Hemorrhagic Panniculitis Caused by Delayed Microemboli From Intravascular Device

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REPORT OF A CASE

A woman in her 70s had acute onset of asymptomatic and persistent ecchymoses with firm central nodules on the buttocks, arms, and thighs during the previous 4-week period. She reported no history of trauma, recurrent epistaxis, or other signs of a bleeding dyscrasia and took 81 mg of aspirin daily for 6 months. She reported no medi- cally formed on the buttocks, arms, and thighs. Skin biopsy specimens revealed extensive hemorrhage and a panniculitis with sparse, subtle, intra-arteriole, gray amorphous deposits that, on analysis by scanning electron microscopy with energy-dispersive radiography analysis and infrared spectrometry, were most consistent with a hydrophilic polymer. This type of hydrophilic polymer coats catheters and stents such as those used in aortic aneurysm repair.

CONCLUSIONS AND RELEVANCE This is an unusual case of microemboli from the polymer coating intra-arterial stents starting months after placement and causing a panniculitis. Prior observations show that polymers coating intravascular devices have the potential to break down gradually and long after the device’s placement, but clinical consideration for delayed microembolization is underrecognized until catastrophic impairment or death.
identified atrophy of the left kidney with no other significant abnormalities. Chest radiography findings were normal.

Two punch biopsies from the right and left thighs were performed. The biopsy specimens revealed extensive dermal and subcutaneous hemorrhage, slight thickening of the subcutaneous fibrous septa with increased inflammation composed of lymphocytes and eosinophils, lobular fat necrosis in the panniculus lobule, and rare perivascular multinucleated giant cells (Figure 2). However, both specimens showed intravascular and subendothelial gray amorphous deposits (Figure 2 and Figure 3). Staining of these deposits was negative for Alcian blue, von Kossa, periodic acid-Schiff, elastin, and Congo red but unexpectedly positive for nuclear fast red used as a counterstain for the Alcian blue and von Kossa sections (Figure 4). An elastic stain confirmed the amorphous material to be in small arterioles. Further evaluation of the deposits with scanning electron microscopy with energy-dispersive radiography analysis and infrared spectrometry revealed them to be a foreign material, consistent with a hydrophilic polymer.

The patient continued to develop new blue-hued papules on the palms and fingers until 2 months after onset, when she received 2 intravascular stent repairs for a type III endoleak with celiac artery fenestration. On follow-up 6 months later, she no longer developed papules, plaques, or ecchymoses, and the older lesions resolved.

**Discussion**

This case demonstrates an unusually delayed presentation of microembolic disease from the polymer coating of a surgically implanted device presenting with a panniculitis and ecchymoses. With the few reported cases of polymer microemboli, the cutaneous manifestations occurred abruptly, in a localized manner, and were thought to be secondary to the insertion devices and not the stents. In this case, it is most likely that degradation from and embolization of the polymer coating led to the microemboli.
polymer coating of the initial stent are the sources of the cutaneous findings. To our knowledge, this finding represents the first case of a stent-related polymer causing cutaneous embolic disease.

Several previous cases of microemboli due to polymer coatings of devices after intravascular procedures have been documented. Broadly, these articles identified a gray amorphous luminal deposit on histologic analysis that was not consistent with amyloid, fibrin, cryoglobulin, or calcium. However, there are slight differences in the pattern of luminal deposits and chemical composition of embolized polymers, such as polyacrylamide or polyvinylpyrrolidone, compared with our case. For example, polyvinylpyrrolidone stains with Congo red and polyacrylamide stains with colloidal iron and elastin. The purpose of our stain selection was to identify the involved intravascular substance. Alcian blue is a standard stain for acid mucopolysaccharides, while von Kossa stain is commonly used for calcifications. Nuclear fast red was used as a background stain for the Alcian blue and von Kossa stains. Our sample was negative for Alcian blue and von Kossa; therefore, it was not an acid mucopolysaccharide or calcification. The intravascular substance unexpectedly stained with the counterstain used.

There are several potential explanations for the unique staining properties. First, polymer microemboli will biodegrade over the course of a few weeks to months. This degradation may have altered the staining profiles. Second, incorporated serum proteins may have also changed the polymer’s staining characteristics and composition. Future evaluations of polymer-associated emboli with scanning electron microscopy and infrared spectroscopy would better characterize the features of the polymers.

The mechanisms behind these polymer microemboli remain uncertain. Insertion devices, such as catheters, are most commonly implicated after vascular surgery, but the emboli in these cases develop days to weeks after surgery. However, Denardo et al demonstrated that stents degrade over time; therefore, this occurrence may be responsible for polymer microemboli that occur weeks to months after surgery. This study included 4 US Food and Drug Administration-approved companies and 5 stents from each company and involved performing microscopic evaluation of stents both before and after balloon inflation. One stent was noted to have preinflation damage, and all tested stents demonstrated degradation after inflation. However, there remain no US Food and Drug Administration guidelines for governing the level of particulate matter that can be generated by coated medical devices. We hypothesize that degradation of the polymer used to coat the stents would most likely explain the delayed presentation of months rather than weeks. While this outcome may represent the natural degradation of the polymer in the human body, turbulent blood flow over a free edge of the stent, which is inherent in a type III endoleak, may lead to gradual rather than abrupt stent damage. An endoleak is the presence of blood flow between a graft and the vascular component that is being used. Specifically, type III endoleaks result from a defect in the graft material or inadequate sealing in areas where stents may overlap. In our case, the initial aortic aneurysm repair was conducted 6 months before onset of symptoms and marked by multiple significant intraoperative complications that may have predisposed the stent’s polymer coating to degrade and embolize. Repair of the type III endoleak and a new stent resolved her dermatitis, suggesting the polymer from the initial stent was the source of the polymer microemboli.

Cutaneous emboli from polymers related to the insertion device have presented as firm violaceous nodules near the vascular insertion site in areas such as the extremities. Most often, however, polymer microemboli from vascular catheterization have been reported in the lungs, heart, brain, and kidneys and these microemboli were predominantly noted with delayed presentation ranging from weeks to years. To our knowledge, all polymer microemboli in our case were localized to the skin, and, fortunately, the patient sustained no other organ damage.

Conclusions

This case demonstrates that it is important for both dermatologists and pathologists to be aware that iatrogenic microemboli from stents may occur months after vascular surgery. These emboli may present as panniculitic or hemorrhagic lesions. A thorough medical history review and early consideration of this eventuality in the differential diagnosis may prevent significant morbidity or mortality.
Three-dimensional (3-D) printing is the creation of a 3-D object from a digital model through the successive layering of material, a process known as additive manufacturing. The first 3-D printer was developed in 1984 by Charles W. Hull, but only since the beginning of this decade has the technology become widely available for a multitude of applications in engineering, industrial design, biotechnology, and medicine. Considering all of its future potential, 3-D printing is certainly an exciting new area of bioengineering and dermatological research.

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