Adhesive Postoperative Small Bowel Obstruction: Incidence and Risk Factors of Recurrence After Surgical Treatment

A Multicenter Prospective Study

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Objective: The aim of the present study was to determine the cumulative incidence and the risk factors of recurrence in patients operated on for an adhesive postoperative small bowel obstruction (SBO).

Summary Background Data: Postoperative intraperitoneal adhesions, or bands, resulting from any type of abdominal surgery, are the main cause of adhesive postoperative small bowel obstructions, which represent a life-long issue. Recurrences after operated adhesive postoperative SBO are a threatening potentiality for patients and a difficult problem facing any surgeon. Today the cumulative incidence and the risk factors of recurrence have been retrospectively reported but have never been prospectively evaluated in a multicenter study.

Methods: From January 1997 to January 2002, we enrolled 286 patients operated on for an adhesive postoperative SBO in a prospective multicenter trial. A systematic follow-up was carried out and ended in April 2003. Studied factors for recurrent adhesive postoperative SBO were as follows: age, gender, ASA status, number and sites of previous operations, previous operation for adhesive postoperative SBO, elapsed time from the latest operation, surgical approach, number and type of obstructive structures, site and mechanism of obstruction, final operations, and postoperative surgical and medical complications. They were analyzed using Kaplan-Meier method. A Cox regression model was used to determine the independent risk factor of recurrence.

Results: The median follow-up was 41 months (range, 1–75 months). The cumulative incidence of overall recurrence was 15.9%, and for surgically managed recurrence 5.8%. In multivariate analy-
sis, the risk factors for the overall recurrences were age <40 years (hazard ratio [HR], 2.97; confidence interval [CI], 1.48–5.94), adhesion or matted adhesion (HR, 3.79; CI, 1.84–7.78) and, for the surgically managed: adhesions or matted adhesions (HR, 3.64; CI, 1.12–11.84), and postoperative surgical complications (HR, 5.63; CI, 1.73–18.28).

Conclusion: Operated adhesive postoperative SBO is a clinical entity with a high recurrence rate and specific risk factors of recurrences. Thus, the patients operated on for adhesive postoperative SBO may be candidates for the preventive use of anti-adhesion agents, particularly when a risk factor of recurrence is present.

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Opening the peritoneal cavity, in whatever type of surgery, leads to the formation of potentially obstructive structures (adhesions or bands) in almost 95% of patients. Today, with the increased incidence of abdominal surgery, these structures are the most frequent cause of small bowel obstruction (SBO). Since 1990, it has been reported that adhesive SBO occurs in 3% of all laparotomies, 1% during the first postoperative year. After operated adhesive postoperative SBO, a risk of recurrence remains and the literature reported a wide ranging rate of overall recurrence (range, 8.7%–53%) at 3 years and more. These variations may be due to the retrospective type of the studies commonly inducing missing data, incomplete follow-up leading to missing patients, and to the monocenter design of the studies entailing selection bias. Only one study used a multivariate analysis, the best way to highlight independent risk factors. For these reasons, in patients operated on for an adhesive postoperative SBO, we conducted a prospective multicenter study to determine the cumulative incidence and the risk factors of recurrence using a multivariate analysis.

METHODS

From January 1, 1997 to January 1, 2002 (5 years; end of enrollment), 286 patients (186 women, mean age, 55.8 years; SD 21.2 years; range, 16–99 years), were operated on...
for an adhesive postoperative SBO. The study was conducted in 20 gastrointestinal surgical units (8 university, 8 general, and 4 private hospitals). The centers initiated and ended the study at different times. Once a center entered the study, all consecutive eligible patients were included. Each center entered a median number of 14 patients (range, 1–44 patients). The median inclusion time was 40 months (range, 1–55 patients).

Eligibility Criteria

Patients operated on for an adhesive postoperative SBO were eligible for our study. A total of 188 patients (66%) were operated on within the 24 postadmission hours, the others after this period. The operating surgeon was free to choose technical points like intraoperative lavages, sutures, type of anastomosis, and drainage. Antiadhesion agents were never used.

Noneligibility Criteria

Patients under 16 years old, foreigners without French residency, patients with Crohn’s disease, ulcerative colitis, peritoneal carcinomatosis, associated abdominal cancer, peritoneal infection (abscess, peritonitis), or a past history of abdominopelvic irradiation were excluded. Patients with a SBO during the first postoperative month, corresponding to a possible “early postoperative obstruction,” were also excluded.

Data Collection

All the demographic, medical, and follow-up data were collected by the operating surgeon with a standardized data collection form.

Follow-up

Patients were systematically followed up by the operating surgeon at 1, 6, 12, 18, and 24 months through a consultation and at the end of the follow-up (April 2003) (6 years 3 months, or 75 months) through a consultation or a phone call. The data about the date and type of recurrence managed in the same or in another surgical unit were collected. The follow-up included the postoperative period (hospital stay and the month after hospital discharge) and the long-term follow-up.

Endpoint

The endpoint was dates of recurrences. The recurrence was strictly defined as a readmission with a clinical presentation of SBO: ileus with symptoms requiring a nasogastric drainage, a plain abdominal radiograph showing liquid levels, a small bowel dilatation, and no gas in the large bowel. At this moment, two groups were individualized as follows: 1) patients featuring a resolving medically managed SBO following the absence of other obstructive pathologic event etiologically different 1 month after hospital discharge; and 2) patients surgically treated, either urgently (continuous pain, peritoneal irritation, fever, metabolic disorders) or because of worsening symptoms and signs or a failure to resolve.8,9,16

In that way, two different points were considered: overall recurrence including operated and nonoperated recurrences and the surgical recurrences solely including the operated one.

Risk Factors

Preoperative risk factors (n = 7) were as follows: age, gender, ASA status,17 number and sites of previous operations according to a classification already reported:1 mid and hind gut (abdominal wall, small intestine, appendix, rectum, colon), foregut and other abdominal organs (stomach, gall bladder, pancreas, kidney, bladder, hernias), and female reproductive tract. A previous operation for adhesive postoperative SBO and the elapsed time from the latest operation to the inclusion adhesive postoperative SBO operation were also noted.

Intraoperative risk factors (n = 8) included surgical approach whether conventional or laparoscopic, obstructive structures defined as bands (>1 cm long and <1 cm diameter), simple adhesions (<1 cm long and >1 cm diameter) and matted adhesion (dense, multiple, and tangled),4,10 site of obstruction (operative field, incision, other organs), number of intraperitoneal pathologic structures divided for obstruction release, obstruction mechanism (strangulation, volvulus >360° of rotation of the obstructed intestinal loop or mixed), obstructed organs (duodenojejunum, ileum), and intestinal status (viable, reversible ischemia, necrosis with or without bowel perforation). The final operations were classified according to their presumed increasing degree of severity: band section, lysis of simple adhesion, lysis of matted adhesion, extensive adhesiolysis,18 sutured or not serosal defect or sutured accidental enterotomy, and bowel resection whatever the previously mentioned procedure.

Postoperative risk factors (n = 2) included medical and surgical complications. We also recorded duration of inhospital stay, postoperative deaths, and deaths reported during the follow-up.

Statistical Analysis

Survival time was calculated from the date of the operation for adhesive postoperative SBO to the date of recurrence or the date on which the data were censored if a patient died, was still alive at the end of the follow-up, was lost to follow-up, or had nonsurgical recurrence in the analysis of surgical recurrence.

Cumulative event rates were calculated by the Kaplan–Meier method, and differences between the groups were assessed with the log-rank test. Age was categorized by quartiles. The fully adjusted multivariable Cox regression model was built using stepwise procedure with variables with P ≤ 0.10 in univariate analysis. Relative risks were expressed as hazard ratios (HR) with a 95% confidence interval (CI). Patients lost to follow-up were compared with those not lost to followup using χ² test (or Fisher exact test when appropriate). All statistical tests were two-tailed. In all analyses P ≤ 0.05 was considered as significant. Statistical analyses were performed with SAS software (version 8.1, SAS Institute, Cary, NC).

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RESULTS

Postoperative Outcomes and Follow-up of Patients

Median duration of in-hospital stay was 10 days (range, 2–69 days). The median follow-up was 41 months (range, 1–75 months; 3 years 5 months). Twenty-seven patients (9%) were lost to follow-up at the end of the study (one third over 2 years of follow-up).

During the postoperative period, 39 (14%) patients sustained 40 (14%) postoperative complications. Twenty-three (8%) were medical complications: 19 cardiac or pulmonary, 2 urinary, 1 diabetic complications, and 1 deep venous thrombosis. Seventeen (6%) were surgical complications: 12 wound sepsis, 5 intra-abdominal complications. These latter were 3 postoperative intestinal necroses due to a misjudgement of an “apparent” reversible ischemia followed by 2 reoperations and 1 necropsy, 1 operated intra-abdominal abscess, and 1 nonoperated persisting ileus. One patient had both 1 urinary complication and 1 wound sepsis.

Eight patients (3%) (median age, 86 years; range, 76–98 years) died, each with a complication: 7 cardiac or pulmonary complications and 1 of 3 postoperative intestinal necrosis. They suffered significantly more complications ($P < 0.001$) than the 278 alive patients who sustained 31 complications (11%).

During the long-term follow-up of the 278 patients, 19 other patients (7%) (median age, 78 years; range, 38–89 years) died, none with a recurrent adhesive postoperative SBO. These patients had previously sustained 6 postoperative complications (2 surgical: 1 wound infection, persisting ileus; and 4 medical: 3 pulmonary and 1 diabetic complication) (31.5%) compared with 25 (10%) in the 259 patients who were alive ($P = 0.012$).

Finally, in the postoperative period and long-term follow-up, 27 patients (10%) died. These patients suffered significantly more postoperative complications ($n = 14; 52\%$) than the 259 patients who were still alive ($n = 26; 10\%$) ($P < 0.0001$).

Recurrences

Incidence and Risk Factors of Overall Recurrence

Incidence: There were 33 (12%) primary recurrences: 22 (two thirds) medically treated and 11 (one third) surgically treated. Six were secondary recurrences (18%): 4 surgically treated and 2 medically treated. The rate of secondary recurrences was the same after the primary medically (4 of 22) or surgically treated recurrences (2 of 11).

Globally, 33 patients sustained 39 recurrences: 24 medically and 15 surgically managed (Fig. 1). There were no third recurrences.

The cumulative incidence of overall recurrences was: at 1 year 5.5% ± 1.4%, at 3 years 11.3% ± 2%, at 5 years 13.5% ± 2.3%, and 15.9% ± 3.3% at the end of the study (Fig. 2).

In the univariate analysis, 7 factors were statistically significant ($P \leq 0.05$) (Tables 1, 2): age <40 years (range, 16–40 years) (Fig. 3), adhesion, matted adhesion, number of adhesions or bands ≥2, absence of bowel resection, other treatments, and latest operation for adhesive postoperative SBO. The latest operation was for adhesive postoperative SBO in 30 (10.5%) patients. Overall, 35 (12%) patients underwent 39 operations for SBO before inclusion.

Three other factors with a $P$ value $>0.05$ and $\leq 0.10$ were included in the multivariate analysis: strangulation, viable intestinal status, and postoperative surgical complications.

The other factors with a $P$ value $>0.10$ were not included in the multivariate analysis (Tables 1, 2), particularly the number of previous operations (60% of the patients underwent 2 or more operations including 22%...
with 3 or more) and the site of latest operation. For this item, there is no difference in the recurrence rate between appendectomies, accounting for 20% of previous operations, and gynecologic operations (respectively, 11% and 9% recurrences). The laparoscopic approach, with a conversion rate of 31%, did not influence the recurrence rate whether this risk factor was analyzed in intention-to-treat or after eliminating the conversion cases. Regarding the statistically significant risk factors, there was no difference between patients completing the whole follow-up and those lost during follow-up.

In the multivariate analysis, two independent factors were statistically significant (Table 3): patients <40 years old (HR, 2.7; CI, 1.48–5.94) and adhesions or matted adhesions (HR, 3.79; CI, 1.84–7.78). Adhesions and matted adhesions (HR, 2.7; CI, 1.48–5.94) and adhesions or matted adhesions (HR, 3.64; CI, 1.12–11.84) of the risk factors of recurrence following an operated adhesive postoperative SBO: age <40 years, adhesions or matted adhesions. Eight intestinal resections were performed in patients with reversible ischemia or serosal defect or accidental enterotomy associated or isolated, corresponding to 6 patients with bands and 2 patients with adhesions or matted adhesions. We entitled this set of patients the “debatable resection group.”

Intestinal resection was not judged necessary for 241 patients. This group included 173 patients with a viable intestine and 68 patients of the “debatable resection group,” corresponding to 51 patients with bands and 17 patients with adhesions or matted adhesions.

### Age <40 Years (n = 76)

In this group of 76 patients, 14 (18%) recurred. Nine patients (12%) were resected with no recurrence (0%), no complication and no death. Sixty-seven patients (88%) were not resected and 14 recurred (21%) with 2 complications and no death. Among the 20 recurrences, we counted 8 (40%) patients of “debatable resection group.”

### Adhesions or Matted Adhesions

In this group of 106 patients, 21 (20%) recurred. Twelve patients (11%) were resected and 1 (10%) recurred. Ninety-four patients (89%) were not resected and 14 (21%) recurred with 3 complications and no death. Among the 20 recurrences, we counted 8 (40%) patients of the “debatable resection group.”

### Postoperative Surgical Complications (n = 17)

In this group of 17 patients, 4 (23.5%) recurred. Four patients (23.5%) were resected with no recurrences (0%). Thirteen patients (76.5%) were not resected and 4 recurred (31%) with 1 death. Among the recurrences we counted 3 patients (3 of 4) belonging to the “debatable resection group.”

It is noteworthy that an apparent reversible ischemia due to bands led to 3 postoperative necroses (2 reoperations) and 1 death.

### DISCUSSION

The present study provides for the first time a multicenter and a prospective estimate of the overall and surgical cumulative incidence (15.9% and 5.8%, respectively) and of the risk factors of recurrence following an operated adhesive postoperative SBO: age <40 years, adhesions or matted adhesions, and postoperative surgical complications (Table 3).

Our death rate (3%) and complication rate (14%) are consistent with those reported in recent studies: death rate between 0% and 3.8% and complication rate between 0% and 27%. In our series, all the patients who died were over 75 years old (median age, 86 years; range, 76–98 years). Our early and long-term deaths are linked to the rate of postoperative complications (10% in living patients group vs. 31.5% in the deceased patients, P = 0.012). These results confirm those recently published stressing the deleterious effects of postoperative complications on early and late survival.

Recurrences were the core of our study. Their precise definition is a major issue. The obstructive etiology of the
surgically treated recurrent SBO is indisputable. Conversely, taking account of the “medically” treated recurrent SBO may be confusing even though overall recurrence is commonly reported in the literature.\textsuperscript{8,9,11} That is why we adopted stringent criteria of recurrence (used in all the centers), adding to the general definition of medical recurrence,\textsuperscript{10,19} the absence of any other obstructive pathologic event etiologically different during the postadmission month.

With regards to our cumulative overall recurrence (15.9\% \pm 3.3\% at the end of the study), Fevang et al\textsuperscript{10} reported a rate of 29\% at 25 years, 50\% appearing during the 5 first years, ie, 14.5\% at 5 years consistent with our results. Higher rates (33\%–55\%) were reported by others.\textsuperscript{8,9,11} This difference may be due to their overall long-term (10–12.8 years) readmissions and especially to their wider inclusion criteria (nonoperated adhesive postoperative SBO, past history of irradiation, cancer, other bowel obstruction)\textsuperscript{8,9} or to the lower number of included patients (n = 90).\textsuperscript{11} Probably for these latter reasons, Mucha\textsuperscript{7} reported a higher surgical recurrence rate of 8.5\% at 3 years (vs. 4.8\% in our series). However, our results are reinforced by the low final rate (9\%) of patients lost to follow-up. In other studies, the number of patients lost to follow-up was not reported. Our follow-up features a realistic length (6 years 3 months) for a prospective study,\textsuperscript{8–11}even if the potential onset of recurrences has been highlighted in the very long term.\textsuperscript{10} Unlike Fevang et al,\textsuperscript{10} we did not record any third recurrence. That may be related to our strict inclusion criteria eliminating the early postoperative SBO with inflammatory phenomena and so possibly more prone to recurrence.\textsuperscript{15} The shorter length of our follow-up (median, 3.4 years vs. 11 years) also makes a third recurrence less probable.

The present study clearly confirms that operated adhesive postoperative SBO may be classified as a high-risk recurrence procedure.\textsuperscript{5,6} Thus, our overall and surgical recurrence rates (15.9\% and 5.8\%) may also compare with those reported in high risk surgical procedures of adhesive postoperative SBO, like colorectal surgery. Indeed, for this type of surgery, overall adhesive postoperative SBO ranges from 7\% to 26\% at 2 to 10 years.\textsuperscript{21–25}

If not related to chance or to other unstudied factors, the fact that age lower than 40 years appeared in our multivariate

\begin{table}[h]
\centering
\caption{Preoperative Risk Factors of Recurrence After Operated Adhesive Postoperative Small Bowel Obstruction (SBO): Univariate Analysis}
\begin{tabular}{|c|c|c|c|c|c|}
\hline
 & \multicolumn{2}{|c|}{Overall Recurrence} & \multicolumn{2}{|c|}{Surgical Recurrence} \\
 & n & % & HR & 95\% CI & P & HR & 95\% CI & P \\
\hline
Age & & & & & & & & \\
<40 yr & 76 & 26 & 1.91 & (0.78–4.68) & 0.05* & 1.30 & (0.37–4.27) & 0.3 \\
40–59 yr & 85 & 30 & 0.81 & (0.29–2.24) & 0.36 & (0.07–1.97) & 0.05* & 0.58 & (0.11–3.19) & 0.36 & (0.07–1.97) \\
60–75 yr & 55 & 19 & 0.50 & (0.13–1.94) & 0.58 & (0.11–3.19) & 0.36 & (0.07–1.97) \\
>75 yr & 72 & 25 & 1 & 1 & 1 & 1 & \\
\hline
Gender & & & & & & & & \\
Female & 186 & 65 & 0.91 & (0.45–1.86) & 0.7 & 1.34 & (0.42–4.27) & 0.6 \\
Male & 100 & 35 & 1 & 1 & 1 & 1 & \\
\hline
ASA & & & & & & & & \\
I & 137 & 48 & 1.65 & (0.56–4.88) & 0.6 & 2.28 & (0.28–18.99) & 0.2 \\
II & 88 & 31 & 1.62 & (0.52–5.09) & 0.62 & (0.17–2.16) & 0.3 & 4.28 & (0.53–34.80) & 0.2 \\
III, IV & 61 & 21 & 1 & 1 & 1 & 1 & \\
\hline
No. of previous operations & & & & & & & & \\
1 & 113 & 40 & 1.00 & (0.32–3.11) & 0.8 & 0.69 & (0.13–3.74) & 0.3 \\
2 & 109 & 38 & 1.21 & (0.40–3.68) & 0.62 & (0.17–2.16) & 0.3 & 1.42 & (0.30–6.68) & 0.3 \\
3–5 & 64 & 22 & 1 & 1 & 1 & 1 & \\
\hline
Site of previous operation & & & & & & & & \\
Foregut: other organs & 43 & 15 & 1.57 & (0.68–3.67) & 0.3 & 1.05 & (0.32–3.41) & 0.7 \\
Female reproductive tract & 79 & 27 & 0.80 & (0.21–3.09) & 0.47 & (0.05–4.21) & 0.2 \\
Mid and hind gut & 164 & 57 & 1 & 1 & 1 & 1 & \\
\hline
Latest operation for adhesive postoperative SBO & & & & & & & & \\
Yes & 30 & 10 & 2.44 & (1.06–5.63) & <0.04* & 0.63 & (0.08–4.83) & 0.6 \\
No & 256 & 90 & 1 & 1 & 1 & 1 & \\
\hline
Elapsed time from latest operation to adhesive postoperative SBO operation & & & & & & & & \\
<3 mo & 25 & 9 & 0.68 & (0.16–2.86) & 0.6 & 0.73 & (0.10–5.62) & 0.4 \\
3–12 mo & 52 & 18 & 0.70 & (0.27–1.83) & 0.62 & (0.17–2.16) & 0.3 & 0.32 & (0.04–2.45) & 0.2 \\
>12 mo & 209 & 73 & 1 & 1 & 1 & 1 & \\
\hline
\end{tabular}
\end{table}

HR, hazard ratio; CI, confidence interval.
*Significant risk factor.
analysis as an independent risk factor of recurrence raised question. This factor was not found as independent in the sole multivariate analysis of the literature, probably because it was analyzed as a continuous and not a categorized variable as recommended. In other studies, it was merely evoked or not analyzed. Pathophysiologic explanation of the role of young age in the onset of recurrences are rare. There is no study dedicated to the potential specificity of the peritoneal healing in the young adult. Only a quicker peritoneal regeneration in the immature rat has been experimentally described. As well, a higher frequency of adhesive postoperative SBO after abdominal surgery in early life, especially in the neonatal period, was reported. Likewise, the possible role of the decrease of gastrointestinal tract mobility with aging in postoperative adhesion formation, has never been investigated. Besides the high recurrence rates of these

### TABLE 2. Intraoperative or Postoperative Risk Factors of Recurrence After Operated Adhesive Postoperative Small Bowel Obstruction: Univariate Analysis

<table>
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<tr>
<th></th>
<th>Overall Recurrence</th>
<th>Surgical Recurrence</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
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<td>Surgical approach</td>
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<td>Obstructive structures</td>
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</tr>
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*Significant risk factor.
†Not significant but included in the multivariate analysis (P < 0.10).
patients <40 years of age, the postoperative mortality of our patients was zero and the morbidity low (2 complications) in agreement with Fevang et al\textsuperscript{19} who reported a mortality and a morbidity rates close to zero in the 1990–1995 group of patients <60 years old. Our rates of secondary surgical recurrences following surgically and medically treated primary recurrences (3 of 22 vs. 1 of 11) are quite similar. Consequently, in the absence of symptoms of intestinal necrosis, our results may suggest in this group of patients, a more sensible conservative approach of adhesive postoperative SBO as already recommended.\textsuperscript{16} On the other hand, in our operated patients <40 years of age, the high number of recurrent patients (21%), encompassing 57% of patients belonging to the “debatable resection group” may favor more resections.

Adhesions or matted adhesions were already reported as a risk factor of recurrence.\textsuperscript{9,10} The magnitude of the surgical peritoneal trauma, due to the frequently difficult division of this type of obstructive structures, logically produces attendant inflammatory reaction. The resulting decrease of the intraperitoneal fibrinolytic activity\textsuperscript{31–33} may favor adhesion formation and recurrence. In this group, the number of recurring patients (21%) in absence of resection is patent. That may argue in favor of more bowel resections, especially for the patients belonging to the “debatable resection group.” The beneficial effect of intestinal resection might relate to the decrease of the traumatized intestinal serosa area. In this way, it may be hypothesized that adhesive postoperative SBO frequency is linked to the extent of both the parietal peritoneal trauma (incision and site) and the intestinal serosa.

A laparoscopic approach has been proposed to decrease the incisional trauma and to lower the rate of recurrence.\textsuperscript{34–36} The present study included more than one third initial laparoscopic procedures with a conversion rate of 31%, close to the rates of other series (32.2%–40.9%).\textsuperscript{35,36} It resulted in a slightly higher but nonstatistically significant ($P = 0.9$; power 4%) rate of recurrences in the laparoscopic approach. Probably, further several different even smaller incisions and a mandatory identical parietal and visceral adhesiolysis as laparotomy do not decrease the magnitude of the peritoneal trauma. In relation with the low power of the test (4%), statistical evidence would require a substantially larger number of patients.

Postoperative surgical complications as a factor of surgical recurrence was already evoked, albeit not asserted.\textsuperscript{10} This factor may be linked to the previously reported increased number of adhesions resulting from postoperative surgical complications, incisional or intraabdominal, whatever the initial operation.\textsuperscript{37} The distribution of recurrences after the postoperative surgical complications (4 patients recurred after conservative treatment vs. none after resection) may also lead to more resections especially among patients of the “debatable resection group.” This attitude is particularly justified in patients sustaining an “apparent” intestinal reversible ischemia due to bands, complicated in our series by 3 postoperative necroses (2 reoperations) and 1 death.

The number of previous operations does not appear as a risk factor of recurrence in contrast with the results of other univariate and multivariate analyses.\textsuperscript{9,10} This difference may be due to the higher rate of previous operations in our patients (22% sustained 3 or more previous operations compared with 6% and 11%, respectively, in the Fevang et al\textsuperscript{10,19} and Miller et al\textsuperscript{19} series), possibly weakening their results. Furthermore, our results do not highlight any specific category of previous operations entailing a higher rate of recurrence. This is consistent with the global findings of Fevang et al\textsuperscript{10} who used a slightly different classification. However, our study did not confirm their reported higher rate of recurrences after appendectomies when compared with gynecologic operations. That may be due to our already mentioned stringent...
eligibility and noneligibility criteria, warranting a strict adhesive etiology.\textsuperscript{13–15}

CONCLUSION

Today, operated adhesive postoperative SBO proves to be a clinical entity with high incidence and specific risk factors of recurrence: age <40 years, presence of adhesion or matted adhesion, and postoperative surgical complications. These results render patients undergoing operated adhesive postoperative SBO candidates for the preventive use of anti-adhesion agents,\textsuperscript{1,3,4,38} particularly when a risk factor of recurrence is present.

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References