A retrospective audit of long-term lower limb complications following leg vein harvesting for coronary artery bypass grafting

R. Garlanda, F.A. Frizelleb,*, B.R. Dobbsb, H. Singha

a Department of Cardiothoracic Surgery, Christchurch Hospital, Riccarton Avenue, Christchurch, New Zealand
b Department of General Surgery, Christchurch Hospital, Riccarton Avenue, Christchurch, New Zealand

Received 11 October 2002; received in revised form 30 January 2003; accepted 17 February 2003

Abstract

Objective: To evaluate the prevalence of leg complications following leg-vein harvest for coronary artery bypass grafting. Method: A questionnaire was sent to patients who had coronary artery bypass surgery between January 1993 and December 1998. Questions addressed pain, numbness, infection, swelling and general healing. The relationship between the risk factors of diabetes, peripheral vascular disease, previous fractures/injuries to legs, previous deep vein clots and arthritis affecting the legs with post operative symptoms of pain, numbness, swelling and general healing was explored with multivariate analysis. Results: Of 700 questionnaires sent out 497 were returned, of which 422 (60%) were suitable for analysis. Numbness or tingling related to the wound was reported by 256 (61%), of whom 94 (37%) improved within 3 months. However, 105 (41%) had persistent numbness beyond 2 years. Pain in the wound was reported by 193 (46%), of whom 149 (77%) reported that this had improved by 3 months and only 19 (10%) had pain persisting beyond 2 years. A leg wound infection was reported by 126 (32%) patients, with 82 (65%) of these receiving antibiotics. A total of 336 (87% of 387 responses) described their wound as completely healed at 3 months. Unilateral leg swelling was reported by 175 (41%) with 98 of these (56% of those with swelling) improving by 3 months and 41 (23%) with swelling persisting beyond 2 years. There was no relation of wound problems to examined risk factors diabetes (P-values for numbness 0.31, wound healing 0.15, swelling 0.21, pain 0.22) and peripheral vascular disease (P-values for numbness 0.8, wound healing 0.21, swelling 0.18, pain 0.09). There was insufficient data to comment on the influence of fractures/injuries to legs, previous deep vein clots and arthritis affecting the legs. Conclusions: Wound complications are common following leg vein harvest. Prevalence of infection was higher than has previously been reported. Few people suffer long-term pain from saphenous nerve damage although paraesthesia and swelling were common long-term complications. We did not identify either diabetes or peripheral vascular disease as a risk factor for pain, numbness, swelling or problems with general healing. There is a need for a large multicentre prospective study.

Keywords: Coronary artery bypass grafting; Complications; Saphenous vein; Wound infection

1. Introduction

Despite the recent increased use of arterial conduits for coronary revascularization, the majority of coronary artery bypass grafting (CABG) operations use a venous conduit, harvested from the patient’s legs. The complications associated with varicose vein surgery are well documented in general surgical literature and litigation [1,2]. Few studies, however, have addressed the issue in regard to coronary revascularization surgery, where the wounds are usually longer, and the focus of this part of the operation is obtaining a good conduit and not cosmesis [3–7], and often undertaken by a less experienced member of the team.

The frequency of wound infections are typically under reported by surgeons [8], and many of the other problems such as neuropathy may not be specifically assessed in the follow-up of patients undergoing CABG. Few studies have looked at outcomes beyond six months or used large numbers of patients [3–7]. The current literature is focused on lowering complications through minimally invasive harvest methods [9] or wound closure techniques [10–12].

The aim of the present study was to identify prevalence of long-term complications in the leg wound following vein harvest for coronary artery bypass surgery in our patient group, to look at risk factors for complications and to determine how these problems affect quality of life. The
findings are a baseline from which improvements in techniques can be compared as well as allowing patients to be better informed of likely outcome prior to surgery.

2. Method

A retrospective questionnaire was sent to all living patients in the Canterbury region who received coronary bypass surgery from either Christchurch or Dunedin Hospitals. This covers a single service that is run in two geographical locations involving five different surgeons. Usual practice would be for the registrar (either rotational or training) to harvest the saphenous vein. The technique for vein harvest was that a linear incision is made 1.5 cm above and anterior to the medial malleolus. The saphenous vein is dissected. The incision is then continued upwards, staying over the vein and up to the length required. The vein is harvested without any subcutaneous tissue, taking care not to damage the saphenous nerve. The side branches are tied or stapled. The wound is closed in single or two layers depending on surgeon preference. A suction drain is placed if necessary.

The list of patients was obtained from Clinical Case Mix Data Base and records cross-checked with the hospital computerized patient records system to attempt to exclude deceased patients and confirm current address.

The questionnaire asked for yes/no responses to the presence of specified complications: pain, swelling, general healing, numbness and infection. Symptom duration was determined when present. In the case of infection, treatment with oral or intravenous antibiotics, debridement or skin grafting was ascertained. Demographic data regarding gender, side of wound and date of surgery was also obtained. Return of the questionnaire was anonymous in a pre-addressed and stamped envelope provided (Appendix A).

Ethical approval was obtained through the local ethics committee. Returned surveys were entered onto a spreadsheet in a Microsoft Excel program. Analysis by pivot tables was performed with significance being determined to be $P < 0.05$.

3. Results

Seventy-one percent of surveys were returned (497 out of 700 sent). Of these 422 were suitable for analysis. The median age at time of operation of those replying was 67.6 years (range 27–90). Of these 422 patients 226 had their left leg operated on, 130 had their right and 66 had both. The other 75 were excluded because the patients had either died (22 returned by relatives), had no leg wound (35 harvested from internal mammary and/or radial arteries only) or were insufficiently completed to be usefully included [17]. This was a response rate of 60%, giving sufficient power to the study to calculate prevalence data. Follow up time since surgery ranged from 1 to 6 years with a median of 3.6 years.

The limb complications are outlined in Table 1. A leg wound infection was reported by 126 (26%) of patients, with 82 (65%) of these received antibiotics. 336 (87%) described their wound as completely healed at 3 months. Numbness or tingling related to the wound was reported by 256 (61%), of which 94 (37%) improved within 3 months; however, 105 (41%) had persistent numbness beyond 2 years. Pain in the wound was reported by 193 (46%), of which 149 (77%) reported that this had improved by 3 months and only 19 (10%) had pain persisting beyond 2 years. Unilateral leg swelling was reported by 175 (41%) with 98 (56%) improving by 3 months and 41 (23%) with swelling persisting beyond 2 years.

The risk factors looked at were diabetes, peripheral vascular disease, and previous fractures/injuries to legs, previous deep vein clots and arthritis affecting the legs. The results are summarized in Table 2. Multivariate analysis shows that there is no significant relationship of wound problems to the risk factors of diabetes ($P$-values for numbness 0.31, wound healing 0.15, swelling 0.21, pain 0.22) and peripheral vascular disease ($P$-values for numbness 0.8, wound healing 0.21, swelling 0.18, pain 0.09).

There was insufficient data to comment on the influence of fractures/injuries to legs, previous deep vein clots and arthritis affecting the legs.

4. Discussion

There has been considerable research in regard to many aspects of coronary revascularization, however the knowledge of the complications that result from removing the saphenous vein from the leg to provide a conduit is very limited. The present study would suggest that leg complications are common after leg vein harvest, with most patients having some problem as a direct result of the saphenous vein harvest.

Leg wound infections are common and the importance of them lies not only in the morbidity of the leg infection but also in the recognized association of leg wound infections and sternal wound infections [7,13]. The rate of wound healing with time since CABG

<table>
<thead>
<tr>
<th>Complication</th>
<th>6/52</th>
<th>3/12</th>
<th>6/12</th>
<th>1 year</th>
<th>2 years</th>
<th>4 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain duration</td>
<td>N</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td></td>
<td>76</td>
<td>39.4</td>
<td>39.4</td>
<td>37.8</td>
<td>7.8</td>
<td>5.2</td>
</tr>
<tr>
<td></td>
<td>73</td>
<td>37.8</td>
<td>37.8</td>
<td>7.8</td>
<td>5.2</td>
<td>4.7</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>14.8</td>
<td>14.8</td>
<td>9.0</td>
<td>6.3</td>
<td>7.0</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>11</td>
<td>11</td>
<td>13</td>
<td>8</td>
<td>4.6</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>12</td>
<td>12</td>
<td>13</td>
<td>8</td>
<td>4.6</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Numbness</td>
<td>N</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td></td>
<td>56</td>
<td>21.9</td>
<td>21.9</td>
<td>18.3</td>
<td>8.6</td>
<td>7.4</td>
</tr>
<tr>
<td></td>
<td>38</td>
<td>14.8</td>
<td>14.8</td>
<td>9.0</td>
<td>6.3</td>
<td>7.0</td>
</tr>
<tr>
<td></td>
<td>23</td>
<td>11</td>
<td>11</td>
<td>13</td>
<td>8</td>
<td>4.6</td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>12</td>
<td>12</td>
<td>13</td>
<td>8</td>
<td>4.6</td>
</tr>
<tr>
<td></td>
<td>18</td>
<td>12</td>
<td>12</td>
<td>13</td>
<td>8</td>
<td>4.6</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>12</td>
<td>12</td>
<td>13</td>
<td>8</td>
<td>4.6</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Swelling</td>
<td>N</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td></td>
<td>66</td>
<td>37.7</td>
<td>37.7</td>
<td>18.3</td>
<td>8.6</td>
<td>7.4</td>
</tr>
<tr>
<td></td>
<td>32</td>
<td>18.3</td>
<td>18.3</td>
<td>9.0</td>
<td>6.3</td>
<td>7.0</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>9.3</td>
<td>9.3</td>
<td>13</td>
<td>8</td>
<td>4.6</td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>8</td>
<td>8</td>
<td>13</td>
<td>8</td>
<td>4.6</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>5</td>
<td>5</td>
<td>8</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Wound healing</td>
<td>N</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td></td>
<td>215</td>
<td>55.6</td>
<td>55.6</td>
<td>31.3</td>
<td>9.3</td>
<td>2.8</td>
</tr>
<tr>
<td></td>
<td>121</td>
<td>33.3</td>
<td>33.3</td>
<td>18.3</td>
<td>13</td>
<td>8.6</td>
</tr>
<tr>
<td></td>
<td>36</td>
<td>11</td>
<td>11</td>
<td>13</td>
<td>8</td>
<td>4.6</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>3.8</td>
<td>3.8</td>
<td>13</td>
<td>8</td>
<td>4.6</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
infections in clean wounds is supposed to be low; however, recent studies have shown it to be higher than previously reported in many types of surgery, and most of them occur following discharge [8]. The definition of wound infection is clearly important, as the tighter the definition, the lower the rate of wound infection. The term surgical site infection is the current term used and recognizes the important difference of a deep infection versus a simple superficial infection. In this study, however, the definition of wound infection used is very loose, with its retrospective diagnosis relying on patients’ subjective recollection, and without records of bacterial colonization or indicators of infection. There could be a problem with data accuracy with the retrospective nature of this study, due to a possible increase due to patients including erythema, or any wound complication, being classified as a wound infection. It may also lead to a decrease due to the failure of patients to remember complications.

The rate of post-operative antibiotic use for the treatment of wound infections supports the reported rate of wound infections by patients and was higher than we expected. Another explanation of the high rate of post-operative antibiotic use might be overprescribing by general practitioners or hospital doctors of antibiotics for erythema, and antibiotic use was not predicted by the recognized risk factors [8].

We found that 0.05% of wounds did not heal. A study of 1090 CABG procedures found that 36 (3.5%) did not heal and 54 (5%) experienced a limb-threatening lower limb extremity complication [17]. The risk factors identified in that study for wound problems was increased age, female gender, diabetes, and longer pump time [17]. Chronic lower extremity ischaemia from peripheral vascular disease was a major contributing factor for the development of wound problems, being identified as a problem in 23/36 cases; however, it was only recognized pre-operatively in 10/36 [17]. Another study has found a very similar result [18].

Two-thirds of patients experienced numbness for some period of time after the operation, and half of these had numbness persisting beyond 6 months. Only a small number had pain persisting beyond 6 months indicative of neuralgia. A previous prospective study of post-operative neuralgia in the legs after saphenous vein/CABG from Manchester (UK) found that at 6–8 weeks from surgery 13/50 had areas of anaesthesia, 4/50 had hyperaesthesia and 9/50 had pain [3]. At 14–18 months they still found 4/37 had anaesthesia, 5/37 had hyperaesthesia (an increase of 1 from the 6–8 weeks post-operative assessment) and 3/37 had pain [3]. They also found that repairing the leg incision in single layer as compared with two layers better preserved cutaneous sensation [3]. The authors comment that they believe this relates to neuropraxia of the saphenous nerve trunk and its branches in the subcutaneous tissues, with subcutaneous sutures [3]. Similar results were observed from a study in Sheffield were 32 patients (39 lower limbs) were followed prospectively and it was found that 35/39 (90%) of lower limbs examined showed some degree of anaesthesia 3 days post-operatively and 23/39 (72%) at a mean follow-up of 20 months [4]. The mean area of sensory loss was 53.4 cm² at 3 days post-operative, and at 20 months this had reduced to 31.7 cm² [4]. Hyperaesthesia and pain were infrequently noted [4].

We did not study the incidence of the various wound complications in regard to how the wounds were closed. A number of studies have examined the role of either two-layer (with subcutaneous layer) compared with single-layer closure or staples [10–12]. Overall, the findings support a single-layer closure and not using staples as the most favourable.

Retrospective studies such as the present one are always

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>Total N</th>
<th>Infected</th>
<th>Numbness</th>
<th>Pain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>Diabetes</td>
<td>83</td>
<td>20</td>
<td>24.1</td>
<td>26</td>
</tr>
<tr>
<td>PVD</td>
<td>25</td>
<td>13</td>
<td>52.0</td>
<td>18</td>
</tr>
<tr>
<td>Leg Injury</td>
<td>24</td>
<td>4</td>
<td>16.7</td>
<td>11</td>
</tr>
<tr>
<td>DVT</td>
<td>17</td>
<td>8</td>
<td>47.1</td>
<td>8</td>
</tr>
<tr>
<td>Arthritis</td>
<td>57</td>
<td>19</td>
<td>33.3</td>
<td>26</td>
</tr>
</tbody>
</table>

Table 2 Incidence of complications related to risk groups

Risk factor Total N Infected Numbness Pain
<table>
<thead>
<tr>
<th></th>
<th></th>
<th>n</th>
<th>%</th>
<th>n</th>
<th>%</th>
<th>n</th>
<th>%</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetes</td>
<td>83</td>
<td>20</td>
<td>24.1</td>
<td>26</td>
<td>31.3</td>
<td>39</td>
<td>47.0</td>
<td>29</td>
<td>34.9</td>
</tr>
<tr>
<td>PVD</td>
<td>25</td>
<td>13</td>
<td>52.0</td>
<td>18</td>
<td>72.0</td>
<td>17</td>
<td>68.0</td>
<td>14</td>
<td>56.0</td>
</tr>
<tr>
<td>Leg Injury</td>
<td>24</td>
<td>4</td>
<td>16.7</td>
<td>11</td>
<td>45.8</td>
<td>14</td>
<td>58.3</td>
<td>11</td>
<td>45.8</td>
</tr>
<tr>
<td>DVT</td>
<td>17</td>
<td>8</td>
<td>47.1</td>
<td>8</td>
<td>47.1</td>
<td>7</td>
<td>41.2</td>
<td>11</td>
<td>64.7</td>
</tr>
<tr>
<td>Arthritis</td>
<td>57</td>
<td>19</td>
<td>33.3</td>
<td>26</td>
<td>45.6</td>
<td>33</td>
<td>57.9</td>
<td>33</td>
<td>57.9</td>
</tr>
</tbody>
</table>
limited by the recollection of the participants. This could be a major source of bias, as e.g. excluding deceased patients potentially excludes a patient group who could have had poorer outcomes. The data that are provided by this retrospective study should as such be an underestimate of lower limb complications following venous conduit harvesting.

Endoscopic leg vein harvesting may reduce vein harvesting problems. The concerns with endoscopic harvest have been increased harvest time, additional expense and the potential for vein trauma. A number of prospective randomized trials and retrospective cohort studies have shown less leg wound complications; however, speed of harvest was significantly slower [19–24]. The quality of the veins removed appears excellent [20,25]. The difficulty with the endoscopic technique is the learning curve and cost of change; however, in the long term the technique may well prove to be superior. There is little written about wound issues and the use of radial artery conduits, other than the neurological consequences [25].

It is clear from this study that lower limb vein harvesting is a significant source of morbidity. Given the poor quality of data available, however, there is a need for a large prospective study.

References


Appendix A. Questionnaire

please circle correct response

1. What date did you have your bypass surgery? ________________

2. Which leg was the vein taken from? Right / Left

Did you have varicose veins? No / Yes

4. Prior to surgery did you have problems with ulcers or skin healing on the legs? No / Yes

5. Was the leg wound painful? No / Yes

If so, how long did it last? (circle one)
Less than 6 weeks
6 weeks to 3 months
3 to 6 months
6 months to a year
1 to 2 years
2 to 4 years
current

Is this controlled by medication? No / Yes

Did you have numbness or tingling around the wound? No / Yes

If so, how long did it last? (circle one)
Less than 6 weeks
6 weeks to 3 months
3 to 6 months
6 months to a year
1 to 2 years
2 to 4 years
current

7. Did you have swelling of the operated leg compared to the other leg? No / Yes

If so, how long did it last? (circle one)
Less than 6 weeks
6 weeks to 3 months
3 to 6 months
6 months to a year
1 to 2 years
2 to 4 years
current

Was the wound infected? No / Yes
If so, requiring (circle one):

- antibiotic tablets
- antibiotic injections
- further surgery to clean the wound
- skin grafting

9. How long did it take the wound to heal? (circle one)

- Less than 6 weeks
- 6 weeks to 3 months
- 3 to 6 months
- 6 months to a year
- 1 to 2 years
- 2 to 4 years
- not healed yet

If you had problems with the any/some of the above complications please indicate the extent it limited your activities and for how long:

Try to indicate only if the leg wound was the MAIN cause for being limited ie NOT due to shortness of breath, chest pain etc - otherwise indicate the last option

(circle one)

No restriction
Mobile out of the house, restricted from some activities
Confined to house and surrounds, able to do most activities unaided
Bedridden

Restricted from other cause (if so, what?)

Do you have? (circle one):

- diabetes
- peripheral vascular disease
- previous fractures/injuries to legs
- previous deep vein clots
- arthritis affecting the legs

Thank-you very much for completing the survey, please return it in the envelope provided as soon as possible.