"Non absorbable barbed sutures for diastasis recti. A useful device with unexpected risk: two case reports"

Lorenzo Giorgi, Filippo Boriani, Veronica Ponti, Andrea Margara.

Affiliations below.

DOI: 10.1055/a-2181-8382


Conflict of Interest: The authors declare that they have no conflict of interest.

Abstract:

Background
The introduction of non-absorbable barbed sutures in plastic surgery has allowed the achievement of significant results in terms of efficacy and short and long-term outcomes. However, a non-absorbable material with no antibacterial coating could act as a substrate for sub-clinical bacterial colonization and thereby determine recurrent subacute and chronic infective-inflammatory processes. The authors report a clinical experience of subacute infectious complications after two cases of diastasis recti surgical correction.

Methods
The authors present a two-case series in which a non-absorbable barbed suture was used for the repair of diastasis recti. The postoperative course was complicated by surgical site infection. The origin of the infectious process was clearly localized in the fascial suture used for diastasis correction. The suture was colonized by bacteria resulting in the formation of multiple granulomas of the abdominal wall a few months postoperatively.

Results
In both cases reported, the patients partially responded to the antibiotic-targeted therapy, and reoperation was required. The microbiological analyses confirmed the colonization of sutures by Staphylococcus Aureus.

Conclusion
Barbed non-absorbable sutures should be avoided for diastasis recti surgical correction in order to minimize the risk of infectious complications suture-related.

Corresponding Author:
Prof. Filippo Boriani, University of Cagliari, Surgical sciences, Monserrato, Italy, borianifilippo@gmail.com

Affiliations:
Lorenzo Giorgi, IRCCS Humanitas Research Hospital, General Surgery, Rozzano, Italy
Filippo Boriani, University of Cagliari, Surgical sciences, Monserrato, Italy
Veronica Ponti, Humanitas Mirasole SpA, Hand and Plastic surgery, Milano, Italy
Andrea Margara, Casa di Cura Humanitas San Pio X, Plastic Surgery, Milano, Italy
“Non absorbable barbed sutures. A useful device with unexpected risk: two case reports”

Lorenzo Giorgi ¹ ² (ORCID: 0000-0002-4862-0263), Veronica Ponti ³ (ORCID: 0000-0002-5482-9813), Filippo Boriani ⁴ (ORCID: 0000-0002-7739-9801), Andrea Margara ³ (ORCID: 0000-0002-6860-5482)

¹ Division of General Surgery, Department of Surgery, Humanitas S. Pio X Hospital, Milan, IT, Italy
² Department of Biomedical Sciences, Humanitas University, Pieve Emanuele, 20090 Milan, Italy
³ Plastic Surgery Service, Humanitas S. Pio X Hospital, Via Nava 31, 20159, Milan, IT, Italy
⁴ Department of Plastic Surgery and Microsurgery, University Hospital of Cagliari, University of Cagliari, Monserrato, Italy

Corresponding author: Filippo Boriani Department of Plastic Surgery and Microsurgery, University Hospital of Cagliari, University of Cagliari, SS 554 Km 4,500, 09042 Monserrato (CA), Italy

Abstract

Background

The introduction of non-absorbable barbed sutures in plastic surgery has allowed the achievement of significant results in terms of efficacy and short and long-term outcomes. However, a non-absorbable material with no antibacterial coating could act as a substrate for sub-clinical bacterial colonization and thereby determine recurrent subacute and chronic infective-inflammatory processes. The authors report a clinical experience of subacute infectious complications after two cases of diastasis recti surgical correction.
Methods

The authors present a two-case series in which a non-absorbable barbed suture was used for the repair of diastasis recti. The postoperative course was complicated by surgical site infection. The origin of the infectious process was clearly localized in the fascial suture used for diastasis correction. The suture was colonized by bacteria resulting in the formation after a few months of multiple granulomas of the abdominal wall a few months postoperatively.

Results

In both cases reported, the patients partially responded to the antibiotic targeted therapy and reoperation was required. The microbiological analyses confirmed the colonization of sutures by Staphylococcus Aureus.

Conclusion

Barbed long-acting non-absorbable sutures and sutures treated with antibacterial coating should be preferred avoided for diastasis recti surgical correction in order to minimize the risk of infectious complications suture-related.

The paper’s main novel aspect is that this is the first clinical report describing infectious complications after surgical correction of diastasis recti with barbed polypropylene sutures. The risk of microbiological sub-clinical colonization of polypropylene suture untreated with antibacterial coating has therefore to be taken into account.

Keywords: Diastasis recti; Abdominal wall; Non-absorbable barbed suture; Granulomas; Polypropylene suture.


**Article**

**Introduction**

During the last few decades, with the rising of the prevalence of obesity (worldwide obesity has nearly tripled since 1975) (1) and consequently of weight loss surgery surgical technique, post-bariatric body contouring plastic surgery has increased exponentially. Abdominoplasty, thigh lift, brachioplasty, mastopexy, upper and lower back lift are among the most performed post-bariatric surgery procedures.

The growing interest in this field has resulted in the introduction of new suture materials and techniques to achieve the best results with the minimum incidence of complications. Barbed self-anchoring sutures are a relatively new type of surgical suture in which the multiple barbs anchor the tissue without knots, distributing tension evenly among the sutures, thus leading to a better wound healing while also reducing operative time. (2) In addition, many authors consider barbed sutures useful to diminish the skin fibrotic reaction as they dramatically diminish the number of knots and therefore the risk of granulomas.

Although some studies confirmed that barbed non-absorbable sutures are not associated with an increased rate of adherence of bacteria according to in vitro wound models (3), the actual risk in vivo remains unclear (4).

In this case series we report two patients who underwent abdominoplasty and concurrent repair of diastasis recti using by means of non-absorbable undyed spiral barbed bidirectional polypropylene suture, calibre 2, named STRATAFIX, produced by ETHICON (Raritan, NJ, USA). Both cases were complicated with surgical site infection (SSI) in which the suture used in the running-suturing of the rectus for fascial repair was colonized by bacteria with formation of multiple granulomas on the abdominal wall along the midline, requiring in both cases re-intervention.


Case 1

In May 2017 a 37-year-old female, smoker, underwent abdominoplasty with diastasis recti repairment correction following massive weight loss post bariatric surgery (sleeve gastrectomy). The patient presented developed SSI with dehiscence of the surgical wound and formation of an abscess, which was drained and treated with broad spectrum antibiotics and Negative Pressure Wound Therapy (NPWT). In July 2017 a CT scan showed the presence of a fluid accumulation in the subcutaneous tissue (9x3 cm): the patient continued with NPWT until a complete healing of the wound was achieved.

From this moment, the patient consulted numerous physicians in multiple hospitals in the area.

After 6 months, skin ulcers along the midline appeared and they were initially treated with antibacterial alginate and silver dressing. (Fig. 1) In February 2018 a wound culture from the ulcers resulted turned out to be positive for Methicillin-resistant Staphylococcus Aureus (MRSA) and adequate antibiotic therapy was started.

In May 2018 the patient accessed to the Emergency Department (ED) upon referral from the attending physician in response to an abdominal CT scan that was suspected for was compatible with an intra-abdominal abscesses. At the physical examination, periumbilical wounds/fistulas were found, without pus. The liponecrosis induced by the partial resorption of the sutures utilized to treat the diastasis of recti muscles was hypothesized as the cause of the repeated abscess phenomena.

In July 2018 she was hospitalized due to progressive worsening of multiple pus-secreting fistulous tracts, for which a CT scan showed subcutaneous localization: in that period, she underwent surgical intervention surgery with complete abscess removal and NPWT. After 4 months of dressings and targeted antibiotic therapy, the wounds closed completely.
In August 2019 the patient underwent was treated for umbilical hernia surgical repair in another clinic. The procedure was complicated by wound infection that was drained and treated with broad spectrum antibiotics: the surgical report did not indicate mention the placement of a mesh. After 3 months, the patient was admitted in the ED for multiple subcutaneous nodular formations, suspicious for abscesses, on the midline and at the periumbilical level (Fig. 2). Blood chemistry tests were normal (negative inflammation indices) and abdominal ultrasound confirmed the presence of multiple fluid collections compatible with abscesses. A culture swab on the wound was performed and it tested positive for oxacillin and methicillin resistant Staphylococcus Aureus (MRSA). The patient started targeted antibiotic therapy based on Teicoplanin, but showed slow and with poor healing.

In May 2020 a surgical revision was performed in our centre: on that occasion, the skin containing the ulcerations was removed and the fistulous tracts were followed deep to the superficial fascia of recti muscles; the non-absorbable suture originally used for recti diastasis and an umbilical granuloma were completely removed. These findings were subjected to histological and culture examination which confirmed the presence of MRSA.

The patient was then discharged and continued therapy at home, with scheduled follow-ups in our hospital. (Fig. 3)

Case 2

The second patient was a 39-year-old female that in October 2019 underwent abdominoplasty with diastasis recti repair with non-adsorbable barbed bidirectional polypropylene suture after weight loss surgery (sleeve gastrectomy). The postoperative course was complicated by SSI in the middle third of the incision. The culture swab from the wound resulted positive for
Staphylococcus Aureus (SA). The infection was promptly treated with targeted antibiotic therapy with complete healing of the wound after a few weeks.

In the following course, small ulcerations appeared all along the midline incision, progressively evolving into granulomatous nodules. These lesions were treated with multiple dressings but unsuccessfully. (Fig. 4)

The patient finally underwent reintervention in May 2020, during which all the nodular lesions were incised and followed from the skin down to the superficial recti fascia and the non-adsorbable suture used in the previous surgical intervention was completely removed. Interestingly, both the wound swab collected preoperatively and the suture were positive for SA colonization.

The result after healing was optimal and she with complete patient’s satisfaction.

Discussion

Diastasis recti is an anatomical condition in which the linea alba in the epigastrium appears to be thinner and presents as a midline bulging of the anterior abdominal wall. Surgical repair of diastasis recti can be performed simultaneously during an abdominoplasty or hernia repair and consists of either a single- or double-layer suture closure of the recti fascia, according to surgeon’s preference. (5)

There are currently no guidelines for the best suture to be used in recti diastasis repair (6) and even if traditionally the most preferred suture materials for the fascia plication were non-absorbable, new evidence suggests that long-acting absorbable sutures (barbed or smooth) are an effective alternative (7).

In these two cases, the recurrent and complicated ulcerations of the skin may have most probably had an origin from the surgical wound infection. Our hypothesis is that the non-absorbable suture used for the synthesis of the fascia of recti muscles was colonized throughout its length by bacteria,
in a sort of “sub-clinical infection” (as suggested by the fact that in both patients the culture confirmed the same pathogen both superficially and on the suture once removed). The local and systemic antibiotic therapies were never capable of eradicating the infection, leading to recurrent phenomena of infectious exacerbation with abscesses and granulomas formation. The aggressive surgical therapy, with the complete removal of the granulomas, the fistulous tract, the infected skin, and the polypropylene suture seemed to be the only successful therapy capable of completely eliminating bacterial contamination.

The central pathogenic role of the biofilm in determining chronic and sub-clinical bacterial colonizations is supported by numerous recent studies (8): biofilm-residing bacteria on non-absorbable material can be resistant to both the immune system and antibiotics (9,10). The current knowledge on how biofilm may contribute to the pathogenesis of disease indicates several different mechanisms: a reservoir of pathogenic bacteria that can trigger infectious acute/sub-acute manifestations, or even playing a more active role for example by contributing to chronic inflammation. A study by Chalya and coworkers (11) has shown in their 872 patients’ series that nonabsorbable sutures are more frequently associated than absorbable sutures with stitch sinus and chronic pain. Rosen and Hartman (7) have reported in their series of 17 patients two cases of minor seroma and one case of infected hematoma with long-acting barbed sutures made of polydioxanone.

On the other hand Van Uchelen et al (12) observed with a cross-sectional study on patients treated with absorbable sutures (N=40) that 40% of them presented recurrent diastasis proven with ultrasound 6 months postoperatively.

Barbed sutures have the advantage of a reduced surgical time and consequently fewer indirect costs related to operation room, as described by Gutowski and coworkers (13).

Antiseptic-coated sutures are seldom reported as a tool for correcting recti diastasis, but are increasingly employed for laparotomies. For correction of recti diastasis the scientific evidence supporting antibiotic-coated sutures is little.
A multicenter randomized clinical trial including 1224 patients explored rates of surgical site infection in patients undergoing midline laparotomies. By comparing groups treated with uncoated PDS versus triclosan-coated suture (TCS) PDS Plus for fascia closure, no differences were demonstrated in infection rates of the 2 groups (14).

Even though other studies have also failed to demonstrate any efficacy of antibiotic sutures in preventing surgical site infections,(15) proof that TCSs reduce the risk of surgical wound infection in all kinds of surgery has been described (16). Table 1 reviews the types of coatings available in the medical literature and recent studies on TCSs.

Although the case series is short, based on this experience and on a careful review of the literature, the current evidence supports the recommendation to employ long-term absorbable sutures, in order to maintain a good degree of retention in the postoperative course, thereby allowing for the biologic timing necessary for collagen formation and remodeling, with effective abdominal wall continence.

The evidence for recommending the use of coatings is weak and controversial.

**Conclusion**

In conclusion, the permanent material used in these two cases (i.e., the polypropylene) can act as a substrate for the creation of bacterial biofilm, thus leading to a sub-acute/chronic inflammation resistant to multiple treatments. Our final suggestion in terms of suture choice for correction of diastasis is to prefer barbed long-acting absorbable sutures or sutures treated with some form of antibacterial coating, for example triclosan-coated suture (10).
Compliance with Ethical Standards

This article does not contain any studies with human participants or animals performed by any of the author.

Written informed consent was obtained from every patient

CRediT author statement

Lorenzo Giorgi: Conceptualization, Writing-Original draft preparation
Veronica Ponti: Conceptualization, data curation
Filippo Boriani: Conceptualization, Writing-Reviewing and Editing, Supervision
Andrea Margara: Conceptualization, Supervision

The authors, Lorenzo Giorgi, Veronica Ponti, Filippo Boriani and Andrea Margara declare that they have no funding or conflicts of interest to disclose.

References


Table 1 Coating types described in the medical literature

<table>
<thead>
<tr>
<th>Coating type</th>
<th>Suture material</th>
<th>Available in the market</th>
<th>Studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triclosan</td>
<td>Polyglactin</td>
<td>Yes</td>
<td>Onesti et al 2018 (17)</td>
</tr>
<tr>
<td></td>
<td>Polydioxanone</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Material Description</td>
<td>Material Used</td>
<td>Absorption</td>
<td>Studies</td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>-----------------------</td>
<td>------------</td>
<td>----------------------------------</td>
</tr>
<tr>
<td>Metallic nanoparticles</td>
<td>Silk</td>
<td>No</td>
<td>invitro studies</td>
</tr>
<tr>
<td>Silver nanoparticles</td>
<td>Silk, absorbable</td>
<td>No</td>
<td>(invitro and invivo studies)</td>
</tr>
<tr>
<td></td>
<td>braided</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>unspecified material</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Propolis and biogenic silver nanoparticles</td>
<td>Silk</td>
<td>No</td>
<td>(invitro and invivo studies)</td>
</tr>
<tr>
<td>Silver nanoparticles and hyperbranched</td>
<td>Polyglycolic acid</td>
<td>No</td>
<td>invitro study</td>
</tr>
<tr>
<td>polylysine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zinc oxide nanoparticles</td>
<td>Gum</td>
<td>No</td>
<td>(invivo study)</td>
</tr>
<tr>
<td>Antimicrobial peptides</td>
<td>Spider silk</td>
<td>No (invitro study)</td>
<td>Franco AR et al 2019 (26)</td>
</tr>
<tr>
<td>------------------------</td>
<td>-------------</td>
<td>-------------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>Berberine and Artemisin</td>
<td>Silk</td>
<td>No (invitro and invivo studies)</td>
<td>Wang X et al 2022 (27)</td>
</tr>
<tr>
<td>Triclosan (Systematic review and meta-analysis)</td>
<td>Vycril, Monocryl, PDS, Chinese silk</td>
<td>Yes (clinical studies)</td>
<td>Otto-Lambertz C et al 2023 (28)</td>
</tr>
<tr>
<td>Triclosan (Meta-analysis)</td>
<td>Vycril</td>
<td>Yes (clinical studies)</td>
<td>He P et al 2022 (29)</td>
</tr>
<tr>
<td>Triclosan and (Clinical multicenter prospective trial and meta-analysis)</td>
<td>PDS, Vycril</td>
<td>Yes (clinical study and meta-analysis)</td>
<td>Miyoshi N et al 2022 (30)</td>
</tr>
</tbody>
</table>

Fig. 1: Skin ulcers appeared along the midline after 6 months from the abdominoplasty
Fig. 2: Reappearance of cutaneous lesions after umbilical hernia repair

Fig. 3: Final result

Fig. 4: Multiple granulomas on the midline incision