Best evidence topic - Coronary

Is it safe to perform endoscopic vein harvest?

Charlene Tennyson¹, Christopher P. Young², Marco Scarci³,*

¹King’s College Medical School, London, UK
²Cardiothoracic Surgery Unit, Guy’s and St Thomas’ NHS Foundation Trust, London, UK

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Summary

A best evidence topic in cardiac surgery was written according to a structured protocol. The question addressed was: in [patients undergoing coronary revascularisation] is [endoscopic vein harvest] superior to [open harvest] in improving [clinical outcome and cost-effectiveness]? Altogether >166 papers were found using the reported search, of which eight represented the best evidence to answer the clinical question. All papers agreed that endoscopic vein harvesting (EVH) reduces the level of postoperative pain (pain score for EVH=0.52±0.95; open technique=1.02±1.51; P=0.03) and wound complications (range from 3 to 7.4% for EVH and 13 to 19.4% for conventional technique). These clinical benefits were associated with a high level of patient satisfaction. On average, four papers found that the length of hospital stay was reduced in the EVH group [weighted mean difference (WMD) -1.04 to -0.85; confidence interval (CI) -1.92 to -0.16; P=0.02]. The overall occlusion rates of venous grafts after six months were 21.7% for EVH and 17.6% for open technique. There were no differences in the six months occlusion and disease rates between EVH and conventional vein harvest (CVH), as determined by means of univariate analysis (P=0.584). However, some papers (PREVENT-IV sub-analysis and Yun et al.) called into question EVH by reporting high vein occlusion rates. At six months, this was 21.7% for EVH and 17.6% for open technique rising to 46.7% vs. 38.0% (P<0.001) at 12–18 months. At three years, endoscopic harvesting was also associated with higher rates of death, myocardial infarction, or repeat revascularisation (20.2% vs. 17.4%; P=0.04), death or myocardial infarction (9.3% vs. 7.6%; P=0.01), and death (7.4% vs. 5.8%; P=0.005). We conclude that EVH reduces the level of postoperative pain and wound complication, with a high-level of patient satisfaction but a sub-analysis of a large RCT has recently called into question the medium- to long-term patency of grafts endoscopically harvested.

Keywords: Minimally invasive; Endoscopic vein harvesting; Coronary artery bypass grafting

1. Introduction

A best evidence topic was constructed according to a structured protocol. This is fully described in the ICVTS [1].

2. Three-part question

In [patients undergoing coronary revascularisation] is [endoscopic vein harvest] superior to [open harvest] in improving [clinical outcome and cost-effectiveness]?

3. Clinical scenario

A recently published article in a leading medical journal attributed increased saphenous graft failure and worse clinical outcomes to endoscopic vein harvesting (EVH). Consequently, the leader in EVH produced a statement with evidence to disprove the article’s evidences. You resolve to check the literature yourself.

*Corresponding author. Cardiothoracic Surgery Unit, 6th Floor, Borough Wing, Guy’s Hospital, London, SE1 9RT, UK. Tel.: +447515542899 (Mobile)/4471887188 (Hospital).
E-mail address: marco.scarci@mac.com (M. Scarci).
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4. Search strategy

Medline 1950 to October 2009 using Ovid interface.
[vein harvest*.mp] and [endoscopic.mp OR minimally invasive.mp]
In addition, the reference lists of all relevant papers were searched.

5. Search outcome

One hundred and sixty-six papers were found using the reported search. From these eight papers were identified that provided the best evidence to answer the question. These are presented in Table 1.

6. Results

Lopes et al. [2] analysed the database from the Prevent IV trial to determine the long-term outcome of EVH. One thousand seven hundred and fifty-three patients had EVH and 1247 conventional vein harvest (CVH). Patients who underwent endoscopic harvesting had higher rates of vein-graft failure at 12–18 months than patients who underwent open harvesting (46.7% vs. 38.0%; P<0.001). At three years, endoscopic harvesting was also associated with higher rates of death, myocardial infarction, or repeat revas-
Table 1
Best evidence papers

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<tr>
<td>Lopes et al., (2009), N Engl J Med, USA, [2]</td>
<td>Retrospective cohort study (level 2b)</td>
<td>1753 patients had EVH and 1247 open surgery</td>
<td>Death or myocardial infarction at 3 years EVH vs. conventional technique</td>
<td>Death or myocardial infarction (9.3% vs. 7.6%; adjusted hazard ratio, 1.38; 95% confidence interval (CI), 1.07–1.77; ( P = 0.01 )), and death (7.4% vs. 5.8%; adjusted hazard ratio, 1.52; 95% CI, 1.13–2.04; ( P = 0.005 ))</td>
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<td>Burris et al., (2006), Innovations, USA, [3]</td>
<td>Prospective cohort study (level 2b)</td>
<td>44 segments of veins, 20 uncontrolled pressure saline distension and 24 no distension</td>
<td>Intraluminal clot strands Clot strands were observed in 45.4% (20 of 44) of imaged SVG segments (severity of observed clots: 54%, mild; 32%, moderate; 14%, severe)</td>
<td>Compared with grafts distended with saline, vein segments that were not distended displayed significantly higher endothelial integrity (60.1% ± 27.2% vs. 24.7% ± 24.1%; ( P = 0.05 ))</td>
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<td>Athanasiou et al., (2004), Eur J Cardiothoracic Surg, UK, [4]</td>
<td>Meta-analysis (level 1a)</td>
<td>27 studies with a total of 4953 patients undergoing coronary artery bypass grafting (CABG)</td>
<td>Non-infective wound healing disturbances (NIWHD): wound drainage, haematoma, dehiscence, necrosis, and need for surgical debridement and seroma formation</td>
<td>NIWHD were significantly lower in the MIVH group (4%) compared to CVH group (13%); Odds ratio (OR): 0.24; CI: 0.16–0.38</td>
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<td>Allen et al., (2005), Innovations, USA, [5]</td>
<td>Systematic review (level 1a)</td>
<td>Systematic review of 36 studies involving 9632 patients</td>
<td>Wound related complications Reduced by 73% OR: 0.27; 95% CI 0.13–0.55; ( P = 0.0001 )</td>
<td>EVH reduces wound related complications and postoperative length of stay. Compared to OVH, in EVH there are significant improvements in patient satisfaction and postoperative pain levels</td>
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<tr>
<th>Author, date and country</th>
<th>Study type (level of evidence)</th>
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<tr>
<td>Yun et al., (2005), J Thorac Cardiovasc Surg, USA, [6]</td>
<td>Randomized controlled trial (level 1b)</td>
<td>200 patients undergoing CABG were prospectively randomized into either EVH or CVH groups</td>
<td>Leg wound complications</td>
<td>7.4% vs. 19.4%; EVH in favour</td>
<td>EVH significantly reduces leg wound complications, when compared to OVH. EVH does not compromise 6th month patency rates. Overall patency rates, however, are not dependent upon method of vein harvesting but rather individual patient characteristics and target and vein related variables</td>
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<td>Cheng et al., (2005), Innovations, USA, [7]</td>
<td>Meta-analysis (level 1a)</td>
<td>36 studies including 9632 patients undergoing CABG</td>
<td>Wound complications</td>
<td>OR = 0.31; 95% CI 0.23–0.41; P &lt; 0.0001 in EVH</td>
<td>EVH shows a significant reduction in wound complication and wound infection rates. The need for surgical wound intervention is reduced in EVH compared to OVH</td>
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<td>Reed, (2008), Int J Low Extrem Wounds, USA, [8]</td>
<td>Meta-analysis (level 1a)</td>
<td>24 studies</td>
<td>Wound infection rates</td>
<td>OR = 0.19; 95% CI 0.14–0.25; P = 0.001</td>
<td>MIVH technique significantly reduced wound infection rates and wound healing disturbances</td>
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<td>Rao et al., (2008), J Thorac Cardiovasc Surg, UK, [9]</td>
<td>Study of cost-effectiveness of MIVH using a novel statistical analysis</td>
<td>Study of cost-effectiveness of MIVH using a novel statistical analysis</td>
<td>HRQoL (health related quality of life utility) on discharge</td>
<td>0.9443 after MIVH and 0.6815 after CVH</td>
<td>By using these calculated utility estimates, Rao et al. suggest that MIVH is a cost-effective alternative to CVH techniques</td>
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cularisation (20.2% vs. 17.4%; adjusted hazard ratio, 1.22; 95% confidence interval (CI), 1.01–1.47; $P=0.04$), death or myocardial infarction (9.3% vs. 7.6%; adjusted hazard ratio, 1.38; 95% CI, 1.07–1.77; $P=0.01$), and death (7.4% vs. 5.8%; adjusted hazard ratio, 1.52; 95% CI, 1.13–2.04; $P=0.005$).

The leader in EVH devices replied that this study was not designed as a head-to-head comparison of EVH and open vessel harvesting (OVH) and is subject to a number of important limitations. Patients were not randomly assigned to harvest procedure. In the absence of randomisation, outcomes cannot be definitively attributed to EVH rather than to confounding factors. Further, the study did not standardise a number of factors that are known to affect the quality of the graft, including harvest technique (use of heparin pre-harvest), harvester experience, institution EVH volume and post-harvest graft handling (careful avoidance of over-distension). Burries et al. [3] conducted a prospective study on endoscopically harvested veins that were intraoperatively prepared for grafting by using saline distension at uncontrolled pressure ($n=24$) or without distension ($n=20$). Optical coherence tomography, a catheter-based infrared imaging system, was used to identify and characterise intraluminal clot strands in surplus vein segments. These segments were also assessed for luminal tissue factor activity and percent endothelial integrity by CD31-directed immunohistochemistry. Clot strands were observed in 45.4% (20 of 44) of imaged saphenous vein graft (SVG) segments (severity of observed clots: 54%; mild; 32%, moderate; 14%, severe). Compared with grafts distended with saline, vein segments that were not distended displayed significantly higher endothelial integrity (60.1% ± 27.2% vs. 24.7% ± 24.1%, $P=0.05$) and lower tissue factor activity (1.28 ± 0.95 U/cm² vs. 12.3 ± 5.5 U/cm², $P=0.001$) despite having a higher incidence of clot stands (65.0% vs. 29.1%, $P=0.02$). These results support the evidence that clot strands of varying severity are a common finding after endoscopic vein harvest and that saline distension is not completely effective in removing clot strands and increases overall graft thrombogenicity.

Athanasiou et al. [4] conducted a meta-analysis of 27 studies, involving a total of 4953 patients, comparing the effectiveness of minimally invasive vein harvest (MIVH) to that of CVH. The total number of non-infective wound healing disturbances (wound drainage, haematoma, dehiscence, necrosis, need for surgical debridement and seroma formation) were significantly lower in the MIVH group (4%) compared to CVH (13%) [Odds ratio (OR): 0.24; CI=0.16–0.38]. Hospital length of stay was significantly reduced in patients who underwent MIVH as opposed to CVH [weighted mean difference (WMD) of −1.04; CI=−1.92 to −0.16].

Allen et al. [5] performed a systematic review of 36 trials involving 9632 patients. Overall, the odds of wound complications were reduced by 73% (OR=0.27; 95% CI 0.13–0.55; $P=0.0001$) in the EVH group. EVH patients also showed a significant reduction in length of postoperative hospital stay (WMD −0.85 days; 95% CI −1.55, −0.15; $P=0.02$) and greater improvements in postoperative pain (Visual analogue pain scale: mean difference (WMD) −2.18 points; 95% CI −3.56, −0.79; $P<0.002$).

There were no significant differences observed between the two techniques when looking at quality of conduit harvest. Average time required to harvest the graft was increased (WMD 7.64 min; 95% CI 0.82–14.46; $P<0.03$) and mean closure time was significantly reduced (WMD −17.73 min; 95% CI −25.65, −9.80; $P<0.0001$) with EVH compared with CVH technique.

Yun et al. [6] reported the results of a randomized controlled trial involving 200 patients. The authors compared six months patency rates of greater saphenous veins removed with both techniques. EVH significantly reduces leg wound complications (7.4% vs. 19.4%; $P=0.014$). The overall occlusion rates after six months were 21.7% for EVH and 17.6% for CVH. However, there was evidence of significant disease (>50% stenosis) in an additional 10.2% of EVH grafts and 12.4% of CVH grafts. There were no differences in the six months occlusion and disease rates between EVH and CVH, as determined by means of univariate analysis ($P=0.584$). By means of multivariable logistic regression, EVH was not found to be a significant risk factor for graft occlusion or disease. The adjusted OR was 1.15 (95% CI, 0.65–2.05; $P=0.594$).

Cheng et al. [7] performed a meta-analysis of 36 studies involving 9632 patients. The risk of wound complications was significantly reduced by EVH compared with CVH (OR=0.31; 95% CI 0.23–0.41). Other benefits associated with EVH include a reduced risk of wound infection (OR=0.23; 95% CI 0.20–0.53; $P=0.0001$). Need for surgical wound intervention was also significantly reduced (OR=0.16; 95% CI 0.08–0.29). The incidence of pain,
neuralgia, and patient satisfaction was improved with EVH compared with CVH. Operative time was significantly increased (WMD 15.26 min; 95% CI 0.01, 30.51), length of hospital stay was reduced (WMD −0.89 days; 95% CI −1.15, −0.15), and so were readmissions (OR = 0.53; 95% CI 0.29–0.98).

Reed [8] conducted a meta-analysis comparing leg wound infections following MIVH and CVH techniques. This showed a significant reduction in wound infection rates in favour of the MIVH group (OR = 0.19; 95% CI 0.14–0.25). Similarly, wound healing disturbance rates were significantly improved with MIVH technique (OR = 0.26; 95% CI 0.20–0.34).

Rao et al. [9] performed a meta-analysis of cost–effectiveness of MIVH. They estimated the health-related quality of life utility (HRQoL) on discharge to be 0.9443 after MIVH and 0.6815 after CVH. Six weeks postoperatively, the utility was 0.9599 after MIVH and 0.8219 after CVH. By using these calculated utility estimates, they suggested that MIVH is a cost–effective alternative to CVH techniques. The incremental cost–effectiveness ratio (ICER) of $19,858.87/quality adjusted life year (QALY) compares favourably with other health care interventions. Probabilistic sensitivity analysis demonstrated with a 95.6% certainty that MIVH was the most cost–effective technique at a cost–effectiveness threshold of $50,000/QALY.

7. Clinical bottom line

We conclude that EVH reduces the level of postoperative pain, length of hospital stay and wound complication, with a high level of patient satisfaction, but a sub-analysis of a large randomised control trial has recently called into question the medium- to long-term patency of grafts endoscopically harvested.

References


eComment: Endoscopic harvesting results in high quality vein and arterial grafts

Authors: Peter Matt, Heart-Surgery Center, Basel-Bern, Switzerland; Bernhard Winkler, Friedrich Eckstein

doi:10.1510/icvts.2009.227090A

We have read this article with interest [1]. Endoscopic graft harvesting has been an important technical improvement in coronary bypass surgery (CABG) during the recent years. The stigma of long skin incisions has overcome and associated wound healing difficulties have decreased, with subsequent improvement in early physical ability and shortened hospital stay [2, 3]. The study by Lopes and colleagues [4] is provocative and challenges this ‘improvement’ in CABG as graft-patency might be reduced. However, there are important limitations of the study as non-randomization and detailed operative data (coronary status, target vessels bypassed, endoscopic technique and devices used) are lacking. Patency rate might depend more on patient characteristics and target variables than the vein harvesting technique used. Nevertheless, the discussion on the safety of endoscopic vein harvesting reminds us of the importance of excellent graft harvesting in CABG. While it is common use to assign graft harvesting to a non-physician practitioner or a perfusionist, the more complex endoscopic graft harvesting as such an endeavor might require more experienced technical skills. We strongly believe that endoscopic graft harvesting results in high quality vein and arterial grafts if harvested correctly.

References


eComment: Minimally invasive endoscope-enhanced venous conduit harvesting techniques

Authors: Jamshid H. Karimov, Department of Adult Cardiac Surgery, G. Pasquiniucci Heart Hospital, Via Aurelia Sud, 54100 Massa, Italy; Kakhaber Latsusbaia, Mattia Glauber
doi:10.1510/icvts.2009.227090B

We would like to make some comments on the best evidence topic presented by Tennyson and collaborators, reporting whether (in patients undergoing coronary revascularization) endoscopic vein harvesting technique is superior to the conventional (open) approach [1].

A concern about wound morbidity associated with the conventional technique of saphenous vein harvesting has led to the development of a variety of minimally invasive techniques [2]. The endoscopic approach became popular because it offers better cosmetic results due to a shorter incision length than in conventional approach, and as a method that could evidently decrease the incidence of postoperative pain and infection, and reduce the costs of associated health care.
Several studies were taken into consideration within this topic to compare the endoscopic technique with the open harvesting technique. We think that the impossibility to consider the results according to the exact harvesting device is one of the limitations of this study. Any conduit harvesting device available on the market follows almost the same less invasive (endoscopy-enhanced) preparation concept, but the harvesting technique, the technical characteristics of the device, the working conditions and supposedly the quality of the harvested veins are not the same. Minimally invasive conduit harvesting techniques are evolving and probably will ever do so because of increasing attractiveness, hospital interests, industrial influence, etc. But one thing is clear: smarter harvesting solutions/techniques are necessary to allow harvesting venous conduits of a quality comparable to those prepared in a conventional way, as the number one criterion for comparison has to be the avoidance of conduit quality alteration [3].

A biased patient satisfaction, difficult-to-measure postoperative pain and scar will certainly remain important issues. Further studies on a larger group of patients will probably be helpful in revealing the risk of perioperative endothelial damage. Mid-term and long-term graft patency results should not be overshadowed by aesthetic, economic or other reasons, thus enabling us to identify, really ‘is it safe to perform endoscopic vein harvest or not?’.

References

