ORIGINAL ARTICLE

SALVAGE OF MEGA-FISTULA WITH NEZAKATGOO TECHNIQUE

ABSTRACT

Introduction: Mega-fistula is understood as an arteriovenous fistula that is very dilated throughout its course, tortuous, sometimes aneurysmal, and that presents flows above 2L/min; this carries the risk of generating multiple complications (from aneurysmal rupture, recirculation, and heart failure due to overload, among others). Its usual treatment is ligation or prosthetic replacement.

Material and methods: The technique described by Nezakatgoo et al. was performed on three patients with mega fistulas (operated between 2020 and 2023) in whom salvage surgery and recovery of the entire fistula was performed. Complete dissection of the fistula from its anastomosis to the arch of the cephalic vein is performed, the vein is calibrated with a 24-34 Fr chest tube, and the excess of the mega-fistula and aneurysms are resected. In the case of stenotic areas, these are enlarged, or new anastomoses are made, and in the case of stenosis of the arch, a new anastomosis is made in the axillary vein.

Results: The first case describes a left humerocephalic fistula made in 2011, which, after the plastic surgery, required two angioplasties due to stenosis in the middle third (at 125 and 236 days after the plastic surgery). It remains patent, with a total patency of 156 months since its initial confection and 36 months since the plastic. The second patient presents a mega-fistula performed in April 2019, which, after plastic surgery, required angioplasty for stenosis at one time at 509 days and continues to be permeable to date, with a total patency of 56 months and 30 months since plastic. The third fistula was operated in the context of total fistula thrombosis and required, in the first instance, a thrombectomy prior to reconstruction. It evolved in two episodes (at months 2 and 5), with stage IIb steal treated by banding (Miller technique) on both occasions. It presents a total patency of 57 m and 18 m from the plastic. All patients remain on dialysis to date due to the reconstructed fistula.

Conclusions: Salvage of mega-fistula is a valid procedure to continue the useful life of native fistulas in the short and medium term; if necessary, complementary procedures are required to solve problems similar to those of other fistulas.

Keywords: *mega-fistula, hemodialysis, native arteriovenous fistula.*

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INTRODUCTION

Due to dialysis patients' increasing number and longevity, vascular accesses must last as long as possible. Using native arteriovenous fistulas (AVF) becomes ideal since they have a higher patency rate, low risk of infections, and the possibility of being maintained more cost-effectively in the long term.

Multiple factors influence the proper functioning of vascular access (arterial inflow, stenosis, dilatations, theft, hematomas, and thrombosis, among others); transformation into a mega-fistula is one of them. A mega-fistula is defined as one that presents significant dilatation along its entire course; it is tortuous and usually has flows greater than 2 L/minute. In addition, they may present cardiopulmonary recirculation greater than 20%, heart failure with cardiac output greater than 4-8 L/min, and a cardiac index greater than 3[1]. A systematic review of 43 studies that included 11,374 fistulas describes an incidence of 1.5% per year[2]. As a predisposing factor, it is common to find critical stenosis at the exit (cephalic arch or subclavian vein), which would explain the aneurysmal dilatation of the entire vein. It is also frequent in post-transplant patients, either due to their factors or because of the lack of follow-up of the access[2].

The usual treatments for this situation are resection of the dilated segment and anastomosis, resection with prosthetic interposition, or even ligation and abandonment of the access, generally using the association of a catheter, either transient or semi-permanent[2,3].

MATERIAL AND METHODS

The technique described by Nezakatgoo et al.[4] makes it possible to rescue these mega-fistulas so that the patient can continue dialysis with his native fistula, with the benefits that this implies, and without the need to place a catheter a posteriori. The following is a description of the technique according to the author.

Anesthesia is decided according to the patient's characteristics. The operation begins with control of the AVF within 2 cm of the arterial anastomosis and the venous end proximal to the venous dilatation. Control is acquired up to the deltopectoral groove, depending on the degree of aneurysmal degeneration of the AVF. Heparin is administered intravenously. The fistula is clamped near the arterial anastomosis and as proximal as possible along the venous end. The fistula is then sectioned 2 cm from the venous clamp, and a stump of vein is left with the arterial anastomosis. A longitudinal elliptical skin incision is made over the aneurysmal portion of the AVF, and any thinned or ulcerated skin is excised. The vein is released circumferentially along its entire length. Once fully mobilized, the vein is opened longitudinally, and the excess aneurysmal fistula tissue is removed. An appropriately sized thoracostomy tube (24 Fr-36 Fr) is placed into the vein (to gauge its final diameter). Then, the vein is sutured longitudinally over the tube with a continuous, monofilament, nonabsorbable suture. The integrity of the suture line is tested with heparinized saline before tunneling. The vein is sutured to the tapered portion of the thoracostomy tube, which is attached to a tunneling device. The circumferential suture from the vein to the thoracostomy tube distributes pressure evenly while pulling the vein through the tunnel, resulting in less trauma.

The repaired vein is then tunneled through a new anteromedial subcutaneous tunnel and pulled out through the original incision. This tunneling is performed by rotating the vein through 90 degrees, which allows the suture line of the repaired mega-fistula to be hidden and buried in the central face of the tunnel. This rotation is critical because it protects the suture line from further dialysis punctures and allows a vein surface that has not previously been used for access or has not been involved in the repair to be most suitable for future punctures. A 90-degree rotation distributed in a manner has not caused kinkings. A term-terminal venous anastomosis is performed with a 5-0 polypropylene suture. After the operation, patients are usually discharged on the same day. The revised AVF is used for dialysis access on the first postoperative day without transitional catheter placement.

EXPERIENCE OF OUR GROUP

Case number 1

A 28-year-old man with a history of renal transplantation and hyperparathyroidism. Dialyzed for a humerocephalic fistula made in 2011. He consults for inadequate flow and pain during dialysis. A fistulography was performed, showing tortuosity, multiple aneurysms, and significant stenosis in the arch of the cephalic vein. Under general anesthesia, the technique described above was performed, and the fistula was anastomosed to the axillary vein due to the stenosis in the arch (*Image 1*). The patient evolved with compartment syndrome (first described as atraumatic compartment syndrome associated with dialysis vascular access surgery) in the legs that required fasciotomy and evolved favorably without sequelae. He required two angioplasties at 125 days and 236 days after plastic

surgery for stenosis. He is dialyzed through the access 36 months after the plastic and 156 months since its creation.

Case number 2

A 51-year-old woman with a history of tuberous sclerosis dialyzing for a humerocephalic fistula created in April 2019. A fistulography is performed that shows multiple aneurysms with stenosis between them, without stenosis at the distal level. Under plexus anesthesia, the Netzakangoo technique is performed, but with the variation of requiring resection of the stenosed segment and preparation of an intermediate anastomosis (*Image 2*).

Angioplasty is required 509 days after plastic surgery. It is permeable 56 months after its creation and 30 months after the plastic surgery.

Case number 3

A 41-year-old man with a right humerocephalic fistula made in March 2019. He presented with inadequate flows and elevated venous pressure on dialysis. A fistulography showed significant tortuosity with multiple sites of stenosis and dilatation. Before the scheduled surgery, the patient presented thrombosis, requiring thrombectomy in addition to 2 resections of stenotic segments with anastomosis and distal anastomosis in the axillary vein due to stenosis of the cephalic arch. After two months, the patient developed ischemia syndrome associated with stage IIa dialysis access with a flow rate of 3 L/min (*Image 3*). Banding was performed with the modified Miller technique[5] on two occasions (64 and 169 days). It has been permeable for 57 months after its creation and 18 months since the plastic.

DISCUSSION

The development of a mega fistula is due to multiple factors and is a conditioning factor for the proper functioning of the access during hemodialysis. Netzakangoo describes in his original work that he obtained a primary patency of 67.1 months in 102 patients until the first revision. The primary functional patency of the rescued mega-fistula was 90.2% at 95 months, with a mean follow-up of 36.29 months. The range of recovered functional patency was 7 to 95 months. Fourteen patients required further revision (13.7%); other complications described were steal syndrome (6.9%), thrombosis (4.9%), development of stenosis (2.9%) and infection (2.0%). Transplantation was performed in 10 patients, and another 10 patients died, all with functioning fistulas.

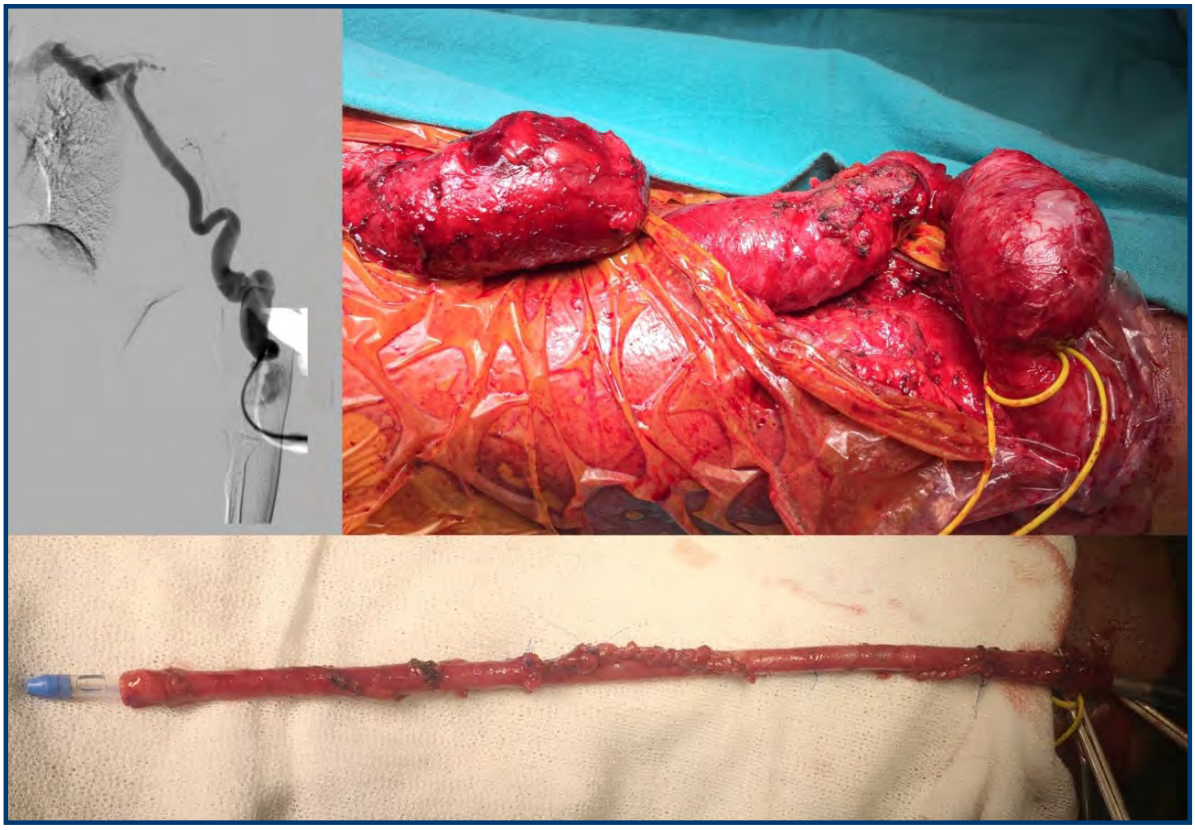

IMAGE 1. Top: aneurysmal and tortuous mega-fistula. **Below:** the prepared vein over the thoracotomy tube.

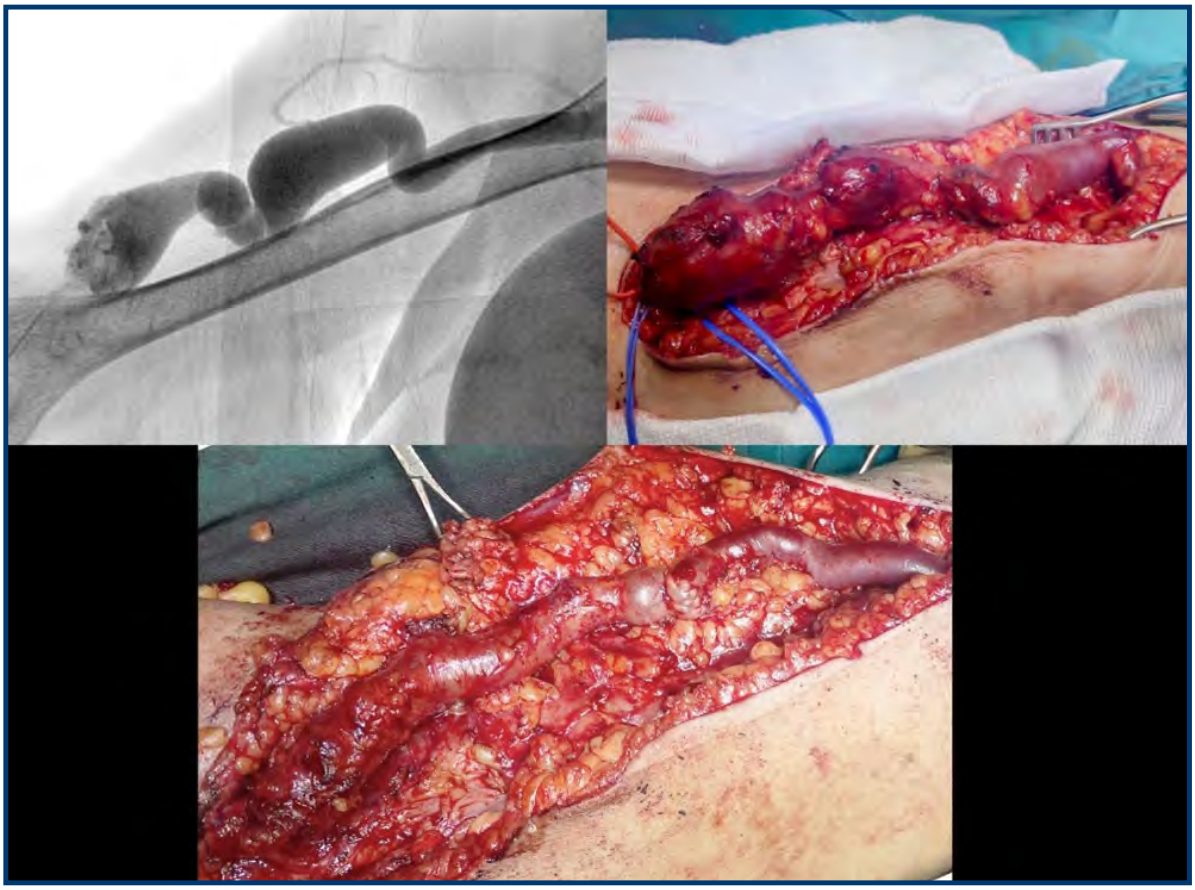

IMAGE 2. Above: aneurysmal and tortuous mega-fistula. **Below:** The vein is already repaired, and anastomosis is observed in the distal third.

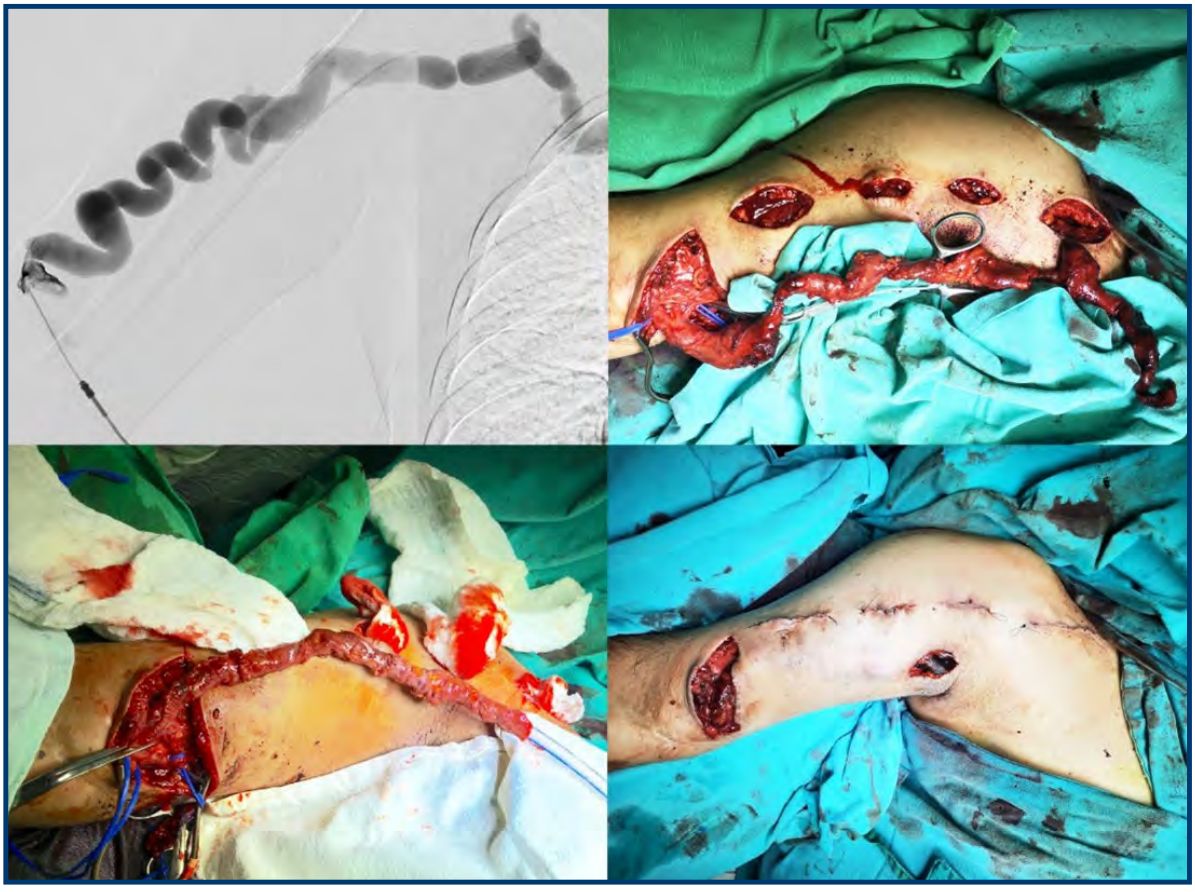

IMAGE 3. Above: Aneurysmal, tortuous, and multiple stenosis mega-fistula. **Below:** Vein already repaired.

RESULTS

Due to these favorable results, we decided to initiate our own experience. All our patients are on adequate dialysis through the same access despite having presented post-surgical complications (stenosis, steal, and compartment syndrome); all of them resolved without sequelae. The mean follow-up was 835 days (range 503-1021). The duration of primary assisted patency until the first procedure was 232 days (range 64-209), with 100% primary assisted patency to date. One of the things we learned after the relatively early stenoses of the first cases was to prefer a 28 Fr chest tube as we did in the last case. We also chose limb block as the anesthesia of choice, as these are prolonged surgeries (mean: 130 minutes), and we believe that the compartment syndrome in the first case was related to decubitus and arterial hypotension associated with general anesthesia in the context of poor arterial beds. As these were our first cases, we preferred to use a transitional catheter for one week until the surgical site was in better condition for the first puncture, performed without intercurrences.

As an observation, although the number of patients does not seem significant, the dialysis center of our institution has approximately 100 patients on hemodialysis, so our incidence is within the expected range.

CONCLUSIONS

Salvage of mega-fistulas is a technically feasible procedure with morbidity comparable to other vascular accesses with superlative long-term results, considering that conventional treatments would otherwise most likely be associated with loss of access or a shortening of its useful life.

Declarations

The authors declare no conflict of interest.

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