Surgery Journal 3 (3): 49-54, 2008
ISSN: 1816-3211

Surgical Considerations for the Laparoscopic Management of Special Diseases of the Gallbladder

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Abstract: Laparoscopic surgery is the gold standard for the treatment of symptomatic gall stones. However, it remains unclear when an open surgical or a laparoscopic approach is more appropriate in difficult acute or rare cases. The tactical concept in the decision making is presented. Between June 1990 and December 2001, 7303 patients underwent a cholecystectomy, 6942 operations were completed minimally invasive. There were 990 (13.6%) with acute cholecystitis and 47 (0,6%) with malignant disease of the gallbladder. A conversion was required in 1.66% of all operations and in 10.61% for acute cholecystitis. The total rate of complications was 4.2% without significant differences between acute or chronic cholecystitis. In the study period there were 47 patients with malignancies of the gallbladder. The 5-years, survival rate depended on the stage of the tumour and the operation carried out. The clinical suspicion of malignancy is usually associated with an advanced stage. In these cases open laparotomy is the access of choice. Early tumours are frequently incidentalomas that laparoscopic surgery alone can be sufficient to cure. In summary, laparoscopic resection can be considered safe even for difficult indications. A standardised surgical approach and an experienced team is most important.

Key words: Laparoscopy, acute cholecystitis, gallbladder carcinoma, surgical, symptomatic gall stones

INTRODUCTION

Soon after its invention, laparoscopic surgery became the gold standard for the treatment of symptomatic gall stones. With growing experience this technique was increasingly used for more complicated operations, e.g., for acute cholecystitis and carcinoma of the gall bladder. However, it remains unclear when an open surgical or a laparoscopic approach is more appropriate in these settings. We conducted a retrospective analysis of our data to present our tactical concept with guidelines to help in the decision making process of indications and surgical management in these special indications.

MATERIALS AND METHODS

Between June 1990 and December 2001 7303 patients underwent a cholecystectomy at the Moabit Hospital, Berlin. The mean age of all subjects was 53.5 years. Seventy four percent were female. A conventional open approach was chosen in 240 (3.3%) cases. All other operations were started laparoscopically. One hundred and twenty one (1.6%) procedures were converted intra-operatively from a laparoscopy to open laparotomy. The remaining 6942 (95.1%) operations were completed minimally invasive.

The focus of this study was to assess surgical techniques for acute cholecystitis and malignancy of the gall bladder. We attempt to share our considerations and lay out the possible surgical management for these challenging indications.

For this purpose all operations carried out for acute cholecystitis or malignancie were analysed in this study and compared to the others. In the group of all operations we found 990 (13.6%) out of 7303 with acute cholecystitis and 47 (0.6%) with malignant disease of the gallbladder. The histological examination of all tissue samples was performed at the Institute of Pathology of the Moabit Hospital, Berlin.

RESULTS

Acute cholecystitis: Nine hudred and ninty patients (13.6%) presented with acute cholecystitis. One hundred

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and fifteen of 990 (11.6%) operations for acute cholecystitis were performed as primarily open laparotomies. All 115 were undertaken during the early years of laparoscopic surgery and showed a decreasing frequency over time.

More than 50% of all cholecystectomies were started as an open procedure in the first year, while no procedure has been a primarily open laparotomy since 1999. In total, during the period investigated primarily open operations were performed in 11.6% of all cases of acute cholecystitis and 1.98% of all cases of chronic cholecystitis. This difference was statistically significant. A conversion from laparoscopy to laparotomy was required in 1.66% of all operations. For acute cholecystitis this rate was 10.61% and remained stable throughout the study, which was also significantly different to the respective rate for chronic gall bladder inflammation at 0.3% (Table 1).

For acute cholecystitis the mean duration of the surgical procedure (75 min) and the hospital stay (6.5 days) was longer compared to the other operations (55 min, 5 days) but without significance.

In 2002, hospital stays were shortened by opening a short stay ward handling pre- and post-operative patients on an outpatient basis. Currently, an average patient stays in hospital for 3.1 days when suffering from chronic cholecystitis and 6.9 days when acute cholecystitis has been diagnosed.

In patients older than 75 years of age, acute cholecystitis was a more common indication for surgery than in younger ones. Patients older than 75 years underwent surgery for acute cholecystectomy in 28.5% of all operations in this age group, while this diagnosis was only made in 12.4% of all younger patients.

During the early years of laparoscopic cholecystectomy, this technique was only used in 9% of all patients aged 75 and older. With increasing experience, though, it was becoming more popular for this subgroup, too. However, in 1995 it was only applied in 50% of all procedures. Since 1998, all operations are started laparoscopically-even in elderly patients.

Complications: The total rate of complications in the period investigated was 4.2%. There were no significant differences between acute or chronic cholecystitis. Details are given in Table 2.

Cancer of the gall bladder: Fourty seven (0.6%) patients were found to have a cancer of the gall bladder. The mean age of these subjects was 70.6 years (women 72 years, men 65 years). Eighty five percent were female. Forty five adenocarcinomas, 1 squamous cell carcinoma and 1 sarcoma were diagnosed.

Table 1: Results of operations for chronic and acute cholecystitis

	Chronic cholecystitis	Acute cholecystitis
Number	6313 (86%)	990 (14%)
Operation		
Open operation	125 = 2%	115 = 13%
Konversion	16 = 0.3%	105 = 11%
Duration of operation	~ 55 min	~ 75 min
Hospital stay	5 days	6.5 days
Age		
< 75 years	87.6%	12.4%
> 75 years	71.5%	28.5%
Total	244 (3.9%)	62 (5.7%)

Table 2: Complication rates

	Chronic cholecystitis	Acute cholecystitis
Number	6313	990
General complications (Lung/Heart/Kidney)	50 = 0.8%	10 = 1.2%
Minor (Hematoma, Woundinfection)	153 = 2.4%	42 = 4.1%
Major (Bleeding, Bile duct injury)	25 = 0.4%	4 = 0.4%
Intraabdominal Infection	16 = 0.25%	4 = 0.4%
Total	244 = 3.9%	62 = 5.7%

The 47 tumours of the gall bladder were classified as Tis (7 patients), T1 (2), T2 (17), T3 (6) and T4 (15). Histological examination revealed 45 adenocarcinomas, 1 squamous cell carcinoma and 1 sarcoma. The Tis, T1 and T2 tumours were located in the fundus (18 patients), corpus (4) and neck (4) of the gall bladder. Seventeen of 47 patients were suspected pre-operatively of suffering from a malignant tumour. Investigations in these subjects included abdominal CT scanning, ERC or cholangiography.

All operations for Tis and T1 tumours were started and completed laparoscopically. Twelve of 17 T2 tumours were performed laparoscopically; 5 operations were laparotomies based on a pre-operative suspicion of malignancy. In 5 out of 6 operations for T3 tumours the surgeon started laparoscopically; 2 of these procedures had to be converted into open laparotomy. The 15 T4 tumours were evenly operated using open (8 patients) and minimal invasive surgergy (7 patients).

The 5-years survival rate for patients with Tis and T1 tumours was 100% following laparoscopy. No re-explorations were needed. Ten of 17 patients with stage T2 carcinomas had to undergo total resection of the gall bladder, adjacent liver segments (IVB and V) and the lymph nodes located in the hepatic hilum and the hepato-duodenal ligament. This was done either during an open re-exploration (8 patients) or in the setting of a primarily open procedure (Bittner, 2004). Seven subjects did not undergo radical resection as they were frail, elderly and/or had limiting co-morbidity. All 6 patients with a T3 tumour

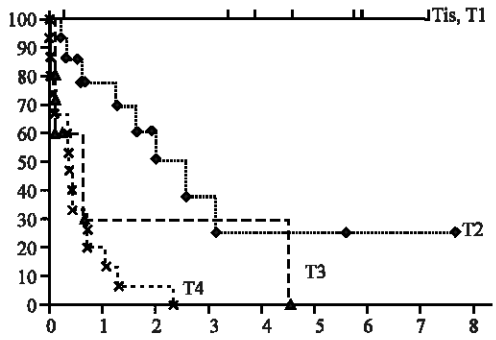

Fig. 1: Kaplan-Meier plot for gallbladder carcinoma (n = 47)

underwent total resection as described above. This procedure was part of a primarily open laparotomy (1 patient), an intra-operative conversion from laparoscopic to open surgery (Bittner, 2004) or an open second look operation following a minimal invasive procedure (Chan *et al*., 2003). Seven of 15 patients suffering from a T4 tumour were initially treated by laparoscopy. However, in 6 of these cases only a biopsy was taken, while in 1 case a conversion to a total resection was required. The latter was also performed in 3 out of 8 cases that had a laparotomy for a T4 tumour. In the remaining 5 cases an open procedure was performed to take biopsies for confirmation of the diagnosis.

The mean survival rate of all 47 patients was 447 days post-operatively to the end of the observation period in December 2001. Kaplan-Meier plots of the survival times are shown in Fig. 1. In patients with a T2 tumour, there was a significantly better survival rate for those treated with radical surgery as compared to cholecystectomy without hepatic resection and lymph node clearance. All patients treated with cholecystectomy only died within 5 years. For patients with T3 tumours the 5-year survival rate was 0% despite radical operation. Fourteen of 15 subjects with a T4 tumour had died after 13 months. In this group, radical surgery made no significant difference to taking a biopsy only.

Two cases of metastatic spread to the site of the laparoscopic port were found in patients treated during the early years (1991 and 1994).

Surgical considerations and technique

Acute cholecystitis: Based on our experience we recommend the following approach for acute cholecystitis.

All these patients should undergo laboratory and ultrasonographic investigations to rule out any biliary obstruction. If there is no evidence of obstruction the patients should be treated laparoscopically. In case of biliary obstruction a therapeutic ERC with or without papillotomy should be attempted. Subsequently, a diagnostic laparoscopy should be performed to assess the patient's suitability for minimal invasive surgery. If there is oedematous inflammation of the gall bladder only, a laparoscopic cholecystectomy will usually be feasible. A putrid gall bladder, however, should be tapped, drained and irrigated first. Thereafter, minimally invasive surgery might continue or might need to be converted to an open laparotomy (Fig. 2).

Figure 3 shows the proposed algorithm for the management of acute cholecystitis.

Some issues should be kept in mind when planning the operation.

- In general, the procedure is the same for both chronic and acute cholecystitis.
- There should be a standardised approach with obligatory exploration of Calot's triangle.
- The puncture and lavage of a putrid gall bladder is mandatory.
- The use of a two way instrument for suction and irrigation is useful and important.
- When intending to convert to open laparotomy, this should be done early.
- When encountering technical difficulties or unusual anatomy during laparoscopy, a conversion to open surgery is advisable.
- The use of subhepatic drains is mandatory.
- Acute cholecystitis requires an experienced surgeon.

Carcinoma of the gall bladder: After evaluation of our results we suggest the following management of the carcinoma of the gall bladder: the clinical suspicion of a malignancy of the gall bladder is usually associated with a tumour of an advanced stage. In these cases open laparotomy is the therapy of choice since it allows the total resection of the tumour with the hepatic segments IVB and V and systematic lymphadenectomy.

Tis and T1 tumours of the gall bladder are frequently incidentalomas found at the end of the operation or during histological examination. In these cases a cholecystectomy on its own is curative.

Stage T2 and T3 tumours require a radical resection that can be done either by switching to a laparotomy or by re-exploring the abdomen. In our view the latter is preferable if there is no pre-operative suspicion of a malignancy. This enables the surgeon to discuss risk and prognosis with the patient in the changed light of the new diagnosis. Furthermore, the histology report and exact staging are available enabling a transfer of the patient to a specialised centre for a radical operation.

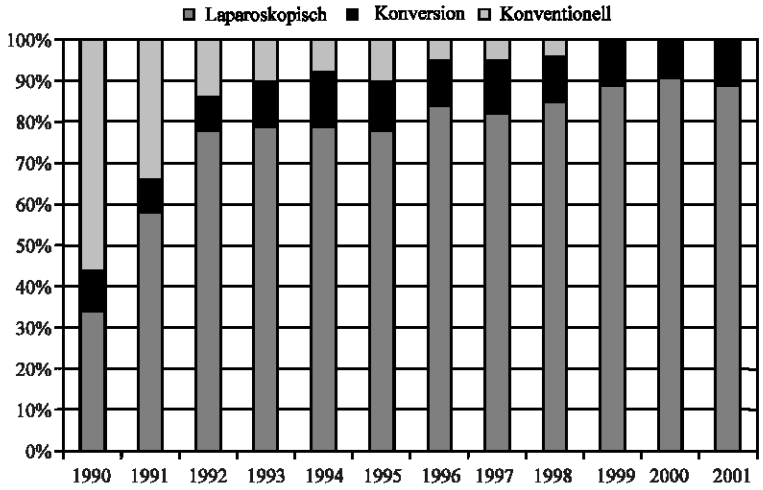

Fig. 2: Amount of conversions, open and laparoscopic surgery in acute cholecystitis

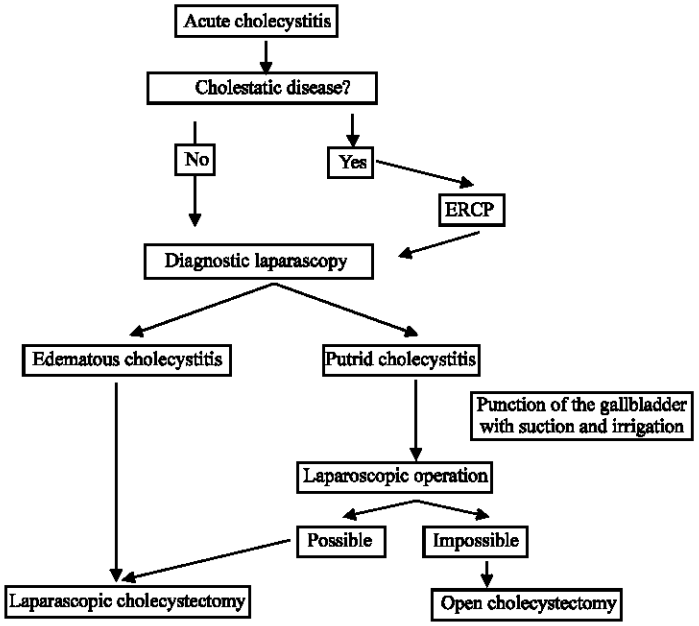

Fig. 3: Algorithm for the management of acute cholecystitis

Once the liver is affected by the gall bladder carcinoma (stage T4) a laparoscopic biopsy is sufficient to confirm the diagnosis. A radical surgical approach does not change the outcome.

If the suspicion of a malignancy arises intra-operatively, extreme caution should be exercised not to perforate the gall bladder. This requires an experienced surgeon. The preparation of the gallbladder should be done very careful to avoid any spillage of tumour-cells. The surgical strategy is not different to benign cases regarding the preparation of calot´s triangle. After dissection of the cystic duct and the cystic artery, in cases of suspected malignancy the preparation of the bladder out of the liver bed should have possible tumour infiltration in mind. In doubt, a conversion to open extended resection of the liver is a good choice.

The gall bladder should be removed from the abdominal cavity in an impermeable retrieval bag. When a second operation for a radical resection is required the incision sites of the trocar of the previous laparoscopy should be resected.

DISCUSSION

Within a few years, laparoscopic cholecystectomy has become a standard procedure. While, there are few

contraindications for its use to treat uncomplicated symptomatic gall stones the situation is more complex for other diseases, i.e., acute cholecystitis or carcinoma of the gall bladder.

Growing experience in laparoscopy stimulated its application for difficult indications. Bittner *et al.* (1997) described an increased use of minimally invasive surgery from 1.87-83.3% of all cholecystectomies from 1991 to 1996. These figures are based on 483 patients with acute cholecystitis. They correlate well with our findings. Also, our results with regards to the conversion rate to open laparotomy and the duration of operations are comparable. Furthermore, our study confirms that there is a similar rate of complications in patients treated for acute or chronic cholecystitis, respectively.

In a prospective, non-randomised trial Hohmann and Schramm (1999) compared the outcome of open (n = 104) and laparoscopic (n = 124) cholecystectomy for acute cholecystitis. The rates of complications were similar. While the duration of an open operation was 20 min less, the hospital stay was significantly longer than for laparoscopic approaches (13.4 vs. 6.6 days). Furthermore, the advantage of a shorter duration of an operation diminishes with increasing experience in using laparoscopy. Our trial showed that the average duration for both open and keyhole surgery was 75 min.

In accordance with Bittner's *et al.* (1997) findings our rate of conversion from laparoscopy to laparotomy was higher in patients treated for acute cholecystitis than in subjects undergoing an elective intervention for chronic inflammation. Bittner found a rate of 12%, confirming our rate of 10.61% for acute cholecystitis. In contrast, Manger *et al.* (2001) describes a rate of 8.5% only. However, 20-39.5% of his cholecystectomies were primarily open laparotomies.

Post-operatively, the hospital stay for acute cholecystitis was only marginally longer than for chronic cholecystitis (6.5 vs. 5 days). We were able to reduce the inpatient stay for elective cholecystectomies to 3.1 days by setting up a pre-operative assessment clinic and transferring the post-operative follow up partly into outpatient care. These changes, however, had no impact on the duration of hospital admissions for acute cholecystitis.

In summary, laparoscopic resection can nowadays be considered as a safe procedure even for difficult acute cholecystitis. A standardised surgical approach and an experienced team is critical, though (Bittner *et al.*, 1997; Bittner, 2004; Ulrich *et al.*, 2001; Kraas and Farke, 2002).

In subjects with confirmed carcinoma of the gall bladder or a strong clinical suspicion thereof laparoscopy is not recommended. A radical resection of the gall bladder and the lymph nodes in the hepato-duodenal ligament is preferable providing a potentially curative operation (Donohue, 2001). Most cases of malignancies, however, are diagnosed incidentally during laparoscopy. These cases bear the question whether the surgeon should switch to an open procedure immediately or perform a second operation later.

Histological classification (Tis-T4) of the tumour is usually only available after completion of the operation. This prevents an intra-operative conversion to open surgery unless the tumour is macroscopically visible.

There is sufficient evidence that a radical operation should be performed for tumours of stage T2 or higher (Donohue, 2001). Not yet settled is the discussion how carcinoma in situ (Tis) and stage T1 should be treated.

Yamaguchi *et al.* (1996) reports no advantage of radical surgery over laparoscopy alone. Weiland *et al.* (2002), however, found a 3-years survival rate of only 47% in patients with T1 tumours and recommended an open exploration for any suspected neoplasia. Rückert and Müller (2001) also favour radical surgery in most cases. In our own trial, in contrast, no tumour related death has occurred yet after laparoscopic removal of a Tis/T1 carcinoma. Key issues for this success seem to be the complete resection of the gall bladder without perforating the organ, the use of a retrieval bag when malignant tumours are suspected and the regular and thorough cleansing of all instruments during the operation. These measurements effectively prevented metastatic spread that had previously been seen at the insertion site of the device.

CONCLUSION

Our data in accordance with other trials (Chan *et al.*, 2003; Donohue, 2001; Yeh *et al.*, 2004) show that laparoscopic surgery alone is sufficient to cure the early stages of gall bladder malignancies.

In case of intraoperative suspicion of gall bladder malignancy the laparoscopic procedure should be done very careful by an experienced surgeon, any opening of the gall bladder should be avoided and the use of retrieval bags is recommended.

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