

Cite this article as: Siddiqui S, Whooley J, Miceli A, Bartolozzi F, Soo A. Endoscopic vein harvesting: a guide for approaching difficult cases and assessing patients preoperatively. *Interact CardioVasc Thorac Surg* 2022; doi:10.1093/icvts/ivac142.

Endoscopic vein harvesting: a guide for approaching difficult cases and assessing patients preoperatively

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Received 28 November 2021; received in revised form 25 April 2022; accepted 24 May 2022

Abstract

Coronary artery bypass grafting remains the most commonly performed cardiac surgical procedure worldwide. The long saphenous vein still presides as the first choice conduit as a second graft in multivessel coronary artery bypass grafting surgery. Traditionally, the long saphenous vein has been harvested with an open approach which can potentially result in significant wound complications in certain circumstances. Endoscopic vein harvesting is a minimally invasive vein harvesting technique, which requires a single 2–3 cm incision and is associated with a quicker return to normal daily activities, decreased wound complications and better quality of life in the longer term. There is a learning curve associated with endoscopic vein harvesting adoption and there are certain patient factors that can prove to be challenging when adopting an endoscopic approach. This commentary aims to provide a concise guide of certain challenging patient factors that operators may encounter during endoscopic vein harvesting, and how to approach these patients in both the preoperative and intraoperative settings. We suggest that with appropriate planning and awareness of the challenging patient factors and problematic venous anatomy that exists, the operator can consistently formulate a strategy for ensuring a successful endoscopic harvest.

Keywords: Endoscopic vein harvesting • Minimally invasive surgery • Long saphenous vein • Coronary artery bypass grafting

INTRODUCTION

Coronary artery bypass grafting remains the most commonly performed cardiac surgical procedure worldwide [1, 2]. The long saphenous vein (LSV) still presides as the first choice conduit as a second graft in multivessel coronary artery bypass grafting surgery [3]. Traditionally, the LSV has been harvested with an open approach, which involves a long incision along the medial part of the thigh or leg. This open approach has the potential for significant wound complications in certain patient cohorts, including postoperative pain, infection and delayed wound healing [4], resulting in significant prolongation of in-hospital length of stay and requirement of community wound care. Examples of those patient groups with a higher propensity for wound complications include those patients with diabetes mellitus [5, 6], peripheral vascular disease [7], chronic renal failure and increased body mass index (BMI) [8]. Endoscopic vein harvesting (EVH) is a minimally invasive vein harvesting technique, which requires a single 2–3 cm incision and is associated with a quicker return to normal daily activities, decreased wound complications and better quality of life in the longer term. Despite initial concerns regarding

LSV patency and mortality rates associated with EVH [9], recent data have demonstrated no differences in cardiovascular events between endoscopic or open approaches, with a decrease in leg-wound complications associated with EVH [10]. There is a learning curve associated with EVH adoption [11] and there are certain patient factors that can prove to be challenging when adopting an endoscopic approach. This commentary aims to provide a concise guide of certain challenging patient factors that operators may encounter during EVH, and how to approach these patients in both the preoperative and intraoperative settings.

APPROACHING CHALLENGING PATIENT FACTORS

When assessing patients in the preoperative setting, it is imperative to assess and plan for extremes in BMI and stature, as well as tailoring your approach for those patients with peripheral venous/arterial disease and those emergency cases on anticoagulation and antiplatelet agents. Table 1 provides a brief summary of our helpful tips for approaching these cases.

Table 1: Summary of useful tips when approaching challenging patient factors

Challenging patient factors	Tips
High BMI	<ul style="list-style-type: none"> • Preoperative ultrasound of the long saphenous vein is essential for assessment of vein quality, dimension, depth and for the identification of side branches. • Ultrasound both legs preoperatively to facilitate the quick cross-over to the contralateral leg if difficulty arises. • If there is difficulty identifying the vein through the incision, start with a tip search using the tip of the conical dissector. • Performing a fasciotomy can widen the tunnel and maximize your view.
Low BMI	<ul style="list-style-type: none"> • Initial careful dissection is crucial. • Mobilization of the posterior and lateral sides first, the anterior aspect of the vein should easily dissect subsequently. • Resist inflating the cuff of BTT as it can put pressure on a particularly superficial vein.
Short stature	<ul style="list-style-type: none"> • Plan your incision in the lower leg to maximize conduit length and consider switching to the contralateral thigh if further conduits are required.
Peripheral venous/arterial disease	<ul style="list-style-type: none"> • Careful selection of the appropriate site for the incision.
Anti-coagulated patients	<ul style="list-style-type: none"> • Adopt a careful and meticulous approach to dissection to maximize haemostasis. • Utilize redivac drains to prevent haematoma formation.

BMI: body mass index; BTT: blunt tip trocar.

In patients with high BMI, the vein is often embedded deep within in the fat. It can be difficult to find a deep vein with a small 2 cm incision. The fat has a propensity to bleed within the tunnel and can potentially obscure the operator's vision. We term this a 'fat avalanche'. During the preoperative assessment, ultrasound of the LSV is essential for assessment of vein quality, dimension and depth. It is useful to map the incision site and identify potentially complicating side branches. We advise to always ultrasound both legs preoperatively. This facilitates quick cross-over to the contralateral leg if you have difficulty finding the vein. If you cannot find the vein through the incision, start with a tip search using the tip of the conical dissector. Performing a fasciotomy can widen the tunnel and maximize your view. Conversely, in patients with low BMI, the LSV can be very superficial. This may pose problems when inserting the blunt tip trocar port to create the tunnel. A careful approach to the initial dissection is crucial. If you are unable to dissect the anterior surface of the vein at the beginning, then attempt to dissect the posterior and lateral sides of the vein first. By mobilizing the posterior and lateral sides, the anterior aspect should easily dissect subsequently. If space becomes an issue, perform a lateral fasciotomy to widen your view, and facilitate dissection of the anterior surface of the vein. Resist inflating the cuff of blunt tip trocar as it can put pressure on a particularly superficial vein, further complicating your harvest.

In patients with short stature, the location of your incision can be problematic as there is often insufficient LSV length from knee to groin. We advise planning your incision in the lower leg and consideration of use of the contralateral thigh if further conduits are required. This again highlights the importance in preoperative planning and ultrasound mapping in forging your harvest plan. In patients with peripheral arterial and vascular disease, culminating in ulcers, venous eczema or distal amputations, the location of your incision is also crucial. The operator needs to plan where make your incision to maximize the length of vein that can be harvested, while minimizing the risk of wound complications. The careful selection of the appropriate site for the incision should be mindful of avoiding ulcers, erosions and cellulosic areas. Those patients who require urgent or emergency surgeries are frequently on heparin infusions, anti-coagulants and dual

antiplatelet agents. Performing EVH in the urgent setting in these patients can be challenging as they are more prone to bleeding that could potentially prompt the conversion to an open harvest. Ultimately, by performing EVH in these patients you seek to reduce the risks of postoperative bleeding and haematoma formation linked to the more traumatic open vein harvesting. This hinges on a careful and meticulous approach to dissection to maximize haemostasis. The utilization of redivac drains is particularly useful in preventing haematoma formation in these patients.

APPROACHING PROBLEMATIC VENOUS ANATOMY

Preoperative bedside ultrasound is essential in formulating the operative strategy and to identify any variations in venous anatomy that may prove challenging during EVH (Table 2).

The problems posed by those patients with superficial veins are similar to that of patients with low BMI that we have dealt with earlier. The blunt tip trocar port insertion risks damaging a superficial LSV that is adherent to the overlying skin. Vein dissection may also result in the avulsion of small branches. A lateral fasciotomy can be performed to aid in creating a tunnel that can sufficiently accommodate the EVH cannula. It is important to flag these conduits with the surgeon following extraction to ensure that any potential small branch avulsions are carefully repaired with a 6/0 Prolene.

In those patients with varicose veins, the prevailing issue is bleeding. The vein can be thin-walled with a ballooned diameter that is usually too dilated to be suitable for grafting. However, in some cases, local varicosities can be present in otherwise good veins. This is another circumstance where preoperative ultrasound of both legs is crucial in the overall conduit assessment and planning. If both legs have varicosities, which are unlikely to provide an appropriate conduit, inform the surgeon early about the conduit quality to prompt consideration of alternative conduits (i.e. radial artery or bilateral mammary arteries.) Dilated side branches also have the potential to bleed easily if they are not divided carefully during EVH. Bleeding from a big branch can rapidly fill the tunnel forcing the operator to convert EVH into an

Table 2: Summary of useful tips when approaching problematic venous anatomy

Problematic venous anatomy	Tips
Superficial veins	<ul style="list-style-type: none"> • Careful dissection. • Perform a lateral fasciotomy to create a tunnel that can sufficiently accommodate the EVH cannula. • Flag these conduits with the surgeon following extraction to ensure that any potential small branch avulsions are carefully repaired with a 6/0 Prolene.
Varicose veins	<ul style="list-style-type: none"> • Preoperative ultrasound of both legs is crucial. • Inform the surgeon early about the conduit quality to prompt consideration of alternative conduits.
Dilated side branches	<ul style="list-style-type: none"> • Dissect the branch from fat distally to ensure enough length to gain sufficient control. • Minimize tension on the branch when dissecting and avoid pulling or rotating at the branch junction. • Use several short 2–3 s buzzes encourages coagulation within branch rather than a single large buzz. In the final pass definitively divide the branch.
Calf veins	<ul style="list-style-type: none"> • Ultrasound mapping can prove invaluable in EVH in the calf. • Careful dissection is of paramount importance. • Decision-making is crucial and if >2 lengths of LSV are required, early consideration should be placed on switching to the contralateral thigh as opposed to the ipsilateral calf, especially in less experienced operators.

EVH: endoscopic vein harvest; LSV: long saphenous vein.



Video 1: Approaching challenging patient factors and problematic venous anatomy during endoscopic vein harvesting.

open harvest to pursue haemostasis. Big side branches also increase the risk of carbon dioxide embolism. When approaching these dilated side branches, it is crucial to dissect the branch from fat distally to ensure enough length to gain sufficient control. The operator must be careful to minimize tension on the branch when dissecting and avoid pulling or rotating at the branch junction. The use of several short 2–3 s buzzes encourages coagulation within branch rather than a single large buzz. In the final pass definitively divide the branch. Some experienced operators recommend increasing the pressure in the insufflator to 13–15 mmHg temporarily to collapse the superficial venous system before dividing dilated branches—however, the potential risk of a carbon dioxide embolism should be mentioned as a word of caution.

Finally, calf veins can be technically difficult during the EVH learning curve. Most operators are trained to perform EVH in the thigh, which affords more space to manoeuvre. In contrast, space is at a premium in the calf. As the operator is gaining experience, ultrasound mapping can yet again aid in identifying LSV course, diameter and side branches that can prove invaluable in EVH in the calf. Careful dissection is of paramount importance.

However, as the operator accumulates experience, decision-making is crucial and if >2 lengths of LSV are required, early consideration should be placed on switching to the contralateral thigh as opposed to the ipsilateral calf [Video 1].

CONCLUSION

Endoscopic vein harvest is being universally adapted due to decreased rates of wound complications when compared to open vein harvest. There is an associated learning curve with EVH, and it can be challenging to adopt it in certain patient cohorts initially. However, we suggest that with appropriate planning and awareness of the challenging patient factors and problematic venous anatomy that exists, the operator can consistently formulate a strategy for ensuring a successful endoscopic harvest. We recommend the use of preoperative bedside ultrasound of the LSV, clear decision-making and closed-loop communication with the surgeon intraoperatively.

Conflict of interest: none declared.

Reviewer information

Interactive CardioVascular and Thoracic Surgery thanks Robert Guidoin, Francesco Zaraca and the other anonymous reviewer(s) for their contribution to the peer review process of this article.

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