FACTORS INFLUENCING FREQUENCY OF CONVERSION DURING LAPAROSCOPIC CHOLECYSTECTOMY

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The aim of the study was to evaluate factors influencing the frequency of conversion during laparoscopic cholecystectomy; to observe dynamic trends concerning frequency of classic versus laparoscopic cholecystectomies; and to evaluate correlations between the experience of a surgeon and conversion incidence.

Material and methods. A retrospective study was performed, reviewing the records of 3337 patients operated on for gallbladder stones from January 2000 to December 2005 in three hospitals in the Pomeranian Region of Poland: Department of General, Endocrine and Transplant Surgery, Medical University of Gdańsk; Department of Surgery, 110th Military Hospital in Elbląg and Department of Surgery, Hospital in Słupsk.

The main issues evaluated were: dynamic changes in frequency of laparoscopic versus classic cholecystectomies; frequency of conversions, reasons for conversion; correlation between experience of a surgeon and conversion incidence; and demographic data.

Results. Out of 3337 patients, there were 2390 (71.62%) females and 947 (28.3%) males. For these patients, 1493 procedures (45.2%) were performed as classical, 1804 (54.06%) as laparoscopic, and 176 (9.7%) as converted from laparoscopy to open procedure. Sex distribution in the laparoscopic group was 1352:452 (F:M 74.9%:25.05%) and in the converted group was 107:69 (60.8%:39.2%).

The main problems relating to conversion during laparoscopic cholecystectomy were: adhesions – 108 (61.36%), gall-bladder perforations – 8 (4.5%), tumors – 10 (5.6%), technical problems – 28 (15.9%), hemostasis problems – 11 (6.25%), unrecognizable anatomical structures – 24 (13.6%), complications of ‘e fundo’ cholecystectomy – 24 (13.6%) and equipment problems – 4 (2.27%).

It was also observed that SHO’s and surgeons with greater experience are performing more conversions during laparoscopic procedures.

Conclusions. Laparoscopic cholecystectomy is a safe procedure recommended as a gold standard for gallbladder stone treatment. Frequency of this procedure is rising in centers in the Pomeranian region. The highest incidence of conversions is associated with adhesions after previous open operations. Consultants perform earlier conversion due to greater experience and better estimation of risk factors.

Key words: laparoscopic cholecystectomy, conversion, experience, adhesions

The first laparoscopic cholecystectomy performed in 1985 by Erich Mühe became a milestone in the progress of contemporary surgery, in the face of strong initial controversy (1). Despite opposition during its infancy, today it is obvious that the laparoscopic approach has ga-
ined the status of “gold standard” in a significant number of surgical procedures (2-6). Concerning uncomplicated cholelithiasis, laparoscopic cholecystectomy (LC) is the procedure of choice even in patients with serious concomitant diseases, such as circulatory insufficiency, ischemic heart disease or morbid obesity (7). Predominantly in the latest group of patients, special attention should be drawn to the importance of avoiding the open approach due to possible surgical complications, including wound suppuration, which can lead to prolonged hospitalization and sometimes difficult treatment for incisional hernias (8). These facts bring significant importance to the ability of preoperative determination of the risk of conversion to the open approach. It should be underlined that the conversion should not be perceived as the mistake or a complication, but on the contrary, as a reasonable decision in the context of the conditions or situations found during the laparoscopy (9). Such a decision should be made with full confidence, and any prolongation of the conversion in the lack of progress of the surgery should never take place.

Nevertheless, it should be kept in mind that the decision of conversion might have some other, extra surgical consequences. As presented by Kaska et al., patients converted from videoscopic to open adrenalectomy reported higher pain in the postoperative period and significantly longer convalescence, compared not only to the videoscopic group, but also to those patients treated with open adrenalectomy as the treatment of choice (10).

The aim of this study was to retrospectively analyze the reasons for the conversion from laparoscopic to open cholecystectomy involving factors characterizing both the patients and the operating surgeons. It also involved the overall view on the dynamics of changes in the frequency of use of laparoscopic cholecystectomy in selected surgical departments of Pomerania between 2000 and 2005.

MATERIAL AND METHODS

A retrospective study covered three Pomeranian Region surgical departments: Department of General, Endocrine and Transplant Surgery, Medical University in Gdańsk; Department of Surgery, 110th Military Hospital in Elblag and Department of Surgery, Hospital in Słupsk. During the period from January 2000 until December 2005, 3337 patients were operated on for cholelithiasis. Of these, 1804 patients were operated on by laparoscopic method and 1493 with the open approach. Demographic data is presented by tab. 1. There were no significant differences between either examined group in reference to these data.

In order to analyze the influence of the experience of the surgeon on the conversion rate, the surgeons were classified according to two separate criteria. The first criterion was the current position of the surgeon in his/her training. Thus, the operators were classified as: SHOs (n=7), Registrars (n=17), and Consultants (n=34). The second criterion was their experience in laparoscopic cholecystectomy. This division produced two groups: less than 50 (n=36), and 50 or more (n=22). These criteria have been adapted according to Del Rio et al. (9) and the curriculum of surgical training by the General Council For Medical Training in Poland (Centrum Medycznego Kształcenia Podyplomowego) (11).

All laparoscopic cholecystectomies were performed under general anesthesia. Pneumoperitoneum was achieved with Veress needle or by minilaparotomy. Intrabdominal CO₂ pressure was 10-12 mm Hg. LC was performed with a 3 or 4 trocar approach. The gallbladder was extracted through the sub umbilical or midline epigastric access. If drainage was needed, a Redon’s drain was placed. All preparations were sent for histopathological examination.

Statistical analysis was performed with the STATISTICA 7.1 PL software licensed to the

| Table 1. Demographic data for patients according to operating access |
|----------------------|------------------|------------------|---------------|
|                      | CC               | LC               | p             |
| Age (median and range) | 57,11 ± 14,75    | 52,54 ± 14,8     | < 0,0001      |
|                      | (14 – 94)        | (14 – 92)        | test t-Studenta |
| Sex index M:F        | 2,18 : 1         | 3,07 : 1         | < 0,001       |
|                      | test chi²         |                   |               |
Medical University of Gdańsk, Poland. The analysis involved the chi² and U Manna-Whitney tests for non-parametric data, the Student’s t test and ANOVA for parametric data, and logistic regression for multivariable evaluation. In order to dichotomize some predictive parametric variables, a k-means cluster analysis was performed. p values less than 0.05 were considered statistically significant. The results, depending on their character, have been described by means, standard deviations, median values, range, rate or odds ratio with a 95% confidence interval.

RESULTS

Analysis of the dynamics regarding the extent of using laparoscopic cholecystectomy from 2000 to 2005 in the selected surgical departments of Pomerania are presented in fig. 1. There were only 37.79% LCs in 2000, while in 2005 this figure reached 72.41%.

Out of the entire number of 1804 LCs, 176 were converted to the open approach (9.6%). Tab. 2 presents demographic data of the converted patients compared to the ones in whom the operation was completed laparoscopically.

The main reasons for conversion were as follows: 1 – adhesions (108 cases – 61.36%); 2 – technical problems – for instance, a cystic duct that was impossible to clip (28 cases – 15.9%); 3 – anatomical structures impossible to determine (24 cases – 13.6%); 4 – bleeding (11 cases – 6.25%); 5 – tumors (10 cases – 5.6%); 6 – perforation of gallbladder (8 cases – 4.5%); 7 – equipment problems (4 cases – 2.27%).

In order to dichotomize the age of the patients (needed for further logistic regression analysis), cluster analysis was performed. It determined two separate groups: under 59 years of age (n=1079) and 59 or older (n=538).

The results of univariate analysis are presented in fig. 2 through 5. A significantly hi-
Factors influencing frequency of conversion during laparoscopic cholecystectomy

Fig. 4. Work experience versus conversion rate

Fig. 5. Laparoscopic experience versus conversion rate

Table 2. Demographic data for patients operated on by laparoscopic method versus converted

<table>
<thead>
<tr>
<th></th>
<th>LC</th>
<th>Conversion</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>52.08 ± 14.7</td>
<td>56.59 ± 15.6</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Sex index F:M</td>
<td>3.35 : 1</td>
<td>1.55 : 1</td>
<td>&lt; 0.0001</td>
</tr>
</tbody>
</table>

A higher conversion rate was observed in male patients older than 59 and for registrars as operators.

Logistic regression involved four input variables: age of the patients dichotomized at the level of 59 years, sex of the patients, laparoscopic experience of the operator and training status of the operator. The fourth variable did not reach statistical significance. The results of the analysis are presented in fig. 6.

The strongest impact was observed for the sex of the patients – OR = 2.19 (1.4 – 3.1), indicating the male sex as a predictor of conversion. Interestingly, greater experience in laparoscopy positively influenced the conversion rate – OR = 1.82 (1.1 – 2.5). Finally, the age of the patients above 59 was co-associated with a higher risk for conversion – OR = 1.56 (0.9 – 2.2). The training status in general surgery turned out to be non-influential on the conversion rate.

DISCUSSION

The presented analysis of 3337 cases of cholecystectomies performed in three surgical departments of Pomerania between 2000 and 2005 demonstrated significant progress in laparoscopy in this region of Poland. The relatively high conversion rate (9.6%) observed in the study might be associated with the strong emphasis addressed in teaching young surgeons in those departments.

The conversion rate reported in the literature ranges from 4.8% to as much as 32.5% (tab. 3). The quality of good practice in Great...
Table 3. Epidemiological data showing the most common causes of conversion in other studies

<table>
<thead>
<tr>
<th>Author</th>
<th>Country</th>
<th>Years of research</th>
<th>Number of LC</th>
<th>Number of conversion</th>
<th>% of conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simopoulos i wsp.</td>
<td>Greece</td>
<td>1992-2004</td>
<td>1804</td>
<td>94</td>
<td>5.2</td>
</tr>
<tr>
<td>Kama i wsp.</td>
<td>Turkey</td>
<td>1992-1999</td>
<td>1000</td>
<td>48</td>
<td>4.8</td>
</tr>
<tr>
<td>Tayeb i wsp.</td>
<td>Pakistan</td>
<td>1997-2001</td>
<td>1249</td>
<td>94</td>
<td>7.5</td>
</tr>
<tr>
<td>Del Rio i wsp.</td>
<td>Italy</td>
<td>2001-2003</td>
<td>176</td>
<td>57</td>
<td>32.5</td>
</tr>
</tbody>
</table>

Britain demands a conversion rate lower than 5% for elective laparoscopic cholecystectomies and lower than 10% for emergency LCs (16). At the time that LC was announced as the “gold standard” for gall-badder stone treatment, the number of papers considering the percentage of laparoscopic cholecystectomy versus open cholecystectomy was scarce. Our results revealed that the number of LCs was 32.8% in 2000 and gradually increased to 72.5% in 2005. Still, this number is far lower than the percentage observed in western countries. By 1992, over 80% of the 600 000 cholecystectomies performed in the United States were carried out laparoscopically (17). In the Australian state of New South Wales, the number of elective cholecystectomies in 2005 reached 22,198. Out of this number, 98.72% were performed laparoscopically and only 1.28% were performed by open method (18). Moreover, the recent accent in LC is stressed when performing operations as day-case surgeries (without a night spent at the hospital) or as 23-hour procedures. In the UK, 75% of elective LCs are performed as day-case procedures and 90% as 23-hour ones (16). In Poland, elective LC is still considered to demand 48-72 hours of hospitalization.

In our studies, intraabdominal adhesions were the most frequent cause for conversion – 64.7%. Technical problems and anatomic structures making reliable identification impossible accounted for 37.1% and 22.8%, respectively. Similarly, Tayeb et al. reported that adhesions (56.2%) and technical problems (19.2%) were the reasons for conversion in their studies (15). In the Brodsky et al. study, technical problems represented 61% of conversions and 25% of anatomic identification problems (14).

The significant difference in the frequency of conversions in male patients might be associated with a longer period of disease and a higher number of attacks treated conservatively before the surgery was considered (19, 20). Therefore, the intensity and frequency of omental adhesions with the gall-bladder and more difficult anatomical identification might convince the operating surgeon to perform conversion. Similar explanations may be attributed to the greater age of the patients as a factor contributing to higher conversion rates.

Multivariable analysis also underlined the importance of those two variables as co-factors of increased conversion rate. The third predictor was curiously identified as the larger experience of the operator in laparoscopy. This inadequate finding might be interpreted in the context of better ability to recognize that the intraabdominal situation will not be able to be resolved laparoscopically. This leads to a quicker decision about conversion by a more experienced laparoscopist. Such an attitude prevents early reoperations and serious postoperative complications. On the other hand, univariate analysis suggests a higher conversion rate for intermediate experienced surgeons (Registrars). This result can be omitted in the context of multivariable analysis, as the latter one is the only approved form of data-based conclusions in such a complicated clinical environment (21, 22).

Interestingly, logistic regression did not reveal the influence of the current form of surgical training on the conversion rate. This finding might serve as an input for discussion on the changes that could be undertaken concerning didactics of videoscopic training.

**CONCLUSIONS**

1. In summary, this study emphasizes the dynamic progress of laparoscopic gallbladder surgery in Pomerania.

2. Based on these studies, it might be concluded that male patients over 59 undergo conversion most frequently. Having the LC performed by an experienced laparoscopist provides an opportunity to make a decision on conversion with adequate timing.
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COMMENTARY

Several years ago, when the number of laparoscopic cholecystectomies in particular centers constituted a race with time and ranking position, one center presented zero conversions. The authors tried to convince others that every cholecystectomy can be performed by means of laparoscopy. The presented views did not answer questions concerning the condition of the patients before the operation. There are many factors influencing conversion from laparoscopic to classical surgery. The first one is the qualification of patients for surgery. The following question arises: were all of the patients that were admitted to the center qualified for laparoscopic cholecystectomy? If not, then there was a selection before the operation. Additionally, there is no clear-cut opinion on the matter in the presented study.

The study presents many reasons of conversion, although I would only like to mention a few. Experienced surgeons did not have fewer conversions. Does this mean that experience is
of no significance? No. The laparoscopic technique is a completely different operative technique than the opening of the abdominal cavity. The transfer of experience from open to laparoscopic surgery is not possible. The habits from classical surgery can even hinder an operation, since an experienced surgeon has his own habits and favorite surgical methods. The “transfer” to laparoscopic surgery is easier for beginners. On the other hand, teaching a surgeon laparoscopy from the beginning can lead to a professional bias. Training should focus on both classical and laparoscopic surgery. Otherwise, when “old” surgeons retire, classical operations will be endangered, even those dealing with the reconstruction of the biliary ducts.

The Authors of the study demonstrated that the wisdom of the operator derives from surgical experience. Experienced surgeons decided earlier to convert to open surgery. That is wisdom – it is better to open the abdominal cavity three times rather than prolong the surgical procedure and, in the end, damage the biliary ducts.

The influence of the gender of the patients with cholelithiasis on intraoperative difficulties has been known for a long time. The anatomy and topography of the male gall-bladder is more “troublesome” than that in women. During the times of open surgery, I personally became convinced of the difficulties connected with male gallbladder surgery.

The age of the patient is a significant factor of conversion, due to the fact that elderly patients present with a long-lasting history of cholelithiasis. One can observe a solid, difficult to operate inflammatory infiltration or solid pericystic adhesions. Thus, long-standing cholelithiasis can pose a technical problem.

Another problem and factor influencing the need for conversion is the presence of an inflammatory process in the vicinity of the gall-bladder. Acute cholecystitis, empyema, and cholecystocele are not contraindications to performing laparoscopic surgery. Do the above-mentioned factors have an influence on conversion? In my opinion, no. The enlargement of the image during laparoscopy enables one to identify different structures and, if the process is acute, the preparation of anatomical elements does not pose a problem.

Finally, the Authors of the study did not mention whether the biliary ducts were damaged and, thus, what the factor influencing conversion was. Knowledge of these factors would have made evident the positive role of the surgeons’ experience. The positive role of the surgeons’ experience would have been evident.

My long-standing experience with laparoscopic surgery shows that the above-mentioned method, in spite of the progress in experience and instruments used, has its limitations, a fact that the surgeon must remember.

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