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Utilizing T-Line Mesh for Periumbilical Hernia Repair: Evaluation of Short-term Outcomes

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Background: Abdominal periumbilical hernias are prevalent within the adult population. When symptomatic, quality of life may be affected. This case series of 10 patients evaluates the short-term outcomes of using the T-Line mesh in periumbilical hernia repair.

Methods: A retrospective review of adult patients with symptomatic periumbilical abdominal hernia treated with open repair with T-Line mesh was performed at a tertiary referral center. Ten patients with an average age of 51 years were offered surgical treatment. Measures of postoperative outcomes included readmission within the 30-day postoperative period; recurrence; surgical site infection; development of seroma and hematoma; and the presence of pain, numbness, or bloating. Descriptive statistics were computed in Microsoft Excel.

Results: All 10 patients reported improvement in symptoms. All repairs were elective and classified as clean (100%). Hernias included 40% primary umbilical, 50% ventral, and 10% incisional. The average defect size was 10 cm^2, with a range from 1 to 25 cm^2. The T-Line mesh was placed in a sublay manner, with an average mesh size of 36 cm^2. No patients were readmitted in the 30-day postoperative period. There were no occurrences of surgical site infection or hernia recurrence. No hospital readmissions and no follow-up visits with hernia recurrence were noted at 3 months.

Conclusions: We present a case series of 10 patients presenting with symptomatic periumbilical hernias who underwent repair with the T-Line hernia mesh without short-term surgical occurrences. Long-term studies are required to accurately reflect safety and efficacy. *(Plast Reconstr Surg Glob Open 2024; 12:e6287; doi: 10.1097/GOX.0000000000006287; Published online 8 November 2024.)*

INTRODUCTION

Abdominal wall hernias are prevalent in approximately 2% of the adult population, and options to surgically repair these hernias include primary tissue repair and the various types of mesh repair present on the market.[1] Despite these options, the surgical community continues to see recurrence rates of 2.7% and 27% in mesh and tissue repair, respectively.[1] Several studies have sought to explain the mechanical properties of holding tissues together and preventing the expansile forces from overcoming tensile forces, which is often due to "cheese-wiring" as the sutures pull through the tissue or rupture of the sutures, leading to hernia recurrence.[2] A double-blinded randomized controlled trial known as the STITCH (Suture Techniques to Reduce the Incidence of the Incisional Hernia) trial also demonstrated the importance of small bites versus large bites for the closure of a midline incision to distribute the tension and to prevent incisional hernias.[3] On the same spectrum, these principles ultimately highlight the concept of distributing tension in hernia repairs to prevent recurrence. When using mesh, the distribution of tension is on the mesh rather than on the tenuous tissue that would otherwise be included in a primary tissue repair.[1,2] We describe in this study, a novel product known as the T-Line hernia mesh and the strategic methods that are used to incorporate this mesh, decrease tension, and increase anchoring strength to ultimately improve outcomes.

The T-Line hernia mesh is a moderate-weight, macroporous, polypropylene mesh that includes mesh extensions intended to replace traditional sutures to allow for the fixation of the mesh. When using these mesh extensions,

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the anchoring strength becomes approximately 275% greater than a traditional hernia mesh incorporated with sutures.[4,5] This study aimed to provide the technical details of T-Line mesh and its application in umbilical, ventral, and incisional hernia repair at a single institution.

METHODS

Study Design

A retrospective review of adult patients with symptomatic umbilical, ventral, or incisional hernias treated with T-Line hernia mesh was performed at a tertiary referral center. The diagnosis of a periumbilical hernia was made clinically by physical examination with a notable fascial defect. Due to symptoms, these patients were offered surgical treatment. Classification of the hernia was according to the European Hernia Society guidelines.[3] The population of patients included adults aged 18 years and older with symptomatic umbilical, ventral, or incisional hernias diagnosed by physical examination who underwent open hernia repair with T-Line mesh between 2023 and 2024. The decision to use mesh was made intraoperatively if the defect was more than 0.5 cm to reduce the risk of hernia recurrence. Ten adult patients with an average age of 51 years with an umbilical, ventral, or incisional hernia were included in this review. The average size of the hernia defect measured at the time of the operation was approximately 10 cm^2. Body mass index (BMI); history of hypertension, diabetes, ascites, chronic obstructive pulmonary disease (COPD); history of ileostomy or colostomy and dialysis; smoking status; prior radiation to the abdomen or pelvis; dyspnea; inflammatory bowel disease; abdominal aortic aneurysm; renal failure; transplant procedure; liver failure; and immunosuppressed condition (Table 1) were included in our analysis. Postoperative outcomes were observed 30 days after surgical repair. Measures of postoperative outcomes included readmission within the 30-day postoperative period; hernia recurrence; surgical site infection; development of seroma and hematoma; and the presence of pain, numbness, or bloating (Table 2). No hospital readmissions and no follow-up visits with hernia recurrence were noted at 3 months.

Table 1. Patient Demographics

Patient Demographics	n (%)
Total patients	10
Age (average), y	50.6
Sex	
Male	8
Female	2
BMI (average), kg/m^2	34.6
ASA physical status classification	
I	0 (0)
II	5 (50)
III	5 (50)
History of	
Hypertension	6 (60)
Diabetes	0 (0)
Ascites	0 (0)
COPD	0 (0)
Ileostomy/colostomy	0 (0)
Anticoagulation	0 (0)
Dialysis	0 (0)
Smoking status	
Current smoker	2 (20)
Nonsmoker	8 (80)
Prior radiation to the abdomen/pelvis	0 (0)
Renal failure	0 (0)

ASA, American Society of Anesthesiologists.

Takeaways

Question: How is the novel T-Line mesh used for abdominal hernia repairs? What are the short-term outcomes and complications regarding its use? What is the surgical technique?

Findings: A step-by-step approach with figures and video demonstrating the application of T-Line hernia mesh in abdominal hernia repair is provided. A 10-patient case series demonstrated satisfaction of hernia repair with no recurrences.

Meaning: This series demonstrates our experience with the T-Line hernia mesh in treating abdominal hernias. More robust and long-term studies are required to fully assess its safety and efficacy.

Table 2. Outcomes After Hernia Repair Using T-Line Mesh

Outcomes	n (%)
Hernia location	
Umbilical	4 (40)
Ventral	5 (50)
Incisional	1 (10)
EHS class	
M1	0 (0)
M2	0 (0)
M3	9 (90)
M4	0 (0)
M5	1 (10)
EHS class	
L1	0 (0)
L2	9 (90)
L3	1 (10)
L4	0 (0)
EHS width	
W1	6 (60)
W2	4 (40)
W3	0 (0)
Surgical Characteristics	
Operative time (average), min	43.2
Primary fascial closure	10 (100)
Wound classification—clean	10 (100)
Total defect size, cm	10
Hernia repair plane	
Sublay	10 (100)
Retrorectus	0 (0)
Intraoperative complication	0 (0)
30-d complication	
Seroma	1 (10)
30-d readmission	0 (0)
Follow-up (average), d	16

EHS, European Hernia Society.

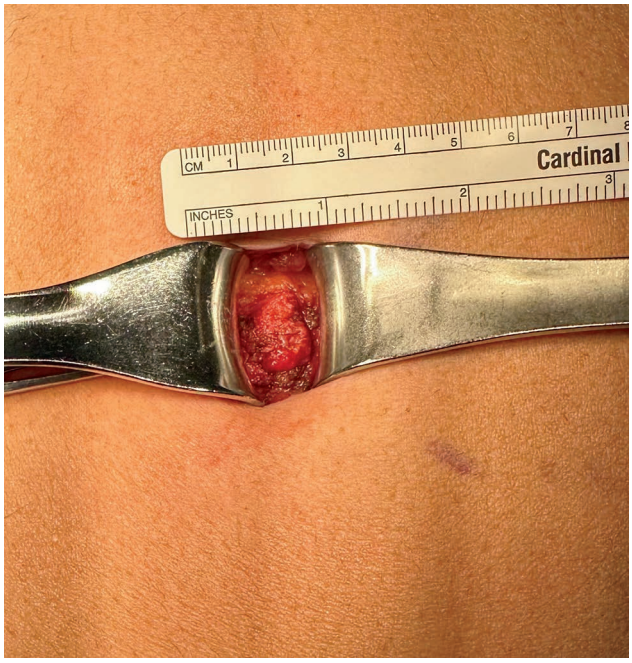

Fig. 1. A photograph identifying a umbilical hernia defect greater than 0.5 cm for mesh repair.

Surgical Technique

The majority of the cases reviewed were ventral, periumbilical hernias. Therefore, the technique described is with regard to umbilical hernia repair. The procedure begins with preparing and draping the patient per standard abdominal surgery. A curvilinear incision is made either above or below the umbilicus, and the hernia sac is dissected off the umbilical stalk down to the level of the fascial defect. Given the higher rates of recurrence in primary tissue repair even for small umbilical hernias less than 2 cm,[1] mesh was used for hernia defects discovered to be more than 0.5 cm. The dissection is carried out within the preperitoneal space to reveal the fascial edges of the hernia defect (Fig. 1). The mesh is trimmed to size, and the 4 mesh extensions, each loaded with the attached needle, are anchored within the adjacent fascia (Fig. 2). The 2 mesh extensions are secured into the defect by anchoring the needles through the adjacent fascia on 1 edge (Fig. 3). The remaining 2 mesh extensions are secured to the other edge of the defect by anchoring the needles through the adjacent fascia of the opposite side (Fig. 4). This allows the mesh to be anchored at these 4 points as the 4 mesh extensions are pulled through the fascia. This technique secures the mesh and eliminates the dead space circumferentially between the mesh and fascia (Fig. 5). Using 1 of these mesh extensions, the needle is used to close the fascia in a primary fascia via a running closure. This improves the anchoring strength of the mesh and reinforces the repair (Fig. 6). All of the mesh extensions are then trimmed (Fig. 7). The deep tissue and skin are then closed in multiple layers (Fig. 8). [**See Video (online),** which shows the T-Line hernia mesh umbilical hernia repair technique.]

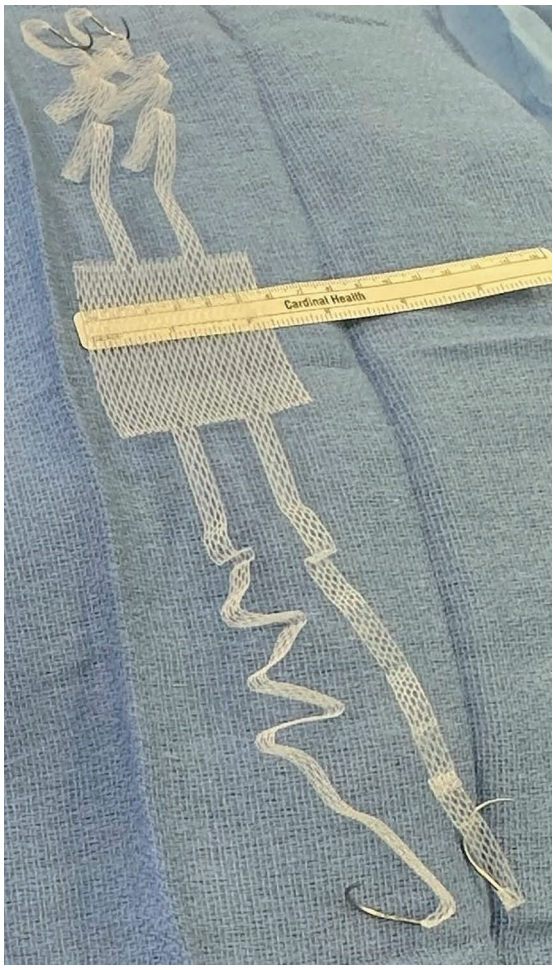

Fig. 2. A photograph of the T-Line mesh trimmed to ensure adequate coverage of the defect. Attached are the 4 mesh extensions, each with an attached needle.

RESULTS

We identified 10 patients (mean age 51 years, BMI 34.6 kg/m^2, 80% male) who had undergone periumbilical hernia repair with the novel T-Line hernia mesh since its first availability at our institution. All repairs were elective and classified as clean cases (100%). Hernias included 40% primary umbilical, 50% ventral, and 10% incisional. Of these, 10% repairs were performed on recurrent hernias from previous repairs. The average defect size was approximately 10 cm^2, with a range from 1 to 25 cm^2. The T-Line mesh was placed in a sublay manner, with an average mesh size of 36 cm^2. The average operative time was 43.2 minutes. No patients were readmitted in the 30-day postoperative period. One patient had a postoperative seroma development within the 30-day postoperative period, which required intervention with aspiration in the outpatient office. With an average follow-up of 16 days, there was no evidence of surgical site infection or evidence of recurrence. There was also no documented complaint regarding associated bloating, pain, or numbness (Table 2). No hospital readmissions and no follow-up visits with hernia recurrence were noted at 3 months.

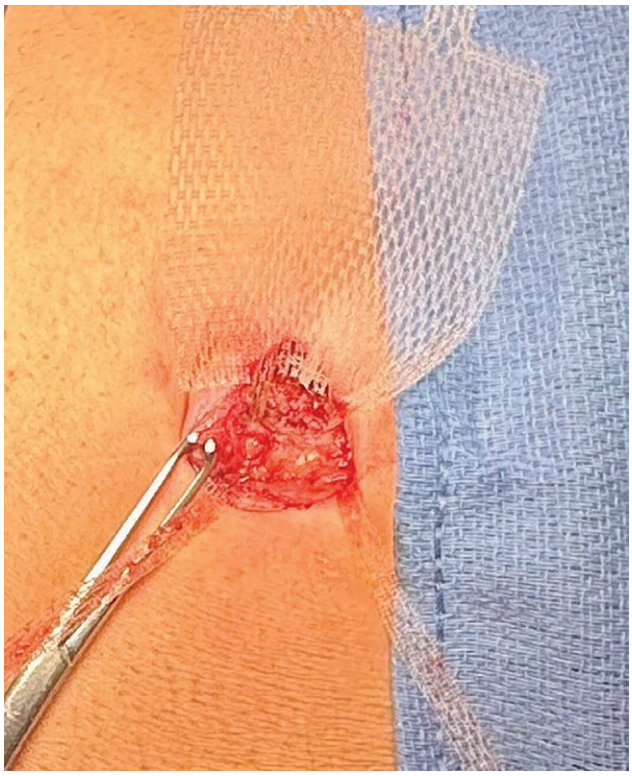

Fig. 3. A photograph of the first 2 mesh extensions with the attached needle used to secure the mesh at 1 edge of the defect by traversing the adjacent fascia.

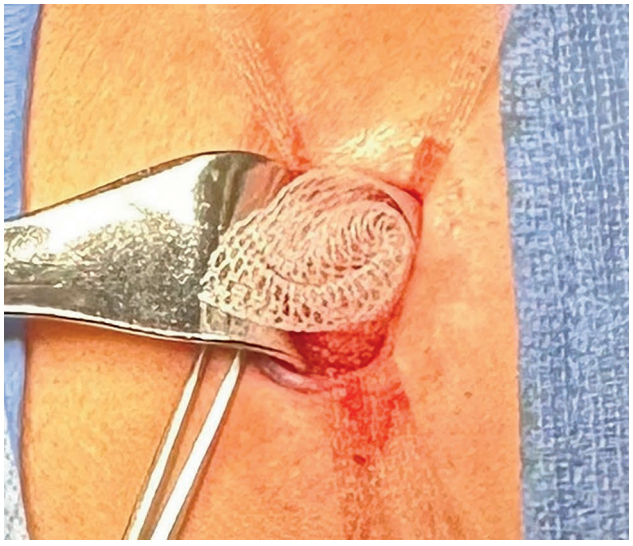

Fig. 4. A photograph of the mesh extensions with the attached needle used to secure the mesh at opposite edge of the defect.

DISCUSSION

In the United States alone, there is an estimated volume of 610,998 ventral hernia repairs performed per year.[2,4] A major decision during a hernia repair is whether the defect should be closed primarily or reinforced with the use of mesh. Despite the demonstrated benefits of

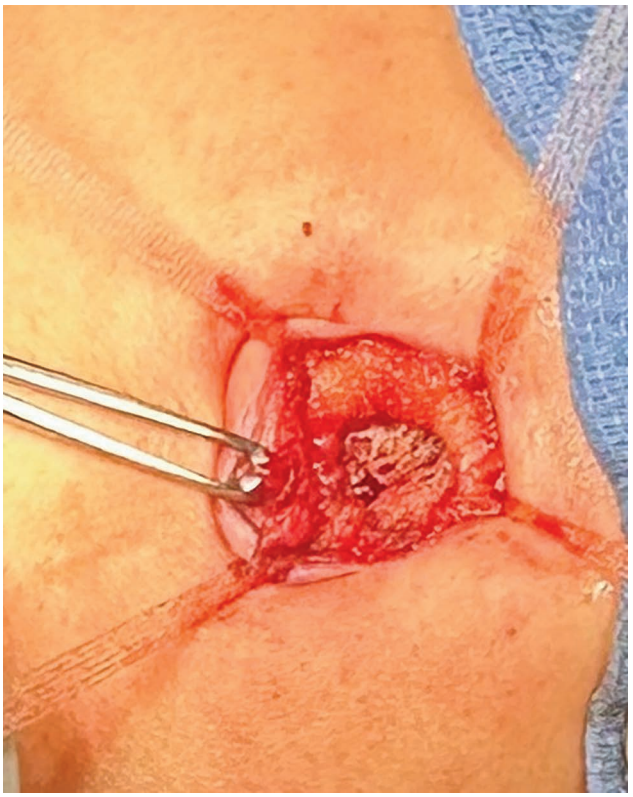

Fig. 5. A photograph of all 4 mesh extensions traversed through the adjacent fascia anteriorly to secure the mesh in place and fill the defect.

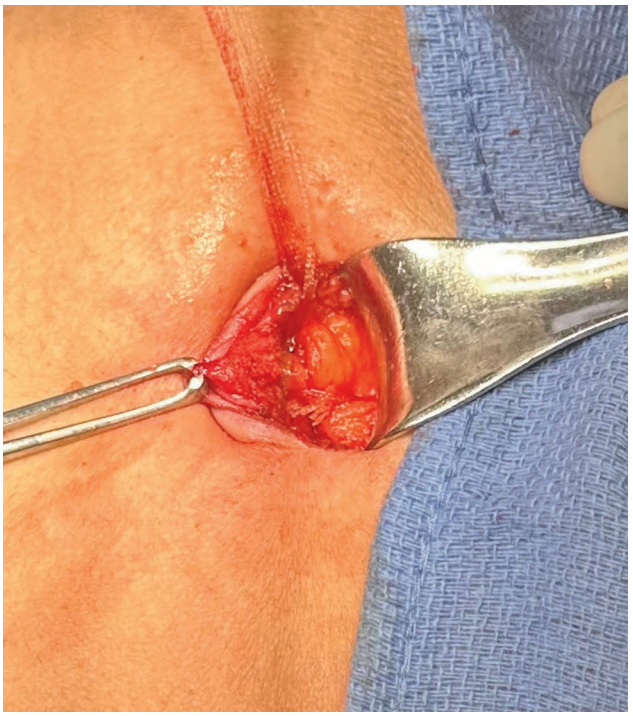

Fig. 6. A photograph demonstrating the attached mesh extension being used to close the fascial defect in a primary manner over the mesh with the attached needle.

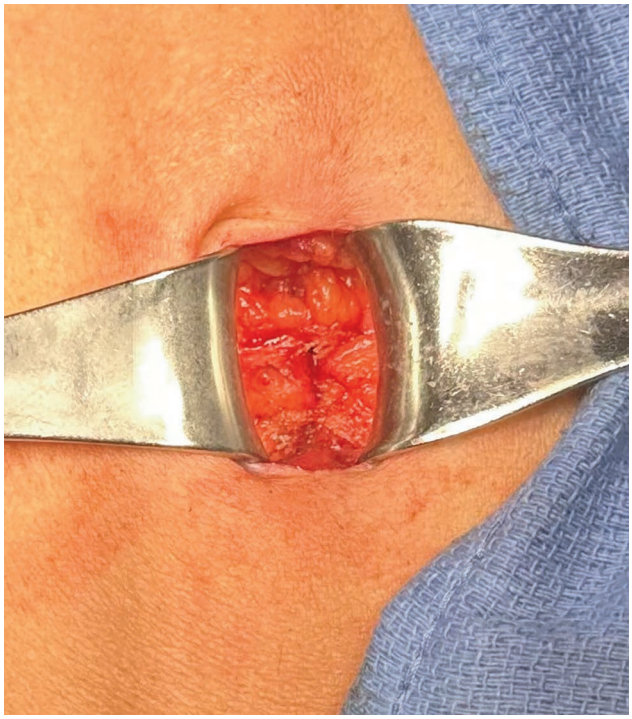

Fig. 7. A photograph of the mesh extensions trimmed to fit within the surgical wound.

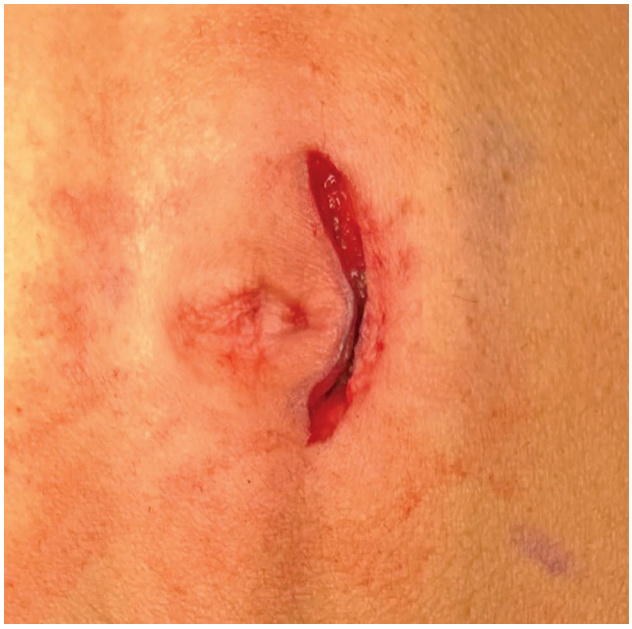

Fig. 8. A photograph of the deep tissue and skin closed primarily.

mesh, surgeons continue to routinely use primary tissue repair, indicating a reluctance to use mesh.[1,2,6] This is in the setting of multiple prospective randomized trials that have demonstrated the advantages of mesh use.[7–10] These studies report lower postoperative hernia recurrence rates and demonstrate the greatest benefits, particularly, in patients with a history of cirrhosis or those undergoing emergent hernia repair.[7–10]

In many of these abdominal wall hernia repairs, a permanent synthetic mesh is chosen.[7–10] The reason for this is that many of these hernia repairs are clean wounds with a low likelihood of infection.[7–10] As a result, there is also very little data to support the use of a biologic or bioabsorbable mesh because of the low wound and mesh infection complication rates from the use of synthetic mesh.[7–10] In terms of the type of mesh, it should be chemically and physically inert, noncarcinogenic, nontoxic, nonimmunogenic, and nondegradable during the healing process.[11] Also, various locations were described when attempting to incorporate the mesh, which include placing the mesh as a sublay (intra-abdominal, preperitoneal, and retrorectus), inlay (between fascial edges), or onlay (over primarily closed fascia), with various outcomes reported between each technique.[12] Many surgeons favor the sublay position of the mesh given that it has previously been suggested to have the lowest recurrence and surgical site infection rates.[13] Other risk factors that need to be considered during the hernia repair are the patient's comorbid conditions that may increase the risk of recurrence or infection. Those who are at elevated risk for postoperative complications and recurrence include patients with obesity, COPD, immunosuppression, hypertension, diabetes, history of smoking, or previous hernia repair.[14,15]

The purpose of this study was to demonstrate the application of the T-Line hernia mesh via a sublay preperitoneal technique for the repair of umbilical, ventral, and incisional hernias. Although the fascial defect was able to accommodate primary closure, the purpose of the study was to highlight the institutional experience regarding the use of an innovative product that allows for the stronger fixation of a permanent mesh to reduce the rate of hernia recurrence, given the high rates of recurrence in primary repair alone.[1,16–18] Specifically, the T-Line mesh is a polypropylene mesh that incorporates the use of tentacle mesh extension sutures to allow for deployment and anchoring. Although previous studies have demonstrated success in the use of a polypropylene mesh with tentacle straps, the T-Line mesh has biomechanical data to demonstrate its enhanced anchoring strength in repair.[5,16–18] Various other institutions have also demonstrated the success of T-Line mesh during the repair of ventral hernias or when performing abdominal wall reconstruction, but none have used the T-Line mesh with such frequency for umbilical hernias as reported herein.[19–21] The additional benefit of the mesh extensions in this device is that they can be used multiple times in multiple locations of the fascia to further anchor the mesh. Subsequent backstitches can further secure the mesh in a locking mechanism. This allows the mesh to incorporate into the adjacent tissue and provide an increase in anchoring strength and reinforcement.[22] The ability to secure the mesh with the tentacle extension sutures also provides a fast and reliable method without the added fatigue of tying down multiple knots as performed with traditional sutures.

The final product is a mesh that lays flat against the closed defect, therefore reinforcing the mesh against the tissue to allow for better integration. Biomechanically, this can be achieved because the mesh extensions pull the

mesh laterally and anteriorly just beneath the repaired defect, keeping the mesh taught and flat against the tissue. This prevents the creation of a mesh "taco," which can be formed when traditional sutures are used to secure the edges of the mesh to the edges of the hernia defect, therefore creating a dead space between the center of the mesh and the tissue to which the mesh is secured. This resulting dead space can be prone to the development of seromas or infections. In addition, we found that the use of the T-Line mesh did not increase operative time, which is another practical benefit of this device.

Although our follow-up was limited to 3 months, most hernia recurrences may occur within 6–12 months.[14] We were able to demonstrate the short-term durability of the T-Line mesh without notable surgical site complications and morbidity. The complication that we observed in 1 patient was the development of a seroma within the 30-day postoperative period, requiring intervention. However, this was in a patient with an incisional hernia of approximately 25 cm^2, a BMI of approximately 41 kg/m^2, and an operative time of 54 minutes. This suggests that this patient may have already been predisposed to the development of a seroma, not necessarily caused by the mesh, but due to a larger defect size, higher BMI, and longer operative time. Overall, our study population was relatively healthy without major comorbid conditions who presented for an elective hernia repair. The study included patients with a history of hypertension (60%), liver failure (10%), or smoking (20%). No patients had a history of diabetes, COPD, renal failure, ascites, dialysis, inflammatory bowel disease, abdominal aortic aneurysm, dyspnea, immunosuppression, ileostomy or colostomy, transplant, or prior radiation to the abdomen or pelvis. Most patients, however, did have a BMI classification considered obese (60%) or severely obese (20%), which would predispose them to a postoperative complication. T-Line mesh use may be particularly beneficial in these patients with a heightened risk of suture failure by providing better integration, and thus reinforcement, of the hernia repair. In our current study, no hospital readmissions and no follow-up visits with hernia recurrence were noted at 3 months.

This study has significant limitations due to the small sample size and short overall follow-up period. Studies have shown that hernia recurrence accuracy improves with longer follow-up, and thus, further studies will be required to include a longer follow-up to accurately reflect the safety and efficacy of the T-Line mesh. Additionally, the relatively healthy patients in our study do not accurately reflect the comorbidities present in a broader population at risk for hernia repair failure. These factors limit the external validity of our study. This study was not meant to test a hypothesis, but rather to describe the application of a novel surgical product. Larger clinical studies using this mesh in periumbilical hernia repair are necessary to provide additional insight regarding the safety and efficacy.

CONCLUSIONS

This case series demonstrates the application of the T-Line hernia mesh in patients with symptomatic periumbilical hernias who underwent repair with the T-Line hernia mesh. In this series, there were no short-term complications. Long-term studies are required to accurately reflect safety and efficacy.

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DISCLOSURE

The authors have no financial interest to declare in relation to the content of this article.

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