

Prospective study of single-stage repair of contaminated hernias with the novel use of calcium sulphate antibiotic beads in conjunction with biologic porcine submucosa tissue graft

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SUMMARY

In single-stage hernia repair in the setting of contaminated fields there is a high rate of infection following mesh repair. New strategies to decrease infection in this challenging patient population are needed. Stimulan calcium sulfate antibiotic beads (CSAB) are a biodegradable material that deliver high concentrations of antibiotics locally to a site of insertion. Their use in the prevention of infection has not been described in hernia graft implantation. Here we describe our use of CSAB in a series of 11 patients with modified Ventral Hernia Working Group class III and Centers for Disease Control and Prevention class II–IV wounds undergoing single-stage incisional ventral hernia repair. We found that implantation of CSAB in single-stage hernia repair in the setting of contaminated fields was feasible with low systemic antibiotic levels. Further research should be undertaken to investigate the efficacy of this novel tool in hernia repair.

In single-stage hernia repair in the setting of contaminated fields, it is estimated that approximately 46% of patients will develop a surgical site occurrence (SSO) following mesh repair.¹ New strategies to decrease SSO in this challenging patient population are needed.

Stimulan calcium sulfate antibiotic beads (CSAB) are a biodegradable material that deliver high concentrations of antibiotics locally to a site of insertion. They have been used in the salvage of infected medical prostheses, including orthopedic and breast implants and vascular grafts,² but their use in the prevention of infection has not been described in hernia graft implantation. Here we describe the SSO among patients undergoing single-stage hernia repair in contaminated fields with biologic porcine submucosa tissue matrix and the novel use of CSAB. We used Stimulan CSAB (Biocomposites Ltf.), which deliver high concentrations of vancomycin and gentamycin over a period of approximately 6 weeks, with minimal systemic absorption.

SERIES COHORT

We examined the feasibility of using CSAB among patients with modified Ventral Hernia Working Group (VHWG) class III and Centers for Disease Control and Prevention (CDC) class II–IV wounds undergoing single-stage incisional ventral hernia repair. Between September 2017 and January 2018, 11 patients underwent single-stage repair of incisional ventral hernia with porcine submucosa hernia graft and CSAB (Table 1). Six patients (55%) had dirty wounds (CDC class IV), ten (91%) had a recurrent incisional hernia, and 7 (64%) underwent simultaneous

Table 1. Demographic and clinical characteristics of 11 patients undergoing single-stage ventral incisional hernia repair with biologic mesh and calcium sulfate antibiotic beads

| Characteristic | No. (%) [*] |
|--|----------------------|
| Age, yr, mean \pm standard deviation | 62.5 \pm 10.8 |
| Male | 4 (36.4) |
| Female | 7 (63.6) |
| ASA class | |
| 1 | 2 (18) |
| 2 | 6 (54) |
| 3 | 3 (27) |
| 4 | 0 (0) |
| 5 | 0 (0) |
| BMI category | |
| Underweight | 0 (0) |
| Normal weight | 2 (18) |
| Overweight | 3 (27) |
| Obese | 6 (55) |
| CDC wound classification | |
| Clean | 0 (0) |
| Clean-contaminated (II) | 2 (18) |
| Contaminated (III) | 3 (27) |
| Dirty-infected (IV) | 6 (55) |
| Smoking status | |
| Smoker | 1 (9) |
| Nonsmoker | 10 (91) |
| Diabetes | 2 (20) |

ASA = American Society of Anesthesiologists; BMI = body mass index; CDC = Centers for Disease Control and Prevention.
^{*}Unless indicated otherwise.

explantation of infected mesh. Four patients (36%) underwent simultaneous bowel resection. The median fascial defect was 20.0 cm long and 13.5 cm wide. Nine patients (82%) underwent anterior external oblique component separation, and 1 (9%) underwent a trans-versus abdominis release.

OPERATIVE DETAILS

Complete fascial coverage of the hernia graft was performed in all patients, using component separation if required. If infected mesh was present, it was completely removed during the single-stage surgery. A porcine submucosa hernia graft was used to reinforce the repair, placed in the intraperitoneal abdominal position. Fixation of the hernia graft was accomplished using interrupted #1 PDS sutures. CSAB were placed on top of the hernia graft with the fascia closed over top. They were also placed on top of the fascia in the subcutaneous space. Closed suction drains were used in the subfascial space, on top of the hernia graft and in the subcutaneous space. Primary skin closure was performed in all patients, and negative pressure therapy placed on top of the skin.

Ancef 2 g IV was administered preoperatively, and no systemic antibiotics were administered postoperatively.

On postoperative day 1 the mean serum levels of the antibiotics were gentamycin 0.96 \pm 0.8 mg/L and vancomycin 2.24 \pm 0.8 mg/L.

WOUND INFECTION

Two patients (18%) developed an SSO in the form of a wound infection. These patients presented 2 months after surgery, and the wounds occurred as superficial subcutaneous abscesses not involving the mesh. Infections were treated with percutaneous drainage and systemic antibiotics, with complete resolution. No patients required explantation of the infected graft or reoperation for management of their infection.

At 2-year follow-up, 1 patient experienced a recurrence. This patient also had developed an SSO.

DISCUSSION

We describe the novel use of CSAB in conjunction with biologic porcine submucosa tissue graft for single-stage repair of contaminated incisional hernias. To our knowledge, this is the first description of the use of CSAB in the treatment of incisional hernias in contaminated settings.

Previous studies have described a high rate of wound infection in patients undergoing single-stage repair of ventral hernias in contaminated fields. The Case Medical Center Hernia Database reported an SSO rate of 46% for patients with a Modified Ventral Working Group class III wounds. Specific to porcine submucosa tissue graft for repair hernias in contaminated fields, an infection rate of 56% has been reported.³ Our SSO rate of 18% is not in keeping with previous reports in the literature and warrants further study.

Hernia recurrence has also been associated with VHWG class, with a reported rate of 32.5% for patients with class III wounds and 52.5% for patients with class IV wounds.¹ Previous reports using porcine submucosa hernia grafts in contaminated fields report recurrence rates of 26%,⁴ 30%⁵ and 43%.³ The possibility that infection of porcine submucosa grafts may be associated with infection should be explored further.

Systemic antibiotic levels on postoperative day 1 measured in our series were below therapeutic levels and show that CSAB are unlikely to cause systemic toxicity.

All operations in our series were performed by a single surgeon, and our follow-up period of 24 months was short. This may limit the external validity and generalizability of our results to other patient populations. In addition, our sample size was small and there was no control group, so this study serves only to show that CSAB in hernia repair are feasible and safe.

CONCLUSION

CSAB are a new tool for surgeons treating patients with complex contaminated abdominal-wall hernias. Future comparative research should be undertaken to further describe the effectiveness of this treatment.

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