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Successful transarterial glue embolisation by wedged technique for a tentorial dural arteriovenous fistula presenting with a conjunctival injection

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Abstract Many tentorial dural arteriovenous fistulae (TDAVF) present with intracranial haemorrhage. We report a patient who presented with conjunctival injection. Transarterial embolisation of the TDAVF was undertaken with a wedged injection of a low concentration of N-butyl cyanoacrylate, arresting the flow next to the proximal segment of the venous outlet. After three sessions, a complete cure was achieved. We present a useful method which has not been reported previously.

Keywords Tentorial dural arteriovenous fistula · Transarterial embolisation · N-butyl cyanoacrylate

Introduction

It is estimated that tentorial dural arteriovenous fistulae (TDAVF) comprise approximately 8.4 % of intracranial DAVF, many of which present with intracranial haemorrhage [1, 2]. We saw a patient who presented with conjunctival injection. We carried out transarterial embolisation with N-butyl cyanoacrylate (NBCA) to close the meningeal shunts. Recent recommendations on treatment assume that transarterial embolisation alone is inadequate; occlusion of arteriovenous shunts and the initial portion of the draining vein is the key to complete, successful treatment without recurrence [3, 4]. We performed a total of 11 embolisations in two of which dilute liquid adhesive was injected into the shunts and the venous outlet by 'wedging' the catheter into the feeding artery. Secondary occlusion of the vessels not directly embolised was also achieved. Wedged injection of NBCA can give the same result as surgical interruption of leptomeningeal venous drainage or transvenous coil embolisation.

Case report

A 53-year-old man presented with conjunctival injection. An intracranial lesion was suspected and he was referred to our institution. CT and MRI showed numerous dilated vessels on the right, near the lateral part of the tentorium. Angiography demonstrated a TDAVF with numerous feeding vessels from the internal and external carotid arteries and vertebrobasilar system (Fig. 1 a, b, c, d). Internal carotid angiography showed the fistula to be fed by tentorial branches (Fig. 1 d). Vertebral angiography showed the shunts, and a varix close to the surface of the tentorium fed by the lateral temporal branch of the posterior cerebral and superior cerebellar arteries and posterior meningeal branches (Fig. 1 c). Draining and varicose veins were seen on the surface of the tentorium. The superficial drainage connected to the vein of Labbé and the deep drainage ran along the tentorium to the galenic system. Therapeutic options such as transarterial embolisation, alone or combined with surgery or stereotactic radiosurgery, surgery alone, or transvenous embolisation were considered. Since transvenous embolisation was thought technically difficult and the patient did not wish surgery, transarterial treatment was undertaken via the femoral artery with a 4 F catheter and a 0.018 catheter in three separate sessions. At the first, we treated seven meningeal branches of the external carotid artery and a posterior temporal branch of the right posterior cerebral artery, using the "flow related technique", in-

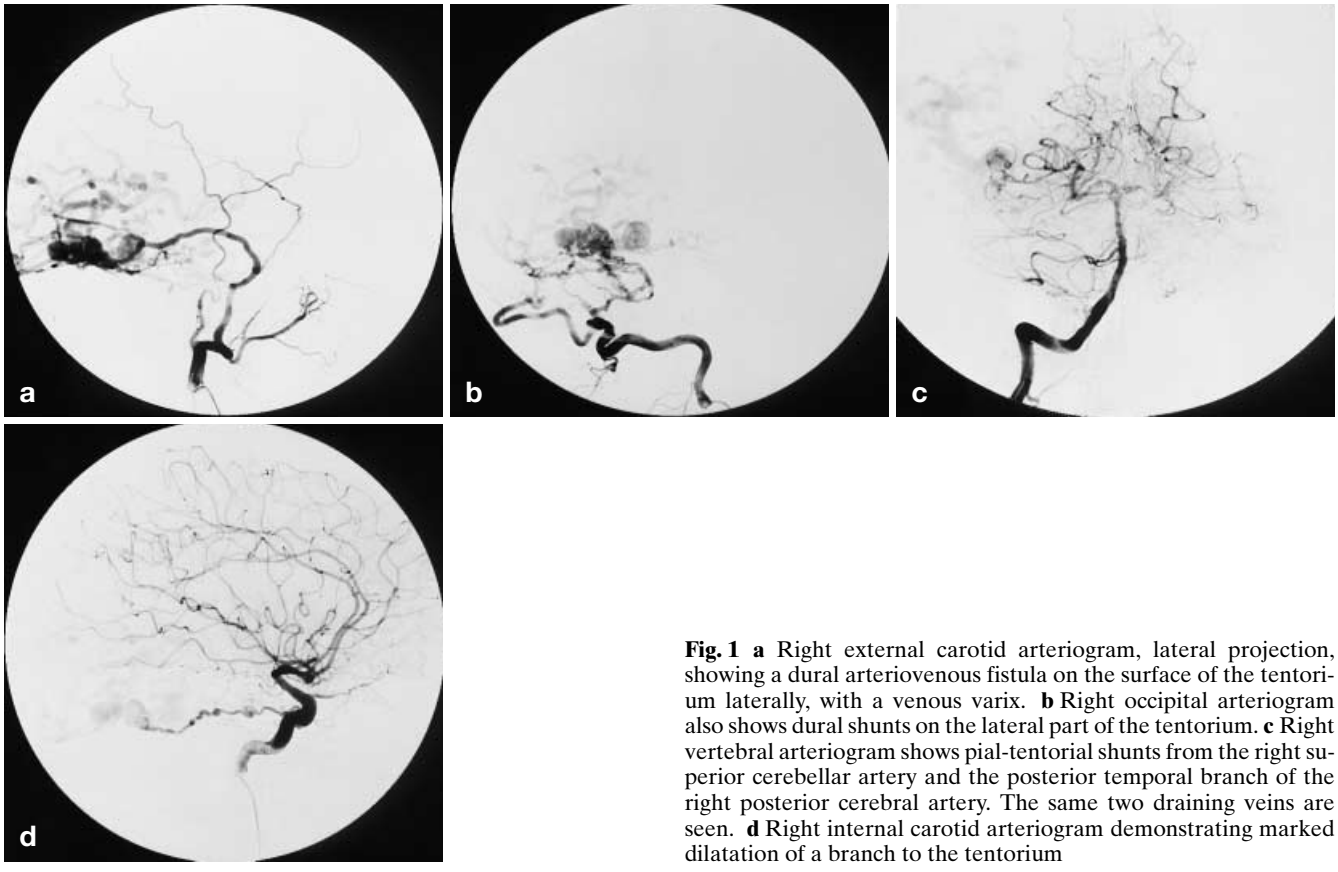

Fig. 1 **a** Right external carotid arteriogram, lateral projection, showing a dural arteriovenous fistula on the surface of the tentorium laterally, with a venous varix. **b** Right occipital arteriogram also shows dural shunts on the lateral part of the tentorium. **c** Right vertebral arteriogram shows pial-tentorial shunts from the right superior cerebellar artery and the posterior temporal branch of the right posterior cerebral artery. The same two draining veins are seen. **d** Right internal carotid arteriogram demonstrating marked dilatation of a branch to the tentorium

jecting a concentrated mixture of NBCA, lipiodol and tantalum powder (1:0.5–1:1) with the flow to close the main meningeal and pial shunts. About 40% of the shunts were reduced. At a second session, 3 weeks later, we performed embolisation of the residual occipital lesions from the meningeal branches of the right vertebral artery and the right middle meningeal artery, with approximately 70% reduction of the shunt flow. Angiography demonstrated complete closure of the deep venous draining. A temporary mild facial palsy was noted.

This took 2 months to recover, and 6 months later we carried out further transarterial embolisation via the middle meningeal artery. We performed 11 embolisation, in two of which a low concentration of glue (NBCA, lipiodol, tantalum powder 1:2.5–3:1) was injected into the nidus and the venous outlet by wedging the microcatheter in the feeding artery. Secondary occlusion of the vessels not directly embolised was also achieved. External carotid angiography before and after the procedure and a postprocedure plain film demonstrated complete filling of the nidus and the first part of the draining vein by NBCA. The venous fistula and varix were totally obliterated. The patient has been asymptomatic since the last procedure.

Discussion

Conjunctival injection is a rare presentation with a poor prognosis. The underlying requires prompt, complete treatment, as partial therapy is not fully protective. Radiosurgery, surgical removal of the shunts, and endovascular treatment are the choices available. For tentorial lesions, surgery is often selected [5, 6].

Several groups have chosen radiosurgery, to minimise recurrence rates. Conventional external beam radiotherapy in doses of 15–51 Gy has been used to treat cranial DAVF, but it takes a few years for thrombosis to occur and the frequency of effective obliteration is unknown. Even when irradiation is effective, there are risks of haemorrhage in the interval between treatment and occlusion and delayed radiation-induced damage. Stereotactic radiosurgery has not been proved to be beneficial for cranial DAVF [7].

Clipping of the leptomeningeal veins draining a tentorial fistula has become the established technique [9]. It has lower morbidity and mortality than the more extensive surgery required for excision of the fistula. The evidence is that by occluding the venous drainage, the shunts are obliterated, with subsequent regression of the feeding arteries [4, 5]. The surgical approach to tentorial lesions is easy.

Recent reports suggest that transvenous embolisation is feasible [10], but in this case transvenous coil embolisation would have been inadvisable because of the complex venous anatomy and the risk of venous perfo-

ration, although some draining veins have a thick, collagenised wall secondary to longstanding arterial flow. Treatment consists of obliteration of the fistula, and reducing the risk of the fistula recruiting alternative venous drainage. Diversion of arterialised flow into cortical veins is also required to eliminate the risk of haemorrhage from venous varices. Partial occlusion of draining veins may result in diversion of arterialised flow into cortical veins, with the risk of venous hypertension or haemorrhage [11,12]. Careful assessment of the pattern of venous drainage is essential to ensure preservation of normal venous drainage; failure to do this may result in a catastrophic venous infarct [13, 14].

Recently developed devices present new opportunities for carrying out an ideal procedure. The effects of NBCA, the substance we used, are permanent and its use is reported as almost equivalent to surgery. [14]. We injected it using the "flow related" technique, in which concentrated NBCA was injected with the blood flow, and the "wedged" technique, with a low concentration of NBCA, arresting the blood flow. We used the latter for complete occlusion of the shunts, including the venous outlet. The first step was to close the main shunts with the "flow related technique", the second to select small feeding vessels for wedged injection. As the main shunts have already been closed, glue can be injected using the wedged technique near the proximal segment of the venous outlet without its being pushed back by the flow from the unembolised vessels. Fragmentation of the glue mixture is not to be feared because the flow has been arrested.

A facial palsy was a relatively transient complication of the second session. The middle ear receives blood from five main arterial systems: the caroticotympanic branch of the internal carotid artery, the anterior, superior, inferior and posterior tympanic branches of the internal maxillary, middle meningeal, ascending pharyngeal and stylomastoid branch of the occipital (or posterior auricular) arteries respectively. There is considerable variation in the posterior tympanic branch. We suspect that the facial palsy occurred when inadequate occlusion of the posterior tympanic branch rendered the vertical segment of the nerve ischaemic in the fallopian canal [15].

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