

# Necrotizing Fasciitis Following Endoscopic Harvesting of the Greater Saphenous Vein for Coronary Artery Bypass Graft

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## ABSTRACT

The greater saphenous vein (GSV) remains the most commonly harvested conduit for revascularization in coronary artery bypass grafting (CABG). Published literature shows that minimally invasive vein harvesting techniques have a significantly lower incidence of wound infection rates than conventional open vein harvesting techniques have. We report a case of necrotizing fasciitis, an infection with a mortality rate of 30% to 50%, after endoscopic harvesting of the greater saphenous vein to be used as a conduit in a CABG procedure. Though minimally invasive vein harvesting techniques have advantages of smaller incisions and a decreased overall rate of wound infection, clinicians should be aware of this potentially lethal infection that may occur.

**Key Words:** Necrotizing fasciitis, CABG, GSV harvesting.

## INTRODUCTION

Coronary artery bypass grafting (CABG) is the most common operation in cardiac surgery. The greater saphenous vein (GSV) remains the most commonly harvested conduit for revascularization in CABG surgery. Multiple studies in the literature have examined lower extremity infection rates after vein harvesting. Studies show a clear advantage of minimally invasive vein harvesting (MIVH) techniques with harvest surgical site infection of 3% to 13%<sup>1,2</sup> compared to 12% to 29%, and even as high as 43.8% with conventional vein harvests (CVH).<sup>3,4</sup> Though technically more difficult and time consuming, MIVH has been endorsed by many over CVH. We reviewed 19 randomized controlled trials that compared the incidence of leg wound infection after minimally invasive and open saphenous vein harvesting,<sup>5–23</sup> (Table 1) where almost all studies showed the superiority of the endoscopic technique over the open one and its almost absolute safety.

Necrotizing fasciitis is a rare but serious and often lethal infection of the soft tissue, characterized by rapid and progressive necrosis of subcutaneous fat, superficial fascia with relative sparing of skin and underlying muscles. Smoking, diabetes, intravenous drug use, peripheral vascular occlusive disease, and consuming diseases are predisposing factors, but the disease can also develop in otherwise healthy patients. Necrotizing fasciitis can occur after surgical procedures, minor trauma, trivial scratches, or even in apparently intact skin.

The exact pathogenesis of the disease is not completely understood, but it is believed to be the result of a synergistic and multi-bacterial infection, with  $\alpha$ -hemolytic and  $\beta$ -hemolytic streptococci having the most important role.<sup>24</sup> Clinical presentation can vary, but includes fever, systemic toxicity, and pain out of proportion to clinical findings. Diagnosis can be challenging because the disease does not present with a typical early clinical course. Diagnosis is best made after surgical debridement has already been performed. Delays in diagnosis result in poor clinical outcomes with a mortality rate of 30% to 50%.<sup>25</sup> In addition to the loss of function and life incurred by this condition, the financial healthcare cost could be deleterious indicating the great importance of best efforts in avoiding it.

Department of Surgery, Staten Island University Hospital, New York, USA; Presented as an oral presentation at the 19<sup>th</sup> SLS Annual Meeting and Endo Expo in New York, New York, USA. September 1–4, 2010.

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DOI: 10.4293/108680811X13022985131453

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**Table 1.**

Review of Randomized Controlled Trials Comparing Leg Wound Infection Rates After Minimally Invasive and Open Saphenous Vein Harvesting for Coronary Artery Bypass Grafting

Authors	Date	MIVH/CVH <sup>a</sup>	Conversion	Follow-up (Days)	Leg Infection %	
					MIVH <sup>a</sup>	CVH <sup>a</sup>
Dusterhoft et al <sup>5</sup>	2001	128/127	Not recorded	14 Postdischarge	3.2	9.4
Hayward et al <sup>6</sup>	1999	50/50	22%	42 Postdischarge	10	12
Fabricius et al <sup>7</sup>	2000	62/30	5%	3 & 6 Postop	3.2	30
Folliguet et al <sup>8</sup>	1998	30/30	Not recorded	7 & 10 Postop	3.3	3.3
Puskas et al <sup>9</sup>	1999	47/50	6%	28 Postop	4.2	4
Carpino et al <sup>10</sup>	2000	66/66	10.6%	14 Postdischarge	4.5	19.7
Tevaerai et al <sup>11</sup>	1997	15/15	Not recorded	7 Postop	0	13.3
Allen et al <sup>12</sup>	1998	54/58	5.6%	42 Postop	1.9	10.3
Kiaii et al <sup>13</sup>	2002	69/65	Not recorded	42 Postop	4.1	22.2
Black et al <sup>14</sup>	2002	22/18	18%	42 Postop	4.5	27.8
Cisowski et al <sup>15</sup>	2000	45/15	Not recorded	7 Postop	66.6	26.6
Bonde et al <sup>16</sup>	2004	30/30	6%	42 Postop	0	13.3
Schurr et al <sup>17</sup>	2002	80/60	6%	5 Postop	0	13.3
Isgro et al <sup>18</sup>	1999	103/105	2%	Not recorded	1.9	8.6
Perrault et al <sup>19</sup>	2004	17/15	Not recorded	Not recorded	0	6
Wang et al <sup>20</sup>	2005	106/119	Not recorded	42 Postop	20.8	41.2
Yun et al <sup>21</sup>	2005	100/100	3%	30 Postop	7.4	19.4
Lai et al <sup>22</sup>	2006	588/985	Not recorded	Not recorded	0.5	2.74
Andreasen et al <sup>23</sup>	2008	66/63	14%	30 Postop	3	27

<sup>a</sup>MIVH=minimally invasive vein harvesting; CVH=conventional (open) vein harvesting.

All reports emphasize the importance of early diagnosis and radical surgical debridement, followed by administration of broad-spectrum antibiotic agents and intensive care with aggressive fluid replacement. Hyperbaric oxygen (HBO) may be important as an adjunctive measure in the treatment of necrotizing fasciitis. The combination of early, radical debridement and early administration of HBO has reduced the mortality rate.<sup>26,27</sup>

Historically, necrotizing fasciitis was first mentioned by Hippocrates around the fifth century AD as a complication of erysipelas. In 1871, Joseph Jones provided the first description of the disease, which he encountered as a necrotizing soft-tissue infection of the extremities afflicting members of the confederate army during the Civil War. Meleney<sup>28</sup> published a comprehensive report describing 20 cases of hemolytic *Streptococcus* gangrene characterized by rapid onset irregular, indistinct erythema, blisters, and bullae. In 1918, Pfanner<sup>29</sup> described a similar

entity as “necrotizing erysipelas,” attributing it to  $\beta$ -hemolytic streptococci. In 1952, Wilson<sup>30</sup> published an article on the entity, which coined the term *necrotizing fasciitis*.

CVH results in a long surgical wound over the extremity. Infections are usually apparent early along the suture line. MIVH harvests the saphenous vein through several small incisions. This results in a closed space where infection may not be so apparent initially. We report a case of necrotizing fasciitis of the lower limb in a patient following harvesting of the patient’s saphenous vein for use in a coronary artery bypass graft.

**CASE REPORT**

A 47-year-old man, who underwent an off pump, 4-vessel, coronary artery bypass graft, presented 3 weeks postoperatively with right lower leg pain, swelling, and redness associated with a low-grade fever but no fluctuance. He

has a past medical history significant for systolic congestive heart failure, coronary artery disease, myocardial infarction, type II diabetes mellitus, hypertension, and hypercholesterolemia. The patient is a chronic heavy smoker of 3 packs to 4 packs per day for 25 years.

He was initially treated for symptoms and discharged home on a second-generation cephalosporin. The patient returned 8 days later, having completed the antibiotic course, complaining of significant worsening of symptoms though he had no fever or chills. On physical examination, there was a marked increase in tenderness and erythema, warmth, swelling of his right leg; purulent drainage was expelled from the endoscopic incision, and a small distal eschar. The patient was found to have hyperkalemia; ACE inhibitors and Aldactone were stopped. There was no leucocytosis. Duplex scan revealed superficial thrombophlebitis. Drainage of the wound was done at this point, and this was repeated on a few day intervals after that. Because the patient was afebrile with the absence of leucocytosis, this was felt to be an adequate initial treatment accompanied by intravenous antibiotics. With no acceptable improvement in wound healing, the decision was made for radical surgical debridement.

When seen for consultation by the plastic surgery service, the patient had developed significant additional skin necrosis and erythema (**Figure 1**), though the patient was still afebrile without leucocytosis. Upon exploration of the wound, extensive necrosis was seen subcutaneously leading to immediate suspicion of necrotizing fasciitis. Radical debridement was performed. Gram staining of tissue ex-



**Figure 1.** Initial postoperative presentation of the patient; skin necrosis surrounded by areas of erythema is noted.

udates was positive for few polymorph nuclear cells, many gram-negative rods, while wound culture showed many *Hafnia alvei*, few *Enterococcus fevalis*, and few *Staphylococcus aureus*. The specimen consisted of multiple fragments of necrotic tissue, with foci of necrosis, showing connective tissue with extensive necrosis and necro-inflammatory debris, as well as acute osteomyelitis affecting the small bone fragments (**Figure 2**).

A second debridement was done 2 days later, creating an open wound composed of most of the medial aspect of the right leg surface, after which the patient was begun on a 2-week course of intravenous antibiotics followed by a 10-day course of oral antibiotics, and the patient was discharged home on hospital day 14 (**Figure 3**). Repeated dressing was done thereafter allowing the wound to granulate over the next 3 months.

When adequate granulation tissue was achieved, the wound was once again debrided (**Figure 4**), and the entire defect was covered with a split-thickness skin graft (**Figure 5**). The skin graft continued to heal until the wound was covered (**Figure 6**).

## DISCUSSION

The patient in this case displayed necrotizing fasciitis, following a coronary artery bypass graft harvesting of his saphenous vein. This patient's condition was caused by a polymicrobial infection, with few *Staphylococcus aureus*, few *Enterococcus fevalis*, and many *Hafnia alvei*. While *Staphylococcus* and even *Enterococcus* have been found in the literature to contribute to necrotizing fasciitis, there



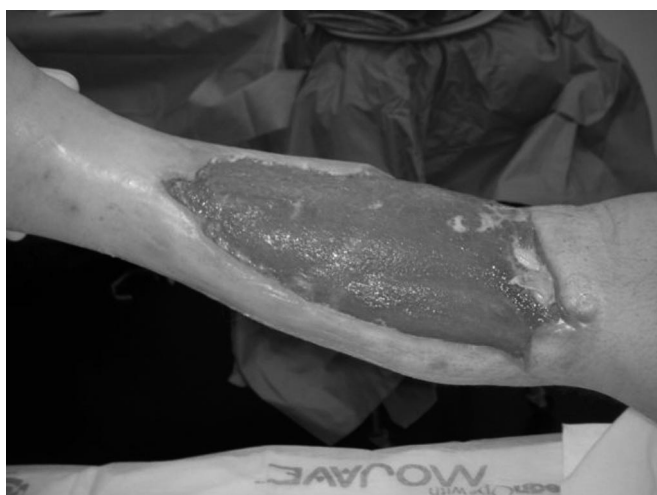
**Figure 2.** Wound presentation after initial radical debridement of necrotic and infected tissues.



**Figure 3.** Wound presentation after second debridement done 2 days after the initial debridement.



**Figure 5.** Postoperative view of meshed split thickness graft used to cover the wound surface.



**Figure 4.** Healthy granulation tissue throughout the wound seen after 3 weeks of repeated dressings and wound care.



**Figure 6.** Final wound outcome after complete take of the graft with full epithelialization of the skin.

are no reports in the literature of *Hafnia alvei* having a significant role in the disease state.

Reports of necrotizing fasciitis following the endoscopic harvesting of a saphenous vein for a CABG in a sterile setting are exceedingly rare, with no similar cases being reported in the literature. It starts with a picture of simple wound infection, but then spirals to be one of the most dangerous wound infections with a high incurred cost of life and a financial burden on the healthcare system.

The average total cost of hospital stay following CABG with endoscopic MIVH in one institution has been quantified at \$38 639 compared to \$37 169 following CVH.<sup>31</sup>

The cost of readmission for wound complications (mainly leg wound infection) has also been estimated at \$171 per patient.<sup>32</sup> Despite this, the cost of MIVH looks to be higher than the cost for CVH. The cost (total patient charges) incurred for treatment of necrotizing fasciitis could be deleterious, being very variable. Depending on the severity and mode of treatment used, it can be anywhere from US \$1025 to \$514 889 with a median of \$54 533 and a mean of \$34 887; similar costs have also been reported in other countries.<sup>33,34</sup>

A systematic review<sup>35</sup> with grade A evidence showed that the wound infection rate was 3% in endoscopic harvesting compared to 14% for CVH. The study reviewed 14 studies

collecting prospective data from 1997 to 2002. The total number of pooled subjects was 1527, of which 801 (52%) had MIVH and 726 (48%) had CVH. Absolute risk reduction of 7.2% observed in that study meant that for MIVH, every 14 patients that undergo the minimally invasive procedure prevent one patient from having a leg wound infection. The study suggested that minimally invasive vein harvesting for CABG results in much lower infection rates owing to reduced traumatic injury to surrounding tissues, fewer disturbances to skin vascularity and reduced extent of skin flap creation. None of the patients included in that systematic review was reported to have a full-blown picture of necrotizing fasciitis as described in our case report. This implies the rarity of the case, yet our report underpins the fact that it could still happen and that all measures should be taken to avoid its occurrence. Many of these patients have multiple medical issues and may not present with traditional findings of elevated temperatures and leucocytosis. Because of the potential for a closed space infection, aggressive treatment should be started when this type of infection is clinically suspected.

## CONCLUSION

Despite the fact that endoscopic saphenous vein harvesting is a safe procedure, necrotizing fasciitis is a potential life-threatening complication of this procedure. One should be cognizant of the atypical presentation of necrotizing fasciitis in high-risk patients. In addition to a high mortality rate, this infection may lead to a great impact on the quality of the patient's life as well as financial costs to the healthcare system.

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