The use of fibrin and gelatin fixation to repair a kinked internal carotid artery in carotid endarterectomy

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INTRODUCTION

The course of the internal carotid artery (ICA) after carotid bifurcation shows many variations such as curves, kinks, and coils. Ten percent of the ICA follows a medially curved course. Aging and atherosclerotic changes can increase the tortuosity of the vessel. During carotid endarterectomy (CEA), the kinking of the ICA after suturing may occur due to the differences in the arterial wall thickness of the proximal ICA, which is thin after plaque resection and the thicker wall of the distal ICA. It is presumed that curved ICAs are inclined to kink. The use of fibrin and/or gelatin in the repair of the kinking or torsion of vessels has been described in previous studies. We herein report our experience with an ICA that was kinked during CEA and its repair, which involved the application of a scaffold with fibrin and gelatin. To our knowledge, this is the first report to describe fixation with fibrin and gelatin as a salvage method to resolve the kinking of the cervical ICA during a CEA procedure.

CASE REPORT

A 68-year-old male with left hemiparesis admitted to our institute. Magnetic resonance imaging showed multiple spotty cerebral infarctions in the right middle cerebral artery. The right cervical ICA showed 75% stenosis...
with a plaque hemorrhage, which might have caused an artery-to-artery embolism. The cervical ICA showed a strong curved course in the medial direction after the stenotic lesion on magnetic resonance angiography (MRA) [Figure 1a]. CEA was planned to reduce the risk reduction of recurrence. After final closure, a distal portion of the ICA was found to have been kinked after removal of the plaque due to the discrepancy in vessel wall thickness [Figure 2]. Fibrin glue and gelatin were used to reinforce the medial arterial wall and repair the kink. Gelatin was soaked with fibrinogen before fixation. The fibrinogen-soaked gelatin was applied to reconstruct the kinked ICA and return it to its optimal position. The gelatin was fixed with thrombin which converts fibrinogen to fibrin. Intraoperative Doppler sonography and indocyanine green angiography demonstrated the release of the kink. Postoperative MRA showed an appropriate course and no kinking of the ICA [Figure 1b]. The ICA shape was preserved at 1 year after the operation [Figure 1c].

**DISCUSSION**

The kinking of arteries after surgical manipulation can lead to a critical ischemic event. Yuan et al. showed, with the use of intraoperative duplex ultrasonography, that the kinking of the ICA was observed in approximately 9.5% of 285 patients who underwent CEA. They described the use of a patch graft to prevent the intraoperative kinking of the ICA. Fibrin is used to fix kinked vessels into an optimal position in a variety of surgical fields. Fundaró et al. reported that 14 coronary bypass vessels were fixed with fibrin to correct their shape in cases where the vessels were too long or kinked. They used a few drops of fibrin glue and did not use gelatin. Furthermore, fibrin has been used to repair the long and tortuous arterial and venous pedicles of microvascular flaps and to stabilize donor vessels in transplantation to avoid the complications associated with kinking or compression. We have reported that application of fibrin and gelatin fixation for tortuous or kinking graft vessels to correct their position in an intracranial revascularization surgery, including vertebral artery reconstruction. Because there is no place to fix the graft to surroundings such as in a subdural or epidural space, gelatin can make a scaffold reinforce the fibrin.

However, allergic side effects have been reported. The use of fibrin and gelatin was reported to have caused a vasospasm of the cortical arteries in a patient who underwent arachnoid plasty. The administration of steroids dissolved the vasospasm which indicated the involvement of an allergic reaction to the fibrinogen mixture (especially aprotinin). Gelatin may also cause mass effects and the edema of the soft tissue. Although there were no complications associated with the use of fibrin and gelatin in our clinical cases, fibrin and gelatin fixation should be used as a salvage method, to reconstruct the vessel in the appropriate shape and optimal position.

**CONCLUSION**

The utilization of fibrin and gelatin for the reconstruction of a kinked or tortuous ICA should be considered in CEA as a simple salvage method to reinforce the ICA wall and maintain cerebral blood flow.

**Financial support and sponsorship**

Nil.

**Conflicts of interest**

There are no conflicts of interest.
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