Twenty-four consecutive laparoscopic hepatectomies in a tertiary care center

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ABSTRACT

Introduction. With the advances in minimally invasive surgery, laparoscopic hepatectomy has shown to be an interesting alternative in liver surgery. Laparoscopic liver resection presents many advantages over an open surgery approach.

Objective. To evaluate early and late results of laparoscopic hepatectomies in a tertiary hospital.

Methods. Authors reported on a series of twenty-four patients who underwent laparoscopic hepatectomy performed by a single surgical team at Santa Lucia Hospital, Brasília, Brazil, from June 2007 to January 2012.

Results. The median age was 53 years (range: 21-71 years). There were thirteen women and eleven men. Thirteen patients presented with benign lesions, while eleven patients had malignant lesions. The mean lesion size was 4.96 cm. There were six major hepatectomy procedures and eighteen minor hepatectomy procedures. The mean duration of operation was 205 minutes (range: 90-360 minutes). The mean intraoperative blood loss was 300 mL (range: 100-1500 mL). Two patients received transfusion (8%). There was one open conversion. There was no mortality or reoperation. Postoperative morbidity rate was 11% (n = 2). One patient presented lobar pneumonia, while another presented intraoperative bleeding and incisional hernia in the late postoperative period. The median hospital stay was four days (range: 2-11 days). The median time needed for resuming daily activities was 13 days (range: 7-40 days). The median follow-up time was 18 months (range: 6-48 months), and there was only one hepatic recurrence.

Conclusion. Laparoscopic hepatectomy is a safe surgical approach for treating both benign and malignant hepatic lesions. This small series presented no mortality and a low morbidity rate. There was a low hepatic recurrence rate during a long-term follow-up program.

Key words. Laparoscopy; hepatectomy; liver neoplasms; neoplasm metastasis.
RESUMO

Vinte e quatro hepatectomias laparoscópicas consecutivas em hospital terciário.

Introdução. Com a evolução da cirurgia minimamente invasiva, as hepatectomias laparoscópicas têm se mostrado uma alternativa interessante para o cirurgião hepático. Hepatectomia por via laparoscópica apresenta muitas vantagens sobre a abordagem aberta.

Objetivo. Avaliar os resultados preoces (morbidade e mortalidade) e tardios (complicações tardias e recidiva das lesões) das hepatectomias laparoscópicas em hospital terciário.

Método. Os autores relatam uma série de vinte e quatro doentes submetidos à hepatectomia laparoscópica por uma única equipe cirúrgica do Hospital Santa Lúcia, Brasília-DF, Brasil, entre junho de 2007 e janeiro de 2012.

Resultados. A mediana de idade foi 53 anos (variou de 21 a 71 anos). Foram treze mulheres e onze homens. Treze doentes tinham lesão hepática benigna, enquanto onze tinham lesões malignas. A média do tamanho das lesões foi 4,96 cm. Foram seis hepatectomias maiores e dezoito hepatectomias menores. A média de tempo cirúrgico foi 205 minutos (variação de 90 a 360 minutos). A média de sangramento intraoperatório foi 300 mL (variação de 100 a 1.500 mL). Dois doentes foram transfundidos. Houve uma conversão. Não houve mortalidade, e nenhum doente foi reoperado. A morbidade pós-operatória foi 8% (n = 2). Um doente apresentou pneumonia lobar, enquanto outro apresentou hemorragia intraoperatória e hérnia incisional nos pós-operatório tardio. A mediana de internação foi 4 dias (variação de 2 a 11 dias). A mediana de retorno às atividades cotidianas foi 13 dias (variação de 7 a 40 dias). A mediana de seguimento foi 18 meses (variação de 4 a 38 meses), e houve apenas uma recidiva de lesão hepática.

Conclusão. A hepatectomia laparoscópica representa um método cirúrgico seguro de tratamento para lesões hepáticas. Esta pequena série apresentou mortalidade nula e baixa morbidade. Houve baixa recorrência de lesão em longo prazo.

Palavras-chave. Laparoscopia; hepatectomia; neoplasias hepáticas; metástase neoplásica.

INTRODUCTION

Since the performance of the first laparoscopic hepatectomy in 1992 by Gagner et al., this approach has become the treatment of choice for hepatic tumors in reference centers. Azagra et al. performed the first anatomical laparoscopy, which consisted of a successful left lateral sectionectomy or sectionectomy (segments II-III) in a patient with hepatic adenoma of segments II and III. Laparoscopic hepatectomy should be used as a last resource in laparoscopic surgery due to the anatomical complexity of this surgical approach and the lack of surgeons with experience in both laparoscopy and hepatic surgery. In general, like other laparoscopic procedures, laparoscopic hepatectomy presents many advantages over an open approach. Some of its advantages are less postoperative pain, early mobilization, minimal ileus, earlier resumption of oral intake, and shorter hospital stay. At, first, minor hepatectomy for superficial lesions was performed with great confidence. Nonetheless, the advances in laparoscopic instruments and hepatic transection devices as well as greater experience in complex laparoscopic hepatobiliary resections have allowed the use of both right and left major laparoscopic hepatic resection to increase.

Recently, laparoscopic hepatectomy has been performed with both minimal morbidity and no mortality in reference centers. In recent years, some authors have taken the view that laparoscopic hepatectomy should be the preferred approach in cases of both benign and malignant hepatic lesions. Even difficult-to-access lesions in the right hepatic lobe may be resectable with great confidence by the laparoscopic route, with low conversion and morbidity rates. Thus, laparoscopic hepatectomy has started a new era in minimally invasive hepatobiliary surgery. It has been established that, for specific patients and when performed by a team with expertise in both hepatic and advanced laparoscopic surgery, laparoscopic hepatectomy is safe and presents results identical to those obtained with open operations. In Brazil, however, there have been only some anecdotal case reports, and few small series have been reported. Machado et al. and Pais-Costa...
et al.\textsuperscript{27,28} showed that laparoscopic hepatectomy was effective, with good results regarding either malignant or benign hepatic lesions.

The aim of this study was to describe both the short and long-term results of laparoscopic hepatectomies to treat benign and malignant liver diseases, performed by a single surgical team in a private reference hospital in Brasília, Brazil.

METHODS

Between June 2007 and January 2012, 24 consecutive laparoscopic hepatectomies were done at Santa Lucia Hospital, Brasília, Brazil. All resections were performed by a single surgical team. The indications for laparoscopic resection of benign liver tumors were the following: preoperative diagnosis of hepatic adenoma with 5 cm or more in diameter; cystadenoma; uncertain diagnosis based on imaging or biopsy findings; and presence of symptoms. The laparoscopic approach was chosen because of the size and location of the lesions. Large tumors, tumors close to major vascular structures, and tumors located in central positions were excluded from this sample.

Liver resections were defined in accordance with the International Hepato-Pancreato-Biliary Association (IHPBA) terminology, derived from the Couinaud classification. Subsequently, major hepatectomy was defined as resection of three or more segments. Ultrasonography, computed tomography, and magnetic resonance were performed on all patients. When the radiological diagnosis was uncertain, liver biopsy was performed by the percutaneous route. Radio-guided percutaneous drainage was tried to treat all diagnosed hepatic abscesses.

The surgical technique for laparoscopic hepatic resection was determined case by case, in accordance with previously described technical principles.\textsuperscript{6,7,18,20-23,27} In general, the procedures were performed with carbon-dioxide-pressure control over the pneumoperitoneum, with a positive pressure of 12 mmHg. A 30-degree laparoscope was used with four or five port sites, depending on the case and in accordance with the surgeon’s preference and location of the lesion.

Either intra-hepatic Glissonian approach (Figures 1 and 2) or extra-hepatic Glissonian approach (laparoscopic dissection of both hepatic pedicles and the major biliary tree) was performed in accordance with the surgeon’s choice. Liver transection was preferably performed.
using Ligasure Device (10 mm size, Covidien, US), as shown in Figure 3. More rarely, in two cases of this series, liver transection was done by Ultracision shears (Ethicon-Endosurgery, US). Small vascular or biliary ducts were sealed using ultrasonic devices, while major structures were sealed using metal clips or Hemo-o-lock clips. Portal pedicles and hepatic veins were divided using a linear stapler (Endogia – 30 or 45 mm – vascular type), in accordance with Gumbs et al.13 Except for two cases in which the patients presented an abdominal incision due to previous open surgery (one case of right subcostal and one case of median laparotomy), the surgical specimen was resected by means of a Pfannenstiel incision. The surgical specimen was moved into a plastic bag or glove. Abdominal drainage was generally not performed. When necessary, suction drains were used (in three cases).

Figure 3. Right hemi-hepatectomy – transection of hepatic parenchyma with Ligasure 10 mm

RESULTS

Thirteen laparoscopic hepatectomy procedures were performed to treat benign hepatic lesions, while eleven were performed because of malignant lesions. There were thirteen women and eleven men. The median age was 53 (range: 21-71 years). Fifteen patients presented solitary lesions, while nine presented multiple lesions. The right hepatic lobe was compromised in thirteen cases, while the left hepatic lobe was compromised in eleven cases. Only two patients presented bilateral lesions (both malignant). The etiology of the lesions were adenoma (n = 4), metastasis (n = 9), hepatocellular carcinoma (n = 2), focal nodular hyperplasia (n = 4), hepatic abscess (n = 2), hemangioma (n = 2), and biliary cystadenoma (n = 1). The main symptoms were pain (n = 10), palpable mass (n = 8), discomfort (n = 7), and early satiety (n = 6). The lesion diameter ranged from 1.8 to 12 cm (mean: 4.96 cm).

All patients underwent preoperative radiological investigations through abdominal ultrasound, computed tomography, and nuclear magnetic resonance. These examinations showed that twenty-one patients presented a solid liver tumor (87.5%), while three patients presented a cystic lesion (12.5%). For malignant lesions, PET-Scan was also performed. The tumor markers carcinoembryonic antigen, alpha-fetoprotein, and carbohydrate antigen (CA 19.9) were assayed in all cases. Eight of the twenty-four patients underwent tumor biopsy (by the percutaneous route in six cases, by laparoscopy in two cases). In this series, tumor biopsy allowed us to obtain a certain diagnosis in four cases (50%, i.e. four out of eight biopsies).

In twelve patients, the surgical indication was malignant or premalignant disease. There were two cases of hepatocellular carcinoma, three of non-colorectal non-neuroendocrine metastasis, six of colorectal cancer liver metastasis, and one of hepatic cystadenoma. In the non-colorectal non-neuroendocrine metastasis group, the primary origin was the following: kidney = 1, small intestine = 1, pelvic soft tissue sarcoma =1. In the other twelve patients with benign disease, the most common indications were the following: presence of symptoms, hepatic adenoma (diameter > 5 cm), uncertain preoperative diagnosis, or failure of percutaneous treatment of hepatic abscesses.

Among the benign solid tumors (n = 10), preoperative typical features of hepatic adenoma,
focal nodular hyperplasia, and hemangioma were found in almost all of these patients (n = 8). Eight of them presented symptoms such as pain and discomfort. One case presented multiple adenomatosis with three lesions. This patient reported abusive use of anabolic steroids. Uncertain diagnoses were the surgical indication in the case of two patients (focal nodular hyperplasia = 1 and hemangioma = 1). Histological examination confirmed the preoperative diagnosis in all these patients. One case of focal nodular hyperplasia was diagnosed preoperatively, while three cases presented atypical radiological findings. The indication for liver resection in these patients was an uncertain diagnosis (differential diagnosis with hepatocellular carcinoma) in one case and right upper quadrant pain due to a bulky hanging tumor located in the V hepatic segment in the other case. Both cases of hepatic abscesses had been previously unsuccessfully treated by percutaneous drainage. Subsequently, laparoscopic hepatectomy was performed because both lesions presented central locations within the hepatic lobe, with partial destruction of the adjacent liver parenchyma. Two patients who presented bilateral metastasis successfully underwent “two-stage” laparoscopic hepatectomy.

The laparoscopic procedure was completed in 23 patients (95%). One patient who presented a giant hemangioma (10 cm) underwent open conversion due to massive intraoperative bleeding. There were six major hepatectomy procedures and eighteen minor hepatectomy procedures (Figure 5). The distribution of hepatectomies were as follows: right hepatectomy (n = 2), left hepatectomy (n = 4), lateral left segmentectomy or bisegmentectomy II-III (n = 6), right posterior sectionectomy or bisegmentectomy VI-VII (n = 8), bisegmentectomy V-VI (n=1), monosegmentectomy V (n = 2), and monosegmentectomy VI (n = 1). The surgical features of the hepatectomies are shown in Table 1. Twenty hepatic resections were performed by an intra-hepatic Glissonian approach, while four hepatectomies (all of them major hepatectomies) were done through an extra-hepatic Glissonian approach (with dissection of both main hepatic pedicles and the major biliary tree). Two patients required postoperative blood transfusions. Three patients underwent surgical drainage of the liver bed using suction drains. The drains were taken out on the fourth or fifth postoperative day. There was no gas embolism in this series.

Table 1. Surgical features

<table>
<thead>
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<th>RESULTS</th>
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<tr>
<td>Vascular clamping – n (%)</td>
<td>1 (18)</td>
</tr>
<tr>
<td>Intraoperative blood loss – mean (range)</td>
<td>300 mL (100-1500)</td>
</tr>
<tr>
<td>Blood transfusion – n (%)</td>
<td>2 (18)</td>
</tr>
<tr>
<td>Duration of surgery – mean (range)</td>
<td>240 min (90-360)</td>
</tr>
<tr>
<td>Weight of the specimen – mean (range)</td>
<td>285 g (57-1040)</td>
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</tbody>
</table>

n = number of patients

The mean duration of the operation was 205 minutes. For the initial cases (n = 5), the mean duration of the operation was greater than in the subsequent operations (257 versus 197 min). However, most of the major hepatectomy procedures (80%) were performed in the later cases. There was no mortality in this series. Postoperative complications occurred in two patients who underwent one right hemi-hepatectomy and one left hemi-hepatectomy (8%) (Table 2). One patient presented infectious left lobar pneumonia, which was treated with antibiotics. Another patient presented intraoperative bleeding and underwent open conversion. This patient presented incisional hernia at the postoperative period, which was laparoscopically treated. There was neither biliary leakage nor hepatic insufficiency. There was no reoperation in this series. Oral intake was resumed on the first postoperative day in all but one patient who underwent open conversion. The median hospital stay was four days (range: 2-11 days). All patients but one used low doses of common analgesics such as dipyrone during the postoperative course. One patient used narcotic analgesia during the postoperative course. The median time needed for the patients to return to their
daily activities was 13 days (range: 7-40 days). Characteristics of the postoperative course are shown in Table 2.

Table 2. Postoperative course

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<th>RESULTS</th>
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<tr>
<td>Morbidity – n (%)</td>
<td>2 (11)</td>
</tr>
<tr>
<td>Reoperation – n (%)</td>
<td>0</td>
</tr>
<tr>
<td>Specific liver resection complications* – n (%)</td>
<td>1 (5.5)</td>
</tr>
<tr>
<td>Nonspecific complications – n (%)</td>
<td>1 (5.5)†</td>
</tr>
<tr>
<td>Mortality – n (%)</td>
<td>0</td>
</tr>
<tr>
<td>Hospital stay – median (range)</td>
<td>4 d (2-11)</td>
</tr>
<tr>
<td>Return of normal activities – median (range)</td>
<td>13 d (7-30)</td>
</tr>
<tr>
<td>Oral intake (hours)</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>10 (52)</td>
</tr>
<tr>
<td>12</td>
<td>4 (23)</td>
</tr>
<tr>
<td>24</td>
<td>3 (17)</td>
</tr>
<tr>
<td>&gt; 24</td>
<td>1 (7)</td>
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</table>

*Intraoperative bleeding. †lobar pneumonia.

The mean follow-up time in this series was 24 months (median: 18 months; range: 4-39 months). All the symptomatic patients achieved complete symptom relief. Among the cancer patients, all but one patient with non-coelectoral non-neuroendocrine metastasis (adenocarcinoma of the small intestine) did not experience recurrence. All of them present good quality of life.

DISCUSSION

Laparoscopic hepatectomy is an advance in the continuing development of minimally invasive surgery in general and laparoscopic liver surgery in particular. Advances in expertise related to laparoscopic procedures, ongoing technological advances in laparoscopic devices, and increased patient awareness of the availability of these techniques have created growing interest in the application of these techniques to laparoscopic hepatectomy.\(^\text{16}\) The surgical skills required for laparoscopic hepatectomy have evolved in parallel with the adaptation of laparoscopic techniques to procedures in hepatectomy. Hilar dissection, biliary or vascular repair, mobilization of the liver, and transection of the parenchyma are more technically demanding and potentially more dangerous than other laparoscopic procedures that have been previously reported. Anatomical hemi-hepatectomy requires a clear understanding of general liver anatomy, experience in advanced hepatobiliary surgery, and, additionally, the ability to dissect major vascular and biliary structures using a laparoscopic approach.\(^\text{10,14,16, 23}\)

Despite the various obstacles and challenges, laparoscopic hepatectomy presents great advantages over open hepatectomy. The major advantages of laparoscopic hepatectomy are those of all laparoscopic surgical procedures. Laparoscopic hepatectomy causes less tissue damage, and this has been associated with lower levels of postoperative pain, fewer peritoneal adhesions, shorter hospital stay, and an earlier return to daily activities.\(^\text{3,4,7,11}\) Moreover, two recently published case-control studies\(^\text{16,17}\) and one cohort study\(^\text{5}\) have shown that laparoscopic hepatectomy provided lower blood loss, reduced morbidity, fewer overall operative complications and, especially with regard to malignant disease, no significant difference either in tumor recurrence or in long-term survival.\(^\text{15,16,17,29,30}\) Furthermore, the cosmetic advantages are excellent when laparoscopic hepatectomy is performed. It is particularly important when performed to treat benign disease.\(^\text{3,14,24}\) Earlier resumption of oral intake is also a great advantage, considering that hepatectomy is a major surgical procedure. For these reasons, the laparoscopic approach should be taken into account in the management of both benign and malignant liver disease.\(^\text{4,5,8,12,16,17,23}\)

According to some authors,\(^\text{3,11,14,17,23}\) the use of the laparoscopic route should not modify or broaden the indications for either benign or malignant liver disease. The same principles applied to open
hepatic surgery must be respected. Therefore, especially in the case of benign disease, it should be reserved for symptomatic lesions, specific complications or even uncertain diagnosis (differential with primary or metastatic neoplasms). Patients should be offered more liberal surgical resection, especially for hepatic adenoma, because of the high risk of rupture and malignant degeneration.  

Despite the initial skepticism about the use of laparoscopic hepatectomy to treat malignant neoplasms, it is nowadays frequently performed, since this procedure is secure and effective. Some authors have taken the view that laparoscopic hepatectomy is as safe as conventional open hepatectomy.

For left lesions, some authors have considered laparoscopic hepatectomy to be the initial approach in reference centers, performed by surgeons with high levels of expertise. Campos et al. recently published a single series of left laparoscopic resections in which the clear advantages of the laparoscopic approach were observed. More recently, in a cohort study that compared laparoscopy and open left lateral segmentectomy, Carswell et al. observed that laparoscopy was superior because there is less need for postoperative opiate analgesia and because postoperative hospital stay is shorter. In this study, it was observed that there was no use of opiates and none of the patients presented complications on the third postoperative day, especially regarding left lateral segmentectomy procedures. It was also observed in this series that the results were similar, without postoperative opiate administration, for all but one patient who underwent open conversion (left hemi-hepatectomy for giant hemangioma). With especial regard to left resections, only one patient presented complications (intraoperative bleeding and incisional hernia). In Brazil, we had previously reported the safety of the left lateral segmentectomy by an intrahepatic approach for treating left side lesions in the liver. In a series of 78 patients, Zhang et al. observed totally successful laparoscopic liver resections, with no conversion to open procedures and only four patients receiving transfusions. In this series, there was one perioperative complication (intraoperative bleeding), and only two patients received transfusions (in a case of major right hepatectomy due to a large cystadenoma of 12 cm in diameter and a case of left hemi-hepatectomy due to giant hemangyoma). Although the rate of conversion to open surgery has ranged from 0 to 15%, it depends on the resection type, experience of the team, and volume of the lesion. The present open conversion rate is similar to that found in the literature.

Although the initial experiences with right liver resection were technically demanding, some authors have taken the view that the laparoscopic approach should be the preferred choice, even for posterior right lesions (segments VI-VII). In this series, despite the fact that it was a small sample, there were more cases of right resections, including two cases of formal right hepatectomy, five cases of posterior right sectionectomy (SVI-VII), two cases of monosegmentectomy of segment V, and one case of segmentectomy of segment VI. The major advantage of laparoscopic hepatectomy for resecting posterior right lesions is that it avoids the large open incision that is generally necessary to access posterior pedicles. Right-side hepatic resections are not only technically more difficult, but also present higher conversion rates than left resections do. Laparoscopic hepatectomy for right lesions can be considered feasible and safe, as Cho et al. have shown in a recent study. For the posterior right sectionectomy in this series, an intra-hepatic approach was preferred, as already described in Brazil by Machado et al. Like Machado’s series, we reported the high efficacy of this technique for treating posterior lesions in the right lobe. This approach avoids large incisions, which tend to cause pain. Moreover, it is safe and may decrease intraoperative bleeding as seen in this study, in which the five patients who underwent posterior right sectionectomy received no transfusions and showed minimal intraoperative bleeding.

In one of the largest series of 300 minimally invasive liver resections, which were compared with open procedures, Koffron et al. observed that the laparoscopic approach was superior to the open
technique. The advantages were related to the duration of the operation, blood loss, transfusion requirement, length of hospital stay, overall operative complications, and local malignant recurrence. These authors concluded that the outcomes from minimally invasive liver resections compared favorably with those from the standard open operation. In a study previously published by the present author on a single series of cases of open hepatectomy due to metastasis (n = 30 cases), in which almost all of the patients were operated by the senior author (Costa SRP), the overall mortality was 3%, while the morbidity rate was 46%. The reoperation rate was 16%, and 44% of the patients received transfusions. The median blood loss was 800 ml. Although it was difficult to compare the outcomes of the laparoscopic series and those of a contemporary open series, given the higher proportion of major hepatic resections (66% vs. 25%) and greater severity of metastatic disease (age, nutritional state, and associated diseases) in the open series, in addition to the lack of a specific statistical test to compare those samples, the laparoscopic series presented some advantages. There was less mortality, morbidity, blood loss, and fewer transfusions and reoperations. In Brazil, a few authors have published studies on laparoscopic hepatectomy. Machado et al. observed both low mortality and zero mortality in laparoscopic hepatectomy procedures performed due to colorectal cancer liver metastasis, and their results were similar to those found in this series. This has also been observed in more recent studies, in which mortality was generally zero, while general morbidity ranged from 0% to 10%. However, with regard to right resections, morbidity is proportionally higher than in left resections, as described by Koffron et al., who suggest that right lesions may be more difficult to treat. Cho et al. observed an overall morbidity rate of 28%, when considering only right liver resections. In this series, there was no reoperation, which differs from what some authors had previously reported. However, major hepatectomy only accounted for 25% (n = 6) of this series, which may have contributed to the low morbidity rate in this study.

To date, with regard to malignant disease, studies have suggested that there is no difference between laparoscopic hepatectomy and open hepatectomy in relation to port-site metastasis, free margins, local-systemic recurrence or even survival rates. However, there have only been a few match-controlled studies, with no ideal level of evidence. Historical series have shown no difference between laparoscopic hepatectomy and open hepatectomy performed on malignant disease. Nevertheless, such findings should be viewed with caution, and new studies need to be conducted in order to answer these unresolved questions.

In conclusion, laparoscopic hepatectomy is a safe surgical approach to treating focal hepatic lesions consisting of either benign or malignant disease. In this small series, both zero mortality and low morbidity were associated with low late tumor recurrence.

REFERENCES


