Barbed Absorbable Suture Closure for Large Mohs Surgery Defect

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Report of a Case

An 83-year-old man presented with a recurrent micronodular basal cell carcinoma located on the left lateral chest measuring 2.3 × 2.1 cm. His medical history was significant for coronary artery disease and the use combined clopidogrel bisulfate and aspirin antiplatelet therapy, which was maintained during surgery. The tumor was extirpated with 6 stages of Mohs micrographic surgery, producing a 10.5 × 8.9-cm defect to the deep subcutaneous tissue. The patient was adamant about returning to his recreational activities, including golf, as soon as possible. Wound management options were discussed with the patient, and the limitations of each were noted.

Therapeutic Challenge

Cutaneous surgery usually produces defects that can be managed by a ladder of reconstructive approaches. In this case, none were ideal for this patient. Second intention healing would have produced a prolonged recovery. Primary closure with layered interrupted sutures would be at risk for dehiscence. Full-thickness skin graft might have only partial take. Split-thickness skin grafting would result in poor cosmesis and a donor wound. Local tissue advance flap closure would have produced a large potential space because of extensive undermining and the concomitant risk of hematoma or seroma formation.

Solution

To repair the large defect, a running deep subcutaneous plication was performed using absorbable barbed suture. The wound edges were debeveled and minimally undermined (0.5-1.0 cm) to facilitate wound edge eversion. A novel suture that includes a double needle and a bidirectional barbed component was selected (Quill PDO suture; Angiotech Inc). The material (#0-0 polydioxane suture) was used owing to its long tissue holding time and the relative strength (equivalent to #2-0 suture, once the physical effects of the barbs are counted). Hemostasis was controlled with electrocautery and gentle pressure. The first arm of the suture was placed in the deepest portion of the subcutaneous tissue, superficial to skeletal muscle fascia, extending at least 2.0 cm lateral to the wound edge before exiting within the more superficial subcutaneous layer. The suture arm was gently pulled to engage the barbed portion (Figure, A). The same arm was repeatedly run in an inverted vertical mattress fashion, passing from the midsubcutaneous layer to the deep subcutaneous tissue and again to the opposite side. The net effect is that of a looping spiral. Every 2 passes, the suture was gently pulled parallel to the axis of desired wound closure, allowing the barbed portion to engage and partially approximate the tissue. This is reminiscent of the lacing of a corset undergarment. Through this continuous, partial approximation, the central area of the defect, where maximum wound tension is expected, was brought to partial approximation. On completion of the first entire suture run from wound apex to apex, the suture was passed retrograde 2 loops to ensure overlap.

Figure. Closure of Large Surgical Defect With Barbed Suture

A, A large surgical defect following Mohs surgery on the trunk of a patient receiving dual clopidogrel and aspirin anticoagulation. The wound is debeveled but not undermined. The first suture pass is placed in the very deep subcutaneous tissue and brought out within the deep subcutaneous tissue gently until the barbs engage. One arm of the barbed suture is subsequently run in a continuous vertical looping fashion within the deep subcutaneous layer. Each bite of the needle is extended peripherally at least 2.0 cm from the wound edge in order for the points of tension to be lateral to the dermal wound margins (black arrows), thereby minimizing the risk of dermal vasculature strangulation. Traction is placed on the suture parallel to the wound closure in order to close the deepest layer of tissue and allow the bars to fully engage. The second arm of the suture is passed in a similar pattern, but in the subcutaneous plane, superficial to the first pass, leading to tension-free dermal margin approximation. Minor standing cones are excised, and the remaining closure is accomplished with running polypropylene or other superficial closure material. B, Wound at 8-week follow-up.
in the direction of the barbs, thereby locking in the closure tension before passing laterally out of the epidermal surface and being cut flush with the skin.

The second suture arm was run in the same direction but in a more superficial subcutaneous plane. The resulting wound demonstrated tension-free dermal edge approximation. Minor standing cones were excised. The dermis and epidermis was closed with 1 layer of running #2-0 polypropylene suture. Cephalexin was administered after surgery. The postoperative course was unremarkable. The resultant scar was acceptable (Figure, B). The Video demonstrates this suture technique in a different patient in whom wide undermining was appropriate, allowing us to demonstrate the lateral extension of the deepest layer of suture.

**Discussion**

Closure of large cutaneous defects requires that the dermal wound edge has minimum tension to allow the progress of proper wound healing cascade. This can be achieved in several of the standard cutaneous suturing techniques. Most cutaneous closures use the buried vertical mattress suture, which places tension within the dermis. Our patient had a defect on the trunk that demonstrated limited skin mobility and an insufficiently thick dermis to allow dermis-only wound edge approximation without extensive undermining. A second alternative, the suspension suture, allows for approximation of 1 subcutaneous tissue margin to a firm musculouskeletal structure, most commonly on the face. This was not an option in our case.

The barbed suture was found to assist in this type of defect closure because the barbs along the suture material allow for strong engagement of the very deep fibrous adipose tissue, likely through the collagenous septae. The subcutaneous anatomy of the trunk is poorly characterized, in contrast to that of the face 

In traditional deep tissue closure, there are points of high tension with each tied knot. In contrast, we use the inherent benefit of a pulley principle, spreading wound tension along a larger area. We applied this reconstructive technique to more than 80 other surgical defects in axial and other locations with no major complications and no notable delayed suture reaction. In addition to facilitating closure of large defects, we believe that the technique is faster than conventional closure.

We largely omitted undermining. As the deep subcutaneous tissue is approximated, an excess of subcutaneous tissue is created, forcing the dermis to evert. Because the deep layer of tissue contains a very robust vascular supply, we do not expect necrosis from this high-tension layer of closure. The subsequent subcutaneous layer of closure further approximated the dermis, allowing for final tension-free cutaneous closure. The choice of suture is varied. In this case, we selected nonabsorbable suture for the final superficial closure, which was later removed. In the Video, we have used absorbable gut suture. In other cases we use an additional barbed suture with a rapid absorption time (Quill Monoderm suture; Angiotech Inc). In each situation, only a very narrow lip of undermining in the superficial subcutaneous layer is done to facilitate wound edge eversion. As a result, there is not enough potential space for hematoma or seroma formation. Finally, because of the deep-layered approximation, the functional result is that of a plication of the deep subcutaneous tissue.

In cutaneous surgery, several authors have used barbed nonabsorbable sutures, primarily for cosmetic purposes, with variable results. The size of the suture required for equivalent strength is generally larger than that for an equivalent nonbarbed suture. Such endorb sutures were initially used in our collection of patients. Subsequently, we have used exorb barbs sutures, where the barbs extrude from the suture core (V-Loc suture, Covidian Inc) and as such do not need to be adjusted for size. The use of absorbable barbed sutures is established in orthopedic surgery for closure of incisional access wounds where the tissue is already in near approximation. In contrast, Mohs surgery excisional defects require wound edge approximation to permit final closure. In many situations, this initial step is a challenge. As we describe in the present case report, the closure of a large surgical defect can be accomplished using an absorbable barbed suture.