Technical Note

Embolization of haemodialysis arteriovenous fistulas complicated by venous hypertension: a feasibility study

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Introduction

A haemodialysis arteriovenous fistula (AVF) can lead to venous hypertension in the upper extremity because of stenotic and/or obstructive complications of the deep venous system. These complications may occur for anatomical reasons in rare cases [1], but frequently are due to the more and more diffuse utilization of central venous catheters as a vascular access for haemodialysis. Stenotic and/or obstructive complications of the deep venous system may lead to venous hypertension, oedema of soft tissues and collateral circulation at the level of the shoulder [2]. Sometimes, the collateral circulation is not able to establish haemodynamic compensation, so that upper arm oedema gets more and more severe and may evolve towards elephantiasis. The problem may be solved either by means of open surgical and/or percutaneous catheter-based techniques, which tend to establish de novo central venous circulation [2] or, more simply, by means of the surgical ligation of the AVF. However, the latter may be difficult to perform, due to the inveterate oedema, the thickening of the skin and the high risk of bleeding often coexistent when venous hypertension is present. Embolization of the haemodialysis AVF might be a smart solution in some selected cases complicated by venous hypertension. Embolization, first described nearly a century ago, has emerged recently as a durable first-line treatment of many vascular conditions, particularly in the field of endovascular surgery. As technological advancements allow easier and safer access to small and remote lesions, embolization is being utilized more frequently to treat difficult lesions, such as abnormal arteriovenous communications [3]. To the best of our knowledge, embolization of haemodialysis AVF has not been reported so far.

The aim of this study was to verify the feasibility of embolization procedures of haemodialysis AVF complicated by venous hypertension.

Cases

Two points need to be underlined before describing the two embolization techniques we applied in two patients: (i) the probability of failure of the surgical intervention had been evaluated as very high by the vascular surgeons and (ii) an AVF had been prepared in the contralateral arm some weeks before the two procedures.

Embolization procedure no. 1

A 74-year-old male patient had been treated by haemodialysis in the last 10 years. His left arm, bearing a latero-lateral brachio-basilic AVF at the elbow, started showing a larger and larger oedema in the previous 10 months. Angiography documented a complete occlusion of the left brachio-cephalic venous axis and a collateral circulation at the level of the shoulder with a well-functioning AVF (Figure 1a). A detachable balloon was placed in the proximal site of the efferent vein of the AVF. The balloon was detached from its guide-wire, determining the embolization and the stop of blood flow in the vein. Secondarily, two Gianturco coils were inserted both at the proximal and at the distal sites of the vein, at the juxta-anastomotic level, thus, completing the embolization of the vein. The procedure was able to determine a complete occlusion of the AVF and a rapid resolution of the oedema, assuring at the same time the perviousness of the brachial artery (Figure 1b).
Embolization technique no. 2

A 78-year-old female patient had been treated by haemodialysis in the last 13 years. Her left arm, bearing a termino-terminal distal radio-cephalic AVF, started showing a larger and larger oedema in the previous 12 months leading to elephantiasis associated with skin dystrophy. Angiography documented a complete occlusion of the left subclavian–anomalous venous axis and a collateral circulation at the level of the shoulder with a well-functioning AVF (Figure 2A). A stop of the blood flow was obtained after puncturing the cephalic vein and applying the ‘stop-flow’ technique by means of a balloon. Secondly, tissue-adhesive Histoacryl® was injected into the post-anastomotic site of the vein, proximally to the stop of the blood flow created by means of the balloon. Embolization determined a rapid thrombosis of the vein with consequent AVF occlusion. The angiogram obtained after the procedure, besides documenting the lack of blood flow in the AVF, showed the ulnar and interosseous arteries, which had not been evident before the embolization procedure.
Histoacryl® (B/Braun Aesculap, Germany) was injected into the post-anastomotic site of the vein, proximally to the stop of the blood flow created by means of the balloon. Embolization determined a rapid thrombosis of the vein with consequent AVF occlusion. The angiogram obtained after the procedure, besides documenting the lack of blood flow in the AVF, showed the ulnar and interosseous arteries, which had not been evident before the embolization procedure (Figure 2b). Also in this case, a rapid disappearance of the oedema occurred with a progressive resolution of the elephantiasis (Figures 3a and 3b).

The two endovascular procedures were uneventful. Both patients showed a good function of the left upper arm in the months following the procedure.

Discussion

Venous hypertension associated with a haemodialysis AVF may be asymptomatic, if an adequate collateral circulation develops. Alternatively, it may manifest itself as a vascular access thrombosis, sometimes with a large oedema of the arm with bluish discolouration and pigmentation of the skin and, in more severe cases, with ulcerations of the finger tips, neuralgias and functional impotence of the arm [4].

The primary goal of therapy is to reduce venous hypertension by means of open surgical and/or percutaneous catheter-based techniques, which tend to establish de novo central venous circulation [2,4]. However, long-term results of balloon angioplasty with stenting do not appear encouraging [4]. Thus, the simplest solution in all cases appears to be AVF ligation. However, sometimes, the surgical intervention on an arm affected by a large and inveterate oedema may present some technical problems, such as the difficulty in obtaining a good local anaesthesia or an easily elicitable bleeding. Recently, the application of embolization techniques to treat visceral artery aneurysms has been explored, with encouraging results [3]. Many are the tools that have been utilized in embolization techniques, such as tissue-adhesive Histoacryl®, detachable balloons, coils, covered stents and microparticles; their choice depends on both the site and the type of lesions. As far as the potential side effects of tissue-adhesive Histoacryl® are concerned, it must be underlined that this product leads to an exothermic reaction. The improper application of too thick a layer of adhesive can lead, on polymerization, to thermal damage to tissue.

Embolization offers a minimally invasive treatment for lesions that have traditionally been considered inoperable, as well as those requiring extensive surgical resections and/or reconstructions that are associated with high morbidity [3]. As far as haemodialysis patients are concerned, angioplasty and transluminally placed endovascular grafts to treat venous abnormalities have been suggested [5,6].

To the best of our knowledge, ours is the first report on embolization of haemodialysis AVF complicated by venous hypertension. In our hands, AVF embolization was a safe, effective and rapid procedure with virtually no side effects. Furthermore, this technique offers a variety of technical solutions according to the anatomical varieties of AVF.
In conclusion, the endovascular occlusion of AVF is a safe, effective and rapid procedure in selected cases complicated by venous hypertension.

Conflict of interest statement. None declared.

References


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