Revising a failing antebrachial loop graft for hemodialysis: the "snail" procedure

George S. Georgiadis[1], Damianos Doukas[1], Stylianos Panagoutsos[2], Christos Argyriou[1]

[1] Department of Vascular Surgery, Medical School, "Democritus" University of Thrace, University General Hospital of Evros, Alexandroupolis, Greece
[2] Department of Nephrology, Medical School, "Democritus" University of Thrace, University General Hospital of Evros, Alexandroupolis, Greece

Abstract:

Maintaining the lifespan of a vascular access (VA) is of paramount importance especially for end-stage renal disease patients. Any revision operation is an integral part of VA expertise, and in this regard any description of dedicated surgical or endovascular solution is of value. This case refers to the conversion of a purely prosthetic VA (loop antebrachial shunt) to a composite one, un-recruiting the outflow deep vein system of the lower arm and creating a different venous drainage pathway using a newly created superficial vein vessel. This technique incorporates the use of a new PTFE segment "looking" downwards to the antebrachial level, resembling a "snail" configuration of the whole circuit.

Key words: AV fistula, prosthetic grafts, dialysis access, techniques in vascular access, revision procedure

INTRODUCTION

The arteriovenous communication generates a large pressure gradient between the high-pressure, inflow artery and the low-resistance outflow vein, deviating an increased flow volume through the fistula, because of the bypassed resistance of the peripheral capillary bed.[1] We noticed in selected prosthetic lower or upper arm vascular access (VA) cases that despite superficial outflow vein thrombosis the circuit continues its functionality through the deep vein system especially when the initial vein anastomosis incorporates large perforating branches. In this occasion, the deep vein network decreases its resistance when the vein valves become gradually incompetent. However, this diversion of blood flow enables primary or secondary superficial veins, initially of suboptimal diameter to dilate, contributing to the total vein blood proximal outflow. From a practical point of view, these newly created veins could be used in future dedicated revision operations extending the VA lifespan. We describe the "*snail*" technique revising a failing antebrachial loop graft with thrombosis of the outflow basilic vein but draining to multiple deep vein branches, in which the vein anastomosis was relocated distally to a newly created large superficial antebrachial vein. This facilitation of its drainage, from the deep to superficial vein network was performed using a new PTFE portion in a retrograde direction, achieving a "*snail*" circuit configuration.

Author for correspondence:

George S. Georgiadis

Professor of Vascular and Endovascular Surgery
"Democritus" University of Thrace University General Hospital of Alexandroupolis Dragana Area, Alexandroupolis, Greece, 68100
Tel: +30 6944299711
E-mail: ggeorgia@med.duth.gr, georgiadis.vasc@gmail.com
doi: 10.59037/d8g2nb75
ISSN 2732-7175 / 2025 Hellenic Society of Vascular and Endovascular Surgery Published by Rotonda Publications
All rights reserved. https://www.heljves.com

CASE AND TECHNIQUE DESCRIPTION

M.Y. is a 76 year old female patient with past medical history of diabetes mellitus, hyperlipidemia and moderate aortic valve stenosis. She was on hemodialysis program through an antebrachial short loop shunt on the left side for the last 34 months. Renal physicians requested a venography because of evidence of high venous pressures during dialysis, although a satisfactory thrill was detected at clinical examination. The patient complained for intermittent rest pain due to the presence of a moderate lower arm edema. Primary patency of the loop shunt was 25 months and initial vein outflow was through the elbow basilic vein.

Surprisingly, the fistulogram at the level of the elbow revealed basilic vein occlusion however, blood outflow was now diverted to the deep antebrachial vein system through a large perforating brach. Furthermore, no central vein lesion was detected (Fig. 1A). An unexpected finding was the presence of a large antebrachial superficial branch, possibly receiving the blood flow from the high flow graft fistula, through the deep veins.

The latter branch showed continuity with the cephalic vein above elbow (Fig. 1B). This new superficial vein network was not present at the primary operation. To rescue this long-standing VA before thrombosis occurs, we performed a novel but simple technique, we called *"snail"* procedure. Instead of extending the vein limb of the PTFE to the brachial cephalic vein in an antegrade fashion we choose to extend retrograde to the antebrachial superficial branch, at its most distal dilated point, in order to considerably increase the puncture area. The latter would include a long vein component (Fig. 2). This facilitation of its drainage from the deep to

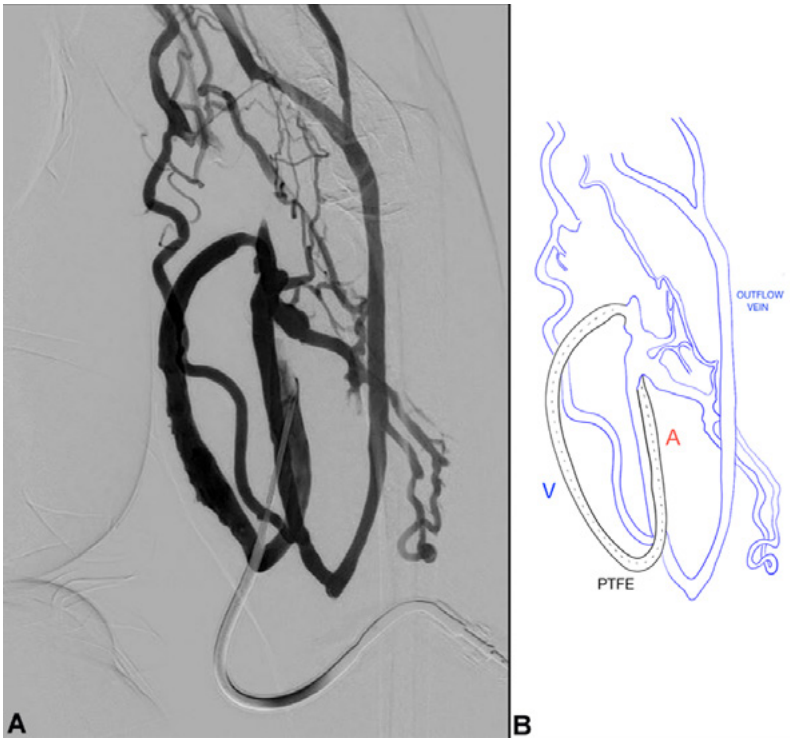

FIGURE 1: A. Venography of the left arm at the level of the elbow. Note the diversion of blood flow to the deep and subsequently to the superficial vein network. The initial arteriovenous graft loop is rather short B. Schematic representation of the venogram (A: graft arterial limb, V: graft vein limb, PTFE: polytetrafluoroethylene).

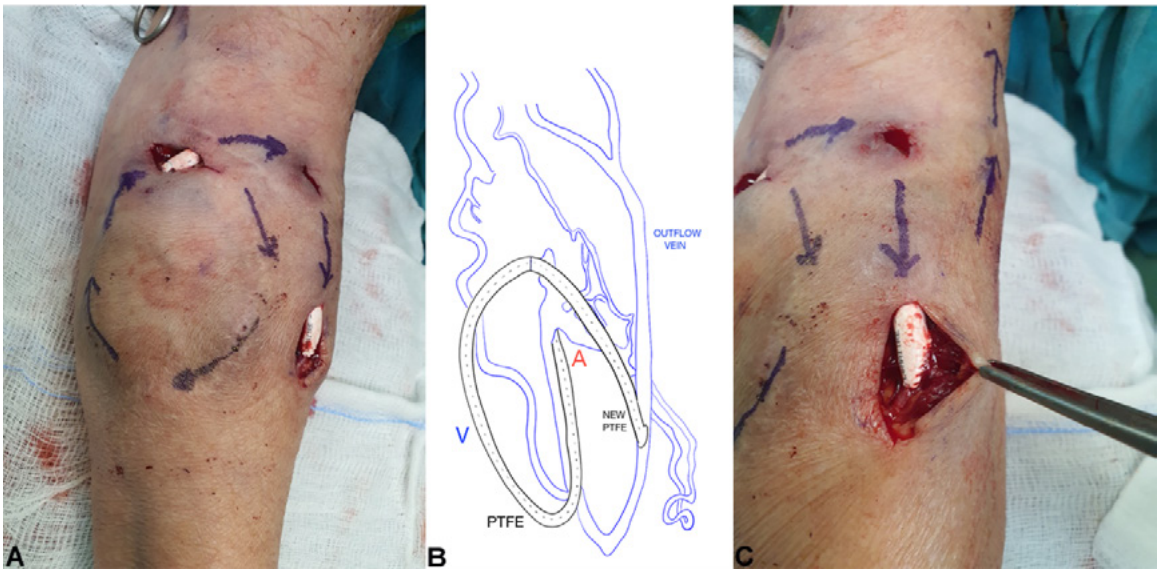

FIGURE 2: A. The “*snail*” operation: The new inserted PTFE portion “looks” antegrade, ending to the large superficial antebrachial vein vessel B. Schematic representation of the procedure. Note that the previous vein anastomosis is interrupted, un-recruiting the outflow deep vein system of the lower arm and creating a different venous drainage pathway C. The new vein anastomosis was performed at the antebrachial superficial mature branch, at its most distal dilated point, in order to considerably increase the puncture area.

superficial vein network using a new PTFE portion in a “*snail*” circuit configuration enabled us to increase the lifespan of the arm regarding the available sites for VA construction. Furthermore, most of the old PTFE portion of this “*snail*” configuration can be punctured immediately for hemodialysis without the need of a central venous catheter (CVC). The “*snail*” configuration resembles to the loop antebrachial “*semi-shunt*” or “*semi-graft*” we described earlier, utilizing a PTFE segment as the arterial limb and a long cephalic vein segment as the vein limb (semi-loop forearm composite graft). Their difference is a

longer PTFE portion (three halves) and a vein anastomosis oriented towards the distal vein network (antegrade direction). Furthermore, un-recruit of the outflow deep vein system of the lower arm and creation of a different venous drainage pathway takes place.

It is obvious that the previous vein anastomosis is interrupted, and the new PTFE portion anastomosed in an end-to-end fashion with the old PTFE segment. Definitely, several other revision options arose for this interesting and complex case. Firstly, a mid-antebrachial autogenous fistula or secondly, an elbow brachial-cephalic fistula could be performed, without interrupting the PTFE graft circuit and without requirement for a CVC. However, these autogenous options render the PTFE graft in danger of thrombosis while awaiting the vein to further mature adequately. Another option is to extend the vein limb of the previous PTFE to the cephalic vein at elbow level using a short PTFE in horizontal position (POLO operation), however, this solution would sacrifice the whole antebrachial cephalic vein and few cm of brachial cephalic vein, even if again a CVC would not be necessary. Preserving the antebrachial vein outflow in the POLO operation and obtain more cm of puncture area would require a supplementary procedure (destroying the vein valves using a valvulotome to obtain retrograde blood flow) but the high possibility of antebrachial edema should not be overlooked.

Preservation of veins is an integral part of the VA plan reported in the latest DOQI guidelines.[2] We managed to do this preserving proximal VA options while transferring the previous VA version to a distal one. This technique can be applied in prosthetic failing VA's, when vein flow is diverted to the deep circulation and simultaneously a superficial and of good caliber distal vein is present. Preferably, the latter should have a long, not deep and continuing path above the elbow.

VA operations like the "*snail*" procedure need experience and preferentially should be performed by VA surgeons.[3,4] Any revision procedure extending the VA lifespan and more importantly lower and upper arm lifespan, is of value. This practice although simplistic, was sound, and enabled the conversion of a purely prosthetic VA to a composite one, with obvious benefits. In contrary to the "distal to proximal, step by step approach", we applied the reversed rule, with the next step to the antebrachial area instead of the brachial area. So far, we perform the "*snail*" procedure in 3 patients. We had one thrombosis 14 months after revision, which was treated extending the PTFE after thrombectomy, few cm proximally to the same outflow vein.

REFERENCES

1 Georgakarakos EI, Xenakis A, Kapoulas KC, Tsangaris S, Georgiadis GS, Lazarides MK. A computational study of the factors influencing pressure in arteriovenous fistulae venous aneurysms. *J Vasc Access* 2013; 14(4): 325-329.

2 Lok CE, Huber TS, Lee T, Shenoy S, Yevzlin AS, Abreo K, et al; KDOQI Vascular Access Guideline Work Group. KDOQI clinical practice guideline for vascular access: 2019 update. *Am J Kidney Dis* 2020;75(4)(suppl 2): S1-S164.

3 Georgiadis GS, Polychronidis A. Access surgery and the role of nephrologists. *Am J Kidney Dis* 2003; 41(5): 1126; author reply 1127.

4 Georgiadis GS, Kantartzi K, Argyriou C. Complex revision operations should be performed only by vascular surgeons and a few expert nephrologists. *J Vasc Access* 2017; 18(1): e6-e7.