CoreVista® Technology for Endoscopic Vessel Harvesting

A review of the use of CoreVista® Technology and its benefits for EVH

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Abstract

Coronary artery bypass grafting surgery is the commonest cardiac surgical procedure. Minimally invasive Endoscopic Vessel Harvesting (EVH) is fast becoming the standard of care on account reduced harvest site morbidity as compared with conventional open harvesting techniques, and improved patient satisfaction.

Good clinical outcomes and cost benefits are experience dependent as there is a significant learning curve associated with EVH. CoreVista® Technology is designed to improve hand-eye coordination in minimally invasive procedures, potentially improving accuracy and reducing the number of cases required to achieve competence. This study evaluates the use of CoreVista® Technology for EVH and summarises the benefits for each stakeholder group, including hospitals, staff, patients and companies that provide technology for EVH.

Introduction

Coronary Artery Bypass Grafting (CABG) is one of the most common operations performed worldwide; also considered the 'Gold Standard' for patients with multi vessel coronary artery disease [1]. Surgeons commonly use the left internal thoracic artery (LITA) as a pedicle graft to bypass the left anterior descending artery. However, for the other coronary arteries, bypass conduits must generally be harvested from areas of the body remote from the chest and used as free grafts. Commonly used free grafts include the long saphenous vein harvested from the leg and the radial artery harvested from the arm.

Traditional harvest techniques involve open incisions in the leg or arm. The Endoscopic Vessel Harvest (EVH) technique makes use of much smaller incisions to create a much less invasive procedure. Whilst smaller incisions generally provide a superior cosmetic result, they are also associated with less blood and heat loss during surgery, quicker healing and much less pain, all of which factors contribute to a much faster recovery.

Since its first application in the 1990s, EVH has become widely used in CABG procedures due to decreased wound-related complications, post-operative pain, and length of stay. A randomised controlled trial has shown that wound complications are substantially less than in open vessel harvesting (OVH) 7.4% versus 19.4% p = 0.014 [2].

Generally, latest generation EVH technology and endoscopes are compatible with commercially available imaging stacks. However, these stacks are bulky and very expensive, occupying precious space in operating theatres, and require the attention of circulating operating theatre staff for positional adjustments before and during surgery.

CoreVista® Technology is a patented, versatile and novel alternative that brings a high quality screen into the operative field. The technology has been successfully used previously for Transcatheter Aortic Valve Replacement [3]. In EVH procedures, the CoreVista® screen is orientated above the vessel harvesting incision or incisions and having it operable by the EVH operator independent of other circulating operating theatre personnel. Its versatility allows different configurations, providing the EVH operator with comfort and adaptability during the entire procedure. Figure 1 illustrates the surgery theatre set up while performing CABG and radial artery EVH; a similar configuration for harvesting the long saphenous vein is possible with the monitor positioned on the opposite side of the table, directly in front of the operator.

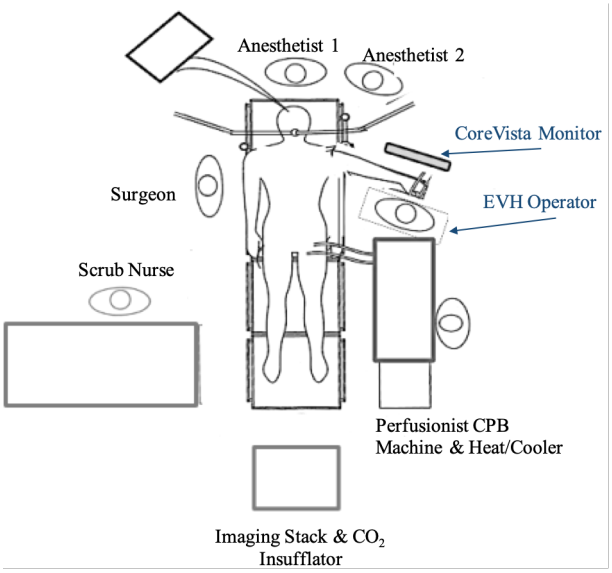

Figure 1. Theatre set up with the CoreVista® device while performing radial artery EVH.

The monitor screen's position adaptability plays a vital role during the surgical process, specially in this type of minimally invasive surgeries that requires a high level of manual dexterity [4]. Several studies have suggested that the monitor should be positioned in front of the surgeon, aligned with the task space and at eye level, minimizing inconsistency between the hand and eye and improving hand-eye coordination [5,6].

The purpose of this study is to explore and evaluate the use of CoreVista® Technology for EVH and to summarise its benefits.

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Methods

Qualitative analysis. We performed a retrospective review of all the possible benefits CoreVista® Technology brings to each stakeholder, including hospitals, hospital staff, companies that currently provide technology for EVH procedures, and patients.

Quantitative analysis. Results of this research includes the information of four EVH procedures performed on a population of seven males and one female, aged 59.1 ± 3.3 years, where CoreVista® Technology was used. The acquired data comprises patient's graft configuration, number of grafts, age, gender, conduit, length of stay (LOS), wound infections and other wound complications.

Results

Qualitative analysis. Several benefits for the different stakeholders of CoreVista® Technology were identified. This novel device is an affordable solution to equip operating theatres where CABG surgery is performed, allowing them to optimize the space in operating theatres and around the operating table.

Faster learning curve, due to the fact that the monitor is directly in front of the operator and the setup of the EVH tools and screen are identical to that experienced during simulator training. This similarity, noticeably improves hand-eye coordination during the EVH procedure, provides the operator with a higher motor speed and facilitates an earlier adoption of the technology, specially when a surgeon has limited experience [4].

Staff also benefit from better posture of the EVH operator during surgery with less back and neck discomfort, improving long term productivity and efficiency (Fig. 2).

For companies that already provide EVH technology, CoreVista® represents a new source of revenue and synergy with existing products. Easier acquisition of the requisite skills will encourage technology adoption and speed up new account conversion. A novel and patented integrated solution with key features IP protected provides competitive advantage.

Regarding patient benefits, it is known that a faster recovery and shortened hospital stay can be achieved with EVH; less wound complications; i.e. less infections and absence of leaky leg syndrome, lymphorrhea, and superior cosmesis, but only once the EVH operator has achieved full competence.

Table 1. Patient data on EVH using CoreVista® Technology

Patient	Grafts no.	Age	Conduit	LOS (days)
1	5	66	LSV	7
2	2	55	LSV	6
3	2	52	LSV	6
4	4	72	RA	7
5	3	54	LSV	6
6	2	72	RA	6
7	3	47	RA	6
8	2	55	LSV	6

Figure 2. EVH operator using CoreVista® Technology. Note the position of the monitor directly in front of the operator and the comfortable upright posture.

Quantitative analysis. EVH procedures carried out using CoreVista® Technology in this study presented no wound infections or other wound complications.

The total length of stay for patients was 6.2 ± 0.2 days. Long saphenous vein (LSV) was the endoscopically harvested conduit used in five cases whereas radial artery (RA) was used in three. In terms of graft configuration, the LIMA was anastomosed to the LAD in all cases and LSV or RA used for the remaining vessels.

Discussion and Conclusion

All EVH procedures were successfully performed using CoreVista® Technology. Consistent with existing literature, there was 0% rate of wound complications and all patients were quickly discharged home [7].

Good clinical outcomes are experience dependent. EVH has a learning curve and the clinical and cost benefits of EVH are not realised until operators have achieved competence.

It is known that operators with 100 cases or more have shorter harvesting times and improved conduit quality leading to superior long term graft patency. This is because EVH is technically challenging and requires new psychomotor skills that differ from those used in traditional open vessel harvesting [8].

Previous studies of endoscopic skill learning have consistently shown that the visual display should be placed directly ahead of the operator to preserve visual-motor mapping. For example, in a kinematic visual-motor transformation task, participants were significantly faster at completing an aiming task when the monitor was positioned

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0^0 from the midline (like CoreVista® Monitor) as compared with 45^0 or even 90^0 angles, commonly experienced in the cardiac theatre operating environment [4].

There is a functional relationship between head position and arm movements. Therefore, improved hand-eye co-ordination facilitated by the CoreVista® Technology will likely reduce the number of cases required to achieve competence. Improve productivity and accuracy are anticipated in the longer term by allowing the operator to work from a comfortable upright posture throughout the procedure.

The versatility of CoreVista® Technology allows the EVH operator to improve not only the posture but also the hand-eye coordination, leading to an improved motor speed and accuracy which yields to an optimal performance.

Figure 3. EVH Training using CoreVista® Technology. Note the similarity with simulator set up, *i.e.* the monitor directly in front of the trainee and the natural upright posture of trainer and trainee.

In addition to this, the similarity between the surgical field and the virtual surgical training provided by CoreVista®, will reduce the necessary number of EVH procedures to master the technique, leading to an early adoption of the technology and reducing costs for those companies in charge of providing EVH technology and training (Fig. 3).

Several benefits for hospitals, staff, patients and EVH technology companies were identified in this study. We believe that CoreVista® Technology has an enormous potential in improving the productivity, efficiency and clinical outcome of EVH procedures.

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Declared conflict of interest

Mr. Fraser Sutherland is a director of CardioPrecision Ltd

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