



REVIEW ARTICLE

Bridging Cardiac Surgery and Interventional Cardiology in Yemen: Implementing the Heart Team Concept in a Resource Limited Healthcare System

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Abstract

The interface between cardiac surgery and interventional cardiology has evolved rapidly worldwide, driven by advances in transcatheter therapies and multidisciplinary decision-making frameworks. Central to this evolution is the Heart Team concept, which integrates expertise from multiple cardiovascular disciplines to optimize outcomes in complex cardiac disease. While this model is well established in high-income countries, its implementation in low-resource and conflict-affected settings such as Yemen remains limited. Yemen faces a growing burden of cardiovascular disease, characterized by a persistent prevalence of rheumatic heart disease alongside a rising incidence of ischemic heart disease. This paper provides an in-depth review of the current interface between cardiac surgery and interventional cardiology in Yemen, incorporating regional epidemiological data, system-level challenges, and clinical practice realities. Strategies for implementing a pragmatic Heart Team model adapted to local constraints are discussed, with emphasis on valvular and coronary artery disease. Multidisciplinary collaboration is proposed as a cost-effective and achievable pathway to improve cardiovascular outcomes in Yemen.

Keywords

Heart Team, Cardiac surgery, Interventional cardiology, Yemen, Rheumatic heart disease, Coronary artery disease

improved imaging techniques, and evidence-based multidisciplinary care models. This evolution has significantly blurred the traditional boundaries between cardiac surgery and interventional cardiology, particularly in the management of complex coronary artery disease and valvular heart disease [1].

The Heart Team concept was developed to address this increasing complexity by ensuring balanced, patient-centred decision-making through collaboration between cardiac surgeons, interventional cardiologists, imaging specialists, anaesthesiologists, and other healthcare professionals [2]. International guidelines now strongly endorse Heart Team discussions for patients with complex coronary anatomy, severe valvular disease, or elevated procedural risk [3,4].

In Yemen, however, healthcare delivery occurs under severe structural, economic, and political constraints. Despite these challenges, cardiovascular disease remains a leading cause of morbidity and mortality. Understanding how the interface between cardiac surgery and interventional cardiology functions within this context is essential for improving outcomes using available resources.

Introduction

Cardiovascular medicine has undergone a major transformation over the past two decades, marked by the rapid expansion of catheter-based therapies,

Epidemiology of Cardiovascular Disease in Yemen and the Region

Cardiovascular disease represents a significant and growing public health challenge in Yemen. According



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to the World Health Organization, non-communicable diseases account for approximately 55-60% of all deaths in Yemen, with cardiovascular diseases constituting the largest proportion [5].

Rheumatic Heart Disease

Rheumatic heart disease (RHD) remains highly prevalent in Yemen, reflecting limited access to early diagnosis and treatment of streptococcal infections. Regional data from the Middle East and North Africa (MENA) region indicate that RHD prevalence ranges from 1 to 3 per 1,000 population, with higher rates in low-income and conflict-affected countries [6]. Yemen is considered among the countries with the highest burden of RHD, particularly affecting children and young adults, leading to premature morbidity and mortality [7].

Ischemic Heart Disease

Ischemic heart disease (IHD) is increasingly prevalent in Yemen due to rising rates of smoking, diabetes mellitus, hypertension, and physical inactivity. The Global Burden of Disease study estimates that IHD is now the leading cause of cardiovascular death in Yemen, accounting for more than 20% of total mortality [8]. Notably, Yemeni patients often present at a younger age and with more advanced disease compared with populations in high-income countries [9].

Late Presentation and Comorbidities

A defining feature of cardiovascular disease in Yemen is late presentation. Patients frequently seek care only after the development of advanced symptoms, heart failure, or irreversible end-organ damage. This is compounded by a high prevalence of anemia, malnutrition, chronic kidney disease, and infectious diseases, all of which increase procedural risk and complicate management decisions [10].

Cardiac Surgery in Yemen: Capacity and Constraints

Cardiac surgery services in Yemen are limited to a small number of tertiary centers, primarily located in major urban areas. The scope of practice is largely confined to conventional open-heart procedures, including surgical aortic valve replacement (SAVR), mitral valve repair or replacement, and coronary artery bypass grafting (CABG) [11].

Advanced surgical techniques such as minimally invasive cardiac surgery, robotic surgery, or mechanical circulatory support are generally unavailable. Surgical outcomes are often influenced by systemic limitations, including delayed referrals, limited preoperative optimization, restricted intensive care unit capacity, and shortages of trained personnel [12].

Given these constraints, accurate patient selection and optimal timing of surgery are critical. These

decisions cannot be made in isolation and require close collaboration with interventional cardiologists and imaging specialists.

Interventional Cardiology Practice in Yemen

Interventional cardiology is relatively more accessible than cardiac surgery in Yemen. Most tertiary hospitals provide diagnostic coronary angiography and percutaneous coronary intervention (PCI). However, structural heart interventions such as transcatheter aortic valve replacement (TAVR), transcatheter mitral valve repair, or tricuspid valve interventions are not routinely available [13].

Patients requiring advanced transcatheter therapies are often referred abroad, leading to inequities in access to care based on financial capability. Despite these limitations, interventional cardiologists play a pivotal role in diagnostic evaluation, hemodynamic assessment, risk stratification, and perioperative planning [14].

The Heart Team Concept in a Yemeni

Current practice

In most Yemeni institutions, cardiovascular decision-making remains fragmented and specialty-driven. Formal Heart Team meetings are rare, and treatment decisions are often made independently by cardiologists or surgeons without structured multidisciplinary discussion [15].

Rationale for a Heart Team in Yemen

In resource-limited settings, the consequences of inappropriate or poorly timed interventions are magnified. A Heart Team approach can help reduce futile procedures, optimize resource utilization, and improve patient outcomes without requiring substantial financial investment [16].

A Feasible Model

A pragmatic Heart Team in Yemen could include a cardiac surgeon, interventional cardiologist, echocardiography specialist, anaesthesiologist or intensivist, and senior nursing staff. Regular case discussions, even on a weekly basis, could significantly enhance decision-making quality [17].

Valvular Heart Disease: A Central Interface

Aortic valve disease

Severe aortic valve disease in Yemen is managed almost exclusively with surgical intervention. In elderly or high-risk patients, the absence of transcatheter alternatives makes multidisciplinary evaluation essential to avoid excessive procedural risk and poor outcomes [18].

Mitral valve disease

Rheumatic mitral valve disease is common and often advanced at presentation. Comprehensive

echocardiographic assessment is crucial for determining reparability and surgical strategy, emphasizing the need for close collaboration between cardiologists and surgeons [19].

Tricuspid valve disease

Tricuspid regurgitation is frequently under-recognized and undertreated in Yemen. Late referral contributes to poor surgical outcomes, underscoring the importance of early identification through multidisciplinary evaluation [20].

Coronary Artery Disease and Revascularization Decisions

Coronary artery disease management represents a key interface between cardiac surgery and interventional cardiology. While PCI is widely practiced, CABG capacity is limited, and many patients present with complex coronary anatomy not adequately addressed by international guidelines [21].

Heart Team discussions are essential to balance procedural risk, completeness of revascularization, long-term durability, and resource utilization in these complex cases [22].

Training, Workforce, and Future Directions

The lack of cross-disciplinary training remains a major barrier to integrated cardiovascular care in Yemen. Long-term strategies should focus on joint educational initiatives, multidisciplinary case reviews, and regional or international training collaborations [23].

Telemedicine and regional partnerships may provide opportunities to integrate advanced expertise into local decision-making processes, even in the absence of advanced technologies [24].

Conclusion

The interface between cardiac surgery and interventional cardiology in Yemen is shaped by a high burden of rheumatic and ischemic heart disease, late patient presentation, and significant resource constraints. Despite these challenges, the adoption of a structured Heart Team approach tailored to local realities represents a practical, cost-effective, and impactful strategy for improving cardiovascular care. Multidisciplinary collaboration should be viewed not as an optional enhancement, but as a fundamental requirement for delivering safe and effective cardiovascular care in Yemen.

Conflict of Interest

The author declares no conflicts of interest.

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