Role of computed tomography in tailoring reoperative procedures and changing trends in reoperative cardiac surgery

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Keywords: Reoperative cardiac surgery • Computed tomography (CT) • Changing trends

Hamid et al. [1] present the well-known fact that reoperative cardiac surgery has a higher mortality, by virtue of the fact that the operation is a repeat one. The study had an operative mortality rate of 9.5%. Re-entry complications occurred in 2.7% although the mortality rate of this group was less than 1%.

The reasons that a repeat cardiac operation has an increased mortality compared with a primary operation have been described by the current study. Reoperative cardiac surgery, as demonstrated by multiple series, carries a higher risk of re-entry injuries which reflects in poor early and late outcomes [2]. The authors have outlined the anatomical structures that might be inadvertently encountered during re-entry and discussed the role of computed tomography (CT) in helping ameliorate this risk, which we totally agree with. They have highlighted a significant change in the trend towards preoperative planning in reoperative cardiac surgery. However, there are additional reasons for increased mortality. These patients may have ischaemic heart disease that is more mature, with declining left and right ventricular function and they may be older with more comorbidity.

Careful preoperative planning and meticulous operative skills are two key steps to successful outcomes for complex reoperative procedures. The crux of both preoperative planning and surgical technique is precise and accurate demonstration and understanding of mediastinal anatomy. The authors have demonstrated that multislice CT scan imaging is readily available and it allows understanding of possible re-entry injuries by demonstrating precise anatomy and proximity to key structures. Preoperative CT imaging not only reduces the risk of re-entry and prevents adverse outcomes but also has shown to reduce hospital stay with significant reductions in hospital charges [3].

Risks to a patent internal thoracic artery are not only during re-entry but also during its mobilization which is necessary for repeat grafting. Clearly defining the position, lie and proximity to key anatomical structures helps reduce the risks of such later inadvertent injury.

Over the past decades, CT imaging prior to reoperative procedures has gained popularity with cardiac surgeons. All patients at our centre have routine preoperative CT scans with 3D reconstructions. 3D reconstruction with CT angiography provides accurate delineation of previous patent coronary artery grafts which are at risk during re-entry [4-6]. As the authors demonstrate, some patients with suspected renal injuries could be excluded from CT imaging due to significant risk of contrast nephropathy. All patients excluded from CT imaging should be considered for tagged cine magnetic resonance imaging with a finite element model. This modality not only provides precise anatomical proximity of key structures but underlines an accurate quantitative assessment of retrosternal adhesions before reoperative cardiac surgery. It also provides quantitative assessment of right ventricular strain and the relationship to the posterior sternal border [7]. Sodian et al. have demonstrated virtual 3D printing models to demonstrate and enhance understanding of mediastinal anatomy for preoperative evaluation for reoperative procedures [8].

We have travelled on a journey of modalities stretching from plain lateral chest X-rays to virtual 3D printed models of the heart, with each modality providing a better understanding allowing us to deliver safer entry to the chest, minimizing the risk of re-entry injuries and should be utilized as a routine for reoperative cardiac procedures.

These imaging modalities should be used to provide a tailored plan in each patient having their chest opened, which can vary from a routine straightforward sternotomy to opening the chest having established bypass, with cooling and decompression of the left ventricle. In addition, there will be the small group who may have a vital, and possibly a unitary, coronary graft sitting behind and on the sternum, where approaching the heart through a thoracotomy might be appropriate.

There remain other strategies in repeat operations, in addition to understanding the anatomy and relationships of structures, such as the management of diseased bypass grafts, the dissection of adhesions to avoid damaging the heart itself and optimal protection of the heart during cross-clamping.

One could argue that now that we have ascertained that reoperative surgery has such high risks, these procedures should be the domain of surgeons with established experience in reoperative surgery and the era of a surgeon performing an occasional repeat procedure has passed.
REFERENCES