Hypothesis: The prevalence of and risk factors for incisional hernias among temporary stoma wounds have implications for clinical practice.

Design: Retrospective cohort study.

Setting: University tertiary care hospital.

Patients: All adult patients with a stoma closed between January 1, 2000, and August 1, 2004. Of 150 living patients, 111 (74.0%) were included for analysis after follow-up at the outpatient clinic.

Main Outcome Measures: The main outcome was incisional hernia in a temporary stoma wound, defined as a defect within the musculature and fascia detected by ultrasonographic examination. Risk factors for incisional hernias and the diagnostic validity of clinical symptoms and palpation during the Valsalva maneuver were determined.

Results: After a median follow-up of 35 months (range, 5-77 months), hernia prevalence was 32.4%. Among patients with a body mass index (calculated as weight in kilograms divided by height in meters squared) of less than 30, hernia prevalence was 25.8%; among patients with a body mass index of 30 or higher, hernia prevalence was 59.1%. Palpation demonstrated the highest sensitivity (58.3%). One in 6 patients had discomfort at the temporary stoma site and no palpable defect but showed an incisional hernia on ultrasonographic examination. Obesity was the sole significant risk factor identified in this study (odds ratio, 5.53; 95% confidence interval, 1.72-17.80). The presence of a stoma in situ for less than 6 months showed a trend toward being a risk factor (odds ratio, 2.38; 95% confidence interval, 0.96-5.99).

Conclusion: Incisional hernias occur in 1 of 3 temporary stoma wounds, and a body mass index of 30 or higher is a risk factor.


THE FIRST RECORDED SURGICAL creation of a stoma was in 1776 by the French surgeon Pillore; stoma formation is considered a valuable and frequently used tool in intestinal surgery to bypass a diseased or anastomosed bowel segment.1,2 Despite the advantages provided by the use of stomas, stoma closure carries an often underestimated rate of morbidity and mortality, with complications, such as postoperative bowel obstruction, infection, and anastomotic leakage, occurring in 20% to 27% of patients.7,8 A subsequent complication is incisional hernia at the temporary stoma site. The prevalence of incisional hernias was thought to be about 2% to 7% based on earlier findings.9,10 However, the prevalence was found to be 31% to 48% in recent research.11,12 Compared with the general hernia rate among abdominal incisions (10%), the incisional hernia rate at temporary stoma sites is unfavorable and warrants further investigation.13,14

First, it is important to determine the true prevalence of these hernias by assessing the diagnostic validity of physical complaints and by physically examining each patient. Therefore, physicians will be better able to link symptoms to a specific condition (ie, incisional hernia). Second, identification of risk factors for incisional

See Invited Critique at end of article

up to 48% of patients with a stoma face complications, such as high output, prolapse, retraction, or parastomal hernia, leading to skin irritation, pain, unpleasant odors, difficulties with stoma bag application, aesthetic complaints, limitations on physical activity, and decreased quality of life.3-5 The best method for resolving these problems is closure of the stoma, which is performed in about two-thirds of temporary stomas.6 However,
hernias in temporary stoma wounds may lead to new strategies for hernia prevention in high-risk patients. So far, diagnostic validity and risk factors have been addressed only among small study groups, with low follow-up rates or with questionable methods. Therefore, we conducted a retrospective cohort study among patients who had undergone closure of a temporary stoma at our institution and who responded to our invitation for clinical and ultrasonographic examination of their stoma wound.

METHODS

PARTICIPANTS

All adult patients who had a surgical stoma closed between January 1, 2000, and August 1, 2004, at the Department of General Surgery, Maastricht University Medical Center, Maastricht, the Netherlands, were identified by operation code in the hospital database. The national registry was checked to eliminate patients who were deceased. The remaining patients were invited by letter to visit the outpatient clinic for clinical and ultrasonographic examination of their temporary stoma wounds. Patients who did not respond initially were telephoned and invited to participate. In cases of multiple temporary stoma wounds, only the first stoma site closed between January 1, 2000, and August 1, 2004, was used for analysis. Patients who had undergone mesh repair of an incisional hernia in the temporary stoma wound were included in the study if data were available about the initial presentation of the incisional hernia. Patients with mesh repair at sites other than the stoma wound underwent ultrasonographic examination and were excluded if the mesh borders were within 3 cm of the temporary stoma site. Follow-up of patients was conducted between January 18, 2005, and July 28, 2007. The study was performed in compliance with the Declaration of Helsinki.

CLINICAL EXAMINATION

At the outpatient clinic, all patients were first evaluated for physical discomfort at the temporary stoma wound site, followed by clinical examination. Clinical examination and palpation was performed in an erect position and a supine position during the Valsalva maneuver. Any palpable defect and need for repositioning due to the hernia were recorded. Ultrasonographic examination was then performed.

ULTRASONOGRAPHIC EXAMINATION

Ultrasonographic examination was performed while the patient was in a supine position during the Valsalva maneuver. The abdominal wall surrounding the temporary stoma wound was imaged with an ultrasonographic system (SSD-2000; Aloka, Tokyo, Japan) using a 7.5-MHz linear array probe. A hernia was defined as a defect within the abdominal musculature and both fascia as detected by ultrasonographic examination (Figure). All patients were examined by the same physician (M.H.F.S.), who was experienced in clinical and ultrasonographic examination of midline abdominal scars for herniation.

RISK FACTORS

Information concerning possible risk factors was obtained from the hospital database, operative notes, ward notes, medication lists, hospital discharge summary, and patient. The following demographic characteristics were recorded: sex, age at stoma site closure (<65 or ≥65 years), and body mass index (BMI [calculated as weight in kilograms divided by height in meters squared]) (<25, 25-29.9, or ≥30). The recorded preoperative risk factors were as follows: underlying disease (malignant neoplasm, inflammatory bowel disease, fistula, or other), American Society of Anesthesiologists (ASA) index at stoma closure (1, 2, 3, or 4), diabetes mellitus (yes or no), chronic obstructive pulmonary disease (yes or no), aortic aneurysm (yes or no), collagen disease (yes or no), parastomal hernia (yes or no), hernia other than a parastomal hernia (yes or no), corticosteroid use (yes or no), smoking (yes or no), prior laparotomies (<4 or ≥4), peritonitis at the time of stoma creation (yes or no), type of stoma (ileostomy or colostomy), and interval (in months) during which the stoma was in situ. The recorded intraoperative risk factors were suture material for closure of the fascia (nonabsorbable or absorbable) and skin closure (open or closed). The recorded postoperative risk factors were as follows: length of hospital stay in days after stoma closure; wound infection defined as the presence of erythema, induration, and discharge of serous fluid or pus (yes or no); and reoperation within 30 days (yes or no).

STATISTICAL ANALYSIS

Statistical analysis was performed using commercially available software (SPSS for Windows, version 15.0; SPSS Inc, Chicago, Illinois). Diagnostic validity of physical discomfort, the
presence of a palpable defect, and the combination of both was
determined using sensitivity, specificity, positive and negative
predictive values, and odds ratios (ORs, calculated by logistic
regression analysis). Subgroup analyses were performed using
2-sided Fisher exact test.

To identify risk factors for incisional hernias, univariate ORs
were first calculated using logistic regression analysis for all risk
factors. A final multivariate logistic regression model was then
fitted, including all risk factors with \( P < .20 \) as covariates. \( P < .05 \)
was considered statistically significant. Unless stated other-
wise, data are expressed as the median (range).

### RESULTS

The diagnostic validity of clinical symptoms and palpation
was established, and multiple variables were explored for risk factor analysis. Based on these results, we formulated implications for clinical practice.

Between January 1, 2000, and August 1, 2004, a total
of 186 patients underwent closure of a stoma site. By the
time of follow-up, 36 patients had died, leaving 150 pa-
tients for evaluation. Of these, 11 (7.3%) refused consent,
11 (7.3%) were unable to attend the outpatient clinic,
and 12 (8.0%) could not be contacted, despite multiple
attempts. The remaining 116 patients were followed up in
our outpatient clinic. Of these, 5 patients were excluded
because of mesh repair at a site other than the temporary
stoma wound. This operation was performed
readily undergone mesh repair of the temporary stoma
wound. The total incisional hernia prevalence was 32.4%
(36 of 111 patients).

Parastomal hernia was present in 13.5%
(36 of 111 patients). Palpation demonstrated the highest sen-
sitivity, specificity, and positive and negative
predictive values, followed by physical discomfort
and palpation, with ultrasonography as the reference
(Table 1). Sensitivity, specificity, and positive and negative
predictive values were calculated for all variables
and are presented in Table 2.

Table 1. Diagnostic Validity of Physical Discomfort
and Palpation, With Ultrasonography as the Reference

<table>
<thead>
<tr>
<th>Variable</th>
<th>Palpable Defect</th>
<th>Physical Discomfort</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Palpable Defect</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>12</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>36</td>
<td>52</td>
</tr>
</tbody>
</table>

Table 2. Sensitivity, Specificity, and Positive and Negative
Predictive Values

<table>
<thead>
<tr>
<th>Variable</th>
<th>Physical Discomfort</th>
<th>Palpable Defect</th>
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<tbody>
<tr>
<td></td>
<td>Sensitivity, %</td>
<td>Specificity, %</td>
<td>Odds ratio</td>
</tr>
<tr>
<td>Physical discomfort</td>
<td>41.7 (26.7-57.9)</td>
<td>97.3 (91.7-99.4)</td>
<td>1.52-9.28</td>
</tr>
<tr>
<td>Palpable Defect</td>
<td>58.3 (42.1-73.3)</td>
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<td>10.81-241.52</td>
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<td>Total</td>
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Abbreviation: Ellipsis, not applicable.

35 (5-77) months after closure of the stoma. Temporary
ileostomies (42.3%) and colostomies (37.7%) had been
created for the indications of malignant neoplasms
(47.7%), inflammatory bowel disease (29.7%), fistula
(9.0%), or other underlying diseases after 3 (2-12) la-
porotomies. Peritonitis was present in 24.3% of all
patients at the time of stoma closure. Comorbidities and
risk factors included diabetes mellitus (14.4%), chronic
obstructive pulmonary disease (4.5%), smoking (24.3%),
and corticosteroid use (8.1%). No patients had collagen
disease or an aortic aneurysm. Almost 60% of patients
were overweight (BMI, \( \geq 25 \)), while 19.8% of patients
were obese (BMI, \( \geq 30 \)). Parastomal hernia was present in 13.5% of
patients, and other hernias were present in 28.8% of
patients. The ASA index at stoma closure was between 1
and 2 for most patients (93.8%).

The stomas remained in place for 6 (1-48) months, and
the suture material for closure of the fascia was absorbable
(79.6%) or nonabsorbable (20.4%). Wound infection (10.7%)
was associated with a BMI of 30 or higher (\( P = .04 \)) but not
with skin closure (\( P = .60 \)). Reoperations were performed in
5 patients for fistula (n = 2), anastomotic dehiscence, deep
space abscess, and suspicion of an incisional hernia, which
proved to be a collection of subcutaneous fat. The length of
hospital stay was 7 (2-217) days.

### ULTRASONOGRAPHIC EXAMINATION

On ultrasonographic examination, 35 of 110 patients were
found to have an incisional hernia. One patient had al-
ready undergone mesh repair of the temporary stoma
wound. The total incisional hernia prevalence was 32.4%
(36 of 111 patients).

### CLINICAL EXAMINATION

Diagnostic validity was compared among physical dis-
comfort at the temporary stoma wound, the presence of
a palpable defect, and the combination of both (Table 1
and Table 2). Palpation demonstrated the highest sen-
sitivity, yet only 58.3% of patients with an incisional her-
nia were seen with a palpable defect. Positive and nega-
tive predictive values and ORs were comparable for the
presence of a palpable defect alone and the combination

PATIENT CHARACTERISTICS

The patients (56 male and 55 female) were aged 62 (18-
84) years at stoma site closure and were followed up for

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The patients (56 male and 55 female) were aged 62 (18-
84) years at stoma site closure and were followed up for
of physical discomfort at the temporary stoma wound and a palpable defect. Of 27 patients with physical discomfort at the temporary stoma wound, 10 patients (37.0%) had a palpable defect confirmed on ultrasonography. Another 5 patients (18.5%) with physical discomfort had no palpable defect but were identified to have an incisional hernia on ultrasonography. These 5 patients and the remaining 12 patients with physical discomfort (but with no detectable defect on ultrasonography) demonstrated no morbid obesity as a risk factor ($P = .13$ and $P = .45$, respectively).

**RISK FACTORS FOR INCISIONAL HERNIAS**

On univariate analysis, the following were unrelated to incisional hernia risk ($P > .40$): sex, age at stoma site closure (including various cutoffs between 35 and 75 years), ASA index at stoma closure, underlying disease, the presence of chronic obstructive pulmonary disease, type of stoma, peritonitis at the time of stoma creation, suture material for closure of the fascia, open skin, length of hospital stay after stoma closure, and wound infection (Table 3). Factors potentially impairing healing (the presence of diabetes mellitus, corticosteroid use, and smoking) were unrelated to incisional hernia risk either in total ($P = .33$) or individually ($P = .22$, $P = .95$, and $P = .41$, respectively). The number of prior laparotomies and a history of hernia (parastomal, other, or combined) also did not increase hernia risk ($P > .30$). Reoperation after stoma closure was a nonsignificant risk factor ($P = .20$), nor did it reach significance or improve the model on multivariate analysis. Hernia prevalence was 23.8% among patients having malignant neoplasms and elective clean operations at the time of stoma creation.

Therefore, the only 2 risk factors that were entered into the multivariate analysis were BMI and the interval during which the stoma was in situ (Table 3). In the resulting model, obesity (BMI, $\geq 30$ vs $<25$) was the sole significant risk factor for an incisional hernia in a temporary stoma wound (OR, 5.53; 95% confidence interval, 1.72-17.80). Hernia prevalence among patients with a BMI of 30 or higher was 59.1% (13 of 22) compared with 25.8% (23 of 89) among patients with a BMI of less than 30.

The presence of a stoma in situ for less than 6 months showed a trend toward being a risk factor for an incisional hernia in a temporary stoma wound (OR, 2.38; 95% confidence interval, 0.96-5.99). Subgroup analysis showed that a stoma in situ for less than 6 months was significantly associated with younger age ($P = .003$) and with fewer hernias other than parastomal hernias ($P = .03$).

### Comment

In this retrospective cohort study, incisional hernias were confirmed in almost 1 of 3 temporary stoma wounds (32.4%) by ultrasonography. With the largest cohort to date (111 patients), a high rate of follow-up (74.0%), and a lengthy follow-up (35 months), this rate seems to be a valid approximation of the true incisional hernia rate in patients with closed stoma wounds. It is also close to the 31.4% and 32.3% rates found in 2 recent smaller studies that focused on incisional hernias in temporary stoma wounds. However, the rate compares unfavorably with the 10% to 15% incisional hernia rates ob-

### Table 3. Logistic Regression Analysis of Risk Factors for Incisional Hernia

<table>
<thead>
<tr>
<th>Variable</th>
<th>Prevalence, %</th>
<th>Univariate Odds Ratio (95% CI)</th>
<th>$P$ Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female vs male</td>
<td>49.5</td>
<td>0.87 (0.39-1.93)</td>
<td>.73</td>
</tr>
<tr>
<td>Age at stoma site closure, y</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\geq$65 vs $&lt;65$</td>
<td>42.3</td>
<td>0.81 (0.36-1.82)</td>
<td>.61</td>
</tr>
<tr>
<td>Body mass index$^a$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$&lt;25$</td>
<td>40.5</td>
<td>1.00 [Reference]</td>
<td></td>
</tr>
<tr>
<td>25-29.9</td>
<td>39.6</td>
<td>0.92 (0.36-2.37)</td>
<td>.45</td>
</tr>
<tr>
<td>$\geq30^b$</td>
<td>19.8</td>
<td>3.97 (1.35-11.66)</td>
<td>.40</td>
</tr>
<tr>
<td>American Society of Anesthesiologists index at stoma closure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>53.6</td>
<td>1.00 [Reference]</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>40.2</td>
<td>1.57 (0.66-3.73)</td>
<td>.22</td>
</tr>
<tr>
<td>3</td>
<td>6.2</td>
<td>0.45 (0.05-4.17)</td>
<td>.86</td>
</tr>
<tr>
<td>Underlying disease</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malignant neoplasm</td>
<td>47.7</td>
<td>1.00 [Reference]</td>
<td></td>
</tr>
<tr>
<td>Inflammatory bowel disease</td>
<td>29.7</td>
<td>1.39 (0.54-3.59)</td>
<td>.27</td>
</tr>
<tr>
<td>Fistula</td>
<td>9.0</td>
<td>2.79 (0.70-11.09)</td>
<td>.84</td>
</tr>
<tr>
<td>Other</td>
<td>13.5</td>
<td>1.86 (0.56-6.17)</td>
<td>.22</td>
</tr>
<tr>
<td>Factors for wound impairment$^c$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>61.3</td>
<td>1.00 [Reference]</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>31.5</td>
<td>0.48 (0.19-1.21)</td>
<td>.94</td>
</tr>
<tr>
<td>2</td>
<td>6.3</td>
<td>0.27 (0.03-2.37)</td>
<td>.72</td>
</tr>
<tr>
<td>3</td>
<td>0.9</td>
<td>NC</td>
<td></td>
</tr>
<tr>
<td>Prior laparotomies $&lt;4$ vs $\geq4$</td>
<td>54.1</td>
<td>1.50 (0.68-3.34)</td>
<td>.32</td>
</tr>
<tr>
<td>Peritonitis at the time of stoma creation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes vs no</td>
<td>24.3</td>
<td>0.84 (0.33-2.16)</td>
<td>.72</td>
</tr>
<tr>
<td>Chronic obstructive pulmonary disease</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes vs no</td>
<td>4.5</td>
<td>1.41 (0.23-8.85)</td>
<td>.71</td>
</tr>
<tr>
<td>History of hernia</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes vs no</td>
<td>37.8</td>
<td>1.51 (0.67-3.39)</td>
<td>.32</td>
</tr>
<tr>
<td>Type of stoma</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Colostomy vs ileostomy</td>
<td>57.7</td>
<td>1.04 (0.47-2.33)</td>
<td>.92</td>
</tr>
<tr>
<td>Interval during which the stoma was in situ, mo $&lt;6$ vs $\geq6$</td>
<td>50.5</td>
<td>1.92 (0.85-4.35)</td>
<td>.12</td>
</tr>
<tr>
<td>Suture material for closure of the fascia</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Absorbable vs nonabsorbable</td>
<td>79.6</td>
<td>1.15 (0.42-3.19)</td>
<td>.79</td>
</tr>
<tr>
<td>Skin closure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Open vs closed</td>
<td>10.8</td>
<td>1.05 (0.29-3.74)</td>
<td>.94</td>
</tr>
<tr>
<td>Length of hospital stay after stoma closure, d $\geq7$ vs $&lt;7$</td>
<td>54.6</td>
<td>0.76 (0.34-1.69)</td>
<td>.50</td>
</tr>
<tr>
<td>Wound infection</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes vs no</td>
<td>10.7</td>
<td>0.78 (0.19-3.13)</td>
<td>.72</td>
</tr>
<tr>
<td>Reoperation within 30 d Yes vs no</td>
<td>4.5</td>
<td>3.32 (0.53-20.81)</td>
<td>.20</td>
</tr>
</tbody>
</table>

Abbreviations: CI, confidence interval; NC, ranges from 0 to infinity.

$^a$Calculated as weight in kilograms divided by height in meters squared.

$^b$Multivariate odds ratio (95% CI), 1.15 (0.43-3.12); $P = .009$.

$^c$Include diabetes mellitus, corticosteroid use, and smoking.

$^d$Multivariate odds ratio (95% CI), 2.38 (0.96-5.99); $P = .06$. 

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served in temporary midline laparotomy wounds.\textsuperscript{13,14} The rate also compares unfavorably with older studies\textsuperscript{9,10} reporting a 2% to 7% prevalence of incisional hernia among temporary stoma wounds. This might be explained by the fact that the older studies focused mainly on the early complications of stoma closure, such as anastomotic leakage or wound infection.

Ultrasonography was used in this study and in a recent study by Cingi et al.\textsuperscript{15} Traditionally, the occurrence of hernia was defined as a palpable protrusion at the old incision site. Using diagnostic modalities such as ultrasonography or computed tomography, additional defects (covert on palpation) can be identified. The sensitivity of palpation during the Valsalva maneuver was also assessed herein; only 58.3% of all hernias identified on ultrasonography were detected by palpation in this study. This finding has clinical relevance because at least 1 in 6 patients with discomfort at the temporary stoma site had an incisional hernia that was identifiable only by ultrasonography.

Almost 60% of all patients with morbid obesity were found to have developed an incisional hernia. Obesity was the only risk factor for incisional hernias identified in our cohort of patients with closed stomas. Morbid obesity had previously been identified in other studies\textsuperscript{18,19} as the most common risk factor for incisional hernias in laparotomy wounds. Although this association has become apparent, the actual cause remains unclear. On the one hand, there may be a mechanical explanation for early fascial dehiscence among patients with obesity. Abundant subcutaneous fat tissue can hinder a good overview of the operation site and may become necrotic underneath sutures, leading to their loosening. Furthermore, the tangential force on the abdominal wall is higher in these patients due to the increased abdominal wall radius.\textsuperscript{20} On the other hand, the disease process might be associated with or influenced by the state of obesity itself, as incisional hernias can be regarded as a disease of the extracellular matrix, regulated by inflammatory cytokines.\textsuperscript{21,22}

The interval during which stomas remained in situ was 6 months, which is comparable to other studies.\textsuperscript{6,15} A trend was observed for patients with a stoma in situ for less than 6 months to develop more incisional hernias. No other risk factors were observed among these patients in subgroup analyses except for a higher proportion of younger patients and the presence of fewer hernias other than parastomal hernias. A longer period of convalescence for incisional hernias may lead to better results. However, stomas carry significant morbidity, which is best resolved by closure.

Additional risk factors such as smoking, corticosteroid use, chronic obstructive pulmonary disease, history of hernia, and type of stoma have been suggested to influence the incisional hernia rate,\textsuperscript{18,23} but we did not observe this in our study. Similarly, suture material (absorbable vs nonabsorbable) did not affect incisional hernia rates in our study. A recent trial on closure of midline laparotomy wounds also found no significant difference in the effect of absorbable vs nonabsorbable sutures.\textsuperscript{15} Furthermore, we observed a wound infection rate of 10.7% that was associated with high BMI but not with skin closure, which is in accord with a prospective study by Latfat et al\textsuperscript{24} comparing primary vs delayed skin closure after ileostomy reversal.

Together, the results of this study and previous investigations indicate that patients undergoing stoma reversal, especially in the case of obesity, are at high to very high risk of incisional herniation. Prophylactic mesh is implanted in high-risk patients undergoing aortic aneurysm repair or open bariatric surgery.\textsuperscript{25,26} Moreover, mesh is placed in definitive stoma formations to prevent parastomal hernias.\textsuperscript{27,28} The next step may be placement of mesh in temporary stomas to prevent parastomal hernias and incisional hernias after stoma reversal. However, insertion of a foreign object poses risk for infection or fistulization, which should be clearly communicated to patients.

Limitations of this study are its design (as a cohort study with data gathered retrospectively) and the sole measurement of incisional herniation. Patients deceased at the time of the investigation were excluded according to our study variables. Among the surviving patients, a high rate of follow-up (74.0%) was achieved, and the duration (35 months) was sufficient to capture at least 80% of all hernias that can be expected to originate from the procedure.\textsuperscript{30} More hernias might have been detected with the use of computed tomography. Nevertheless, ultrasonography is an easily accessible, inexpensive, fast, and minimally invasive imaging technique that possesses high accuracy. In cases of negative ultrasonographic findings, computed tomography could be used.

In conclusion, a high rate of incisional hernia formation occurs after stoma closure, affecting 1 in 3 patients. As many as 1 in 6 patients with physical discomfort may have a nonpalpable incisional hernia revealed on ultrasonographic examination. A BMI of 30 or higher is a risk factor for herniation of the temporary stoma wound. Future research should focus on the cause of incisional hernias, particularly in the case of obesity, and on prophylactic mesh placement.

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The issue of incisional hernia has been present for as long as we have been performing abdominal operations. Schreinemacher et al present their data on the less-published hernias at stoma sites following closure and analyze the contributing risk factors. They noted a high rate of incisional hernia following stoma closure (32.4%) and found that a BMI of 30 or higher was the only contributing factor. The study draws attention to a common condition about which the literature is sparse. The creation of an ostomy is a frequently undertaken surgical procedure, and reversal is undertaken in some patients. Studies on the fate of temporary stomas delve into the immediate postoperative outcomes following stoma closure. In contrast, Schreinemacher et al focus on the long-term complication of hernia occurrence at the stoma site after closure.

There are several aspects that were inadequately addressed in the study and some that need further investigation. The authors do not mention the type of ostomy created, as there could be a difference in outcomes between loop and end ostomies. Few patients in the study underwent ostomy creation for diverticulitis, which tends to be one of the more common indications. Several known risk factors such as lung diseases, smoking, and diabetes mellitus did not have a bearing on hernia occurrence in this study. It is also notable that a history of hernia did not affect the rate of stoma site hernia. The authors’ reference to the INSECT trial is incorrect because that trial compared different absorbable sutures and not absorbable vs nonabsorbable sutures.