An easy way to facilitate manipulation of veins during coupler device usage

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ABSTRACT

Venous thrombosis is the primary reason for flap loss and classical venous anastomoses are hand-sewn under an operating microscope. Technical errors may result in damage at the anastomosis due to an inadequate eversion of the vessel walls, the introduction of unequal bite distances or endothelial injury at the suture sites, causing increased thrombotic potential. Since the introduction of microvascular free-tissue transfer, surgical technique modifications and new devices have become highly sought after as a means for improving overall outcome. Vessel couplers are one such device, with pins and coupling rings providing an alternative to traditional hand-sewn anastomoses. In this article, we describe a technique that we used to decrease vessel wall handling and minimize trauma, which involves dividing the vessel into three leaflets and then excising the excess vessel wall.

Key words: Free flaps, venous thrombosis, microsurgery

Introduction

Increased technical expertise and experience has reduced the failure rate of free flaps to as low as 1.3% [1]. However, flap failure remains a devastating event for the patient and necessitates additional intervention. The main causes of microvascular flap failure involve multiple factors, including hematoma, arterial thrombosis, and venous thrombosis [2].

Performing venous anastomoses is one of the most challenging parts of microsurgery, and flap loss from venous thrombosis is more common than other causes [3]. Technical errors may result in damage at the anastomosis due to inadequate eversion of vessel walls, the introduction of unequal bite distances or endothelial injury at the suture sites, causing increased thrombotic potential [4]. There is a steep learning curve for performing microsurgical venous anastomoses, which requires much practice to achieve adequate proficiency [5]. Venous couplers have recently emerged as a highly effective and useful device in reconstructive microsurgery. The use of anastomotic microvascular devices has gained in popularity over the last two decades as an alternative to classical hand-sewn anastomoses. Vessel ends are delivered through opposing coupler rings and everted on pins; the coupler device then approximates the rings to each other, which remain in place and compress the vessel walls. As in hand-sewn anastomoses, frequent vessel handling and repetative manipulation...
of the vessel wall during the coupling process may cause anastomotic failure. Here, we describe a technique to decrease vessel wall handling and facilitate manipulation by making 3 axial incisions and preparing three leaflets, which we excise after securing the vessels on the coupler device rings.

**Technical Details**

The application of the venous coupler device in microsurgery has previously been described in the literature [6]. The recipient and donor vessels are divided and superficial adventitia is trimmed off. The lumens are visualized for any debris or the presence of any valves that may interfere with anastomosis. After irrigation of vessels with heparinized saline, the venous sizer (Synovis) is then used and the appropriate size coupler is chosen. First, the flap vein is passed through the lumen of the coupler, with the vein being passed more than 3 to 4mm than usual. The first two axial incisions were made along the vessel wall between two pins. The created leaflet is secured over the pins. The other incision is made between the remaining four pins and these leaflets are secured over the two pins. Lastly, the excess vessel wall leaflets are trimmed to the depth of the incisions (Figures 1 and 2). The same process is then performed on the recipient vein. The lumens are inspected again and irrigated with heparinized saline. The coupler is then closed by turning the handle, and the rings are squeezed with a mosquito forceps to ensure tight engagement (Figures 3, 4, 5, and 6).

**Discussion**

The continuing advances in understanding of free flaps and surgical techniques have made free-tissue transfer a reliable technique, with reported flap survival rates ranging between 95 and 99% [7]. However, flap failure remains a devastating event for the patient and necessitates additional intervention. Venous thrombosis is the primary reason for flap loss and classical venous anastomoses are hand-sewn under an operating microscope. Many innovative devices designed to facilitate microsurgical anastomoses have been evaluated for use, including arterial staplers, arterial couplers, and venous couplers [8]. The anastomotic venous coupler is a safe and effective device to facilitate microvascular anastomoses, which can be performed with a high de-

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Figure 1. Creation of leaflets. Three leaflets were created by making three incisions along the vessel. The incision depth was adjusted accordingly each time.

Figure 2. Engaging of leaflets. Each leaflet was secured over the two pins.

Figure 3. Completion of vessel engagement and trimming. Vessel was completely secured over the pins; the remaining parts of the vessel were trimmed.
An easy way using a coupler device

The venous coupler ring-pin system was first described in the literature by Nakayama in 1962. The Unilink system (3M) is based on the same concept that is now known as the Microvascular Anastomotic Coupler System (Synovis Micro Companies Alliance, Birmingham, AL) [9]. The venous coupler device has evolved as a highly effective and easy-to-use tool in microsurgical reconstruction, especially with vessel anastomoses of less than 2 mm in diameter. When the donor/recipient vessel discrepancy is greater than a mm, the venous coupler failure rates increase and there is much literature concerning the controversy of device usage [10]. We believe that these increased failure rates are attributable to increased vessel wall handling and increased technical difficulty of the coupling process. Making cuts and securing the vessel with minimal trauma makes the anastomosis safer and more reliable, even with vessel diameters less than 2 mm. We also used these techniques in two end-to-side anastomoses in which the donor vessels were adapted to the coupler device with these technique and for the recipient vessel a classical adaptation of the coupler process was made.

Performing microvascular anastomosis is a critical component of the free-tissue transfer technique. Meticulous technique and minimal handling of the vessels to avoid iatrogenic injury to the endothelial lining is required to reduce the thrombotic potential of the anastomosis and the adjacent endothelium. We believe that making three axial incisions and preparing three leaflets is very useful in the manipulation of the vessel wall during the coupling process, especially in small-sized vessels and in anastomoses with size discrepancies.

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Conflict of interest statement

The authors have no conflicts of interest to declare.

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