



Long and Short Term Evaluation of Freestyle Stentless Bio-prosthesis BY Cardiovascular Magnetic Resonance (CMR)

Thesis

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By

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

قالوا

لسببائك لا علم لنا
إلا ما علمتنا إنك أنت
العليم العظيم

صدقة الله العظيم

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List of Abbreviations

Abb.	Full term
2D.....	Two dimensional
3D.....	Three dimensional
AAD	Ascending aorta disease
ACC/AHA	American College of Cardiology/American Heart Association
AV	Atrioventricular
AVR.....	Aortic valve replacement
CABG.....	Coronary artery bypass graft
CMR.....	Cardiovascular magnetic resonance
CT	Computed tomography
ECG	Electrocardiogram
EF	Ejection fraction
FA	Flip angle
LV	Left ventricular
MRA.....	Magnetic resonance angiogram
NSF.....	Nephrogenic Systemic Fibrosis
PC	Phase-contrast
PHV	Prosthetic heart valve
PWV	Pulse wave velocity
TAVI	Transcatheter aortic valve implantation
TE	Echo time
TR	Repetition time
TTE.....	Trans-thoracic echocardiography
VENC.....	Velocity encoded

INTRODUCTION

The Freestyle stentless (Medtronic Inc, Minneapolis, Minn) aortic bio-prosthesis is a xenograft composed of a thin synthetic sewing cuff attached to a glutaraldehyde preserved porcine aortic root using an alpha-amino oleic acid leaflet as an anti-calcification treatment. Unlike other bio-prosthesis, the Freestyle aortic bio-prosthesis does not have a stent and the absence of stent has been reported to provide better hemodynamic properties compared with stented biological valves, with less turbulent flow and larger efficient effective orifice area (*Gulbin and Reichensperner, 2009*).

The Freestyle aortic root is inserted surgically by transecting the aorta just above the sino-tubular ridge and mobilizing the coronary ostia in order to have access to and remove the diseased aortic valve and insert the proximal end of the Freestyle aortic root in its place, while the distal end is sewn end to end with the ascending aorta (*Neal et al., 1995*).

The quality of images and therefore the diagnostic capability of a cardiovascular magnetic resonance (CMR) study in a patient with PHV depend on artefacts from the metallic components of the PHV since this valve is stentless with no metallic component, the quality and diagnostic capabilities of cardiovascular magnetic resonance (CMR) is very high.

Aortic stiffness is increasingly used as an independent predictor of adverse cardiovascular outcomes. So, evaluation of the impact the Freestyle stentless (Medtronic Inc, Minneapolis, Minn) aortic bio-prosthesis upon aortic vascular function using cardiovascular magnetic resonance (CMR) measurements of aortic distensibility and pulse wave velocity (PWV) will be very informative (*Musa et al., 2016*).

AIM OF THE WORK

Stentless xenograft bio-prosthesis may be the future valve of choice for aortic valve replacement. And since few studies have investigated the Medtronic Freestyle Stentless bio-prosthesis® (Medtronic Inc., Minneapolis, MN, USA) as a full root replacement, the study aim was to evaluate the long and short-term clinical outcome after aortic valve replacement with the Medtronic Freestyle bio-prosthesis (Medtronic Inc, Minneapolis, MN, USA), regarding distensibility and pulse wave velocity (PWV).

Chapter 1

RADIOLOGICAL ANATOMY

Normal cardiac anatomy by MRI:

MRI is now superior to other modalities, as it has a very high ability to visualize highly sophisticated cardiac structure without the need to use contrast agents or subjecting the patients to high radiation dose like the case with other modalities (*Babar et al., 2010*).

Moreover, the MRI provides a lot of crucial data regarding flow assessment as well as providing reliable functional calculation

The 2 complementary imaging techniques are;

- 1- The spine and gradient echo (fast dark-blood or black-blood T1-weighted SE-MRI techniques). They are used mainly for anatomical assessment of the heart and great vessels as well as directing additional sequences which could be added to the study.
- 2- The bright blood sequences. They are used for assessment of cardiac motion, volumes and function, in addition to assessment of the fine structures as the valves and the leaflet motion pattern (*Carr et al., 2001*).

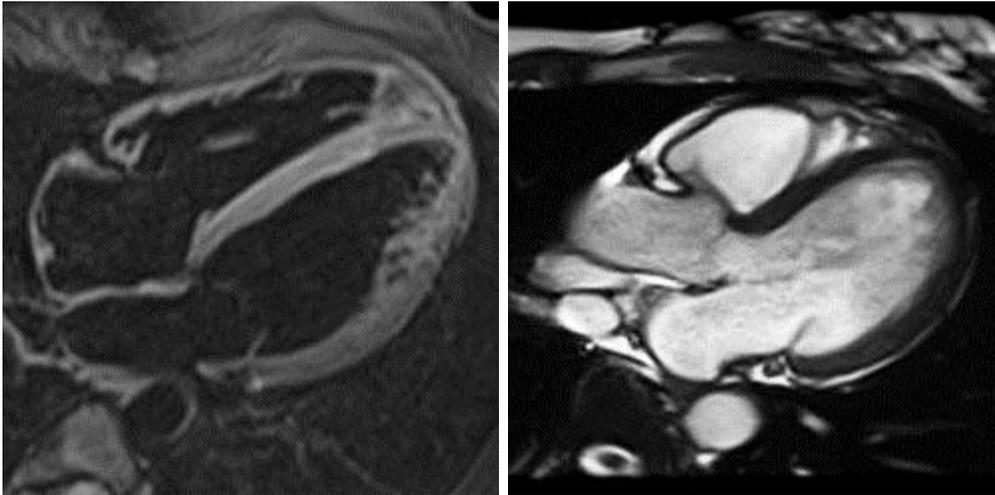


Figure (1): The image on the left is a fast spin echo (dark-blood), magnetic resonance sequence. Four chamber trans-axial (short axis of the thorax), while the image of the right is a gradient echo-(white-blood) Three chamber view.

Valves:

The heart has two sets of valves the atrioventricular (AV) valves connecting atriums to ventricles and the semilunar valves one for each of the two major arteries.

The atrioventricular (AV) valves, are two valves one each side of the heart connecting the atriums to the ventricles having the morphology of being bi-leaflet mitral valve to connect the left atrium to the left ventricle; and tri-leaflet tricuspid valve to connect the right atrium to the right ventricle (*Lapierre et al., 2010*).