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Case report

Treatment of symptomatic popliteal artery aneurysms with venous bypass by the AESA (asymmetric end-to-end spatulated anastomosis) technique

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ARTICLE INFO

Article history:
Received 18 February 2015
Received in revised form
22 April 2015
Accepted 4 May 2015
Available online 1 June 2015

Keywords:
Intimal hyperplasia
Myointimal hyperplasia
Autologous venous graft
Asymmetric peripheral anastomosis
Graft patency

ABSTRACT

We report 6 cases of critical limb ischemia in 4 patients due to symptomatic popliteal artery aneurysm and we present the AESA (asymmetric end-to-end spatulated anastomosis) technique for use in autologous vein bypasses in crural vessels. This is a modified technique of conventional end-to-end spatulated anastomosis, which results in an asymmetric configuration of the anastomotic lateral walls. Using this modified technique the anastomosis' area is greater and the opposite lateral anastomotic sites are always at different inclined levels. Therefore, in cases of intimal hyperplasia formation this asymmetric configuration may avoid the marked stenosis of the anastomosis and consequently the procedure's failure. In all cases, the asymmetric end-to-end anastomosis was used for revascularization of a single patent crural vessel. All procedures were successful and all target vessels remain patent for a median follow up of 15 months so far.

Introduction

Lower extremity aneurysms are relatively uncommon and in 70% of cases the affected vessel is the popliteal artery. Typically, a popliteal artery aneurysm (PAA) affect a male (m:f ratio is approximately 7.4:1) aged over than 65 years-old. In this population the prevalence of PAA larger than 15 mm in diameter is approximately 1% [1]. PAAs are usually asymptomatic, while clinical manifestations include symptoms from compression of adjacent nerves and veins as well as chronic or acute leg ischemic symptoms due to distal crural thromboembolism. Occurrence of symptoms has been associated with the PAA's size and those with diameter > 26 mm have been

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http://dx.doi.org/10.1016/j.crvasa.2015.05.004

found to be prone for distal ischemia. In this clinical setting the PAA's exclusion with autologous vein bypass has significantly greater primary patency compared with synthetic grafts and still remains the gold standard [2]. Endovascular repair is justified only for anatomic suitable cases in the elderly and in very high-risk patients [3].

Early (<30 days) thrombosis of an autologous vein graft (AVG) is usually associated with operative technical errors, while restenosis and AVG's thrombosis due to recurrent atherosclerotic process represents the leading cause of failure in the mid- and long-term [4]. Pathophysiological adaptation and structural changes of an implanted AVG in the arterial circulation includes mainly a proliferative neointima formation. Further and excessive progression of this proliferative response results in intimal hyperplasia (IH), which narrows the vessel's lumen especially at the anastomotic sites and represents the primary cause of AVG's thrombosis and failure in the short- and mid-term [4,5].

Surgical technique plays an important role in prevention of AVG's failure due to IH in crural bypasses and especially in cases with poor run-off vessels [6]. Herein, we report a small series of 4 patients with 6 PAAs treated by the AESA (asymmetric end-to-end spatulated anastomosis) technique, and we describe this technique, which represent a modification of conventional end-to-end anastomosis (ETE) for use in bypasses to the small in caliber and with poor run-off peripheral arteries.

Material and methods

Technique description

Performing a vascular ETE anastomosis by a simple circular suture line results in some narrowing. In conventional technique this narrowing can be overcome by cutting the ends obliquely. Accomplishment of an oblique anastomosis necessitates a small longitudinal arteriotomy at the anterior wall of recipient artery, and optionally two small and equal lateral vascular wall excisions, triangular in shape [Fig. 1.1(*a* and *b*)]. Following this technique the recipient artery's vascular end has two symmetric anastomotic lateral walls (Fig. 1.2), and both of them lie at the same inclined level according to the vessel's axis [Fig. 1.3 (*X*)]. The same technique is used at the posterior wall of graft's distal end. This configuration, using a running suture, results in an oval shape, spatulated end-to-end anastomosis (Fig. 1.4).

Contrary to this conventional anastomosis, the proposed AESA technique has the following modifications: the length of arteriotomy should be at least 4 times the diameter of recipient artery (Fig. 1.5). The excision of the two lateral vascular walls is obligational and the two excisions are not equal, with one of them being significantly greater [Fig. 1.5 (*a* and *b*)]. Ideally and depending on the target vessel's diameter the width of the one lateral wall excision should be at least 3 times the width of the other one (Fig. 1.5, $b > a$). This modification results in two asymmetric lateral walls and one of them lies lower than the other [Fig. 1.6 (*a* and *b*)]. The two lateral walls are not at the same inclined level according to the vessel axis and the two levels [Fig. 1.7 (*Y* and *Z*)] have an obtuse angle between them

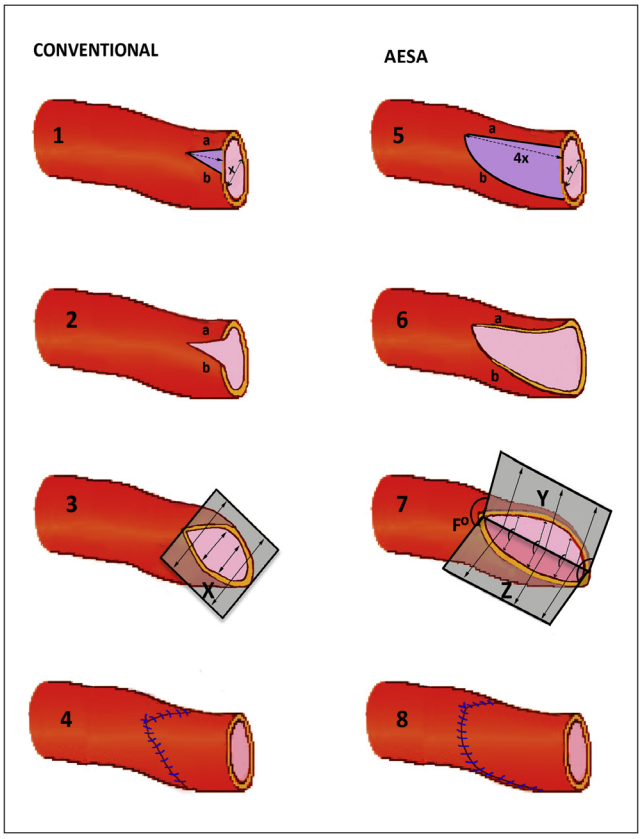

Fig. 1 – Differences between conventional (1, 2, 3, 4) and AESA (5, 6, 7, 8) anastomosis technique. 1.1: small longitudinal arteriotomy at the anterior wall of recipient artery, followed optionally by two small, triangular and equal lateral vascular wall excisions (*a* and *b*). 1.2: the two lateral anastomotic walls excisions (*a* and *b*) are symmetric. 1.3: both lateral anastomotic walls lie at the same inclined level (*X*) according to the vessel's axis. 1.4: conventional spatulated end-to-end anastomosis. 1.5: longitudinal arteriotomy with length at least 4 times the artery's diameter (*x*). Obligational and unequal excisions of the two lateral vascular walls. One of them (*b*) is significantly greater than the other (*a*). The width of excision *b* should be at least 3 times the width of excision *a* ($b > a$). 1.6: The two lateral anastomotic walls are asymmetric and one of them lies lower than the other (*a* and *b*). 1.7: The two lateral walls are not at the same inclined level according to the vessel axis and the two levels (*Y* and *Z*) have an obtuse angle between them (F°). 1.8: The area of AESA is significantly greater than the conventional one.

(Fig. 1.7, F°). With analogous technique for the venous graft's distal end, and using a running suture this modification results in an asymmetric, oval in shape, spatulated ETE anastomosis. The area of asymmetric anastomosis is significantly greater than the conventional one (Fig. 1.8).

The potential benefit of this modification in the short- and mid-term is expected to be shown in cases with IH. In these cases, the conventional anastomosis has an increased