Right carotid-cutaneous fistula and right carotid pseudoaneurysm formation secondary to a chronically infected polyethylene terephthalate patch

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ABSTRACT

Carotid endarterectomy (CEA) remains the treatment for significant carotid stenosis and stroke prevention. Approximately 100,000 CEAs are performed in the United States every year. Randomized trials have demonstrated an advantage of patch carotid angioplasty over primary closure. Complications from patches include thrombosis, transient ischemic attack, stroke, restenosis, pseudoaneurysm (PA), and infection. PA after CEA is rare, with a reported average of 0.37% of cases. We describe an unusual case of PA after polyethylene terephthalate (PTFE) patching for CEA. An 88-year-old female with Alzheimer’s disease living in a nursing facility with a history of skin cancer on her right chest developed a new area of intermittent brisk bleeding on her right neck which was initially believed to be related to her skin cancer. She had a remote history of right CEA with a PTFE patch approximately a decade ago. A computed tomography angiograph-head-and-neck with showed a partially thrombosed PA in the region of her right common carotid artery bifurcation with a tract containing gas and fluid extending to the skin surface suspicious for a partially thrombosed, leaking PA. She was taken urgently to the operating room on broad-spectrum antibiotics where we performed a right neck exploration, ligation of a bleeding carotid PA by ligation of the right common, internal, and external carotid arteries, explantation of a chronically infected polyethylene terephthalate patch, and closure with a sternocleidomastoid advanced flap with multilayered closure. She was discharged to her nursing facility with 6 weeks of ceftriaxone intravenous (IV) and metronidazole IV through a peripherally inserted central catheter (PICC) line with no neurological sequelae.

Key Words: Carotid artery endarterectomy, polyethylene terephthalate patch, pseudoaneurysm

INTRODUCTION

Carotid artery endarterectomy (CEA) remains the treatment for significant carotid stenosis and stroke prevention. Approximately 100,000 CEAs are performed in the United States every year.⁴ Randomized trials have demonstrated an advantage of patch carotid angioplasty over primary closure in reduction of stroke, death, arterial occlusion, and return to surgery for repair of the arteriotomy created during CEA. Meta-analysis favors patching for a reduction of long-term restenosis rate.⁴ Common types of carotid artery patch material are autologous vein, bovine and porcine pericardium, polyethylene terephthalate (PTFE) or Dacron, and expanded PTFE (ePTFE). Complications from patches include thrombosis, transient ischemic attack (TIA), stroke, restenosis, pseudoaneurysm (PA), and infection.

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PA after CEA is rare, with a reported average of 0.37% of cases.\(^3\) It can occur due to suture failure, degeneration of the arterial wall or patch material, and infection. Infection is associated with 33% of PAs and is most associated with staphylococci.\(^4\) PA is twice as common in patch angioplasty than in primary closure,\(^5\) and prosthetic patch angioplasty has a greater risk of PA formation than when using venous patches.\(^6\)

A Cochrane review including 13 trials with 2083 operations analyzed different materials used for CEA artery closure. Within the review, seven trials compared vein closure to PTFE, and six compared Dacron grafts to other synthetic materials. Dacron and ePTFE patches had similar rates of restenosis and occlusion compared to vein patches. There were no significant differences in the outcomes between vein patches and synthetic materials, except PAs. Two additional conclusions were based on small outcomes and the significance was uncertain: PAs occurred less frequently in synthetic patches than vein patches, and Dacron grafts were associated with a higher risk of stroke, TIA, thrombosis, and restenosis.\(^7\) Two trials showed a significant reduction in the risk of PA with PTFE patching (0.8%) compared with vein patching (11.9%).\(^8\) Two other trials did not report any PAs in either group. The clinical significance of PA formation in PTFE patching was unclear as none of the PAs ruptured or caused ipsilateral strokes.\(^9,10\)

**CASE REPORT**

We describe an unusual case of PA after polyethylene terephthalate (PTFE) patching for carotid endarterectomy (CEA). An 88-year-old female with Alzheimer’s disease living in a nursing facility with a history of skin cancer on her right chest developed a new area of intermittent brisk bleeding on her right neck which was initially believed to be related to her skin cancer. The new-onset bleeding initially occurred 6 weeks before the patient’s arrival at our hospital. A general surgeon rounding at the patient’s facility recommended a computed tomography (CT) scan, but the patient refused and her family supported her decision. Instead, the wound was bandaged and kept clean. The bleeding eventually stopped, but suddenly occurred again the night of her arrival to our hospital [Figure 1]. Her past medical history included hypertension, hyperlipidemia, chronic kidney disease Stage III, skin cancer of the right chest wall (not formally evaluated), and a right CEA with a polyethylene terephthalate patch approximately a decade ago. Her vital signs were normal and her hemoglobin was 11.5 on arrival and hence, we ordered a CT angiograph (CTA)-head-and-neck with showed a partially thrombosed PA in the region of her right common carotid artery bifurcation with a tract containing gas and fluid extending to the skin surface suspicious for a partially thrombosed, leaking PA [Figure 2]. The CTA also showed a markedly attenuated right internal carotid artery as it entered the skull base. She was taken urgently to the operating room on broad spectrum antibiotics where we performed a right neck exploration, ligation of a bleeding carotid PA by ligation of the right common, internal, and external carotid arteries, explantation of a chronically infected polyethylene terephthalate patch, and closure with a sternocleidomastoid advanced flap with multilayered closure [Figure 3]. Wound cultures eventually grew *Streptococcus anginosus* and diphtheroids. She was discharged to her nursing facility with 6 weeks of ceftriaxone intravenous (IV) and metronidazole IV through a PICC line with no neurological sequelae.

**DISCUSSION**

Randomized trials have demonstrated an advantage of patch carotid angioplasty over primary closure in carotid endarterectomy (CEA) surgery. There are several well-known complications of this CEA, and the overall morbidity and mortality rates are <6% in symptomatic patients and <3% in asymptomatic patients.\(^11,12\) The complications and timing of these complications include stroke (perioperative <3% for asymptomatic patients and <5% for symptomatic patients),\(^13,14\) myocardial infection (<2% risk within 30 days),\(^15\) hyperperfusion syndrome – essentially a syndrome of cerebral reperfusion after years of a low-flow carotid vascular bed resulting in ipsilateral headache, focal seizures, or rarely, intracerebral hemorrhage (1%–3% of cases within 2 weeks),\(^16,17\) cervical hematoma (3.4% overall incidence, with an increased risk if receiving antiplatelet or anticoagulation postoperatively),\(^18,19\) nerve injury (the majority of cranial nerve injuries resolve after surgery, with the risk of permanent cranial nerve injury <1%; the most commonly injured nerves, in order of incidence, are the hypoglossal nerve, facial nerve, and vagus and glossohypopharyngeal nerves with similar incidences),\(^20,21\) carotid restenosis (up to 20% of cases originally, although more recent literature suggests lower values of 2.6%–10% at 5 years; early stenosis occurs within 2–3 years of the
CEA when the restenosed area becomes highly cellular and minimally ulcerated – resulting in a minimal risk of consequential embolization – and late stenosis, which occurs after 2–3 years postoperatively and is the result of ongoing atherosclerosis – resulting in a new potential source of embolic disease),[34‑43] and finally infection. Wound infections occur rarely and usually superficial. For most deep infections, such as what occurred in our patient, there is usually carotid patch involvement – although data regarding this is very limited and mostly based on case series. There is not adequate data in the literature to determine whether or not a specific type of foreign patch increases infection risk, and the infections themselves have been known to occur years later.[45] Usually when deep infections present early, the patient has neck swelling and drainage at the incision site; later-occurring deep infections are known to present as draining sinus tracts or pulsatile neck masses indicating PA. Initial management usually is directed at empirically treating *Staphylococcus* and *Streptococcus* species, about half of the cases may resolve with antibiotics alone.[45] If the infection is persistent, patch excision is mandated in conjunction with carotid artery ligation (as in our patient), reconstruction with autogenous vein graft, or bypass.[44]

Since there are so few cases of deep infections in the literature, it is important to report these cases. As we previously mentioned, it is believed that PA is twice as common in patch angioplasty than in primary closure,[5] and prosthetic patch angioplasty has a greater risk of PA formation than when using venous patches.[6] The patient, an 88-year-old female with Alzheimer’s disease living in a nursing facility with a history of skin cancer on her right chest, developed a new area of intermittent brisk bleeding for 6 weeks on her right neck which was initially believed to be related to her skin cancer. She had a remote history of right CEA with polyethylene terephthalate (PTFE) patching. The bleeding eventually stopped not only atypical for Pas but also suddenly occurred again the night of her arrival to our hospital. She was eventually diagnosed with a right carotid-cutaneous fistula and right carotid PA formation secondary to a chronically-infected PTFE patch.

Quick recognition of this rare complication is essential when it occurs and care should be taken while in the operating room. Since bleeding may be intermittent, surgeons should maintain a high index of suspicion for this condition whenever there is unexplained intermittent bleeding at the skin overlying a known CEA surgical site. A CTA is an appropriate diagnostic test to consider in these cases. For our patient, wound cultures eventually grew *S. anginosus* and diphtheroids; however, cultures are not always positive. As such, long-term antibiotic is necessary as a chronically-infected patch is often the inciting factor and cultures are not always positive. Coverage should be broad if there is no positive culture.

Although the literature remains somewhat sparse to support our hypothesis, it is our belief that our patient’s PTFE patch may have played a key role in the formation of her chronic PA since we use bovine pericardial patches at our institution when patching is necessary and we have not seen this type of late-presenting deep infection yet in our own patients.

**Declaration of patient consent**
The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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**Conflicts of interest**
There are no conflicts of interest.
