Michael C. Dalsing, MD, SECTION EDITOR

A systematic review and meta-analysis of one-stage versus two-stage brachiobasilic arteriovenous fistula creation

Ian Jun Yan Wee,[a,b] Ismail Heyder Mohamed, MD, FRCS,[a,c] Amit Patel, PhD, MRCP(Lond), MRCS(Eng), MAcadMEd, FFICM, FRCPath,[a,d,e] *and* Andrew M. T. L. Choong, FRCS (Gen Surg), FEBVS (Hons), MFSTEd, FAMS (General Surgery),[a,f,g,h] *Singapore; and London and Liverpool, United Kingdom*

ABSTRACT

Background: Long-term patency of arteriovenous fistulas (AVFs) is critical for hemodialysis vascular access. We compared the efficacy of a one-stage vs two-stage approach to brachiobasilic AVF creation by primarily investigating primary and secondary patency rates. We hypothesize that the two-stage is superior to the one-stage procedure in terms of efficacy and safety.

Methods: This review was performed as per the Preferred Reporting Items for Systematic Reviews and Meta-Analysis guidelines. Searches were performed on MEDLINE, EMBASE, Google Scholar, and Cochrane Database. Risk of bias and quality assessment scores were both performed based on previously validated tool.

Results: The systematic search revealed a total of 242 publications for possible inclusion. On the basis of title and abstract review, two randomized controlled trials and nine case-cohort series fit our inclusion criteria. There were no statistically significant differences in failure rates (pooled risk ratio [RR], 1.10; 95% confidence interval [CI], 0.79-1.55; $P = .25$), 1-year primary patency rates (RR, 1.31; 95% CI, 0.83-2.06; $P = .24$), 1-year secondary patency rates (RR, 0.97; 95% CI, 0.54-1.77) and 2-year secondary patency rates (RR, 1.19; 95% CI, 0.54-2.63; $P = .67$) between both groups. However, the two-stage procedure had significantly improved 2-year primary patency rates (RR, 2.50; 95% CI, 1.66-3.74; $P < .00001$). There were no differences in steal syndrome, hematoma, infection, pseudoaneurysms, or stenosis, although there was a trend toward an increased incidence of postoperative thrombosis (RR, 1.81; 95% CI, 0.95-3.45; $P = .07$) in one-stage procedures.

Conclusions: With improved 2-year primary patency rates and the absence of significant differences in complications, this study suggests potential benefit of a two-stage over a one-stage procedure for brachiobasilic AVF creation. However, rather than being a definitive answer, our results merely highlight the continuing need for an adequately powered, well-designed, randomized controlled trial to interrogate this question further. (J Vasc Surg 2018;68:285-97.)

Keywords: Brachiobasilic fistula; Brachiobasilic arteriovenous fistulas; Transposed basilic vein arteriovenous fistula; end-stage renal disease

An arteriovenous fistula (AVF) involves the anastomosis of a vein with an artery, hence allowing for venous enlargement, and thickening of the wall.[1] There are several advantage of AVFs over arteriovenous grafts and central venous catheters, such as improved patency rates, improved mortality rates,[2-4] a lower risk of infection,[5] and lower rates of inflammation,[3] thrombosis, and central venous stenosis.[6] It is, however, not without its drawbacks. AVF are associated with maturation failure, evident in a recently published large cohort study, which demonstrated a dismal nonmaturation rate of 24%.[7] Hence, this outcome could potentially be averted with early postoperative assessment of hemodynamic parameters to identify patients with increased risk.[8]

Because access should ideally be placed as distally as possible and preferentially in the upper extremities, a

From the SingVaSC, Singapore Vascular Surgical Collaborative,[a] Yong Loo Lin School of Medicine, National University of Singapore,[b] Singapore; Renal Transplantation and Vascular Access Surgery, Royal London Hospital, London[c]; the Stem Cell Transplantation and Cellular Therapy Unit, The Clatterbridge Cancer Centre NHS Foundation Trust,[d] and the Institute of Translational Medicine and School of Medicine, University of Liverpool,[e] Liverpool; and the Cardiovascular Research Institute[f] and Department of Surgery, Yong Loo Lin School of Medicine,[h] National University of Singapore, and the Division of Vascular Surgery, National University Heart Centre,[g] Singapore.

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Correspondence: Andrew M.T.L. Choong, MBBS, FRCS (Gen Surg), FEBVS (Hons), MFSTEd, FAMS (General Surgery), Consultant Vascular and Endovascular Surgeon, Department of Cardiac, Thoracic and Vascular Surgery, National University Heart Centre, 5 Lower Kent Ridge Rd, Singapore (e-mail: suramctl@nus.edu.sg).

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radiocephalic primary AVF is most preferred, followed by brachiocephalic, and lastly brachiobasilic.[1] This is in line with the guidelines by the National Kidney Foundation Dialysis Outcomes Quality Initiative.[9] In addition, proximal AVFs are reported to have better long-term patency with fewer complications than distal AVFs.[10] Moreover, as patients with end-stage renal disease have longer life expectancies and diabetes-related complications, radiocephalic primary AVFs becomes increasingly difficult to perform given the poor quality of distal cephalic veins, as a consequent of venous insults from prior multiple venipunctures and cannulations.[11] In addition, patients who are obese or cachectic often have problems with the RC and brachiocephalic access.[12]

The brachiobasilic AVF procedure was first described by Dagher et al,[12] who shifted the basilic vein from the axilla to the antecubital fossa, and relocated it in a subcutaneous tunnel. The end of the relocated vein was then anastomosed with the brachial artery to act as the vascular access conduit for hemodialysis. The use of the basilic vein is advantageous because it is less prone to previous venipuncture given its deeper location. However, the vein must be mobilized and superficialized, increasing the complexity of the operation.[13] Over the years, several revisions and modifications have been made to the technique including; an endoscopic approach[14,15] and a modified delayed two-stage transposition.[16-18] The superficialization of the brachiobasilic AVF (BBAVF) can be achieved by one of two methods: (1) transposition technique where the entire length of basilic vein is mobilized and positioned anterolaterally under a subcutaneous flap,[19] or (2) the elevation technique, where the vein is elevated superficially without mobilization to the surgically recreated deep fascia and subcutaneous tissue in the medial aspect of the arm.[18]

Currently, there are two usual methods of BBAVF creation: a one-stage or a two-stage operation. The one-stage procedure first creates an anastomosis between the basilic vein and the brachial artery, followed by either elevation or transposition of the basilic vein in one procedure. As a single procedure, one assumes a reduced risk of infection, as well as decreased anesthetic risk. It is, however, an extensive dissection, which exposes patients with immature fistula to a bigger operation. In contrast, a two-stage procedure allows for the maturation of the basilic vein first. This process results in the basilic vein being more easily palpable, less liable to damage, and easier to superficialize. This procedure does, however, increases costs[20] and may result in increased infection and anesthetic risk because it exposes the patient to two procedures. Furthermore, the second procedure of fistula elevation is performed with the assumption that the fistula has matured; however, this assumption is flawed because the only method to determine its maturity is via cannulation. Evidence is lacking as to which method of BBAVF creation is better and this review attempts to address this paucity of data by comparing one-stage vs two-stage BBAVF creation in a meta-analysis.

OBJECTIVES

In adult patients undergoing access procedures for hemodialysis, the systematic review and meta-analysis aims to determine the efficacy of one-stage vs two-stage BBAVFs by comparing the primary and secondary patency rates at specific time points (1 and 2 years), fistula failure rates, and complication rates. We hypothesize that the two-stage procedure is superior to the one-stage procedure in terms of efficacy and safety.

METHODS

The study method was conducted as per the guidelines of the Cochrane Handbook of systematic reviews and meta-analysis[21] and reported according to the PRISMA statement guidelines.[22]

Eligibility criteria. We included any article that specifically compared one-stage vs two-stage BBAVF, which included randomized trials and nonrandomized retrospective observational cohorts and/or case series. Participants included adults with chronic renal disease who underwent a BBAVF procedure either using a one-stage or two-stage procedure. Studies included were full text, and restricted to English.

Outcome measures. All outcome definitions were in accordance with the Society for Vascular Surgery reporting guidelines,[23] and the North American Vascular Access Consortium guidelines.[24] Primary fistula failure was defined as immediate failure of the BBAVF within 72 hours of surgery, early or late dialysis suitability failure. Primary patency was defined as the interval from the time of access creation to the first thrombosis occurring at access site, or any intervention to restore blood flow. Secondary patency was defined as the time from access creation until access abandonment, and includes any interventional procedures to restore patency. If the authors reported functional patency, they were included into the summary estimate by excluding primary failures from the analysis, as described elsewhere,[25] The primary outcome measures were primary fistula failure rates, and primary and secondary fistula patency rates at specific checkpoints, including 1 and 2 years. Secondary outcomes were mean time to fistula use, maturation rates, and complication rates of steal syndrome, hematoma, infection, thrombosis, and stenosis. Complications were defined in accordance with the Society for Vascular Surgery guidelines.[23]

Literature search. We performed an electronic search on the following databases: Medline (via PubMed), Google Scholar, Embase, OvidSP and Cochrane databases to identify all English published and indexed case reports of one- and two-stage BBAVF in adults.