CASE REPORT

Guglielmi detachable coils in the treatment of carotid-cavernous fistula

V. Sawlani a,*, R. Phadke b, S. Kumar b, R.B. Gujral b

Departments of a Radiology, Morriston Hospital, Swansea, UK; and b Radiology, Sanjay Gandhi Postgraduate Institute of Medical Sciences, Lucknow, India

Introduction

In embolotherapy for the treatment of carotid-cavernous fistula (CCF), several embolic agents and techniques have been reported depending on the type of fistula, size of fistula, and its venous drainage. Direct CCF is commonly treated via a trans-arterial endovascular approach with detachable balloons.1–2 However, trans-arterial balloon embolization fails in 5–10% of cases.3,4 Sometimes balloon embolization causes subtotal occlusion of the fistula and occlusion of draining veins leading to aggravation of symptoms.

The dural CCF is not amenable to trans-arterial balloon embolization because of multiple small feeders arteries.5 Placement of fibred platinum coils via the trans-venous route is the preferred mode of treatment.6 However, angiographic and clinical cure is not often achieved due to difficulty in placing these coils.

Guglielmi detachable coils (GDC) have been used infrequently in the management of CCF. We present our experience of using GDC as supplement embolization in treating type A and type D dural fistulae in which the primary treatment failed to produce optimal results. The role of GDC embolization in treatment of CCF is also reviewed.

Case reports

Case 1

A 42-year-old man presented with symptoms due to spontaneous CCF. Digital subtraction angiography (DSA) revealed a type D CCF supplied by the branches of external carotid artery (ECA) and cavernous branches of internal carotid arteries (ICA). Major feeders were from branches of left ECA, i.e. neurorhinegeal division of ascending pharyngeal artery, artery of foramen rotundum and middle meningeal artery. All the feeders converged on to the posterior compartment of the left cavernous sinus. The fistula drained preferentially posteriorly into the inferior petrosal sinus (IPS) and partly into the superior ophthalmic vein (SOV); Fig. 1(a) and (b).

Transvenous embolization was performed using a microcatheter (Fastracker 18, Target Therapeutics, CA, USA) through the IPS. Initially two 0.018 £ 50 mm fibred platinum coils (Boston Scientific/Target, CA, USA) were placed into the posterior part of cavernous sinus, partly projecting into IPS. The IPS was still partly filling on check angiogram. As it was difficult to place any additional fibred platinum coil, a 7 £ 30 mm standard GDC-18 coil (Boston Scientific/Target) was placed to completely pack the posterior compartment of the cavernous sinus and the superior end of the IPS (Fig. 2(a) and (b)). The anterior compartment of the cavernous sinus was left intact. A post-procedure angiogram revealed total obliteration of the fistula (Fig. 2(c)). At 12 months follow-up the patient was asymptomatic.

Case 2

A 31-year-old man presented with the symptoms of a type A traumatic CCF. DSA revealed a direct CCF from the C3 portion of left cavernous carotid artery, draining posteriorly into the IPS and cortical veins (Fig. 3(a)). Transfemoral arterial balloon embolization was performed by placing two latex balloons, 8 £ 18 mm in size (BAL 2 X-ray, BALT Extrusion, France) in the cavernous sinus to occlude the fistula. The post-embolization check angiogram showed a small residual fistula with anterior drainage into superior ophthalmic vein, as balloons were located in the posterior part of the cavernous sinus (Fig. 3(b)). Because of the small size of the remaining communication, it was not possible to place the third balloon and the procedure was terminated. After the procedure patient’s ophthalmic symptoms worsened due to diversion of venous flow anteriorly towards superior ophthalmic vein. Subsequently the residual anterior part of cavernous sinus was packed by four standard GDC-18 coils (8 £ 30, 7 £ 20, 6 £ 20, 4 £ 10 mm) through the trans-arterial route. Post-procedure angiogram showed complete obliteration of fistula (Fig. 4(a) and (b)). Over the next 2 days the orbital...
swelling and chemosis progressively decreased. The patient was completely asymptomatic at 9 months follow-up.

Discussion

The aim in treatment of CCF is to occlude the communication and/or cavernous sinus via an endovascular approach. The choice of route, technique and embolic agent depends upon the type of fistula and its architecture. 1–4

The goal of embolization in dural CCF (DCCF) is to promote thrombosis within the cavernous sinus. Transvenous embolization has been carried out via the superior ophthalmic vein or the inferior petrosal sinus. 5–8 The angiographic cure is achieved in 77–88% of cases. 8,9 Fibred platinum coils are commonly used as embolic agents as these are thrombogenic. 6,10 However, their delivery is not controlled, may be difficult to place, and may even induce trauma. Care should be taken placing these coils through inferior petrosal sinus because drainage of the pons and brainstem may be via the inferior petrosal sinus.

GDC coils are softer, easier to control, exchangeable and less traumatic than balloons and fibred platinum coils. 11,12 GDC coils are, however, expensive. Fibred platinum coils are thrombogenic and occupy space thereby reducing the number of the GDC coils required and used together can achieve the effective closure of fistula and complete clinical cure in a relatively safe manner.

Embolization with detachable balloons with preservation of the ICA has been the treatment of choice for traumatic high-flow CCF. However, trans-arterial balloon embolization fails in 5–10% of cases. 3,4 Moreover in a partially balloon-occluded fistula the patient’s symptom may be aggravated due to diversion of venous flow as seen in case 2 in the present study. In this situation trans-arterial GDC may be used to pack the remaining cavity or fistula to achieve complete closure. The combination of detachable balloon and GDC appears to be a good alternative to achieve effective closure of direct type A high-flow CCF. The combination allows a smaller number of expensive GDC coils to be used.

GDC can be used primarily to occlude slow flow or small fistulae. 12,13 In high-flow CCF these softer coils may get displaced easily. GDC are pliable and easy to manoeuvre in the residual fistula. They adapt to the shape of the cavernous sinus without producing a significant mass effect on the intracavernous cranial nerves. Choice of an appropriate coil size is based on the diameter of the cavernous sinus and on the size of fistula.13

In conclusion GDC has a definite role to play in the treatment of CCF either as a primary or secondary embolization procedure through trans-arterial or trans-venous route. The type D dural CCF can be effectively obliterated via the trans-venous route by thrombogenic fibred platinum coils followed by softer, less traumatic GDC in a controlled
Figure 2. (a) Placement of the fibred platinum coils followed by GDC in the posterior compartment of cavernous sinus and inferior petrosal sinus. (b) Post-embolization selective left ascending pharyngeal angiogram showing total closure of DCCF and (c,d) post-embolization selective left distal ECA angiogram showing occlusion of DCCF.
and safe manner. For high-flow direct fistulae particularly after subtotal occlusion by balloon embolization, GDC packing of residual fistula may be considered to achieve the complete closure.

References

5. Halbach VV, Higashida RT, Hieshima GB, Reicher M, Norman D, Newton T. Dural fistula involving the cavernous sinus: Figure 3 Direct type A CCF. (a) Left ICA digital subtraction angiogram, arterial phase in lateral view shows a fistula from the C3 portion of cavernous–carotid artery (arrow), draining posteriorly into the inferior petrosal sinus (arrowhead) and cortical veins. (b) Post-balloon embolization left ICA DSA showing a small residual fistula with anterior drainage into the superior ophthalmic vein (white arrow).

Figure 4 (a) Unsubtracted left ICA angiogram, lateral view and (b) left ICA DSA anteroposterior view showing placement of GDC coils in the anterior compartment of cavernous sinus with complete obliteration of fistula.