



## Carotid Endarterectomy with Patch Angioplasty: A Case of Postoperative Infection and Literature Review

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### Abstract

Infections are a rare but recognized complication of carotid endarterectomy with patch angioplasty. Its prevalence is approximately 1% of all synthetic patch angioplasties and may present with a variety of symptoms including local swelling, pain, hemorrhage, and/or neurological deficit. The presentation of suspected infection can be early in the post-operative period or delayed by years. The underlying micro-organism tends to direct, at least in part, the timing of presentation. Patients with suspected infections require urgent vascular surgery evaluation. We present a case of a patient with a suspected infected Dacron graft patch angioplasty four weeks post carotid endarterectomy. The patient presented with pain, swelling, and erythema without signs of systemic infection. This patient was managed with explantation of the Dacron graft and vein patch with extended antibiotic therapy. We additionally performed a thorough review of all current literature and case series to identify symptomatology, infectious etiologies, recommended antibiotic regimens and length of therapy, and evaluated multiple surgical treatment modalities.

**Keywords:** Carotid endarterectomy infection; Dacron patch; Management

### Introduction

Stroke remains a leading cause of death in the United States with approximately 80% secondary due to ischemia and with 80% of that group confined to the carotid artery territory [1]. James Ramsey Hunt first described the syndrome of stroke secondary to carotid artery disease in 1914 with the first successful carotid endarterectomy performed by DeBakey in 1953 [2]. Data from the European Carotid Surgery Trial (ECST) and the North American Symptomatic Carotid Endarterectomy Trial (NASCET) shows that Carotid Endarterectomy (CEA) reduces the long term risk of stroke for severe symptomatic carotid artery stenosis and is superior to medical therapy in preventing ipsilateral stroke [3-4], and is also true of asymptomatic high grade stenosis [5-6]. There are several commonly employed techniques used to repair the carotid artery following endarterectomy. These repairs include either interposition or patch with vein, bovine pericardial and synthetic patch with either Dacron or PTFE. Most surgeons now employ a Dacron patch angioplasty as it has several reported advantages over primary arteriotomy closure including lower perioperative stroke and arterial thrombosis rates and lower incident of recurrent stenosis on long-term follow-up [7-9]. They appear to be preferred by most surgeons due to their readily available nature, allow for the preservation of the greater saphenous vein to be conserved for the future use of coronary artery surgery or peripheral vascular disease and its relatively low cost [10]. Prosthetic patch infection is a rare incident but is one of the most severe complications following carotid patch angioplasty [11-15].

### Case Presentation

We present a case of a 54-year-old male patient who underwent a right carotid endarterectomy with Dacron patch angioplasty for carotid stenosis in March 2018. The patient had a benign postoperative course with the exception of right tongue deviation likely secondary due to a traction injury. Patient had no hematoma development post-operatively and was discharged on the first post-operative day. Patient followed-up in the office 2 weeks after surgery with no overt signs of infection or tenderness, only mild right sided tongue deviation. Approximately one month after surgery the patient was evaluated in the emergency department with a new complaint of fevers, chills, and weakness  $\times 1$  week. Upon evaluation the patient was noted to have erythema, induration, and warmth to the area of previous CEA with edema extending from inferior incision line to the post auricular location. No fluctuant masses were noted at that time and no sinus formation or purulent drainage was noted. Vital signs on admission showed tachycardia but otherwise hemodynamically

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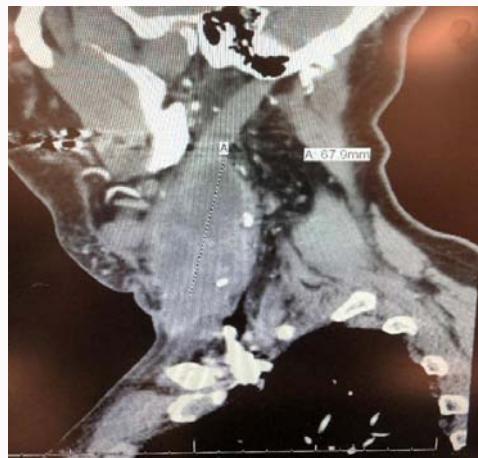
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**Figure 1:** Right carotid region fluid collection abscess vs. hematoma, coronal view.



**Figure 2:** Right carotid region fluid collection abscess vs. hematoma, sagittal view.

stable and afebrile. Routine lab work was most notable for white blood cell count of 12.8 with a shift at 77% neutrophils and no bands. Hemoglobin was noted to be 14.6, CRP and sedimentation rate were both elevated at 17.8 and 76 respectively. Due to patient's recent carotid endarterectomy patient underwent a CT angiography of the neck which showed a lobular low-density structure with peripheral rim enhancement and internal septations in the right neck located between the sternocleidomastoid muscle and right carotid artery measuring 3.8 cm × 2.9 cm × 6.8 cm (Figure 1 and 2). This mass had surrounding stranding and induration in the immediate area to include the superficial subcutaneous fat along the right sternocleidomastoid muscle without discrete tract formation or signs of occlusion to the artery or pseudoaneurysm development. There was no air in this collection and discrete differentiation between abscess and hematoma formation could not be made based upon imaging. Given the recent surgical intervention and the differential diagnosis the patient was admitted to vascular surgery service and was subsequently started on vancomycin and cefepime. The following day the patient was noted to have expansion of the erythema and induration progressing anterior towards the midline of the neck and extension further posterior in the post auricular location. Patient did complain of a worsening headache, difficulty opening mouth due to swelling and had a Tmax overnight of 38.7°C. Patient was subsequently taken to the operating room that day. Exploration of the right neck showed a large volume of white viscous milky material below the deep cervical fascia and (WAS) subsequently evacuated after cultures taken. The right carotid sheath was entered and found to have excellent palpable pulses of the common, external, and internal carotid arteries with appropriate incorporation of the Dacron patch. There were no signs of aneurismal changes and no evidence of arterial or venous bleeding was noted. As expected, there was a significant fibrotic change due to the recent surgery approximately one month ago. The area was copiously irrigated, and the Dacron patch was subsequently removed and replaced with a right great saphenous vein patch and placement of a JP drain in the right carotid sheath. Postoperatively, patient was admitted to the ICU and antibiotics were continued. Patient continued to progress daily with no complications. The patient remained on vancomycin and cefepime, despite negative wound culture growth, and blood cultures were additionally noted to be unremarkable. On postoperative day #5, the patient was discharged with recommendations from infectious disease for two

weeks treatment with daptomycin, cefepime, and caspofungin in which a PICC line was placed and treatment initiated. Caspofungin was initiated for concerns of late presentation of a fungal infection due to the absence of a bacterial etiology. The JP drain was removed before discharge with only serous discharge postoperatively. Patient subsequent postoperative evaluations showed decreased erythema, induration, and absence of subjective fevers and chills. Patient completed his two week course of antibiotics. At this time, follow up continues with the primary attending surgeon without recurrence.

## Discussion

The incidence of prosthetic patch infections following carotid endarterectomy appears to be quite low, approximately 0.25% to 0.5% of all carotid endarterectomies. Clinical presentation is diverse ranging from asymptomatic to patch rupture. However, based upon literature review the most common signs appear to be neck swelling, pseudoaneurysm, and a local draining sinus. These signs along with a history of recent CEA should alert providers to seek an urgent vascular surgery consult. Time to presentation appears to be bimodal in nature and may be driven by the virulence of the pathogen [16]. Early presentation, within 9 weeks, may be related to post-operative wound hematoma or skin infection with cultures from the operative field often showing more virulent organisms such as MRSA or Gram negative bacteria. Late infections, greater than 9 weeks and up to several years later, tend to be less virulent and often caused by *Staphylococcus epidermidis* [17,18]. However, a wide range of pathogens is certainly possible and completing a review of the current literature showed 14 case series with infective pathogens to include: Alpha-hemolytic *Streptococcus* sp., group-A beta hemolytic *Streptococcus* sp., *Bacteroides* sp., *Pseudomonas* sp., and *Methicillin Resistant S. Aureus* sp. Review of those series shows that *S. Aureus* and *S. Epidermidis* appear to be the most common. Of note, multiple cases in those series showed no growth of any bacteria despite obvious signs of infection at the time of operation. It is possible these cases represented less virulent pathogens that antibiotics and the body's immune system was able to suppress. It is also possible that these incidences represent sterile phlegmonous containing macrophages and inflammatory cells without infection. Antibiotic treatment was tailored to each patient in these series based upon speciation and consult with infectious disease. Antibiotic treatment often ranged from 1 to 6 weeks depending on the virulence and recommendations

from infectious disease with no standard practice identified. The natural progression of a synthetic patch infection involves local or systemic sepsis, either in the early or late post-operative period, with the development of erythema, induration, swelling and sinus tract development. The primary concern with these infections is lack of ability to sterilize the foreign material with antibiotics alone and the potential development of a pseudoaneurysm and subsequent patch rupture. Once infection in the local region is suspected imaging modalities may aide in the diagnosis if uncertainty exists. Ultrasound has been shown to be a reliable but operator dependent method of diagnosis. Its use may show discrete fluid collections with or without the presence of tissue planes between the patch and fluid collection suggesting possible lack of infection of the patch. CT and MRI have also been extensively used for operative planning. All modalities appear to be surgeon preference without discrete benefit of one over another. Surgical intervention for infected foreign material tends to follow the widespread accepted practice of removal of all infected tissue, removal of infected non-native material, and repair with vein patch or vein interposition. Greater than 50% of repairs were performed in this manner according to literature review. However, this repair method is not accepted by all physicians and other means of repair have been attempted. In one report, six Dacron patches were replaced with further Dacron grafts after excision of all apparently infected material [19]. This resulted in nearly 50% reinfection rate. Another controversial treatment modality is ligation of the carotid artery which showed previously high stroke rates approaching 50% [19,20]. Naylor reports of five cases involving this method of treatment, which showed preoperatively two patients, had complete occlusion of the artery. This allowed ligation without consequence. The remaining three underwent extensive evaluation including duplex ultrasonography and intra-operative Transcranial Doppler (TCD) to monitor cerebral perfusion during clamping with subsequent ligation. All reported cases had acceptable morbidity outcomes according to the author. Knight reports of two cases of conservative treatment with complete excision of macroscopically infected material, antiseptic washout, tailored long-term antibiotics without the need for excision of the patch. Zacharoulis also reported two cases following the same principle but also included a sternocleidomastoid rotational flap. In all four cases no complications were reported, and resolution of the infections was indicated by the authors. A recent 2017 case series also reports of five Dacron patch infections with subsequent use of bovine pericardial patch without complications and resolution of infection.

## Conclusion

Carotid patch infections are a rare but recognized complication of carotid endarterectomies. Its prevalence is approximately 1% of all synthetic patch angioplasties. Patients may present with a variety of signs including local swelling, pain, hemorrhage, and/or neurological deficit. However, swelling and sinus formation appeared to be the most common sign with systemic infection appearing to be rare. Delays of diagnosis may be caused by lack of symptomatology, delayed presentation after carotid endarterectomy, and lack of clinical suspicion by primary providers. Patients presenting with neck swelling who have a history of carotid endarterectomy must have an urgent vascular evaluation. Duplex ultrasound, CT, and MRI have all been described as effective means of evaluation without clear evidence of superiority in one modality. Surgical exploration and drainage of infection should be regarded as mandatory. Replacement of synthetic patch with a second synthetic patch carries a high reinfection rate and is not recommended. Ligation of the artery has been successful

in very select cases but negates the indication for the original surgery. Surgical exploration and washout without removal of the patch appears to be a viable alternative in highly selective cases with those with no signs of patch infection. However, the most common course of treatment, and probably the most conservative approach, is replacement of the patch with either a vein patch or interposition vein graft. In those individuals without a suitable vein for harvesting a bovine pericardial patch is a viable option. Antibiotics are essential to the management of post-operative carotid infections and should be tailored to *Staphylococcal* sp. or *Streptococcus* sp. as these are the most likely pathogens. Infectious disease consultation should be requested and is needed to guide the treatment and duration. No standard length of antibiotic therapy was determined in the review of the literature.

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