesis mean gradient of 20 mmHg, with aortic prosthesis area of 1.1 cm<sup>2</sup>.

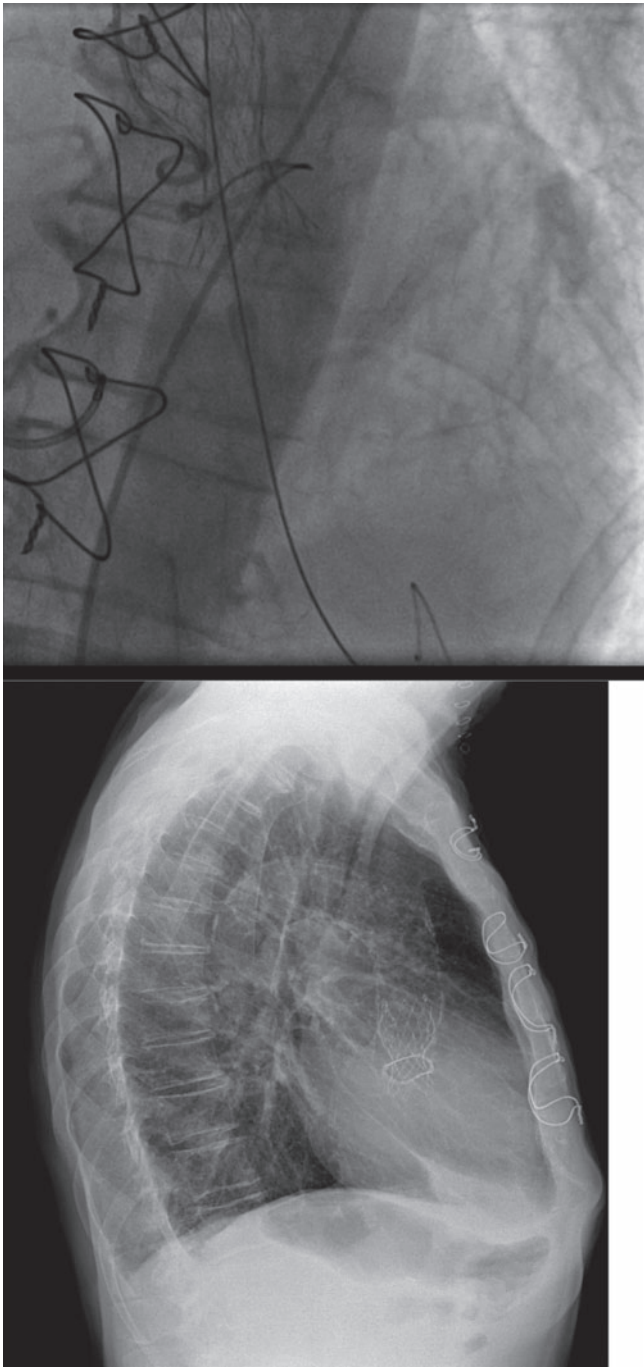
In the Post-operative follow up there is an important improvement of signs of heart failure within the first week for the patient.

The patient was seen one month after the procedure with a clear clinical improvement and regression of his episodes of cardiac decompensation.

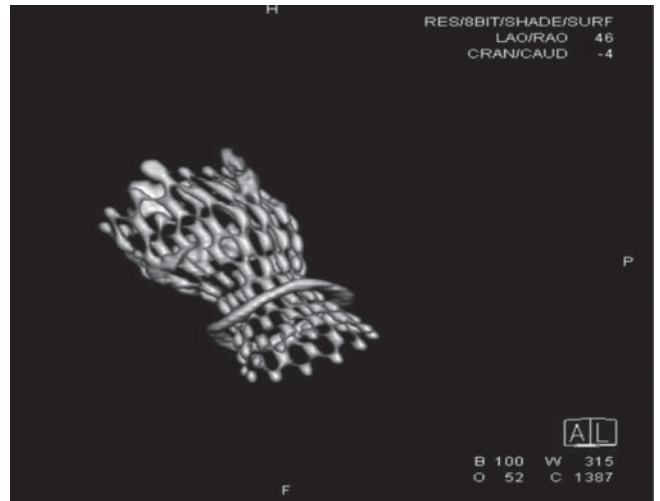
The entry in our case of the right native carotid artery was facilitated by the introduction of a prosthesis carotid in Dacron. The advantages of this procedure, are an optimal neuromonitoring during the carotid surgery in local anaesthesia and a simple implantation of the catheter-based aortic valve prosthesis via the same



**Figure 1.** Computed tomographic viewing the aortic prosthetic ring with calcifications before and after the endovalve implantation.



**Figure 2.** Angiographic view of the introduction of the percutaneous aortic valve on the degenerated bioprosthesis and the result seen in the chest radiograph.



**Figure 3.** Computed tomographic view of the percutaneous valve relative to the ring of the degenerated bioprosthesis.

access and during an only short period of general anaesthesia. Importantly, as already mentioned above, the introducing sheath for the TAVI must only be advanced into the "Dacron chimney" and not further into the carotid artery to provide a sufficient antegrade flow throughout the whole procedure.<sup>1,2</sup>

Very limited experience exists with surgical access via the carotid artery. In a small series reported by Modine et al of 12 patients, the procedure was successful in all. There was no mortality, but 1 patient had a stroke, which means that electroencephalogram monitoring in parallel to the procedure seems necessary to monitor cerebral perfusion.<sup>3</sup>

The median time for the implantation of the valve in valve is about 120 minutes in the European register.<sup>3</sup> For our case, it was 180 minutes with a fluoroscopy time of 36 minutes. This was explained by the initial implantation of the Dacron prosthesis.

For the valve in valve procedure the most common risk is the less optimal deployment of the percutaneous valve, secondary to calcifications usually present on the bioprosthesis especially if it is asymmetric.<sup>3</sup> Correct sizing is paramount, as undersizing may increase the risk of paravalvular regurgitation or valve migration whereas oversizing may lead to leaflet distortion within the transcatheter



heart valve, There is also often the need to implant a permanent pacemaker (5.7% to 20% for Corvalve) which remains the most common event described in the first 30 days with a positioning 2 to 6 mm below the base of the aortic annulus, which may interfere with the atrioventricular node, located very close to the aortic region and sub-membranous septum.<sup>3,4</sup>

### Conclusion

The common carotid access has been demonstrated to be a feasible and safe access route for TAVI. It appears to be a valuable alternative access for patients who cannot undergo trans-femoral TAVI, to expand the benefit from this technology with less bleeding events, less access-related complications and immediate patient ambulation.

### Disclosures

The authors declare that there is no conflict of interest.

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*Special Articles*  
*in Memory*  
*of*  
*Dr. Chiu-On Pun*

# Subclinical Atrial Fibrillation: A New Paradigm for Stroke Prevention

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**LAU: *Subclinical Atrial Fibrillation: A New Paradigm for Stroke Prevention.*** Approximately one out of five strokes is associated with atrial fibrillation (AF). AF is often intermittent and asymptomatic. Detection of AF after cryptogenic stroke will change therapy from antiplatelet to oral anti-coagulation agents for secondary stroke prevention. A critical step is to convert "covert" AF into ECG documented AF. External rhythm recording devices have registered a high incidence of AF to occur after a cryptogenic stroke, but are limited by short duration of continuous recordings. Invasive cardiac monitoring using insertable leadless cardiac monitors (ICMs) are sensitive means to identify subclinical AF (SCAF) after cryptogenic stroke, and AF has been reported to occur in up to 30% of these patients. It will be even more attractive to identify SCAF before a stroke occurs. Recent series in pacemaker and implantable cardioverter defibrillator showed that short episodes of SCAF increased stroke risk, with odds ratio ~2.2-3.1 compared to those without SCAF recorded. However, temporal sequence of recorded SCAF and stroke occurrence was uncertain, and the overall stroke risk was lower compared with patients with clinical AF at similar risk scores. This article reviews the incidence and clinical role of using implanted devices to detect SCAF and discuss the implication of SCAF so detected in primary and secondary stroke prevention. (*J HK Coll Cardiol* 2015;23:10-20)

*Atrial Fibrillation, Implantable Cardioverter Defibrillator, Pacemaker, Stroke*

## 摘要

大約20%中風事件伴有心房顫動(房顫)。房顫通常為間歇性，無症狀性發作。在原因不明性中風中檢測到房顫將會改變預防二次中風的治療方案，即從抗血小板治療轉化為抗凝治療。關鍵的一步是將「隱匿性」房顫轉化為心電圖記錄的房顫。體外心律記錄儀可以記錄到在原因不明性中風後出現房顫的高發生率，但易受到短時間連續記錄時程的限制。通過插入式無鉛心臟監視器進行侵入性心臟監測是發現原因不明性中風後亞臨床房顫的敏感方法，並且在這些患者中房顫的檢出率可達30%。更加引人注意的是這種方法可以在中風之前檢測出房顫。最近系列的心臟起搏器和植入型心臟復律除顫儀顯示短時間的亞臨床房顫可以增加中風的危險性，與未檢測到亞臨床房顫比較，比值比為2.2-3.1。然而，短時間記錄到的亞臨床房顫和中風的關係是不明確的，中風的總危險性要比具有相似危險分數的臨床房顫患者低。本文綜述了植入型儀器檢測亞臨床房顫的發現率和臨床作用，並討論檢測亞臨床房顫在預防首發和二次中風的意義。

關鍵詞：心房顫動、植入型心臟復律除顫儀、心臟起搏器、中風

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## Introduction

Epidemiological evidence suggests that atrial fibrillation (AF) increase ischaemic stroke risk by 5- to 6-fold independent of other risk factors.<sup>1</sup> AF related stroke tends to be more severe,<sup>2</sup> and mortality rate is higher (70-80%) compared with stroke without AF. There is also a high recurrence rate.<sup>3</sup>

AF episodes are often asymptomatic, and AF may present for the first time with complications such as thromboembolism and heart failure. Indeed, paroxysmal AF has similar stroke risk compared to sustained AF.<sup>4</sup> About 25% of strokes has no obvious underlying cerebrovascular disease or other stroke risk factors. AF is an important underlying mechanism for cardioembolism in these patients. Apart from overt neurological deficits, recurrent cerebral emboli can cause cognitive dysfunction and dementia.<sup>5</sup>

In the absence of documented AF, secondary and primary prophylaxis of stroke relies on the use of antiplatelet agents. If AF is the cause of stroke, aspirin can reduce stroke risk by 22% compared to placebo. However, oral anticoagulation using warfarin can additionally reduce this risk by 38-63% compared to aspirin.<sup>6</sup> More recently, non-vitamin K oral anticoagulation agents (NOACs) have been shown to be at least non-inferior to warfarin and have a lower incidence of major haemorrhagic complications, thus improving the risk-benefits ratio of stroke prevention in AF. This background makes primary and secondary prophylaxis of AF related stroke attractive. A critical step is to document underlying AF.

## AF Documentation

Due to the intermittent occurrence and often asymptomatic presentation of AF, routine ECG, 24 hour Holter and patient triggered recording devices have low detection rate of AF. Several types of external monitors with attached electrodes have allowed intermediate term continuous AF monitoring. Electrodes used include wet or dry electrodes.<sup>7</sup> These provide not only patient

triggered recordings, but automatic recording if AF occurs. Patient tolerability has improved with improved electrode design.

Longer term recording of cardiac rhythm is possible with implantable leadless cardiac monitors (ICMs), such as by the Medtronic Reveal XT™. As P waves are not well detected in ICMs, irregularity of RR interval is used as a surrogate for AF, the so called Lorentz plot<sup>8</sup> is arithmetically used to register AF. This had been tested in the XPECT Trial.<sup>9</sup> In this study, 247 patients with high AF burden received the Reveal XT™. The stored rhythm was recorded simultaneously with the ECG to an external Holter monitor for 46 h. This showed a sensitivity, specificity, positive predictive value and negative predictive value of the Reveal XT to identify AF of 96.1, 85.4, 79.3 and 97.4% respectively, with an accuracy of 98.5%. Further, false positivity is reduced by superimposing the R waves to examine for a possible P wave. The device has been further miniaturized and can be implanted with an injection mechanism (the LINQ™, Medtronic).

Obviously, cardiovascular implantable electronic devices (CIEDs) with attached atrial electrodes provide an excellent recording of AF. In the pacemaker population, Israel et al<sup>10</sup> showed in CIEDs, a significantly higher sensitivity of AF detection

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### Table 1. Technical aspects of AF detection using implanted atrial leads

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1. Closely spaced atrial bipolar lead
2. Bipolar sensing (atrial tip-atrial ring)
3. High atrial sensitivity (0.1-0.5 mV)  
(minimise under/intermittent sensing for AF detection)
4. Short PVARP
5. PVAB  $\geq$  25 ms to reject far field R wave
6. AEGM validation
7. Duration of AHRE to consider as AF

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AF=Atrial fibrillation; AEGM=atrial electrogram; AHRE=Atrial high rate episode PVAB=Post ventricular atrial blanking; PVARP=Post ventricular atrial refractory period

compared to Holter recordings. Table 1 shows the technical aspect to detect AF in CIEDs. Accurate recording requires a closely spaced atrial bipole (<1 cm), an appropriate atrial sensitivity setting, post ventricular atrial refractory period (PVARP) and blanking (PVAB) adjustment.

Programming appropriate atrial rates and episode durations cut off is also critical to register AF. A low cut off rate of AF detection will increase false positivity due to inclusion of noises and far field events such as R wave, whereas a high rate cut off will miss AF episodes when atrial signals become small or fall within the PVARP and PVAB. Programming a short cut off episode duration will increase sensitivity to detect brief AF episodes, but will include false positive detection of noise, whereas a longer cut off duration will increase accuracy but miss brief AF events. A validation of the Medtronic. AT500 and GEM III AT algorithms suggested sensitive AF detection if far field R waves were rejected.<sup>11</sup> In 5,769 pacemaker detected "atrial high rate events" (AHREs), Kaufman et al<sup>12</sup> examined the relative contribution of programmed cut off detection rate and duration on accuracy of AF detection. An increase in cut off detection rate from 190 to 250 bpm reduces false positive detection, especially if shorter AF detection rates were programmed. A cut off detection duration of >6 minutes will have a 17.3% false positive detection, compared to 3.3% if detection duration of >6 hours was programmed. It was concluded that validation by atrial electrograms (AEGMs) would be important for shorter detected AF episodes of >6 minutes, whereas this became less critical for longer episodes >6 hours. As most studies do not vigorously relate symptoms with device detected AF episodes, this review uses the term subclinical AF (SCAF) for AF detection by implanted, to distinguish them from the occurrence of clinical AF.

## Secondary Prevention in Cryptogenic Stroke

Kishore et al<sup>13</sup> summarized 32 trials which have used either external monitors or ICMs to detect AF in

patients after ischaemic stroke or transient ischemic attack (TIA). There was substantial heterogeneity between studies, with an overall detection rate of any new AF occurring in 11.5%, with higher detection rate in selected (e.g. cryptogenic stroke) versus unselected patients groups (13.4 vs 6.2%). Longer duration of recording and older patient age increased the chance of AF detection. There was insufficient data on the stroke type (lacunar vs non lacunar) and the timing of starting recording after the index stroke on AF detection rate. A large prospective study<sup>7</sup> recruited 572 ambulatory patients with a mean age of 55 years at a mean of 75 days after a stroke or TIA. Patients were randomized to receive either a 30-day event-triggered external recorder using dry electrodes or with another 24h Holter recording. The primary end point was detected AF >30 s, which was reached in 16.1% of patients versus only 3.2% using Holter only, and had led to an increase in oral anticoagulation use (18.6 vs 11.1%). Clinical AF was only detected in 0.5% of patients after 90 days, and AF was more often detected if the device was administered within 30 days of the index stroke. The limitations of this study are the delay in administering AF recording, exclusion of more serious stroke and non-ambulatory patients, and lack of AF burden measurement (as only <2.5 minutes per episode can be measured). Occurrence of AF after 30 days was not determined by this study.

More prolonged monitoring using invasive recordings in a similar population was reported in the CRYSTAL AF study.<sup>14</sup> In 441 patients at a mean of 38 days after a cryptogenic stroke either an external Holter or ICM (Reveal XT) was used to assess the time of first AF >30 s occurrence (Figure 1). AF was detected in 12.4% compared with 2.0% using ICM compared to Holter (p<0.001), again resulting in a higher percentage of oral anticoagulation use (14.7 vs 6.0%, p<0.007), and a trend to a lower recurrent stroke rate (7.1 vs 9.1%). At 3 years, the device projected battery life, AF was detected in 30% of patients. Most of the episodes of detected AF were asymptomatic (74% and 79% at 6 and 12 months respectively). Other prospective studies have documented a variable incidence of AF detection of

15.9%,<sup>13</sup> with the results of the Stroke Prior to Diagnosis of Atrial Fibrillation Using Long Term Observation with Implantable Cardiac Monitoring Apparatus Reveal (SURPRISE) showing an incidence of new AF in 18.6% in 3 years.<sup>15</sup>

Taken together, AF is a common occurrence in cryptogenic stroke and its detection will significantly affect the use of antithrombotic treatment. Since AF is detected in up to 30% of such patients in 3 years, arguably antithrombotic therapy with NOACs may be considered in such patients even without AF documentation. This is the subject of 2 prospective randomized studies in which either dabigatran or apixaban will be compared to aspirin in patients with cryptogenic stroke.

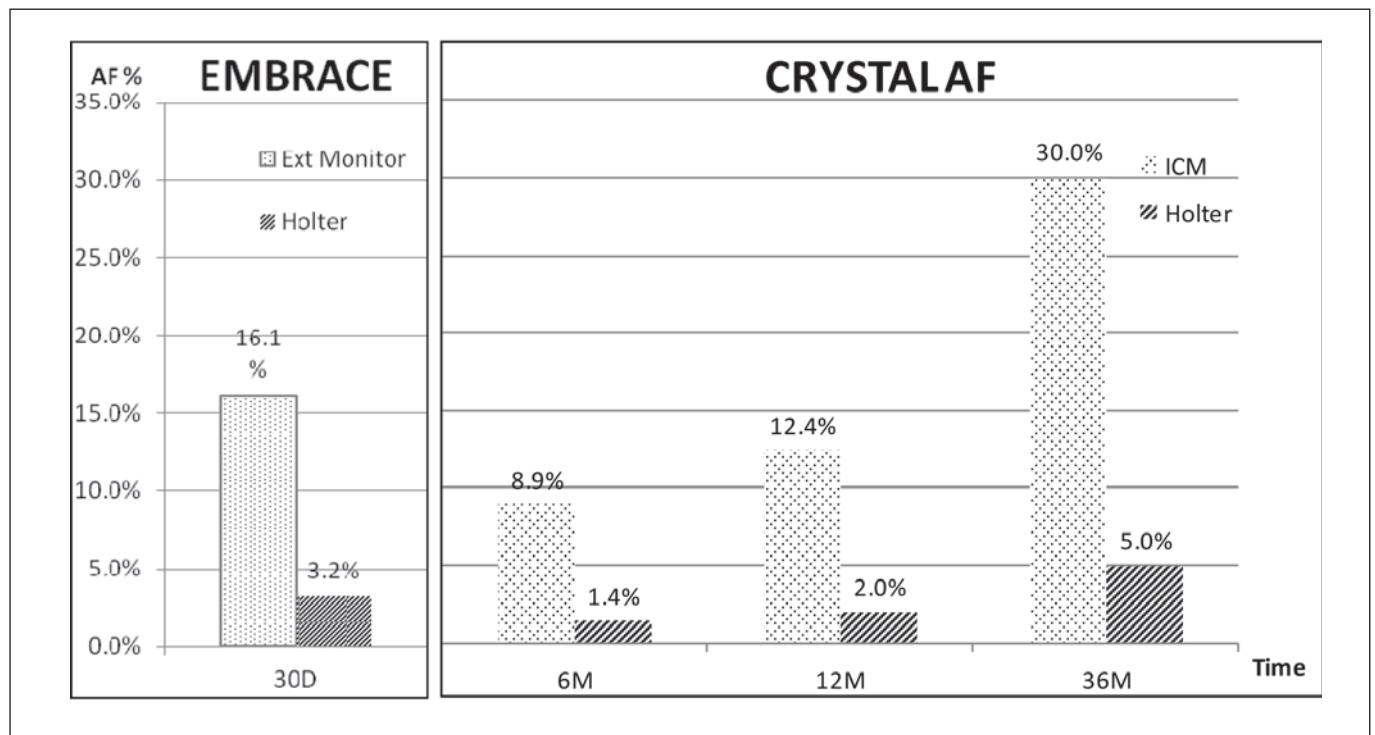
### Primary Prevention of Stroke by Early Scaf Detection Using Implanted Devices

The strong association between clinical AF and

ischaemic stroke, and the proven benefit of anticoagulation prophylaxis make early AF detection of clinical interest. Implanted CIEDs are the most reliable methods to detect AF. However, especially for shorter and asymptomatic SCAF episodes, it is uncertain if they predict clinical AF development or stroke (and other thromboembolic events) themselves. The relationship of SCAF detected by CIEDs and future clinical AF and stroke provides important background information for the clinical importance of SCAF.

### Frequency of SCAF Detected by CIED and Relation to Clinical AF

Gillis et al<sup>16</sup> reported SCAF to be detected in 68% of 231 patients with sinus node disease, and an incidence of 50.6% of SCAF was documented in 617 patients with DDD pacemakers.<sup>17</sup> An incidence of 44% of AF was detected in 226 patients during a long follow up period of 7 years,<sup>18</sup> with a much higher incidence of AF in



**Figure 1.** Prolonged external monitoring and Implantable leadless cardiac monitor (ICM) versus Holter recording to detect AF in patients after cryptogenic stroke. AF was detected in 8.9%, 12.4% and 30% by ICMs at 6, 12 and 36 months respectively. Data reproduced from the references 7 and 14.

patients with a prior history of AF than those without (87 vs 22%). Independent of prior history, AF detection was associated with a 10 fold increase in incidence of persistent AF and 2.5 fold increase in major cardiovascular events. Persistent AF occurred in 22% patients. With AEGM validation, a 55% incidence of SCAF was recorded in 254 patients with 54% of them with sinus node disease.<sup>10</sup> Several studies have also shown an incidence of SCAF in 69-79% in patients with prior history of AF,<sup>19-21</sup> and 25-45% in patients without prior history.<sup>19,22-26</sup>

Two studies<sup>19,26</sup> have examined the relationship of SCAF detected by device and the development of clinical AF (Table 2). In the retrospective MOST study,<sup>19</sup> patients with an episode of SCAF (rate  $\geq 220$ /min, duration  $>5$  minutes) increased risk of clinical AF by 5.9 times. The ASSERT study<sup>26</sup> prospectively evaluated 2,580 patients without prior history of AF and found a 10.1% incidence of SCAF (defined as atrial rate  $\geq 190$ /minute and  $>6$  minutes) at 3 months, after a 1 month post-implant blanking period. The presence of SCAF increases the risk of clinical AF by 5.6 times.

Taken together, SCAF is commonly recorded in patients with CIEDs, and the incidence appears to be higher in those with a prior history of AF than those

without. Furthermore, in patients with a recorded SCAF episode with or without prior history of AF, future risk for clinical AF to develop would be at least 5 times higher.

### SCAF in Predicting Stroke and Other Thromboembolism

Five large studies have examined the relationship of CIED recorded SCAF and future thromboembolic risk (Table 2).<sup>19-21,25,26</sup> With the exception of the ASSERT, all studies had included some or all patients with prior history of clinical AF. Oral anticoagulation (primarily vitamin K antagonist) was used in 18-32%, with aspirin use in over half of the remaining patients. Prior thromboembolic events occurred in 1.4-20%, in a population with an overall CHADS<sub>2</sub> score of 1-2.2. The definition of SCAF recorded by CIEDs ranged from  $>5$  minutes in MOST, to 24 h in Botto et al study, or SCAF burden  $\geq 5.5$  h/day in TRENDS.

The number of thromboembolic events in these studies is relatively small, with 51 events occurring in largest ASSERT trial that had recruited 2,580 patients, and only 14 events among 725 patients in Capucci's study. The overall annual thromboembolic rate ranges from 0.89%<sup>26</sup> to 2.5%.<sup>20</sup> SCAF detected by the device

**Table 2. Subclinical AF recorded by implanted pacemakers and cardioverter defibrillators on the risk of development of clinical AF and stroke (and other thromboembolic events)**

	n	Mean FU age (m) (yr)	Prior AF	Atrial activation	Duration	Clinical AF (RR)	P	Prior TE	Prior OAC	CHADS <sub>2</sub>	No. of pts with TE	TE (RR)	P	TE %/yr	SCAF(+) Annual TE%	SCAF(-) Annual TE%	
MOST <sup>19</sup>	312	74	27	60%	AHRE $\geq 220$ /min	$>5$ min	5.9	0.0001	20%	24%	-	10	2.8	0	1.60%	2.20%	0.60%
Capucci <sup>21</sup>	725	71	22	100%	AT/AF	$>1$ day	-	-	1.80%	32%	1.8	14	3.1	0.04	1.20%	-	-
Botto <sup>12</sup>	568	70	12	100%	AT/AF	$>1$ day	-	-	1.40%	25.20%	$\sim 1.0$	14	5.3	-	2.50%	3.60%	0.60%
TRENDS <sup>25</sup>	2486	71	17	20%	AT/AF burden	$\geq 5.5$ h/day	-	-	13.40%	20.80%	2.2	40	2.2	0.06	1.20%	2.40%	1.10%
ASSERT <sup>26</sup>	2580	76	34	0%	AT $\geq 190$ /min	$>6$ min	5.6	$<0.001$	12.10%	18%	$\sim 1.2$	51	2.5	0.01	0.89%	1.78%	0.69%

FU=follow up, OAC=oral anticoagulation, RR=relative risk, pts=patients, SCAF=Subclinical atrial fibrillation, TE=Thromboembolism

increased the relative risk for thromboembolism by a factor of 2.2-5.3 compared to no SCAF detected. Annual thromboembolic rates were similarly higher in those patients with detected SCAF versus those without.

The event rates for the ASSERT which included only patients without prior AF are tabulated in Table 3. SCAF detected at 3 months increased the relative risk of thromboembolic events and clinical AF to 2.81 and 5.0 respectively. Similar to other studies, no difference in total and cardiovascular mortality has been reported so far.

### SCAF Duration and CHADS<sub>2</sub> Scores in Relation to Thromboembolism

In a retrospective analysis, Botto et al<sup>20</sup> had attempted to stratify thromboembolic risk in a cohort of 567 patients with a total number of 14 events. There was a relationship between duration of SCAF and CHADS<sub>2</sub> score with stroke event. At a CHADS<sub>2</sub> score of 1, only AF >24 h would increase the annual stroke rate to 4% compared to 0.6% for SCAF that lasted shorter. At a CHADS<sub>2</sub> score of 2, any SCAF >5 minutes resulted in a 4% stroke rate. In the TRENDS study, only SCAF burden >5.5 h/day increased thromboembolic rate to 2.4%/year, in a population of CHADS<sub>2</sub> score of 2.2. Likewise, the thromboembolic risk in ASSERT became significant only when SCAF was >17.72 h.

In a pooled analysis of over 10,000 patients, Boriani et al<sup>27</sup> compared the duration of CIED recorded

SCAF and stroke risk (Figure 2). The hazard ratio of SCAF >5 minutes was similar to the impact of having sustained AF, and progressively increased the SCAF duration, and the risk appeared to plateau off when SCAF reached 24 hours.

Despite these findings, the annual risk for thromboembolism in these studies are lower than expected when compared to patients with clinical AF with similar CHADS<sub>2</sub> scores. Indeed, in the ASSERT study involving patients without prior AF, the annual rates of thromboembolic events with SCAF detected were lower than expected from published risk of CHADS<sub>2</sub> score (Table 4). The reason for the lower stroke risk for SCAF compared to clinical AF is uncertain. Possibilities include: patients with CIEDs are different from clinical AF patients, that atrial leads might have generated a different type of AF, or SCAF may represent less severe or early AF that require time to become an establish risk. Finally, a substantial percent of patients in these studies were on anti-thrombotic therapy which would have reduced embolic risk.

### Is Subclinical AF Only a Risk Marker for Stroke?

The traditional belief is that AF results in cardioembolic events from atrial clots due to mechanical stasis in the atrium. Indeed, in trans-esophageal

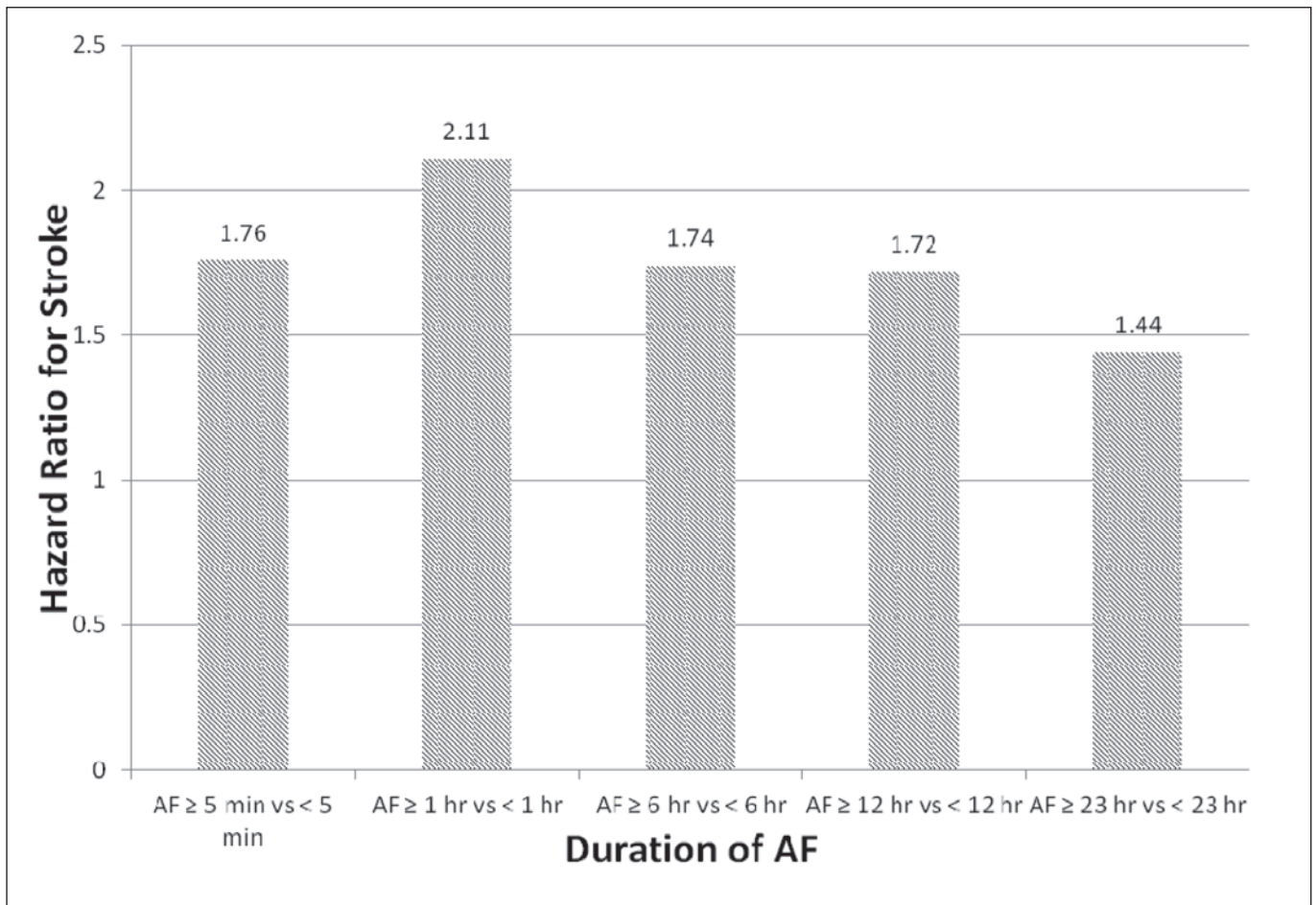
**Table 3. Clinical outcome of patients with CHADS<sub>2</sub> ≥2 who were recruited in the ASSERT trial**

Event	Asymptomatic AF detected by device				SCAF		
	Present N=187		Absent N=1790		present vs. absent		
	Events	%/ year	Events	%/year	RR	95% CI	P
Ischaemic stroke or systemic embolism	10	2.19	35	0.79	2.81	1.39-5.68	0.004
Vascular death	16	3.51	137	3.10	1.11	0.66-1.87	0.68
Stroke / MI / vascular death	25	5.48	185	4.18	1.29	0.85-1.95	0.24
Clinical atrial fibrillation or flutter	29	6.36	61	1.38	5.00	3.21-7.79	<0.00001

MI = Myocardial infarction; SCAF = Subclinical AF detected (Rate >190/min and >6 mins)

Modified from Healey JS, Connolly SJ, Gold MR, et al; ASSERT Investigators. Subclinical atrial fibrillation and the risk of stroke. *N Engl J Med* 2012;366:120-9.<sup>26</sup>





**Figure 2.** Relative risks for AF related stroke according to the duration of subclinical AF (SCAF) episodes detected by implanted cardiac electronic devices. Duration of SCAF  $\geq 5$  minutes progressively increases stroke risk that plateaued when SCAF duration reached 24h. Modified from Boriani G, Glotzer TV, Santini M, et al. Device-detected atrial fibrillation and risk for stroke: an analysis of >10,000 patients from the SOS AF project (Stroke preventiOn Strategies based on Atrial Fibrillation information from implanted devices). *Eur Heart J* 2014;35:508-16.<sup>27</sup>

**Table 4.** Annual stroke (and other thromboembolic) risk (in %) at different CHADS<sub>2</sub> scores compared to the reported risk in patients with clinical AF. While subclinical AF (SCAF) increased risk of events, the risk remained substantially lower than the occurrence of clinical AF

CHADS <sub>2</sub>	<2	2	>2	P
SCAF detected	0.56%	1.29%	3.78%	P=0.35
SCAF not detected	0.28%	0.70%	0.97%	P=NS
Clinical AF in reference population	2.8%	4.0%	> 5.8%	—

Modified from Healey JS, Connolly SJ, Gold MR, et al; ASSERT Investigators. Subclinical atrial fibrillation and the risk of stroke. *N Engl J Med* 2012;366:120-9.<sup>26</sup>

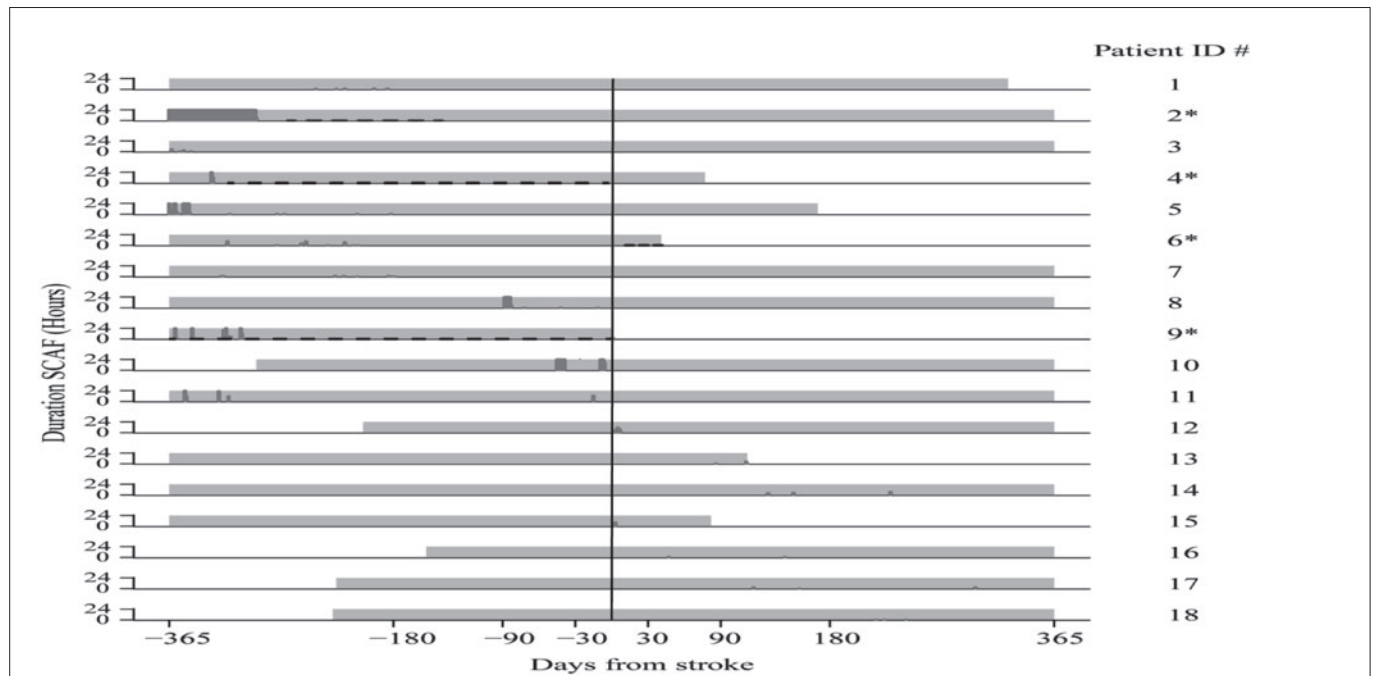
echocardiographic studies, substantial risk for left atrial thrombosis occurred when AF lasted > 48 hours.<sup>28</sup> This led to the guideline recommendation of prior oral anticoagulation for 4 weeks before cardioversion for AF > 48 hours. Recent observations suggest paroxysmal AF increased stroke risks<sup>29</sup> as sustained AF. Indeed, even transient episodes of AF or high atrial rates induced by atrial pacing can lead to increased platelet activation and thrombin generation.<sup>30,31</sup>

With an implanted CIED, it is possible to relate the temporal occurrence of SCAF and stroke and other thromboembolic events. Daoud et al<sup>32</sup> analysed the device recordings of the 40 patients who developed an event in the TRENDS study. They documented that only half of these patients had a SCAF before the event. Of these, only about half had SCAF 30 days before the thromboembolism to suggest a causative mechanism. Overall, 29/40 (72.5%) of patients had no close temporal proximity of SCAF to stroke and may be considered to have stroke due to non-cardioembolic causes. The only

factors that predicted SCAF to occur before a thromboembolic event are patients with a long duration of entry into the study (485±273 vs 251±221 days, p<0.01) and a higher mean and maximum AF burden.

In a similar analysis, the ASSERT investigators<sup>33</sup> showed that only 51% (26/51) patients with stroke (or other thromboembolism) had SCAF occurring before, and only 8% of the overall cohort had SCAF within 1 month of the event (Figure 3). This suggests that in patients without prior AF, as many as 92% of the stroke may be due to non-cardiac emboli not related to SCAF.

Taken together, SCAF detected by CIEDs predicted the occurrence of clinical AF and increased the risk of stroke. However, especially in studies in which most patients did not have AF at the baseline, the annual risk for stroke (and other thromboembolism) when SCAF was detected is lower than expected from clinical AF with equal risk factors. A temporal relation



**Figure 3.** Temporal relationship between subclinical AF (SCAF) recorded by either a pacemaker or implantable cardioverter defibrillator in the 18 patients who had such an episode before the stroke (or thromboembolic events). The vertical line shows the time of implant and the red lines shows AF detection.<sup>33</sup>

between SCAF occurrence and stroke was plausible only in a minority of patients. These suggest non-cardioembolic causes may be more important in patients with only SCAF detected without clinical AF.

### When Should SCAF Be Anticoagulated?

The IMPACT trial<sup>34</sup> is a prospective randomized trial that randomized over 2000 patients with ICD or CRTD to receive vitamin K antagonists or not based on the CHADS<sub>2</sub> score, and the presence or absence of SCAF as detected by CIED and monitored by remote monitoring. The moderate risk group (CHADS<sub>2</sub> ≤4) was randomized to receive warfarin in the presence of SCAF or to terminate warfarin when SCAF became undetected. The primary end point was a composite of stroke, embolism or major bleed. Early results were presented and suggested anticoagulation guided by SCAF detected by CIED to be equal to routine clinical care. The reasons for the neutral result are not certain, and the full report is awaited.

After validation of device recorded SCAF to be accurate AF registration, it seems reasonable now to consider their thromboembolic risk in the decision for anticoagulation. In patients with prior clinical AF, they should be anticoagulated according to their CHADS<sub>2</sub> or CHA<sub>2</sub>DS<sub>2</sub>-VASc scores as suggested by current guideline.<sup>35</sup> There is no guideline for patients with only SCAF detected (Table 5). For CHADS<sub>2</sub> = 0, SCAF requires no anticoagulant, whereas most clinicians

would start oral anticoagulants for CHADS<sub>2</sub> ≥3. For CHADS<sub>2</sub> = 1, based on the ASSERT trial, the risk of stroke probably is outweighed by the risk of warfarin. At CHADS<sub>2</sub> = 2, warfarin is likely indicated. Longer episodes of SCAF (especially close to 24 h) increase stroke risk. When NOACs are considered, it seems reasonable to initiate anticoagulation for a lower CHADS<sub>2</sub> score or shorter AF duration. At present there is no objective cohort data or randomized data to confirm this recommendation.

### Conclusion

In the presence of a cryptogenic stroke, SCAF of up to 30% in 3 years can be recorded by an implanted ICM. While there is no randomized data, most would consider the use of oral anticoagulation instead of aspirin therapy in secondary prevention for recurrent stroke. More controversy centered about SCAF recorded by implanted CIEDs. Recorded SCAFs predicted clinical AF. However, recorded SCAF, while increasing stroke (and other thromboembolic risk) occurred at a magnitude that is substantially less than what occurred when AF developed clinically. In addition, a temporal relation between SCAF and stroke occurred only in a minority of patients. Until more data become available, the use of oral anticoagulation in this cohort remains expert opinion, although CHADS<sub>2</sub> score and duration of AF may help to identify a group of patients who may be such candidates.

**Table 5. Anticoagulation consideration when only subclinical AF (SCAF) is recorded by an implantable cardiac electronic device**

Confirmed it is AF	A trial electrogram validation; duration and rate programmed
CHADS <sub>2</sub> = 0	Warfarin not needed
CHADS <sub>2</sub> = 1	Warfarin may not be needed (or start warfarin if AF ~ 24h)
CHADS <sub>2</sub> = 2	Consider warfarin if AF ~ 24h (possibly shorter if NOACs are used)
CHADS <sub>2</sub> ≥3	Warfarin is indicated

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1950-2015

## Obituary

### In Memory of Dr. Pun Chiu On

Dr. Chiu On Pun, affectionately called C.O. by his close friends, was an eminent cardiologist, a kind and considerate doctor, and, above all, a very nice man.

Born in Hong Kong on 6 November 1950 at the former Alice Ho Mui Ling Nethersole Hospital at the junction of Bonham Road and Breezy Path, the young C.O. received kindergarten and primary education at St. Mary's Church Primary School and Kindergarten, and graduated from King's College in 1968. During secondary school at King's, he actively participated in extra-curricular activities, including serving as a scout patrol leader, and this might explain how he developed himself to be a successful professional with principles and self discipline.

After matriculation at Raimondi College, he entered the University of Hong Kong where he graduated M.B.B.S. from the Faculty of Medicine in 1975. He then served as Medical Officer at the Accident & Emergency Department, Queen Elizabeth Hospital (QEH) before his training in Internal Medical and Cardiology at the same hospital.

In 1980, Dr. Pun obtained his M.R.C.P and went for oversea training at Gardiner Institute, University of Glasgow on a government overseas training scholarship. In 1984, he was promoted to the position of Senior Medical Officer, Prince of Wales Hospital (PWH) cum Honorary Clinical Lecturer in Medicine at the Chinese University of Hong Kong, Department of Medicine. In 1985-1986, he worked as Visiting Cardiology Associate at the Department of Cardiology, the Royal Melbourne Hospital, Melbourne, Australia where he learned advanced electrophysiology and pacing techniques from leading cardiologists like Dr. Harry Mond. In 1987, he obtained TESTAMUR NASPE<sub>x</sub>AM (Special Competency in Cardiac Pacing), North American Society of Pacing and Clinical Electrophysiology. From 1987, he obtained fellowship from various colleges including FHKCP, FRCP (Glasgow), FRCP (Edinburg) and in 1993 he became founding Fellow of the Hong Kong Academy of Medicine, FHKAM (Med).

During his tenure as Medical Officer at Q.E.H. and later Senior Medical Officer at P.W.H., Dr. Pun was well-known as a hard-working doctor, dedicated to his work, kind and gentle to junior colleagues as well as all his patients. He was most willing to teach, and indeed he spent a lot of time teaching young doctors and nurses. His work ethics, his passion for teaching younger cardiologists and his kindness to people are simply exemplary. Yet, it is equally remarkable Dr. Pun always managed to keep a low profile. He left the public hospital and went into private practice in 1996, and continued to serve his patients who had nothing but praise and respect for him.

Dr. Pun had served as council member of the Hong Kong College of Cardiology since 1992, and as President from 2007 to 2009. He had been a director of the Hong Kong Heart Foundation for the past sixteen years. He played a major role in promoting activities of the College, and the Foundation in all aspects: training young cardiologists and allied health, organizing scientific and CME meetings, heart health education for the public and up-holding the medical professionalism and the high standard of cardiology in Hong Kong. He certainly had won the respect and admiration by his colleagues and all those who knew him.

We are all saddened by the news that Dr. Pun Chiu On passed away so suddenly, at the pinnacle of his illustrious career, on February 15, 2015. His passing away is a big loss to all for us. May C.O. rest in peace, and no doubt his sprits will remain in our hearts for years to come!

*Dr. KO Tak Him, Patrick*

Past President

On behalf of the Council of Hong Kong College of Cardiology

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# Hong Kong College of Cardiology



Twenty-Third Annual Scientific Congress

29 - 31 May 2015

Sheraton Hong Kong Hotel and Towers  
Hong Kong

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# Scientific Programme

## Friday, 29 May 2015

0800	3/F	Registration	
0900-1030	<b>Tang Room</b>	<b>Free Paper Session</b> Ischemic Heart Disease Percutaneous Coronary Intervention Congenital and Structural Heart Diseases	
	<b>Ming II Room</b>	Cardiac Imaging	
1030-1100	Terrace of Sung Room	Coffee Break & Visit Exhibits	
1100-1230	<b>Tang Room</b>	<b>Free Paper Session</b> Heart Failure Cardiac Surgery Cardiac Arrhythmia Cardiac Rehabilitation	
	<b>Ming II Room</b>	Hypertension and Hyperlipidemia Miscellaneous	
1230-1400	Oyster Bar & Sky Lounge	Lunch	
1400-1500	<b>Ballroom C</b>	<b>Best Paper Oral Presentation</b>	
1500-1630	<b>Ballroom C</b>	<b>Mainland / Taiwan / Hong Kong Expert Forum</b> Long-term Outcomes of Left Main PCI: New Insights from Fu Wai Database How to Deal with Life-threatening Complications during TAVI Optimization of Culotte Stenting for Non-Left Main Bifurcation	Bo Xu (PR China) Wei-hsian Yin (Taiwan) Liang-long Chen (PR China)
1630-1700	Terrace of Sung Room	Coffee Break & Visit Exhibits	
1700-1830	<b>Ballroom C</b>	<b>Mainland / Taiwan / Hong Kong Expert Forum</b> Mitral Valve Repair: How to Choose the Right Ring Percutaneous Implantation of a Ventricular Partitioning Device for Treatment of Ischemic Heart Failure: Initial Experience and Challenge Cases from Shanghai Tenth People's Hospital Management Strategy for In-stent Restenosis of DES	Song Wan (Hong Kong) Ya-wei Xu (PR China) Wei-min Li (PR China)
1845-1930	<b>Ballroom C</b>	<b>Hong Kong Heart Foundation Lecture</b> Stroke Prevention in Atrial Fibrillation Amongst Chinese: a Not-to-missed Opportunity	David CW Siu (Hong Kong)
1930-2100	<b>Ballroom A&amp;B</b>	<b>Welcome Dinner</b>	

0830-1300	<b>Ballroom C</b>	<b>Joint World Association of Chinese Cardiologists and Hong Kong College of Cardiology Scientific Symposium</b> <i>The Symposium is sponsored by Medtronic International Ltd.</i>	
		<b>Part A: Frontier in Cardiology 心血管前言</b>	
0830-0850		Disruptive Technology in Clinical Research: Mobile Technology in Personalized CV Health	Alan CY Yeung (USA) 楊清源
0850-0910		Quality of Care and Outcomes Research: How They Fit	Henry H Ting (USA)
0910-0930		From Bench to Bedside - a Personal Experience	Yean-leng Lim (Australia) 林延齡
0930-0950		Disease Management and Control: From Research to Clinical Practice in Sweden	Michael LX Fu (Sweden) 傅良雄
0950-1010		The Ways to Perform Clinical Research besides Daily Clinic Work for Cardiologists	Kai Hu (Germany) 胡凱
		<b>Part B: Hypertension 高血壓</b>	
1010-1030		Efficacy of Folic Acid Therapy in Primary Prevention of Stroke among Adults with Hypertension in China	Yong Huo (PR China) 霍勇
1030-1050		Management of Hypertension in 2015	Chung-seung Chiang (Hong Kong) 蔣忠想
1050-1110		Young-onset Hypertension in Taiwan	Jaw-wen Chen (Taiwan) 陳肇文
1110-1120		Tea break	
		<b>Part C: Imaging and New Technology 影像和新技术</b>	
1120-1140		From Research to Clinical Practice of Cardiac MRI: Inspiration and Insight from Interesting Patients	Dali Feng (USA) 馮大力
1140-1200		Current Challenges in Genetic and Clinical Research on Sudden Cardiac Death	Jian-ming Li (USA) 李劍明
1200-1220		Endothelial Progenitor Cells and Cardiovascular Diseases	Shing-jong Lin (Taiwan) 林幸榮
1220-1240		What We Have Learnt after Two Decades of PCI: Insights from Novel Imaging Technology and Novel Devices	Stephen WL Lee (Hong Kong) 李偉聯
1240-1300		New Trend and Development of Left Atrial Appendage Occlusion	Jiang-tao Yu (Germany) 余江濤

## Saturday, 30 May 2015

0800	3/F	Registration	
0830-1230	<b>Ballroom C</b>	<b>Joined Symposium - Cross-straits Medicine Exchange Association / Hong Kong College of Cardiology</b> Guideline and Practice: Clinical Case Based Conference (GAP-CCBC) (Presentation in English or Putonghua)	
		A Case of Takayasu's Arteritis with Coronary Artery Involvement Beijing Fuwai Hospital, Institute of Cardiovascular Disease 阜外心血管病醫院	Kai Liu (PR China) 劉凱
		Cardiogenic Shock after Failed Reverse Wire in LM Bifurcation by Radial Approach Kaohsiung Veterans General Hospital 高雄榮民總醫院	Feng-yu Kuo (Taiwan) 郭風裕
		The "Tears" of a Young Lady Guangdong General Hospital 廣東省人民醫院	Shi-xin Yi (PR China) 易詩欣
		Complications in Percutaneous Left Atrial Appendage Occlusion Shanghai Tenth People's Hospital 上海市第十人民醫院	Ya-wei Xu (PR China) 徐亞偉
		Utilization of BVS to Treat LAD Stenosis for a Patient Who May be a Candidate for CABG in the Future Chang Gung Memorial Hospital, Linkou 林口長庚紀念醫院	Hsin-fu Lee (Taiwan) 李信賦
		Let's Have a Up & Down Roller Coaster Ride! Queen Elizabeth Hospital 香港伊利沙伯醫院	Yuet-wong Cheng (Hong Kong) 鄭月旺
		Antithrombotic Therapy for Atrial Fibrillation and Coronary Artery Disease Beijing Fuwai Hospital, Institute of Cardiovascular Disease 阜外心血管病醫院	Yi-hong Hua (PR China) 華倚虹
		My Unpredictable Nightmare You Never Know Cheng Hsin General Hospital 振興醫院	Man-cai Fong (Taiwan) 馮文楷
		Fight with Aortic Dissection Hebei Yan Da Hospital 河北燕達醫院	Ting Gong (PR China) 宮婷
		Resolution of Heyde's Syndrome after Transcatheter Aortic Valve Implantation - a Case Report Xiamen Cardiovascular Hospital 廈門市心血管病醫院	Bin Wang (PR China) 王斌
		Facilitated PCI in Inferior STEMI Conde S Januario General Hospital 仁伯爵綜合醫院	U-po Lam (Macau) 林如波
		A 46-year-old Woman with Myocardial Infarction Affiliated Zhongshan Hospital of Da Lian University 大連大學附屬中山醫院	Nan Chu (PR China) 初楠

0930-1200	<b>Ballroom A&amp;B</b>	<b>Symposium for Allied Cardiovascular Health Professionals 2015 : Management of Acute Cardiac Emergencies</b> Management of Acute Myocardial Infarction Acute Management of Life Threatening Arrhythmias Management of Acute Aortic Dissection Management of Acute Pulmonary Embolism	Arthur SY Yung (Hong Kong) Andy WK Chan (Hong Kong) Lik-cheung Cheng (Hong Kong) Danny HF Chow (Hong Kong)
1230-1345	Oyster Bar & Sky Lounge	Lunch	
1400-1430	<b>Ballroom</b>	<b>23rd ASC Opening Ceremony</b> Guest-of-Honor: Dr. Donald K.T. Li President of Hong Kong Academy of Medicine	
1430-1530	<b>Ballroom</b>	<b>Medtronic Symposium</b> Stent or Not? Consideration for Stenting Small Vessel The Latest Result of Global Symplicity Registry in Korea Leadless Pacemaker	Vincent OH Kwok (Hong Kong) Byeong-keuk Kim (Korea) Chu-pak Lau (Hong Kong)
1530-1630	<b>Ballroom</b>	<b>Symposium on Anti-Platelet Therapy Update</b> Unmet Needs for Dual Anti-Platelet Therapy - From Evidence to Clinical Practice	Marc Cohen (USA)
1630-1800	<b>Ballroom</b>	<b>Plenary Lectures</b> The Role of Vasodilatory Beta-blocker: a European Perspective Clinical Application of NOACs in Daily Practice Treatment of Severe Hypercholesterolemia - Current Concept and Evidence	Josep Redon (Spain) Hung-fat Tse (Hong Kong) Min-ji Charng (Taiwan)
1830-1915	<b>Ballroom C</b>	<b>Dr. Chiu-on Pun Memorial Lecture</b> Silent Atrial Fibrillation: a New Paradigm for Stroke Prevention	Chu-pak Lau (Hong Kong)
1915-2045	<b>Ballroom A&amp;B</b>	<b>Dinner</b>	

*\*Coffee break will be served at 10:30 - 11:00 & 17:00 - 18:30 at 4/F of Sung Terrace.*

## Sunday, 31 May 2015

0800	3/F	Registration	
0830-1030	<b>Ballroom C</b>	<b>PCI Cases Discussion Prize Presentation</b>	
1030-1100	Terrace of Sung Room	Coffee Break & Visit Exhibits	
1100-1300	<b>Ballroom C</b>	<b>Plenary Lectures</b> Polymer Free BA9™ Drug Coated Stent : Insights from the EGO-BioFreedom Study Filling the Gaps in the Management of AF Patients Taking NOACs: What's New in the Antidote Development? The Latest Update on NOACs: From the Management of SPAF to VTE/PE Treatment Cardioprotection of Beta-blockers along CV Continuum	Stephen WL Lee (Hong Kong) Raymond SM Wong (Hong Kong) Jan Steffel (Switzerland)  Pak-hei Chan (Hong Kong)
1300-1430	Ballroom A&B	Lunch	
1430-1530	<b>Ballroom C</b>	<b>Plenary Lectures</b> Absorb BVS: Clinical Trial Update and Potential Patient Benefits Does Lesion Preparation Matter?	Krishna Sudhir (USA) Kam-tim Chan (Hong Kong)
1530-1700	<b>Ballroom C</b>	<b>Symposium on Transcatheter Structural Heart Intervention</b> Changing Landscape of TAVI - Update of Evidence  Something You Need to Know about MitraClip  Percutaneous Left Atrial Appendage Closure: an Update and Results from a Hong Kong Registry	Michael KY Lee (Hong Kong) Boron CW Cheng (Hong Kong) Ngai-yin Chan (Hong Kong)
1700-1730	Terrace of Sung Room	Coffee Break & Visit Exhibits	
1730-1900	<b>Ching Room</b>	<b>Symposium on Cardiac Pacing</b> The Role of Pacemaker and Implantable Loop Recorder in Syncope Pacing in Sick sinus Syndrome and Atrioventricular Block - Which Pacing Site and Which Pacing Algorithm? Pacing for Heart Failure - at the Heart or at the Nerves?	Kathy LF Lee (Hong Kong) Yat-sun Chan (Hong Kong)  Jo Jo SH Hai (Hong Kong)
1900-2030	<b>Sung Room</b>	<b>Farewell Dinner</b>	

# Paediatric Cardiology Symposium Programme

**Saturday, 30 May 2015**

0830-0835	<b>Tang Room</b>	Welcome Address	Kai-tung Chau (Hong Kong)
0835-1030	<b>Tang Room</b>	<b>Paediatric Cardiology Symposium I</b> Ebstein Anomaly: Imaging & Novel Surgical Strategies Echocardiographic Assessment of Fetal Cardiovascular Function Transcatheter Closure of Ventricular Septal Defect: Strategies for Device Selection and Results of Mid-to-Long Term Follow Up The Current Status of Fetal Cardiac Arrhythmia A Tale of Two Systems: Fontan-associated Liver Disease	Benjamin Eidem (USA) Hui-shen Wang (PR China) Xu Zhang (PR China)  Yi-min Hua (PR China) Pak-cheong Chow (Hong Kong)
1030-1100	4/F of Sung Terrace	Coffee Break & Visit Exhibits	
1100-1230	<b>Tang Room</b>	<b>Free Paper Session</b> Paediatric Cardiology I	
1230-1345	Oyster Bar & Sky Lounge	Lunch	
1400-1430	<b>Ballroom C</b>	<b>Opening Ceremony</b>	
1430-1610	<b>Tang Room</b>	<b>Paediatric Cardiology Symposium II</b> Evaluation of Ventricular Diastolic Function in Children: Integration into Clinical Practice Outcomes of Transcatheter Occlusion of Patent Ductus Arteriosus in Infants less than 12 months Long Term Outcome Following Transcatheter Pulmonary Valvotomy for Pulmonary Atresia with Intact Ventricular Septum Initial Experience with the New Pul-Stent in Treating Post-operative Branch Pulmonary Artery Stenosis	Benjamin Eidem (USA) Fang Liu (PR China)  Robin HS Chen (Hong Kong) Ting-liang Liu (PR China)
1610-1810	<b>Tang Room</b>	<b>Free Paper Session</b> Paediatric Cardiology II	

## ABSTRACTS

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Abstracts for Free Paper Session:

### ISCHEMIC HEART DISEASE AND PERCUTANEOUS CORONARY INTERVENTION

#### **Novel Application of Transradial Coronary Catheter Ikari Left 5 Fr. (IL3.5/4) for both Coronary and Selective Carotid Angiography**

M Chan, CJ Wu, PH Sung, HY Fang

<sup>1</sup>Department of Medicine, Tseung Kwan O Hospital, Hong Kong; <sup>2</sup>Division of Cardiology, Department of Internal Medicine, Chang Gung Memorial Hospital - Kaohsiung Medical Center, Chang Gung University College of Medicine, Taiwan

**Abstract Aims:** To assess the feasibility and safety of using a single 5 French Ikari left catheter for both transradial diagnostic coronary angiography and selective carotid angiography.

**Methods and Results:** A group of patients (115) presenting to Chang Gung Memorial Hospital Kaohsiung, from 1/2010 to 1/2013 with cerebral ischemic symptoms or a history of stroke or transient ischemic attack with non-invasive imaging evidence of significant carotid stenosis ( $\geq 70\%$ ) were selected for this study. We evaluated the success rate of using a single ikari left transradial catheter for coronary angiography and subsequent carotid angiography. Complications recorded included those related to access site, cardiovascular complications including stroke, myocardial infarction, hyperperfusion syndrome and death. Ninety-five percent of patients successfully underwent both coronary and carotid angiography with the 5 french ikari left catheter via transradial access. 7% developed acute complications, with the majority being minor. Two patients (2%) developed stroke, of which one was after subsequent carotid stenting.

**Conclusions:** Use of the 5 French Ikari left catheter is safe and effective with a high success rate for both transradial coronary and carotid angiography.

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#### **Levels of Asymmetric Dimethylarginine (ADMA), An Endogenous Nitric Oxide Synthase Inhibitor, and Risk of Coronary Artery Disease: A Meta-analysis Based on 4,713 Participants**

C Xuan,<sup>1,2</sup> H Li,<sup>1</sup> BB Zhang,<sup>3</sup> GW He,<sup>2,4</sup> QW Tian,<sup>1</sup> LM Lun<sup>1</sup>

<sup>1</sup>Department of Clinical Laboratory, The Affiliated Hospital of Qingdao University, China; <sup>2</sup>Basic Medical Research Center, TEDA International Cardiovascular Hospital, China; <sup>3</sup>Department of Molecular Microbiology, Oslo University Hospital, Norway; <sup>4</sup>Department of Surgery, Oregon Health and Science University, USA

**Background:** Asymmetric dimethylarginine (ADMA) acts as an endogenous inhibitor of endothelial NO synthase (eNOS) by competing with L-arginine. This causes low expression of NO and endothelial dysfunction. Numerous studies have evaluated the association between the serum ADMA level and risk of coronary artery disease (CAD). However, results from previous studies are conflicting.

**Methods:** Pubmed, Web of Science, Embase, Ovid, Cochrane databases were searched to identify eligible studies published in English before *December 2014*. The association was assessed by weighted mean differences (WMD) with 95% confidence intervals (CI). The publication bias was explored by Begg's and Egger's test. Sensitivity analysis was performed to evaluate the stability of results.

**Results:** A total of 16 case-control studies containing 2,939 patients and 1,774 controls were involved in the meta-analysis. The pooled result indicated that the CAD patients had a higher level of ADMA than health controls (WMD: 0.248, 95% CI: 0.156-0.340;  $P=1.16 \times 10^{-7}$ ). Sensitivity Analysis

suggested that the result was stable. Further subgroup analysis found a similar pattern in patients with myocardial infarction (WMD: 0.397, 95% CI: 0.112-0.683;  $P=0.0106$ ), in stable angina pectoris (WMD: 0.197, 95% CI: 0.031-0.364;  $P=0.02$ ), and in unstable angina pectoris (WMD: 0.857, 95% CI: 0.293-1.420;  $P=0.003$ ).

**Conclusions:** The meta-analysis results indicated that the elevated ADMA level is associated with an increased risk of CAD.

**ABSTRACTS**

Abstracts for Free Paper Session:

**ISCHEMIC HEART DISEASE AND PERCUTANEOUS CORONARY INTERVENTION**

**Behavioural Risk Factors: Health – Related Quality of Life Among Patient with Coronary Heart Disease**

R Shrestha  
Nursing Campus Maharajgunj, Nepal

**Introduction / Objective:** It is gradually emerging as a major public health problem in many developing countries including Nepal. Consequences of CHD are that it often results in depletion of the health related quality of life (HRQL) of patients. The aim of this study was to assess the HRQL of CHD patients.

**Methods:** A descriptive cross sectional design was used to assess HRQL of 254 CHD patients attending out-patient department of Shahid Gangalal National Heart Centre (SGNHC), Bansbari, Kathmandu, Nepal. Purposive sampling technique was used for data collection by face to face interview technique using the MacNew Health – related Quality of Life tool.

**Results:** The results of the study showed that mean  $\pm$  SD for emotional domain was  $3.87 \pm 1.01$ , for physical domain was  $3.81 \pm 0.88$  and social domain was  $3.82 \pm 0.88$  and global score of HRQL was  $3.83 \pm 0.87$  on 7- point likert scale. The different demographic characteristics influencing HRQL was found to be sex, living status and Occupation. As the different domains of HRQL was significantly correlated with each others. The descriptive statistics of individual domain scores according to level of HRQL was found to be greater number in below average group in each domain including global HRQL score.

**Conclusions:** In all domains, the HRQL of CHD patients attending the cardiac centre is below average Hence, HRQL of CHD patients needs to be enhanced by regular follow up, organization of counseling sessions and use of self instructional module (SIM) on "Living well with CHD".

**Clinical Outcome of Bare Metal In-stent Restenosis Treated with Drug Eluting Stent**

RCY Fung, MH Jim, CK Chan, PK Cheung, W Hui, K Fan  
Cardiac Medical Unit, Grantham Hospital, Hong Kong

**Purpose:** Although the use of drug eluting stents (DES) significantly reduces coronary restenosis rate, due to various reasons, a large number of patients are still implanted with bare metal stents (BMS). These patients may present to us with symptomatic in-stent restenosis (ISR). BMS ISR is not a benign phenomenon with a significant number of patients present with acute coronary syndrome. How best to manage these patients is still an important question. In the treatment of BMS ISR, most existing studies only involved patients with first generation DES. The majority of these studies confirmed its superior clinical outcome. Although the second generation DES has better efficacy and safety than the first generation DES in treating de novo coronary lesions, only very limited BMS ISR studies involved patients with second generation DES. They were either small in sample size or short in follow up time. In this retrospective cohort study, patients with BMS ISR diagnosed angiographically and treated with first or second or mixed generations DES between 1 January 2006 and 31 June 2011 were included. The primary objective is to determine the incidence of major adverse cardiac event (MACE). The secondary objective is to determine if there is any independent predictor for MACE.

**Method:** Consecutive patients presented with BMS ISR treated with DES in Grantham Hospital (Hong Kong, China), United Christian Hospital (Hong Kong, China) or Royal Alexandra Hospital (Edmonton, Canada) between

1 January 2006 and 31 June 2011 were included. Those who have non-native coronary artery BMS ISR or DES ISR or BMS ISR not treated DES were excluded. Clinical and procedural data were retrieved from the computer based electronic clinical records, percutaneous coronary intervention registries of the individual hospitals and the Alberta Provincial Project for Outcome Assessment in Coronary Heart Disease (APPROACH) registry. MACE was defined as stent thrombosis, all cause mortality, target lesion revascularization (TLR) and myocardial infarction (MI).

**Results:** A total of 207 patients were identified. Eighty-six (41.5%) patients were treated with first generation (paclitaxel and sirolimus) stents, one hundred and ten (53.1%) patients were treated with second generation (everolimus, zotarolimus, biolimus) stents and 11 (5.3%) patients had mixed first and second generation stents implanted. The mean follow up time was  $3.3 \pm 1.9$  years. The number of MACE was 50 (24.2%). There were 15 (7.2%) deaths, 2 (1.0%) stent thrombosis, 12 (5.8%) TLR and 22 (10.6%) MI. After adjustment for cofounders, the only independent predictors of MACE were left ventricular ejection fraction less than 35% (hazard ratio (HR) 5.2, 95% confidence interval (CI)  $2.4 \pm 11.4$ ,  $p < 0.001$ ), renal impairment at the time of PCI (HR 2.5, 95% CI 1.2-5.4,  $p = 0.026$ ) and previous history of ischaemic stroke (HR 2.9, 95% CI 1.4-5.8,  $p = 0.003$ ).

**Discussion:** This study provides long term follow up data (a mean follow up time of  $3.3 \pm 1.9$  years) for patients implanted with first and second generation DES. Moreover it includes patients from different countries which allow us to control for regional differences. The overall MACE rate for the treatment of BMS ISR by DES was 24.2% which was comparing favorably to that of the balloon angioplasty and brachytherapy.



**ABSTRACTS**

Abstracts for Free Paper Session:

**ISCHEMIC HEART DISEASE AND PERCUTANEOUS CORONARY INTERVENTION**

**Outcomes in Reperfusion Therapy of Octogenarians with ST-segment Elevation Myocardial Infarction**

YW Cheng, CF Tsang, CK Kwok, NH Luk, SF Chui, YH Cheng, KC Chan, LK Chan, HS Ma, CY Wong, LY Tam, CL Fu, CW Chan, KY Lee, KC Ho, KT Chan, CS Chiang  
Department of Medicine, Queen Elizabeth Hospital, Hong Kong

**Background:** As a result of increased life expectancy, octogenarians constitute an increasing proportion of hospital admission for ST-segment elevation myocardial infarction (STEMI). STEMI in older patients is known to associate with higher mortality. We evaluated the results of reperfusion therapy in octogenarians in a regional hospital.

**Methods:** A retrospective review of all patients older than 80 years old with diagnosis of STEMI who either activated primary PCI or given thrombolytic therapy between Jan 2013 to Feb 2015 in Queen Elizabeth Hospital was performed. Patients with delayed presentation and those who refuse reperfusion treatment were excluded. Their clinical characteristics and outcomes were analyzed.

**Result:** A total of 57 patients, 30 male (52.6%) and 27 (47.4%) female, ranged from 80 to 98 years old with a mean age of  $84.8 \pm 4.36$  were identified. Ten (17.5%) patients presented with shock before reperfusion therapy. Primary PCI was activated in 32 patients (56.1%). Thrombolytic treatment in form of Streptokinase and Tenecteplase was given in 16 (28.1%) and 9 (15.8%) patients respectively. Anterior STEMI was the most common presentation. Six patients did not have coronary angiography performed after thrombolytic treatment either because of patient refusal or development of free wall rupture. Twenty-two (38.6%) patients showed single vessels disease on

subsequent coronary angiography. Five patients turned out to have minor CAD. Among them, 1 patient diagnosed Tako-tsubo cardiomyopathy while 3 patients had concomitant atrial fibrillation. As at end March 2015, 21 (36.8%) patients died within one year. Cumulative mortality at hospital discharge was 24.6% and by 30 days was 19.3%. Patient with Diabetes Mellitus, shock on presentation or eGFR less than  $40 \text{ ml/min/1.73 m}^2$  was associated with higher mortality ( $p < 0.05$ ). Six (10.5%) patients died of free-wall rupture. Ten (17.5%) patients had bleeding episode after reperfusion therapy while 5 (8.8%) patients had major bleeding requiring blood transfusion. None of patient had intracranial hemorrhage. Re-infarction occurred in 2 (8%) patients receiving thrombolytic treatment.

**Conclusion:** Reperfusion therapy was delivered in octogenarian population with reasonable success. However, short term adverse event rates including mortality are still significant despite advances in drug-eluting stents, newer antithrombotic agents and intensive care in the management of STEMI.

**1 Year Outcome Comparing Drug Coated Balloon Only Angioplasty Versus Second Generation DES in Diabetic Patients with de novo Small Vessel Coronary Artery Disease**

TT Nyein, D Sinaga, A Sim, ASP Seah, FH Jafary, HH Ho, PJJ Ong  
Tan Tock Seng Hospital, Singapore

**Aims:** PCI in patients with diabetes and small vessel coronary artery disease (SVD) has higher risk of adverse clinical events. Drug coated balloon (DCB) has been used to treat de-novo coronary lesion with promising result. We compared the 1 year clinical outcome of drug coated balloon only angioplasty (DCBA) versus second generation DES in SVD amongst diabetic patients in a 'real world' setting.

**Methods and Results:** We retrospectively analyzed the 1 year outcome of all diabetic patients who underwent PCI to de-novo lesion with DCB or second generation DES with device size  $\leq 2.5 \text{ mm}$  between 2011 to 2013. Ninety-two patients were intervened with DCBA (100% Sequent Please), male 71.1%, mean age  $60.4 \pm 10.9$  years old? HbA1c  $8.4 \pm 2.6\%$ ; 91.3% had hyperlipidaemia, 88.0% had hypertension and 25.0% had history of smoking. 28.7% of the patients presented with stable angina, 53.2% with NSTEMI and 16.0% with STEMI. The most common target vessel was left anterior descending artery at 41.5% and type C lesion accounted for 46.8% of the cases. The demographics and presentations of the 80 DES patients were not significantly different from the DCBA group. DES used were Resolute Integrity (36.3%), Xience (26.3%), Biomatrix (25.0%), Promus (8.8%) and Nobori (3.8%). The reference diameter in the DCB treated vessel was  $2.23 \pm 0.28 \text{ mm}$  vs  $2.44 \pm 0.21 \text{ mm}$  in the DES group ( $p = 0.09$ ). The average

size of the DCB used was smaller than the corresponding DES (diameter  $2.26 \pm 0.21 \text{ mm}$  vs  $2.36 \pm 0.12 \text{ mm}$ ,  $p < 0.01$  and length  $20.3 \pm 5.7 \text{ mm}$  vs  $22.7 \pm 7.5 \text{ mm}$ ,  $p < 0.01$  respectively). There was a trend towards a larger acute lumen gain after DES implantation compared to DCBA ( $1.6 \pm 0.5 \text{ mm}$  vs  $1.1 \pm 0.9 \text{ mm}$ ,  $p = 0.10$  respectively). Despite the predominantly ACS presentation, patients treated with DCB received significantly shorter duration of dual antiplatelet therapy (DAPT) than the DES group ( $7.0 \pm 4.7$  months vs  $11.7 \pm 1.9$  months,  $p < 0.0001$  respectively). At 1 year, 9 major adverse clinical events (MACE) were observed at DCBA arm versus 12 in the DES group (9.6% vs 15.0% respectively  $p = 0.76$ ). There was lower number of myocardial infarction (MI) observed in the DCBA group than the DES group (2 (2.2%) vs 8 (10.0%),  $p < 0.05$  respectively). There were otherwise no significant differences in death (0 (0%) vs 3 (3.8%)  $p = 0.09$ ) or target lesion revascularization rate (7.4% vs 6.3%,  $p = 0.77$ ) between those treated with DCB and DES respectively.

**Conclusions:** Diabetic patients with SVD in this Asian cohort have poorly controlled HbA1c and rampant comorbidities. Those treated with DCB only angioplasty have smaller reference vessel size and achieved smaller acute lumen gain compared to those treated with DES. However, such anatomical advantage with DES did not translate into better MACE rate compared to the DCB group at 1 year follow up. In fact, patients treated with DCB have lower MI rate and received shorter course of DAPT. Drug coated balloon may be a safe and effective alternative to modern DES in the treatment of de novo small vessel disease in diabetic patients.

**ABSTRACTS**

Abstracts for Free Paper Session:

**CONGENITAL AND STRUCTURAL HEART DISEASES**

**A Novel Mutation of TBX5 Gene in Chinese Patients with Isolated Ventricular Septal Defect**

Xi Zhang,<sup>1</sup> HT Hou,<sup>1</sup> YY Jiang,<sup>1</sup> J Wang,<sup>1</sup> XL Wang,<sup>1</sup> XC Liu,<sup>1</sup> ZG Liu,<sup>1</sup> Q Yang,<sup>1,2</sup> GW He<sup>1,3</sup>

<sup>1</sup>TEDA International Cardiovascular Hospital, China; <sup>2</sup>Department of Medicine & Therapeutics, The Chinese University of Hong Kong, Hong Kong; <sup>3</sup>The Affiliated Hospital of Hangzhou Normal University & Zhejiang University; Department of Surgery, Oregon Health and Science University, USA

**Purpose:** Ventricular septal defect (VSD) is the most frequently occurring congenital heart disease (CHD) in newborns. A number of genetic studies have linked TBX5 mutations to cardiac abnormalities. Here, we identify potential pathogenic mutations for TBX5 and provide insights into the etiology of isolated VSD in Chinese patients.

**Methods:** Case-control mutational analysis was performed in 354 patients with isolated VSD and 341 healthy controls. First, all the coding exons and intron-exon boundaries of TBX5 were sequenced in VSD patients and controls. Sanger sequencing with high-resolution melting (HRM) curve analysis was then combined to detect new TBX5 mutation and identify its frequency.

**Results:** A novel heterozygous missense mutations (c. 40C>A) was identified in TBX5 gene exon-2. This mutation leads to proline to threonine substitution at position 14, which is highly conserved among many species. The damaging and disease causing of this mutation is predicted by Polyphen2, SIFT and Mutation Taster. No more c. 40C>A mutation was found in enlarger cases and controls by HRM analysis.

**Conclusion:** We identified a novel heterozygous missense mutation in TBX5 gene exon-2 in isolated VSD patients in Chinese population and found that this missense mutation probably causes the disease. Further, our results showed the important role of HRM as a reliable and efficient method to determine disease-related gene mutation in congenital heart disease.

**Comparison of Transcatheter Aortic Valve Implantation (TAVI) in Extreme-risk and High-risk Patients in the Local Asian Population**

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**Introduction:** Transcatheter Aortic Valve Implantation (TAVI) for treatment of severe aortic stenosis (AS) has been proved to improve survival and quality of life in a group of inoperable and high-risk symptomatic patients. This involves percutaneous implantation of a transcatheter heart valve through the femoral or subclavian artery routes without subjecting the patients to open heart surgery or cardio-pulmonary bypass. Limited data is available on the safety and efficacy in the local Asian population.

**Objectives:** We report the results of the TAVI procedures done in Queen Elizabeth Hospital (QEH) for a group of extreme-risk and high-risk symptomatic severe AS patients and compare with the CoreValve US Pivotal Trial.

**Methods:** The TAVI procedures are done in QEH by a multi-disciplinary TAVI heart team comprising cardiologists, cardiac surgeons, anaesthesiologists, radiologists and cardiac nurses. All potential patients would be interviewed independently by the cardiologists and cardiac surgeons. The TAVI Heart Team then decided whether the patient should undergo SAVR or TAVI. All patients were assessed by echocardiogram, CT scan and angiogram to decide on suitability. Echocardiogram and 6-minute walk test would be performed according to schedule post-procedure. All complications

would be reported to an independent Safety Monitoring Committee. All data will be captured by the local QEH Registry. Patients were considered extreme-risk (or inoperable) if their Logistic EuroSCORE was  $\geq 20$  and high-risk if it was between 10-20.

**Results:** From December 2010 to January 2015, 45 patients (29 males and 16 females) with symptomatic severe AS underwent the TAVI procedure. Average age was  $83.2 \pm 5.1$  and  $80.2 \pm 4.6$  years and the mean Logistic EuroSCORE was  $32.4 \pm 9.7$  and  $12.1 \pm 3.9$  for extreme-risk and high-risk patients respectively. All procedures were done under general anaesthesia in our cardiac catheterization laboratory or hybrid OR. Aortic valve area improved from  $0.62 \pm 0.2$  cm<sup>2</sup> to  $1.83 \pm 0.31$  cm<sup>2</sup> and from  $0.75 \pm 0.15$  cm<sup>2</sup> to  $1.96 \pm 0.35$  cm<sup>2</sup> with mean gradient decreased from  $51.3 \pm 13.0$  mmHg to  $8.6 \pm 6.7$  mmHg and from  $49.3 \pm 12.2$  mmHg to  $9.2 \pm 2.9$  mmHg for extreme-risk and high-risk group respectively. Majority of patients have only trivial to mild aortic regurgitation during subsequent follow-up. Permanent pacemakers were implanted in 5 patients (25%) for extreme-risk and 2 patients (8%) for high-risk group. 30-day all-cause mortality was 0% and 4% for extreme-risk and high-risk respectively in our cohort and it was 8.4% and 3.3% respectively in the CoreValve US Pivotal Trial. One-year all-cause mortality was 15% and 8% for extreme-risk and high-risk patients respectively in our cohort and it was 24.3% and 14.2% respectively in the CoreValve US Pivotal Trial. All patients showed marked symptomatic improvement in terms of NYHA Functional Class, 6-minute walk test and quality of life measurement. This compares favourably with results of the CoreValve US Pivotal Trial and the Asia TAVI Registry.

**Conclusions:** Being a high-risk procedure, TAVI was shown to be safe and feasible in a group of extreme-risk and high-risk symptomatic severe AS local Asian elderlies and this benefit compares favourably with international clinical trials and registries.

**ABSTRACTS**

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Abstracts for Free Paper Session:

**CONGENITAL AND STRUCTURAL HEART DISEASES**

**Changes in Echocardiographic, Functional and Psychological Improvement in Adults Following Percutaneous Transcatheter Atrial Septal Defect Closure: A Pilot Study**

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**Purpose:** To investigate the echocardiographic improvement and clinical outcomes of patients <60 years and patients ≥60 years after atrial septal defect (ASD) percutaneous closure.

**Methods:** Retrospective study of 38 adult patients underwent percutaneous ASD closure in TMH were reviewed. We had collected and compared the two patients groups with age <60 years and age ≥60 years on the last pre-operative and earliest post-operative echocardiographic measurement of pulmonary arterial systolic pressure (PASP) and right ventricular internal diastolic diameter (RVID). Another retrospective analysis was performed among 13 patients with half yearly follow up on functional performance and quality of life by occupational therapist.

**Results:** For the aspect of cardiac remodeling, changes in PASP in patients groups <60 years and ≥60 years both decreased significantly with p-value <0.001. Significant improvement in RV dilation was also noted in the two patients groups (p-value <0.001). Twelve patients attended all occupational therapy assessment sessions, with mean age of 49.25; and among them 4 patients with age over 60. Percutaneous ASD occlusions were all done via femoral approach. Amplatzer septal occlude (St. Jude Medical) was the device of choice. The atrial septal device was successfully implanted in all patients.

Friedman test was used to analyze among the outcome measures of the patients after 6 months of follow-up. Statistically significant differences were observed in functional capacity, mood status and quality of life, with p-value ranged from 0.002 to 0.05.

**Conclusions:** Percutaneous transcatheter ASD closure is a safe procedure with satisfactory short-term outcomes even after the age of 60.

**ABSTRACTS**

Abstracts for Free Paper Session:

**CONGENITAL AND STRUCTURAL HEART DISEASES**

**Transcatheter Aortic Valve Implantation by Hydra Transcatheter Aortic Valve System: First-in-man Experience**

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**Background:** Transcatheter treatment of aortic stenosis is becoming part of standard therapy. Specifically, patients considered at high or prohibitive surgical risk have been consistently shown to benefit from this type of intervention. A number of different transcatheter aortic valves are commercially available. Recently, the Hydra Aortic Valve was developed. We report the results of the first-in- human implantations of the Hydra Valve.

**Methods:**

**Patients:** Implantation of the Hydra transcatheter aortic valve was performed in 15 patients with symptomatic severe aortic stenosis in the period from May 2014 to March 2015 at two invasive centers (King Chulalongkorn Memorial Hospital and Rajavithi Hospital, both Bangkok, Thailand). In all cases, surgical treatment was deferred per heart team decision due to an expected high surgical risk. All patients gave informed consent for the procedure. Pre-procedural examinations included trans-thoracic echocardiography, coronary angiography, and multi-slice, ECG-gated computed tomography (CT) to visualize aortic annulus, aorta, and iliofemoral access vessels. For follow-up, patients had trans-thoracic echocardiography performed before discharge and at 1 month after the procedure. Any complications were documented at these time points.

**Hydra transcatheter aortic valve:**

**Valve:** The Hydra Aortic Valve self-expanding stent frame is made of nitinol and the 3 leaflets and sealing cuff are bovine pericardium, see Figure 1. The three tentacles (antenna) on the stent frame provide flexible anchors at the outflow which conforms to the shape of the aorta, while the inflow section of the frame exerts a higher radial force to ensure attachment to the aortic annulus. The pericardial part of the bioprosthesis is sutured to the stent frame. The valve is produced in 3 sizes, 22, 26, and 30 mm, see Figure 1 for prosthesis dimensions and sizing choice for various annular diameters.

**Results:**

**Population:** All patients were symptomatic severe aortic stenosis, 2 patients (14%) had severe symptoms (NYHA class 3).

**Outcome:** Implantation of the Hydra Valve was accomplished in all cases. There were no instances of delivery system failure. In 5 patients, valve position was suboptimal after final release, and a second Hydra Valve was implanted successfully in these patients. Two procedures were complicated with aortic dissection. All patients survived the procedure, two patients died within the first 30 days. One patient required permanent pacing.

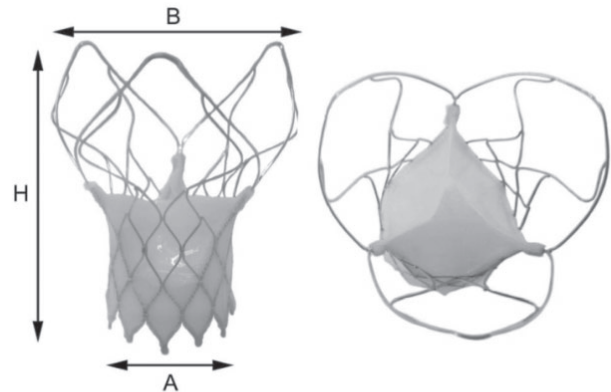
Twelve patients completed full echocardiographic assessment at 30 days. Prosthetic valve Mean aortic gradient declined from 49 mmHg pre-procedure to 11 mmHg.

**Discussion:** In this report, we describe the first results from human use of the new self-expandable transcatheter Hydra Aortic Valve in humans. Its efficacy for treating degenerative aortic stenosis is documented.

**Safety and efficacy:** The two mortalities within the first 30 days were not related to valve function.

Vascular complications included two aortic dissections, which is normally a rare occurrence. Access site complications encountered were mostly mild, and comparable in frequency to those generally reported elsewhere. The complication rate is primarily related to the size of the access sheath. With its 18F delivery system, the Hydra Aortic Valve is similar in profile to several other next-generation transcatheter valves. Atrioventricular block requiring new pacemaker implantation was seen in only one patient. This is a reassuring result, as a relatively high rate of pacemaker implantation has been a persistent feature of the most commonly used self-expanding aortic valve, the Medtronic CoreValve. If confirmed in larger populations, this feature could potentially be attributed to the lack of flaring of the inflow end of the prosthesis. Post-procedural valve gradients demonstrated no significant obstruction to flow, and the values are in line with results from other transcatheter aortic valves. Paravalvular leaks were common, but in only one case was it of more than mild severity at 30-day follow-up. This is comparable to results from other valves without sealing skirts. However, the presence of paravalvular leakage also contributed to necessitate postdilatation in 6 cases and the deployment of a second valve in 5 cases.

**Conclusion:** The Hydra Aortic Valve is useful for transcatheter treatment of severe aortic stenosis. Initial results indicate hemodynamic performance of the implanted bioprosthesis is good, and complication rates seem acceptable. Further evaluation in larger series is needed.



Catalog No.	HYDRA22	HYDRA26	HYDRA30
Diameter (A)	22mm	26mm	30mm
Diameter(B)	36mm	43mm	45mm
Height(H)	55mm	53mm	51mm
For annulus size:	18 to 20mm	21 to 23mm	24 to 26mm

**Figure 1.** The hydra valve.

**ABSTRACTS**

Abstracts for Free Paper Session:

**CARDIAC IMAGING**

**Impacts of Valvulo-Arterial Impedance on Severe Aortic Stenosis – A Multi-Imaging Modalities Prospective**

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**Background:** Aortic stenosis (AS) has become more prevalent as the population is aging and advances in cardiac imaging makes AS more readily diagnosable. Valvulo-arterial impedance (Zva), an index to assess overall after-loads, has been proven to positively correlate with the AS severity. Zva also carries prognostic value. As most patients with severe AS are apparently asymptomatic, Zva may be useful in further sub-categorizing severe AS and treatment plan can be tailored accordingly. This study aims to evaluate the impact of Zva on cardiac parameters in patients with severe aortic stenosis by means of cardiovascular magnetic resonance (CMR).

**Method:** All patients with severe aortic stenosis were referred to the CMR unit of Royal Brompton Hospital, London, for pre-operative CMR. Each patient had a trans-thoracic echocardiography within one week from the CMR study. Zva was calculated as the sum of systolic blood pressure and the aortic valve continuous-wave Doppler mean gradient divided by the left ventricular stroke volume index. Patients were categorized into 2 groups according to their calculated Zva. "High Zva" is defined as Zva higher than or equal to 4.5 mmHg/mL/m<sup>2</sup> whereas "Low Zva" is defined as Zva lower than 4.5 mmHg/mL/m<sup>2</sup>. Various echocardiographic and CMR parameters were compared between the 2 groups. Statistical analysis was done by t-test and ANOVA.

**Results:** 52 patients were screened and 27 of them were excluded due to missing clinical data. Total of 25 patients were recruited into the final analysis. They are categorized into 2 groups, high Zva (n=12) and low Zva (n=13). Baseline characteristics between the 2 groups were comparable

except patients with high Zva had higher systolic blood pressure. On echocardiography, calculated aortic valve areas (AVA) by continuity equation, dimensionless performance index (DPI) and left ventricular ejection fraction (LVEF) were comparable between the 2 groups. However, on CMR, patients with high Zva had lower LVEF, higher left ventricular end-diastolic volume (LVEDV), higher right ventricular end-diastolic volume (RVEDV), higher left atrial volume index (LAVI) and higher left ventricular mass index (LVMI). Findings are summarized in Table 1.

**Conclusion:** In the setting of severe aortic stenosis, those with high Zva had worse cardiac parameters on CMR than those with low Zva. These findings may provide insights on treatment directions and prognosis for patients with severe aortic stenosis.

**Table 1.** Echocardiographic and CMR parameters between severe AS patients with high Zva and low Zva

	Low Zva (n=13)	High Zva (n=12)	P-value
Age	79.4	76.6	0.85
SBP	132.4	149.8	0.026
Zva	3.72±0.17	5.16±0.77	0.007
DPI	0.25±0.03	0.23±0.05	0.64
AVA-echo	0.86±0.09	0.86±0.13	0.91
LVMI-CMR	81±16.2	108±18	0.034
LVEF-CMR	65±13.7	49±10.3	0.048
LVEDV-CMR	127±38.4	223±64.1	0.042
RVEF-CMR	59±6.3	56±10.4	0.1
RVEDV-CMR	110.2±26	124.6±22	0.042
LAVI-CMR	65±15.3	76±12.5	0.044
AVA-CMR	0.78±0.17	0.81±0.07	0.295

**Effect of Continuous Positive Airway Pressure Therapy on Right Ventricular Function by Speckle Tracking in Obstructive Sleep Apnea Subjects**

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**Background:** Obstructive sleep apnea (OSA) is associated with right ventricular (RV) dysfunction and use of continuous positive airway pressure (CPAP) may improve RV function. 2D speckle tracking is a relatively new method for assessment of RV function and has recently been included in international guidelines for RV function assessment. We hypothesize that RV strain is more sensitive than conventional echo parameters in detecting early changes in RV function.

**Purpose:** To investigate the effect of OSA on right ventricular function and the impact of CPAP therapy.

**Method:** We prospectively recruited 23 patients (19 male, mean age 54+/-9) with newly diagnosed with OSA (mean respiratory disturbance index (RDI) 30.6+/21.3) and follow up for 1 month after initiation of CPAP therapy. Echocardiographic images were acquired with a modified apical 4 chamber view. RV global and free wall longitudinal strain by speckle tracking, tricuspid annular plane systolic excursion (TAPSE), and RV fractional area change (FAC) were measured. Offline strain analysis was performed by cardiologists off-site experienced in strain analysis and blinded to clinical data.

**Results:** At baseline, the mean RV global strain and free wall strain were -23.1+/-3.0% and -26.9+/-4.4% respectively, with TAPSE 2.21+/-0.2 cm and FAC 34.5+/-8.2%. At one month after CPAP therapy, there was statistically significant improvements in RV free wall strain (-30.4+/-4.4%, relative change 13.0%, p=0.03) and a trend towards improvement in RV global strain (-24.5+/-3.5%, relative change 6.06%, p=0.082). There were no significant changes in TAPSE (2.25+/-2.9 cm, p=0.37) and FAC (35.9+/-10.3%, p=0.57) post CPAP therapy.

**Conclusion:** Use of CPAP therapy improves RV function in subjects with OSA. RV free wall longitudinal strain is more sensitive in detecting subtle changes in RV function compared to conventional parameter of TAPSE and FAC.

**ABSTRACTS**

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Abstracts for Free Paper Session:

**CARDIAC IMAGING**

**Effect of Surgical Correction of Tetralogy of Fallot on Short-term Right and Left Ventricular Function as Determined by Two-Dimensional Speckle Tracking Echocardiography**

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**Purpose:** The impact of surgical repair on short-term right ventricular (RV) and left ventricular (LV) function in patients with tetralogy of Fallot (TOF) is scarce. The purpose of our study is to assess biventricular function in patients with TOF before and after operation by two-dimensional speckle tracking echocardiography (STE).

**Methods:** 36 patients with TOF before, and 1 week, 3 months, and 6 months after operation were studied. RV and LV global longitudinal strain (GLS) and strain rate (GLSRs), and LV global circumferential and radial strain and strain rate were measured by STE.

**Results:** Compared with controls, lower RV GLS and GLSRs in preoperative patients with TOF decreased further at 1 week after operation, then improved at 3 months and 6 months after operation, but remained lower than normal values. While LV longitudinal, circumferential and radial strain and strain rate improved at 1 week after operation, and increased to normal level at 6 months after operation. RV and LV strain and strain rate had no correlation with the type of surgery. Age was the independent predictor of RV GLS and GLSRs ( $\beta_1 = -0.212$ ,  $P_1 = 0.012$ ;  $\beta_2 = -0.180$ ,  $P_2 = 0.033$ ). Age and LV end-diastolic volume were the independent predictor of LV strain and strain rate.

**Conclusion:** After repair of TOF, LV function rapidly improves, but RV function underwent transient deterioration, followed by a improvement toward normal values. The difference in right and left ventricular recovery and RV transient changes after operation can be subtly analyzed by STE. STE appears to be a valuable tool for follow-up assessment of biventricular function after congenital heart disease surgery.

ABSTRACTS

Abstracts for Free Paper Session:

CARDIAC IMAGING

**The Clinical Value of Transthoracic Echocardiography in Diagnosis of Anomalous Origin of Pulmonary Artery**

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<sup>1</sup>Department of Ultrasound, Union Hospital, Tongji Medical College, Huazhong University of Science and Technology, China; <sup>2</sup>Department of Medicine, George Washington University, USA

**Purpose:** Anomalous origin of pulmonary artery (AOPA) is a rare but important congenital malformation which frequently involves the right pulmonary artery. Preoperative transthoracic echocardiography (TTE) is the primary imaging tool in the diagnosis of AOPA. The purpose of this study was to review the clinical values of TTE for the diagnosis of AOPA.

**Methods:** We retrospectively analyzed the TTE characteristics of 14 cases with anomalous origin of the right pulmonary artery from the ascending aorta (AORPA) or unilateral absent pulmonary artery (UAPA) from 2007 to 2014 in one single institution. The results were compared with the findings at surgery in order to assess the diagnostic value of TTE.

**Results:** (1) The corrective surgeries were performed in all 14 cases. The TTE diagnoses of 13 cases were consistent with findings at surgery. The coincidence rate for TTE and surgical findings was 92.9%. AORPA and UAPA shared some TEE features in common, which are the exit of two concordant ventricular outflows tracts and absence of a normal pulmonary arterial bifurcation. (2) Nine patients had AORPA, which all had a proximal origin from the posterior or lateral aspect of the ascending aorta close to the aortic valves in our series. All patients had a left aortic arch. The parasternal long axis view and short axis view showed the anomalous vessel arose from the ascending aorta above the aortic valve (Figure 1). The associated cardiovascular abnormalities included aortopulmonary septal defect, interruption of aortic arch, patent ductus arteriosus, ventricular septal defect and atrial septal defect. Severe pulmonary artery hypertension was noted in

all cases (Table 1). (3) Five patients had UAPA. Three patients with absent left pulmonary artery had Tetralogy of Fallot while 2 patients with absent right pulmonary artery had patent ductus arteriosus. TTE reveals absence of the right or left pulmonary artery from any angle.

**Conclusions:** TTE plays an important role in the non-invasive and accurate diagnosis of AOPA. TTE can clearly display its site of origin and course, as well as other associated malformations and hemodynamic changes.

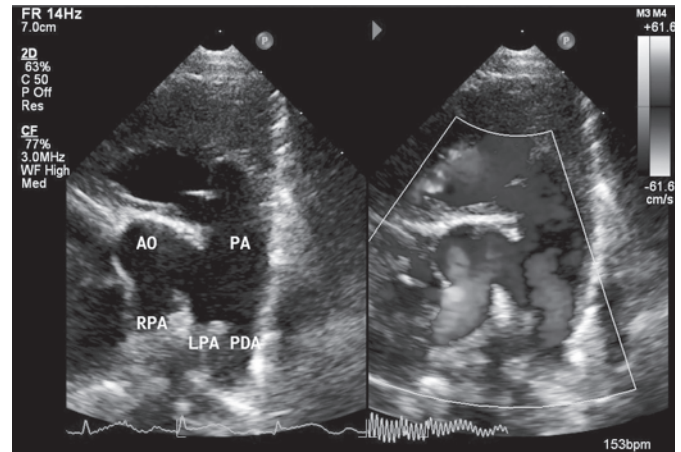


Figure 1. Parasternal short axis view of AOPRA.

AO: aorta, PA:pulmonary artery, PDA: patent ductus arteriosus, RPA: right pulmonary artery, LPA: left pulmonary artery

Table 1. The clinical data on 9 patients with AORPA

Pt.	Gender/Age	AORPA(mm)	LPA (mm)	D-AVO (mm)	TR (mmHg)	Shunt direction	Associated cardiovascular abnormalities
1	M/7yr	16	10	23	90	L-R	PDA
2	M/3yr	17	15	22	/	Bi	APSD,IAA,PDA
3	M/2m	7	5	12	86	Bi	VSD,ASD
4	F/4m	9	8	12	97	/*	ASD
5	M/29d	7	5	7	62	Bi	APSD,IAA,PDA
6	M/21d	9	7	19	/	Bi	APSD,IAA,PDA
7	F/4m	5	6	10	/	R-L	APSD,IAA,PDA
8**	F/6yr	12	16	24	117	L-R	PDA
9	M/19d	4.5	7	/	81	Bi	PDA

Pt: patient; M: male; F: female; yr: years; m: months; d: days. AORPA: the diameter of the anomalous right pulmonary artery; LPA: the diameter of the left pulmonary artery; D-AVO: the distance from origin site to the aortic valve; TR: tricuspid regurgitation; L-R: left to right; Bi: bidirectional; R-L: right to left; PDA: patent ductus arteriosus; APSD: aortopulmonary septal defect; IAA: interruption of aortic arch; VSD: ventricular septal defect; ASD: atrial septal defect

\*The shunt direction of ASD is difficult to be visualized because of the turbulence of severe tricuspid regurgitation.

\*\*Misdiagnosed echocardiographically as anomalous origin of left pulmonary artery from the ascending aorta

**ABSTRACTS**

Abstracts for Free Paper Session:

**CARDIAC IMAGING**

**Diagnostic Value Of transthoracic Echocardiography in Patients With Coarctation of Aorta: The Chinese Experience in 53 Patients Studied Between 2008 and 2012 in One Major Medical Center**

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**Purpose:** Although aortography is well known as the "gold standard" for the diagnosis of coarctation of aorta (CoA), the method is invasive, expensive and not readily accepted by some patients. Ultrasound diagnosis for CoA is non-invasive, inexpensive, readily accepted by every patient, and can be repeated as frequently as necessary. The purpose of this presentation is to evaluate the applicability of transthoracic echocardiography for the diagnosis of CoA.

**Methods:** The echocardiographic appearances of 53 patients with CoA who had undergone surgery during a 5-year period from January 2008 to October 2012 were analyzed retrospectively, and the results were compared with findings at surgery.

**Results:** Fifty-three patients with CoA include six with isolated CoA and 47 of CoA associated with other cardiac anomalies. Of the 53 operated patients, 48 were correctly diagnosed preoperatively by echocardiography, while two were misdiagnosed as interrupted aortic arch and the diagnosis was missed in three other patients. Thus the diagnostic accuracy rate was 90.6%, and the misdiagnosis rate was 9.4%.

**Conclusions:** Preoperative echocardiographic evaluation offers very satisfactory anatomic assessment in most patients with CoA. It makes preoperative angiography unnecessary. Thus transthoracic echocardiography should be the first-line method for the diagnosis of coarctation of the aorta.

**Effect of Aerobic Exercise on Echocardiographic Epicardial Adipose Tissue Thickness, Anthropometrics and Lipids in Overweight and Obese Individuals**

CB Kalyana, GM Arun, K Padma, G Vasudeva, N Krishnananda  
Manipal University, India

**Background:** Echocardiographically measured epicardial adipose tissue thickness (EEATT) has been recently proposed as therapeutic target in obesity management and it is also considered as an important risk factor for cardiovascular diseases. The objective of study was to investigate the effect of aerobic exercise training on EEATT, anthropometrics and body composition in healthy overweight and mild obese Indians.

**Methodology:** 170 healthy mild obese sedentary women (90) and men (80) with Body Mass Index of 25.00 to 34.99 were randomly assigned to exercise group to complete 12 weeks of moderate intensity treadmill exercise and control group participants were not given any lifestyle modification. All the participants underwent anthropometric evaluation, measurement of aerobic capacity and blood test for lipid profile. EEATT was measured by an experienced sonographer. Data analysis was done using repeated measures ANOVA.

**Results:** EEATT values significantly reduced by -16.24% following 12 weeks of aerobic exercise along with a reduction in weight by 2.96%, body mass index by 3.11%, waist circumference by 2.29%. The study group also had changes in total cholesterol by -2.60%, low density lipoprotein cholesterol by -4.23%, high density lipoprotein cholesterol by 5.18%, triglycerides by -6.53% and fasting blood sugar by -3.08% with an improvement in aerobic capacity measured as VO2 peak by 12.18%. There were no significant changes seen in the control group after 12 weeks of no intervention.

**Conclusion:** 12 weeks of moderate intensity aerobic exercise is effective in reducing the EEATT in overweight and obese individuals. The reduction in EEATT was associated with an improvement in body composition and metabolic parameters.



**ABSTRACTS**

Abstracts for Free Paper Session:

**CARDIAC IMAGING**

**Correlation of Echocardiographic Epicardial Adipose Tissue Thickness with Metabolic Parameters, C-reactive Protein and Aerobic Capacity in Asian-Indians**

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Manipal University, India

Echocardiographic epicardial adipose tissue thickness (EEATT) is an indicator of visceral fat (VF) in the body and a risk factor of cardiovascular diseases. The objective of our study was to correlate EEATT with body fat percentage (BFP) and VF levels measured using Bioelectrical Impedance Analyser (BIA), lipid profile and fasting blood sugar (FBS) levels in overweight and obese Asian-Indians.

**Methodology:** A cross sectional study was conducted on 170 overweight and mildly obese Asian-Indian individuals. Waist circumference (WC) was measured in centimetres as per the guidelines of National Institute of Health (NIH). Four electrodes Bio Impedance Analyser was used to record the BFP and VF levels. Blood test was conducted after 10-12 hours of fasting; lipid profile and measurement of highly sensitive C-reactive protein (HS-CRP) were performed. All the participants also underwent a trans-thoracic two-dimensional M-mode echocardiogram (Philips iE 33) by an experienced sonographer to measure EEATT. The cardio respiratory endurance test on the participants was conducted using Bruce protocol, aerobic capacity (VO2 peak) was expressed in ml/kg/m<sup>2</sup>. Pearson's correlation coefficient test was used.

**Results:** EEATT was found to show good correlation with WC (r=0.72) and VF levels (r=0.77) measured by BIA. It showed moderate correlation with weight (r=0.47), BMI (r=0.52) and BFP (r=0.46) HSCR (r=0.47), FBS (r=0.35), LDL-C(r=0.33), TG(r=0.31) and TC (r=0.29). EEATT values showed weak negative correlation with HDL-C (r= -0.12) and VO2 peak values (r= -0.15)

**Conclusion:** EEATT has not been correlated with abnormal metabolic profile and aerobic capacity in overweight and obese Asian-Indians, but correlated well with measures of central obesity.

**A Rare Case of Giant Left Coronary Artery Aneurysm: Diagnosis by Echocardiography**

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**Clinical Presentation:** A 61-year-old Chinese female presented at a local hospital with a complaint of retro-sternal pain, which radiated to the back. The pain got more serious when she was excited or doing heavy activity and could be relieved at rest. In recent 3 years, the symptom was significantly aggravated.

**Imaging Findings:** Transthoracic echocardiography (TTE) showed that a cystic aneurysm-like structure (with approximate dimensions of 7.7 cm×7.2 cm×8.6 cm) was along the course of left coronary artery in the parasternal great artery short-axis view. The aneurysm was located between the left coronary sinus and the pulmonary artery, the wall was markedly thickened and presented as inhomogeneous enhancement in echogenicity, and regular iso-echo (with strong echo of calcification inside). CDFI showed that vortex signal could be detected in cystic structure, continuous flow spectrum was detected, and there was no blood flow signal in iso-echo area of the wall. Computed tomography angiography (CTA) of coronary artery revealed that on the left of middle mediastinum, a mass shadow (with approximate dimensions of 8.5 cm×7.6 cm×6.2 cm) with mixture density was seen in the territory of left coronary artery and left anterior descending branch with spot or strip calcification.

**Role of Imaging in Patient Care:** Non-invasive imaging tools for diagnosis of CAA include coronary angiography, CTA and Echocardiography etc. Combined with different imaging methods, the dilation lesion, shape and extent of coronary artery could be assessed accurately. When feeding arteries and parent artery of aneurysm are tiny, coronary CTA and coronary arteriography are superior to TTE, and can provide more accurate and comprehensive information. When the aneurysm was too giant, especially when chambers are pressed, tiny rupture can be easily missed. TTE is more sensitive to detect the slight shunt from chambers and aorta. TTE can precisely display the images of aneurysm, aorta or chambers. TTE, CTA and coronary arteriography have respective advantages and disadvantages.

**Summary and Discussion Points:**

1. TTE has advantages in accurately diagnosis of G-CAA.
2. Echocardiography results are highly consistent with what was revealed in surgery.
3. TTE is more accurate than CTA under some circumstance. It is economical, convenient and non-invasive, and it has good repeatability and become the first choice for diagnosis and follow-up study of coronary aneurysm.

## ABSTRACTS

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Abstracts for Free Paper Session:

### CARDIAC IMAGING

#### **Sinus of Valsalva Aneurysm Extending Into Left Ventricle: Combined Diagnosis of Conventional and Live Three-dimensional Echocardiography**

WJ Zhang, YL Yang, MX Xie, XF Wang, Q Lv, L He, J Wang, L Li, J Zhang, Y Wang, JF Liu

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**Objective:** To investigate image features of sinus of Valsalva aneurysm (SVA) extending into left ventricle by conventional and live three-dimensional (3D) echocardiography and evaluate diagnostic value of the two imaging modalities.

**Methods:** Echocardiographic features of 5 patients with SVA extending into the left ventricle treated at our hospital were reviewed and analyzed retrospectively, and compared with surgical findings. Four were combined diagnosed by conventional and 3D echocardiography before surgery.

**Results:** The SVA extending into the left ventricle presented a thin-walled saccular lesion with the origin adjacent to the aortic annulus. The aneurysms were observed going back and forth between the aortic root and the left ventricle in 4 with intact interventricular septum, even into the aorta over the annulus level when the aneurismal origin was wide enough, or between the left and the right ventricles via a ventricular septal defect in another case. In 4 patients with combined diagnosis, either conventional or live 3D echocardiography could clearly delineate the origin, extending position, morphologic change or motility of the aneurysm, complicated aortic valvular lesion (mainly presenting annulus displacement and valve prolapse) and

associated obstruction of the left ventricular outflow tract. Furthermore, 3D echocardiography was superior to conventional ultrasound in the indication of the aneurismal defect and both prolapse of the involved aortic annulus and valve.

**Conclusions:** The SVA extending into the left ventricle has distinguished echocardiographic features and could be accurately diagnosed by either conventional or live 3D echocardiography. 3D echocardiography is more sensitive to whether ruptured or not and more favorable to evaluate occurrence mechanism of the aortic regurgitation than conventional echocardiography.

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#### **Assessment of Flow Field of Right Ventricle in Diastole by Vector Flow Mapping in Patients with Atrial Septal Defect Before and After Closure**

J Liu, W Wu, M Liu, Y Yang

Union Hospital, China

**Objective:** To assess the changes of the flow field in diastole of the right ventricle before and a short term after surgery in patients with the atrial septal defect (ASD) by the vector flow mapping (VFM).

**Methods:** 20 patients with ASD were enrolled as patient group, while 20 healthy volunteers were chosen as control group. The pre- and post-operative characteristics of the flow field were compared by vector, streamline and vortex modes of the VFM, separately. The parameters at basal, mid and apical levels of the two groups were also recorded and compared, including diastolic peak velocity (Vp), diastolic peak flow (Fp) and diastolic Q+ (DQ+).

**Results:** Before ASD closure, the ASD group had intensive but disordered vector and stream lines, the vortex area below the tricuspid leaflets in diastole was also larger than the control group. After operation, the line intensity and direction consistence were recovered and the vortex area was reduced to some degree, but still different from the control group. The Vp, Fp and DQ+ in each level of right ventricle were lower than those before operation, but still higher than the control group.

**Conclusions:** The hemodynamics of the flow field in the right ventricle of the ASD patients was improved after operation, but still not completely recovered in the short time. The vector flow mapping could be used for the postoperative monitoring and follow-up of the cardiac hemodynamics.

**ABSTRACTS**

Abstracts for Free Paper Session:

**HEART FAILURE**

**Human Umbilical Cord Blood derived Mesenchymal Stem Cells improve Cardiac Function in cTnT<sup>R141W</sup> Transgenic Mouse of Dilated Cardiomyopathy Through Multiple Mechanisms**

X Gong, G Wang

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**Purpose:** Cell transplantation is a promising strategy in regenerative medicine, the beneficial effects of bone marrow mesenchymal stem cells (BM-MSCs) in the heart diseases are widely reported, however, MSCs in these studies are animal autogenous derived, data are still scarce on MSCs from human umbilical cord blood(UCB-MSCs). We investigated whether the intramyocardial xenogeneic administration of UCB-MSCs offers benefit in preserving heart function in cTnT<sup>R141W</sup> transgenic mouse model of dilated cardiomyopathy (DCM).

**Methods:** Cultured UCB-MSCs, which were identified by morphology, differentiation and cell surface markers, were transplanted into cTnT<sup>R141W</sup> transgenic mouse to examine apoptosis, fibrosis, vasculogenesis and their associated Akt pathway. We also determined levels of VEGF and IGF-1, growth factors required for their differentiation into cardiomyocytes, which also contributes in cardiac regeneration and improved heart function. Moreover, medium produced by MSCs preconditioned under normoxia or hypoxia was collected for subsequent in vitro assays.

**Results:** MSCs significantly decreased chamber dilation and contractile dysfunction in cTnT<sup>R141W</sup> mouse. MSCs transplanted hearts showed a significant decrease in cardiac apoptosis and their regulation with Akt pathway. Cardiac fibrosis and cytoplasmic vacuolization in the MSCs group was significantly lower. Importantly, the levels of VEGF and IGF-1 were increased in MSCs transplanted hearts, suggesting endogenous cardiac regeneration. In vitro, the MSC-conditioned medium displayed anti-apoptotic activity in h9c2 cardiomyocytes subjected to hypoxia, further confirmed the paracrine effects of MSCs.

**Conclusion:** UCB-MSCs preserve cardiac function after intramyocardial transplantation in a DCM mouse model, which may be associated with inhibition of cellular apoptosis, inflammatory, up-regulated expressions of Akt, VEGF, IGF-1 and enhanced angiogenesis.

**Efficacy and Safety of 1-h Infusion of Recombinant Human Atrial Natriuretic Peptide in Patients with Acute Decompensated Heart Failure: A Phase III, Randomised, Double-blind, Placebo-controlled, Multicentre Trial**

G Wang,<sup>1</sup> P Wang,<sup>1</sup> Y Li,<sup>2</sup> W Liu,<sup>3</sup> S Bai,<sup>3</sup> Y Zhen,<sup>4</sup> D Li,<sup>5</sup> P Yang,<sup>6</sup> Y Chen,<sup>6</sup> L Hong,<sup>7</sup> J Sun,<sup>8</sup> J Chen,<sup>9</sup> X Wang,<sup>10</sup> J Zhu,<sup>11</sup> D Hu,<sup>11</sup> H Li,<sup>12</sup> T Wu,<sup>13</sup> J Huang,<sup>1</sup> H Tan,<sup>1</sup> J Zhang,<sup>1</sup> Z Liao,<sup>1</sup> L Yu,<sup>1</sup> Y Mao,<sup>1</sup> S Ye,<sup>1</sup> L Feng,<sup>1</sup> Y Hua,<sup>1</sup> X Ni,<sup>1</sup> Y Zhang,<sup>1</sup> Y Wang,<sup>14</sup> W Li,<sup>14</sup> X Luan,<sup>1</sup> X Sun,<sup>1</sup> S Wang<sup>1</sup>

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**Aims:** Although atrial natriuretic peptide is a promising agent for acute decompensated heart failure (ADHF), no large clinical trial was reported to back its efficacy.

**Methods and Results:** This randomised, double-blind, placebo-controlled, multicenter study randomised 477 patients to receive either recombinant human ANP (rhANP) or placebo for 1-h infusion at a ratio of 3:1 in combination of standard therapy. The coprimary end-point was dyspnoea improvement at 12 hours among all patients and decrease of pulmonary capillary wedge pressure (PCWP) at one hour among catheterized patients.

**Results:** 358 (93 catheterized) patients were randomly assigned to the rhANP group, and 118(28 with catheter) to the placebo group. The proportion of patients with-dyspnoea improvement at 12 hours tended to be more in the rhANP group (32.0%) than that in the placebo group (25.4%, P=0.177). Those treated with rhANP had a significantly greater reduction in PCWP at 1-h than with placebo (-7.74±5.95 vs. -1.82±4.47 mmHg, P<0.001). Cardiac index increased and systemic vascular resistance decreased more significantly in the rhANP group. The rate of renal impairment and other adverse events within 3 days were similar in the two groups. Mortality at one month was 3.1% in the rhANP group versus 2.5% in the placebo group (hazard ratio 1.21, 95% confidence interval [CI], 0.34 to 4.26; P=1.00).

**Conclusion:** For patients with ADHF, in addition to stand therapy, 1-h infusion of rhANP had prompt, transient haemodynamic improvement and a small, nonsignificant effect on dyspnoea, with acceptable safety. (WHO International Clinical Trials Registry Platform (ICTRP) number, ChiCTR-IPR-14005719.)

**ABSTRACTS**

Abstracts for Free Paper Session:

**HEART FAILURE**

**Pregnancy Complicated with Heart Failure: Analysis of Risk Factors in a Tertiary Hospital in Indonesia**

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**Background:** Pregnancy with heart failure (HF) is an important issue because it accounts for 35% of female cardiovascular mortality. It will lead to the high rate of maternal and perinatal morbidity and mortality, especially in the low-resources settings without advance facilities. A number of studies have shown various incidence of HF during pregnancy. This study aim to find the incidence of HF during pregnancy and its risk factors in a Indonesian tertiary hospital.

**Methods:** This retrospective evaluation was performed during January to December 2013 at Cipto Mangunkusumo Hospital, Jakarta-Indonesia, a tertiary-care hospital. The data was obtained from singleton deliveries database including patients with HF and normal patients. Bivariate and multivariate analysis were carried out finding at the risk factors of HF.

**Results:** Seventeen out of 2132 the subjects had HF (7.7/1000). Of these, the median age of maternal was 31 years (range 19-41), 7 subjects (41.2%) were primigravida, 5 subjects (29%) had severe preeclampsia. Most patients (52.9%) were in NYHA functional class II. After adjusting with age and parity, anemia during labor (adjusted OR 2.86, 95%CI 1.028-7.98), asthma during pregnancy (adjusted OR 1.89, 95%CI 1.54-7.75), superimposed preeclampsia (adjusted OR 246.05, 95%CI 35.173-1721.3) and chronic

hypertension (adjusted OR 60.376, 95% CI 4.99-729.1) were found as risk factors of HF during pregnancy. However severe preeclampsia was not associated with HF.

**Conclusion:** Anemia during labor, asthma, superimposed preeclampsia and chronic hypertension were the risk factors of HF during pregnancy.

**Characteristics, Managements, and One-year Outcome of Patients with Acute Heart Failure in the Beijing Region: A Report of the Beijing Acute Heart Failure Registry Study**

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**Purpose:** Acute heart failure (AHF) causes high mortality and morbidity. The Beijing Acute Heart Failure Registry study aimed to assess the characteristics, management, and predictors of mortality in patients with AHF in the Beijing population.

**Methods:** Patients presenting with AHF in 14 emergency departments (EDs) in Beijing between 1 January 2011 and 23 September 2012 were registered, and followed up by one year.

**Results:** 3335 patients (median age 71 years, 53.2% male) were enrolled in the registry. Coronary heart disease (43.3%) was the commonest etiology, while myocardium ischemia (30.2%) was the main precipitant, of AHF. Beta-blockers, angiotensin-converting enzyme inhibitors or angiotensin receptor blockers (ACEIs/ARBs), and mineralocorticoid receptor antagonists (MRAs) were given after discharge to 39.9%, 28.7%, and 23.6% of patients, respectively. Overall mortality rates in EDs, at 30 days and 1 year were 3.81%, 15.3%, and 32.2%, respectively. Factors such as older age, higher NYHA functional class, lower systolic blood pressure, lower serum sodium, lower hemoglobin, and higher heart rate, higher serum creatinine, higher

brain natriuretic peptide (BNP) or N terminal pro BNP, underuse of beta-blockers and ACEIs/ARBs independently predicted death in short and long term. In addition, worsening HF independently predicted death at 1 year (hazard ratio: 0.848; 95% confidence interval: 0.725 - 0.992; *P*=0.0399).

**Conclusion:** AHF accounted for high mortality, and recommended therapies, which is protective against AHF, was underused in the Beijing population. These data may provide evidence for the guideline update, and it is essential to establish a program to promote the implementation of recommended therapies in the management of AHF.

**ABSTRACTS**

Abstracts for Free Paper Session:

**HEART FAILURE**

**Acute Chord Rupture of the Mitral Valve Posterior Leaflet in Heart Failure Progression in Hypertensive Patient with Coronary Heart Disease and Chronic Obstructive Lung Disease**

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**Introduction and case report description:** A 76-year-old woman was admitted because of dyspnea, lower limbs edema and fever during the previous several days. She noted a sharp appearance of sudden dyspnea a week ago. In the district hospital chest X-ray was carried out and bilateral lower lobe pneumonia was revealed. There wasn't any significant positive treatment outcome. Thus heart failure was regarded the leading causes of the disease, and the patient was referred to the cardiology department. Over the past 20 years patient suffered from arterial hypertension and regularly took antihypertensive drugs. She had a 30 years history of work with paint materials. Upon admission she had attenuation of the percussion sound in the basal parts of the lungs. Pulmonary auscultation revealed hard breathing, dry wheezing. Also the left heart boundaries expanding, systolic murmur at all points of auscultation, mainly in the area of the projection of the mitral valve, which is held in the left axillary region, edema of the limbs were registered.

**Description of the problem, procedures, techniques and/or equipment used:** Mitral chordae tendinae rupture is a rare but important cause of severe mitral valve insufficiency and left ventricular dysfunction in patients with degenerative mitral valve disease. The electrocardiogram showed sinus rhythm, left ventricular hypertrophy with no signs of ischemia. Transthoracic echocardiography reported the left heart cavities enlargement, first stage aortic valve stenosis, 2nd stage of pulmonary hypertension (73 mmHg) and mitral valve posterior leaflet chordae tendinae rupture with severe mitral regurgitation. Angiography showed 40% stenosis of the proximal left anterior descending artery and 40% stenosis of the proximal segment of the right

coronary artery. Multidetector computed tomography with angiography of the pulmonary arteries revealed the presence of cardiomegaly, pulmonary arterial hypertension and moderate bilateral hydrothorax. Convincing evidence for pulmonary embolism at the time of the study hasn't been identified.

**Questions, problems or possible differential diagnosis:** The patient had aortic stenosis, but it was slightly expressed and could not cause a substantial heart chamber enlargement, severe left ventricular failure, dyspnea, double-sided hydrothorax, double-sided congestive pneumonia. In addition there were particular auscultation pictures – systolic murmur mainly in the mitral valve with the left axilla radiation. The presence of the patient heart chamber dilatation because of ischemic cardiomyopathy were excluded during coronary angiography - no severe and hemodynamically significant coronary artery lesions revealed. The patient presented with the signs of pulmonary hypertension (73mm Hg) with the sudden appearance of dyspnea and required differential diagnosis with thromboembolism of pulmonary artery small branches. We conducted angiography of the pulmonary artery and revealed no pulmonary embolism. Patient had chronic obstructive pulmonary disease, but after a week of bronchodilator therapy ERF values improved significantly (FEV1 increased significantly) from 0.7 to 1.5, dyspnea decreased, but remained.

**Answers and discussion:** The diagnosis of acute chord rupture of the mitral valve posterior leaflet is usually difficult to quickly establish in patients with left ventricular dysfunction and requires very careful differential diagnosis especially in old-patients with co-morbidities.

**Conclusions and implications for clinical practice:** Acute chord rupture of the mitral valve posterior leaflet is rare but serious cause of severe mitral valve insufficiency, acute heart failure manifestation or chronic heart failure progression and leads to difficulties in the differential diagnosis of the reasons of heart failure. Acute chord rupture in degenerative mitral valve disease should be suspected in older patients with left ventricular dysfunction and co-morbidities as a cause of heart failure.

**ABSTRACTS**

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Abstracts for Free Paper Session:

**CARDIAC SURGERY**

**Current Status of Hybrid Thoracic Aortic Intervention**

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**Introduction:** Thoracic aortic diseases involving aortic arch and descending thoracic aorta are the most challenging group of conditions and conventional treatments are associated with significant morbidity and mortality. In recent years, a hybrid approach combining thoracic aortic endovascular aortic repair (TEVAR) and minimally invasive surgery results in better clinical outcomes.

**Purpose:** To provide better service to patients with thoracic aortic diseases through a team approach.

**Methods:** We prospectively studied patients underwent TEVAR in Prince of Wales Hospital from 1/2008 to 1/2015. A multi-disciplinary team held regular meeting to determine best interventional approach and review post-operative outcomes. Patients' demographics, operative procedures, post-operative complications including bleeding, stroke, paraplegia and mortality were recorded. Data was prospectively collected and entered for analysis after being validated by a research assistant.

**Results:** A total of 107 patients received TEVAR during the study period. There were 7 patients with total aortic de-branching, 45 patients with extra-anatomical bypass of head and neck vessels to facilitate TEVAR. Two patients developed post-operative bleeding requiring re-exploration. Four patients developed minor stroke and 3 patients developed paraplegia that resolved after lumbar drain for cerebral spinal fluid drainage. The overall procedural

related mortality is 2.9% (1 from retrograde type A dissection, 2 from ruptured false lumen) and 30-day mortality is 6.7%. The overall survival at 1 year, 3 year and 5 year are 86%, 83% and 81% respectively.

**Conclusions:** In modern era, the multi-disciplinary team approach to thoracic aortic pathologies results in better clinical outcome. The team approach ensures best clinical care delivered to patients.

**ABSTRACTS**

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Abstracts for Free Paper Session:

**CARDIAC ARRHYTHMIA**

**Identification of Collagen Types and Ultrastructure Changes in the Atrial Tissue from Patients with Mitral Valvular Disease and Permanent Atrial Fibrillation**

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**Purpose:** Atrial fibrillation (AF) is a common complication in heart valvular disease and is associated with cellular structure abnormality. We aimed to study the collagen types and to investigate the changes of morphology and cell ultrastructure in the tissue of the right atrium from patients with mitral valvular disease and permanent AF.

**Methods:** The right atrial appendage obtained from patients with mitral valvular disease associated with either sinus rhythm (SR, n=4) or permanent AF (AF=6 months, n=4). One part of the sample was used for histological analysis and collagen fiber quantitation; the other part was analyzed by transmission electron microscope to observe cell ultrastructure.

**Results:** In both patients, Type I collagen was found under capillary endothelial and vascular basement membrane. Type II collagen was positive in cardiomyocytes and fibril cardiac muscle. Type III collagen was colored in mesothelial cells, vascular endothelial cells, and myocyte cytoplasm. Type IV collagen was located around cardiomyocytes, especially on vascular basement membrane and myocardial cell membrane. Atrial fibrosis was

higher in AF patients than that of SR patients. In AF patients, there was a large number of immature fibrocytes among myocytes. The connection of myocytes was disrupted or disorientated. Electron microscope study revealed that the cell striations were cracked or disappeared and that "Glycogen Lake" existed in the myocardial cells. Further, mitochondrion was swelling.

**Conclusions:** Our study identified different types of collagen in the atrial appendage and revealed that there are atrial fibrosis and ultrastructural abnormalities related to AF in the mitral valvular disease. The present study provides evidence of structure changes that may lead to the abnormal conductance of the electrical signal and arrhythmia in the heart valvular disease.

**ABSTRACTS**

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Abstracts for Free Paper Session:

**CARDIAC REHABILITATION**

**Application of Mobile Applications to Improve Patients' Health after Cardiac Rehabilitation**

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**Introduction:** Medicine is getting into a digital era. Telemedicine is an innovative way that more patients might be able to improve their health. There are health-related mobile applications (apps) developed and available for download. Those apps can help patients improve and empower their lifestyle, including daily physical activities, nutrition and weight management.

**Purpose:** The aim of this abstract is to explore if mobile medicine and mobile apps are popular and applicable to cardiac patients.

**Methods:** After phase II cardiac rehabilitation (CR), cardiac patients would be enrolled in a health qigong class that empowered them to sustain exercise habit and provide peer support. A questionnaire was designed to assess if those patients had used health apps to track their heart rate or exercise record.

**Results:** A total of 38 questionnaires were done. There were 27 males (71%), their age ranged from 46 to 91 years. Among them, 15 (39%) patients took pulse rate, 4 (11%) used the rate of perceived rate of exertion and 1 (3%) used polar to monitor their exercise intensity. Six (16%) patients would recheck their pulse rate immediately after exercise. Seventeen (45%) were smartphones user, only 3 patients had heard about and/or tried health apps. Among those 17 patients, 82% of patients would download health apps that were free of charge and 94% of patients would track their heart rate while exercise.

**Conclusions:** In this survey, 45% of patients own a smartphone and 8% (3 out of 38) patients had tried those mobile applications. However, 94% of those smartphones users would apply mobile medicine or mobile applications to track and log their health record. For health care professionals in cardiac rehabilitation, with the quick development and widespread of mobile phone technologies, knowledge and recommendation of safe and reliable mobile applications with validation to cardiac patients deserves further study.



**ABSTRACTS**

Abstracts for Free Paper Session:

**HYPERTENSION AND HYPERLIPIDEMIA**

**Probuco Treatment Results in Regression of Tendon Xanthomas and Xanthelasma in Patients with Heterozygous Familial Hypercholesterolaemia**

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**Objectives:** Probuco is a di-phenolic anti-oxidant drug with anti-atherosclerotic effects. It is known to reduce HDL-C and it may increase reverse cholesterol transport. The present study examined the effect of probuconol on reducing tendon xanthoma and xanthelasma in Chinese patients with familial hypercholesterolaemia (FH).

**Methods:** In this single arm, open label study, Chinese patients with FH were treated with probuconol 500 mg twice daily with the morning and evening meals for 24 weeks. Fasting lipids were measured at baseline and after 12 and 24 weeks. The volumes of the Achilles tendons were measured by magnetic resonance imaging at baseline and after treatment with probuconol for 12 and 24 weeks. The size of xanthelasma was assessed by the investigators.

**Results:** A total of 24 patients participated in the study and 6 patients withdrew due to side effects or personal reasons. In the 18 patients (13 females, 58.1±8.9 years) who completed the study, there was a significant reduction in plasma HDL-C (from 1.72±0.40 mmol/L to 0.93±0.32 mmol/L), but no significant change in LDL-C or triglycerides. The mean(±SE) volumes of the Achilles tendons on both sides were significantly reduced (Left: 13.85±1.73 cm<sup>3</sup> to 12.96±1.60 cm<sup>3</sup>, P=0.002; Right: 13.86±1.73 cm<sup>3</sup>

to 12.98±1.60 cm<sup>3</sup>, P=0.002) after 24 weeks treatment. The lipid content of the Achilles tendons on both sides was also significantly reduced at the end of the study (Left: 18.7±0.8% to 17.4±0.5%, P<0.05; Right: 18.5±0.6% to 17.6±0.7%, P<0.05). There was no correlation between the changes in Achilles tendon volume and the changes in HDL-C levels or other lipids with probuconol. The size of xanthelasma was reduced in 4 out of the 5 patients with these deposits.

**Conclusion:** This small study showed that treatment with probuconol for 24 weeks resulted in regression of size and lipid content of tendon xanthoma which was independent of the changes in lipids.

**Association of Systolic Blood Pressure with Body Weight and the Metabolic Syndrome in Children**

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**Introduction:** Our previous study in British schoolboys suggested a strong relationship between systolic blood pressure (SBP) and obesity. To characterize this relationship further, we analyzed the latest United States National Health and Nutrition Examination Survey (NHANES) data.

**Methods:** 1981 participants (1007 boys, 974 girls) of NHANES 2011-2 age <20 (mean age 13.0±3.5 yrs) were included in the analysis. The National Center for Health Statistics Research Ethics Review Board approved the protocol. Certified personnel measured blood pressure. Central laboratories analyzed the blood samples. Lifestyle information was obtained using questionnaires.

**Results:** SBP and diastolic blood pressure (DBP) correlated with body weight (BW) (r=0.51 and 0.28 respectively, p<0.001) more strongly than with BMI or waist circumference. SBP correlated more strongly with BW in boys than girls (r=0.57 and 0.38 respectively, p<0.001; age-adjusted r=0.34 and 0.26 respectively, p<0.001). In boys, SBP also correlated with serum insulin, HDL and triglycerides (r=0.22, 0.22 and 0.32 respectively, p<0.001), but these correlations became insignificant when adjusted for BW. There was no significant association between SBP or DBP with smoking, alcohol intake, quantity or quality of sleep, hours of television viewing, hours at computer, or amount or rigor of physical exercise. In a general linear model, BW, age and gender explained 30% (35% in boys and 16% in girls) of the variance in SBP.

**Conclusions:** Increased SBP in children is strongly related to BW; in boys, it is also associated with components of the metabolic syndrome. Our results emphasize the importance of children's eating habits.

**ABSTRACTS**

Abstracts for Free Paper Session:

**MISCELLANEOUS**

**Serum Calcium and Incident Diabetes: A Retrospective Study in Hong Kong Chinese and Meta-Analysis**

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**Purpose:** Bone and mineral metabolism plays a role in glucose metabolism. Recent studies suggested that serum calcium is also associated with the risk of diabetes. **Aims.** We aimed to evaluate the association of serum calcium with incident diabetes in Hong Kong Chinese.

**Methods:** We conducted a retrospective cohort study on 1702 male and 4394 female Hong Kong Chinese aged 20 or above free of diabetes at baseline, and the incident diabetes was determined from electronic patient record databases. We also conducted a systematic literature review for similar studies and calculated an overall relative risk (RR) using a fixed-effect model. **Results:** In 59130.9 person-years of follow-up, 631 participants developed diabetes. Serum total calcium (third quartile, HR 1.42; 95% CI 1.12-1.8; highest quartile, HR 1.41; 95% CI 1.11-1.79; as compared to the lowest quartile) were significantly associated with incident diabetes. Significant interactions with BMI and age were observed. Greater total calcium intake was significantly associated with less incident diabetes (comparing extreme quartiles, hazard ratio 0.78; 95% confidence interval 0.61-0.98). In meta-

analysis of three studies including ours, with a total of 34,117 participants, the pooled RR of incident diabetes was 1.43 (95% CI 1.20, 1.70) in individuals with serum calcium level greater than 2.44 mmol/L.

**Conclusion:** Elevated serum total calcium and lower total calcium intake were associated with incident diabetes. The mechanism warrants further investigation.

**Significance of ER Stress-mediated K<sub>Ca</sub> Channel Inhibition in Endothelial Dysfunction**

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**Background and Objectives:** Although hyperhomocysteinemia has been long recognized as an independent risk factor for atherosclerotic diseases, the underlying mechanisms by which homocysteine induces endothelial dysfunction remains incompletely understood. Whether endothelial calcium-activated potassium (K<sub>Ca</sub>) channels are involved is uncertain and the significance of endoplasmic reticulum (ER) stress in K<sub>Ca</sub> channel-dependent endothelial function in hyperhomocysteinemia remains unexplored. We investigated the effect of homocysteine on endothelial K<sub>Ca</sub> channels in coronary vasculature with further exploration of the role of ER stress.

**Methods:** Relaxation mediated by intermediate- and small-conductance K<sub>Ca</sub> (IK<sub>Ca</sub> and SK<sub>Ca</sub>) channels was studied using myograph in porcine coronary arteries. In coronary endothelial cells, whole cell K<sup>+</sup> currents were recorded by patch-clamp with further differentiation of IK<sub>Ca</sub> and SK<sub>Ca</sub> components, and protein levels of IK<sub>Ca</sub> and SK<sub>Ca</sub> channels were determined for both whole-cell and surface expressions.

**Results:** Homocysteine impaired bradykinin-induced IK<sub>Ca</sub> and SK<sub>Ca</sub>-dependent EDHF-type relaxation and attenuated the vasorelaxant response to the channel activator. IK<sub>Ca</sub> and SK<sub>Ca</sub> channel currents were suppressed by homocysteine. Inhibition of ER stress during homocysteine exposure prevents the suppression of IK<sub>Ca</sub> and SK<sub>Ca</sub> currents, associated with improved EDHF-type response and channel activator-induced relaxation. Homocysteine did not alter whole-cell protein levels of IK<sub>Ca</sub> and SK<sub>Ca</sub> whereas lowered surface expressions of these channels, which were restored by ER stress inhibition.

**Conclusions:** Homocysteine induces endothelial dysfunction through a mechanism involving ER stress-mediated suppression of IK<sub>Ca</sub> and SK<sub>Ca</sub> channels. Inhibition of membrane translocation of these channels by ER stress is responsible for the suppressive effect of homocysteine on channel activity. This study provides new mechanistic insights into homocysteine-induced endothelial dysfunction and advances our knowledge of the significance of ER stress in vascular disorders.

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**ABSTRACTS**

Abstracts for Free Paper Session:

**MISCELLANEOUS**

**The Arterial Stiffness Assessment in An Abdominal Aorta Aneurysm Model of Rat by Pulse Wave Velocity In Vivo**

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**Purpose:** Pulse wave velocity (PWV) is linked to arterial stiffness and becoming an essential prognostic indicator for cardiovascular disease. Supersonic Shear Imaging (SSI) is a novel non-invasive technique based on remote palpation of biological tissues that can image with very high temporal resolution and quantify the local viscoelastic properties of tissues, which can be applied to measure PWV for arterial stiffness evaluation. In the study, we aimed to demonstrate the feasibility and reproducibility of PWV to monitor the arterial stiffness in a rat abdominal aorta aneurysm (AAA) model.

**Methods:** AAA was induced using a CaCl<sub>2</sub> model for 4 weeks in order to investigate the utility of PWV for detecting disease. A total of 40 adult male Sprague-Dawley rats (20 each group) were placed under anesthesia and the infrarenal abdominal aorta was treated with saline (control group) or CaCl<sub>2</sub> (AAA group). The aortas were imaged using an ultrasound system (Aixplorer, SuperSonic Imagine) for PWV measurement every two weeks, and the PWV were measured at the beginning of systole (BS) and the end of systole (ES) with display of the standard deviation for each measurement. Aortas were harvested for histological analysis as well.

**Result:** The PWV at BS and ES were significantly increased in the AAA group at week 2 and week 4 compared with control group, (P=0.01, P<0.001, P=0.002, P<0.001). Histological analysis showed that aortic collagen depositions, elastin fibers and smooth muscle cell numbers were reduced in the AAA group, (P=0.03, P=0.01, P<0.001). There was a good correlation between PWV (BS) and PWV (ES) with collagen content respectively, (r=0.573, P<0.05, r=0.615, P<0.05).

**Conclusions:** PWV is a promising noninvasive technique with the potential to accurately quantify arterial stiffness of vascular disease in vivo; it may contribute to the detection of early stages of cardiovascular disease.

**Ultrasound-targeted microbubble destruction (UTMD) assisted delivery of shRNA against PHD2 into H9C2 cells**

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**Purpose:** Gene therapy has great potential for human diseases. Development of efficient delivery systems is critical to its clinical translation. Recent studies have shown that microbubbles in combination with ultrasound (US) can be used to facilitate gene delivery. An aim of this study is to investigate whether the combination of US-targeted microbubble destruction (UTMD) and polyethylenimine (PEI) (UTMD/PEI) can mediate even greater gene transfection efficiency than UTMD alone and to optimize ultrasonic irradiation parameters. Another aim of this study is to investigate the biological effects of PHD2-shRNA after its transfection into H9C2 cells.

**Methods:** pEGFP-N1oreukaryotic shPHD2-EGFP plasmid was mixed with albumin-coated microbubbles and PEI to form complexes for transfection. After these were added into H9C2 cells, the cells were exposed to US with various sets of parameters. The cells were then harvested and analyzed for gene expression.

**Results:** UTMD/PEI was shown to be highly efficient in gene transfection. AnUS intensity of 1.5 W/cm<sup>2</sup>, a microbubble concentration of 300 µl/ml, an exposure time of 45s, and a plasmid concentration of 15 µg/ml were found to be optimal for transfection. UTMD/PEI-mediated PHD2-shRNA transfection in H9C2 cells significantly down regulated the expression of PHD2 and increased expression of HIF-1β and downstream angiogenesis factors VEGF, TGF-α and bFGF.

**Conclusions:** UTMD/PEI, combined with albumin-coated microbubbles, warrants further investigation for therapeutic gene delivery.

**ABSTRACTS**

Abstracts for Free Paper Session:

**PAEDIATRIC CARDIOLOGY**

**Measurements in Pediatric Patients with Cardiomyopathies: Comparison of Cardiac Magnetic Resonance Imaging and echocardiography**

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**Aims:** Cardiomyopathies are common cardiovascular diseases in children. Cardiac magnetic resonance imaging (cMRI) and echocardiography (Echo) are routinely used in the detection and diagnosis of pediatric cardiomyopathies. In this study, we compared and explored the correlation between these two measurements in pediatric patients with various cardiomyopathies.

**Methods and Results:** A total of 53 pediatric patients with cardiomyopathy hospitalized in recent three years in our hospital were collected and analyzed. All of them and 22 normal controls were measured with both cMRI and Echo. The cardiac functional score of the patients was graded according to the criteria set by New York Heart Association. The cardiac function indexes measured with both cMRI and echo included left ventricular end diastolic volume (EDV), end systolic volume (ESV), ejection fraction (EF), fractional shortening (FS). These parameters were somehow lower in cMRI measurements compared to that in echo measurements. Index of the diastolic function such as peak filling rate (PFR) measured with cMRI had a good correlation with clinical cardiac functional score, while the index of the diastolic function (E/A, IVRT) measured with Echo was not well correlated with the clinical cardiac functional score. Significant systolic dysfunction was detected by cMRI in 34 patients with dilated cardiomyopathy, left

ventricular noncompaction, or endocardial fibroelastosis. Significant diastolic dysfunction was detected by cMRI in 19 patients with hypertrophic cardiomyopathy or restrictive cardiomyopathy showing an alteration in PFR and EDV.

**Conclusion:** Both cMRI and Echo are of great value in the diagnosis and the assessment of cardiac function in pediatric patients with cardiomyopathy. CMRI could accurately display the characteristic morphological changes in the hearts with cardiomyopathies, and late gadolinium enhancement on cMRI may reveal myocardial fibrosis, which has obvious advantages over Echo measurements in the diagnosis. Furthermore, cMRI can measure quantitatively the ventricular function because it does not make invalid geometrical assumptions.

**Alcohol-induced Histone H3K9 Hyperacetylation and Cardiac Hypertrophy Are Reversed by a Histone Acetylases Inhibitor Anacardic Acid in Developing Murine Hearts**

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**Background:** The expression of cardiac genes is precisely regulated, and any perturbation may cause developmental defects. In a previous study, we demonstrated that alcohol consumption during pregnancy could lead to uncontrolled expressions of cardiac genes and eventually result in cardiac dysplasia. However, the underlying mechanisms remain unclear. In the present study, we have investigated the alcohol-induced cardiac hypertrophy and its potential mechanisms. Furthermore, the protective effect of anacardic acid against the alcohol-induced cardiac hypertrophy has been explored in experimental mice.

**Methods and Results:** C57BL/6 pregnant mice were gavaged with 56% ethanol or saline and the hearts of their fetus were collected for analysis. Binding of p300, CBP, PCAF, SRC1, except GCN5, were increased to the *NKX2.5* promoter in fetal mouse hearts exposed to alcohol. Increased acetylation of H3K9 and increased mRNA expression of *NKX2.5*, *β-MHC* and *Cx43* were observed in the same samples. Treatment with a pan-acetylase inhibitor, anacardic acid, reduced the binding affinity of p300 and PCAF to

the *NKX2.5*, *β-MHC*, *Cx43* promoters and attenuated H3K9 hyperacetylation. Interestingly, anacardic acid down-regulated over-expression of these cardiac genes induced by alcohol and ultimately attenuated ethanol-induced cardiac hypertrophy in fetal mice.

**Conclusions:** Our results indicate that alcohol exposure during pregnancy could lead to fetal cardiac hypertrophy. The over-expression of *NKX2.5*, *β-MHC*, *Cx43* mediated by p300 and PCAF may be critical mechanisms of alcohol-induced cardiac hypertrophy. Anacardic acid can down-regulate the over-expression of cardiac genes and reverse cardiac hypertrophy caused by alcohol treatment in pregnant mice, suggesting it could be a potential therapeutic agent for the treatment of cardiac hypertrophy.

ABSTRACTS

Abstracts for Free Paper Session:

PAEDIATRIC CARDIOLOGY

**BNP/NT-proBNP for Predicting Hemodynamically Significant Patent Ductus Arteriosus in Premature Infants: A Meta-analysis**

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**Objective:** To systematically evaluate the utility of Brain natriuretic peptide/ N terminal proBrain natriuretic peptide (BNP/NT-proBNP) in predicting hemodynamically significant patent ductus arteriosus (hsPDA) in premature infants.

**Methods:** Related literatures published since the date of each database's establishment till April 2014 were searched and collected from online databases including PubMed, Embase, the Cochrane Library, Web of Knowledge, Ovid, CMB, WanFang Data, CNKI and VIP Data. Relevant periodicals and references of the included studies were also manually retrieved. According to the inclusion and exclusion criteria, related studies were selected, data extracted, and quality of the included studies evaluated according to the QUADAS2 by two reviewers independently. After cross-checking and reaching an agreement, meta-analysis was conducted by RevMan 5.2 and MetaDisc1.4, with which homogeneity test was conducted, data from the eligible studies combined, and pooled sensitivity, specificity, positive likelihood ratio, negative likelihood ratio as well as the area under the SROC (AUC) were analyzed.

**Results:** Seven studies with a total of 370 cases were included. The result of meta-analysis showed that, the DOR of BNP/NT-proBNP for prediction of hsPDA in preterm infants was 105.96[95%CI (47.81,234.82)]. The pooled sensitivity, specificity, positive likelihood ratio, negative likelihood ratio, and the AUC were 0.94 [95%CI (0.89,0.98)], 0.91[95%CI (0.87,0.94)], 9.58 [95%CI (6.52,14.06)], 0.08 [95%CI (0.04,0.14)] and 0.9417, respectively.

**Conclusion:** Elevated BNP/NT-proBNP level was significantly associated with the presence of hsPDA in preterm infants. BNP/NT-proBNP is a powerful predictor in predicting hsPDA on preterm infants.

**Clinical Research on Fetal Bradycardia**

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**Objective:** Investigate in the prevalence, spectrum, clinical features and prognosis of fetal bradycardia, as well as the relationship between fetal bradycardia and maternal anti-SSA/Ro and anti-SSB/La.

**Methods:** The cases of fetal bradycardia prenatal diagnosed at West China Second University Hospital were enrolled in this study during 2013-01 to 2013-12. With the determined of prenatal echocardiography and postnatal electrocardiogram, whileas the serum level of maternal anti-SSA/Ro and anti-SSB/La and status of maternal autoimmune diseases, the prevalence, spectrum, clinical features and prognosis of fetal bradycardia were recorded and analyzed.

**Results:** 45 cases of fetal bradycardia were enrolled, the gestational age were 23-34 weeks (mean28.2w). Among them, there were 21 cases of III°AVB, 16 cases of sinus bradycardia, 8 cases of irregular bradycardia (3 cases of II°AVB, 2 cases of LQTS and other 3cases). 8 cases of heart rate (HR) less than 55 bpm, 19 cases HR between 55-70 bpm and 18 cases of HR more than 70 bpm. 10 cases of fetuses were revealed companied with degrees of fetal hydrops (6 cases HR below 55 bpm, 2 cases HR between 55-70 bpm, and 2 cases HR more than 70 bpm). Maternal autoantibodies positive (anti-SSA/Ro and anti-SSB/La) were found in 24 mother, among them, 5 cases of systemic lupus erythematosus, 3 cases of Sjogren's disease, 4 cases of undifferentiated connective tissue disease and 12 cases without clinical symptom; and to their fetuses, there were 17 cases of III°AVB, 5 cases of

sinus bradycardia, 2 cases of irregular bradycardia. To the suffered fetuses, 17 cases were companied with cardiovascular malformation (12 cases of III°AVB, 3 cases of sinus bradycardia, 2 cases of irregular bradycardia). In this study, there were no any cases received prenatal drug therapy. All the fetuses HR below 55 bpm were terminated after prenatal doagnosis. To the 19 cases HR between 55-70 bpm, 10 of them terminated, 3 cases of III°AVB, 5 cases of sinus bradycardia, 1 case of LQTS (postnatal diagnosis). To the 18 cases HR more than 70 bpm, 5 of them terminated, 6 cases of III°AVB, 5 cases of sinus bradycardia, 1 case of LQTS (postnatal diagnosis).

**Conclusion:** Common type of fetal bradycardia including III°AVB, sinus bradycardia and irregular bradycardia (such as the II°AVB, LQTS). The prognosis of fetal bradycardia was poor, and some types of fetal bradycardia have closely relationship to connective tissue disease, especially maternal autoantibodies positive (anti-SSA/Ro and anti-SSB/La).

**ABSTRACTS**

Abstracts for Free Paper Session:

**PAEDIATRIC CARDIOLOGY**

**Clinical Analysis of Percutaneous Balloon Pulmonary Valvuloplasty for Pulmonary Stenosis in Merger with Subvalvular Pulmonary Stenosis and Supravalvular Pulmonary Stenosis in Children**

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**Objective:** To evaluate the clinical efficacy of percutaneous balloon pulmonary valvuloplasty(PBPV) for pulmonary stenosis(PS) in merger with subvalvular pulmonary stenosis (mild) and supravalvular pulmonary stenosis.

**Methods:** A total of 45 patients of pulmonary stenosis in merger with subvalvular pulmonary stenosis (mild) and supravalvular pulmonary stenosis, who encountered in author's hospital during past 10 years, were enrolled in this study. The diagnosis was conformed by clinical manifestations, ECG, X-ray, echocardiography. The size of valve ring, valvular area, the pulmonary valve differential pressure was confirmed before the PBPV. The balloon with the diameter being (20%-40%) bigger than the valve ring was confirmed. After the PBPV, the PA-RV (pulmonary artery-right ventricle) pressure was measured immediately. The pulmonary valve open, ECG, pulmonary valve and tricuspid valve regurgitation were checked.

**Results:** 45 case of pulmonary stenosis in merger with subvalvular pulmonary stenosis (mild) and supravalvular pulmonary stenosis, 42 cases of intervention is successful, the success rate was 93.333%. In the pulmonary stenosis in merger with subvalvular pulmonary stenosis (mild) and supravalvular pulmonary stenosis group, Preoperative and postoperative

pulmonary valve differential pressure was statistically significant( $P<0.05$ ). In pulmonary stenosis in merger with subvalvular pulmonary stenosis (mild) and supravalvular pulmonary stenosis, Preoperative and postoperative pulmonary valve differential pressure was statistically significant( $P<0.05$ ).

**Conclusion:** The blood flow velocity of right ventricular outflow tract is less than 3.810 m/s, PBPV surgery is the treatment of subvalvular pulmonary stenosis (mild). Percutaneous balloon pulmonary valvuloplasty is a safe and effective method for pulmonary stenosis with supravalvular pulmonary stenosis (the diameter of supravalvular pulmonary stenosis is greater than 5 mm). In pulmonary stenosis in merger with subvalvular pulmonary stenosis (mild) and supravalvular pulmonary stenosis, the effect of percutaneous balloon pulmonary valvuloplasty is very well for the well developed of pulmonary valve ring and mild-to-moderate dysphasia pulmonary valve ring.

**Interventive Closure of Ventricular Septal Deffct Close to the Aortic Valve in Children**

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**Purpose:** It is still controversial of transcatheter closure of sub-aortic ventricular septal defect (VSD) in children, especially with aortic valve prolapse (AVP). The aim of our study was to explore the feasibility and safety of interventional closing VSD in children with the superior rim <1.5 mm from the aortic valve by left ventricular (LV) angiography.

**Methods:** 19 patients, with a LV angiography-determined non-subarterial VSD of which the superior rim was <1.5 mm from the aortic valve, consented to receive interventional therapy using devices made in China from Jun 2008 to Oct 2014. Devices were implanted under transthoracic echocardiography (TTE) and fluoroscopy monitoring.

**Results:** These patients were 11 males and 8 females, age 3-16 years, weighing 13.0-44.6 kg. TTE showed limited aortic regurgitation (AR) in 2 (10.5%), mild AVP in 5 (26.3%) and membranous ventricular septal aneurysm in 3 (15.8%) patients before operation. Angiography showed diameter of the VSDs ranged 2-16 mm. Devices with a waist diameter 0-3 mm larger than the VSD were chosen. Sixteen (84.2%) defects were successfully closed using the symmetrical VSD occluder. Two of those used the eccentric occluder at first but failed and switched to the symmetrical occluder-one had residual shunt and the other had a poorly deployed device with its left disk blocking the LV outflow track. Three (15.8%) were closed using the

eccentric occluder. One of those three patients switched to the eccentric occluder after a failed attempt with the symmetrical one, for it caused a notch in the right coronary cusp on repeated LV angiography and an increased AR was detected by TTE. All patients were discharged 7-10 days post-operation. Two months to 6 years' follow-up found no aortic valve perforation or stenosis, no worsening nor improvement to the previously existed AVP and AR, no tricuspid valve damage or III°AVB.

**Conclusions:** In children, some of the VSD sitting close to the aortic valve even with mild AR or AVP, can be effectively treated using the interventional approach. The symmetrical VSD occluder is suitable for most cases of this kind.

**ABSTRACTS**

Abstracts for Free Paper Session:

**PAEDIATRIC CARDIOLOGY**

**Maternal Exposure to Di(2-ethylhexyl)phthalate Impacts Fetal Cardiac Development**

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**Backgrounds:** Di(2-ethylhexyl)phthalate(DEHP), a commonly used phthalate ester plasticizer, is an endocrine disruptor resulting in increased incidence of various developmental malformations. However, effects of maternal DEHP exposure on cardiac development have not been assessed.

**Purpose:** This study aims to explore the associations between maternal occupational exposures to phthalates periconceptionally and isolated congenital heart defects (CHDs) in human, and to evaluate the effects of maternal DEHP exposures on fetal cardiac development in mice.

**Methods:** A case-control study with standardized data collection involving 761 children with isolated CHDs and 609 children without any congenital malformations was conducted in Sichuan Province of China from March in 2012 to August in 2013. An adjusted job exposure matrix was used for maternal occupational DEHP exposure assessment. Logistic regression analysis was performed to assess the associations between maternal occupational DEHP exposures and CHDs. Totally, 75 female pregnant C57BL mice were randomized equally into 5 groups consisting the blank group, vehicle group, and three DEHP groups (0.5 g/Kg, 1 g/Kg and 2 g/Kg). Pregnant dams in different groups received respective intervention by gavage once daily from E6.5-E14.5. HE staining was used to examine the fetal cardiac malformations. Fetal cardiac development-related genes (Nkx2.5, GATA4, TBX5, MEF2C, CHF1) mRNA and protein expression were determined by real-time quantitative PCR.

**Results:** Maternal occupational exposures to phthalates periconceptionally are associated with perimembranous ventricular septal defect (PmVSD) ( $P=0.001$ , adjusted OR 3.7, 95%CI 1.7-8.0), patent ductus arteriosus (PDA) ( $P=0.002$ , adjusted OR 3.8, 95%CI 1.6-8.9), secundum atrial septal defect (s-ASD) ( $P=0.008$ , adjusted OR 3.5, 95%CI 1.4-8.7) and pulmonary valve stenosis (PS) ( $P=0.035$ , adjusted OR 4.2, 95%CI 1.1-16.0). Maternal exposures to DEHP could induce various fetal cardiac malformations (including septal defects, myocardial developmental abnormalities, hypoplasia) in mice with a dose-dependent manner. The GATA4, MEF2C and CHF1 mRNA and protein expression of fetal heart were significantly down-regulated by DEHP, which is dose dependent.

**Conclusions:** Maternal exposures to phthalates periconceptionally increase the risk of some CHDs phenotype. Administration of DEHP in pregnant mice can result in various fetal cardiac malformations.

**Percutaneous Transcatheter Closure of Congenital Coronary Artery Fistulae with Patent Ductus Arteriosus Occluder in Children: Focus on Patient Selection and Intermediate-term Follow-up Results**

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**Backgrounds:** The prognostic implications of clinically silent coronary artery fistula (CAF) and its intermediate/long-term outcomes after transcatheter closure have not been well studied, especially in children.

**Purpose:** This study intended to determine the prognostic implications of asymptomatic CAF and to evaluate the intermediate follow-up outcomes following transcatheter occlusion with patent ductus arteriosus (PDA) in children.

**Methods:** Eighteen children with congenital CAF were divided into two groups: the intervention group ( $n=14$ ; maximal coronary artery diameter [MCD]  $\geq 5$  mm and/or fistulous orifice diameter [FOD]  $> 2$  mm), and the non-intervention group ( $n=4$ ; MCD  $< 5$  mm and FOD  $\leq 2$  mm). Patients in the intervention group received percutaneous occlusion with PDA occluder. Clinical outcomes and follow-up data were analyzed and compared between different groups.

**Results:** Patients with clinically silent CAF were followed for 8-130 months. At the mean follow-up of 36 months, patients in the non-intervention group did not show any changes in the measured parameters over time. In contrast, patients in the intervention group showed significant increase of MCD

( $8.31 \pm 2.16$  mm to  $12.75 \pm 3.01$  mm;  $P=0.001$ ) and FOD ( $3.75 \pm 3.42$  mm to  $4.82 \pm 1.81$  mm;  $P=0.03$ ). In addition, 3 cases of aneurysm formation and 2 cases of mild heart failure were detected before the patients received the attempted transcatheter closure. A total of 14 patients underwent cardiac catheterization with an attempt to close the CAF. Placement of occlusion devices succeeded in 10 patients (71.5%) and failed in 4 patients (28.5%). Ten children with successful transcatheter closure were followed 3-62 months (median, 36 months). At the median time of 36 months, all patients with closure were in New York Heart Association functional class I and asymptomatic. The MCD decreased from  $9.66 \pm 3.86$  mm to  $7.82 \pm 3.83$  mm ( $P=0.36$ ).

**Conclusions:** All asymptomatic CAFs in children with MCD  $\geq 5$  mm and/or FOD  $> 2$  mm should be closed as early as possible to prevent later complications. Transcatheter closure of CAF using the PDA occluder is an effective and safe approach in appropriately selected children and showed favorable intermediate-term follow-up outcomes.

**ABSTRACTS**

Abstracts for Free Paper Session:

**PAEDIATRIC CARDIOLOGY**

**Efficacy of Prenatal Diagnosis of Major Congenital Heart Disease on Perinatal Management and Perioperative Mortality: A Systematic Review and Meta-Analysis**

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**Objective:** No general agreement has been made on the effectiveness of prenatal diagnosis besides hospitalized outcomes. Hence, a meta-analysis of published literature was conducted to assess the effect of prenatal diagnosis.

**Methods:** A review of the literature has identified relevant studies up to December 2013. A meta-analysis was performed followed the guidelines from the Cochrane review group and the PRISMA statement. Studies were identified by searching PUBMED, EMBASE, the Cochrane Central Register of Controlled Trials and WHO clinical trials registry center. Meta-analysis was performed in a fixed/random-effect model using Revman 5.1.1.

**Results:** The results from 13 cohort studies in 12 articles were analyzed to determine the optimal treatment with the lower rate of perioperative mortality in prenatal diagnoses. The superiority of a prenatal diagnosis had been proven because the surgical procedure could be scheduled during the early neonatal period (95% CI, -0.76, -0.40). The prenatal diagnosis had also remarkably reduced the preoperative and postoperative mortality rate for cases of transposition of great arteries (95% CI=0.06, 0.80; 95% CI=0.01, 0.82, respectively), as well as overall results with all subtypes (95% CI=0.18, 0.94; 95% CI=0.46, 0.94, respectively).

**Conclusion:** Prenatal diagnosis has an efficacy on perinatal management providing an earlier intervention for major congenital heart disease, but only results in a reduction of perioperative mortality in cases of transposition of great arteries. Further investigations are necessary for evaluating the benefits from prenatal diagnosis on life quality during long-term follow-up.

**Evaluation Oxidative Stress in Placenta of Fetal Cardiac Dysfunction Rat Model and Antioxidant Defenses of Maternal Vitamin C Supplementation with the Impacts on P-glycoprotein**

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**Aim:** The oxidative stress of placenta during fetal heart dysfunction (FHD) is lack of evaluation. So we carried an experiment to explore whether vitamin C (VitC) can be supplied for placental protection under FHD and its impacts on P-glycoprotein expression.

**Methods:** Fetal heart dysfunction was induced by twice intra-amniotic injections of isoproterenol, then (VitC) was supplied. HE staining was used to evaluate placental histology, and oxidative stress was measured by total antioxidant capacity, total superoxide dismutase, and level of advanced oxidation protein products (AOPPs) as well as apoptosis rate. Real-time PCR was adopted to measure the expressions of superoxide dismutase-1 (Sod-1), glutathione peroxidase-1 (Gpx-1) and endothelial nitric oxide synthase (eNOS) in placenta. Finally western-blot was performed to detect P-glycoprotein expression.

**Results:** All isoproterenol twice treated fetuses exhibited significant (P<0.05) contractile dysfunction by fetal echocardiography compared to others. The HE staining showed that severe placental hydrops in FHD group, and hydrops could be reduced by VitC treatment. Total antioxidant capacity and total superoxide dismutase decreased in FHD and elevated after VitC supplementation. And level of AOPPs increased in FHD and dropped after

VitC supplementation. Apoptosis analysis demonstrated that there was a mild increasing apoptosis rate of FHD. Reductions of Sod-1 and eNOS mRNA expression were confirmed in FHD, but these could be recovered after VitC supplementation, with same tendency of the P-glycoprotein.

**Conclusion:** Severe oxidative injuries were identified in placentas of FHD with P-glycoprotein repression. VitC administration can reduce the oxidative stress and rebuild the protective mechanism of placenta.



## ABSTRACTS

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Abstracts for Free Paper Session:

### PAEDIATRIC CARDIOLOGY

#### **Clinical Study of Patent Ductus Arteriosus Associated with Ventricular Noncompaction in Children**

L Zhang, X Huang, P Huang, T Wang, J Yuan, F Gong  
Heart Center, Affiliated Guangzhou Women and Children's Medical Center of Guangzhou Medical College, China

**Objective:** To summarize the clinical characteristics of patent ductus arteriosus (PDA) associated with noncompaction of the ventricular myocardium (NVM) in children and explore the effect of PDA interventional therapy / surgical treatment on PDA associated with NVM children' prognosis.

**Methods:** Medical records contained 42 children of PDA associated with NVM (24 male and 18 female, media age 1 year 2 months) from January 2000 to December 2014 were collected, which included the treatment group (n=31) and no treatment group(n=11). Their clinical manifestations, the effect of interventional or surgical treatment and follow-up were summarize and compared. These children would be compared with 18 children of isolated NVM (isolated group, 8 male and 10 female, media age 2 year 2 months) as well.

**Results:** (1) In the treatment group, 19 of which had recurrent pneumonia, shortness of breath after activities, cyanosis, or backward growth. 18 of the 19 cases had improvement after therapy, and only 1 case still had backward growth. However, 5 case in the no treatment group had backward growth and had no obvious improvement to the end of follow-up. The rate of clinical alleviation in treatment group was obviously higher than that in no treatment group. (2) Left atrium diameter(LAD) and left ventricular diastolic diameter (LVDD) in treatment group at 1 month, 6 months and 1 year after

interventional or surgical therapy were significantly narrowing when they were compared with those before therapy. (3) The difference between treatment group and no treatment group was significant in Ejection fraction (EF), LAD and LVDD to the end of follow-up.

**Conclusion:** Children of PDA associated with NVM have different clinical symptoms, and they rarely occur severe arrhythmia and blood clots. PDA may aggravate NVM children' clinical symptoms and affect their heart function. PDA interventional or surgical therapy can improve their prognosis.

**ABSTRACTS**

Abstracts for Free Paper Session:

**PAEDIATRIC CARDIOLOGY**

**Three-Dimensional Rotation, Twist and Torsion Analyses Using Real-time 3D Speckle Tracking Imaging: Feasibility, Reproducibility, and Normal Ranges in Pediatric Population**

L Zhang,<sup>1,4</sup> W Han,<sup>1</sup> M Xie,<sup>1</sup> J Gao,<sup>1,2</sup> J Wang,<sup>1</sup> L Yuan,<sup>1</sup> Y Yang,<sup>1</sup> P Yin,<sup>3</sup> S Ge<sup>4,5</sup>

<sup>1</sup>Department of Ultrasound, Union Hospital, Tongji Medical College of Huazhong University of Science and Technology, China; <sup>2</sup>Department of Ultrasound, Wuhan Women and Children Medical Center, China; <sup>3</sup>Epidemiology and Health Statistics, Huazhong University of Science and Technology, China; <sup>4</sup>The Heart Center, St. Christopher's Hospital for Children/Drexel University College of Medicine, USA; <sup>5</sup>Deborah Heart and Lung Center, USA

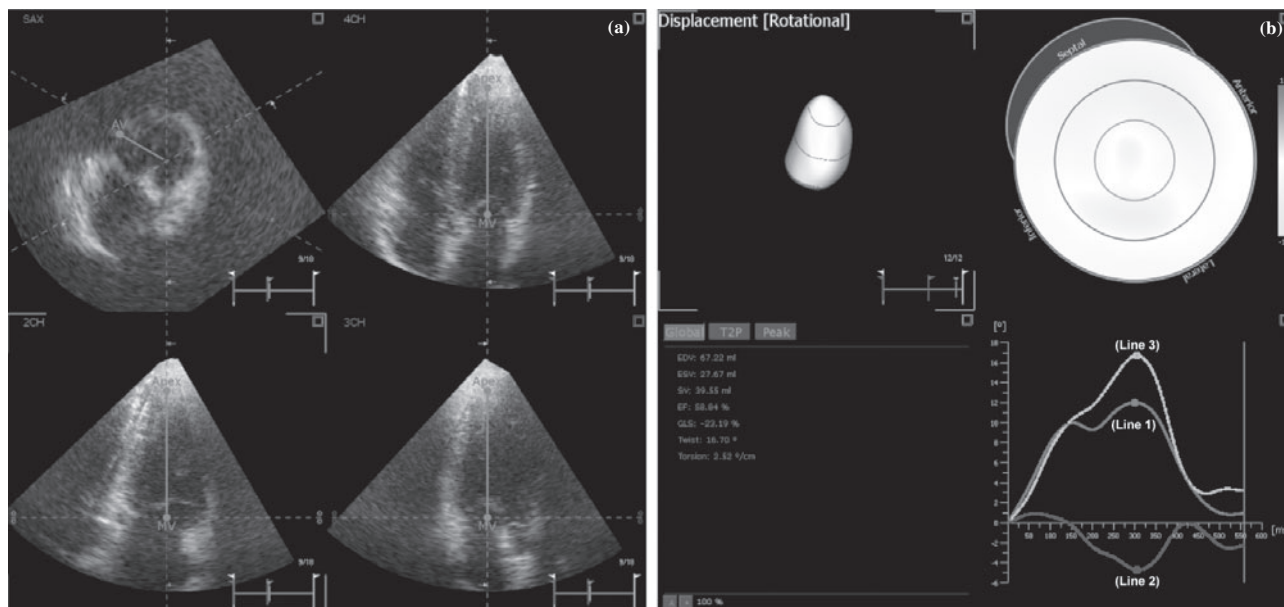
**Purpose:** The aims of this study were to evaluate the feasibility and reproducibility of LV rotation, twist and torsion by real-time 3D speckle-tracking echocardiography (RT3DSTE) in children and to establish the maturational changes and normal values.

**Methods:** A prospective study was conducted in 347 consecutive healthy subjects (181 male/156 female, mean age 7.12±5.3 years, and range from birth to 18-years old) using real-time 3-D echocardiography (RT3DE). The LV rotation, twist and torsion measurements were made off-line using TomTec software (4D LV-Analysis 3.0, TomTec Imaging Systems, Munich, Germany). Manual landmark selection and endocardial border editing were

performed in 3 planes (apical "2"-, "4"-, and "3"- chamber views) and semi-automated border identification and tracking yielded LV rotation, twist and torsion measurements.

**Results:** LV rotation, twist and torsion analysis by RT 3DSTE was feasible in 307 out of 347 subjects (88.5%), excluding 40 subjects secondary to the low frame rates or incomplete 3D images. There was no correlation between rotation or twist and age, height, weight, BSA or HR, respectively, using canonical correlation analysis. However, there was a modest negative correlation between age and LV torsion (R=-0.19, P<0.001). The normal ranges were defined in this cohort for rotation and twist, and for each age group for torsion. The intra-observer and inter-observer variabilities for apical and basal rotation, twist and torsion ranged from 7.3%±3.8% to 12.3%±8.8% and from 8.8%±4.6% to 15.7%±10.1%, respectively. Interclass correlation coefficients ranged from 0.78 to 0.89 and from 0.76 to 0.83 for intra-observer and inter-observer measurements for rotation, twist and torsion, respectively.

**Conclusions:** We conclude that analysis of LV rotation, twist and torsion by this new RT3DSTE methodology is feasible and reproducible in pediatric population. There are no maturational changes in rotation and twist. LV torsion decreases with age in this cohort but only modestly. Further refinement is warranted to validate the utility of this new methodology in more sensitive and quantitative evaluation of congenital and acquired heart diseases in children.



**Figure 1.** Three-dimensional speckle-tracking echocardiography (3DSTE) offline analysis. (a) First, the long axis (LAX) view is selected. The mitral valve landmark is placed at the annular level in the middle of the mitral valve, and the apical landmark is placed at the apex. Then, the short-axis view is selected. The aortic valve landmark is placed at valve level in the middle of the aortic valve. (b) Manual tracking revision is performed if needed. The analysis of LV rotation at apical (Line 2), rotation at basal (Line 3) and twist (Line 1) variables can be derived and displayed.

**ABSTRACTS**

Abstracts for Free Paper Session:

**PAEDIATRIC CARDIOLOGY**

**Plasma Levels of Monokine Induced by Interferon-gamma/Chemokine (C-X-C motif) Ligand 9, Thymus and Activation-Regulated Chemokine/Chemokine (C-C motif) Ligand 17 in Children with Kawasaki Disease**

S Feng, SK Yadav, F Gao, Q Yi

Department of Cardiovascular Medicine, Children's Hospital of Chongqing Medical University, Zhongshan Er Road, Yuzhong District, China

**Background:** Monokines induced by interferon-gamma/Chemokine (C-X-C motif) ligand 9 (MIG/CXCL9), thymus and activation-regulated chemokine/Chemokine (C-C motif) ligand 17 (TARC/CCL17) are chemotactic factors that specifically collect and activate leukocytes, which are considered as chemoattractants of T helper cells. In the present study, we have investigated the effects of T helper type-1 (Th1) cells and T helper type-2 (Th2) cells in Kawasaki disease (KD) by determining plasma levels of MIG/CXCL9 and TARC/CCL17 and exploring the relationship between MIG/CXCL9, TARC/CCL17 levels and coronary artery lesions (CAL).

**Methods:** 43 children patients with KD and 19 healthy controls were included in this study. General characteristics were obtained from all subjects. Plasma concentrations of chemotactic factors of MIG/CXCL9 and TARC/CCL17 were measured by enzyme-linked immunosorbent assay (ELISA) for all subjects.

**Results:** Plasma levels of MIG/CXCL9, TARC/CCL17, and the ratios of MIG/TARC were significantly elevated in pediatric patients with KD compared to that in the control group. There were also significant higher levels of MIG/CXCL9, TARC/CCL17, MIG/TARC ratios and prominently lower Hb levels in KD with CAL compared to KD without coronary artery

lesions (NCAL). Hb was significantly decreased and plasma MIG/CXCL9 levels had a significant negative correlation with CRP in KD with CAL patients (KD-CAL), whereas a positive correlation of plasma MIG/CXCL 9 with WBC was observed in KD without CAL patients (KD-NCAL).

**Conclusion:** Th1 and Th2 cells may be involved in an imbalanced activation in pediatric KD patients during an acute period of the disease. Furthermore, immune lesions of vessels in KD patients may be mediated by the imbalanced activation of Th1 and Th2 cells.

**Early and Mid-term Outcomes of Transventricular Valvotomy Approach for Initial Treatment of Pulmonary Atresia with Intact Ventricular Septum**

G Chen, B Jia, L Wu, F Liu, M Ye, Y Mi

Children's Heart Center, Children's Hospital of Fudan University, China

**Objective:** To review the short and medium term surgical outcomes of transventricular pulmonary valvotomy (TPV) in patients with pulmonary atresia-intact ventricular septum (PA/IVS) and non-right ventricular dependant coronary circulation.

**Background:** For patients with pulmonary atresia with intact ventricular septum, percutaneous radiofrequency-assisted valvotomy and balloon dilation is the first choice for most patients. A kind of alternative hybrid procedure: transventricular pulmonary valvotomy is now widely used in developing countries without radiofrequency perforation equipments in cath labs. However, data on outcomes with this strategy are mixed.

**Methods:** Data were reviewed retrospectively for 21 patients with PA/IVS and non-right ventricular dependant coronary circulation treated with TPV from 2010-2013 in our center. Patients who had severe neonatal Ebstein malformation, or initial interventional management at another institution were excluded. The mean body weight of the 21 patients was (3.2±0.7)kg and mean age was (16±8)d. The Z-score of tricuspid valve ranged from -2.5~2.2 (-0.9±0.4). The TPV procedure was guided by the Micro-TEE probe, to confirm the position of perforation on the valve. All the patients were followed up for over 12 months. All the patients were divided into two groups: Bi-ventricle repair (BVR) and non-BVR group and the percutaneous

saturation, Z-score of tricuspid valve, reintervention data were collected at 3, 6, 12, 24, 36, 48 months after the procedure.

**Results:** There was one early death after the TPV procedure for severe hypoxemia and parents refused to reoperation. Twelve patients finally underwent BVR and 5 underwent one and half ventricle repair. Three patients were still on follow-up after TPV. The mean follow-up time was (32.3±10.3) months (range 12-60 months) without late death. Early reintervention were needed in 4 patient (20%). One was in BVR group and accepted the percutaneous pulmonary valve balloon dilation for residual obstruction. Three were in one-BVR group and got hypoxemia need modified B-T shunts in 2 and PDA stent in 1 patient (8.3% vs 37.5%, p<0.01). The Z-score in BVR group was significantly larger than non-BVR group, with mean Z-score of (-0.5±0.3) and (-1.5±0.6), respectively (p=0.01). The freedom from reoperation was 80, 70, 35% at 6 months, 1 and 3 years, respectively. In BVR group, 9 of 12 received the ASD device closure, by catheter or surgery. In non-BVR group, 5 received bidirectional Glenn shunt and close the ASD; 1 received reconstruction of right ventricle outflow for muscular obstruction. The mean Z-score ranged from -2~2.2 (-0.5±0.4), -2.1~2.2 (-0.5±0.3), -2.3~2.0 (-0.2±0.3), -0.4~2.2 (0.5±0.8), -0.5~2.2 (0.6±0.8) at 3 months, 6 months, 1 year, 2 and 3 years after TPV.

**Conclusions:** The results of a hybrid approach to treating patients with PA/IVS are excellent. TPV can be used as an alternative method to transcatheter approach. Smaller TV size is associated with greater likelihood of reintervention prior to discharge, and may serve as a surrogate for early RV inadequacy.

**ABSTRACTS**

Abstracts for Free Paper Session:

**PAEDIATRIC CARDIOLOGY**

**Operation Treatment of Left-to-right Shunt Congenital Heart Disease with Pulmonary Arterial Hypertension in 210 cases**

T Shi, Y Chen, M Li, C Wu

Children's Hospital of Chongqing Medical University, China

**Purpose:** To analyze the clinical characteristics and the operation treatment of left-to-right shunt congenital heart disease(CHD) with pulmonary arterial hypertension (PAH).

**Methods:** Totally 210 cases of left-to-right CHD with PAH were collected from September 2012 to September 2013, whose clinical characteristics were retrospectively analyzed and divided into the intervention group (86 cases) and the surgical group (124 cases) according to different therapeutic methods. The similarities and differences of clinical features, operation time, volume of blood transfusion and curative effect between the two groups were analyzed.

**Results:** Among the clinical manifestations and signs, recurrent respiratory tract infections, feeding interruption, different levels malnutrition, cardiac murmur and pulmonary second heart sounds loudly were the most common. The children with cyanosis, severe malnutrition or pulmonary second heart sounds loudly in the surgical group were more than that in the intervention group. The children with growth and development backwardness in the intervention group were more than that in the surgical group ( $P<0.05$ ). The comparison of the results of chest X ray (mainly showed that multiple pulmonary blood and increased heart shadow) and electrocardiogram (mainly showed that double ventricular hypertrophy and right bundle branch block) between the intervention group and the surgical group mostly had no statistical significance ( $P>0.05$ ). The right ventricular hypertrophy occurred more often in the surgical group than in the intervention group ( $P<0.05$ ). The operation time, volume of blood transfusion, postoperative mechanical ventilation

duration, intensive care unit (ICU) care duration, hospitalized duration were significantly longer in surgical group than in intervention group ( $P<0.05$ ). The operation success rate of the two groups were as high as 97.67% and 97.58%, respectively. And there was no statistical significance between the two groups ( $P>0.05$ ).The pulmonary arterial systolic pressure (PASP) in the two groups were significantly decreased after operation ( $P<0.05$ ).

**Conclusions:** CHD with PAH is not easy to early diagnosis. The detection of echocardiography and PASP will do great help in the regularly follow-up in outpatient service. For the children who conform to the interventional treatment for indications can be preferred intervention treatment. But for the children who are low age and with cyanosis or severe malnutrition or pulmonary second heart sounds loudly or the right ventricular hypertrophy showed in electrocardiogram or larger diameter of the defect or higher PASP, surgical treatment should be chose as soon as possible.

**Epicardial Pacemaker Implantation and Follow-up in Infants and Children**

WB Zhange, M Ye, G Chen, WS Qiu, XG Yan, B Jia

The Cardiovascular Center, Children's Hospital of Fudan University, China

**Objective:** To evaluate the feasibility and safety of permanent epicardial pacing in infants and children.

**Methods:** During the period from July 2005 to June 2014, we collected the data of 18 children (11 males) with a mean weight of  $13.3\pm 5.8$  Kg that underwent permanent epicardial pacemaker implantation in the cardiovascular center of Children's Hospital of Fudan University. 11 cases diagnosed as atrium-ventricle block (AVB) after operation of congenital heart disease (CHD) while other 7 cases underwent no heart surgery. The surgical operation records and changes of the parameters of the permanent cardiac pacemakers in follow-up were retrospectively analyzed.

**Results:** The 18 patients had a total of 21 permanent epicardial pacing leads. VVI permanent cardiac pacemakers were implanted in 15 cases and DDD in 3 cases. All the patients had their implantation via midline thoracotomy and all surgical epicardial electrode leads were successfully implanted on the right atrium and the right ventricle. The pulse generators were placed in the abdominal wall in a subcutaneous or submuscular pockets and the pacing leads were prepared for the growing of the children. Follow-ups were taken at an average interval of 32.2 months. There were no dead cases during the management. There was only one lead fracture and one infected wound happened to the patients. Impedance, sensing and stimulation thresholds were in the normal range.

**Conclusion:** Epicardial pacemaker is a premier procedure in infants and children with anatomical abnormalities because of the multiple problems that these special patients pose: age, body size, somatic growth and lifestyle. Permanent pacing in pediatric age group is relatively safe.

**ABSTRACTS**

Abstracts for Free Paper Session:

**PAEDIATRIC CARDIOLOGY**

**Prenatal Diagnosis of Vascular Ring by Fetal Echocardiography Combined with STIC Technique**

Y Wang, M Xie, W Han, L Hong, H Cao, Y Yang, K Li, Y Hu, M Wang  
 Department of Ultrasound, Union Hospital of Tongji Medical College, Huazhong University of Science and Technology, Hubei Provincial Key Laboratory of Molecular Imaging, China

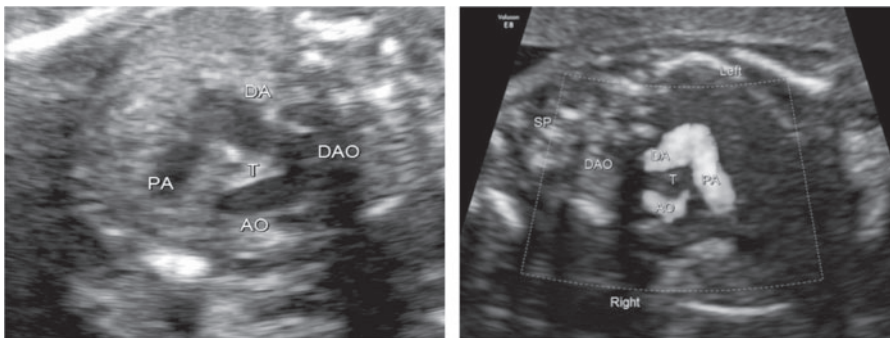
**Objective:** Vascular ring is a rare congenital heart disease, this study aims to evaluate the clinical value of fetal echocardiography combined with STIC technique on the diagnosis of vascular ring.

**Methods:** According to the guidelines of ASE, 285 cases of pregnant women were examined by prenatal echocardiography in Union hospital during March to December 2014, using sequential segmental approach. STIC technique was used to analyze the cardiac volume. All data were collected and stored for further off-line analysis. The sonographic features and prenatal manifestations of vascular ring were summarized.

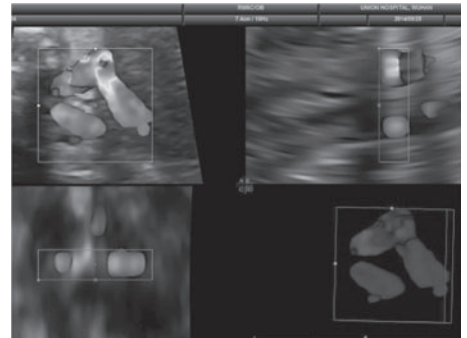
**Results:** (1) Eight cases of fetal vascular ring were diagnosed by prenatal

echocardiography combined with STIC technique. Five cases were confirmed by follow-up echocardiography after delivery, and other 3 cases were proven by autopsy after labor induction. (2) Three vessel and trachea view showed: aortic arch on the right side of the trachea while duct artery arch on the left in 7 cases, forming a U-shaped vascular ring around the trachea (Figure 1). The other case showed aortic arch on the left side of the trachea, and the azygos vein abnormally running between the spine and the trachea, and then flowing into the superior vena cava on the right side of trachea. The U-shaped vascular ring was constituted by the azygos vein on the right side of the trachea and the aortic arch on the left side (Figure 2).

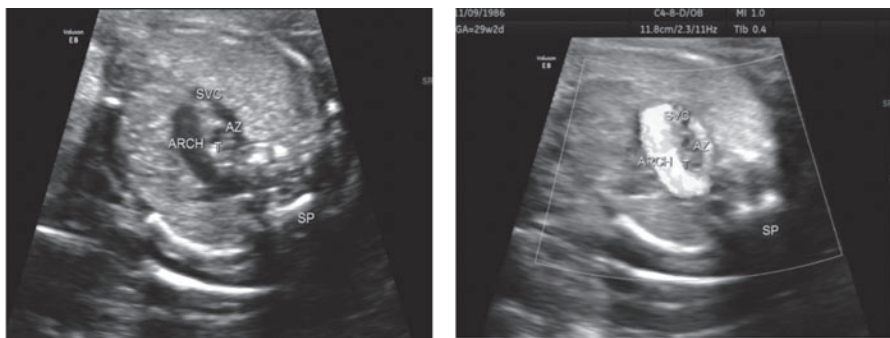
**Conclusion:** (1) The three vessel and trachea view is a vital view on the diagnosis of fetal vascular ring, especially for the vascular ring consisted of dextroaortic arch and left ductus arteriosus, and other types of abnormal vessel orientation around the trachea as well. (2) STIC technique can show the orientation and adjacent structures of the great vessels, which could provide more diagnostic information of fetal vascular ring. It is also important for the prognosis and management of newborns.



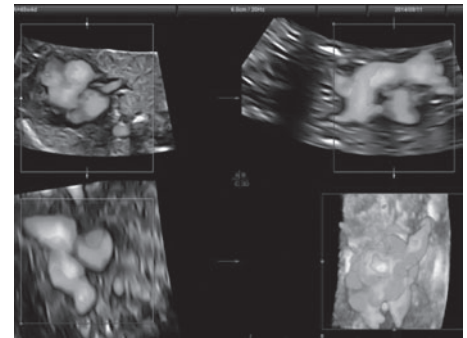
**Figure 1.** U shape vessel ring around trachea by 2D and CDFI: right aortic arch and left ductus arteriosus.



**Figure 2.** U shape vessel rings around trachea by STIC: right aortic arch and left ductus arteriosus.



**Figure 3.** U shape vessel ring around trachea by 2D and CDFI: aortic arch and azygos vein.



**Figure 4.** The aortic arch and the azygos vein formed the U type vessel rings around trachea by STIC.

**ABSTRACTS**

Abstracts for Free Paper Session:

**PAEDIATRIC CARDIOLOGY**

**Prenatal Diagnosis of Pulmonary Stenosis/atresia by Fetal Echocardiography and Cardiovascular cast**

Y Wang, M Xie, W Han, L Hong, H Cao, Y Yang, K Li, Y Hu, M Wang  
 Department of Ultrasound, Union Hospital of Tongji Medical College, Huazhong University of Science and Technology, Hubei Provincial Key Laboratory of Molecular Imaging, China

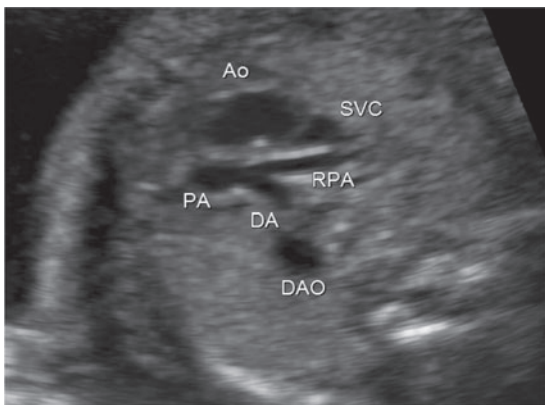
**Objective:** Fetal pulmonary stenosis/atresia is a complicated congenital heart disease. This study aims to investigate the diagnosis of fetal pulmonary stenosis/atresia by fetal echocardiography and cardiovascular cast.

**Methods:** Forty-three out of 432 cases were diagnosed as congenital pulmonary stenosis/atresia by fetal echocardiography, of which 5 cases associated with other complex malformations underwent labor induction. The fetal hearts with the great vessels were made into cardiovascular cast under patients' consent.

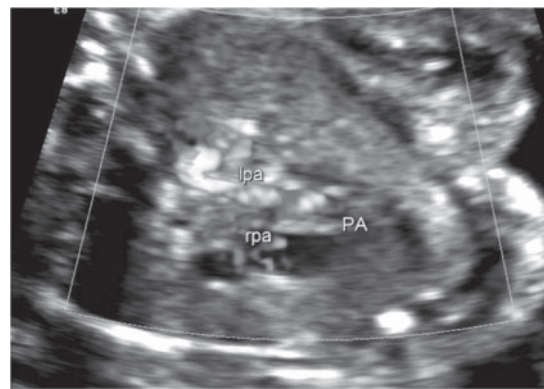
**Results:** (1) Five cases of fetal pulmonary stenosis/atresia associated with other complex malformations diagnosed by prenatal echocardiography, were all confirmed by fetal cardiovascular cast. (2) Abnormalities diagnosed by echocardiography which cannot be displayed in the fetal cardiovascular casts:

aortic regurgitation, mitral valve cleft, right ventricular wall hypertrophy, fetal bradycardia, dextroaortic arch. (3) Other anomalies detected in the fetal cardiovascular casts while misdiagnosed in echocardiography: pulmonary artery crossover, double outlet of the morphological left ventricle, abnormal origin of the left common carotid artery by innominate artery, persistent left superior vena cava, right atrial isomerism.

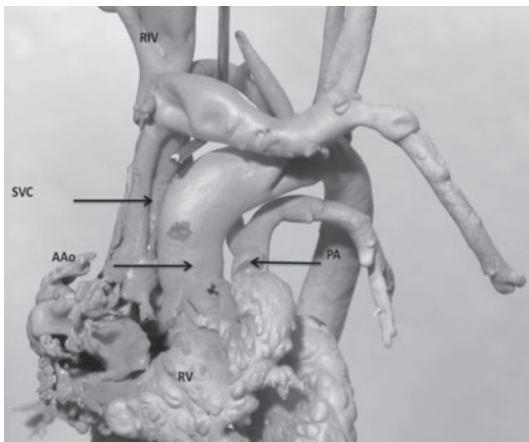
**Conclusion:** (1) Prenatal echocardiography has an indispensable role in the diagnosis of pulmonary artery stenosis/atresia. (2) Fetal cardiovascular cast can accurately and vividly represent the orientation of great vessels and branches, which is helpful to understand malformations of great vessels and to improve the diagnostic ability. (3) Pulmonary stenosis/atresia is always accompanied with other cardiovascular abnormalities. More attention should be paid in the analysis and diagnosis of associated malformations. (4) The comparative study of fetal echocardiography and cardiovascular cast on the diagnosis of pulmonary artery stenosis/atresia has an important value in clinical application, which can offer valuable information to the families and physicians, and also can evaluate pregnancy outcome and provide appropriate guidance for further necessary interventions.



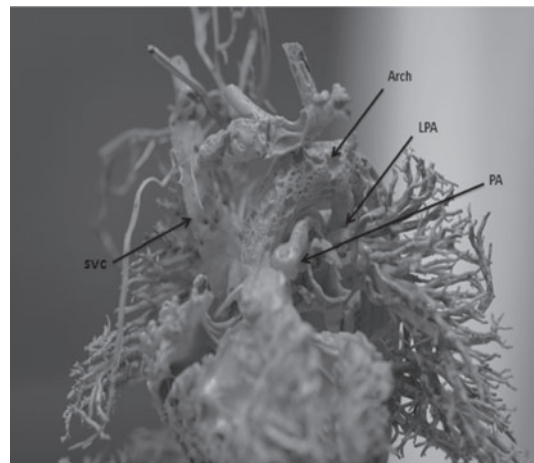
**Figure 1.** Ultrasound of the fetal heart showing pulmonary stenosis (gestational age 23 weeks+6 days).



**Figure 3.** Ultrasound of the fetal heart showing pulmonary atresia (gestational age: 26 weeks).



**Figure 2.** Fetal heart vascular cast with pulmonary stenosis (gestational age 23 weeks+6 days).



**Figure 4.** Fetal heart vascular cast with pulmonary atresia (gestational age 26 weeks).

**ABSTRACTS**

Abstracts for Free Paper Session:

**PAEDIATRIC CARDIOLOGY**

**Percutaneous Balloon Valvuloplasty for Severe Pulmonary Valve Stenosis in Infants: A 10-Year Institutional Experience and Longterm Outcomes**

L He, F Liu, L Wu, XC Liang, CH Qi, HY Deng, GY Huang  
Pediatric Heart Center, Children's Hospital of Fudan University, China

**Background:** Although percutaneous balloon pulmonary valvuloplasty (BPV) is the mainstay of treatment for significant pulmonary stenosis with doming leaflets, it's widely considered to be difficult and relatively large risk for younger and severe stenosis children. This study was undertaken retrospectively to summarize and analyze its immediate and long-term efficacy and safety in neonates and infants with severe or critical valvular pulmonary stenosis.

**Methods:** Seventy-nine patients aged 5d-3y with critical or severe pulmonary valve stenosis admitted to our hospital from January 2005 to December 2014 underwent balloon valvuloplasty. Among them, 10 neonates had critical pulmonary stenosis, who had a tripartite right ventricle with moderate to severe tricuspid regurgitation (TR). Severe TR was seen in 12 and moderate TR in 6 out of other 69 patients of over one month of age. Right ventricular systolic pressure in all patients was equal to or greater than systemic pressure. 43 patients had PFO with right-to-left or bi-directional shunt, 10 patients had PDA, 1 patient had multiple small muscular ventricular septal defects, and 1 patient had atrial septal defect, who undergone the ASD occlusion two-year later. Dilatation with 2 balloons sequentially in one procedure was performed in 12 patients and dilatation with 1 balloon in the other patients.

**Results:** The pulmonary valvuloplasty was accomplished in 74 of the 79 patients, and the dilatation success rate was 93.67%. Four were failure to cross the pulmonary valve with balloon catheter because of the almost atretic valve in 2 and severe spasm of the RVOT in another 2 patients. One was failure to get the pressure gradient across the pulmonary valve down because of the annulus dysplasia. Immediately after dilatation, the systemic pressure gradient from right ventricle to pulmonary artery decreased from 50-132 (76.25±23.7) mmHg to 4-96 (25.29±19.2) mmHg (P<0.001). No significant complications in all patients during or post dilation except cardiac tamponade in one. During a 2 month to 9.6 years follow-up (mean 5.01 years), data showed that: (1) pressure gradient crossing pulmonary valve measured by echocardiography further decreased or remained stable in 70 cases, except one neonate and three infants, whose pressure gradient gradually increased, and needed a second dilatation. Re-dilatation rate was 5.4% (4/74). No case needed further surgery; (2) Tricuspid regurgitation reduced in all patients except for three whose RV were dysplasia; (3) Mild or no pulmonary regurgitation was seen in most of patients post-dilatation, except moderate in six and severe in one. (4) All 10 PDAs closed spontaneously in 3-6 months of follow-up and muscular VSDs were closed as well in 3 months of follow-up. (5) All patients were doing well with asymptoms and acyanosis.

**Conclusions:** Balloon pulmonary valvuloplasty (BPV) is safe and effective in attaining both immediate and long term reduction of pulmonary valvular gradients and is currently the preferred therapeutic modality for valvular PS even small baby patients.

**Safety and Efficacy of Warfarin plus Aspirin Combination Therapy for Giant Coronary Artery Aneurysm Secondary to Kawasaki Disease: A Meta-Analysis**

D Sun, K Wang, S Qin, Y Pang  
Department of Pediatrics, The First Affiliated Hospital of Guangxi Medical University, Nanning, Guangxi Autonomous Region, China

**Objective:** To compare the safety and efficacy of warfarin plus aspirin versus aspirin alone for the treatment of children with giant coronary artery aneurysm (CAA) secondary to Kawasaki disease (KD).

**Methods:** We searched the PubMed, EMBASE, Cochrane Library, CNKI, WANFAN and VIP databases. We selected case-controlled trials of warfarin plus aspirin versus aspirin alone for the treatment of children with giant CAA secondary to KD.

**Results:** Six retrospective studies met our inclusion criteria. There was no significant difference between the warfarin plus aspirin and aspirin alone groups in the rate of CAA regression (OR 1.38, 95% CI 0.52-3.68, p=0.52) or the incidence of persistent CAA (OR 2.34, 95% CI 0.16-33.50, p=0.53), coronary artery stenosis (OR 0.55, 95% CI 0.18-1.72, p=0.30) or thrombus formation (OR 0.50, 95% CI 0.15-1.69, p=0.26). There was evidence that warfarin plus aspirin reduced the incidence of coronary artery occlusion (OR 0.08, 95% CI 0.02-0.29, p<0.0001), cardiac infarction (OR 0.27, 95% CI 0.11-0.63, p=0.003) and death (OR 0.18, 95% CI 0.04-0.88, p=0.03).

**Conclusion:** Warfarin plus aspirin therapy reduced the incidence of occlusion, cardiac infarction and death in children with giant CAA secondary to KD.

**ABSTRACTS**

## Abstracts for Poster Presentations:

**DNA Methylation Regulated Cardiac Myofibrils Gene Expression During Heart Development in Mouse**Y Xu,<sup>1</sup> L Liu,<sup>1,2</sup> B Pan,<sup>1</sup> J Zhu,<sup>2</sup> C Nan,<sup>3</sup> X Huang,<sup>3</sup> J Tian<sup>1</sup><sup>1</sup>Heart Centre, Children's Hospital of Chongqing Medical University, China; <sup>2</sup>Ministry of Education Key Laboratory of Child Development and Disorders; Key Laboratory of Pediatrics in Chongqing, CSTC2009CA5002; Chongqing International Science and Technology Cooperation Center for Child Development and Disorders, China; <sup>3</sup>Department of Biomedical Science, Charlie E. Schmidt College of Medicine, Florida Atlantic University, USA

It is well known that epigenetic plays an important role in controlling the regulation of gene expression during biological development. Troponin I is one of the regulatory myofibril protein in heart, which can control the contraction and relaxation. And troponin is a good model to study the regulation of cardiac gene expression during heart development. Our previous studies have demonstrated that the slow skeletal troponin I (ssTnI), also called fetal troponin I, is partially regulated by epigenetic modification, such as histone acetylation and methylation, and we demonstrated that ssTnI was partially regulated by thyroid hormone. In this study, we explored the epigenetic role of DNA methylation in regulating ssTnI expression. The condition of DNA methylation and the methylation level in CpG islands and CpG island shores were detected using methylation specific PCR (MSP) and bisulfite sequence PCR (BSP) in 2000 bp upstream and 100 bp upstream of ssTnI gene promoter. In addition, we explored DNA methylation level of CpG islands and shores in the cardiac troponin I (cTnI) gene promoter.

We found that the DNA methylation levels of CpG island shores in ssTnI gene promoter were decreased, which corresponded to a decreased expression of ssTnI gene in mouse heart, but the DNA methylation level of CpG islands in this gene were not changed during heart development. However, the methylation level of CpG islands and shores in cTnI were not changed in the development period. Our results indicated that DNA methylation was involved in the epigenetic regulation of ssTnI and played a role in TnI isoform switching in heart during the development.

**Alcohol Exposure Induced Histone3 Hyperacetylation Leading to Overexpression of Cardiac Transcription Factors Through ERK1/2 Signaling Pathway in H9c2 Cells**

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**Aims:** Alcohol has been widely accepted as a common detrimental exposure during pregnancy, which may cause fetal cardiac development abnormalities. Our previous studies displayed that alcohol could induce histone hyperacetylation and over-expression of cardiac transcription factors both in vivo and in vitro. The objective of this study is to investigate the role of ERK1/2 signaling pathway in alcohol-induced histone acetylation imbalance and up-regulation of transcription factors in H9c2 cells.

**Materials and Methods:** Cardiac cell line, H9c2 cell was used in this study. U0126, a specific inhibitor of ERK1/2 pathway was employed to block the ERK1/2 signaling pathway. Western blot analysis was used to detect the phosphorylation levels of ERK1/2 and the acetylation levels of histone3. Real-time PCR was employed to measure the expression of GATA4 and MEF2c. The histone3 acetylation levels in the promoter regions of GATA4 and MEF2C were analyzed using chromatin immunoprecipitation (ChIP) assays.

**Results:** Alcohol could enhance the levels of phosphorylated ERK1/2, and U0126 significantly inhibited alcohol-induced ERK1/2 signaling pathway activation and the hyperacetylation of histone3. U0126 decreased alcohol-induced over-expression of GATA4 and MEF2c, and the basal expression level of GATA4, but not MEF2c. Interestingly, ChIP assay showed that U0126 significantly down-regulated alcohol-induced hyperacetylation of histone3 in the promoter region of GATA4 and MEF2c, and the basal acetylation level of histone3 in the promoter region of GATA4, but not MEF2c.

**Conclusions:** These data indicated that U0126 may reverse the overexpression of GATA4 and MEF2c through down-regulation of histone3 acetylation level in their promoter regions, suggesting that ERK1/2 signaling pathway might be a potential target for the intervention of alcohol induced congenital heart diseases.



## ABSTRACTS

## Abstracts for Poster Presentations:

**Alcohol Increase the Acetylation of Histone H3 to Cause Abnormal Expression of Cardiac Genes in H9C2 Cells via JNK Signaling Pathway**

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**Purpose:** Based on the intervention of alcohol, SP600125 was used to block the JNK signaling pathway in H9C2 cells, to observe the changes in the level of Histone H3 acetylation and over-expression of downstream cardiac specific genes caused by alcohol exposure, to explore whether JNK mediated the effects of intervention by alcohol in H9C2 cells. In this study, we test the hypothesis that JNK signaling pathway mediated the hyper-acetylation of histone H3 and over-expression of cardiac specific genes induced by alcohol exposure.

**Methods:** The optimal dose: After treated the H9C2 cells with alcohol for 36 hour, added different concentrations of SP600125 in the cells to block the JNK pathway. MTT assay was used to detect the cells viabilities to determine the optimal dose of SP600125. The H9C2 cells were divided into five groups, blank group, DMSO group, Alc group, SP group and Alc plus SP group. The histone acetylation enzyme activity was detected by colorimetric assay in H9C2 cells. The level of acetylated histone H3 was measured by western-blotting in H9C2 cells. The expression of cardiac related genes dHAND and eHAND were determined by RT-Q-PCR H9C2 cells. The acetylated histone H3 which were combined in the promoter region of dHAND and eHAND were detected by CHIP-RT-Q-PCR in H9C2 cells.

**Results:** There was no difference between the SP group and DMSO group when treated with 0  $\mu$ M, 5  $\mu$ M, 7.5  $\mu$ M and 10  $\mu$ M of SP600126 in H9C2 cells ( $p>0.05$ ). There was significant difference between the SP group and DMSO group when treated with 15  $\mu$ M, 20  $\mu$ M and 25  $\mu$ M dose of SP600126 in H9C2 cells ( $P<0.05$ ). The HATs activity and level of ACh3 in Alc group had significant difference compared to the blank group and DMSO group ( $p<0.05$ ). The HATs activity and level of ACh3 in SP group had no difference compared to the blank group and DMSO group ( $p>0.05$ ). The HATs activity and level of ACh3 in Alc and SP group had no difference compared to the blank group, DMSO group, or SP group ( $p>0.05$ ). The mRNA expression of cardiac related genes dHAND and eHAND were increased in the Alc group compared to the blank group, or DMSO group ( $p<0.05$ ). The Alc and SP group was no difference compared to the blank group, DMSO group, or SP group ( $p>0.05$ ). There was no difference between the SP group and the blank group, or DMSO group ( $p>0.05$ ). The ACh3 which were combined in the promoter region of cardiac related gene dHAND and eHAND were increased in the Alc group compared to the blank group, SP group, or DMSO group ( $p<0.05$ ). The Alc and SP group was no difference compared to the blank group, DMSO group, or SP group ( $p>0.05$ ).

**Conclusions:** JNK pathway mediated the effect that Alc increase the ACh3 which were combined in the promoter region of cardiac related genes dHAND and eHAND.

**Dyslipidemia in Pregnancy May Contribute to Increased Risk of Congenital Heart Defects**

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**Objective:** To investigate the relation between the presence of dyslipidemia in pregnant women in China and the risk of Congenital heart defects(CHD).

**Methods:** A total of 54 pregnant women in 24 to 28 weeks gestation period were enrolled in this study between March 2013 and June 2014. The case group included 18 women who had fetus with cardiac defects, and each case was matched with 2 controls with no pregnancy complications. Mean ages were 29.06 (SD=3.11) years and 29.03 (SD=3.9) years in the case group and control group, respectively. Main outcome measures were total cholesterol (TC), triglycerides (TG), low-density lipoprotein cholesterol (LDL-c), apolipoprotein.

**Results:** Those in the case group had significantly higher mean LDL-cholesterol (4.15 vs 3.45) and apolipoprotein B (1.23 vs 1.08) (all  $P<0.05$ ) than the control group. After adjustment for potential confounders, a lipid profile with apolipoprotein B>1.21 mg/dl is associated with a higher incidence rate of CHD (61% vs 22%). Univariable logistic regression analysis reveals that CHD risk increases by each standard deviation increase in LDL-cholesterol and apolipoprotein B. An additional backwards stepwise logistic regression model shows that apolipoprotein B is independently and most strongly associated with CHD risk, OR 111.99 (95%CI: 1.2-10252.11) per standard deviation increase.

**Conclusions:** Serum LDL-cholesterol and Apolipoprotein B levels are significantly higher in case group than the control group. Apolipoprotein is associated with a higher incidence rate of CHD. Increased LDL-cholesterol and Apolipoprotein B may be involved in the pathological mechanism of Congenital heart defects.

ABSTRACTS

Abstracts for Poster Presentations:

**Effect of BMP9 and Wnt3a Induce C3H10T1/2 Cells Differentiation Into Cardiomyocyte-like Cells In Vitro**

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**Purpose:** To investigate the effect of co-induction by BMP9 and Wnt3a on differentiation of C3H10T1/2 cells into cardiomyocyte-like cells in vitro.

**Methods:** C3H10T1/2 cells were randomly divided into 5 groups, (1) Blank group (untreated cells), (2) GFP group (cells transfected with AdEasy-GFP), (3) Wnt3a group (cells transfected with AdEasy-Wnt3a), (4) BMP9 group (cells transfected with AdEasy-BMP9), (5) BMP9 and Wnt3a co-induction group (cells transfected with AdEasy-BMP9 and AdEasy-Wnt3a). Western blot and immunofluorescence were used to detect the expression of cardiac-specific proteins Cx43 and cTnT. Q-RT-PCR was used to detect the expression of genes GATA4 and MEF2C 3 weeks after transfection.

**Results:** The expression of proteins Cx43 and cTnT in BMP9 and Wnt3a co-induction group were found higher than control group, GFP group and Wnt3a group ( $P < 0.05$ ), but showed no difference compared with BMP9 group ( $P > 0.05$ ) 3 weeks after transfection. The expression trend of genes among five groups is similar to proteins.

**Conclusion:** Co-induction by BMP9 and Wnt3a can promote C3H10T1/2 cells differentiation into cardiomyocyte-like cells.

**Innominate Artery Cannulation for Antegrade Cerebral Perfusion in Neonates for Complex Cardiac Surgery**

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**Background:** Antegrade Cerebral Perfusion (ACP) is widely performed in neonates for aortic and complex cardiac surgery. The purpose of the present study was to evaluate the flow measurements and safety of direction cannulation of the innominate artery.

**Methods:** This was a retrospective review of consecutive neonates who underwent ACP from January 2011 to July 2014. Patient characteristics, surgical and hemodynamic measurements and postoperative neurologic findings were recorded.

**Results:** 24 neonates underwent ACP during the studying period. There were 2 operative deaths (8.3%) for the whole cohort. One patient who underwent completely repair died of postoperative heart failure, whereas 1 died of overwhelming sepsis. Of the 22 surviving patients, 2 had neurologic abnormalities. 2 patients were discharged with a diagnosis of hypotonia, one had experienced cardiac arrest in the intensive unit and another had undergone preoperative ultrasonography, which demonstrated calcification of the basal ganglia. 20/22 survivors had normal neurologic evaluation on discharge.

**Conclusion:** Innominate Artery Cannulation for antegrade cerebral perfusion is a safe and reliable technique in neonates by low morbidity and mortality, and should be the standard in complex cardiac surgery.

**Associations between ABCB1 and ABCG2 gene polymorphisms of children and isolated septal defects in a Han Chinese population**

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**Backgrounds:** Substantial epidemiological data have demonstrated that several toxicants/drugs exposures periconceptionally are associated with an increased risk of congenital heart defects (CHDs). P-glycoprotein (P-gp) and breast cancer resistance protein (BCRP) in the placenta, encoded by the *ABCB1* and *ABCG2* gene in human, play an essential role in regulating fetal exposure to toxicants/drugs.

**Purpose:** This study aimed to explore the associations between polymorphisms of the *ABCB1* and *ABCG2* gene of children and isolated septal defects in a Han Chinese population, and to investigate the impact of these polymorphisms on the transcription and translation activities of the *ABCB1* and *ABCG2* gene, respectively.

**Methods:** An age and gender matched case-control study involving 210 pairs was conducted. Genotyping of the *ABCB1* and *ABCG2* gene polymorphisms was conducted by sequencing. Forty-six placenta tissues and umbilical cords from healthy Han Chinese mothers with uncomplicated pregnancy were collected. Placental P-gp and BCRP mRNA and protein expression were determined by real-time quantitative PCR and western-blot respectively.

**Results:** For the 3435C>T polymorphism of *ABCB1* gene, more cases were carriers of the CC/CT genotypes (OR: 2.0, 95%CI: 1.1-3.5, P-value: 0.021). For the 34G>A polymorphism of *ABCG2* gene, more cases were carriers of

the GA/AA genotypes (adjusted OR: 1.6, 95%CI: 1.0-2.3). There were no differences in the genotype distributions and allele frequencies of 421C>A polymorphism of the *ABCG2* gene. The placental *ABCB1* mRNA expression of the TT genotype was significantly higher than that of the CC genotype ( $P = 0.03$ ). Compared with TT genotype, lower placental P-gp expression was observed for the CC/CT genotypes. The *ABCG2* mRNA and protein expression did not differ among the three genotypes of 421C>A polymorphism. For the 34G>A polymorphism, the *ABCG2* mRNA and protein expression of the GG genotype was significantly higher than that of the AA genotype.

**Conclusions:** The 3435C>T polymorphism within the *ABCB1* gene and 34G>A polymorphism within the *ABCG2* gene of the children are associated with isolated septal defects in a Han Chinese population, presumably through regulation of placental P-gp and BCRP expression, respectively.

**ABSTRACTS**

Abstracts for Poster Presentations:

**The Study of Fetal Rat Model of Intra-amniotic Isoproterenol Injection Induced Heart Dysfunction and Phenotypic Switch of Contractile Proteins**

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**Objective:** To establish a reliable isoproterenol induced heart dysfunction fetal rat model and understand the switches of contractile proteins.

**Methods:** 45 pregnant rats were divided into 15 mg/kg-once, 15 mg/kg-twice, sham-operation-once, sham-operation-twice and control groups. And 18 adult rats were divided into isoproterenol-treated and control groups. HE staining, Masson staining and transmission electron microscope were performed. Apoptotic rate assessed by TUNEL analysis and expressions of ANP, BNP, MMP-2 and CTGF of hearts were measured.

**Results:** Intra-amniotic injections of isoproterenol were supplied on E14.5 and E15.5 for fetuses and 7 days continuous intraperitoneal injections were performed for adults. Then echocardiography was performed with M-mode view assessment on E18.5 and 6 weeks later, respectively. Isoproterenol-twice treated fetuses exhibited significant changes in histological evaluation, and mitochondrial damages were significant severe with increased apoptotic rate. ANP and BNP increased and that of MMP-2 increased in isoproterenol-twice treated group compared to control group, without CTGF. The isoforms transition of troponin I and myosin heavy chain of fetal heart dysfunction were opposite to adult procedure. The administration of intra-amniotic isoproterenol to fetal rats could induce heart dysfunction.

**Conclusion:** This clinically-relevant model can be used to explore pathophysiological responses during fetal heart dysfunction. The regulation of contractile proteins of fetuses was different from adult procedure.

**Multiple Pulmonary Nodules in Kawasaki Disease: A Case Report**

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A 8-month-old boy was admitted with a prolonged fever, bilateral bulbar conjunctival injection without exudate, red lips and truncal rash. amoxycillin clavulonate had been prescribed without clinical response. Physical examination on admission was significant for irritability and mild cervical, epitrochlear, axillary, and inguinal lymphadenopathy. Laboratory studies showed an elevated C-reactive protein, anemia, thrombocytosis, an elevated erythrocyte sedimentation rate, sterile pyuria and normal liver enzymes. Microbial cultures (blood, pharyngeal swab) were negative for pathogenic specimens. Serologic tests for mycoplasma, chlamydia, cytomegalovirus, Epstein-Barr virus, influenza, parainfluenza, adenovirus and enterovirus were negative. Mantoux test, bone scan, bone marrow aspiration, rheumatoid factor, antineutrophil antibody, antineutrophil cytoplasm antibodies, antinuclear factor, and serum complements were negative or normal. Echocardiography performed on day 8 of illness revealed left coronary arteries dilation without aneurysms. Chest X-ray demonstrated bilaterally disseminated multiple pulmonary nodules 6 mm in diameter and ground-glass alterations. A lung CT scan showed numerous miliary nodules in diffuse and random distribution in both lungs. He was diagnosed with Kawasaki disease and treated with intravenous immunoglobulins and aspirin. The infant was afebrile on day 14. A repeat chest X-ray on day 15 showed resolution of the pulmonary nodules. He was discharged on day 21 in good clinical recovery. An echocardiogram on day 18 was normal, as were follow-up echocardiograms 1, 2, 4 and 6 months after the acute stage of the disease.

**The Influences of Influenza on Kawasaki Disease**

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**Objective:** To explore the influences of influenza on Kawasaki disease (KD).

**Methods:** This retrospective study included 1053 children with KD from January 1, 2011 to December 31, 2013, among which 705 cases accepted the same examination of etiology that were considered comparable. The epidemiology characteristics of the KD, influenza, and KD concomitant with influenza were summarized. The 15 cases of KD only with influenza A or/ and B virus positive formed case group. Each case was matched with 2 control cases and formed control group consisted of 30 children. The differences of clinical manifestations, course of disease, and response to intravenous immunoglobulin (IVIG), laboratory test results, and echocardiographic detection between the two groups were compared.

**Results:** The study showed that 34 cases (4.82%) with KD had documented influenza infections. KD concomitant with influenza occurred in spring and summer more than in winter and autumn, which was similar to all of the KD patients hospitalized. Besides, influenza occurred all the year, but it outbreaked in April and May, with a small peak in September. The median of white blood cell (WBC) and the rate of polymorphonuclear leukocytes (PMN) values were significantly higher in control group than in case group, whereas it was opposite in the lymphocytes and creatine kinase isoenzyme (CK-MB) values comparison. Patients in the case group had a longer median fever course, a higher rate diagnosed with incomplete KD, and a longer median time to be diagnosed compared with the control group.

**Conclusion:** Influenza virus infection had influence on KD to some extent, including its pathological damage, clinical manifestations, diagnoses and treatment. The relationship of KD with influenza is unknown, which need more researches. The presence of a concomitant influenza should be taken more consideration during treatment with salicylates in patients with KD.

**ABSTRACTS**

Abstracts for Poster Presentations:

**Prenatal Diagnosis of Fetal Ebstein's Anomaly and New Finding in the Follow-ups: A Case Report**

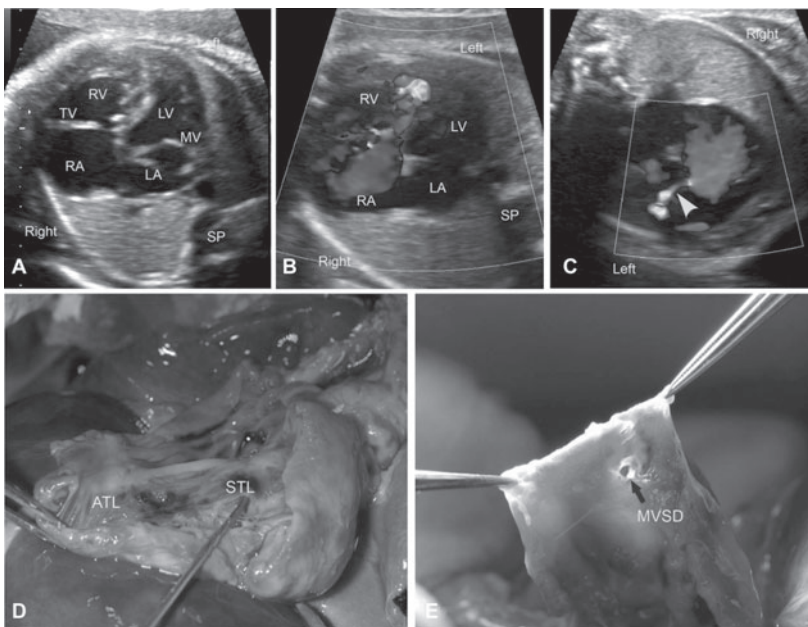
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**Clinical Presentation:** A 31-year-old, gravida 2, para 0 woman undergoing prenatal echocardiography at 24.4 weeks' gestation was diagnosed as fetal Ebstein's anomaly. Her first pregnancy was terminated due to stopped growth of the embryo at 6 week' gestation. She underwent another two follow-up examinations at 28 and 30.5 weeks' gestation respectively. Echocardiography showed a typical manifestation of Ebstein's anomaly and a progressive development in the follow-ups, with a new finding of muscular ventricular septal defect in the last exam. In view of the serious condition and poor prognosis of the fetus, the family decided to induce labor at 31 weeks' gestation. The diagnosis was proved by autopsy with the agreement of parents. The results of autopsy showed: 1) dysplastic septal and posterior tricuspid leaflet displaced downward to the apical about 4~5 mm; 2) global cardiac enlargement with obvious right atrium dilation; 3) two defects observed near the apex of muscular ventricular septal.

**Imaging Findings:** The four-chamber view showed a mild apical displacement of the tricuspid valve. The distance between the septal hinge-points of the tricuspid and the mitral valve was about 5mm without significant change over time. However, the right atrium and atrialized right ventricle were gradually dilated with increased cardiothoracic ratio. A moderate tricuspid regurgitation detected by CDFI in the first exam was developing into severe degree in the follow-ups. Besides, a new finding was recognized in the last exam. A muscular ventricular septal defect not shown in the first two exams was found by CDFI this time.

**Role of Imaging in Patient Care:** Fetal echocardiography plays an indispensable role in the diagnosis of Ebstein's anomaly, which can offer valuable information to the families and clinicians, and provide appropriate guidance for further necessary interventions.

**Summary and Discussion Points:** Fetal echocardiography is capable of diagnosing Ebstein's anomaly; and follow-up is also important to show the development of the disease, especially the dilation of right atrium and the degree of tricuspid regurgitation. Associated abnormalities such as muscular ventricular septal defect unable to discover in the second trimester might be recognized in the later follow-ups, which should be paid more attention to.



**Figure.** A. Apical displacement of the tricuspid valve; B. Tricuspid regurgitation detected by CDFI; C. High velocity shunt in the muscular part of interventricular septum (grey arrow); D. Dysplastic septal tricuspid leaflet downward displacement to the apical; E. Muscular ventricular septal defect with a diameter of 3 mm (black arrow). STL, septal tricuspid leaflet; ATL, anterior tricuspid leaflet; MVSD, muscular ventricular septal defect.