

# Subintimal Angioplasty in the Treatment of Critical Lower Extremity Ischemia: Is Above-Knee Bypass Defunct?

NOTES

George H. Meier, MD, RVT, Norfolk, VA

The treatment of lower extremity arterial ischemia is rapidly changing as new technologies are brought to bear on the age-old problem of the ischemic leg. Endovascular treatments are blossoming everywhere as conventional open surgical bypass loses favor. The influx of the nonsurgical specialist in the treatment of peripheral vascular disease further enhances this drift away from conventional surgical approaches. As a result, new and innovative techniques are sought to allow the treatment of patients formerly managed by open surgery.

One of the fundamental limitations of endovascular treatment is in the management of complete occlusions over long segments. Many patients with peripheral vascular disease do not present until their arteries are completely occluded, often involving the entire superficial femoral segment or more. Although some patients may only have stenosis, limb-threatening ischemia is invariably associated with complete occlusion. Thus, the endovascular management of patients with limb-threatening ischemia necessitates an approach to complete occlusions using endovascular techniques.

Endovascular treatment by balloon angioplasty with or without stenting ideally allows remodeling of the artery to enlarge the lumen. To achieve this remodeling, the lumen must be connected to the subintimal space to allow healing of the lumen in the larger-diameter treated vessel. With complete occlusions, there is no lumen to reconnect. Therefore, we are left trying to find a space where flow can occur and endothelial ingrowth is possible.

In the 1980s, Bolia and colleagues in Leicester, England, accidentally discovered the subintimal technique in the process of managing patients with arterial ischemia. They discovered that guidewire traversal could be achieved in a plane outside the lumen nearer the external elastic lamina. This is the conventional plane used for surgical endarterectomy. By passing a wire through this plane and reentering into the true lumen at natural feathering points, balloon angioplasty can be performed over long segments to open an adequate lumen for distal perfusion. Since their first success, the Leicester group has performed thousands of these procedures with impressive levels of reperfusion. Given the low cost of the procedure and the lack of stenting necessary to achieve patency, this technique holds great promise in the management of complete occlusions in infrainguinal segments.

The main concern of any new technique such as this is the risk. Although we know that the cost of the procedure is low, is it safe? In our own practice, we have performed over 500 subintimal angioplasties with only two emergency procedures. In one patient, a retroperitoneal hemorrhage from an antegrade puncture required emergency exploration. This patient unfortunately succumbed to a myocardial infarction in the perioperative period. A second patient required evacuation of a calf hematoma that had caused a compartment syndrome. At exploration, no bleeding was seen and the patient underwent an uneventful bypass 2 days later.

The other main concern relative to performing subintimal angioplasty is the risk of converting the level of bypass needed to revascularize the leg. In our experience of over 500 cases, no patient has yet to have their bypass level altered by the use of subintimal angioplasty. Nonetheless, we have accepted technical failures in some of these cases to avoid jeopardizing the bypass level necessary for revascularization. If the patient had a viable option for surgical bypass, then that option was maintained after subintimal angioplasty.

What are the limitations of subintimal angioplasty? Patients with significant calcific disease or medial calcinosis are significantly more difficult to manage with subintimal angioplasty. Not only is the development of the subintimal plane more difficult, but reentry can be dramatically harder. In spite of these limitations, success can be achieved in these challenging patients.

What do we feel is the role of subintimal angioplasty in the modern vascular practice? Subintimal angioplasty at the time of diagnostic angiography is an easy undertaking for any vascular surgeon who understands the risks and benefits of intervention in his patient and has the endovascular skills to undertake some of the technical challenges of this procedure. Although other interventions may achieve reasonable success, the true benefit of subintimal angioplasty lies in its relationship to subsequent surgical intervention. If definitive, then any interventionalist would suffice. In many cases, however, subsequent intervention is necessary and surgical decision making is critical to the patient's care. Therefore, we strongly believe that subintimal angioplasty is an ideal tool for the vascular surgeon/interventionalist at the time of diagnostic angiography. It is only with understanding of the subsequent treatment options and their potential risks and benefits that subintimal angioplasty can be effectively applied.

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