Plastic surgeons have experienced a surge in the frequency of body contouring surgical procedures, including brachioplasty, abdominoplasty, mastopexy, upper and lower backlift, and thighlift. Partly fueled by growth of the massive weight loss population over the past decade, surgeons performing contouring procedures of the torso and extremities have achieved greater technical finesse and have a wider range of options to address an inherently heterogeneous population. The increase in literature in this field reflects the expanding interest.

While a great deal of attention has been focused on technique, other issues related to body contouring procedures require more attention. One of these issues is how to make these typically lengthy procedures more efficient, particularly when addressing several body regions in a single surgical session. One of the most challenging hindrances to efficiency in body contouring is wound closure. Traditional layered wound closure technique is time-consuming, and it has other problems beyond time constraints. For example, the longer the patient is on the operating room table, the greater the risk of hypothermia. Hypothermia also occurs secondary to loss of thermoregulatory control with anesthesia and is associated with an increased risk of postoperative infection, coagulopathies, and heart attack. Prolonged surgical procedures are also associated with significant blood loss, venous thromboembolism, and pulmonary issues. Traditional wound closure technique depends on multiple interrupted deep and subcutaneous sutures, leading to inflammatory reactions, causing uncomfortable palpable nodules and potentially exacerbating hypertrophic scars. Large dead spaces associated with body lifting procedures set up the risk of seroma formation, requiring drain placement for adequate evacuation of fluid and risking bacterial inoculation of any retained seroma fluid. Procedures in the axilla or groin may result in temporary lymphatic obstruction, leading to

**Abstract**

Even with the evolution of primary surgical techniques in body contouring, wound closure remains primarily traditional and has not advanced beyond the techniques followed in past decades. Streamlining wound closure would be the next advance for body contouring surgery. Absorbable barbed sutures offer a potential solution, and they are the subject of this review investigating the applications of absorbable barbed sutures in body contouring surgery. Barbed sutures hold tension as closure proceeds, theoretically decreasing the time required for wound closure, approximating dead space, and obliterating subcutaneous knots that may result in palpable, painful granulomas. Review of the literature reveals some evidence of time savings (in some cases significant and, in some, not); however, the literature also shows some wound complications from the use of barbed sutures, including infections and extrusions. Barbed sutures have not yet been conventionally embraced, and the technology will certainly continue to evolve in order to make the devices more desirable for plastic surgeons.

**Keywords**

barbed suture, body contouring, operative time, progressive tension, suture extrusion

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Dr Shermak is Associate Professor of Plastic Surgery in the Department of Plastic Surgery at The Johns Hopkins Medical Institutions, Baltimore, Maryland.

**Corresponding Author:**
Dr Michele A. Shermak, The Plastic Surgery Center of Maryland, 1304 Bellona Avenue, Lutherville, MD 21093, USA.
E-mail: shermakmd@gmail.com
lymphedema and exacerbation of infections in the involved limb. With all of these concerns in mind, the field of body contouring surgery is ripe for a new paradigm in wound closure.

One proposed solution to optimize outcomes is barbed suture technology. Barbed sutures originally gained popularity in minimally invasive facelifting but have demonstrated questionable results in maintaining a stable, remarkable outcome. The facelift barbed suture, applied with the use of a trochar, is primarily a 2-0 polypropylene, permanent suture and may have uni- or bidirectional barbs. The primary mechanism of action of these sutures in the face is purchase of the barbs opposite to the direction of pull, anchoring the tissues and maintaining suspension. Histologic studies have demonstrated creation of a fibrous scar interface with the suture, improving tissue purchase and longevity of outcome.

Extrusion, infection, and palpability have all been reported complications in the literature. Long-term clinical outcomes have not proven to meet the theoretic advantages of barbed sutures in the face, and concerns about underreporting of actual complication rates have been raised, particularly with regard to potential suture breakage with dynamic facial movement and failure of the barbs from tension. Barbed suture technology in face and neck rejuvenation has remained a niche treatment, and use of these sutures is currently "off-label" for this type of surgery.

Barbed suture technology has extended beyond face and neck rejuvenation applications to hand surgery, urogynecologic surgery, and body contouring surgery, but there is only limited literature. In body contouring surgery, barbed sutures were originally marketed for approximation of the Scarpa’s fascia layer in the subcutaneous fat, also known as the superficial fascial system (SFS) described by Dr Ted Lockwood in his writings. One of the benefits of the sutures is that they allow for a running closure, which is faster than interrupted sutures for wound approximation. The barbs provide even distribution across the wound, even tension across the closure, and optimization of the resultant scar. Further improving scar outcome is the lack of knots, reducing inflammatory focus. Specifications for this suture include that it be placed deeply in the subcutaneous fat, so it is not externally exposed, and that at the end of the closure, a backward bite be taken to anchor the suture and prevent unraveling.

The literature describing use of barbed sutures in body contouring surgery is sparse. Our center published an outcomes study investigating the use of the Quill sutures for Scarpa’s fascia approximation in body contouring surgery. The Quill SRS (Angiotech Pharmaceuticals, Inc, Vancouver, British Columbia, Canada) comes in permanent and absorbable varieties, and barbs are arrayed in opposing directions on either side of a transitional, unbarbed segment, with a needle on each end. The 0 PDO suture used in our previous study was made of absorbable monofilament, dyed polydioxanone, comparable in caliber to a traditional 2-0 suture. Absorption of the 0 PDO suture is minimal until approximately 120 days and essentially complete by 180 days. Barbed sutures were used for Scarpa’s fascia closure for body regions including the arms, chest, abdomen, and thighs (Figure 1). The 0 PDO suture is double-armed, and there is a nonbarbed area in the middle of the suture. The sutures were placed into the Scarpa’s fascia, and when pulled taut through the tissue, they caught in the middle of the suture without barbs. Closure then advanced lateral to the central suture. The dermis was then approximated with buried 3-0 monofilament absorbable sutures followed by a running subcuticular 4-0 monofilament absorbable suture. Tissue glue was then placed after operating on the back or thigh.

In that study, 910 operations in 496 patients were analyzed, and barbed sutures were placed in 114 cases in the abdomen (n = 98), bilateral thigh (n = 8), bilateral arm (n = 7), and bilateral chest (n = 1). On unadjusted analysis, the wound complication rate with barbed sutures was 17.5%, compared with 12.0% when barbed sutures were not used (P = .093). On multilevel multivariable analysis, age (odds ratio [OR], 1.04) and body mass index at contour (OR, 1.05) were significant in impairing wound healing (P < .01), and barbed sutures were not associated with wound complication rate. Body mass index has generally been well documented as a high-risk variable in predicting less than optimal outcomes, and the impact of age is just starting to unveil itself as a prognosticator of poor surgical outcomes throughout the subspecialties.

In our subset analysis, barbed sutures were associated with significantly higher wound complication rates in the arm (OR, 8.4; P = .046; Figure 2). It was difficult to compare time required for placement of barbed sutures versus traditional sutures because the cases were variable, consisting of different body regions in a heterogeneous population. For this reason, it was also difficult to scientifically compare scar outcome as a potential benefit of barbed sutures as well. Overall, this study revealed an unremarkable benefit...
of barbed suture, particularly in body contouring procedures involving multiple body regions. In fact, complications occurred that appeared to be specific to the introduction of barbed sutures. Workman et al\(^{28}\) reported a case in which a similar type of barbed suture extrusion was reported where barbed sutures used for superficial closure required operative removal due to infection, fever, and wound-healing issues.

Warner and Gutowski\(^{29}\) published a study investigating the use of barbed sutures in isolated abdominoplasty procedures, using the barbed suture for progressive tension closure (Figure 3). This progressive tension method of closure, originally described by Pollack and Pollack,\(^{30}\) approximates the deep subcutaneous fat to the abdominal wall to close dead space and eliminate the need for drains. The modified progressive tension closure technique with Quill sutures uses barbed sutures to plicate the abdomino-plasty flap to the underlying abdominal wall. The placement of the suture is performed with a running suture technique and provides progressive tension, resulting in minimal tension along the incision line. Data from 58 patients revealed a marked reduction in the time necessary to perform the modified progressive tension suture technique using barbed sutures compared with previously published data.\(^{29}\) Rosen\(^{31}\) published his experience with progressive tension abdominoplasty as well, demonstrating a time improvement with barbed sutures; however, sample numbers were small and statistical analysis was not performed.

Jandali et al\(^{32}\) investigated the use of barbed sutures in breast surgery. While they found time savings with barbed sutures, in bilateral cases more than in unilateral cases, they also found a higher rate of wound complications. They concluded that there was a cost benefit but an increased risk of wound complications, including dehiscence, infection, and suture extrusion, which only trended toward significance. Gilliland et al\(^{33}\) also found a shorter operative time with barbed suture utilization, saving 2.3 minutes in knee reconstruction procedures, but the authors believed the difference had little clinical significance. They found similar outcomes and no difference in complication outcomes between conventional suture and barbed suture closure.

Barbed suture design will undoubtedly see modification over time. Engineers are working to optimize barb design for more specific tissue applications, including modification of geometric shape, frequency, alignment, and sequence of barbs. Studies have been performed utilizing tensiometry and simulation with finite element analysis to determine the effect of changing certain variables of the suture—namely, barb length and barb angle—and they have determined that increasing length improves anchoring and that different angles are best for skin versus tendon.\(^{34,35}\)

**CONCLUSIONS**

Barbed suture technology has captured interest for its applications in body contouring surgery. The literature is sparse and demands more objective data to demonstrate the actual, not just theoretical, benefits of barbed sutures and to ascertain that the benefits outweigh the risks. The field of body contouring surgery would certainly benefit from a technology that expedites surgical times and improves outcomes.

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