



Laparoscopic Treatment of Nonparasitic Liver Cysts: Adequate Selection of Patients and Surgical Technique

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Abstract. Results of laparoscopic fenestration in patients with a highly symptomatic solitary liver cyst (17 patients) or polycystic liver disease (PLD) (9 patients) were prospectively evaluated in a multicenter practice of general surgeons. Conversion to laparotomy was required in two patients because of inaccessible deep liver cyst in one and a diffuse form of PLD in the other. There was no mortality or major morbidity. Mean postoperative hospital stay was 4.6 days after successful laparoscopic procedures. During a mean follow-up of 9 months, 23% of the patients had recurrence of symptoms and 38% had radiographic reappearance of cysts. Factors predicting failure included previous surgical treatment, deep-seated cysts, incomplete deroofing technique, location in the right posterior segments of the liver, and a diffuse form of PLD with small cysts. Adequate selection of patients and type of cystic liver disease and meticulous and aggressive surgical technique are recommended.

Congenital liver cyst is a benign condition with a reported prevalence of less than 5% in the general population [1]. These cysts are usually small, but even large cysts can remain asymptomatic. They may be solitary, multiple, or multiple and diffuse in the liver parenchyma (polycystic liver disease, PLD) and are usually detected incidentally on radiologic imaging. Even a large liver cyst in an asymptomatic patient does not require treatment. Sometimes, albeit rarely, a large liver cyst presents with complications, such as intracystic hemorrhage [2–4], rupture [3], torsion [5], infection [6, 7], or compression of adjacent structures [8]. Treatment is limited to highly symptomatic patients or those in whom complications occur. Various forms of treatment have been proposed, including nonsurgical procedures such as percutaneous aspiration, without [9, 10] or with [11–15] alcohol injection, and surgery, including aspiration [4], partial excision [1, 16], complete excision [1, 13, 17, 18], marsupialization [18], or liver resection [19, 20].

Lin et al. in 1968 described a technique of intraperitoneal fenestration of a large cyst wall by deroofing to provide reduction of massive hepatomegaly by creating a free exit into the peritoneal cavity for fluid secreted by the cystic epithelium [21]. In recent years this technique has been considered by many to be the treatment of choice for solitary liver cyst [2, 13, 16, 19] and for

PLD—as a single procedure [16, 22] or in combination with liver resection [19, 23, 24].

Developments in laparoscopic techniques have proved laparoscopic fenestration to be feasible for both congenital liver cysts [19, 25–37] and PLD [26, 34, 38]. The purpose of this study was to evaluate the results of laparoscopic fenestration in a series of 26 patients from a multicenter practice of general surgeons.

Material and Methods

From April 1990 to December 1994 a total of 26 patients (23 women, 3 men) were referred by their physicians for highly symptomatic cystic liver disease. The mean age was 54 years (range 21–85 years, median 57 years). Two patients weighed more than 100 kg, and two patients were considered high risk for surgery (ASA III in the classification of the American Society of Anesthesiologists). Cystic liver disease was arbitrarily classified as a single dominant cyst with accessory cysts (13 patients), multiple dominant cysts with or without accessory cysts (4 patients), or PLD of > 10 cysts (9 patients). Group I comprised the first two categories ($n = 17$), and group II the third category ($n = 9$). Indications for surgery in groups I and II are listed in Table 1. The major symptom was abdominal pain in the right upper quadrant or the epigastrium. Six patients (23%) had been treated unsuccessfully with repeated aspirations and alcohol sclerotherapy, one patient had laparoscopic treatment, and one patient had open surgical fenestration before the present procedure. The mean size of the largest liver cyst was 14 cm (range 8–20 cm, median 14 cm) in group I and 11 cm (range 6–20 cm, median 11 cm) in group II. Liver cysts were located in the right lobe in 10 patients (59%) in group I and 4 patients (44%) in group II. Multiple and bilobar cysts were found in three patients in group I and four patients in group II.

All patients had negative ultrasonographic features with negative preoperative serology for hydatid disease. Ultrasonography and computed tomography (CT) performed in all patients and magnetic resonance imaging performed in six patients demonstrated typical features, with a thin cystic wall and homogeneous fluid content, but intracystic unilocular septation and hemorrhage

Table 1. Indications for surgery in patients with nonparasitic liver cysts.

Indication	Group I (n = 17)	Group II (n = 9)
Abdominal pain	14	6
Intracystic hemorrhage	2	—
Differential diagnosis with liver cystadenoma	1	—
Abdominal discomfort	0	2
Recurrent jaundice following aspiration	0	1

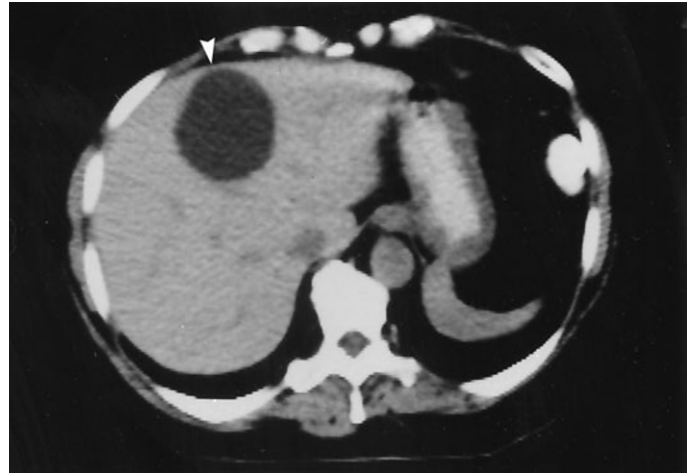
were present in two patients. The absence of a thick, irregular cystic wall or intracystic papillary projections, the cytology and assays for carcinoembryonic antigen (CEA) and CA 19.9 in the cystic fluid when preoperative aspiration was performed, and routine perioperative frozen sections of the cystic wall were criteria used to exclude cystadenoma or cystadenocarcinoma.

The laparoscopic procedure required insertion of four trocars with the patient in the supine position. Laparoscopic fenestration included wide cystic wall deroofing of as many cysts as possible in patients with PLD. Great care was taken to achieve complete hemostasis using coagulating scissors or hook. The mean number of fenestrated cysts was 1.3 (range 1–3, median 1) in group I and 4.3 (range 1–13, median 3) in group II. In situ omentoplasty was performed in 4 patients and peritoneal drainage in 23 patients. Concomitant procedures included cholecystectomy in six patients (for gallstones in two patients, gallbladder cancer in one patient, and technical reasons in the three remaining patients) and fenestration of large kidney cysts in two patients with PLD and polycystic kidneys. Routine histologic examination of the excised cyst wall confirmed the diagnosis of congenital liver cyst(s).

Patients were followed up regularly with repeated CT. Clinical recurrence was defined as reappearance of preoperative symptoms and morphologic recurrence with persistence of fluid collection or reappearance on CT examination. Statistical analysis included appropriate use of the chi-square test, Fisher exact test, and Student's *t*-test. A *p* value of < 0.05 was considered significant.

Results

Laparoscopic fenestration was technically successful in 16 patients (94%) in group I and in 8 patients (89%) in group II. Conversion to laparotomy was required in group I for a patient with a 12-cm deep-sited cyst that was not apparent at the liver surface. This feature was retrospectively diagnosed on preoperative CT (Fig. 1). One patient in group II had a diffuse form of PLD with hundreds of small cysts within the liver parenchyma, and the operation was converted to laparotomy because of incomplete laparoscopic fenestration. The operative conversion rate was not significantly different between the two groups. In three other patients cyst wall deroofing was limited because of restricted access to the cystic wall from the liver surface. The mean duration of the laparoscopic procedure (conversion excluded) was 90 minutes (range 35–150 minutes, median 80 minutes) in group I and 134 minutes (range 90–184 minutes, median 135 minutes) in group II (*p* < 0.02). Operative time in the two patients who required conversion to laparotomy was 90 minutes and 336 minutes (in the patient with PLD). Intraoperative complications included cardiac arrhythmia

**Fig. 1.** Preoperative CT of a patient with a deep-sited liver cyst underneath 1 cm of liver parenchyma on the liver surface (arrow). Conversion to laparotomy was required for detection and fenestration.**Table 2.** Long-term clinical and radiologic recurrence in patients treated by laparoscopic fenestration.

Recurrence	Entire series	Group I	Group II
Symptoms			
Incidence	23% (n = 6)	17% (3/18)	33% (3/9)
Reasons			
Spastic colon (n = 3)		1	2
Cardiac (n = 1)		—	1
Cyst recurrence (n = 2)		2	—
Radiologic signs			
Incidence	38% (10/26) ^a	44% (8/18)	22% (2/9)
Symptoms			
None (n = 7)		5	2
Atypical (n = 1)		1	—
Typical (n = 2)		2	—

^aSmall size in seven patients.

with cardiac arrest during insufflation in an elderly, high risk patient and hemorrhage from the fenestrated cystic wall in three patients; the latter were easily controlled by clipping or use of an argon beam coagulator. No postoperative mortality occurred in this series. Minor postoperative complications (cardiac arrhythmia, severe shoulder pain, acute dyspnea, and pleural effusion) were recorded in four patients (15%).

The mean postoperative hospital stay was 4.6 days (range 3–7 days, median 4 days) for patients with successful laparoscopic procedures and was similar in the two groups. Postoperative hospital stay was 8 and 12 days, respectively, for the two patients undergoing conversion. The mean follow-up was 9 months (range 1–48 months, median 6 months) for all patients: 10 months (range 1–48 months, median 6 months) in group I and 7 months (range 1–17 months, median 3 months) in group II. Clinical recurrence of symptoms was seen in six patients (23%) in the entire series: three patients (17%) in group I and three patients (33%) in group II (not significant). Details of and reasons for recurrence of symptoms are listed in Table 2. Only two of these patients had symptoms related to liver cyst recurrence. In four patients symptoms were related to another cause (spastic colon in three patients and coronary pain in one patient). Precise preoperative assessment of the type and characteristics of the

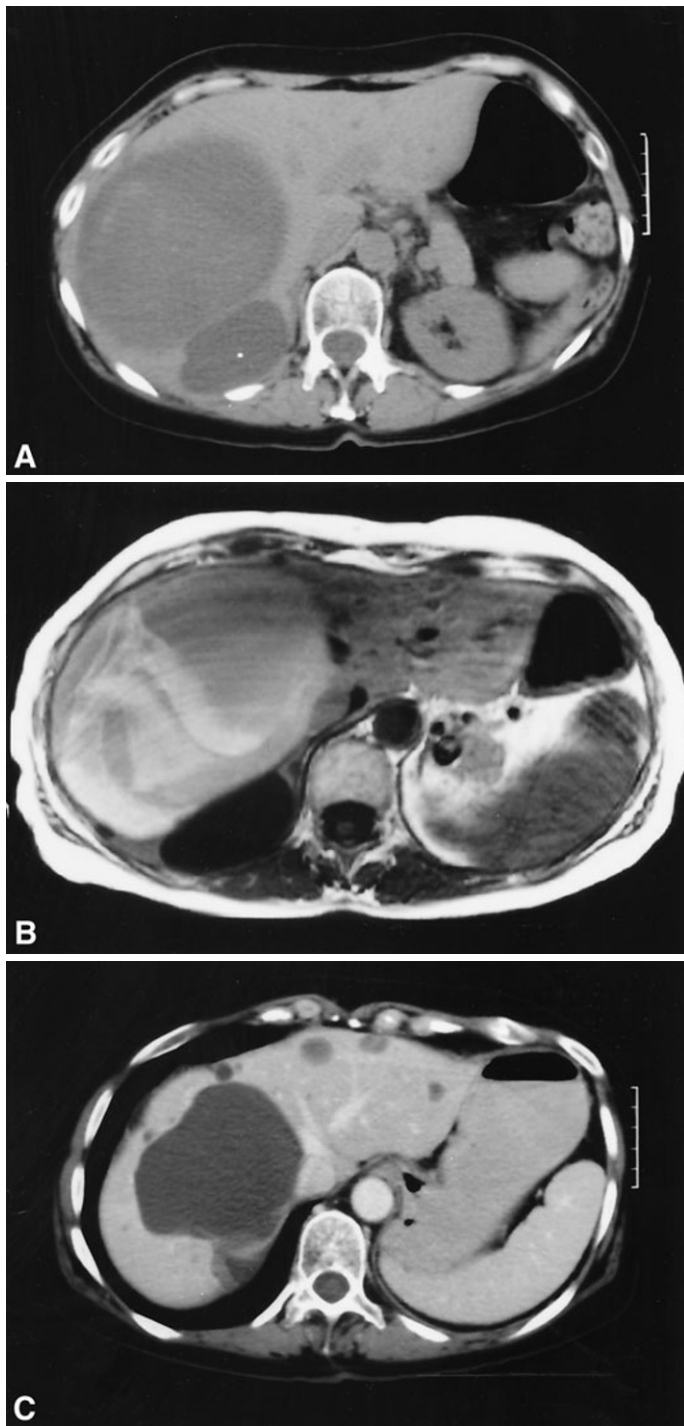


Fig. 2. CT examination of a patient with a giant multiloculated liver cyst. **A.** Preoperative CT: inhomogeneous intracystic content. **B.** Preoperative MRI: intracystic hemorrhage. **C.** Postoperative CT with radiographic cyst recurrence 3 months later.

abdominal pain differentiates patients with cyst-related symptoms (acute or chronic right upper quadrant or epigastric pain, depending on the type of presentation, associated with local sensation of fullness, without other functional gastrointestinal symptoms, and with prompt relief of symptoms after preoperative cyst aspira-

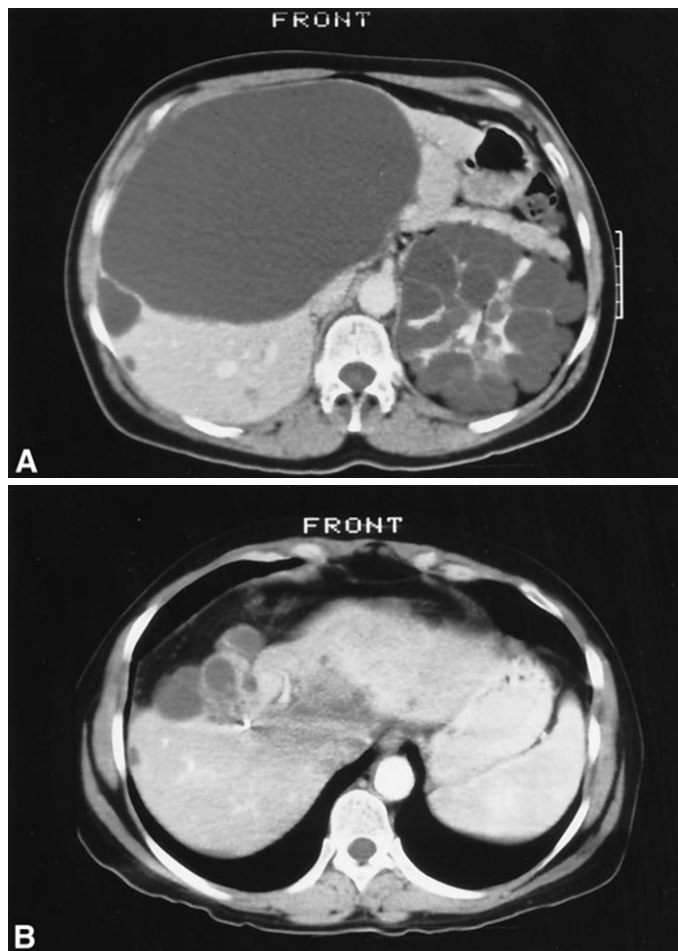


Fig. 3. Patient with type 1 polycystic disease of the liver (PLD), by Morino's classification, associated with polycystic kidney disease. **A.** Preoperative CT with a large superficial liver cyst, an excellent indication for laparoscopic fenestration. **B.** Postoperative CT with an excellent result at 6 months.

tion), who respond to liver volume reduction by fenestration, compared to other patients with more atypical abdominal pain related to other gastrointestinal disease and with, in fact, an asymptomatic liver cyst. Liver cyst recurrence on repeated CT was seen in 10 patients (38%) in the entire series (with a small size compared with the preoperative CT in seven patients) (Fig. 2): eight patients (44%) in group I and two patients (22%) in group II (not significant). These recurrences seen on radiographic studies were asymptomatic in five patients in group I and in two patients in group II. None of these patients underwent reoperation owing to an absence of symptoms. In group I only two patients had cyst-related symptoms, one of whom was reoperated by open fenestration with complete relief of complaints. The remaining patient's abdominal pain was related to spastic colon.

Factors related to radiographic recurrence were multifactorial. A history of surgical fenestration (two patients) was always associated with cyst recurrence, as was incomplete cyst wall deroofting (three patients, three recurrences). Cyst location in segment VI, VII, or VIII (Couinaud classification) was associated with three recurrences in six such cases, compared with two recurrences in 13 other locations in patients without the two



Fig. 4. CT examination of type 2 polycystic disease of the liver (PLD), by Morino's classification. Note the diffuse small cysts in the entire liver, a poor indication for laparoscopic fenestration.

previously mentioned risk factors, but the difference was not statistically significant.

Discussion

No more than 41 cases of laparoscopic treatment of cystic liver disease have been reported up to now [19, 25–38]. Although the results were promising, the follow-up has been short in the reported series. To our knowledge, the present series is the largest published so far, our patients having been treated in a multicenter surgical practice. It permits reliable evaluation of the feasibility of this technique and of the results obtained.

The main findings of our study were that laparoscopic fenestration of simple hepatic cysts was technically feasible in 94% of patients and conferred symptomatic relief in 83%. Moreover, although the duration of follow-up is limited, 44% of patients had recurrence of their hepatic cysts and only 25% of these patients developed recurrent symptoms. This recurrence rate suggests that careful patient selection may improve outcome.

The need for strict selection of patients has already been pointed out by Morino et al. [34], who excluded from surgery 6 of 17 patients because their symptoms were assumed not to be related to their liver cysts. Our experience reinforced this need, with recurrence of symptoms in 23% of patients of the entire series, only one-third of whom had radiographically obvious cyst recurrence. In retrospect, four cases had to be considered as representing poor indications. Careful evaluation of a patient's complaints is mandatory, and when a relation to cystic disease is not clear, ultrasound- or CT-guided cyst aspiration (as a diagnostic test for relief of symptoms) can be worthwhile for avoiding unnecessary intervention. This procedure is safe, and decompression should afford prompt symptomatic relief if the cyst is the cause of the symptoms. Although the effect of aspiration is sometimes temporary, such a diagnostic trial would improve patient selection and reduce the symptomatic failure rate. In this era of minimally invasive therapy, a percutaneous approach should be the first line of therapy, and the laparoscopic approach should be reserved for patients with cyst recurrence and only if cyst-related symptoms are present. It is important to emphasize

that cyst recurrence in asymptomatic patients is not considered an indication for surgery.

Another surprising finding in this series was the high incidence of radiographic cyst recurrence during a limited follow-up of 9 months. Others have also described recurrence in patients with a solitary liver cyst [1, 19, 28] or PLD [34]. In our patients, the recurrent cysts were small compared to the preoperative size and usually remained asymptomatic. Technical factors during the laparoscopic surgical procedure could explain this high failure rate. As initially advocated by Lin et al. [21] and confirmed by others [4, 16, 34], meticulous, extensive fenestration should include deroofting of as many cysts as possible and a wide cyst wall excision. In our patients, all recurrent liver cysts were diagnosed in patients who had had an incomplete deroofting procedure. To be sure, such an aggressive approach might be associated with an increased risk of hemorrhage and bile leakage [2] because vessels and biliary ducts within the cystic septa could be injured during the laparoscopic fenestration. Deep-sited cysts that are not apparent or only partially apparent at the liver surface, or cysts that are located in the posterior right liver or in segment VIII of the dome of the liver, are frequently beyond laparoscopic access. Careful preoperative CT examination of the location of the cyst within the liver parenchyma and of the appearance of the cyst on the liver surface is crucial before surgery. Use of intraoperative ultrasonography can be useful in this regard [31]. To prevent recurrent cysts, use of the argon beam coagulator to destroy the secreting epithelium in the residual cystic cavity or "in situ" omentoplasty may be considered. In summary, technical factors that may affect outcome included (1) extent of deroofting, (2) location of cysts in the liver in regard to cyst appearance at the liver surface, (3) use of an argon beam coagulator for the remaining cystic wall epithelium, and (4) omentoplasty within the residual cavity. Another factor related to treatment failure that was found in this series was previous laparoscopic treatment or open surgical fenestration; in such cases, patients were not benefited by repeat laparoscopy. The presence of dense adhesions usually made laparoscopic fenestration more difficult or rendered it incomplete.

Among a selected group of patients with PLD in our study, laparoscopic fenestration was successful in only 89%, with symptom relief in 67%. Selection of patients with PLD should include only those with large cysts, described as type 1 in Morino's classification (Fig. 3) [34, 38]. In the single-PLD patient with diffuse small cysts in the entire liver, the procedure had to be converted to laparotomy. This type of PLD (type 2 in Morino's classification) must be considered a contraindication for laparoscopic fenestration (Fig. 4).

When these selection factors are taken into consideration, the procedure is safe. There was no mortality or major morbidity in this series. We at no time encountered bile leakage or prolonged ascitic fluid leakage [6, 34, 39], despite the routine use of peritoneal drainage in this series. Finally, patients with cystic liver disease usually benefit from minimally invasive surgery with reduced postoperative stay, quick recovery, and good cosmetic result. However, the most important aim of laparoscopic treatment of cystic liver disease in these selected patients is long-term success with respect to relief of symptoms and elimination of cysts.

In conclusion, laparoscopic fenestration can be recommended for patients with nonparasitic solitary liver cyst, multicystic disease, or type 1 PLD. Selection should be limited to patients who

have cyst-related symptoms, who have large, superficial cysts located in the anterior surface of the liver, and who have not had surgery previously. A meticulous, extensive surgical procedure is necessary. Despite the safety and ease of performance of laparoscopic fenestration, severe restriction of surgical indications and careful selection of patients must be emphasized if acceptable long-term results are to be obtained.

Résumé

Les résultats de la fenestration par coelioscopie chez les patients ayant un kyste hépatique solitaire du foie (17) ou une polykystose du foie (9 patients) ont été évalué par une étude prospective multicentrique réalisée par des chirurgiens généraux. La conversion a été nécessaire chez deux patients, en raison d'une localisation profonde dans un cas, en raison de la diffusion des lésions chez l'autre. Il n'y a eu aucune mortalité ou morbidité majeure. La durée moyenne de séjour a été de 4,6 jours après coelioscopie pure. Pendant le suivi d'une moyenne de 9 mois, 23% des patients ont eu une récurrence des symptômes et 38% ont eu une réapparition radiographique des kystes. Les facteurs pouvant prédire l'échec étaient un traitement chirurgical antérieur, la localisation profonde des kystes, la forme diffuse de la maladie polykystique avec des kystes de petite taille. La sélection appropriée des patients et du type de la maladie kystique ainsi qu'une technique méticuleuse et agressive sont recommandées.

Resumen

Se hizo la evaluación prospectiva de los resultados de la fenestration laparoscópica en pacientes con quistes solitarios sintomáticos (17 pacientes) y con enfermedad poliquística del hígado (9 pacientes) en el contexto de la práctica inter-institucional de un grupo de cirujanos generales. Se requirió conversión a laparotomía en dos pacientes, por quiste profundo no accesible en uno, y por forma difusa de la enfermedad poliquística en el otro. No hubo mortalidad; tampoco se registró morbilidad mayor. La estancia hospitalaria promedio fue de 4.6 días en los pacientes en quienes los procedimientos laparoscópicos fueron exitosos. En el curso de un seguimiento promedio de 9 meses, 23% de los pacientes presentaron recurrencia de los síntomas y 38% reaparición radiográfica de los quistes. Los factores de predicción de falla incluyeron tratamiento quirúrgico previo, quistes ubicados en profundidad, técnica incompleta de 93destechamiento94, ubicación en los segmentos posteriores derechos del hígado y forma difusa de enfermedad poliquística con quistes pequeños. Se recomienda la selección adecuada de los pacientes y del tipo de enfermedad quística, y una técnica quirúrgica meticulosa y agresiva.

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Invited Commentary

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Laparoscopic treatment of nonparasitic cysts of the liver is an appealing but undervalued procedure. The reported results of the Belgian multicenter study are thus welcome. Some major issues remain open for discussion: (1) Is the laparoscopic approach a feasible, safe procedure? (2) Is laparoscopic unroofing of the cysts comparable to what can be done using the open route? (3) What are the criteria for surgical intervention and for the open or laparoscopic approach?

Is the Laparoscopic Approach a Feasible, Safe Procedure?

Laparoscopic fenestration or unroofing of liver cysts appears to be feasible if the lesions are superficial and accessible to the rigid tools introduced through the abdominal trocars. The ease of performance of the procedure depends on the volume and the thickness of the cyst wall. Intraoperative complications may be hemorrhage or peripheral bile duct injury if the resection is extended too far in the liver parenchyma. No morbidity or mortality was reported by Gigot et al., but their enthusiastic statement must be tempered by a cardiac arrest hopefully resuscitated. This accident during peritoneal insufflation might have been avoided with a conventional open technique, which is totally safe.

Is Laparoscopic Unroofing of Cysts Comparable to What Can Be Done with the Open Route?

In most cases the cyst wall resection is more limited than with laparotomy. Thus "minifentration" may be due to difficult access, fear of vascular or biliary duct injury (mostly in the deep cyst fenestration for polycystic disease), or the lack of proficiency of the surgeon. The results of Gigot et al., which are unsatisfactory—with a high rate of cyst recurrence—may certainly be attributed to the incompleteness of the fenestration procedure through laparoscopy.

An indirect argument for the role of the extent of resection may be found in the polycystic disease group, where postoperative ascites is not documented (although most patients underwent drainage). After the open technique and wide fenestration of numerous cysts, massive intraperitoneal secretion of the opened cysts is usual and may be troublesome (dehydration, renal failure). Furthermore, laparoscopy does not allow combined fenestration plus partial liver resection, which may be the best option for selected cases of polycystic disease of the liver. The long-term effectiveness of the laparoscopic approach appears to be less than that with the open technique according to published data, some of them with a short follow-up.

What Are the Criteria for Surgical Intervention and for the Open or Laparoscopic Approach?

As noted by Gigot et al., most cystic lesions of the liver are asymptomatic and do not require treatment. The technical feasibility of a surgical procedure does not justify its performance. A few simple liver cysts should be considered for surgery: large, painful cysts, eventually complicated by intracystic hemorrhage or exceptional compression of adjacent biliovascular structures. Polycystic disease may be a good indication for Lin's fenestration procedure if the cysts are wide enough. Obviously, no benefit can be expected from unroofing a multitude of small liver cysts.

The choice between the open technique and the laparoscopic technique is difficult. "Easy" cases may benefit from the laparoscopic route, but the resection should be extensive to avoid relapse of the cyst. "Complicated" cases (difficult access, intracystic hemorrhage, doubtful diagnosis with a cystadenoma) should be treated by the conventional open technique.

The enthusiastic report by Gigot and colleagues about the merits of laparoscopy should be moderated, as the final outcome cannot be considered satisfactory. Better results with laparoscopic treatment of hepatic cysts should come from a more selective group of patients with the surgery done only by surgeons with high proficiency in liver surgery. The superiority of laparoscopy in terms of morbidity and long-term results has not yet been demonstrated, and this approach should not be recommended for any type of cystic lesions of the liver.