Case Report

Integra® dermal regeneration template as the nidus of staphylococcal toxic shock syndrome: A case report

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Article history:
Received 31 March 2020
Accepted 21 May 2020
Available online 29 May 2020

Keywords:
Integra
Dermal regeneration templates
Toxic shock syndrome
TSS
Infections

Abstract

The literature describes numerous successful applications using dermal regeneration templates such as Integra®. Despite widespread use for burns, trauma, and chronic wounds among others, Integra has associated complications which need continued investigation. Large multi-center studies designed to investigate its safety have shown that infections are the most common complications. In this case report, we share our experience with a patient who developed toxic shock syndrome (TSS) following abdominal scar revision with Integra. The literature reviewed identified one report of TSS in association with Integra use, which was fatal. In our case, the patient recovered uneventfully as a result of early recognition, expedient debridement, and appropriate antibiotic administration. Acknowledging that TSS is a rare but potential...
complication associated with the use of Integra is crucial for early recognition which will improve patient outcomes and reduces mortality.

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Introduction

The first report of dermal regeneration templates was published by Burke et al. in 1981,1 and its most widely used commercial form is Integra (Integra LifeScience Corporation, New Jersey, USA). This bilayer regeneration matrix has been successfully used in a variety of reconstructive methods for burns, trauma, extremities, and chronic wounds among others.2,3 Despite the high rate of successful functional and aesthetic outcomes achieved by Integra-based reconstruction, there are complications associated with its use that must be recognized to maximize patient outcomes and safety.

Large multi-center studies designed to assess the safety of Integra have described complications such as seromas, hematomas, failure of graft take, with infections being the most common.4 These infections are often superficial and can be resolved with antibiotics and adequate wound care.4,5 It is crucial to consider, however, that severe infection can occur, even life-threatening ones from TSS.6 In this article, we share our experience with a patient who developed TSS associated with the use of Integra, as well as the steps we took to successfully manage his life-threatening infection.

Case report

A 13-year-old male with a history of 18% body surface area burns ranging from the sternum to the suprapubic region presented with hypertrophic abdominal scars causing discomfort and subjective limitation in his ability to hyperextend his torso and arch his back (Fig. 1). Due to the massive size of the scars in his abdomen, tissue expansion to serially remove the scars would have been overwhelmingly arduous, and both patient and parent were disinterested. A decision was then made to address the hypertrophic areas, which were excised from the bilateral and mid abdominal wall, which created a wound covered by Integra measuring 21 cm x 6 cm. The midline secondary defect required skin grafting. The rationale in staging repair with Integra first was to offer him a thicker, suppler skin coverage. A wound VAC (KCI, San Antonio, TX, USA) was employed as a bolster. He was hospitalized for one week for pain control, and discharged after his first wound VAC change. On postoperative day 14, his VAC was changed by visiting home health.

Two days later, he developed a severe headache, emesis, and diffuse full-body macular erythroderma. The patient arrived at the outside hospital's emergency department (ED) at 1 pm with fever (101.5°F) and tachycardia (138 bpm). He was normotensive, and his WBC was 21. Upon life flight arrival 1 h later, his blood pressure was 94/47 despite the administration of a 2-liter bolus and the first dose of broad-spectrum antibiotics. During transport, low-dose epinephrine drip and additional fluid resuscitation (1 liter) were administered. After arrival to the pediatric ICU and 2 additional liters, hypotension resolved but he was still tachycardic at 132. The patient underwent standard sepsis workup, which included a full-body examination, negative urine, negative blood cultures, and a negative chest x-ray.

The plastic surgery team evaluated the patient at approximately 6 pm. The majority of the Integra graft was intact except for a 4 x 5 cm area at the epigastric region, which possessed a gray-brownish discoloration under the silastic membrane (Fig. 2). There was no frank purulent drainage, exquisite tenderness, or surrounding crepitus. Approximately 8.5 h following his initial presentation to his hometown’s ED, the patient was brought to the operating room with a BP of 108/60, heart rate of 121, and respiratory rate of 26 at 100% oxygen saturation on room air. Unhealthy tissue was
sharply excised, and approximately 30% (6 cm x 5 cm) of the Integra graft was removed. He was extubated, weaned off vasopressors, and transferred out of the ICU the following day. Intraoperative Integra tissue culture grew Methicillin-Sensitive Staphylococcus Aureus (MSSA). He was treated with IV Clindamycin and Vancomycin for 4 days, followed by a switch to Cefazolin. He underwent twice per day dressing changes, which was conducted using Adaptic gauze (Johnson & Johnson, New Brunswick, NJ) covered by 4 × 4's moistened with 0.25% sodium hypochlorite. He returned to the operating room on postoperative day 5 for minor debridement and was found to have no significant tissue necrosis. 11 days after initial debridement (Fig. 3), he underwent split-thickness skin grafting to both the debrided epigastric area and the intact Integra and was prescribed two-weeks of PO cephalosporins. The appearance of the patient’s fully healed at 18-week follow-up is seen in Fig. 4. He no longer complained of restriction at the epigastrium when hyperextending his chest and remains healed 10 months after skin grafting.

**Discussion**

We discussed our experience with a patient who developed TSS after undergoing abdominal burn scar revision with Integra. Key elements to the patient’s recovery were early recognition and urgent debridement of the source of sepsis. Despite living 250 miles away, he was taken to the operating room without extensive delay. It is essential to acknowledge that the appearance of the wound was not particularly alarming and that it would have been easy to dismiss the severity of the infection; TSS may occur without the presence of invasive infection. Infection under the silicone membrane can be difficult to discern with the untrained eye. In addition, fulminant or invasive infection is not necessary for TSS to occur. The only other case of TSS associated with Integra ever reported also presented with a small, localized area of infection on the Integra. Interestingly, this prior case (2009) also involved secondary burn scar revision. In our patient, aggressive fluid resuscitation, rapid access to air trans-

![Fig. 1. Preoperative appearance of hypertrophic scars on the patient's abdominal wall from the oblique view. A slight flexion of the trunk caused by the extensive abdominal scar contractures is seen at rest.](image)
Fig. 2. Photo showing appearance of abdominal Integra graft upon arrival to the ICU.

Fig. 3. Photo taken 11 days after initial debridement, shortly before the beginning of the split-thickness skin graft operation. Majority of the Integra graft shows signs of dermal regeneration. The previous infected area shows granulation tissue.
Fig. 4. Photo at 18-week clinic follow up demonstrating complete healing of the split thickness skin graft recipient site, and no long-term signs of residual infection. The recurrence of mild hypertrophic scarring visible in this photo did not lead to any clinically significant limitations in abdominal range of motion.

portation, IV antibiotics, and expedient surgical debridement averted the possibility of multiple-organ failure, necrotizing fasciitis, and death.

Regarding the possible role of the wound VAC usage in the development of infections, the literature demonstrates conflicting results. Some studies report a lower rate of infections with wound VAC utilization, while others report a higher one. Therefore, it is difficult to quantify the extent to which the wound VAC dressing contributed to TSS. A possible break in aseptic technique with wound care could have played a factor. There are, however, prophylactic measures that may be taken to decrease the risk of infection when using Integra. Some of these measures include silver-coated dressings, silver-coated polyurethane negative-pressure wound therapy (NPWT) sponges, and antibiotic prophylaxis. The use of these prophylactic measures in preventing infection with Integra use requires further investigation.

Meticulous assessment of the operative site is required for surveillance of infection under the silicone membrane, which can be difficult to recognize by a non-specialist. Long-distance travel from home to treatment center may also pose a major hurdle against rapid access to surgical treatment in the event of TSS. Fortunately, TSS related to the use of Integra is rare. Its occurrence, however, should be discussed with the patient preoperatively. When the patient’s home is far from the health care facility, the employment of Integra for a complex wound may not be advisable in the context of possible TSS manifesting postoperatively.

Conclusion

While Integra offers crucial benefits, such as a better chance for revascularization than direct skin graft in certain situations, the surgeon should be aware that infectious complications are not uncommon. The rare incidence of toxic shock syndrome should be mentioned in the informed consent. Provider’s awareness of this potential complication is paramount when encountering postoperative
patients who have undergone Integra grafting. Early recognition, antibiotic administration, and expeditious debridement are key to improving patient outcomes and reducing mortality.

**Financial disclosure statement**

The authors do not have any financial interests to declare in relation to the content of this manuscript. No funding was received for the creation of this manuscript.

**Previous presentations**

The work presented in this manuscript has not been previously presented nor published.

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