

A novel approach to repair of wound dehiscence in the complicated patient

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Abstract Wound dehiscence following abdominal surgery is a rare but deadly complication and management can be challenging. Multiple risk factors can increase the likelihood of encountering a wound dehiscence, including genetic predisposition. One such genetic disorder is type IV Ehlers-Danlos syndrome, which is associated with extreme friability of tissues, including skin and fascia. Due to the friability of the tissue, closure of the wound with conventional techniques is frequently associated with reoccurrence of the dehiscence. Here, we describe a patient with an abdominal wound dehiscence who was treated successfully with a novel closure technique using the Quill SRS™ [Angiotech] barbed suture. The type of stitches and the technique employed allowed diffusion of wound forces away from the edges for distribution to a larger surface, thus decreasing the chances of ripping the skin in this challenging patient.

Keywords Dehiscence · Ehlers-Danlos syndrome · Barbed suture · Hernia

Introduction

Wound dehiscence can be a major complication in any surgical patient and can be caused by multiple factors. In patients undergoing laparotomy, dehiscence rates have been reported to be between 0.25 and 3% of patients [1, 2]. The basis of dehiscence is related to the forces affecting a healing wound, with the force of the vector pulling away from the midline exceeding the

forces generated for closure. Factors increasing the risk for dehiscence include infection, hematoma, emergency surgeries, and imperfect surgical technique [2–5]. A defect in a patient's innate ability to heal normally can also predispose to dehiscence. Maintenance of a closed wound is additionally influenced by increases in intraabdominal pressure. Closure of a dehisced abdominal wound is particularly challenging, since it typically will involve multiple comorbid complications.

In recent years, significant efforts have been made to improve outcomes in wound closure, including development of new technologies. One such technology is the Quill™ Self-Retaining System (SRS) suture (Angiotech Pharmaceuticals, Vancouver, BC, Canada)—a stitch which utilizes a barbed structure and has self-retaining capabilities. Though made of standard suture materials, tiny barbs are cut into the length of the suture in a helical array and facing in opposite directions from the midline.

While the Quill presents advantages in closure of long incisions in regular patients, it also opens the door for innovative applications in patients with challenging wounds. Here, we present a novel suturing technique applied successfully to close an abdominal wall dehiscence wound in an Ehlers-Danlos syndrome (EDS) type IV patient in whom conventional techniques to close the wound had failed. This technique utilizes the barbed structure of the Angiotech® Quill™ SRS polydioxanone (PDO) suture, but adapts a previously undescribed technique for applying this suture. We further elaborate on this technique, which may be useful in the closure of all wounds that are at high risk of dehiscence.

Case report and surgical technique

A 31-year-old Hispanic female with type IV EDS presented with bilateral iliac aneurysms and underwent an aorticobiliac

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replacement with Dacron™ grafting. Her past medical history was positive for an intracranial aneurysm with cerebral stenting, spontaneous rupture of the colon with partial colectomy, stroke, and a chest tube thoracostomy for spontaneous hemothorax. On postoperative day 9, she developed an intra-abdominal hematoma and dehiscence of the abdominal incision including the fascia. An attempt to close the wound following the evacuation of the hematoma was fraught with difficulty due to fascia and skin dehiscence when minimal suture tension was applied. Evaluation revealed an approximately 25-cm midline abdominal wound with a dehiscence of the skin, which was 8 cm wide and a dehiscence of the fascia that was 5 cm wide. A delayed closure was elected while the patient was treated for a polymicrobial infection and the wound was managed with wet to dry dressings.

Fourteen days following the dehiscence, the patient was taken back to the operating room for debridement and definitive closure. At that time, the wound was found to be clean and a minimal debridement was undertaken with a pulse lavage of the wound with saline-bacitracin solution. Due to tissue fragility and the inability to apply tension on the wound edges, the fascial defect was bridged with an onlay 200-cm² Strattice® mesh layer (LifeCell, Branchburg, NJ). The mesh was secured to the fascia using interrupted 2–0 prolene sutures applied with great care to avoid further trauma to the tissues. The skin, which was very friable, was carefully undermined to approximately 8-cm at the edges of the wound bilaterally to allow advancement to the midline. Scarpa's fascia was approximated and secured using 2–0 PDS sutures, but the skin failed to maintain closure due to extreme fragility. Multiple attempts were made to approximate the wound using traditional suturing techniques, but the skin dehiscence occurred repeatedly similar to a “knife through butter.” Definitive skin closure was accomplished by passing #1 Quill™ SRS PDO suture perpendicular to the incision line (Figs. 1, 2). To accomplish this, Quill stitches with a straightened needle were passed in a line perpendicular to the wound extending deep to the dermis for approximately 5-cm on each side of the wound. Three stitches were used and when pulled through they allowed approximation of the edges of the skin without further tissue damage. The dermal layer and skin were then closed using 3–0 PDS simple interrupted sutures (Fig. 3).

The patient encountered no further events during her hospital course and was discharged the following week. At 6 week follow-up, the patient remained in stable condition.

Discussion

Dehiscence of an abdominal wound presents a difficult surgical challenge and is associated with wound complications such as infections, ischemia, healing disorders or

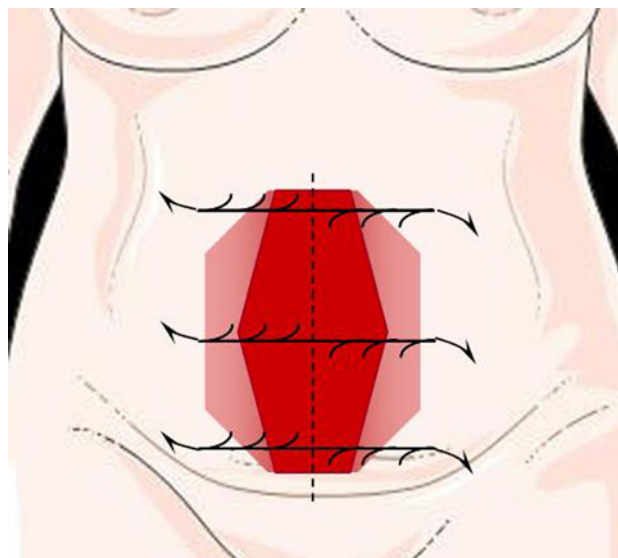


Fig. 1 Novel suture technique using deep Quill sutures perpendicular to wound edges. Diagram is representative of a patient abdomen, with *top* located at the xiphoid process and *bottom* at the pubic symphysis. The *dashed line* signifies the midline patient wound. *Solid lines with curved arrows* on both ends represent direction and alignment of Quill stitches. Needles were straightened prior to passing through tissue to allow deep penetration. Quill sutures were aligned in the midline so that bidirectional barbs change direction at the wound edges



Fig. 2 Intraoperative image of abdominal wound in patient with type IV EDS following dehiscence. Depicts midline dehiscence of patient. Visible in image are the fascial bridging Strattice™ mesh onlay, a drain. The use of Quill® barbed sutures is evident with straight needles passing perpendicular to the wound edges. Also visible are the lacerations at the wound edges from previous suture attempts which have incised the skin and tissues

intra-abdominal complications. Complicated by inflammation, edema, and persistent bacterial colonization, these wounds often require prosthetic or biological mesh for fascia reinforcement, extended hospitalization, and long-term antibiotics in order to achieve complete healing. The



Fig. 3 Postoperative image of the same patient from Fig. 2 demonstrating definitive closure of the abdominal dehiscence. The midline abdominal dehiscence is now closed, with simple interrupted sutures with minimal tension closing only the skin and underlying dermis

initial approach to patients with an abdominal dehiscence includes initial dressing changes, broad antibiotic coverage, debridement of the edges of the wound and treatment of any underlying condition causing the initial dehiscence [6]. Stable closure of the fasciocutaneous layers is the ultimate goal of treatment and the surgical technique employed to achieve this should include closure of the abdominal wall. This should be accomplished methodically, with very little tension being placed on the fascial or cutaneous layers. Following thorough fascial closure, skin edges should be approximated and closed appropriately to prevent ischemia. Common techniques to prevent excessive tension of the wound include undermining of the skin flaps, figure-of-eight suturing, and use of additional suture to spread tension across the wound [7]. However, these techniques are limited because the pulling forces are focused to the narrow strip of tissue at the wound edges. Thus, in patients with compromised skin and fascial strength, these techniques may be inadequate to alleviate tension forces at the wound, leading to recurrent dehiscence.

Type IV EDS is a rare disorder causing extreme fragility of connective tissue due to mutations in protein modifiers of collagen [8]. EDS typically presents with major vascular events, and emergency surgery on these patients is often fraught with complications. The patient described in this article developed a myriad of complications typical to this

syndrome. Wound dehiscence is common in EDS, but may be encountered in any patient following surgery. In this case, traditional techniques used to limit tension at the wound edges were inadequate and recurrent dehiscence resulted. However, the solution was diffusion of the tension across a wider surface area to circumvent the fragility of the tissue at the wound edge. The Quill™ suture is designed with bidirectional barbs that change direction in the center; therefore, the stitch itself is able to distribute force by grabbing tissue along its entire length. Application of the Quill™ stitch perpendicular to the edges of the wound allowed for diffusion of tension over a much greater breadth than typical suturing would allow (in our case 5 cm on each side of the wound) with almost no pulling forces applied on the edges of the wound. This ultimately allowed for appropriate approximation of the wound edges while negating the need for traditional suture.

While the concept of diffusing the amount of force pulling laterally from the narrow margins of the wound to a larger surface of tissue is not new, implementation was difficult to achieve until now. The Quill stitch technology, together with the application of the stitch perpendicular to the wound can today translate the above concept to practical application. This method of wound closure can be an adjunct to the traditional way of wound closure in cases where the vectors of power pulling the tissue laterally are high, increasing the risk for dehiscence of the wound. As in the case of every new surgical technique and medical technology, experience gained with the surgical technique described here will allow us to learn the indication for its optimal use.

Conclusions

The new barbed suture, demonstrated in Quill™ SRS stitches, enables closure of patients with wounds by providing additional “grip” on the tissue and effectively distributing forces more effectively away from the wound edges without the need for surgical knots. This technique may be applicable to any patient in whom it is desirable to provide greater distribution of wound tension and suture stress. Further, the technique may be considered in any complicated patient with dehiscence.

Conflict of interest All authors have no conflicts of interest. Patient records were accessed by approval of the Baylor College of Medicine Institutional Review Board and through protocols of the Texas Heart Institute.

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