Could routine saphenous vein ultrasound mapping reduce leg wound complications in patients undergoing coronary artery bypass grafting?†

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Abstract

A best evidence topic was written in cardiothoracic surgery based on a structured protocol. The question addressed was whether ultrasound mapping of the long saphenous vein (LSV) might reduce leg wound complications by reducing unnecessary leg incisions due to poor quality veins. Altogether, 32 abstracts were identified from the search, from which 5 represented the best evidence to answer the clinical question. The authors, journal, date and country of publication, patient group studied, study type, relevant outcomes and results of these papers are tabulated. Surgical site infections can be extremely distressing for patients, and it is estimated that treating a surgical wound can cost up to £1554 each. Ultrasound mapping of the LSV has been reported to be an accurate way of assessing vein quality preoperatively, reducing unnecessary surgical dissection, theatre time and cost to both the patient and the health service. We identified four studies that showed that ultrasound scanning preoperatively could accurately predict the anatomy and quality of the LSV (correlation coefficient 0.87). One paper showed that ultrasound scanning reduced length of incision ($P = 0.005$), harvest time ($P = 0.04$) and hospital stay and reduced morbidity (although not statistically significant). However, one study found that it could not accurately predict vein wall changes. Evidence from the papers supports the use of preoperative ultrasound assessment of the saphenous vein. Benefits to the patient include a smaller scar, reduced harvest time and minimizing unnecessary incisions.

Keywords: Coronary artery bypass grafting • Ultrasound mapping • Leg wound morbidity • Incision • Long saphenous vein • Preoperative

INTRODUCTION

A best evidence topic was written in cardiothoracic surgery based on a structured protocol. This is fully described in the ICVTS [1].

THREE PART QUESTION

In [patients undergoing cardiac surgery] might [routine saphenous vein mapping] reduce [leg wound complications].

CLINICAL SCENARIO

You have a patient who has triple vessel coronary disease who requires coronary artery bypass grafting, using an internal mammary artery and two saphenous vein grafts. During saphenous vein harvesting, the distal part of the vein seems good and of decent calibre, however, as you continue at the mid calf, the vein bifurcates and narrows into a small unsuitably sized vessel. You continue up the leg and it improves, however, to get the required amount of vein the whole leg is opened. Vascular surgeons routinely ultrasound their patients’ saphenous veins in our hospital, and we wonder if this may have identified this problem.

SEARCH STRATEGY

A structured question was asked: (coronary artery bypass graft, myocardial revascularization, coronary artery bypass operation, cardiac surgery, conduit, saphenous vein, long saphenous vein or great saphenous vein) AND (ultrasound, B mode ultrasound, mapping, duplex ultrasound scan, preoperative vein mapping or ultrasonic imaging) AND (quality, usable, accurate, leg morbidity, wound complication or site selection). Medline (1950-present), EMBase (1980-present), CINHAL (1981-present), and HMIC were searched using these terms. Other search methods included hand-searching of two local academic libraries, searching specialist journals and dissertation abstracts. The search ended when a saturation was reached and when no new evidence was appearing.

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Table 1: This summarizes the articles and key findings that were used in this review

<table>
<thead>
<tr>
<th>Author, date, journal, country Study type (level of evidence)</th>
<th>Patient group</th>
<th>Outcomes</th>
<th>Key results</th>
<th>Comments</th>
</tr>
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<tbody>
<tr>
<td>Luckraz et al., 2008, Interact CardioVasc Thorac Surg, UK [4] Single centre randomised control trial (level 1b)</td>
<td>Sixty-one patients Mapped group: 31 underwent preoperative US mapping of LSV prior to CABG Control group: 30. No US mapping, visual inspection only</td>
<td>Both groups—length of time for harvest (min), length of incision (cm), wound healing (ASEPSIS), degree of pain (pain score), mobilisation (mobility score), length of stay</td>
<td>Incision length mapped (M): 16.8 cm, control (C): 24.1 cm, difference: 7.3 cm (P-value 0.005)</td>
<td>RCT with a large amount of end points. Ultra sound scanning (USS) of the LSV prior to CABG reduces incision length, time of harvest, and hospital stay. Found to correlate well between scanning and intra-op findings</td>
</tr>
<tr>
<td>Cohn and Korver, 2005, Ann Thorac Surg, USA [8] Single centre prospective non-randomised experimental study (level 2b)</td>
<td>Fifty-eight patients undergoing CABG Preoperative USS measuring LSV diameter at 4 points in the leg, calf distal, calf proximal, thigh distal, thigh proximal in anaesthetic room prior to CABG</td>
<td>Vein measurements at proximal and distal calf and thigh, decision changed due to USS</td>
<td>Venous segments examined (464) Normal: 281 (60.6%) Abnormal: 183 (39.4%)</td>
<td>The study shows that a high proportion of abnormalities can be found when performing USS of the LSV, however it is not clear which of these abnormalities indicated changing site of harvest</td>
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<table>
<thead>
<tr>
<th>Location</th>
<th>Calf distal</th>
<th>Calf prox</th>
<th>Thigh distal</th>
<th>Thigh prox</th>
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<tr>
<td>Abnormalities detected</td>
<td>49 (26.8%)</td>
<td>78 (42.6%)</td>
<td>80 (24.7%)</td>
<td>61 (18.8%)</td>
</tr>
<tr>
<td>Normal Segments</td>
<td>31 (16.9%)</td>
<td>25 (13.7%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Continued
A total of 32 abstracts were found, however, once duplicates were removed and inclusion/exclusion criteria were applied, 5 papers were found (see Table 1). Four papers were in English and one in Portuguese that was translated. A number of papers were removed as the patient group consisted of patients undergoing lower limb revascularization. No papers were excluded following methodical assessment, and data were extracted from the five papers. Following contacting relevant authors, only one responded (J. Cohn) who gave an addition paper [2] that was not included in the study as it did not meet the inclusion criteria. Inclusion/exclusion criteria were applied assessing the full text with two appropriate reviewers.
independently assessing all the papers. The papers used are listed in Table 1.

RESULTS

The outcome measures of each study varied slightly, and there are different design types present within the study, therefore meta-analysis is impossible [3]. Three papers agree that the use of preoperative ultrasound can accurately assess the calibre (or diameter) and quality of the LSV, avoiding unusable sections of narrow or diseased veins being unnecessarily harvested [4–6]. This is evidenced by an accurate measurement of the vein via ultrasound compared with the measurement during surgery following distension with a correlation coefficient of 0.87 [4]. It is demonstrated that there is a statistically significant reduction in both the length of incision (P = 0.005) and time of vein harvesting (P = 0.04) when using ultrasound scanning [4]. There was a difference reported between the two groups in wound healing and length of hospital stay, however, it is reported as not statistically significant (P = 0.05).

Barros et al. found that the LSV that were considered appropriate for use with ultrasound assessment matched the visual assessment by the surgeon in theatre. This was confirmed in two cases where the vein was deemed not appropriate via ultrasound but explored anyway (presumably due to lack of conduit elsewhere) and it was found to be of poor quality.

Although ultrasound can be useful in identifying the vein diameter, the study by Giannoukas et al. [7] found that it could not reliably identify fibrotic vein wall changes preoperatively when compared with the histology of the vein.

It was shown by Cohn and Korver [8] that ultrasound could identify abnormalities in the LSV and proved valuable in choosing the location of the vein harvest site, eliminating wasted attempts at harvesting. It is reported that the most common site to start the vein harvest currently is the lower part of the leg [4] and that the most common abnormality was a discontinuous or small-calibre vein most frequently found in the proximal calf area [8].

Of the five papers used, one was a randomized control trial (RCT) [4], and the other four were cohort studies [5–8]. Only one paper includes a power calculation (0.9 using an alpha of 0.01) [4] and has a sample size of 61. Sample sizes of other papers ranged from 38 to 104. The small sample size and lack of more RCTs are limitations of the study.

In the authors’ experience, it is possible to learn and undertake preoperative mapping of the LSV with benefit to patients being demonstrated daily in practice. Surgical site infections can be extremely distressing for patients and can cost up to £1554 to treat each one [9], so any attempt to reduce these complications should be made. With the advent of smaller portable ultrasound devices, the author integrates this as part of the preoperative assessment at the patient’s bedside without the need for expensive departmental scans.

CLINICAL BOTTOM LINE

The outcome measures of the studies included did vary, so direct comparison was not possible. Although the design and quality of the studies varied, this was taken into account. Overall the findings showed that, in all but one case, ultrasound mapping was of benefit in identifying unusable segments of LSV, changing the decision regarding the vein harvest site and reducing the incision length and operative time. One study even found that length of hospital stay was also reduced by 1.5 days in the preoperatively mapped group (although not statistically significant).

Evidence from the papers supports the use of preoperative ultrasound assessment of the saphenous vein. Benefits to the patient are a smaller scar, reduced harvest time and minimization of unnecessary decisions.

Conflict of interest: none declared.

REFERENCES