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Outcomes Following Implantation With Mesh Suture: A Registry of 1111 Patients

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Background: Mesh suture is a novel suture design intended to distribute pressure at the suture–tissue interface, potentially reducing suture pull-through and repair failures. This study aimed to evaluate the feasibility of mesh suture closures across surgical indications and assess early outcomes, with emphasis on abdominal wall closure.
Methods: A registry was created using institutional implant logs from January 2023 to July 2024 across an integrated healthcare system. A retrospective chart review collected demographics, surgical details, and complications.
Results: In total, 1111 patients received mesh suture by 86 surgeons. Most cases involved full-thickness abdominal wall closures (88.2%). Further analysis focused on abdominal wall closures without planar mesh (N = 862). The 90-day surgical site infection rate was 9.0%, and the surgical site event rate was 11.8%. There were 9 (1.0%) fascial dehiscence events, 3 (0.3%) chronic draining sinuses, and 2 (0.2%) enterocutaneous fistulae. The 90-day readmission and reoperation rates were 7.0% and 7.5%, respectively. The hernia formation rate was 4.8%. On univariate analysis, American Society of Anesthesiology class, wound class, and diabetes were significantly associated with major complications ($P < 0.05$). The mean follow-up was 162 days.
Conclusions: Mesh suture appears versatile and user-friendly across specialties and indications. Early outcomes are encouraging; however, prospective studies with longer follow-up are needed to further evaluate long-term performance.
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INTRODUCTION

Suture pull-through is a known phenomenon that occurs as a result of excess pressure at the suture–tissue interface (STI).[1–5] Pressure is force (suture tension) divided by the area upon which it is applied. When the pressure at the STI exceeds the innate strength of the tissues, there can be an abrupt failure of the repair resulting in dehiscence; more commonly, tissue ischemia and the resulting scar at the closure fail over time.[6] This is especially true for abdominal wall surgery, where suture pull-through is a primary failure mechanism for incisional hernia formation. There are several means to decrease the pressure at the STI in abdominal wall surgery, including weight loss, preoperative administration of botulinum toxin, component releases, and prophylactic placement of mesh.[7–9] These adjuncts all work by decreasing suture tension—the numerator of the pressure equation. Despite these methods, repair failures or incisional hernias continue to occur with high frequency, reported in 5%–20% of abdominal operations and up to 52% in high-risk patients.[10–12]

Duramesh mesh suture (MSI Chicago, IL) is a novel suture with design features intended to distribute the forces at the STI to decrease suture pull-through and repair failures. Mesh suture is created from 18 strands of fine polypropylene filaments that are braided and bonded (Fig. 1).[6,13] This design allows the suture to flatten orthogonal to the direction of the force applied, broadening the surface area to diffuse pressure at the STI. In comparison to standard suture, mesh suture has demonstrated greater resistance to suture pull-through in porcine models.[14] In addition, the design of mesh suture promotes fibrovascular incorporation as early as 8 days after implantation,

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strengthening the repair and potentially reducing surgical site infections (SSIs).[6,15–17] The primary aim of this study was to review the clinical indications and early patient outcomes for mesh suture in an integrated healthcare system.

Takeaways

Question: What are the surgical indications and early outcomes following mesh suture closures?

Findings: Mesh suture was used in 1111 patients for 11 unique surgical indications. Among abdominal wall closures, mesh suture closures had a low rate of surgical site infections and surgical site events.

Meaning: Mesh suture is used for a variety of surgical indications across surgical disciplines, suggesting both its versatility and ease of use. Although early outcomes of mesh suture closures are promising, future studies with longer follow-up are needed to further evaluate long-term outcomes.

METHODS

Data Collection

Creation of a mesh suture patient registry was approved by the institutional review board and conducted using the enterprise data warehouse at an integrated health system. Patients were identified through institutional implant logs of mesh suture from January 2023 to July 2024. Patients were treated at 1 urban, academic-based hospital and multiple community-based hospitals. A retrospective review of the electronic medical record identified patient characteristics, surgical details, and follow-up visits. Data collection stopped for patients with mesh suture removal or at the final date of data entry (October 10, 2024). As mesh suture was used as part of standard clinical practice by their surgical team, patients did not give additional informed consent. Surgeons did not receive any incentives or encouragement to influence their treatment options. The instructions for use were available to the surgical team with no additional teaching or training provided.

Outcome Assessment

Our primary outcome was the incidence of SSIs and surgical site events (SSEs) in abdominal wall closures per definitions by Majumder et al.[18] (**See table, Supplemental Digital Content 1**, which displays the definition of SSIs and SSEs, **http://links.lww.com/PRSGO/E34**.) Data were also collected regarding hernia occurrence (following laparotomy closure) and hernia recurrence (following hernia repair). SSIs, SSEs, readmissions, and reoperations were recorded within 1 year of index surgery. Hernia occurrence/recurrence rates were recorded for the longest follow-up time available. Readmissions were further classified as "related to the index surgery" or not. Related readmission indications included SSI, wound complications, and intra-abdominal pathology such as bowel obstruction or anastomosis leak. Reoperations were defined as any operation at the surgical site of mesh suture implantation.

Data Analysis

Statistical analysis was performed using IBM SPSS Statistics 29 (IBM Corp., Armonk, NY). Descriptive statistics were performed to summarize patient characteristics, surgical details, and outcomes. Univariate subgroup analyses were performed using the χ^2 test with post hoc adjusted standardized residuals (cutoff for significance of ±1.96) for categorical variables. For continuous variables, an independent sample t test was performed. A value of P less than 0.05 was considered statistically significant unless otherwise stated. Major complications were reviewed by the senior author (M.S.).

RESULTS

A total of 1111 patients were implanted with mesh suture between January 2023 and July 2024. Mesh suture was used for 11 surgical indications (Fig. 2), primarily abdominal wall closures (88.1%). Fascial (laparotomy) closures were most common (34.9%), followed by ventral hernia repair (25.2%). Eighty-three unique surgeons used mesh suture across 11 surgical specialties (Fig. 3). Most procedures were performed at the academic hospital (76.5%), and the remainder at community-based hospitals. Further analyses focused on full-thickness abdominal wall closures, excluding the following surgical indications: abdominoplasty, hiatal hernia, spine closure, and "other." Additionally, abdominal wall closures in 116 patients that included planar mesh were excluded.

Abdominal Wall Patients

Table 1 reports the demographics of 862 remaining patients. Approximately 50% of cases were classified as Centers for Disease Control (CDC) II–IV. The average

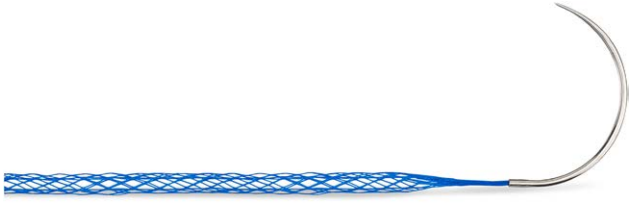

Fig. 1. Duramesh mesh suture device (item MSI-301 pictured).

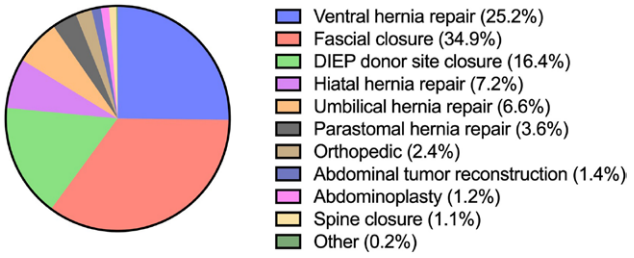

Fig. 2. Surgical indications for mesh suture use.

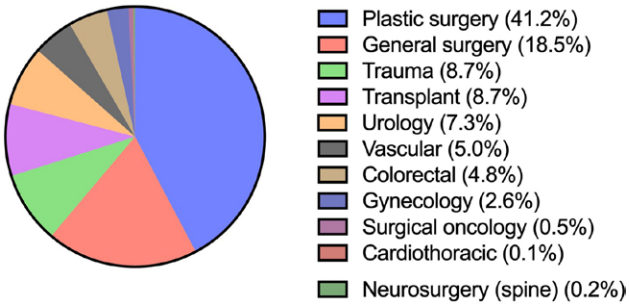

Fig. 3. Surgical specialties that used mesh suture.

Table 1. Demographics of All Patients and Abdominal Wall Patients

	N = 862 (%)
Age (mean ± SD)	57.9 ± 14.2
Race	
White	599 (69.5)
Black or African American	108 (12.5)
Asian	24 (2.8)
Other/prefer not to answer	131 (15.2)
Sex	
Male	338 (39.2)
BMI (mean ± SD)	29.9 ± 7.0
Current smoker	75 (8.7)
Former smoker	326 (37.8)
Cancer	350 (40.6)
COPD	100 (11.6)
HTN	486 (56.4)
DM	183 (21.2)
ASA classification	
I	13 (1.5)
II	274 (31.8)
III	480 (55.7)
IV	92 (10.7)
V	3 (0.3)
CDC wound classification	
Clean	463 (53.7)
Clean contaminated	260 (30.2)
Contaminated	90 (10.4)
Dirty or infected	49 (5.7)
Operative time, min	298.0 ± 172.6
Length of inpatient stay, d (mean ± SD)	6.7 ± 10.6
Length of follow-up, d (mean ± SD)	167.6 ± 137.4

BMI, body mass index; COPD, chronic obstructive pulmonary disease; DM, diabetes mellitus; HTN, hypertension.

hospital stay was 6.7 days, and the mean follow-up was 167 days. A total of 2.1% of patients received 300 units of botulinum toxin 3 weeks before surgery to improve compliance and promote primary fascial closure.[8] Intraoperatively, anterior component release was performed on 6.3% of patients. Of the 299 (34.7%) patients presenting for hernia repair, 34.1% had at least 1 prior hernia repair.

Surgical Site Infections

The overall SSI rate was 9.0% within 90 days and 9.4% within 1 year of the index surgery (Table 2). The superficial infection rate was 4.6%, whereas deep infection and organ space infection rates were 0.5% and 4.8%, respectively. There were significant associations between mesh suture indication and SSI, with abdominal tumor reconstruction more likely to have a deep infection when compared with other indications ($\chi^2 = 20.814$, $P < 0.001$, residual +4.4). Fascial closures were more likely to have an organ space infection (residual +4.1), whereas deep inferior epigastric perforator flap (DIEP) donor site closures were less likely (residual −3.3) ($\chi^2 = 19.858$, $P = 0.001$). Regarding the overall SSI rate, fascial closures were most likely to have an SSI ($\chi^2 = 17.613$, $P = 0.003$, residual +3.0). CDC II and III wound class cases demonstrated an SSI rate of 13.7% within 90 days of surgery in contrast to 5.4% with CDC I (Fig. 3). Most organ space and deep infections occurred in CDC II–IV (82.2%). Wound classification was associated with SSI, with CDC II and III cases more likely to have an organ space infection ($\chi^2 = 23.564$, $P < 0.001$, residual +4.0) and an SSI within 90 days ($\chi^2 = 16.828$, $P < 0.001$, residual +3.9).

Surgical Site Events

The overall SSE rate was 11.8% at 1 year including seroma (4.5%), hematoma (3.9%), soft tissue breakdown (3.4%), fascial dehiscence events (1.0%), chronic draining sinuses (0.3%), and enterocutaneous fistulae (0.2%). Ventral hernia repair and abdominal tumor reconstruction were more likely to have a seroma (residual +3.5 and +2.4, respectively), whereas fascial closures were less likely (residual −2.7) ($\chi^2 = 20.095$, $P = 0.001$). DIEP donor site closures, abdominal tumor reconstruction, and parastomal hernia repairs were more likely to experience soft tissue breakdown when compared with other indications ($\chi^2 = 22.151$, $P < 0.001$, residual +2.0, +2.9, and +2.5, respectively); 78.6% of the SSEs came from CDC II–IV cases. CDC II/III cases had a rate of 11.4% within 90 days when compared with CDC I cases, which had a rate of 9.9% (Fig. 4). CDC II/III and CDC IV cases were significantly associated with fascial dehiscence ($\chi^2 = 12.505$, $P = 0.002$) with a residual of +2.3 and +2.2, respectively. CDC IV cases were associated with chronic draining sinus ($\chi^2 = 6.331$, $P = 0.042$, residual +2.1) and enterocutaneous fistulae ($\chi^2 = 8.027$, $P = 0.018$, residual +2.8).

Readmission and Reoperations

Although 15.3% of patients had a least 1 readmission within 90 days, only about half (7.0%) were related to the abdominal wall surgery (Table 3). (**See table, Supplemental Digital Content 2**, which displays the readmissions by event, **http://links.lww.com/PRSGO/E35**.) There was an association between surgical indication and readmissions ($\chi^2 = 26.922$, $P < 0.001$). Fascial closures were more likely to have readmissions within 90 days (residual +4.9), whereas DIEP flap donor site closures were less likely (residual −4.3). The most common indications for readmission within 90 days were related to a chronic medical diagnosis (15.9%) or SSI (15.9%), and renal problems such as acute kidney injury, renal insufficiency, or renal failure (13.7%). The most common indications for readmissions related to abdominal surgery were SSI (15.9%), abdominal wounds or soft tissue breakdown (9.3%), and pain control (4.9%).

Table 2. SSI and Surgical Site Outcome Rates for Abdominal Wall Closures

n (%)	Total Abdominal Wall N = 862 (100)	Ventral Hernia Repair N = 188 (21.8)	Fascial Closure N = 384 (44.5)	Umbilical Hernia Repair N = 73 (8.5)	Parastomal Hernia Repair N = 38 (4.4)	Abdominal Tumor Reconstruction N = 10 (1.2)	DIEP Donor Site Fascial Closure N = 169 (19.6)	*P**
SSI								
Superficial infection	39 (4.6)	11 (5.9)	18 (4.7)	2 (2.9)	3 (7.9)	1 (10.0)	4 (2.4)	0.439
Deep infection	4 (0.5)	1 (0.5)	2 (0.5)	0 (0)	0 (0)	1 (10.0)	0 (0)	**<0.001**
Organ space infection	41 (4.8)	6 (3.2)	31 (8.1)	2 (2.9)	2 (5.3)	0 (0)	0 (0)	**0.001**
SSI 0–90 d†	78 (9.0)	17 (9.0)	47 (12.2)	4 (5.5)	4 (10.5)	2 (20.0)	4 (2.4)	**0.005**
Total SSI within 1 y‡	81 (9.4)	18 (9.6)	49 (12.8)	4 (5.5)	4 (10.5)	2 (20.0)	4 (2.4)	**0.003**
SSE								
Seroma	38 (4.5)	17 (9.2)	9 (2.4)	2 (2.9)	1 (2.6)	2 (20.0)	7 (4.1)	**0.001**
Hematoma	33 (3.9)	5 (2.7)	23 (6.0)	2 (2.9)	1 (2.6)	0 (0)	1 (1.2)	0.09
Soft tissue breakdown	29 (3.4)	4 (2.2)	9 (2.4)	0 (0)	4 (10.5)	2 (20.0)	10 (6.0)	**<0.001**
Fascial dehiscence	9 (1.0)	1 (0.5)	7 (1.8)	1 (1.4)	0 (0)	0 (0)	0 (0)	0.403
Cellulitis	3 (0.3)	0 (0)	0 (0)	0 (0)	0 (0)	1 (10.0)	2 (1.2)	**<0.001**
Suture granuloma	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	.
Chronic draining sinus	3 (0.3)	0 (0)	3 (0.8)	0 (0)	0 (0)	0 (0)	0 (0)	0.589
Enterocutaneous fistula	2 (0.2)	2 (1.1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.203
SSE 0–90 d†	93 (10.8)	23 (12.2)	41 (10.7)	5 (6.8)	4 (10.5)	4 (40.0)	16 (9.5)	0.056
Total SSE within 1 y‡	102 (11.8)	27 (14.4)	46 (12.0)	5 (6.8)	4 (10.5)	4 (40.0)	16 (9.5)	0.043

*The *P* value represents a significant association of surgical indication with the listed complication on χ^2 analysis. Further post hoc adjusted standardized residuals are reported in the narrative results. Bolded values were statistically significant at a level <0.05.
†n represents the number of patients with at least 1 SSI or SSE event; in some cases, patients may have had >1 event, which is detailed in the remaining table.
‡DIEP.

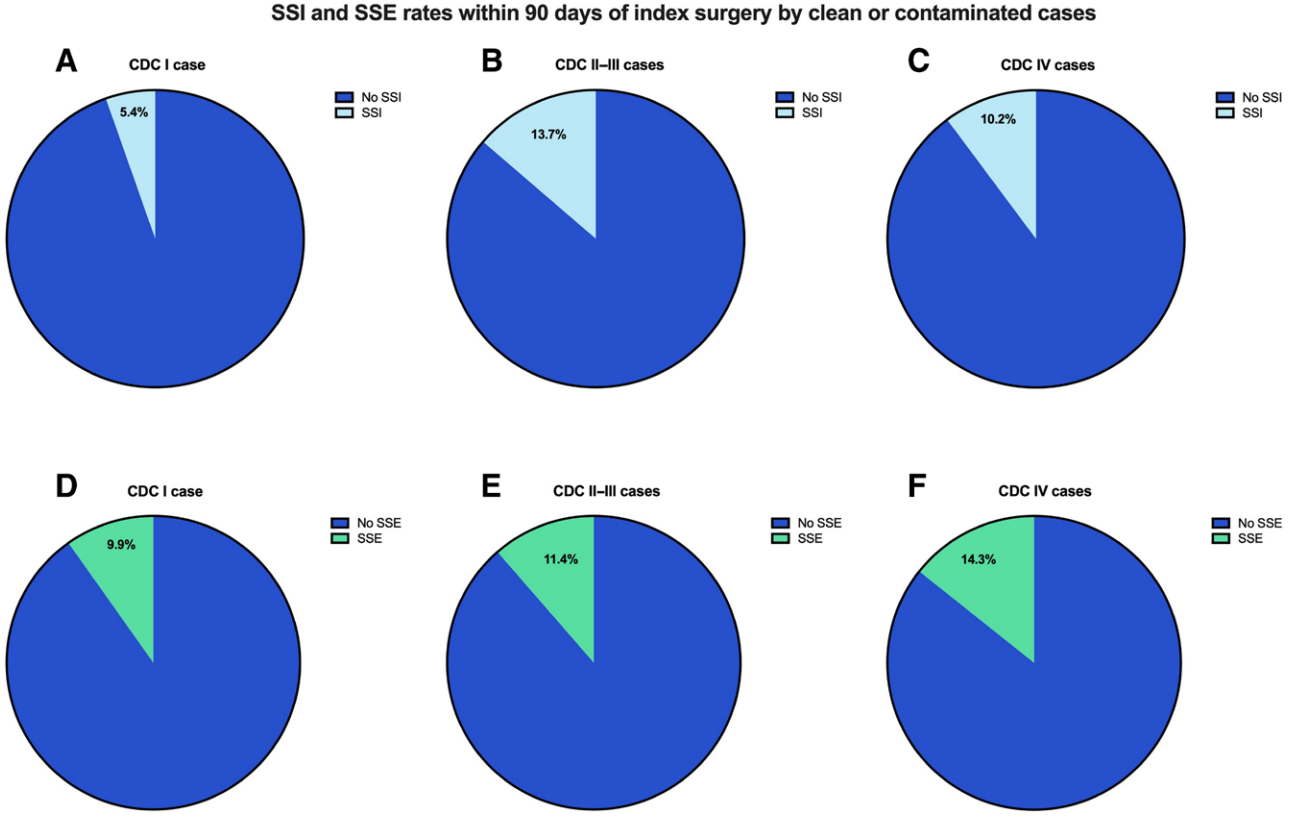

Fig. 4. SSI and SSE rates by CDC wound classification.

A total of 7.5% of patients had a reoperation within 90 days of index surgery and 12.1% of patients within 1 year. There was no significant association between surgical indication and reoperations. The most common indication for reoperation within 90 days was wound revision (21.4%) followed by intra-abdominal pathology

Table 3. Readmissions, Reoperations, and Other Outcomes

n (%)	Total Abdominal Wall N = 862 (100)	Ventral Hernia Repair N = 188 (21.8)	Fascial Closure N = 384 (44.5)	Umbilical Hernia Repair N = 73 (8.5)	Parastomal Hernia Repair N = 38 (4.4)	Abdominal Tumor Reconstruction N = 10 (1.2)	DIEP Donor Site Fascial Closure N = 169 (19.6)	*P**
Readmissions 0–90 d	132 (15.3)	21 (11.2)	84 (21.9)	9 (12.3)	6 (15.8)	1 (10.0)	11 (6.5)	**<0.001**
Related to index surgery	60 (7.0)	8 (4.2)	36 (9.4)	5 (6.8)	3 (7.9)	1 (100)	7 (4.1)	
Readmissions total within 1 y	179 (20.8)	31 (16.5)	108 (28.1)	10 (13.7)	11 (28.9)	4 (40.0)	15 (8.9)	**<0.001**
Related to index surgery	77 (8.9)	13 (7.4)	45 (11.5)	5 (6.8)	5 (13.2)	2 (20.0)	7 (4.1)	
Reoperations 0–90 d	65 (7.5)	9 (4.8)	37 (9.6)	5 (6.8)	3 (7.9)	1 (10.0)	10 (5.9)	0.443
Reoperations within 1 y	104 (12.1)	17 (9.0)	50 (13.0)	6 (8.2)	5 (13.2)	1 (10.0)	25 (14.8)	0.516
Hernia								
Hernia occurrence	39 (4.8)	11 (6.1)	17 (4.9)	2 (2.9)	9 (23.7)	0 (0)	0 (0)	**<0.001**
Hernia intervention performed	21 (52.5)	8 (72.7)	10 (58.8)	1 (50.0)	2 (22.2)			
Other outcomes								
Mesh suture removal	41 (4.8)	8 (4.3)	27 (7.0)	2 (2.7)	2 (5.3)	1 (10.0)	1 (0.6)	**0.032**
Mesh suture replacement	18 (43.9)	2 (25.0)	12 (44.4)	1 (50.0)	2 (100.0)	0 (0)	1 (100.0)	0.325
Death 0–90 d	33 (3.8)	2 (1.1)	31 (8.1)	0 (0)	0 (0)	0 (0)	0 (0)	**<0.001**

*The *P* value represents a significant association of surgical indication with the listed complication on χ^2 analysis. Further post hoc adjusted standardized residuals are reported in the narrative results. Bolded values were statistically significant at a level <0.05.

(20.2%) and hematoma evacuation (17.9%). (**See table, Supplemental Digital Content 3**, which displays the reoperations by event, **http://links.lww.com/PRSGO/E36**.)

Intra-abdominal pathology included anastomosis leak, bowel perforation, lysis of adhesion for bowel obstruction, and other intra-abdominal processes. For the 20 patients who underwent reexploration within 1 year for intra-abdominal pathology, mesh suture was not attributed as the cause for the adhesion or the need for bowel resection; however, 1 surgery occurred outside of the United States for which there is no operative report. Furthermore, mesh suture was immediately replaced in 35.0% of patients.

Major Complications

There were significant associations between American Society of Anesthesiology (ASA) Physical Status classification, wound class, diabetes, operative time, and duration of inpatient hospital stay and major complications (Table 4). Patients classified as ASA IV and V were more likely to have a major complication ($\chi^2 = 19.066$, $P < 0.001$, residual +4.4). CDC I wound class closures were less likely to have a major complication ($\chi^2 = 7.708$, $P = 0.021$, residual −2.6). Patients with diabetes were more likely to have a major complication ($\chi^2 = 4.960$, $P = 0.026$, residual +2.2). Patients with a major complication had longer operative times ($P = 0.035$, mean difference of 31 min) and durations of stay ($P < 0.001$, mean difference of 8.5 d).

Hernia Formation

Thirty-nine (4.8%) patients developed a hernia recurrence/occurrence after index abdominal wall closure (Table 2). Parastomal hernia repair had the highest hernia rate (23.7%) compared with ventral hernia repair (6.1%), fascial closures (4.9%), and umbilical hernia repair (2.9%). Parastomal hernia repair was the most likely to have hernia formation (residual +5.6), whereas DIEP flap donor site closures were the least likely (residual −3.3) ($\chi^2 = 39.448$, $P < 0.001$). Patients who actively smoked (within 4 wk of surgery) were more likely to have hernia formation ($\chi^2 = 8.862$, $P = 0.003$, residual +3.0). The rate of hernia formation in CDC I cases was 3.8%, CDC II/III cases 5.8%, and CDC IV cases 8.8%; there was no significant association between wound class and hernia formation. Hernia formation similarly was not associated with SSI or SSE. The average size of hernia occurrence/recurrence in the greatest dimension was 6.3 cm following mesh suture repair compared with the average preoperative hernia size in the greatest dimension of 9.2 cm (Fig. 5).

DISCUSSION

This study demonstrates, across many surgical disciplines, the early efficacy and safety of mesh suture. Mesh suture was designed to provide a low complexity means to diffuse pressure at the STI with an acceptable risk of infection. The use of mesh suture without specialized training by 83 unique surgeons implies it is similar to the use of standard suture. In comparison, planar mesh requires increased operative time and complexity for placement and may require additional "closing teams."[19] Mesh suture could be a potential improvement to standard suture outcomes and an alternative to planar mesh in hernia prophylaxis and repairs.

Surgical Site Infections

Our study found an SSI rate among abdominal wall closures of 9.4% at 1 year, with a 4.6% rate of superficial infection, 0.5% deep infection, and 4.8% organ space infection. These rates are similar to or superior to a meta-analysis of almost 500,000 patients where the SSI rate was 11% for all laparotomies and 13% for open surgery.[20] Although mesh suture may have greater foreign body material when compared with standard suture, this did not translate into a greater risk of infection. Mesh suture repair shows similar to superior SSI rates

Table 4. Variables Associated With Major Compilations

	No Complications	Major Complication*	*P*†
n (%)	N = 690	N = 172	
Age (mean ± SD)	57.8 ± 14.2	58.0 ± 14.4	0.858
Sex: Male	262 (38.0)	76 (44.2)	0.135
BMI (mean ± SD)	29.8 ± 6.9	30.5 ± 7.2	0.201
ASA class			**<0.001**
I–III	630 (91.3)	137 (79.7)	
IV and V	60 (8.7)	35 (20.3)	
CDC wound class			**0.021**
CDC I	386 (55.9)	77 (44.8)	
CDC II and III	269 (39.0)	81 (47.1)	
CDC IV	35 (5.1)	14 (8.1)	
Active smoking	54 (7.8)	21 (12.3)	0.065
Former smoking	257 (37.3)	69 (40.4)	0.462
Cancer	286 (41.4)	64 (37.4)	0.338
COPD	75 (10.9)	25 (14.6)	0.171
HTN	389 (56.4)	97 (56.7)	0.934
DM	136 (19.7)	47 (27.5)	**0.026**
Operative time, min (mean ± SD)	291.8 ± 167.5	322.7 ± 190.3	**0.035**
Duration of stay, d (mean ± SD)	5.0 ± 5.6	13.5 ± 19.6	**<0.001**

*Major complication = SSI, SSE, or reoperation in 0–90 d.
†The *P* value represents a significant association of surgical indication with the listed complication on χ^2 analysis or *t* test. Further post hoc adjusted standardized residuals are reported in the narrative results. Bolded values were statistically significant at a level <0.05.
BMI, body mass index; COPD, chronic obstructive pulmonary disease; DM, diabetes mellitus; HTN, hypertension.

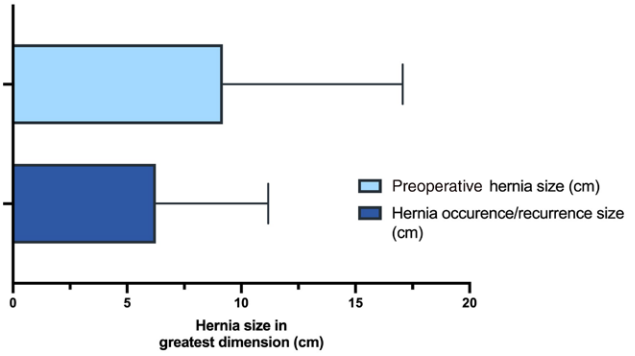

Fig. 5. Hernia occurrence/recurrence size when compared with preoperative hernia sizes

as compared to planar mesh repairs of ventral hernias, with superficial infection rates from 9% to 12% and deep infection rates from 4% to 15%.[21] Quattrone et al[22] examined the outcomes following mesh suture hernia repairs and found similar SSI results to our study, with a 4.8% superficial infection rate and overall SSIs of 6.3%. When looking at CDC II/III cases, our study found an SSI rate of 14.3% at 1 year among abdominal closures when compared with 17% for suture repair of ventral hernias and 15%–21% for mesh-augmented repairs in the literature.[21,23,24]

Surgical Site Events

The rates of SSE in our study were similarly lower than those reported in the literature, particularly the rates of chronic draining sinuses (0.3%), enterocutaneous fistulae (0.2%), and fascial dehiscence (1.0%). Fascial dehiscence often results in urgent surgical intervention with potentially serious consequences for patients. Risk factors for dehiscence include SSI, obesity, and emergent operations.[25] Fascial dehiscence following suture laparotomy closures has a reported rate of 2.6% to 3.3%.[26] Fascial dehiscence is often connected to increased pressure at the STI leading to suture pull-through. Previous porcine models have shown that mesh suture has a greater ability to diffuse pressure at the STI; the low rate of fascial dehiscence in this study suggests that this may be supported in clinical practice.[16]

The risk of chronic draining sinus or fistula formation has been cited as significant in the use of permanent materials in contaminated fields, with rates of chronic draining sinus of up to 4.6% in mesh augmented repairs and 3.5% in permanent suture repairs.[26–28] Therefore, in theory, mesh suture may be at high risk for chronic draining sinuses compared with standard permanent sutures considering its increased surface area. However, this was not found in our study and suggests that the early fibrovascular incorporation properties of mesh suture may make it less inclined for sinus or fistula formation.[17]

Patients With Comorbidities

This study demonstrates that mesh suture can be used in patients with significant comorbidities. The literature identifies several significant predictors for incisional hernia occurrence/recurrence including elevated body mass index, diabetes, smoking, immunosuppressant use, chronic obstructive pulmonary disease, ASA grade, and wound grade (CDC II–IV).[29,30] Interestingly, our study found that major complications were only associated with ASA class IV and V, CDC II–IV wound class, and diabetes. This implies that other comorbidities such as body mass index, cancer, or chronic obstructive pulmonary disease are potentially less important to outcomes in mesh suture use when compared with other closure strategies.

Readmission and Reoperations

Readmissions have significant consequences for the patient and notable healthcare costs.[31] Our study found a readmission rate within 90 days of 15.3%, with about half of those related to abdominal wall closure (7.0%). In comparison, reported readmission rates following ventral hernia repair are up to 19%–22%.[32] The most common abdominal wall–related readmission in our study was for SSI, consistent with the literature that has previously identified SSIs and SSEs as risk factors for readmission.[31,33]

The reoperation rate within 90 days was 7.5%, with most to manage intra-abdominal pathology such as bowel perforation, anastomosis leak, or lysis of adhesions. No surgeon attributed a reoperation to a mesh suture adhesion in their operative reports. In more than one-third of cases where mesh suture was removed for intra-abdominal pathology that required reexploration, it was immediately replaced, demonstrating utility in both primary and subsequent closures. A significant advantage of mesh suture compared with planar mesh augmented techniques is the ease of reentry into the abdomen. Mesh suture can be easily unraveled and pulled out (if early) or can be directly cut through to reenter the abdomen (if already incorporated). In contrast, planar mesh requires redevelopment of tissue layers to remove the entire sheet of mesh, particularly in contaminated cases, to minimize the risks of future complex infections.[34,35]

Hernia Formation

A large meta-analysis of more than 14,000 patients showed the incidence of hernia after midline abdominal wall surgery to be about 12.8%, and recurrence after incisional hernia repair reported in up to 23%–50% of cases.[36,37] Recurrent incisional hernias were estimated to increase the cost of care by $100,000 following closure in 2016.[38] In this study, the rate of hernia formation was 4.8% overall and 3.8% in CDC I cases. Notably, Quattrone et al[22] recently published a study examining the outcomes mesh suture hernia repairs and found a recurrence rate of 4.8%, or 3 of their 63 patients—all parastomal hernia repairs. Contaminated closures (CDC II–IV) increase hernia occurrence/recurrence following abdominal surgery, possibly due to the increased risk of SSI.[30] However, our study found no association between wound class and hernia formation, suggesting mesh suture may not carry greater risks in contaminated cases when compared with clean cases. Prior reported outcomes of CDC II and III abdominal wall closures demonstrate hernia recurrence rates from 23% to 40% depending on the closure technique.[39] This compares favorably to the rate of hernia formation among our CDC II and III cases of 5.8%. Additionally, hernia recurrences/occurrences were on average smaller than preoperative hernias noted in this study (Fig. 5). This suggests that mesh suture repairs are less likely to have complete failure, with hernia formation likely resulting from small areas of weakness in the fascia, in contrast to standard suture where total failure may be more likely. Although follow-up remains limited given mesh suture has only been in use in the United States for 18 months, these early findings are encouraging. Time will tell if the multiple fine permanent filaments and the fibrovascular ingrowth will act as a scar scaffold to provide a lasting closure.

Limitations

Patients from this study were primarily treated at an urban, academic hospital, thus limiting generalizability. Additionally, follow-up duration is short regarding long-term success of the repair and long-term hernia formation rates. There are inherent limitations with retrospective reviews with possible confounding variables that are not captured in our analysis. Furthermore, there was no randomized control comparison group or propensity score match, and therefore, we used the literature to draw comparisons to standard suture and planar mesh closures of the abdominal wall. Future studies incorporating a comparison group would significantly increase the strength of evidence. Finally, selection bias must be considered, given patients at high risk for incisional hernias may have received mesh suture at a disproportionate rate.

CONCLUSIONS

Mesh suture seems to be a feasible and versatile option for tissue approximation across a range of surgical indications, particularly for abdominal wall closure. Early outcomes are encouraging; however, prospective studies that compare mesh suture with traditional suture techniques and planar mesh reinforcement are needed to evaluate long-term outcomes and to better define its relative benefits.

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DISCLOSURE

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