

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

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Abstract

Background: The kinking of the internal carotid artery (ICA) after final closure in carotid endarterectomy (CEA) is thought to be uncommon. When it occurs, it is mandatory to reconstruct ICA to preserve normal blood flow. We herein present a case in which a fixation technique was applied to repair an ICA that became kinked during CEA.

Case Description: A 68-year-old man presented with cerebral infarction due to an artery-to-artery embolism from the right cervical ICA stenosis. CEA was performed 12 days after admission. After final closure, a distal portion of ICA was found to have been kinked following plaque resection in CEA procedure. Fixation with fibrin glue and gelatin was used to reinforce the arterial wall and repair the kink. Postoperative magnetic resonance angiography demonstrated the release of the kink in ICA.

Conclusion: Fixation with fibrin and gelatin is a salvage armamentarium that can be considered in CEA for the repair of kinked or tortuous ICA.

Key Words: Carotid endarterectomy, fibrin/gelatin fixation, internal carotid artery, kinking

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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.^[6] Ten percent of the ICA follows a medially curved course. Aging and atherosclerotic changes can increase the tortuousness 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.^[10] 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.^[1-3,5,8,9] 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

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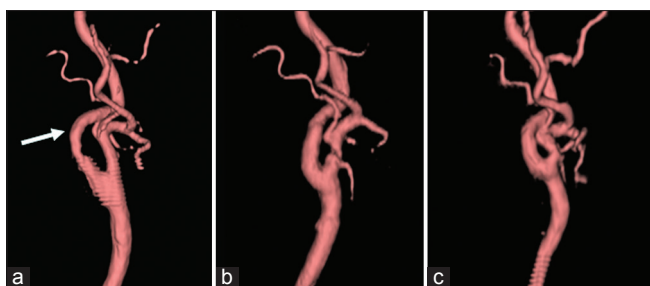


Figure 1: The right lateral view of the internal carotid artery depicted by magnetic resonance angiography volume rendering images. (a) Preoperative magnetic resonance angiography shows the internal carotid artery curved steeply in a medial direction after the stenosis (arrow). (b) Postoperative magnetic resonance angiography shows that the kinked internal carotid artery is properly reconstructed. (c) Magnetic resonance angiography at 1 year after the operation demonstrates that there is no restenosis and that the internal carotid artery shape was preserved

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.*^[10] 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.*^[2] 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

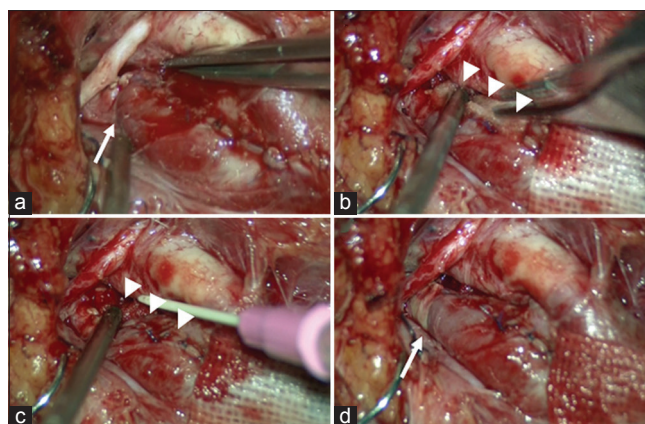


Figure 2: The intraoperative findings. (a) The internal carotid artery is kinked after plaque resection (arrow). (b) Fibrinogen-soaked gelatin (arrowheads) is used to reinforce the kinked internal carotid artery. (c) The fixation (arrowheads) in a medial wall of the internal carotid artery is completed with thrombin. (d) The kink is released (arrow)

flaps^[8,9] and to stabilize donor vessels in transplantation^[11] 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.^[5] 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.^[4,7] The use of fibrin and gelatin was reported to have caused a vasospasm of the cortical arteries in a patient who underwent arachnoid plasty.^[4] 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.^[7] 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.

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Conflicts of interest

There are no conflicts of interest.

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