Ventral Hernia and Other Complications of 1,000 Midline Incisions

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ABSTRACT: We report the outcome in 1,079 consecutive clean or clean-contaminated midline abdominal incisions closed with running 0-loop nylon suture after both elective and emergency operations done between 1984 and 1991. Postoperatively, 79 patients were lost to follow-up, resulting in 1,000 having long-term follow-up. Mean follow-up among these patients was 22 months. Early wound complications included subcutaneous wound infection (18), deep wound infection (17), dehiscence (13), fistula (2), and suture sinus (2). A ventral hernia developed in 42 (4.2%) cases during follow-up. By chi-square analysis, wound infection, dehiscence, class of clean-contaminated wound, patient age >65, or previous midline abdominal incision were not identified as risk factors for development of a ventral hernia. Reuse of a previous midline incision in combination with any wound infection was associated with an increased risk of subsequent ventral hernia (stepwise regression). In our experience, running closure of a vertical midline abdominal wound has not been associated with an excessive incidence of wound complications or of ventral hernia.

THE CHOICE of incision, fascial suture, and suture technique in the performance of a laparotomy remains an area of debate. The issues of this debate include the ease of opening and closing the wound, operative exposure, patient comfort, and the development of wound-related complications such as dehiscence and ventral (incisional) hernia. As is the case with other contested topics, the ability to approximate the truth regarding the ideal laparotomy technique seems to be inversely proportional to the number of publications that address the question. Existing studies on laparotomy methods differ in design, technique(s), follow-up, and conclusions. Interstudy comparison is difficult. As a result, few rules regarding laparotomy technique have developed, the majority of conclusions being guidelines and opinions.

The purpose of the present study is to share our experience with our laparotomy technique of choice, a vertical midline incision with running 0-loop nylon running closure of the fascia. In addition, we examine the incidence of and risk factors for ventral hernia occurring with this technique. The use of this laparotomy technique results in an acceptable rate of ventral hernia and other wound-related complications.

PATIENTS AND METHODS

The participating institutions were Milwaukee County Medical Complex, a county hospital that includes a level I trauma center, the Zablocki Veterans Administration Medical Center, and Froedtert Memorial Lutheran Hospital, a closed-staff referral hospital related to the Medical College of Wisconsin, all in Milwaukee. We reviewed the charts of all patients receiving a vertical midline abdominal incision, for both elective and emergency procedures, between May 1984 and July 1991 and in either the clean or clean-contaminated wound class.

A vertical midline incision (through the linea alba) is used almost exclusively at our institution for laparotomy. For a clean-contaminated case, an intravenous prophylactic antibiotic (usually a cephalosporin) is given within 30 minutes of the skin incision. For an elective colon procedure, gut lavage with oral polyethylene glycol is followed by oral antibiotic administration a day before the operation. When used, a drain or enterostomy exits the abdomen via an incision separate from the vertical midline incision. Topical antiseptics are not used in the wound after fascial closure. Mass closure is done with running 0-loop nylon, incorporating both layers of the rectus sheath. No separate peritoneal closure is used. Skin closure technique is variable.

Data on patient age, date and type of operation(s), wound class, fascial suture material
and technique, date of last follow-up (eg, clinical visit or inpatient admission), and any complication related to the wound were entered into a DBase IV program. From this database, all patients whose incision was closed with running 0-loop nylon were identified, and analysis was done on this group. An attempt was made to contact by telephone those patients who did not have follow-up in the medical record. Patients who died, who had reoperation, or who were lost to follow-up within 2 weeks were not included in the analysis. The short minimum follow-up was selected so that no patient having dehiscence would be excluded.

The guideline for recording a given wound complication in the database was a physician’s description in the medical record of the particular complication. For example, if on a postoperative physical examination an “incisional bulge” was described, then the complication of ventral hernia was recorded in the database. Operative or other intervention was not necessary for wound complications to be recorded.

The incidence of various wound characteristics and complications was calculated. Superficial wound infection, deep wound infection, grouped infection (superficial and deep), dehiscence, previous midline incision, age > 65, and clean-contaminated wound class were each postulated as potential risk factors for the development of ventral hernia.

Association of a potential risk factor with the development of a ventral hernia was determined with the chi-square test. Stepwise regression also was used to determine the interaction of potential risk factors in the development of ventral hernia.

RESULTS

At the participating institutions during May 1984 to July 1991, 1,477 laparotomies were done with a variety of incisions, sutures, and suture techniques. Of these laparotomies, 1,079 were done through a vertical midline incision closed with single layer running 0-loop nylon. Within 2 weeks of the procedure, 79 patients were lost to follow-up (because of patient death in 41 incidences). No wound complications had been recorded in the 79 patients excluded or lost to follow-up. The remaining 1,000 incisions were used for analysis. The length of follow-up ranged from 2 weeks to 6 years and averaged 22 months. The average patient age was 51 years. In 819 procedures (82%) the incision was used once, and in 181 procedures (18%) the incision was used again for a remote second or third operation. There were 555 (56%) clean and 445 (44%) clean-contaminated operations.

There were 120 wound-related complications in 113 patients. Ventral hernia developed in 42 cases (4.2%): of these, 25 (59%), 33 (78%), and 38 (90%) hernias were apparent by 1, 2, and 3 years, respectively. We have no data regarding the precise role of suture breakage or sawing through tissue in the etiology of these hernias. Other wound complications were superficial wound infection, defined as an infection involving skin and subcutaneous tissue, 18 (1.8%); deep wound infection, defined as involving the fascia but exclusive of the abdominal abscess, 17 (1.7%); dehiscence, 13 (1.3%); enterocutaneous fistula, 2 (0.2%); and suture sinus, 2 (0.2%).

Individually, none of the potential risk factors—age > 65, clean-contaminated wound class, previous midline incision, dehiscence, superficial infection, deep infection, or grouped infection (superficial or deep)—was associated with the development of ventral hernia (chi-square analysis, Table).

<p>| TABLE. Significance (Chi-Square) of Potential Risk Factors for Ventral Hernia |
|----|-------------------------------------------------|-------------------------------------------------|--------------------------|</p>
<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Proportion Having Hernia With Risk Factor Present</th>
<th>Proportion Having Hernia With Risk Factor Absent</th>
<th>Probability (X²) That Risk Factor is Significant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subcutaneous infection</td>
<td>2/18</td>
<td>40/98</td>
<td>&gt;.25 (NS)</td>
</tr>
<tr>
<td>Deep infection</td>
<td>1/17</td>
<td>41/985</td>
<td>&gt;.25 (NS)</td>
</tr>
<tr>
<td>Grouped infection (subcutaneous and deep)</td>
<td>3/35</td>
<td>39/965</td>
<td>&gt;.25 (NS)</td>
</tr>
<tr>
<td>Dehiscence</td>
<td>1/13</td>
<td>41/987</td>
<td>&gt;.5 (NS)</td>
</tr>
<tr>
<td>Clean-contaminated wound</td>
<td>21/445</td>
<td>21/545</td>
<td>&gt;.5 (NS)</td>
</tr>
<tr>
<td>Age &gt; 65</td>
<td>11/240</td>
<td>31/760</td>
<td>&gt;.5 (NS)</td>
</tr>
<tr>
<td>Previous midline incision</td>
<td>4/181</td>
<td>38/819</td>
<td>&gt;.1 (NS)</td>
</tr>
</tbody>
</table>

NS = not significant.
When the interaction of multiple pairs of potential risk factors was analyzed by stepwise regression, it was found that the combination of use of a previous midline incision and either a superficial or a deep wound infection was associated with development of a ventral hernia. No other combination of risk factors was significantly associated with hernia. Analysis of the possible interaction of three or more risk factors was not possible because of the small number of ventral hernias.

The relative risk (calculated from the stepwise regression) for ventral hernia in a procedure that reopened a previous midline incision and was followed by either a superficial or deep wound infection, compared with a procedure with no risk factor, is 10.2. The relative risk for ventral hernia of a procedure involving both a previous midline incision and either a superficial or deep wound infection, compared with a procedure involving a previous midline incision as the only risk factor, is 43.2. Infection is, therefore, the key risk factor.

DISCUSSION

Previously elucidated risk factors for ventral hernia include wound infection,7 dehiscence,8 male sex,9 abdominal distention,10 chest infection,11 advanced age12 obesity,91 emergency procedure,11 early reoperation,11 jaundice12 and underlying disease.11 We did not analyze the putative risk factors of male sex, emergency procedure, or comorbid disease.

In our review of 11 studies covering a total of 4,129 midline incisions (with variable closure technique), an overall ventral hernia rate of 10.5% was obtained.4,13,15,16 A similar review will yield a ventral hernia rate of 7.5% for transverse incisions (out of 467 procedures)4,11,18 and 2.5% for paramedian incisions (out of 2,052).2,3,13,14,24,25 It must be emphasized that these rates are obtained by grouping disparate studies. However, the trend in the literature appears to be that midline incisions have a higher hernia rate and paramedian incisions have a lower hernia rate. Some authors have reported that a paramedian wound closed in 2 layers and incorporating the rectus muscle yields an incisional hernia rate lower than that reported for midline wounds.19,15,20,22 Other investigators have found a similar incidence of hernia from either midline or paramedian incisions.2,3,11,12 The use of a transverse incision may result in an equivalent14,13,15 or lower2 incidence of hernia as compared with a midline wound. Subcostal wounds also may be less prone to ventral hernia than midline wounds.2,11 Our ventral hernia rate (4.2%) compares favorably with the mean rates (combined study) reported in the literature for transverse and paramedian incisions.

The choice of nonabsorbable or absorbable suture material in closure of abdominal wounds continues to be of some controversy. Use of nonabsorbable suture has been shown by some authors to result in a lower incidence of ventral hernia than use of absorbable suture3,10,13,24,25. Other investigators have shown no difference.5,7,11,16,18,21,23,25. Closure with nonabsorbable suture has been suggested to predispose to “late” (>1 year after operation) ventral hernia formation,7,24 attributed to the gradual sawing of the suture through the fascia, resulting in a “buttonhole” hernia off the midline.24,25 Closure with nylon has been associated with suture sinus formation in up to 9% of cases.10,13 Polyglactin or polyglycolic acid suture has been recommended to avoid these complications,5,17 though suture sinuses also have been observed with absorbable suture closure.19 Interestingly, we had only two (0.2%) documented suture sinuses.

In comparing interrupted versus continuous closure techniques, neither is reported to be consistently superior.6,15,20,25 Mass closure with continuous suture is the more rapid technique8,14,24,25,35 and results in a lower incidence of burst abdomen as compared with layered closure.5 It is likely that the type of wound and its closure really has little to do with determining the propensity for ventral hernia, and mass closure techniques are gaining more acceptance.3,14,24

The design of our study does not permit an absolute statement regarding laparotomy closure technique. Because of our reliance on the description of wound complications recorded in the medical record, it is possible that an asymptomatic, small, or late-appearing ventral hernia could have been missed. Regarding the evaluation of risk factors for ventral hernia, there are predisposing conditions that we did not evaluate but that could have played a role. We did not perform a prospective comparison with other laparotomy techniques. Although a few other incisions, fascial suture types, and suture techniques were used at the participating hospitals during the study period, their numbers were not large enough to provide a meaningful comparison with midline running 0-loop nylon closure.
Within the limits of our data, however, it may be asserted that a vertical midline abdominal incision closed with running 0-loop nylon yields an acceptably low rate of ventral hernia (4.2%) and of other wound complications. Of the risk factors examined, only wound infection in combination with reuse of a previous midline incision was associated with a risk of postoperative ventral hernia.

Controversy over laparotomy technique will continue and will not be resolved with this report. Our aim has been to offer a perspective on a method of abdominal closure that for us has produced satisfactory results. Using 0-loop nylon for running fascial closure of a vertical midline abdominal incision has not been associated in our experience with an excessive incidence of wound complications or of ventral hernia. We use and recommend this incision and closure technique for all abdominal operations.

References

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