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Novel technique of vein harvesting for reversed saphenous vein bypass graft

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Abstract

Background
The technique of harvesting the great saphenous vein for bypass procedures may affect the results of the procedure. We describe a simple modification of the vein harvesting technique, which consists of leaving the saphenofemoral junction intact after completion of the proximal anastomosis. This modification allows blood to flow into the vein as soon as the proximal anastomosis is completed, thereby shortening the vein warm ischemia time and allowing the vein to distend with blood rather than saline, under physiologic pressure. This modification aims at improved vein integrity during harvesting and therefore improved graft patency.

Patients and methods
In this study, 30 patients were subjected to a femoral distal bypass using our modified technique. In this technique, we create a loop with the great saphenous vein being left in continuity at the saphenofemoral junction and the distal end anastomosed to the common femoral artery at the take-off of the bypass graft. The saphenofemoral junction is then ligated and cut after exposure of the distal target arterial exposure and preparation.

Results
A total of 30 consecutive patients, comprising 16 males and 14 females, were subjected to the technique. Among them, diabetics were 92%, hypertensive 81%, hypercholesteremic 67%, and 60% smokers. Their mean age was 55 years. No adverse effects were observed as a result of using this modification, neither in the form of infection or bleeding nor the increased incidence of cardiac or central complications. A review of the results of 30 consecutive bypass operations performed with the distal anastomosis located at the distal tibial arteries (ankle level) or dorsalis pedis artery using this modified technique showed that the primary 30-day patency rate was 93.1%, at 6 months was 90%, and at 1 year was 87%. Graft patency was documented using a color-flow Duplex scan.

Conclusion
The use of this modification provides nonpressurized saphenous vein dilation and adequate visualization of bleeding tributaries bleeding under vision, thus adequately controlling them before tunneling, hence minimizing postoperative hematoma with the concomitant possibility of infection.

Keywords: Bypass, graft, great saphenous vein, modified

Introduction

The technique of harvesting the great saphenous vein for bypass procedures may affect the results of the procedure. We describe a simple modification of the vein harvesting technique, which consists of leaving the saphenofemoral junction intact after completion of the proximal anastomosis. This modification allows blood to flow into the vein as soon as the proximal anastomosis is completed, thereby shortening the vein warm ischemia time [1], and allowing the vein to distend with blood rather than saline, under physiologic pressure. This modification aims at improved vein integrity during harvesting and therefore improved graft patency.

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The importance of vein harvesting technique in terms of its effect on immediate and long-term vein graft patency has been previously documented [2]. Techniques that cause the least damage to the vein graft endothelium during the process of harvesting may contribute to the improvement of vein graft patency [3]. We describe a modification of the vein harvesting technique, which may favorably affect the outcome. This technique is applicable to the great saphenous vein being harvested for ipsilateral or contralateral infrainguinal bypass using a reversed vein technique.

Aim

The aim is to express a modified technique of vein harvesting that maintains the integrity of the vein and hence enhances the results.

Patients and methods

A prospective noncomparative interventional case series was conducted from March 2018 until March 2019 at Greek Hospital Al-Abassia. All patients received a thorough explanation of the study design and aims. Study participants gave an informed consent before initiation of any study-related procedures. This study enrolled 30 patients who were subjected to femoral distal bypass using our modified technique.

Inclusion criteria

The following were the inclusion criteria:
(1) Adequate great saphenous vein more than 3 mm diameter.
(2) No superficial thrombophlebitis.
(3) No heart failure, EF(Ejection Fraction) more than 60.
(4) Adequate distal runoff.

Exclusion criteria

The following were the exclusion criteria:
(1) Nonadequate GSV (Great Saphenous Vein) and/or with superficial thrombophlebitis.
(2) EF less than 60.
(3) No adequate runoff.

Technique

The GSV was assessed and mapped using vascular Duplex with a linear probe. Duplex was used to assess the diameter of GSV, and to exclude superficial thrombophlebitis, which was mapped and its course marked. The great saphenous vein to be harvested is dissected using the standard technique. We routinely used sharp dissection, and a no-touch technique: the vein itself is not held by any instrument throughout its dissection to minimize trauma. After dissection of the great saphenous vein to the required length for the bypass, its tributaries are transected between 3/0 silk ties, and the vein mobilized from its bed. The distal end of the vein is transected distally above a ligature. The saphenofemoral junction is not ligated. The vein is then gently injected with heparinized saline to which is added a vasodilator. No attempt is made to inject the saline forcibly. Unligated tributaries will leak saline and are now identified and ligated. After systemic heparinization, the distal end of the vein is then anastomosed to the inflow artery using the standard technique. For example, if the common femoral artery is chosen as the inflow artery, the distal end of the great saphenous vein is anastomosed to the common femoral artery. The clamps are removed from the site of proximal anastomosis, thus letting blood to distend the great saphenous vein at physiologic arterial pressure. Our modification consists of not interrupting the proximal end of the great saphenous vein (the saphenofemoral junction), thereby leaving the saphenous vein to function temporarily as a conduit for arteriovenous fistula (Figure 1).

The whole length of the vein will gradually distend with blood, thus alleviating any chance of endothelial damage and stenosis after that within the graft. This is the same reason why we disfavor the use of valvotomy in *in situ* bypass grafting as it in our experience might induce damage of endothelium and stenosis within the graft and along the line of the bypass. Minor tributaries that have been missed on saline injection will start to bleed; therefore, they will be easily identified and ligated or sutured. While the site of the distal anastomosis is being dissected, the vein is covered with warm wet towels (to minimize cold ischemia time) and left to function as an arteriovenous fistula connecting the inflow artery to the common femoral vein through the saphenofemoral junction. On completion of dissection of the site of distal anastomosis, the saphenous vein is then re-examined. An adequate vein would have a palpable pulse all through, from the proximal anastomosis up to the saphenofemoral junction. A good caliber vein (≥3 mm) would even have a palpable thrill indicating high flow. The pulse may be not only palpable but also visible. Operative Doppler would show a high fistula flow. The saphenofemoral junction is then ligated. The vein is then tunneled after marking to avoid twist, with the knee extended to avoid shortening, and the distal anastomosis is performed using the standard technique. This technique could be applied for any artery chosen as an inflow artery, such as the ipsilateral or contralateral common femoral, superficial femoral, or popliteal arteries. All patients received aspirin postoperatively. None of the patients received oral anticoagulation.

Results

The present study was conducted on 30 consecutive patients (16 males and 14 females) who were subjected to the

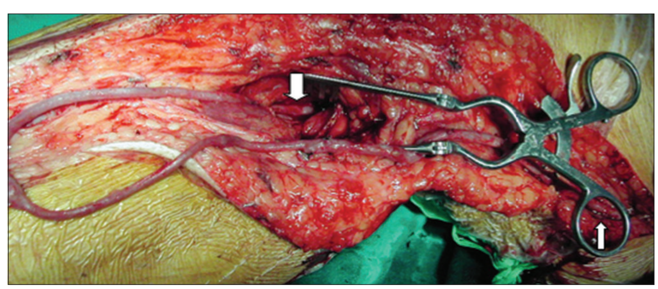

Figure 1: Great saphenous vein anastomosed to the common femoral artery (large arrow) while the saphenofemoral junction is left intact (small arrow).

technique. Among the patients enrolled in this study, diabetics were 92%, hypertensive 81%, hypercholesteremic 67%, and 60% of smokers. Their mean age was 55 years.

No adverse effects were observed as a result of using this modification, neither in the form of infection or bleeding nor the increased incidence of cardiac or central complications. Despite creating a temporary arteriovenous fistula (our modified temporary step), we did not observe significant hemodynamic changes in any of the patients, probably because the fistula was of short duration.

A review of the results of 30 consecutive bypass operations performed with the distal anastomosis located at the distal tibial arteries (ankle level) or dorsalis pedis artery using this modified technique showed that the primary 30-day patency rate was 93.1%, 90% at 6 months, and 87% at 1 year. Graft patency was documented using a color-flow Duplex scan. All 30 operations were performed for critically ischemic limbs, manifested by tissue necrosis or gangrene.

Discussion

Our modification consists of leaving the saphenofemoral junction intact after completion of the proximal anastomosis, thereby allowing the saphenous vein to function as a conduit for temporary arteriovenous fistula, connecting the inflow artery to the common femoral vein. This simple modification in the technique for reversed saphenous vein bypass has several advantages:

First, it shortens the warm ischemia time of the vein because once the proximal anastomosis is completed, pulsatile blood flow will fill the vein, therefore cutting the warm ischemia time to half, compared with the standard technique where the vein is not perfused with pulsatile blood flow until both proximal and distal anastomoses are completed. A long warm ischemia time has been shown to adversely affect endothelial integrity.

Second, it allows distension of the vein under normal physiologic arterial pressure, unlike the standard technique where the vein is distended with heparinized saline using hand pressure. Using a vasodilator added to the saline also is vital to improving the results[4] as agreed upon by Sottiurai and colleagues. Excessive vein distension has been shown to cause intimal damage [5,6], which may precipitate to early thrombosis or late intimal hyperplasia [7]. Our modification, therefore, by ensuring distension under physiologic pressure [8], helps prevent this complication [9–12].

Third, any diseased part of the vein, such as a stenotic segment, will be easily identified during the stage where the vein is functioning as an arteriovenous fistula, therefore allowing the surgeon to rectify the problem and to test it again before performing the distal anastomosis [13].

Finally, this method saves blood loss, which occurs during testing of the vein after completion of the proximal anastomosis, because all the blood used for testing will pass into the circulation through the common femoral vein, and none will be lost. The use of this modification led to 30-day primary patency rate that compares favorably to previously published results of the bypass to the ankle and pedal vessels.

Ethical approval statement

Ethical Committee approval was taken.

Conclusion

Although the primary 1-month, 6-month, and 1-year results of this technique are satisfactory, further prolonged Duplex follow-up studies are needed. Moreover, comparative randomized prospective studies are needed to compare this technique to the classic technique.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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