Use of a Barbed Suture in the Closure of Hip and Knee Arthroplasty Wounds

BRETT R. LEVINE, MD, MS; NICHOLAS TING, MD; CRAIG J. DELLA VALLE, MD

abstract

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Wound closure in primary and revision total hip and knee arthroplasty is an essential and critical component of the procedure. A well-performed closure may take up to 20 to 30 minutes for primary and revision surgeries, respectively. Traditionally, a layered closure is performed using various forms of absorbable and nonabsorbable sutures placed in an interrupted fashion, requiring the surgeon to tie knots to secure each stitch. Disadvantages of knot tying include increased operative time, prominence in subcutaneous layers, and local tissue ischemia. Recently, a bi-directional, barbed suture has been introduced that affords surgeons the ability to close soft tissue layers in a running fashion without the need for knot tying. The bi-directional nature of the barbs allows for simultaneous closure from the wound center, therefore offsetting the increased cost per suture by the decreased number of sutures used and the time saved in the operating room to close the incision. Additional potential advantages of using knotless sutures include enhanced biomechanical strength, increased resistance to catastrophic arthrotomy failure, and a more watertight closure. Our early data support the efficiency and safety of using this suture in total joint arthroplasty wound closure. This article reviews our experience and describes the technique for using barbed sutures during wound closure in 940 cases of primary and revision total joint arthroplasties.
The closure of surgical wounds during total joint arthroplasty procedures is often an overlooked element to the success of the surgery and clinical outcomes. Delayed wound healing, prolonged drainage, and wound dehiscence hold substantial concerns and morbidity for arthroplasty patients. A well-executed wound closure may take 10 to 20 minutes in a primary joint arthroplasty, and 30 minutes in revision cases, depending on the wound length and depth of the surgical dissection. This can often represent 10% to 20% of the time for the overall surgical procedure. Traditional wound closure involves the use of absorbable or non-absorbable sutures in an interrupted, layered closure, with or without the use of skin staples. While this form of incisional closure has historically been successful, there are several potential disadvantages of suture knots with these materials, including local ischemia surrounding the knots, prominent knots as a source of persistent palpable pain, variability in skill levels in knot tying, and an increased length of time spent placing interrupted knots.

A bi-directional, barbed suture that is self-anchooring and requires no knots to be tied during closure was introduced into the United States in 2007. Quill (Angiotech Pharmaceuticals, Inc., Vancouver, British Columbia) is fabricated from polydioxanone (PDO), nylon, and polypropylene, and is offered in a wide array of sizes. The suture core is solid with carefully etched small barbs cut into the suture. These barbs are arranged in a helical array, facing opposite directions from the midpoint. Recent studies suggest that the use of barbed suture for closure of both superficial and deep, surgical wounds leads to good cosmetic and performance outcomes comparable to that of conventional sutures. The paradigm of evenly distributing tension across the length of the suture is unique to bi-directional, barbed sutures. In a recent report, it was shown that bi-directional, barbed sutures outperform the same size conventional materials in regards to tensile strength and wound holding capacity. Similar results regarding strength and efficacy have been presented at the annual American Academy of Orthopedic Surgeons meeting over the past few years. This article reviews the technique and our clinical experience using barbed, bi-directional sutures in the closure of primary and revision hip and knee arthroplasty procedures.

**TECHNique**

A standard, layered wound closure for total hip (THA) or knee arthroplasty (TKA) involves sequentially suturing the fascia/capsule (deep), fatty tissue (intermediate), and subcutaneous (superficial) layers to obtain a “water-tight” and cosmetically pleasing wound. Currently, we close the aforementioned soft tissues layers with a #2 PDO, #0 PDO, or monoderm and a #2-0 monoderm Quill suture, respectively. Typically, for primary and most revision arthroplasty cases, only one suture is required for each layer. The bi-directional, helical array of the bars affords the ability to simultaneously repair the tissues, proximally and distally, away from the midpoint of the incision. Initially, the first pass is pulled until the bars engage at the junction of the reversal of the bars (Figure 1), then 2 throws in each direction are performed and the suture is pulled tight to approximate the soft tissues (Figure 2). With each throw, the suture is pulled taut to assure engagement of the bars and provide a consistent and rapid wound closure (Figure 3). At the wound ends, the suture is backstitched a minimum of 2 to 3 passes before being cut flush with the level of the tissue (Figure 4). The skin edges may be closed with the subcuticular suture alone or supplemented with staples and/or a skin adhesive (Figures 5, 6).

**ClinIcal use summary**

Since the introduction of Quill to our institution, .940 cases using this layered closure with bi-directional barbed sutures have been performed. This includes approximately 350 primary TKAs, 300 primary THAs, 150 revision TKAs, 120 revision THAs, and 20 hip fractures treated with hemiarthroplasties. There have been no notable adverse responses to the suture itself, and no change in our complication
and wound healing rates since adopting the barbed suture closure. Early superficial wound irritation was noted when using the #2-0 PDO material in the subcutaneous layer. However, this issue has been resolved since converting to the monoderm stitch for superficial wound closure. In an unpublished randomized controlled trial, the efficacy and cosmetic outcomes were comparable to a traditional suture closure with a significant decrease in the length of time needed for wound closure at our institution.

DISCUSSION

Since the introduction of barbed, bi-directional sutures, growing interest has been generated among various surgical subspecialties. Successful reports using barbed sutures have surfaced in plastic surgery, gynecologic, and general surgery literature.²,⁶,⁹ Zaruby et al⁹ reported on the use of barbed sutures in a porcine model, concluding that knotless, absorbable barbed sutures are a safe and efficacious alternative for cosmetic skin closure. They also found that yield strength and local soft tissue reactions associated with these sutures were comparable to absorbable monofilament sutures secured with knots.⁹ In orthopedic surgery, the use of knotless wound closures has increased with adopters using the suture for part or all of the closure as described above. Recent presentations have described faster closure rates, greater biomechanical strength, and acceptable cosmetic results.⁵ Despite a greater initial cost, it appears that the time saved in the operating room, with a running closure of the hip and knee soft tissues, ultimately offsets this added expense. A reduction in the number of sharps on the field to be counted and needles to be handled by the operating room staff is an additional benefit. Long-term data and well-controlled randomized trials are needed to validate the early enthusiasm for the use of barbed sutures in THA and TKA.

REFERENCES