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ADVANCED INTERVENTIONAL CARDIAC PROCEDURES AND PERIOPERATIVE CARE REQUIRED TO PREVENT THE EPIDEMIC OF END-STAGE HEART DISEASE IN SRI LANKA

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Introduction

Cardiovascular disease is the leading cause of morbidity and mortality in Sri Lanka[1]. Incidence of Coronary heart disease, in particular that of the younger population, is on the rise in South Asia[2].In addition, the population demographics are changing; As the death rates due to communicable diseases has fallen, life expectancy of population in Sri Lanka has steadily increased and therefore, a rising number of older patients with complex cardiovascular disease is seen in the country.

Many patients, both young and old, whether due to coronary or structural heart disease, progress through end stage of heart failure, which is a common cause for congestion in many cardiovascular clinics in the country and a leading cause of morbidity and financial loss to the patients.

It is in this context, that the timely provision of a state-of-the-art interventional cardiology services befit for the 21st century, is essential for early detection/treatment of coronary and structural heart disease and their sequelae. Often, this process is hindered as the rapid advancements in techniques and skills in interventional cardiology is not communicated well enough to the general physicians initiating treatment of patients in the community, leading to delays in referral of patients, sometimes causing substantial long-term morbidity. The purpose of the current publication is to review with examples, such advancements in minimally invasive interventional cardiac procedures/techniques that are available globally and in Sri Lanka, used to successfully treat coronary and structural heart diseases, helping us stall the epidemic of heart failure.

Multiple aetiologies that lead to heart failure requires different treatment strategies

Whilst coronary disease is predominantly responsible for a large proportion of heart failure presentations in Sri Lanka, other aetiologies such as acquired or degenerative valvular heart disease, congenital structural heart disease, congenital or acquired cardiomyopathies also account for a substantial number of patients attending cardiology clinics with heart failure in Sri Lanka.

The active search for ischemic heart disease, is still poorly performed, based predominantly on tests such as exercise stress test, which has a poor sensitivity and specificity and has been deemed unreliable and superseded by better diagnostic tests in many other countries[3]. Operator-

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dependent advanced imaging modalities to detect rare structural or congenital disease, for instance anomalous vessels causing shunts[4] or morphologically abnormal valves, failing prosthetic valves with conflicting haemodynamic data or concomitant coronary disease is often poorly investigated or managed with new insights late to be implemented[5]. Elderly patients with structural or coronary disease is often deferred treatment, due to fear or bleeding or vascular complications[6], some of which could, in fact, be uncommon.

Coronary artery disease interventions:

The spectrum of coronary artery disease and the risk of death or recurrent myocardial infarction depends on the clinical syndrome of presentation and location of coronary disease. ST elevation myocardial infarction (STEMI) and none ST elevation myocardial infarction/acute coronary syndrome (NSTEMI/ACS) carry the highest risk. Left main or three vessel coronary disease carries a higher risk than simple two or one vessel disease in a non leftmain location.

The treatment of choice for ST elevation is timely delivery of Primary Percutaneous Coronary Intervention (PCI) [7,8] (Figure 1) performed by suitably trained specialist operators who perform the procedure at a sufficient frequency (performing >75 PCI/year minimum, including regular primary PCI) and are able to deal with all subsets of coronary interventions such as graft or stent failure, left main, supported by adjuncts such as intravascular imaging and Rotablation. This is endorsed with evidence based best practices as per guidelines by the European Society of Cardiology[9] and American Heart Association[10].

The cumulative risk of death or recurrent MI at one year is nearly reduced by 50% in real life registries and the incidence of re-infarction, intra-cerebral bleeding and all stroke is substantially reduced by utilization of Primary Percutaneous transluminal coronary angioplasty (PTCA). However, in the absence of a country wide network of facilities that offer primary PTCA, it is imperative that a policy of thrombolysis and transfer to a facility capable of offering rescue PTCA, should the need arise be adopted. This aspect is somewhat restricted in Sri Lanka, partly driven by worry of bleeding sequelae. However, in my practice, where Trans Radial interventions are performed

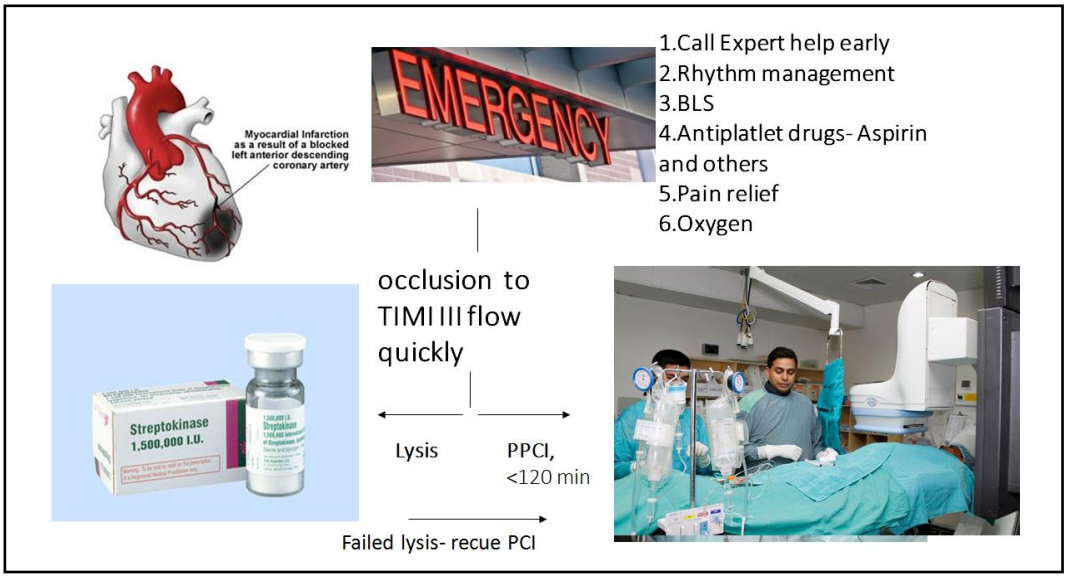

Figure 1: Major heart attacks-(STEMI)-summary of emergency treatment

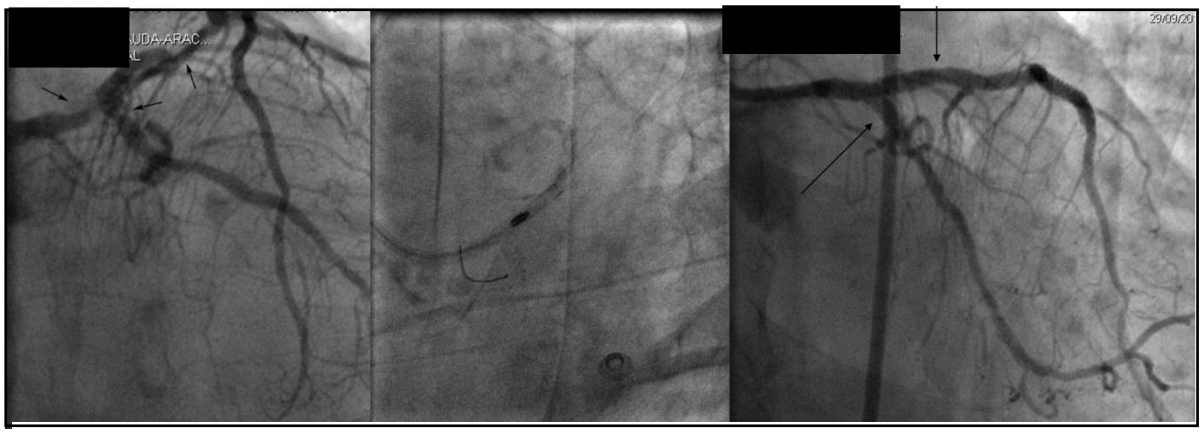

Figure 2: Sri Lanka's first double rotablation (middle panel- rota burr advancement) assisted critical unprotected calcific Leftmain-LAD-Lcx PCI in an 84 year old, performed by the author 5 years ago, with excellent angiographic result and excellent 5 year disease free survival of the patient.

>99% of the time as default access for rescue PTCA, clinically significant bleeding complications are virtually zero.

This tallies well with established data from trials that compare radial access vs femoral access for PTCA in MI. There is well established data to suggest survival benefit over bleeding risk in rescue PTCA[11]. Early invasive strategy for NSTEMI, in all comers, offer a survival benefit extending over a five-year period, with divergent survival curves favouring early intervention, the effect of which is most pronounced in high and intermediate risk groups[12]. It is also of note that patients with seemingly stable angina also derive reduction of cardiovascular events if they have an ischaemia burden over > 10% of the myocardium and receive coronary revascularization. Adjuncts such as pressure wire study during coronary interventions for stable disease, improves selection of patients who are likely to derive most benefit[13].

Coronary interventions during primary PTCA needs quick but careful risk assessment, particularly when balancing the patient's haemodynamic stability, desire to achieve complete revascularization balanced out against costs of single vs staged PTCA, which is an important concern in the context of Sri Lankan patients. PTCA to the severe, non-culprit lesions are associated with lower long term event rates, but at the expense of longer procedure time and contrast, but not necessarily with a higher clinical risk[14]. In my practice, Type A or B coronary lesions that may result in a reasonable outcome post PTCA will be offered to be treated in the index procedure, if patient is stable enough, as this results in considerable improvement of benefit: cost ratio for the patients. Patient may, dependent on the case, derive benefit even with the most difficult type C lesion interventions, provided the operator has the skill mix and the tools required at hand. Examples of such cases include Rotablation of calcific Left main disease[15] (Figure 2), via-graft interventions, repair of coronary dissections, PTCA in patients in cardiogenic shock etc. However, attention to developing systems for early detection of complications such as hypotension, cardiac tamponade, arrhythmia peril-procedurally and early intervention is mandatory in such cases. Careful attention to selection of antiplatelet drugs including new generation rapid loading versions and novel oral anticoagulants (NOACS) is also required.

Transcatheter Aortic Valve interventions (TAVI)

Patients with severe aortic stenosis, with or without coronary disease, with sufficiently high risk of mortality or morbidity with open heart surgery, may be offered TAVI. The first case of balloon expandable TAVI device in Sri Lanka, was implanted in an 82-year-old patient with history of prior stroke, lung disease, coronary disease (which was treated with PCI), with local anesthesia and sedation only (Figure 3). Procedure was completed in 90 minutes, with no complications with excellent final outcome. The 2nd and 3rd such procedures also were completely successful. The TAVI data at present, extending over 5 years, shows excellent outcomes and performance equal or better than surgical valve replacement.

Chronic heart failure and experimental data on intra-coronary autologous stem cell transplantation

End stage heart failure often carries a substantially worse prognosis than some cancers in terms of morbidity and mortality. Coronary revascularization, optimal medical therapy, cardiac synchronization therapy+/- defibrillators, reversal of few contributory causes aims to halt the progress of disease in suitable candidates and Cardiac transplantation option, whilst attractive, is extremely limited in Sri Lanka. In this context, development of alternative approaches to improve the myocardial function is required. An array of stem cells change lineage and undergo genetic transcription changes under appropriate conditions[16,17]. We have now in human subjects, evaluated the feasibility of intra-coronary

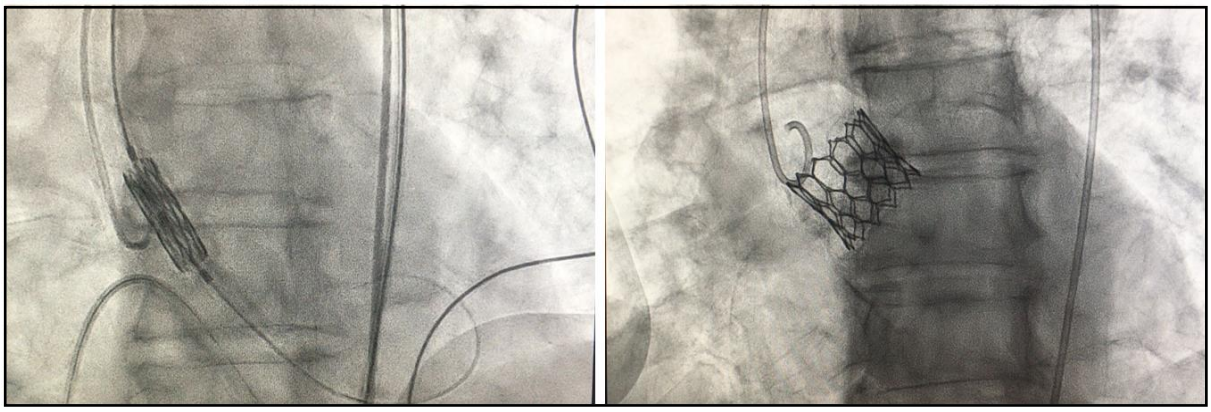

Figure 3: Sri Lanka's first Balloon expandable fully local anaesthetic, percutaneous Transcatheter Aortic Valve Implantation (TAVI), performed by the author- Immediate pre-deployment phase, valve crimped on balloon catheter placed across aortic valve (left) and Post deployment, fully functional prosthetic aortic valve (right).

	Pre-treatment	2 weeks post intracoronary stem cells	2 weeks Post PCI
Timeline	T=0	T=2 weeks	T=2 months
Global EF	14.2%	26.7%	36.1%
Global LV strain	-4.7%	-7.3%	-7.5%

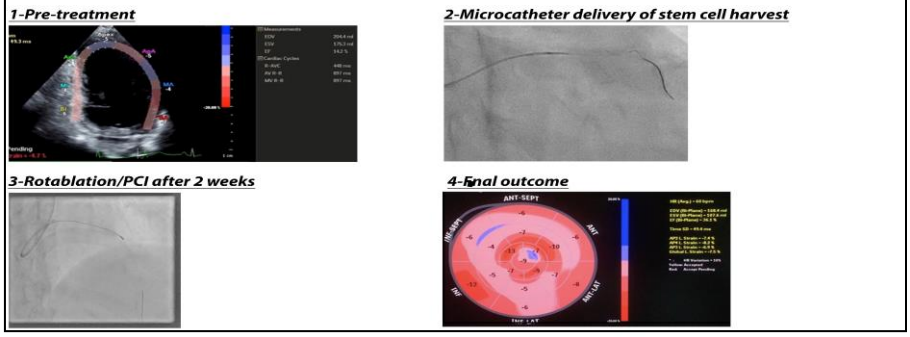

Figure 4: Intra-coronary autologous stem cell transplantation and rotablation assisted PCI – Summary of outcome

transplantation of autologous bone marrow derived peripheral stem cells (in 5 patients with ischaemic and non-ischaemic cardiomyopathies with limited options and intractable symptoms or recurrent hospital admissions). Consistent, short term improvement of left ventricular ejection fraction (LVEF) by 5-10% has been noted, with improvement of functional status in all of them[18](Figure 4). However, long term outcomes and randomized control data are still not available, but safety aspects appear satisfactory in this limited series.

Hypertrophic obstructive cardiomyopathy and alcohol septal ablation

In this condition, left ventricular outflow obstruction and severe hypertrophy presents a substrate for sudden cardiac death, intractable systolic or diastolic heart failure. Whilst surgical myomectomy (or cardiac transplantation), with additional operative risk factors, has been historically the only option available, selected cases may be successfully treated with echocardiography guided percutaneous alcohol septal ablation to achieve a meaningful non-surgical intervention.

Additional interventional cardiac procedures

These would be needed to address shunt closures, ASD or VSD repair, Leadless pacing devices and left atrial appendage closures, Cardioband annuloplasty for mitral and tricuspid regurgitation and left ventricular assist devices etc, which will help prevent progression of cardiac failure or associated complications.

Discussion

The number of cardiac conditions that can successfully be treated by interventional cardiology is growing exponentially and must be delivered by skilled and highly competent operators. New and complex procedures are now possible in various units in the country. Knowledge and awareness of these procedures and various aspects by physicians and general practitioners around the country is mandatory, to ensure quick access to services and achieve sustained reductions mortality and morbidity to the patient populations from the epidemic of heart failure in Sri Lanka.

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