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Original research

A retrospective study of end-to-side venous anastomosis for free flap in extremity reconstruction

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HIGHLIGHTS

- The overall surgery success rate of ETS anastomosis was 96.6%.
- The occurrence of the ETS anastomosis-related venous thrombosis was 2.3% (4/117).
- ETS anastomosis success rate was not affected by local condition of surgery site.

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ABSTRACT

Introduction: The success of end-to-side (ETS) venous anastomosis primarily depends on several mandatory factors including recipient vessel selection and reconstruction site. This retrospective study was designed to analyze the success rate of ETS venous anastomosis for free flap extremity reconstruction.

Methods: Between 2009 and 2011, ETS venous anastomosis was performed in 117 patients to reconstruct soft tissue defects of extremity at Nanjing Drum Tower Hospital. The patients were divided into three groups: (1) only one large recipient vein left, (2) two deep venas, (3) one deep vein and one superficial vein. Medical records and the follow-up data were retrospectively reviewed. The success rates of the three groups were compared with Chi-squared test.

Results: Totally, 5, 52, and 60 patients were included in Group 1, Group 2, and Group 3, respectively. The overall surgery success rate was 96.6% (113/117) with four failures: zero in Group 1, two in Group 2 (2/52, 3.8%) and two in Group 3 (2/60, 3.3%), due to venous thrombosis. The re-anastomosis rate in re-exploration in Group 1, 2 and 3 was 0%, 1.9% (1/52), and 1.7% (1/60), respectively. No complication was observed during the operation.

Discussion: No statistical difference was observed in flap failure rate among the three different types of ETS anastomosis. This suggests that differences of the ETS anastomosis surgical site might not affect the surgery success rate.

Conclusion: These results confirmed that the success rate of ETS anastomosis was not affected by the local conditions of surgery site.

1. Introduction

Microvascular anastomosis, which is crucial to the survival rate of transferred tissues, could be performed either in an end-to-end (ETE) or in an end-to-side (ETS) anastomosis. Traditionally, the recipient artery and vein is sacrificed to provide the pedicle ETE anastomosis [1]. ETS anastomosis has been introduced to address cases where the recipient artery is necessary for distal circulation or when there is only a single artery [2].

Previous studies have shown that ETS arterial anastomosis has advantages such as decreased vessel spasm, elimination of vessel mismatch, and preservation of the distal run-off [3]. Thus, it has been widely used in free flap grafting. However, the incidence of venous thrombosis is higher in ETS anastomosis than that in the arterial thrombosis in lower-extremity reconstruction [2,4,5]. Despite of all that, studies have suggested that ETS venous anastomosis is a safe alternative to ETE anastomosis and definitively is the straightforward option for microvascular anastomosis [6].

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Besides, ETS venous anastomosis is firstly proposed in the cases where one recipient vein remains and the caliber of the donor's vein is smaller than the recipient vein. However, seldom literature have been focused on whether the choice of recipient vein locations, such as superior or deep veins, affect venous survival or surgery success rate or not.

In this study, 117 patients with ETS venous anastomosis for free flap reconstruction in extremity were reviewed retrospectively. To explore the feasibility of ETS anastomosis and demonstrate whether the location conditions of the surgical site affect the success rate or not, patients were grouped into different groups according to the local condition of the surgical site. The success rates of the groups would be discussed.

2. Materials and methods

Between 2009 and 2011, 117 cases (including 75 males and 42 females) undergone microsurgical reconstruction of the extremity at Nanjing Drum Tower Hospital affiliated to Nanjing University. Patients with diabetes, smoking, arterial or venous transplantation were excluded in this study.

Indications for surgery included wound bone with exposed tendons, nerves and blood vessels unable to flap transfer (island flap or skin graft); open reduction external fixation with open fractures. All patients were received anterolateral free flaps which required salvaged venous ETS anastomosis in the reconstruction. Failure ETS was defined as the complete flap loss regardless of its origin (arterial, venous, and/or perforator).

2.1. Operative procedures

All patients underwent one or more debridement. All surgeries were performed under general anesthesia by the same surgical team in Nanjing Drum Tower Hospital. Exploration was performed to locate and prepare a recipient artery and vein. If there was only one remained vein or a large difference in the diameters of recipient and flap vein the venous ETS anastomosis technique was chosen for flap grafting. The recipient arteries and vena were radial, ulnar, brachial, anterior tibial, posterior tibial artery and deep, superficial vena, respectively.

How to choose venous ETS anastomosis? According to our experience, the implementation of ETS anastomosis was depended on the local condition of the surgical site including both the compatibility of the recipient and donor vessels. Patients were divided into three groups according to three different choices of venous ETS anastomosis (Fig. 1). For Group 1, only one larger recipient vein was left. In this group, two venas of the flap were connected to the same one recipient vein. The appropriate distance between the two stomas had not been studied up to now (Fig. 2). For Group 2, two unobstructed deep venas were left without available superficial vena. In this case, a skilled physician might be needed (Fig. 3). In Group 3, there was one remained deep vein and one superficial vein. It was better and easier to anastomose vessels if the superficial vein was available and unobstructed (Fig. 4).

Anastomosis was performed under a microscope with interrupted suture using 8–0 or 9–0 monofilament nylon (Ethicon Co. Johnson and Johnson). During the operation, a pair of microscissors was used to excise a portion of the vessel wall according to the pedicle. The lateral aperture does not exceed 1/2 of the circumferences of the recipient venous. At the end of the operation, the ballooning patency test was performed to evaluate whether the venous stoma was obstructed or not.

At the end of microvascular anastomoses, low molecular weight dextran was routinely infused into patients (500 mL at 20 mL/h) for 5 days postoperatively. Sensitive antibiotics, papaverine hydrochloride (30 mg/6 h), low molecular heparin (5000 I.U./day) were included in the postoperative protocol for patients remained in bed, which usually stopped shortly after mobilization, unless otherwise indicated.

Postoperative flap viability was inspected and controlled by a resident by evaluating color, temperature, and appearance of the flap, and by pin pricking the skin paddle, skin monitor or muscular portion of the flap every 2 h in the following 24 h and every 3–4 h in the following days. In each instance of suspected arterial and/or venous thrombosis, the patient was re-operated to explore the anastomosis immediately. Medical records were retrospectively reviewed for demographics, operative and follow-up data.

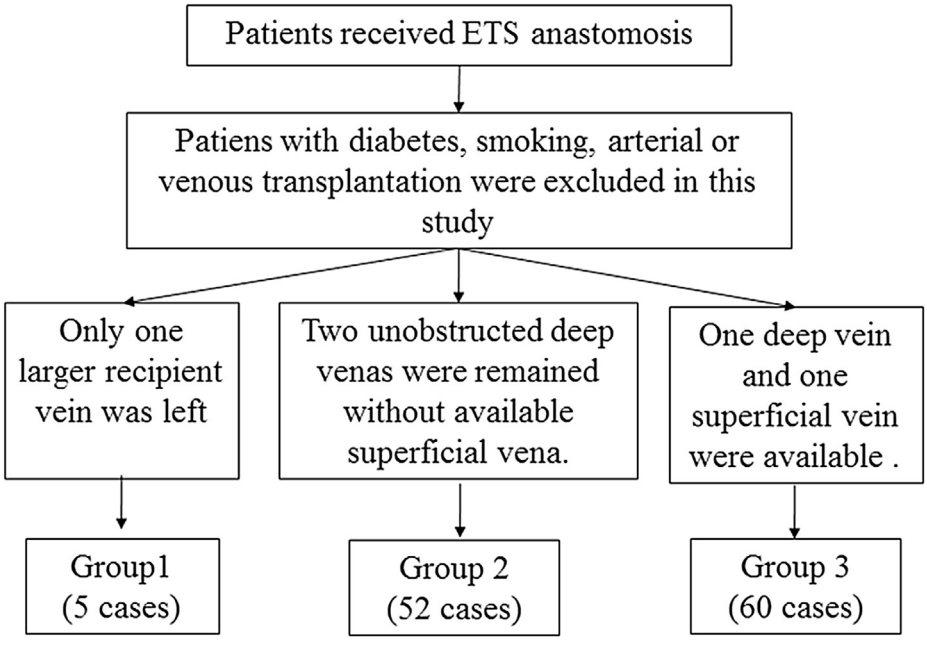

Fig. 1. Patient selection flowchart.