

Abstract 212 Figure 1 dP/dt+ change with incremental pacing

PRSW remained unchanged in all categories with incremental pacing.

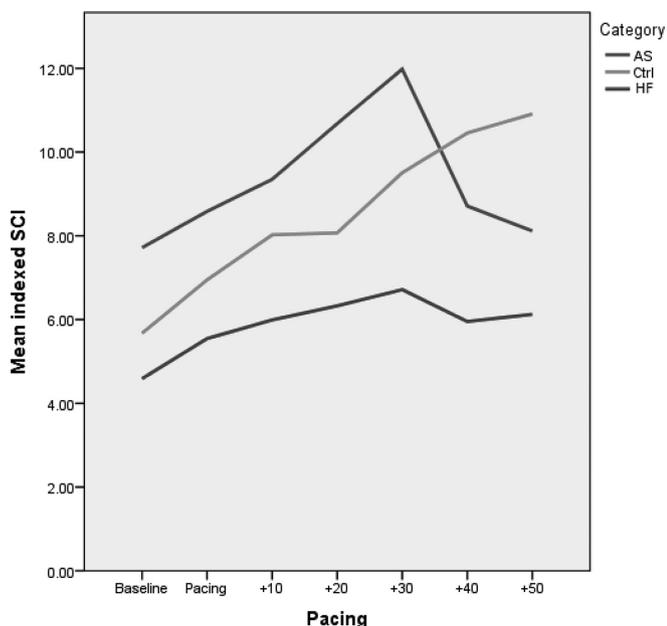
Conclusion These data suggest that aortic stenosis patients with preserved EF have diminished contractile reserve, especially during increased heart rate, and may explain why some of these patients have an unfavorable clinical course post TAVI.

213 THIRD CORONARY ARTERY – AN AUTOPSY STUDY

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10.1136/heartjnl-2016-309890.213

Brief Introduction Anatomy and functionality of the coronary circulation have been of interest to physicians ever since it



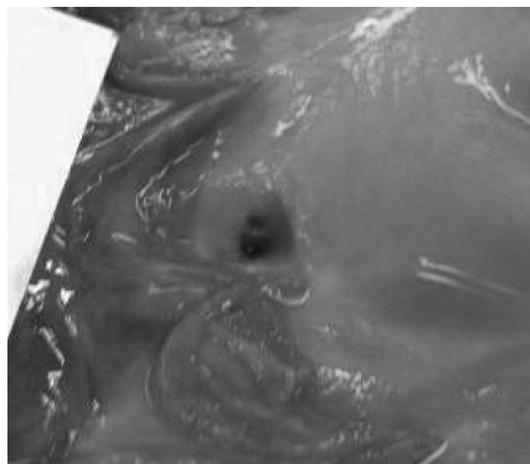
Abstract 212 Figure 2 SCI change with incremental pacing

emerged that mammalian hearts have their own blood supply. If asked how many coronary arteries the normal heart has, most of the medical students (and many practitioners) would answer 'TWO'. However, the frequent presence of two right coronary artery roots is not generally well appreciated, even though it has been evident to anatomists and cardiac surgeons for centuries. The human heart is in most cases vascularized by two coronary arteries, the right and the left coronary artery. Supernumerary coronary artery, which arises independently from the right aortic sinus and passes through sub-epicardial adipose tissue of pulmonary conus and anterior side of the right ventricle; is called Third coronary artery. The Third coronary artery (TCA) is a direct branch from the Right Aortic Sinus (RAS) without any observable common trunk with the Right Coronary Artery (RCA).

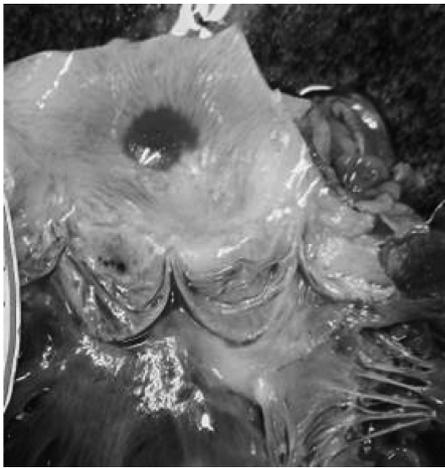
Methodology This study was conducted at Department of Forensic Medicine and Toxicology, Bangalore Medical College and Research Institute, Bengaluru for a period of 6 months from January 1st 2011 to 30th June 2011. A total number of 1779 autopsy cases were performed during the study period, out of which 550 cases were selected for our study. Specimens with observable cardiac defects and decomposed cases were excluded from the study. The hearts were dissected to display the origins of the right, left and third coronary arteries. The aortic root was split posteriorly to enable a clear view of the RAS with its orifices. With the aid of dissecting lenses, the branches of the TCA were displayed and traced distally to confirm the course, branching and termination.

Results Out of the 550 hearts dissected, Third coronary artery (Figure 1) was present in 184 hearts, which amounts to 33.45%. According to the position of the third coronary artery, 83.15% was in 10 o'clock position. Majority of the Third coronary artery, i.e., 78.8% had an independent course without obvious anastomosis. Multiple orifices (Figure 2) have been seen in 3 individuals. It was observed that among the 95 natural death cases, 32 cases were due to sudden natural death of cardiac origin. In these 32 cases, third coronary was present only in 3 cases.

Conclusion The most suitable term to identify supernumerary artery that arises independently from the right aortic sinus is the Third coronary artery. The present study highlights that the incidence of Third coronary artery is 33.45%. It was observed that among the 95 natural death cases, 32 cases were due to sudden natural death of cardiac origin. In these 32 cases, third coronary artery was present only in 3 cases. It



Abstract 213 Figure 1 Third Coronary Artery



Abstract 213 Figure 2 Multiple Orifices

implies that presence of third coronary artery is a boon to the individual and the person who has third coronary artery is less likely to die from sudden natural death due to cardiac origin.

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A MULTISCALE HAEMORHEOLOGICAL COMPUTER-BASED MODEL OF ATHEROSCLEROSIS: AN IN-DEPTH INVESTIGATION OF ERYTHROCYTES-DRIVEN FLOW CHARACTERISTICS

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10.1136/heartjnl-2016-309890.214

Introduction and motivation According to the literature, the annual deaths caused by cardiovascular diseases are dramatically increasing.^{1,2} Atherosclerosis is a cardiovascular disease characterised by increasing arterial inflammation, which causes the blockage of the arterial lumen and the reduction of blood supply to important parts of the human body. This process is driven by fluid-mechanical forces.³ Therefore, understanding variations in blood flow characteristics driven by the erythrocytes might result in new insights on atheroma development. Hence, in this work, we present an in-deep study of haemorrhological blood flow, under disease condition. Formerly, we presented a model of blood-erythrocytes in large arteries,³ comprising an established multiphase technique.^{4,5} This was coupled with a new fluid-structure interaction (FSI) methodology,^{3,6,7} which is based on immersed boundary techniques.⁸ Prior research reported on changes in flow due to plasma-erythrocytes interactions.⁹ This leads to non-Newtonian effects that are here addressed considering the effects of growing haematocrit.^{3,10,11} **Methodology:** The interaction between blood and the artery is simulated using an immersed boundary-based technique.^{3,7} The plasma is modelled as a Newtonian incompressible fluid using the Navier-Stokes equations.^{3,7} The erythrocytes are modelled as spherical particles.³ Moreover, forces resulting from the plasma-erythrocytes interactions are considered to be elastic and based on Hooke's law (DEM model of collisions), which is attained by using a multiphase flow methodology.⁴

Results Simulations of a single-phase fluid-structure interaction (FSI) model that mimic the coupling blood-artery have yielded results comparable with the literature.^{3,6,10,11} This was important to assess both the integrity and the capability of the

methodology. To analyse how the erythrocytes modulate flow, we have considered a series of volume fractions (0.00, 0.15, 0.30, and 0.45) – hematocrit. We observed that, while differences in the distribution of velocities increase with increasing hematocrit, flow recirculation decreases proportionally. This indicates that the inclusion of erythrocytes might result in flow laminarization. The variations in the flow characteristics are more prominent at predilection sites for plaque deposition. We infer this might result from a natural enhancement of flow features, due to the arterial geometry at those locations.

REFERENCES

- 1 S. Mendis *et al.* WHO 2011
- 2 BHF CPANCDP *Annual Statistics*. 2014
- 3 G. Pereira. Imperial College London, *Thesis submitted* 2015
- 4 C. Crowe *et al.* CRC Press 1998
- 5 Y. Tsuji *et al.* *Powder Tech.* 1992
- 6 G. Pereira. *Biophys J.* 2013
- 7 G. Pereira *et al.* SIAM MMS under review 2015
- 8 C.S. Peskin. *J. Comput. Phys.* 1972
- 9 J. Jung *et al.* *J. Biomech.* 2006
- 10 G. Pereira *et al.* *BAS.* 2014
- 11 G. Pereira *et al.* *BAS/BSCR* 2015
- 12 Zhao *et al.* *J. Comput. Phy.* 2011

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TRANSCUTANEOUS VAGUS NERVE STIMULATION (tVNS) DECREASES SYMPATHETIC NERVE ACTIVITY IN OLDER HEALTHY HUMAN SUBJECTS

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10.1136/heartjnl-2016-309890.215

Ageing is associated with autonomic dysfunction and increased risk of chronic cardiovascular disease. The aim of the present study is to assess the effects of a non-invasive method of vagus nerve stimulation, transcutaneous vagus nerve stimulation (tVNS) on autonomic activity in older healthy human subjects aged >60 years.

tVNS was applied to the tragus of both ears in 18 subjects (F=12, M=6). Subjects received either 15 min active tVNS or sham stimulation at two visits while heart rate, blood pressure and respiration were monitored. Heart rate variability was derived from power spectral analysis of beat-to-beat oscillations in heart rate. The LF/HF ratio was calculated using low frequency power and high frequency power. Single-unit muscle sympathetic nerve activity (MSNA) was recorded using microneurography.

12 subjects (M=6) had a significant decrease in LF/HF ratio during active tVNS (1.99 ± 0.24 to 1.25 ± 0.14 ; $p = 0.01$). The remaining subjects (F=6) did not experience any changes in LF/HF. Male subjects had a higher baseline LF/HF ($M = 2.00 \pm 0.16$, $F = 1.47 \pm 0.31$; $p = 0.01$). Low frequency power continued to decrease after active tVNS, with no change in high frequency power. No changes in LF/HF were observed as a result of sham stimulation. Microneurography in 5 subjects detected a decrease in single-unit MSNA frequency and incidence during active tVNS ($Z = -2.02$; $p = 0.04$).

These results indicate that tVNS reduces MSNA and shifts cardiac autonomic control toward parasympathetic predominance in older adults. Further studies are needed to determine the long-term autonomic effects of tVNS in older subjects.