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Original Research

Use of endoscopic vein harvesting (EVH) during coronary artery bypass grafting in United Kingdom: The EVH survey

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ABSTRACT

Objective: Endoscopic vein harvesting (EVH) is growing in popularity and is the method of choice in many centers worldwide as it is associated with lower complication rates compared to the open vein harvesting. The aim of this study was to determine the current use of EVH during coronary artery bypass grafting among cardiac surgeons in United Kingdom and identify the main concerns that limit the use of this technique.

Methods: We developed an online survey with 16 questions about the use of EVH. An invitation to participate was sent to all the adult cardiac surgeons currently in practice in United Kingdom.

Results: A total of 139 surgeons (52%) of 267 currently in practice across 48 different hospitals completed the survey. Twenty five percent of responding surgeons always use EVH while 44% use it for < 10% cases. Forty eight percent of responders regard EVH as an expensive technique and 90% believe that EVH is associated with fewer leg wound issues. Seventy five percent of responding surgeons will use it for their patients due to no leg wound issues while 25% believe that the concerns about patency of EVH are genuine.

Conclusion: The majority of UK cardiac surgeons responding to this survey will preferentially consider EVH for obese and diabetic patients and are convinced by its beneficial impact in reducing leg wound complications. However, the reported routine use of EVH is low. Concerns about cost and patency of the endoscopically harvested vein are the possible barriers for universal adoption of EVH in the United Kingdom.

1. Introduction

Coronary artery bypass grafting (CABG) remains the standard of care for patients with complex, multivessel coronary artery disease [1] as well as diabetics [2]. While the left internal mammary artery (LIMA) is universally recognized as the conduit of choice to revascularize left anterior descending (LAD) artery, there is frequently a need for additional conduits to revascularize other target vessels in patients with multivessel coronary artery disease. Despite constantly emerging new evidence supporting preferential use of arterial conduits in CABG [3,4], long saphenous vein remains the most commonly used supplemental conduit [5].

Traditional open harvesting of long saphenous vein, using long incisions, is associated with leg wound complications particularly in patients with obesity, diabetes, and peripheral vascular disease [6]. Endoscopic vein harvesting (EVH) was introduced in 1996 to mitigate the risk of leg wound complications, improve cosmetic results and enhance patient satisfaction [7]. Over the past two decades, these benefits have become well-established making it the standard of care in United States with approximately 80% of CABG procedures using EVH [8]. However, no such information is available for EVH usage in the United Kingdom.

We undertook a survey to determine the current use of EVH among cardiac surgeons in the United Kingdom during CABG and identify the main concerns and perceptions that limit the use of this strategy.

2. Methods

A questionnaire was developed to assess the use of EVH by cardiac surgeons in the United Kingdom during CABG. The survey consisted of 16 questions relating to the use of EVH in different clinical scenarios. Surgeons were asked to indicate how often they use EVH and to identify concerns and factors limiting widespread adoption of EVH in the United Kingdom. The text of the questionnaire is available in the Appendix.

A list of all cardiac surgeons practicing in Great Britain and Ireland was developed. The accuracy of the list was confirmed by cross-referencing it to Society for Cardiothoracic Surgeon in Great Britain & Ireland (SCTS) database as well as hospital websites. The final list consisted of 267 consultant adult cardiac surgeons.

The survey was developed as an online tool in a user-friendly format. A link to the online survey was e-mailed to all practicing adult

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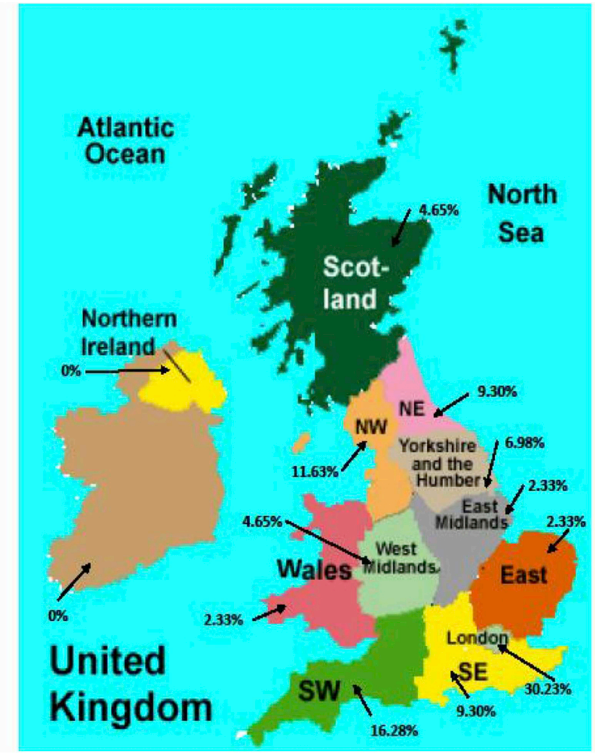

Fig. 1. Regional distribution of survey responders.

cardiac surgeons in Great Britain & Ireland by the first author (MKS) as well as by the SCTS administrator. Each surgeon was assigned a unique log-in that allowed completing the survey only once. The survey was completed online through a secure Web page. Statistical analysis was performed using chi-square tests to compare frequencies of categorical variables. Cronbach's alpha, α (or *coefficient alpha*), measured internal consistency of the entire questionnaire. Data were entered and analyzed using the Statistical Package for Social Sciences (version 17.0) (SPSS Inc., Chicago, IL, USA). The work has been reported in line with the STROCSS criteria [9].

3. Results

A total of 267 surgeons received the invitation to participate in our survey. To increase the response rate, surgeons who did not complete the survey within 1 month from the first e-mail were contacted again by e-mail. One hundred and fifty three surgeons received a second invitation. Finally, 139 surgeons (52%) of 267 adult cardiac surgeons currently in practice in the United Kingdom across 48 different cardiac surgery units completed the survey (Fig. 1). All responders answered all the questions. Cronbach's alpha for the entire questionnaire was 0.83 suggesting that the questionnaire was good in terms of internal consistency. Forty four percent of responders were in practice for ≤10 years, 40% of responders were in practice for 11–20 years, and 16% of responders were in practice for more than 20 years (Fig. 2).

The reported use of EVH in multivessel CABG operations in the United Kingdom is shown in (Fig. 3). Of the responders, 25% always use EVH if they are planning to harvest long saphenous vein. On the other hand, 44% use it very infrequently (< 10 cases). The number of years in practice did not influence the choice of EVH as the preferred strategy for vein harvesting (Table 1). According to 62% responders, the single main factor limiting EVH use is the cost of the procedure. Concerns about patency features as the second most common reason (46%) precluding use of EVH. Other factors perceived as barriers to widespread adoption of EVH include increased operative time and steep learning curve for EVH (Fig. 4). Interestingly, there was a significant difference amongst the 2 groups of surgeons (in practice ≤10 years versus in practice > 10 years) regarding issues that limit use of EVH in current practice (Table 2).

Questions 5 to 9 each dealt with a clinical scenario with a hypothetical patient undergoing CABG varying the clinical conditions to isolate perceptions related to specific patient variables that can impact EVH use. Majority of the respondents (97.7%) did not consider age as a limiting factor for EVH use and approximately 62–75% would use it preferentially for patients with diabetes, high body mass index (BMI) and peripheral vascular disease (PVD). Regarding the preferential use of EVH during urgent operation, there was equipoise with 39% responders in favor of using EVH while 41% against its use. However, there was no statistically significant difference for the use of EVH in each of these clinical scenarios between frequent and infrequent users.

The final section of the survey sought opinion of the practicing surgeons regarding concerns and benefits of EVH. There was a split opinion regarding the cost of EVH. Almost 48% responders regarded it as an expensive technique while 42% had an opposing view. There were significantly far more infrequent users than frequent users who regarded EVH as an expensive technique (P = 0.03). Fifty seven percent of the responders did not consider the learning curve of EVH as a cause for concern compared to 36% who considered it to be an important issue. Almost 54% of the respondents felt that concerns about patency of endoscopically harvested vein grafts were not genuine. In contrast 25% respondents were of the opinion that patency of endoscopically harvested vein was suboptimal while 21% were not sure. Whereas an overwhelming majority of the respondents (91%) were convinced that EVH was associated with fewer leg wound issues there was a near equipoise in responses regarding adequacy of evidence-base to routinely use EVH. Forty seven percent responders answered yes while 33% responded in no and 20% were not sure about adequacy of evidence-base. Similarly a three way split was evident in response to the question about impact of EVH on outcomes of CABG (yes = 42%; no = 30%; not sure = 32%). Finally, 75% of the responders were of the view that no leg wound issues was the single most convincing reason to use EVH.

4. Discussion

This survey was undertaken to delineate perceptions among cardiac surgeons in the United Kingdom that influence the use of EVH as well as to gauge the current use of EVH during CABG. The responses suggested that only 25% of adult cardiac surgeons are actually using it for 100% cases in current practice despite an overwhelming majority of responders being convinced of the benefits of EVH particularly for patients at high-risk for leg wound complications (eg, diabetes, high BMI, and PVD).

Since its introduction into clinical practice in 1996, EVH has been shown to decrease wound-related complications, enhance patient satisfaction, reduce postoperative pain, length of hospital stay, and use of wound-management resources [7,10]. The beneficial impact of EVH in reducing leg wound complications can be attributed to the causation of less trauma to the surrounding tissue, preservation of tissue perfusion, and lack of creation of tissue flaps [11]. A consensus panel of the International Society of Minimally Invasive Surgery recommends EVH as the standard of care (class I, level B) for patients who require saphenous vein for CABG [12]. Whereas EVH has been adopted as the standard of care in United States with approximately 80% CABG procedures utilizing EVH [8], adoption rates are far lower in the United Kingdom. This survey is the first ever to explore EVH utilization rates in the United Kingdom. Currently only 25% of survey responders use EVH for all cases whereas nearly 45% of surgeons use it very infrequently (< 10% cases). These adoption rates are disappointingly low especially in the context of overwhelming majority of surgeons (91%) admitting that EVH is associated with far fewer leg wound complications.

The two most plausible explanations for the low adoption rates of EVH amongst surgeons as suggested by the survey are the concerns

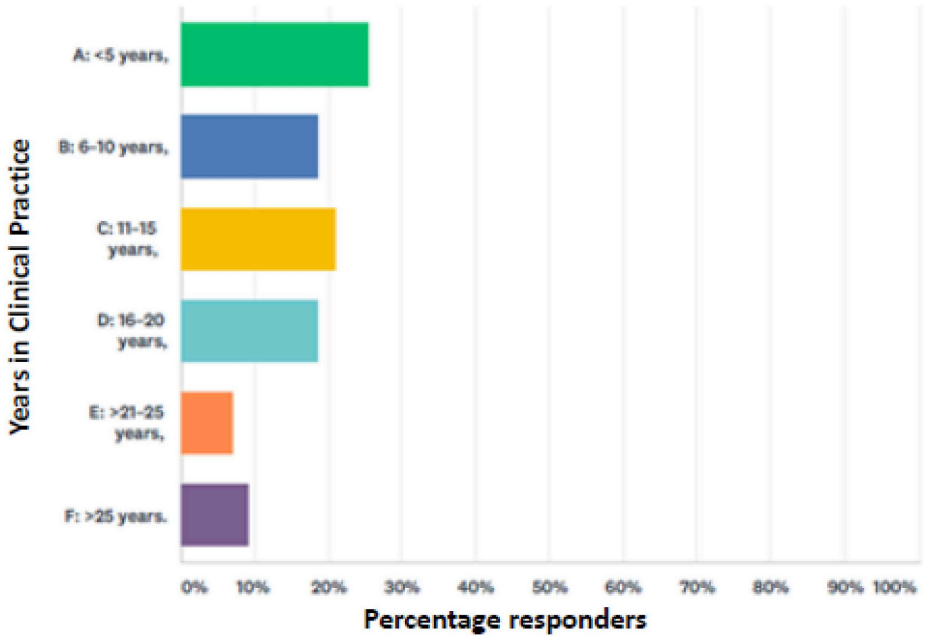

Fig. 2. Years in clinical practice of survey responders.

about patency of endoscopically harvested long saphenous vein and reservations about cost of the procedure. The critics of the technique express concerns about quality and inferior patency of the harvested conduit [13,14]. Two key studies that are often cited by opponents of EVH are the secondary analysis of PREVENT IV trial [13] and sub-analysis of the ROOBY trial [15]. The secondary analysis from the PREVENT IV trial compared outcomes of 1753 EVH versus 1247 open harvest. A significant rate of vein-graft failure (38% open versus 46.7% EVH; OR 1.45, 95% CI, 1.20–1.76) and occlusion (33.8% open versus 42.6% EVH; OR 1.47, 95% CI, 1.20–1.79) was reported by this secondary analysis [13]. Furthermore, EVH was associated with a higher rate of death, myocardial infarction, or need for further

Table 1
Influence of number of years in practice on EVH use.

EVH use	≤10 years in practice (n = 62)	> 10 years in practice (n = 77)	P value
Always (100% cases)	17 (27.4%)	18 (23.4%)	0.91
Very frequently (> 50% cases)	9 (14.5%)	10 (13.0%)	0.96
Often (25–50%)	8 (12.9%)	8 (10.4%)	0.94
Sometimes (6–25%)	3 (4.8%)	3 (3.9%)	0.97
Very infrequently (< 10%)	25 (40.3%)	38 (49.4%)	0.81

NS = not significant.

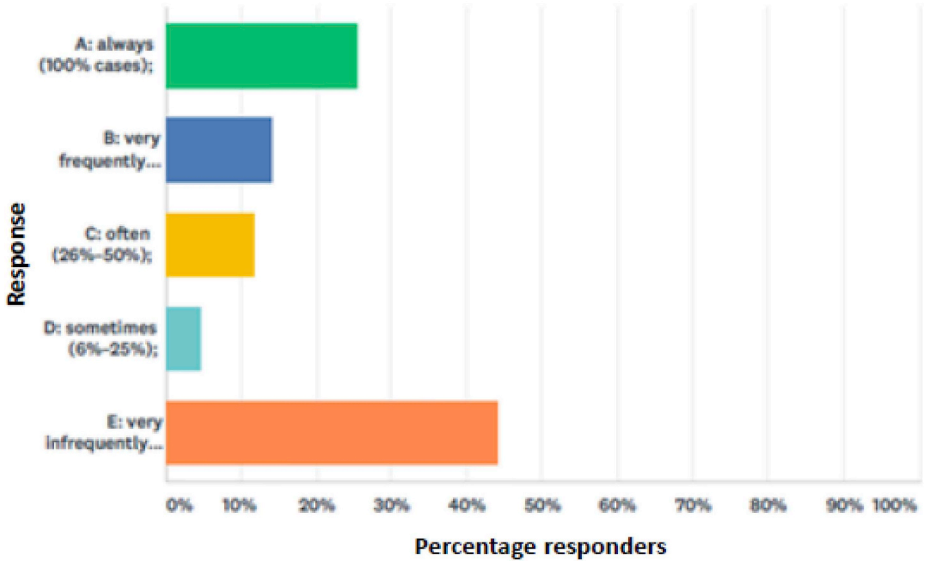

Fig. 3. Utilization rates of EVH in the United Kingdom according to survey responders.

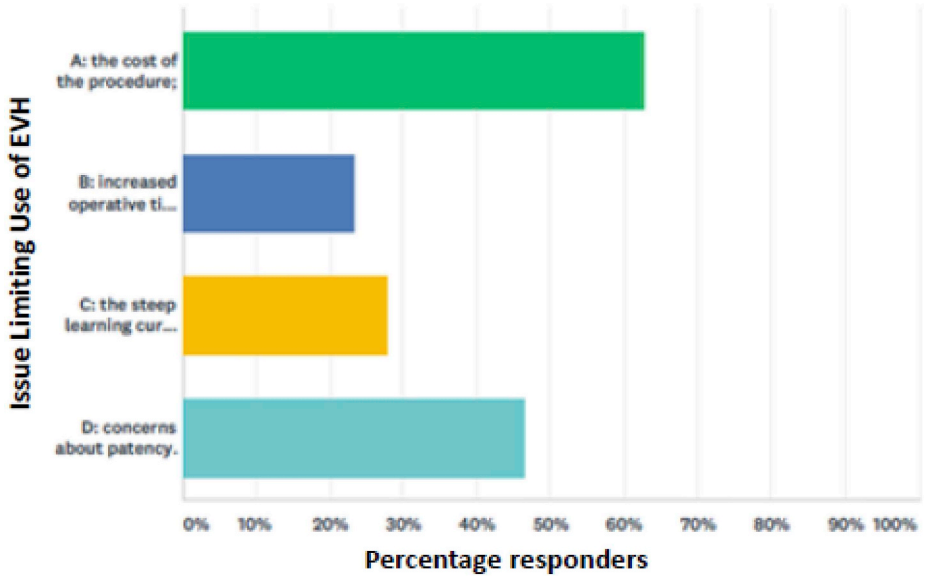

Fig. 4. Issues limiting use of EVH in the United Kingdom according to survey responders.

Table 2
Influence of number of years in practice on perception regarding issues limiting EVH use in current practice[a].

Issue	≤10 years in practice (n = 62)	> 10 years in practice (n = 77)	P value
Cost of the procedure	52 (83.9%)	35 (45.5%)	< 0.001
Increased operative time	14 (22.6%)	18 (23.4%)	0.79
Steep learning curve	19 (30.6%)	19 (24.7%)	0.18
Concerns about patency	21 (33.9%)	43 (55.8%)	0.02

[a] Multiple responses allowed.

revascularization (20.2% *vs.* 17.4%; adjusted hazard ratio, 1.22; 95% CI, 1.01–1.47) up to 3 years [13]. Similarly, the secondary analysis of the subgroup of 894 patients with 1-year angiographic follow-up in the ROOBY trial vein graft patency for EVH versus open technique was 74.5% and 85.2%, respectively (P < 0.0001) [15]. Interestingly, neither of these trials were designed for EVH evaluation. In contrast to these two studies, the Northern New England study group [16] and the recently published REGROUP trial [17] found no safety concerns with EVH. It is important to mention that EVH technology has improved significantly over the past two decades and the results of historical studies are no longer valid in the current era. Moreover, it is well-established that the overall patency rate depends on target and vein-related variables and patient characteristics rather than the method of vein harvesting [18].

In the United Kingdom the total cost of kit per patient is £650 [19]. Clearly, this additional cost makes EVH an expensive technique as recognized by 48% of responders and it is logical to question whether additional costs of EVH are justified by the potential benefits. However, several studies published on the subject have reported significant cost savings after EVH [19–21]. Luckraz et al. [19] in their cost-benefit analysis showed cost savings of £42,778 (including EVH kit costs) favoring EVH. The reduction in costs was due to significantly lower leg wound issues with EVH translating into reduced costs of dressings, additional hospital stay, and costs for attending outpatient wound clinic, amongst others. Another economic analysis performed by Rao and associates [20] demonstrated that EVH was more cost-effective, with an incremental cost-effectiveness ratio of $19,858.87/quality-adjusted life year, comparing favorably with other health care interventions. Similar cost-effectiveness benefit has been reported by Krishnamoorthy and colleagues [21].

Learning curve of EVH is an important issue that can impact total operative time and theatre occupancy, quality of the vein conduit, and postoperative complications [22]. Twenty seven percent of the responders consider steep learning curve as an issue that limits EVH use in current practice while 36% consider it as a cause for concern. Introduction of a surgical training tool specifically for EVH, use of virtual reality simulators, structured intraoperative training under direct supervision of competent mentors and careful selection of cases are some of the interventions that can enable trainees to negotiate the learning curve with minimal anxiety and stress without jeopardizing quality of the conduit or patient safety [22].

There is enough evidence-base to validate widespread adoption of EVH in the United Kingdom as acknowledged by 47% of responders. Furthermore, 75% of the responders would consider the use of EVH to reduce leg wound complications. However, this perception is discordant with the current practice in the United Kingdom whereby the use of EVH remains very low.

These responses represent the results of a voluntary participation in an online survey and are subject to a number of limitations. Although online surveys in many fields can attain response rates equal to or slightly higher than that of traditional modes, internet users today are constantly bombarded by messages and can easily delete such advances. We emailed the survey twice to maximize the response rate yet 48% of the invited cardiac surgeons did not participate in the survey. It is possible that the current practice of these surgeons could significantly differ from the surgeons who participated in the survey. Alternative means to contact non-responders such as postal survey and telephone reminders are well recognized strategies to improve response rate. However, we did not employ these alternative means. Hence, one of the major criticisms of the study is the issue of non-response bias which makes the conclusion questionable. Another major limitation of the study is acquiescence bias. This happens when a question is posed with unbalanced answers like agree/disagree or yes/no. It is a common form of measurement error in surveys and when it happens, it has substantial

effects. Furthermore, answers were not verified for accuracy which is another recognized drawback of online surveys. Despite all the aforementioned limitations this is the first ever survey that provides information about EVH usage in the United Kingdom. It is anticipated that a study from the SCTS database will be published in the near future to provide more accurate information about EVH usage in the United Kingdom.

5. Conclusion

The majority of UK cardiac surgeons responding to this survey will preferentially consider EVH for obese and diabetic patients and are convinced by its beneficial impact in reducing leg wound complications. However, the reported routine use of EVH is low. Concerns about cost and patency of the endoscopically harvested vein are the possible barriers for universal adoption of EVH in the United Kingdom.

Ethical approval

Ethical approval not needed as the study is a survey.

Sources of funding

None.

Author contribution

MKS conceptualization, data curation & writing - original draft.
LW data curation & formal analysis.
SGR conceptualization, methodology, supervision & writing - review & editing.

Conflicts of interest

None.

Research Registration unique identifying number (UIN)

Research Registration.
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Guarantor

SGR.

Disclosures

All authors take responsibility for all aspects of the reliability and freedom from bias of the data presented and their discussed interpretation.

Data statement

The data will be made available on request.

Provenance and peer review

Not commissioned, externally peer-reviewed.

Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ijsu.2019.07.037.

Appendix

Dear colleague, We invite you to participate in a survey about the use of endoscopic vein harvesting (EVH) during coronary artery bypass grafting (CABG) in the United Kingdom. The survey will take approximately 5 min to complete.

The internal mammary artery is regarded as the primary conduit for CABG patients, given its association with long-term patency and survival. However, long saphenous vein (LSV) continues to be utilized universally as patients presenting for CABG often have multiple coronary territories requiring revascularization. Traditionally, the LSV has been harvested by creating incisions from the ankle up to the groin termed open vein harvesting (OVH). However, such harvesting methods are associated with incisional pain and leg wound infections. In addition, patients find such large incisions to be cosmetically unappealing. These concerns regarding wound morbidity and patient satisfaction led to the emergence of endoscopic vein harvesting (EVH). There are little data on the prevalence of EVH use among United Kingdom cardiac surgeons.

When answering the following questions and clinical scenarios, please assume the following: 1) elective or urgent (in-house – waitlist > 24 h) cases with hemodynamic stability (non-emergency); 2) isolated coronary surgery (no major concomitant procedures, eg, valve, aortic, aneurysm); 3) all possible conduits available (eg, no vein stripping, radial artery not previously cannulated); 4) ascending aorta nondiseased such that on pump surgery and traditional proximal anastomoses feasible.

Question 1. How many years have you been in practice as a consultant cardiac surgeon? A: < 5 years, B: 6–10 years, C: 11–15 years, D: 16–20 years, E: > 21–25 years, F: > 25 years.

Question 2. Which region do you practice in? A. Scotland; B. Northern Ireland; C. Republic of Ireland; D. North East; E. North West; F. Yorkshire; G. East Midlands; H. West Midlands; I. East of England; J. London; K. South East; L. South Central; M. South West; N. Wales.

Question 3. In your opinion, which issue limits the use of EVH in current practice? Select all that apply. A: the cost of the procedure; B: increased operative time; C: the steep learning curve; D: concerns about patency.

Question 4. In your current practice, how often do you use EVH if you are planning to use LSV as a conduit? A: always (100% cases); B: very frequently (> 50% of cases); C: often (26%–50%); C: sometimes (6%–25%); D: very infrequently (< 10%).

Question 5. What age cutoff would you not use EVH? A: > 50 years; B: > 60 years; C: > 70 years; D: > 80 years; E: Age is not a limiting factor.

Question 6. Would you preferentially use EVH in a diabetic patient? A: Yes; B: No; C: Not sure.

Question 7. Would you preferentially use EVH in an overweight patient (BMI > 30)? A: Yes; B: No; C: Not sure.

Question 8. Would you preferentially use EVH in the presence of peripheral vascular disease? A: Yes; B: No; C: Not sure.

Question 9. Would you preferentially use EVH in an urgent operation? A: Yes; B: No; C: Not sure.

Question 10. In your opinion is EVH an expensive technique? A: Yes; B: No; C: Not sure.

Question 11. In your opinion is the learning curve of EVH a cause for concern? A: Yes; B: No; C: Not sure.

Question 12. In your opinion are the concerns about patency of EVH genuine? A: Yes; B: No; C: Not sure.

Question 13. In your opinion is EVH associated with fewer leg wound issues? A: Yes; B: No; C: Not sure.

Question 14. In your opinion is their enough evidence-base to routinely use EVH? A: Yes; B: No; C: Not sure.

Question 15. In your opinion does EVH have an impact on outcomes of CABG? A: Yes; B: No; C: Not sure.

Question 16: Which one factor will convince you to use EVH for

your patients? A: better cosmesis; B: No cost implications; C: No leg wound issues; D. Patient preference.

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