DOI: 10.7860/JCDR/2024/73929.19844

Case Series

Surgery Section

Collagen-based Mesh in the Treatment of Posthernioplasty Mesh Infection in Ventral Hernias: A Case Series

NAVEEN NARAYAN[1], KN RAJESH[2], CHETHAN SHIVANNAIAH[3], SUHAS N GOWDA[4]

ABSTRACT

Posthernioplasty mesh infection in ventral hernias presents significant clinical challenges, including increased morbidity and prolonged treatment courses. The use of Surgicoll-Mesh® (collagen-based) in the management of infected posthernioplasty abdominal wounds has yet to be explored. It is thought to offer potential advantages in reducing infection rates and promoting tissue integration. Here, a case series showcasing the successful treatment of three patients with infected posthernioplasty abdominal wounds using Surgicoll-Mesh® to cover the defects is presented. All three cases demonstrated excellent outcomes, including resolution of infection, effective wound healing and no recurrence of hernias. This series highlights the potential of Surgicoll-Mesh® in managing complex abdominal wall infections.

Keywords: Biological mesh, Infection, Postsurgery abdominal wounds

INTRODUCTION

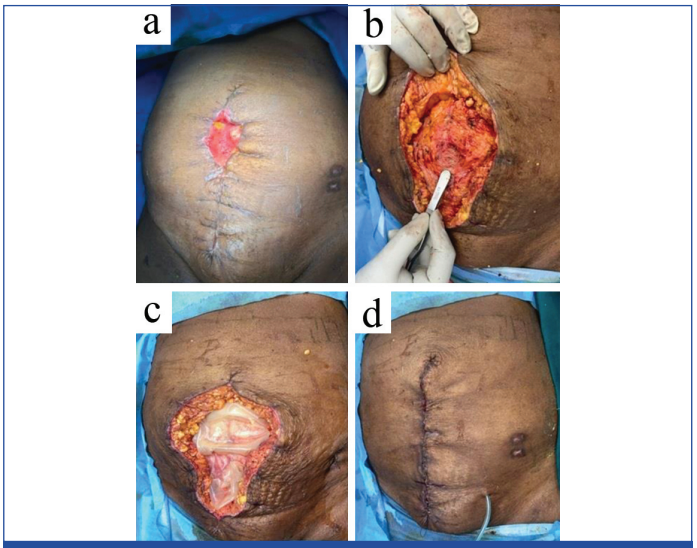
Ventral hernias are a common surgical condition often repaired through hernioplasty, which involves the use of mesh implants to reinforce the abdominal wall. Despite advancements in surgical techniques and materials, postoperative infections remain a significant complication, leading to chronic infections and recurrence of hernias. The management of postinfected ventral hernias is complex and multifaceted, requiring a combination of medical and surgical interventions [1]. Postoperative infections can occur due to several factors, including contamination during surgery, compromised patient immunity, or suboptimal surgical techniques. These infections can lead to chronic inflammation, abscess formation, and the failure of the hernia repair, necessitating further surgical intervention [2,3]. The presence of a mesh implant can complicate the infection, as biofilm formation on the mesh surface can protect bacteria from antibiotics and immune responses, leading to persistent infections [2]. This case series explores the outcomes of using Surgicoll-Mesh® in three patients with infected posthernioplasty wounds.

CASE SERIES

Case 1

A 62-year-old female patient was referred to the Department of Plastic Surgery from the Department of General Surgery and presented with an abdominal wound due to mesh infection posthernioplasty (retrorectus/sublay) for a paraumbilical hernia, seven days after surgery. She had a history of multiple abdominal surgeries. The infected mesh was removed by the general surgeons on the 9th postoperative day after failure of conservative management with culture-specific antibiotics for Methicillin-Resistant *Staphylococcus aureus* (MRSA). Re-suturing was performed on the 14th day after the primary surgery, which resulted in abdominal wound dehiscence on the 18th day.

At the time of presentation, the abdominal wound measured 9 x 5 cm and exhibited granulation tissue, minimal slough, and mild discharge. A culture was sent for antibiotic sensitivity, and the patient was started on an empirical antibiotic (cefixime), followed by a specific antibiotic (meropenem) for an *Escherichia coli* isolate. Three days later, under antibiotic coverage, extensive debridement of the wound was performed. The wound was thoroughly irrigated with saline, and Surgicoll-Mesh® (SURGICOLL-MESH Advanced Biotech Products (P) Ltd., Encoll Fremont, CA, USA) was applied as an onlay and secured with several Vicryl Rapide sutures. The wound was closed in layers, with a Romovac suction drain placed. The drain was removed after seven days, and the suture line healed well by three weeks [Table/Fig-1].



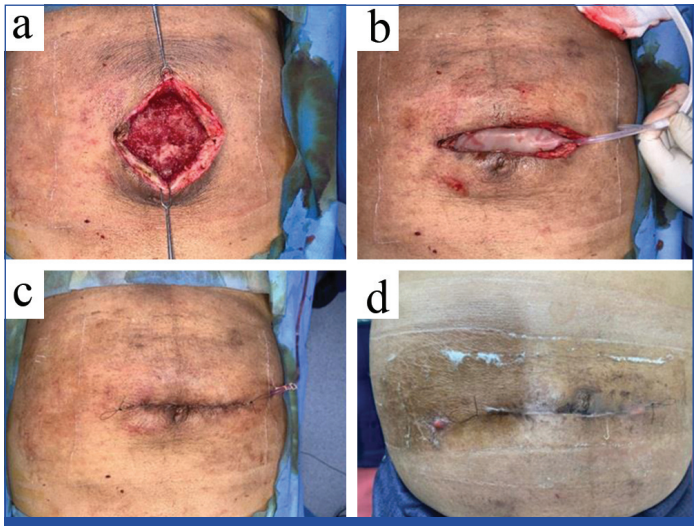
[Table/Fig-1]: (a) Appearance of an abdominal wound due to mesh infection posthernioplasty at the time of presentation; (b) Status after debridement; (c) Surgicoll-Mesh® laid onlay, and (d) After surgical closure with Romovac suction drain.

Case 2

A 42-year-old male with no co-morbidities presented with an infected incisional hernia mesh (onlay). The patient had undergone surgery two weeks prior at another facility for a paraumbilical hernia. Symptoms at the time of presentation to the department of plastic surgery included fever, severe pain, and abscess formation at the operated site. Removal of the infected mesh and drainage of the abscess (approximately 100 mL) were performed immediately under antibiotic coverage, with pus sent for culture and sensitivity testing, which yielded MRSA sensitive to vancomycin.

Eight days after starting vancomycin, and with the patient's general condition improving, the patient underwent debridement, and a Surgicoll-Mesh® was placed over the defect. The wound was closed with a Romovac drain in situ. Meropenem was added as per

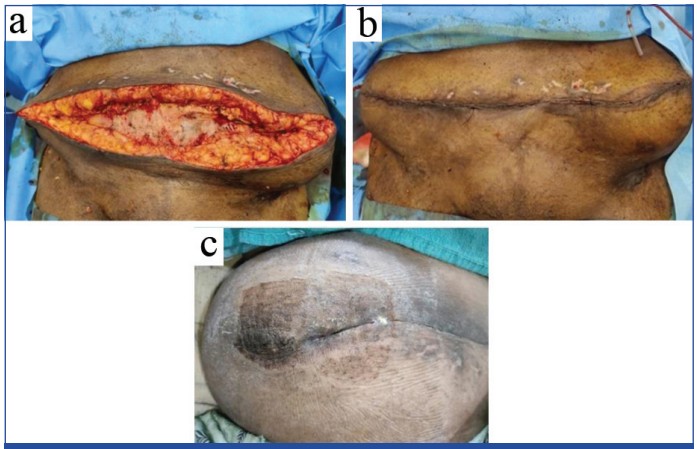
the intensivist's advice. A significant reduction in pain and infection markers was noted within one week. Complete wound healing was observed at the four-week follow-up [Table/Fig-2].



[Table/Fig-2]: (a) Abdominal wound status at the time of second debridement; (b) Placement of Surgicoll-Mesh® and drain in situ; (c) Subcuticular suturing done after deeper intermittent subcutaneous suturing, and (d) Suture line at 10th postoperative day, before suture removal.

Case 3

A 48-year-old female patient presented with an infected mesh following a laparoscopic hernia repair (retrorectus), with symptoms such as swelling, redness, and signs of systemic infection, 10 days after surgery. Immediate explantation of the infected mesh and thorough debridement were performed under antibiotic cover (cefixime). The culture sensitivity report revealed *Klebsiella*, which was sensitive to colistin, and treatment with colistin was initiated. Six days later, with the patient's general condition improved and blood glucose levels under control, patient was taken for surgery, during which a Surgicoll-Mesh® (used as an onlay) was employed for repair, and a drain was placed. Rapid resolution of systemic symptoms was noted within one week. Successful wound closure and integration of the Surgicoll-Mesh® were observed at the four-week follow-up [Table/Fig-3].



[Table/Fig-3]: (a) Transverse abdominal wound after mesh removal and debridement; (b) Closure of abdominal wound after placement of Surgicoll-Mesh® and Romovac suction drain, and (c) Suture line after removal of suture at two weeks.

All cases showed no signs of infection at the two-month follow-up, and no recurrence of hernia occurred even after one year of follow-up.

DISCUSSION

Postoperative infections in hernioplasty for abdominal hernias pose significant challenges, often necessitating mesh removal and complex reinterventions. Diagnosing an infected ventral hernia involves clinical examination, imaging studies, and microbiological tests. Symptoms may include localised pain, redness, swelling, and systemic signs of infection, such as fever [4]. Imaging modalities like ultrasound, Computed Tomography (CT) scans, or Magnetic Resonance Imaging (MRI) can help delineate the extent of the infection and the involvement of the mesh [4]. Culture and sensitivity tests of aspirated fluids or tissue samples guide targeted antibiotic therapy [3].

Treatment Modalities:

1. Conservative management: The initial management of infected ventral hernias may involve conservative measures, especially in patients with minimal symptoms or those who are poor surgical candidates. This includes:
   - Antibiotic therapy: Tailored based on culture results to cover the specific pathogens involved. Prolonged courses may be necessary due to biofilm-associated infections.
   - Percutaneous drainage: Ultrasound or CT-guided drainage of abscesses can help control localised infections [4].
2. Surgical Interventions: Surgical management becomes necessary when conservative measures fail or the infection is extensive. Surgical options include:
   - Debridement and drainage: Removal of infected tissues and drainage of abscesses, preserving the mesh if possible.
   - Mesh removal: In cases of severe infection, complete removal of the infected mesh is required. This is often followed by a staged approach to hernia repair.
   - Primary closure or use of biological meshes: After debridement, primary closure of the defect or the use of biological meshes, such as Surgicoll-Mesh®, which are less prone to infection, can be considered [4].
3. Advanced Techniques: Emerging approaches and technologies are being explored to improve outcomes in infected ventral hernia repairs:
   - Negative Pressure Wound Therapy (NPWT): This can help manage wound infections by promoting granulation tissue formation and reducing bacterial load [4].
   - Antibiotic-impregnated meshes: These meshes, coated with antibiotics, aim to prevent biofilm formation and reduce the risk of infection.
   - Innovative surgical techniques: Techniques such as component separation or laparoscopic approaches minimise tissue trauma and potentially reduce infection rates [4].

Biologic meshes, like Surgicoll-Mesh®, have emerged as alternatives, particularly in infected or contaminated fields, due to their biocompatibility and reduced risk of infection [1]. Surgicoll-Mesh® is a biocompatible collagen mesh produced by Advanced Biotech Products P Ltd. (ABP), utilising US-patented proprietary collagen production technology from Encoll Corporation, CA, USA, to high-purity type-I collagen [5].

Surgicoll-Mesh® is a biologic scaffold derived from collagen, typically of of bovine or ovine origin. Its properties include [5]:

i. Biocompatibility: Surgicoll-Mesh® is designed to integrate with host tissues, promoting cellular infiltration and vascularisation.

ii. Reduced inflammatory response: Surgicoll-Mesh® elicits a milder inflammatory response, reducing the risk of chronic inflammation and infection.

iii. Resistance to infection: The collagen matrix provides a less favourable environment for bacterial adherence and biofilm formation, which is crucial in infected surgical sites.

iv. Degradation and remodelling: Surgicoll-Mesh® gradually degrades and is replaced by native tissue, helping to restore the abdominal wall's structural integrity.

Clinical Applications [5]:

1. Primary and secondary hernia repair: Surgicoll-Mesh® can be used in both primary and secondary hernia repairs, particularly in contaminated or potentially contaminated surgical fields. Its application is advantageous for patients with a history of infection or those undergoing surgery in an infected environment.
2. Treatment of mesh infections: In cases of mesh infection following hernioplasty, Surgicoll-Mesh® was employed after the removal of the infected synthetic mesh. Its use aims to reduce recurrence rates and promote successful integration in an infected field.
3. Complex abdominal wall reconstructions: Surgicoll-Mesh® can also be used in complex abdominal wall reconstructions, where the risk of infection is high and synthetic meshes might be contraindicated [3].

Köckerling F et al., concluded in their study that inguinal hernias can be repaired with biological meshes with a reasonable recurrence rate, and these meshes can serve as an alternative in potentially contaminated fields. However, they believe that biological meshes, in their study, do not have any major advantages over synthetic meshes regarding the most important assessment criterion: recurrence rates. They recommend using collagen mesh in situations involving a contaminated surgical field, as was the case in present series [6].

Conversely, Rosen MJ et al., found in their study that synthetic mesh demonstrated a superior two-year hernia recurrence risk compared to biologic mesh in patients undergoing single-stage repair of contaminated ventral hernias, although both meshes demonstrated similar safety profiles [7].

Contrary to this, Buell JF et al., identified superior outcomes in clinical performance, and the value-based benefits of absorbable biologic scaffolds persisted after the two-year resorption timeframe [8].

In contrast, Atema JJ et al., concluded in their systematic review and meta-analysis that there is no benefit of biologic over synthetic mesh for the repair of potentially contaminated hernias, with comparable surgical site complication rates and a hernia recurrence rate of 9% for both biologic and synthetic repairs [9].

In the current case series, the application of Surgicoll-Mesh® provided a biocompatible scaffold that supported tissue integration and wound healing. None of the patients experienced a recurrence of their hernia or infection during their one-year follow-up, indicating the long-term efficacy of this combined approach. However, a larger randomised controlled trial is essential to demonstrate the efficacy of the results from this case series.

CONCLUSION(S)

Surgicoll-Mesh® represents a promising option in the management of posthernioplasty mesh infections in ventral hernias, which pose significant clinical challenges that require a multidisciplinary approach for effective management. Its biological properties, including biocompatibility, reduced inflammatory response, and resistance to infection, make it suitable for use in complex and contaminated surgical fields. The excellent outcomes observed in these patients suggest that this therapy can be a valuable strategy for treating complex cases of abdominal wall infections.

Continued research and clinical trials are essential to further validate its efficacy and establish standardised treatment protocols.

REFERENCES

[1] Arnold Michael R, Kao Angela M, Gbozah Korene K, Todd HB, Augenstein Vedra A. Optimal management of mesh infection: Evidence and treatment options. Int J Abd Wall Hernia Sur. 2018;1(2):42-49.
[2] Mazzola Poli de Figueiredo S, Tastaldi L, Mao RD, Lima DL, Huang LC, Lu R. Biologic versus synthetic mesh in open ventral hernia repair: A systematic review and meta-analysis of randomized controlled trials. Surgery. 2023;173(4):1001-07.
[3] Jakob MO, Brüggemann A, Moser N, Candinas D, Beldi G, Haltmeier T, et al. Predictors for surgical site infection in patients undergoing therapeutic or prophylactic intra-abdominal onlay mesh (IPOM) implantation in clean and contaminated surgical fields. Surg Endosc. 2023;37(9):6885-94.
[4] Baharestani MM, Gabriel A. Use of negative pressure wound therapy in the management of infected abdominal wounds containing mesh: An analysis of outcomes. Int Wound J. 2011;8(2):118-25.
[5] Surgicoll-Mesh® (Internet), Chennai (Ind): Advanced Biotech Products P Ltd; 2011 [updated 2024; cited 2024 Jul 31]. Available from: https://www.advanced-biotech.com/surgicoll-mesh.html.
[6] Köckerling F, Alam NN, Narang SK, Daniels IR, Smart NJ. Biological meshes for inguinal hernia repair-review of the literature. Front Surg. 2015;2:48.
[7] Rosen MJ, Krpata DM, Petro CC, Carbonell A, Warren J, Poulose BK, et al. Biologic vs synthetic mesh for single-stage repair of contaminated ventral hernias: A randomized clinical trial. JAMA Surg. 2022;157(4):293-301.
[8] Buell JF, Flaris AN, Raju S, Hauch A, Darden M, Parker GG. Long-term outcomes in complex abdominal wall reconstruction repaired with absorbable biologic Polymer Scaffold (Poly-4-Hydroxybutyrate). Ann Surg Open. 2021;2(1):e032.
[9] Atema JJ, de Vries FE, Boermeester MA. Systematic review and meta-analysis of the repair of potentially contaminated and contaminated abdominal wall defects. Am J Surg. 2016;212(5):982-95.

PARTICULARS OF CONTRIBUTORS:
1. Professor and Head, Department of Plastic Reconstructive and Aesthetic Surgery, Adichunchanagiri Institute of Medical Sciences, BG Nagara, Karnataka, India.
2. Associate Professor, Department of General Surgery, Adichunchanagiri Institute of Medical Sciences, BG Nagara, Karnataka, India.
3. Assistant Professor, Department of Plastic Reconstructive and Aesthetic Surgery, Adichunchanagiri Institute of Medical Sciences, BG Nagara, Karnataka, India.
4. Postgraduate Student, Department of Plastic Surgery, SSIMS & RC, Davangere, Karnataka, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Suhas N Gowda,
No. 90, Krishna Nilaya, 14th Main, 14th Cross, 2nd Stage, 2nd Phase, West of Chord Road, Mahalakshmipura, Bangalore-560086, Karnataka, India.
E-mail: naveen_un01@yahoo.co.in

PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: Jul 01, 2024
- Manual Googling: Jul 24, 2024
- iThenticate Software: Aug 06, 2024 (4%)

ETYMOLOGY: Author Origin

EMENDATIONS: 6

AUTHOR DECLARATION:
- Financial or Other Competing Interests: None
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. Yes

Date of Submission: **Jun 30, 2024**
Date of Peer Review: **Jul 25, 2024**
Date of Acceptance: **Aug 07, 2024**
Date of Publishing: **Sep 01, 2024**