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Stent infection after carotid angioplasty – Treatment with dual layer stent

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Abstract:

Stent infection is extremely rare, especially in stents placed in the internal carotid artery (ICA). Treatment in these cases remains controversial and no consensus has been reached, resulting in high mortality in all cases. We report the case of a 78-year-old man undergoing stent placement in the left ICA who, 20 days later, presented with infection at the stent site and a large pseudoaneurysm. The primary infectious focus was the teeth. The patient was treated with antibiotics and placement of a Casper stent, a dual layer braided metal stent with micro-mesh, intended to determine flow diversion and arterial wall reconstruction. Although the procedure was able to reduce the pseudoaneurysm, the patient eventually died of sepsis. We believe that the use of dual layer stents, with a flow-diverting effect, may be a treatment option in selected cases. However, further studies are needed to confirm this hypothesis.

Keywords:

Angiogram, angioplasty, carotid, infection, stent

Introduction

Angioplasty with stent placement is a safe and effective minimally invasive treatment option for stenotic carotid lesions associated with atherosclerosis. However, the procedure is not free of complications, including vascular thrombosis, distal embolization, arterial dissection, neurologic injury, pseudoaneurysm formation, puncture site hematoma, stent dislodgment and misplacement, and infections.^[1-3] Stent infection is an extremely rare complication, with high mortality but no consensus regarding treatment. We report a case of stent infection with pseudoaneurysm formation 20 days after angioplasty of the left internal carotid artery (ICA) that was treated with the placement of a Casper

stent to resolve the pseudoaneurysm by arterial wall reconstruction, given the flow-diverting effect of the device resulting from its braided design and greater metal coverage of the artery. To our knowledge, this is the first report of attempted treatment with this device.

Case Report

A 78-year-old male was admitted with acute ischemic stroke in the territory of the left middle cerebral artery, which was treated with venous thrombolysis. Investigation showed critical stenosis of the left ICA and 50%–69% stenosis of the right ICA on Doppler ultrasound (DUS). Angiography showed occlusion of the right ICA with reperfusion on *vasa vasorum* and 90% stenosis of the left ICA. The patient underwent angioplasty with stent placement in the left ICA 14 days after the episode of acute ischemic stroke [Figure 1].

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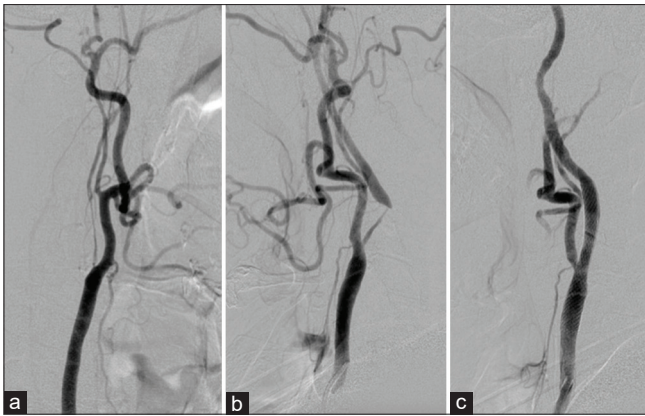


Figure 1: Initial angiogram. (a) Right carotid artery. (b) Left carotid artery. (c) Left carotid angioplasty final result

Both the anesthetic and endovascular procedures were uneventful; the patient progressed without complaints and was discharged 2 days after the intervention. Because the patient was afebrile, and there was no active infectious focus, antibiotic prophylaxis was not given. The patient presented to the emergency department 20 days after treatment with fever. He complained of pain in the left cervical region, and a DUS of the carotid arteries was then performed, which showed only mild intimal hyperplasia within the stent.

Blood culture showed vancomycin-sensitive *Staphylococcus aureus* and the association of several septic teeth in the oral cavity, suggestive of Ludwig's angina. Antibiotic therapy was started, but the patient progressed with worsening pain in the left cervical region and formation of a subcutaneous collection with local edema. A second control DUS showed fluid in the muscle planes around the stent graft, and nuclear magnetic resonance (NMR) confirmed the findings of infection at the stent site. A second cerebral angiography showed only minor irregularities at the stent site with mild intimal hyperplasia [Figure 2].

The patient remained hospitalized for 3 weeks on ceftazidime and vancomycin therapy. The clinical course was stable, with a slight improvement of the cervical edema. A second cervical NMR was performed because of an increase in the cervical collection, which showed a giant pseudoaneurysm of the treated artery, a finding confirmed by angiography [Figure 2]. The case was discussed with the vascular surgery team, and because of contralateral ICA occlusion, bypass surgery for stent resection was not considered a good option, and neither was endovascular occlusion of the diseased carotid artery. Therefore, as an alternative, treatment with the placement of the Casper stent (MicroVention, CA) was suggested. This is a dual-layer braided metal stent with micro-mesh that provides greater coverage of the arterial wall. Its use was intended to achieve arterial

wall reconstruction by the flow-diverting effect of the device. The course of the procedure was uneventful. Immediate results showed contrast retention within the pseudoaneurysm. Ten days later, a control angiography revealed a reduction in the pseudoaneurysm flow and volume [Figure 3]. However, 1 week later, a worsening of his general condition was observed, with a decreased level of consciousness, arterial hypotension, tachycardia, and tachypnea. Septicemia was diagnosed, leading to cardiac arrest and death.

Discussion

Stent infection is a rare complication in the supra-aortic arteries, especially in the ICA, with only a few reports in the literature. Its incidence is believed to be 1:10,000 cases.^[4] Lejay *et al.*,^[5] in a review published in 2018, searched for studies published between 1997 and 2017 evaluating infection in the supra-aortic trunks and found only 8 cases of stent infection in the carotid artery. *S. aureus* was the most frequently isolated microorganism (60% of cases). Probably, the higher incidence on carotid stent infections is explained by the fact that carotid angioplasty is more frequent than angioplasty in other supra-aortic trunks. We cannot know if the carotid artery is more susceptible to infection than other supra-aortic trunks as this complication is too much rare, and there are only a few case reports.

The time interval from stent placement to infection varies between studies, with reports of 13 months,^[6] 20 months,^[7] and 24 months.^[8] There is only one report in the acute phase, with infection developing 2 days after stenting.^[3] In our case, the time interval from stent placement to the onset of symptoms was 20 days. This was the first case of postangioplasty stent infection in our unit, which has >15 years of endovascular stent-grafting and >600 carotid stents deployed.

The pathophysiology of stent infections remains unclear. Some risk factors are well known, including inadequate skin preparation, breaks in sterile technique, puncture site hematoma, increased procedure time, longer wires and catheters, the inadequate aseptic environment of angiographic suites, passing wires or catheters through previously deployed stents, multiple interventions, and deployment of multiple stents.^[1-3] However, based on studies in animal models, it has been suggested that stents offer ideal surfaces for bacterial colonization or iatrogenic introduction, with trauma exposing the arterial media during the procedure as one of the initial events. As a result, an inflammatory process occurs and advances over the arterial wall, leading to processes of thrombosis, septic embolization, pseudoaneurysm formation, arterial rupture, and hemorrhage.^[4-7] The regular use of prophylactic antibiotics is not

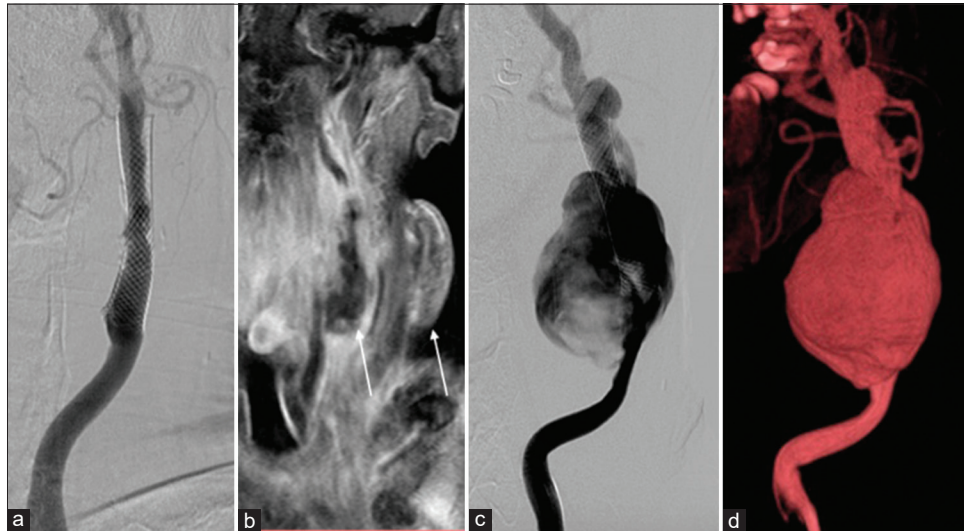


Figure 2: (a) Angiogram demonstrating intimal hyperplasia at the initial phase of the infection. (b) Magnetic resonance showing the pseudoaneurysm and the cervical mass-arrows. (c and d) Angiogram at 2 weeks follow up



Figure 3: (a) Angiogram after delivery of the Casper stent (b-d) Immediate result demonstrating contrast retention inside the pseudoaneurysm. (e) Angiogram 10 days after stent deployment showing reduction in size of the pseudoaneurysm

recommended, as this complication is very rare. It seems reasonable that the use of empirical antibiotic therapy should be limited to suspected or known cases of prosthetic material infection, for which it does not seem reasonable to wait for microbiological sample results. Such situations include severe sepsis, septic shock, and high-risk complications such as arterial rupture. Data regarding the best antibiotic therapy to use are lacking as no well-designed trial exists to study antimicrobial treatment of prosthetic material infection.^[5]

The use of conservative antibiotic therapy has a fatal outcome in up to 50% of cases, thus limiting its use to patients who are unfit for surgery. Therefore, surgery with total removal of the infected content and subsequent installation of an extra-anatomic or *in situ* bypass with autologous material is the preferred approach, despite the high mortality rate associated with the procedure (27.6%).^[2] However, serious complications may occur, such as cranial nerve injury, stroke, reinfection,

and even intraoperative death due to hemorrhagic complications.^[9] Other options include surgical or endovascular occlusion of the affected carotid artery. Endovascular treatment is a good option when the goal is to reduce surgical morbidity, given the lower risk of cranial nerve injury and intraoperative hemorrhage. The timing of intervention remains unclear. As conservative treatment has shown itself unsuccessful, we believe that intervention should be performed as soon as possible, because the natural history of this kind of dissection is the progression of the pseudoaneurysm, until rupture.

What makes our case unique, in addition to reporting an extremely rare complication, is the attempted treatment with a dual-layer stent for arterial wall reconstruction. Endovascular treatment of extracranial carotid artery dissection is not a novel approach, but there are only a few reports involving the use of dual-layer stents. Recently, a study of 19 patients with dissection of the carotid and vertebral arteries treated with dual-layer

stents showed high treatment success rates with few complications.^[10] Kabbasch *et al.*^[11] reported two cases of traumatic extracranial carotid artery pseudoaneurysm treated with dual-layer stents, with complete resolution 11 and 17 days after stent implantation. An advantage of these stents is that they have lower porosity and provide greater coverage of the arterial surface, allowing for greater endothelialization and a flow-diverting effect, which, over time, determines arterial wall reconstruction and resolution of the pseudoaneurysm.

Early monitoring of our patient showed a reduced pseudoaneurysm with contrast retention inside in the acute phase due to the immediate flow-diverting effect. We believe that this treatment option may be considered in selected cases. Nevertheless, this type of complication has high mortality rates regardless of treatment choice.

Conclusion

Stent infection in the ICA is an extremely rare and complex condition, with a high mortality rate. The most common treatment is surgery associated with antibiotic therapy, with stent removal and bypass. We believe that the use of dual-layer stents, with a flow-diverting effect, maybe a treatment option in selected cases. However, further studies are needed to confirm this hypothesis.

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Conflicts of interest

There are no conflicts of interest.

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