

Robotic Hybrid Coronary Revascularization - a need for strategy specific data.

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Abstract

Robotic totally endoscopic techniques to perform the LITA to LAD graft, coupled with PCI, provides the least invasive option to achieve hybrid coronary revascularization (HCR). Shorter hospital stay and reduced need for blood transfusions have been consistently being reported by several studies along with similar long-term outcomes. Considerable variations exist in the definition of HCR which can be single or two-staged with surgical revascularization being carried out after PCI or vice versa. Variations also exist with respect to usage of cardiopulmonary bypass, surgical incisions, and use of minimally invasive robotic techniques. The different strategies of HCR do not lead to similar outcomes and the findings of one strategy cannot be extrapolated to the entire group. Studies reporting different strategies of HCR, should ideally provide more granular data when reporting outcomes.

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Hybrid coronary revascularization (HCR) requires left internal thoracic artery (LITA) graft to the left anterior descending (LAD) coronary artery combined with percutaneous coronary interventions (PCI) for the

non-LAD lesions. Robotic totally endoscopic techniques to perform the LITA to LAD graft, coupled with PCI, provides the least invasive option to achieve HCR. In the study by Torregrossa et al, this strategy of HCR has been compared with conventional off-pump coronary artery bypass grafting (OPCAB), in the specific cohort of women with two vessel coronary artery disease(1). Apart from reporting a niche strategy for HCR, where limited data is available, the authors have used propensity matched groups for comparison, and have also provided long term outcomes which add further value to the paper. The main findings of the study include significantly shorter hospital stay and requirement for blood transfusions, along with similar long-term outcomes in women undergoing HCR. Based on these observations the authors suggest that the shorter hospital stay and lesser requirement for blood transfusion would lead to lesser utilization of hospital resources and result in a financial benefit.

The findings of this study are supported by several other studies. Reduced blood transfusion requirements is indeed the most consistent reported benefit of HCR (2-5). However, while the risk of bleeding and need for blood transfusion has been reported to be lower it is important to remember that considerable variations exist in the definition of HCR. HCR can be single stage, or a two-stage procedure carried out typically during the same hospital admission, however, two separate hospital admissions may also be required. The sequence could be CABG followed by PCI or vice versa. Surgical revascularization is carried out predominantly using OPCAB, but on-pump techniques have also been used. Besides, full and partial, midline and parasternal sternotomies, lateral thoracotomies, robotically enhanced (LITA harvest only) as well as totally endoscopic CABG have all been used as part of HCR(6).

In the study by Torregrossa et al, total endoscopic LITA to LAD anastomosis was performed but variations existed both in stages and in sequence of HCR. Nearly half (50.9%) the cases had HCR performed in the same admission. In the remaining patients HCR was carried out as a two-staged procedure where CABG was performed before PCI in majority of cases (36.4%) and after PCI (12.7%) in a smaller cohort. The number of stages and the sequence in which PCI and CABG are carried out are often dictated by specific clinical needs which in turn affect the outcomes. The PCI first strategy is most commonly undertaken in patients presenting with acute coronary syndrome due to non-LAD culprit lesions. The need for dual anti-platelet agents and incomplete reversal of heparin after surgery make these patients potentially at risk for increased bleeding(7). Outcomes are also influenced by whether the HCR is single stage or a two-stage procedure with staged HCR deemed better than single stage HCR with respect to risk of bleeding and re-interventions, and single stage HCR thought to be superior in terms of major adverse cardiac and cerebrovascular events (MACCE) rates(5). Thus, the different strategies of HCR do not lead to similar outcomes. Furthermore, the findings of one strategy cannot be extrapolated to the entire group and studies reporting different strategies of HCR, should ideally provide more granular data.

The shorter length of hospital stay with HCR seen in this study has also been substantiated by other studies (2-4). However, as nearly half the patients had two separate admissions, a breakdown of length of hospital stay for each admission in addition would have been more informative. The duration between the two admissions and indication for the second procedure would have also provided meaningful insight into whether the HCR was planned or unplanned and whether there was a significant delay between the two procedures. This is important as it has been recommended that in HCR, both procedures should occur within 60 days of each other and the second stage of the procedure ought to be elective (8).

The authors have also reported similar operative times in the propensity matched comparison of the groups. Even though the operative times over the last 2 decades have come down it is generally accepted that totally endoscopic coronary artery bypass involves longer operative time compared with conventional OPCAB. A similar study comparing single stage robotically assisted HCR with conventional OPCAB showed that the operative time in HCR was significantly longer by 2 hours(9). Another study that evaluated the practice patterns and outcomes after HCR reported a shorter procedural time after staged HCR than after single-stage or concurrent HCR. Considering that nearly half the patients in the HCR group had a 2-staged procedure the comparative operative times would have been invaluable.

While clinically it is reassuring to note that the short- and long-term outcomes of HCR were similar to

OPCAB, the suggested economic advantage of HCR appears a little too simplistic. The economic benefit of lesser transfusion and shorter length of stay must be weighed against the cost involved in carrying out two separate procedures, the requirement for two completely different teams, and the fixed and variable costs involved in specialized robotic equipment. A similar study comparing HCR using robotically assisted CABG with conventional OPCAB showed that while post-operative costs in the HCR group were lower due to shorter lengths of stay the overall cost involved in HCR was significantly higher due to the procedural costs (9). A more extensive analysis of the costs involved in HCR revealed that the fixed and total overall costs were significantly higher in HCR with a trend toward higher direct variable costs compared to OPCAB (10). Interestingly, despite higher costs involved with HCR, the contribution margin and the net profit with HCR was found to be higher than OPCAB. The reason behind this paradox is that while reimbursement for CABG is the same whether it is carried out robotically or as a standard OPCAB, HCR draws an additional reimbursement for PCI as a separate procedure (10). While this might be an additional incentive for increased uptake of HCR in centers where costs are reimbursed by insurance, it equally serves as a deterrent in countries where healthcare is state funded.

A quarter of a century has gone by since the first reported HCR(11) and serious efforts have been made to standardize the definitions and what qualifies as HCR(8). Long term data showing outcomes equivalent to conventional CABG has also been reported (12,13). However, the uptake of HCR has remained low, comprising <1% of total CABG volumes (6,14). The authors must be congratulated for the excellent outcome they have achieved using the strategy of total robotic CABG and PCI, but it is inevitable that this strategy of HCR will remain localized to few specialized centers. Shorter length of hospital stay, lesser need for transfusion are certainly attractive benefits of HCR but it may not be sufficient for greater uptake. Wider adoption will only occur when the need for HCR is clinically driven. PCI to the non-culprit LAD lesion followed by surgical revascularization of the LAD is perhaps the most challenging HCR strategy but may be the one that provides the much-needed clinical impetus for increased uptake of HCR. It is also important that more studies report strategy specific outcomes of HCR compared to CABG and PCI to enable a better comparison of different options.

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