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INCISIONAL HERNIA FOLLOWING LAPAROSCOPY: A SURVEY OF THE AMERICAN  
ASSOCIATION OF GYNECOLOGIC LAPAROSCOPISTS

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Objective: To estimate the risk factors for and incidence of post-laparoscopy incisional hernia.

Methods: A questionnaire was sent to all individuals on a mailing list from the American Association of Gynecologic Laparoscopists. Adequately completed responses were entered into a computer-based data bank for analysis. Of the 11,500 surveys mailed, 3293 were returned; of these, 3217 were evaluable.

Results: A total of 933 hernias was reported from an estimated 4,385,000 laparoscopic procedures (an incidence of 21 per 100,000); 167 (17.9%) were reported to have occurred despite fascial closure. Six hundred sixty-five patients (71.3%) had subsequent surgical repair. Seven hundred twenty-five (86.3%) of the 840 hernias in which the size of the original fascial defect was noted, occurred in sites where ports 10 mm in diameter or larger had been placed. The occurrence of hernias is a function of the number of laparoscopies performed ( $P < .0001$ ) and is not related to the length of the surgeon's career ( $P = .41$ ). In at least 157 instances (16.8%), the presenting symptom or morbidity of the hernia was directly related to the involvement of the large or small intestine.

Conclusion: Post-laparoscopy incisional hernias occur at an approximate incidence of 21 per 100,000 and are associated with significant morbidity. These hernias are most likely to occur when large ports are used. As currently practiced, closure is not completely protective. Further methods or devices should be developed to minimize the risk of hernia formation. (Obstet Gynecol 1994;84:881-4)

Over the last decade, the laparoscopic approach has been used in the treatment of an increasing number of disease processes that have been managed traditionally by large cutaneous and fascial incisions. The principal advantages of such a minimally invasive technique for major intra-abdominal procedures are a shortened postoperative recovery and decreased societal costs.<1-3> Included among other proposed advantages is a lower rate of wound-related complications, such as infection, serious and prolonged pain, hernia, wound disruption, and adherence of intraperitoneal structures to the incision site.<4> Though reported cases of post-laparoscopy incisional hernias are few and their occurrence is thought to be rare, a large-scale study providing information regarding incidence rates has not been reported. Therefore, we surveyed the persons named on the mailing list of the American Association of Gynecologic Laparoscopists and gathered data on the incidence of post-laparoscopy incisional hernias as it relates to selected variables.

## Materials and Methods

We obtained a mailing list from the American Association of Gynecologic Laparoscopists that contained the names of approximately 6000 members and 5500 non-members who had attended meetings sponsored by the organization. A simple, one-page survey, developed with the assistance of the Department of Biostatistics at the University of California, Los Angeles, Center for Health Sciences, was sent to each person listed, along with a pre-addressed return envelope that did not include return mail postage. Respondents were not asked to identify themselves, their locale, or their type of practice. The questionnaire inquired about the respondent's experience (the average number of laparoscopies performed per year and the length of career), the number of attempts at closing the fascial defect, the total number of hernias at laparoscopic incision sites encountered in the entire career, the size of the original fascial defect in cases of hernias, the occurrence of hernias despite the fascial closure, patients' symptoms, and hernia management.

Of the 11,500 mailed surveys, 234 were returned as undeliverable because the addressee had moved and not left a valid forwarding address. Of the remaining 3293 returned surveys, 3217 (approximately 28% of the total mailed) were evaluable. These responses were entered into a computer-based data bank for analysis. To be included in the statistical review, a response had to provide the length of the respondent's career, his or her annual average number of laparoscopic procedures performed, and the total number of laparoscopic incisional hernias that had been encountered.

After categorizing respondents according to length of career and the annual number of laparoscopies performed, a  $\chi^2$  test for trend was used to evaluate the association between a surgeon's experience and the occurrence of hernias. The relation between hernia occurrence and port size was analyzed using a  $\chi^2$  test after approximating the proportion of ports 10 mm in diameter or larger, based on the following assumptions of frequency of laparoscopic procedures: Before 1980, there was a predominance of diagnostic laparoscopies using a 10-mm umbilical port and two 5-mm ports elsewhere; between 1980-1990, half of all laparoscopies performed were diagnostic (port sizes the same as mentioned earlier), and half were operative with at least two 10-12-mm ports and two 5-mm ports. After 1990, 30% of laparoscopies were diagnostic and 70% were operative, with port sizes and numbers as described above. For statistical purposes only, we assumed that there was no change in the frequency of laparoscopies performed over the years surveyed. Therefore, after adding together the total number of years our respondents have practiced, we estimated that 6,167,662 ports 10 mm in diameter or larger and 8,770,047 ports smaller than 10 mm were inserted. Therefore, 41.3% of all ports used were assumed to be at least 10 mm.

## Results

The total number of procedures for each of the 3217 respondents was estimated by multiplying career length by the average number of laparoscopies performed per year. A total of 933 hernias was

reported in an estimated 4,385,000 laparoscopic procedures. Based on these numbers, we estimated the incidence of incisional hernias after laparoscopic surgery at 21 per 100,000 cases. One hundred sixty-seven hernias (17.9% of all reported hernias) occurred despite attempted fascial closure of the port site at the antecedent laparoscopy. Six hundred sixty-five patients (71.3%) underwent subsequent surgical repair of their hernias.

The association of experience (length of career and number of laparoscopies per year) and hernia occurrence was analyzed using the proportion of surgeons who had observed at least one hernia during their career (Table 1). The percentage of surgeons who reported hernias during their careers correlated significantly with the number of laparoscopies performed per year ( $P < .0001$ ). Of the surgeons who performed 20 or fewer laparoscopies per year, 7% reported observing one or more hernias in their career, whereas 27% of the surgeons who performed more than 100 laparoscopic procedures per year saw at least one hernia in their career. This trend occurred regardless of the length of the surgeon's career ( $P = .41$ ).

Of the 840 hernias in which the port size was noted, 725 (86.3%) occurred in sites where the diameter was at least 10 mm in diameter. Of these, 345 were associated with ports 12 mm or larger and 380 with ports 10-12 mm in diameter. Only 92 hernias (10.9%) occurred at the site of insertion of ports at least 8 mm in diameter but less than 10 mm, with 23 (2.7%) occurring in sites where ports less than 8 mm had been placed. The relation between hernia occurrence and port size was analyzed after we estimated that 41.3% used ports 10 mm in diameter or larger. We observed that 86.3% of all hernias (or twice as many as expected if there was no relation between port size and hernia occurrence) used ports 10 mm or larger ( $P < .0001$ ). Although the survey did not ask for the hernia site, respondents reported the location in 152 cases, and the umbilical locale was the most common (75.7%). Lateral hernias were found in 23.7% of the cases, and the suprapubic site was involved in one case.

Hernia-related morbidity occurred in 648 patients (69.5% of reported hernias). In 230 cases (24.7%), the hernia was clinically evident, but without associated symptoms or complications. The responding physician did not report the presence or absence of hernia-related symptoms in 55 instances (5.9%). A wide range of hernia-related complications was reported. The most common was a palpable hernia or fascia defect in 204 patients. In at least 157 women (16.8% of all hernias), the presenting symptom or morbidity was related directly to the involvement of the large or small intestine, bowel incarceration, strangulation, obstruction, or intrusion in the subfascial extraperitoneal space. Other symptoms were protruding or incarcerated omentum or peritoneum, pain, and nausea.

A segment of the survey asked if and when an attempt was made to close the fascial defect created by a port. There was a wide range of responses. Almost a third of the reporting surgeons (31.3%) never attempted to close the fascial defect after laparoscopy, 36.6% closed only defects 12 mm or larger, and 18.6% closed all defects 10 mm or larger. In 121 cases (3.8%), the surgeon reported specific criteria for closure, based on a combination of port size, placement site, and patient body

habitus, or another similar formula.

## Discussion

Over the 8 decades since Jacobaeus first reported peritoneoscopy,<5> operative laparoscopy has risen to a position of great importance for both the gynecologic and general surgeon. Though laparoscopy was predominately used as a diagnostic tool or to perform interval tubal sterilizations until the mid-1980s, since that time, an increasing array and number of extensive surgical procedures have been performed using laparoscopic techniques. In 1993 alone, an estimated 1,619,560 laparoscopic procedures were performed in the United States (Ethicon Endosurgery marketing research, Cincinnati, OH). Thorough reviews have been written concerning laparoscopy-associated morbidity.<6,7> However, information regarding hernias at the site of port insertion is limited and usually presented as case reports.<8-12>

Our review is limited by the nature of the retrospective questionnaire and gives results that are, at best, general estimates. In addition to recall bias, there may have been an over- or under-reporting of hernia occurrence, depending on the respondents' definition of herniation. Unfortunately, it is impossible for us to determine if the so-called protusions of bowel or omentum through the incision ( n = 89) were true dehiscences or hernias (ie, covered with skin and peritoneum). It is also possible that calculating the total number of laparoscopic procedures as we did (surgeon's career length multiplied by the number of laparoscopic procedures performed per year) overestimated the number of procedures performed and therefore underestimated the actual hernia incidence. In addition, our study did not differentiate between diagnostic laparoscopy and extensive operative laparoscopy, and the incidence of hernias may be very different at these two ends of the spectrum. Despite these limitations, this study presents valuable findings on the practice patterns and opinions of the surgeons who took the time and expense to answer our questionnaire.

In an attempt to place our incidence statistics in perspective, we reviewed the literature pertinent to incisional hernias. After large anterior abdominal wall incisions, the incidence of incisional hernia is reported to be between 2.9-7.4%.<13-16> Hernia rates seem to differ between subgroups of patients; they are more common if there has been a prior incision or in patients with chronic disease processes, such as cancer. The incidence also appears to be dependent on suture type and closure technique.<13-16> A more valuable comparison for a study like ours would be data regarding incisional dehiscence and hernia at "mini-lap" sites, as these defects are similar in size to those that are made at laparoscopy and present many of the same technical problems related to closure. Unfortunately, the largest published comparative studies of mini-laparotomy and laparoscopy failed to provide information on hernia occurrence.<17-19>

In the largest series on hernias after laparoscopy published to date, Kadar et al<10> report six hernias in 5560 operative laparoscopies. All hernias occurred at extraumbilical locations

when ports 10 mm or larger were used. We also noted that hernias were most commonly reported to occur with large port sizes (those 10 mm or larger giving rise to 86.3% of hernias), though no defect size was immune from the risk of hernia occurrence. Almost 18% of the hernias in our study occurred despite closure of the fascial defect. Kadar et al<sup>10</sup> also reported that attempts at closing the fascia did not assure hernia prevention. They noted that in three of five hernias involving 12-mm trocars, the surgeon had reported fascial closure. The failure of this closure to prevent hernia formation is most likely the product of a number of factors: suboptimal fascial purchases with the needle, a total failure to incorporate the fascia, an inadequate number of sutures for the expanded length of the fascial incision, and, as proposed by Kadar et al,<sup>10</sup> a failure to close the subfascial extraperitoneal dead space that is created by aggressive manipulation of the operative ports.

Unfortunately, not only is fascial closure often inadequate, it can be detrimental to the patient, as demonstrated by the reports of three of the survey respondents. One surgeon entrapped the right ilioinguinal nerve at the time of incision closure, which resulted in the classic symptoms and required operative revision. Two other surgeons reported that they had incorporated intestine into the fascial closure when completing the closure in a "blind" fashion.

Many surgical instrument companies either offer or are developing special devices that are intended to facilitate appropriate en bloc closure of abdominal wall defects induced by placement of laparoscopic ports. Until the merit of these devices is proven, we would encourage that endoscopic surgeons make a concerted effort, using traditional surgical techniques, to close the fascia and subfascial dead space when a port 8 mm or larger has been placed.

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