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ORIGINAL ARTICLE

Laparoscopic vs. open surgery for treating benign liver lesions: assessing quality of life in the first year after surgery

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Abstract Laparoscopic liver surgery has not yet gained widespread acceptance among liver surgeons. Some questions remain regarding indications to surgery and health related quality of life (HRQOL) after surgery, especially for the treatment of benign lesions, has so far not yet been investigated. The aim of this study is to evaluate HRQOL at 1 month, 6 months and 1 year after surgery in two groups of patients undergoing liver resections for benign liver lesions either by laparoscopic or open surgery. From January 2004 to September 2010 75 patients underwent surgery (29 laparoscopic, 46 open) for benign liver lesions. We retrospectively compared surgical results of the two groups and evaluated HRQOL with the SF-36 test. A personal or telephonic interview was administrated for the assessment of HRQOL before surgical treatment and at 1 month, 6 months and 1 year after surgery. Sixty six patients (88%) were available for the study. The length of stay (4.7 vs. 8.2 days, $p = 0.0002$), the reprisal of oral intake (II post-op vs. III post-op, $p = 0.02$) the number of transfused patients (2 vs. 8, $p = 0.1$) and the overall rate of morbidity ($p = 0.06$) were lower in the laparoscopic group. HRQOL was significantly better in the laparoscopic group in the first year after surgery. Surgical treatment for benign liver lesions, when indicated, should be laparoscopic. This approach shows a lower rate of surgical complications with a better quality of life after surgery and a faster reprisal of social and job activities.

Keywords Liver surgery · Laparoscopic liver surgery · Liver lesions · Liver resection

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Introduction

Use of the laparoscopic approach to liver surgery has significantly increased in recent years. Segmentectomies and major hepatectomies are both performed laparoscopically in a few highly specialized centers with good results at short- and long term follow-up [1–4]. Moreover, many reports point out that compared with the open approach for both benign and malignant lesions, laparoscopic liver surgery is a safe procedure, with a lower complication rate in term of intraoperative bleeding, postoperative general complications, postoperative analgesic drug consumption, and hospital stay [1–4]. Vanounou et al. suggest that patients operated for liver malignancies present a higher risk of postoperative complications and a worse quality of life (QoL) compared with those with benign diseases [5], probably because surgical results in patients with neoplastic disease are influenced by the underlying disease, including frequent previous surgery and the need for adjuvant chemotherapy.

To the best of our knowledge, there are no reports in the literature evaluating the impact of the open versus the laparoscopic approach to surgery for benign liver lesions in relation to health-related QoL (HR-QoL). Therefore, we measured the effects of surgical approach and its efficacy [6] on HR-QoL only in patients without malignancies to

avoid the impact of the underlying oncological background on general well-being assessment. The aim of this study was to evaluate retrospectively HR-QoL in two groups of prospectively collected patients undergoing open and laparoscopic surgery for benign liver lesions in a high-volume liver surgery center.

Patients and methods

Patients

Between January 2004 and September 2010 at the Hepatobiliary Surgery and Liver Transplant Centre of the Cardarelli Hospital in Naples, Italy, 395 liver resections and 167 liver transplants were performed. Overall, laparoscopic procedures were performed in 75 patients, 29 of which were performed for benign lesions (group A); 46 patients underwent open surgery (group B). Indications for surgery were subjective symptoms, sharp increase in lesion volume in a 6-month observation period, potential risk for malignant transformation, and uncertain preoperative diagnosis. Patient baseline characteristics are shown in Table 1. Table 2 shows the surgical procedures.

According to the Louisville Statement [7], the decision to perform laparoscopic versus open surgery was based on lesion location in the liver, not on size or number, resulting in more lesions involving segments 7 or 8 or both in group B (Figs. 1, 2). Thirteen patients with cystic lesions underwent open surgery following a preoperative diagnosis of echinococcosis, with suspected biliary fistula in six patients (not confirmed at operation) and a suspicion of echinococcosis in seven; echinococcosis cyst was confirmed in only three of these patients at operation. All 13 patients had total subversion of the right liver lobe substituted by the cystic lesion, so a right hepatectomy was performed. All patients were assessed before surgery with a volumetric computed tomography (CT) scan. Five patients who initially underwent laparoscopic surgery were subsequently converted to open surgery. So we consider these patients for morbidity in group A and for HR-QoL assessment in both groups.

Table 1 Baseline characteristics of the two groups ($n = 75$)

	Group A (lap) ($n = 29$)	Group B (open) ($n = 46$)
Age (years) (SD)	44 (15.71)	44 (15.79)
Previous surgery	0	1
Number of symptomatic patients	16	27
Uncertain diagnosis preoperatively	6	13
Solid lesions	15	33
Cystic lesions	14	13
Median lesions diameter (cm)	3.9 (range 2.8–11.6)	4.0 (range 3.0–12.5) p N.S.*

* Chi square test

Surgical approach

For the laparoscopic approach, with the surgeon standing on the right side of the patient, a pneumoperitoneum was established after accessing the abdominal cavity via an open Hasson technique. Intra-abdominal pressure was kept

Table 2 surgical procedures performed for benign liver lesions

Surgical procedures ($n = 75$)	Group A (lap)	Group B (open)
Major hepatic resections	2	22
Left lateral segmentectomy + IVb	1	1
Left hepatectomy		4
Left hepatectomy + VIII		1
Right hepatectomy	1	13
Right hepatectomy + IVb		2
Right lobectomy		1
Minor hepatic resections	13	11
Left lateral segmentectomy	3	4
Segmentectomy		3
Subsegmentectomy	10	4
Other	14	13
Pericystectomy		6
Fenestration + pericystectomy	14	7
Total	29	46

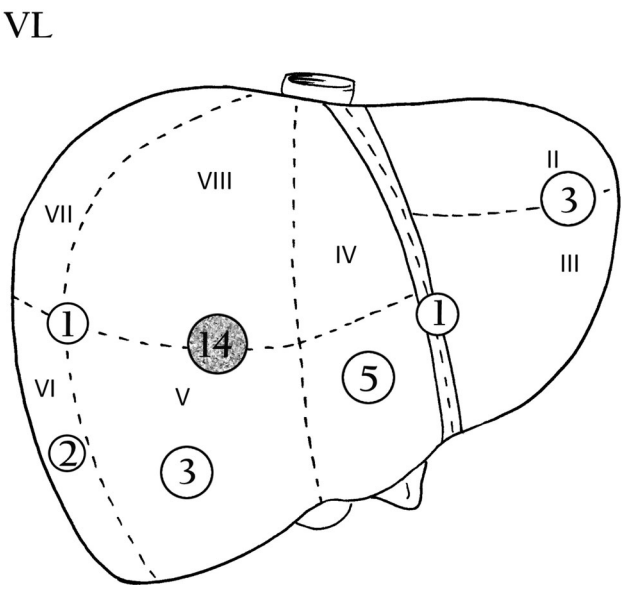

Fig. 1 Distribution of the lesion in group A (in *gray cystic lesions*)

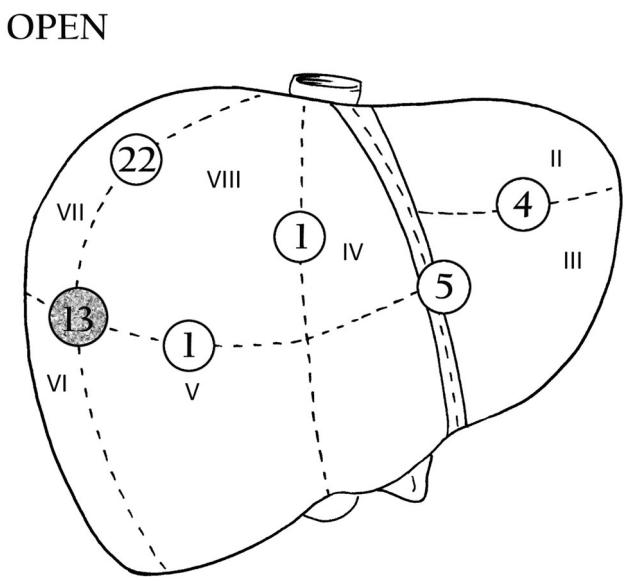

Fig. 2 Distribution of the lesion in group A (in *gray cystic lesions*)

at approximately 14 mmHg. Three additional ports were inserted (one 5 mm, two 10–12 mm). A 30° laparoscope was used. In the open approach, a laparotomy was performed via a transverse subcostal incision with a midline extension.

HR-QoL

Quality of life was measured using the Short-Form Health Survey (SF-36) [8, 9], a validated HR-QoL questionnaire comprising 36 questions and eight scales:

1. Physical functioning (PF)
2. Role-physical (RP)
3. Bodily pain (BP)
4. General health (GH)
5. Vitality (VT)
6. Social functioning (SF)
7. Role-emotional (RE)
8. Mental health (MH)

The test was administered by a personal or telephonic interview before surgery and at 1, 6, and 12 months after surgery.

Patient results were distributed using a Gaussian curve, either before or after surgery (Fig. 3). Each group was compared with a standard normal reference population by using the Pearson index (R^2). For each scale of the SF-36, mean ± standard deviation (SD), mean difference (MD), and percentage were calculated. Differences in HR-QoL between groups were calculated using the parametric Student's *t* test. A *p* value ≤ 0.05 was defined as statistically significant.

Results

Surgical complications according to the Clavien classification [10] are shown in Table 3. We found an overall complication rate of 24 %: 13.8 % in group A and 30.4 % in group B (p 0.05). Only one patient in the latter group had a grade V complication: stroke following major liver resection. Grade III complications comprised one hernia at the trocar site (group A), three hernias (group B), and one reoperation for hemoperitoneum on postoperative day 2 (group B).

Of the 75 patients who underwent surgery for benign lesions, 66 were available for HR-QoL evaluation: 28 in group A and 38 in group B. Causes of drop out are shown in Table 4. Overall surgical results are shown in Table 5, with only eight patients requiring portal clamping (three in group A). Compared with group B, patients in group A showed statistically significantly better results in terms of length of hospital stay (p 0.0002), first bowel movement (p 0.003), and oral intake (p 0.02). Reasons for conversion from a laparoscopic to an open procedure were uncontrolled bleeding in three patients and the need to better assess biliary anatomy in two.

All seven patients lost to follow-up and therefore unavailable for HR-QoL evaluation in group B underwent major liver resection (Table 4). All the 46 patients in the open group underwent only for benign hepatic lesions. Therefore, the number of major resections available for HR-QoL assessment was two of 28 (7.1 %) in group A and 14 of 38 (36.8 %) in group B. Two patients in group B, identified as being lost to follow-up, died within the first year after surgery due to causes unrelated to the surgical procedure (heart attack in one case and car accident in the other). No patient in either group showed a worsening of liver function or required packed red-cell transfusion during or after surgery.

The amount of resection in the 14 patients who underwent major liver resection in group B was minimal, with a median total volume reduction of 11.8 % (range 8–25 %) at the preoperative volumetric CT scan. All timely assessments of HR-QoL, both before and after surgery, were distributed using a Gaussian scale for each domain of the SF-36 (Fig. 3). Domains were similar in both groups preoperatively.

In the first month after surgery PF, RP, and BP were better in group A, even though not significantly different (p 0.1, p 0.1, and p 0.08, respectively). Moreover, a better QoL in group A was more evident at 6 months of follow-up, with a stronger statistically significant difference (p 0.04 and p 0.04 for PF and BP, respectively); PF was also significantly better in group A 12 months after surgery (p 0.05) (Table 6).

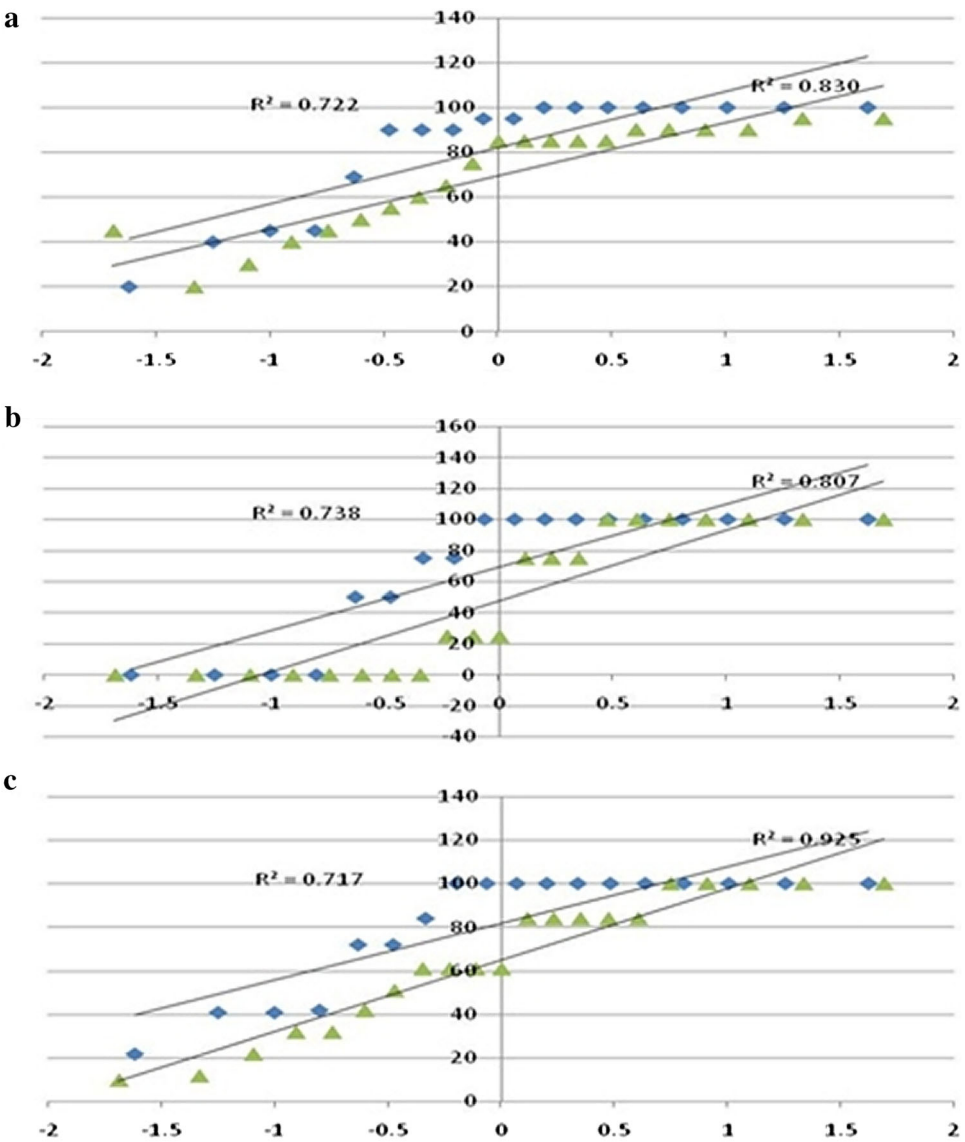

Fig. 3 Distribution of the two groups by a Gaussian scale for each domain of SF-36, **a** physical functioning (PF), **b** role-physical (RP), **c** bodily pain (BP)

Considering all patients converted from group A to group B, HR-QoL PF and BP scales were better 1 month after surgery for group A (p 0.02 and p 0.05, respectively) (Table 7) with no difference 6 and 12 months after surgery.

Discussion

Liver resection was probably the last area of resistance to progress in laparoscopic surgery. Over the last 5 years, we observed an increase in peer-reviewed papers on laparoscopic liver surgery evaluating surgical and oncological results of both wedge and major resections [11–13]. However, to the best of our knowledge, no studies assessing HR-QoL after laparoscopic liver surgery are reported. Also, no study has compared HR-QoL between laparoscopic and open liver surgery for benign lesions only [14, 15]. The presence of many confounding factors determining HR-QoL in patients with neoplastic disease (life expectancy, perception of the disease, need for adjuvant therapies, risk of recurrence, and/or distant metastases) makes it difficult to compare HR-QoL after surgery between such patients and those with benign lesions. We therefore evaluated patients with benign disease only, showing better HR-QoL in such patients undergoing laparoscopic versus those undergoing open surgery in the first year after surgery.

Many previous reports demonstrate that laparoscopic liver surgery is a safe procedure for benign disease [11, 13–17], but indications should not exceed those for an open approach [7]. The Louisville Statement established that indications for surgical treatment of benign hepatic lesions

Table 3 complications according to the Clavien classification

	Group A (lap) *N*: 29	Group B (open) *N*: 46	Total *N*: 75	*p* (Chi square test)
Grade I	1	3	4	
Grade II	1	4	5	
Grade IIIa	1	2	3	
Grade IIIb	1	4	5	
Grade IV	0	0	0	
Grade V	0	1	1	
Total	4 (13.8 %)	14 (30.4 %)	18 (24 %)	0.05

Table 4 Causes of drop out

	Group A (lap)	Group B (open)	Tot
Drop out			
Death		2	2
Not available		4	4
Refused	1	1	3

Table 5 Surgical results in the two groups

	Group A (lap) ($n = 29$)	SD	Group B (open) ($n = 46$)	SD	*p*
Length of hospital stay (days)	4.7	2.54	8.2	3.96	0.0002*
Operating time (mins)	254	135.86	280	128.62	–
Pringle maneuver (n of pts)	3		5		–
Mean duration of Pringle (mins)	26	8.48	22.5	11.9	–
Bowel movements (days p.o.)	II	0.48	II	0.87	0.003*
Oral intake (days p.o.)	II	0.72	III	1.2	0.02*
Transfused patients (*n*)	2		8		0.1§
Conversion	5				–
Morbidity	4		14		0.06§

* *p* value: *t* Student test

§ *p* value: χ^2 test

Table 6 results of SF-36 at 6 and 12 months after surgery

Group	M	SD	MD	PD	*p* value*
SF-36 at 6 months after surgery [group A (lap): $n = 28$; group B (open): $n = 38$]					
PF					
A	93.33	12.34	15.71	20.25 %	0.05
B	77.62	14.63			
BP					
A	96.73	12.65	26.50	37.74 %	0.04
B	70.23	13.35			
SF-36 at 1 year after surgery [group A (lap): $n = 28$; group B (open): $n = 38$]					
PF					
A	93.33	12.34	−5.67	−5.72 %	0.05
B	99.00	2.07			

M mean, *SD* standard deviation, *MD* mean difference, *PD* percentage difference

* *t* Student test

Table 7 Results of SF-36 at 1 month after surgery with "converted" patients in group B

Group	M	SD	MD	PD	*p* value*
SF-36 at 1 month after surgery [group A (lap): $n = 23$; group B (open): $n = 43$]					
PF					
A	87.43	20.80	18.83	27 %	0.02
B	68.60	25.31			
BP					
A	95.07	25.22	19.15	29 %	0.05
B	65.92	30.35			

M mean, *SD* standard deviation, *MD* mean difference, *PD* percentage difference

* *t* Student test

should not be widened simply because they are laparoscopically feasible [7, 18]. Therefore, in such patients, when the indication for surgical treatment is almost exclusively based on subjective symptoms, risk of potential malignant transformation, or a sharp increase in lesion volume in a 6-month observation period, HR-QoL should be one parameter by which to evaluate treatment efficacy. Our results confirm that the laparoscopic approach compared with open surgery leads to reduced hospital stay (4.7 ± 2.54 vs. 8.2 ± 2.96 days; *p* 0.0002), less postoperative pain, and lower morbidity rate [4 (13.8 %) vs. 14 (30.4 %) patients; *p* 0.05].

Kamphues et al. found that QoL in patients operated for symptomatic liver cyst improves after surgery, but he used a cancer-related QoL score without comparing laparoscopic and open approaches [19]. Moreover, patients with benign diseases generally undergo "minor" liver surgery with a lower rate of

complications; therefore, HR-QoL results are more easily comparable than in patients with major liver resections, which have a higher conversion rate [14]. Some studies show that laparoscopic hepatic surgery is a cost-saving procedure: US$1,527–2,939 more cost efficient per patient compared with the open technique. Also, according to the Clavien classification, laparoscopic surgery results in a statistically significant lower morbidity rate than traditional approach [5, 20]. The majority of patients undergoing laparoscopic treatment had a relatively unremarkable postoperative course, with 38 of 44 patients (86 %) experiencing no or very minimal (grade I) postoperative complications [5]. Moreover, laparoscopic liver surgery had a lower rate of hospital readmission after surgery. Gustafson et al. showed that 30-day hospital readmission rates for surgery-related complications were higher, even though not significantly, in patients who underwent open liver surgery compared with those treated laparoscopically (9 of 49 vs. 2 of 27, p 0.20) [21]. Furthermore, 1-year hospital readmission rates due to surgical complications were significantly lower in the laparoscopic group (4 of 27 vs.19 of 49, p 0.002) [21]. However, for surgical treatment of liver metastases, no differences in length of hospital stay between laparoscopic and open surgery were observed [21].

It is difficult to study the costs of a surgical procedure because many parameters, such as patient time off work, drug use for pain at home, need for new outpatient access, and autonomy in daily activities are not easily evaluable. A better HR-QoL, especially in the first year after surgery, may influence directly and indirectly the cost of a surgical procedure. No reported studies, however, examine the impact of postoperative HR-QoL in relation to cost savings, earlier perception of good health, faster return to work primarily in patients operated for subjective symptoms rather than in those with cancer.

In our study, patients in group A began oral intake earlier than those in group B (2 ± 1.2 vs. 3 ± 0.72 days postoperatively; p 0.02). At 1 month after surgery, group A patients showed better HR-QoL PF. This observation is more evidently confirmed when considering patients converted to the open approach (Table 7), with a better PF score in the laparoscopic group. The fact that HR-QoL after 1 month was better in the laparoscopic group confirms that the surgical approach and not the underlying disease or type of resection influences postsurgical QoL.

Statistical power of this study is surely limited by its retrospective design and may have led to selection bias as to how patients were chosen for laparoscopic or open surgery, as well as the number of major resections in the open group (2 vs. 22, respectively). However, 13 of the 22 major resections in group B were small parenchymal resections due to total substitution of the parenchyma by the cystic lesion. Moreover, although a left sectionectomy extended to segment IV B is not properly a major resection we consider the two patients who received this operation (one in group A and one in group B, Table 2) as "major resection" because this type of resection is a different and more difficult technical approach for laparoscopic resection compared to a "simple" left sectionectomy. Therefore, actual major resections in the open group were 8 of 46 (17.4 %) vs. 2 of 29 (6.8 %) in the laparoscopic group. However, in group B patients available for HR-QoL assessment, no significant reduction in median liver volume after major resection was observed (11.8 %; range: 8–25 %). Moreover, median lesion diameter was similar between groups (Table 2), and the decision to perform laparoscopic versus open procedures was based on lesion location according to the Louisville Statement [7] and not on lesion dimensions. Also, in group B, the majority of lesions were located in segments 7, 8, or both compared with group A in which were located in the anterior segments (Figs. 1, 2). Liver function was not impaired in any patient in either group, so the better HR-QoL observed in the laparoscopic group should be related only to surgical approach and not the type or resection.

Many authors argue that, when suitable and in experienced centers, the laparoscopic approach should be preferred to open surgery [1–5, 7, 22]; similarly, we opted for laparoscopic treatment in all cases in which we consider this approach appropriate, reserving the open approach for patients with contraindications to laparoscopic surgery. Six months after surgery, we observed better results in group A, confirming that HR-QoL was related to the surgical approach. Twelve months after surgery, there were no differences between groups, even when considering patients converted from group A to group B.

Assessing HR-QoL is a complex procedure. For surgical patients, it depends on disease perception and the need for other postoperative treatment, which influence all evaluations. Our study shows that symptomatic patients with polycystic disease have better HR-QoL after surgery not only when comparing the two groups but even within each group when comparing different diseases. The resolution of abdominal syndrome (dyspepsia, mass syndrome) produces a better HR-QoL compared with patients who undergo surgery for asymptomatic lesions at risk for hemorrhage, neoplastic transformation, or lesion size and/or sharp volume increase. Thus, improvement in HR-QoL after surgery is more evident in group A. Moreover, patients with polycystic disease are frequently reoperated, and a laparoscopic approach is preferred in order to avoid adhesions.

It is clear that persistent symptoms after surgery influence the health perception of patients after surgery. Approximately 25 % of patients [23] who undergo surgery for symptomatic benign liver lesions remain symptomatic even after surgery. We observed similar data for both groups in our study; therefore, a minimally invasive approach is preferred in order to avoid other symptomatic conditions related to laparotomy.

The better HR-QoL we observed in our patients for the first year after surgery shows that laparoscopic approach can reduce direct and indirect treatment costs of patients with benign liver lesions allow faster recovery after surgery.

In conclusion, our experience shows that surgical treatment of benign liver lesions, when correctly indicated, should be laparoscopic. This approach, with its advantages (shorter hospital stay, less morbidity), results in better HR-QoL early after surgery and the first year and the subsequently better QoL associated with lower direct and indirect costs.

Conflict of interest None.

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