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Case Report

Intrahepatic Glissonian Approach for Laparoscopic Left Lateral Segmentectomy: Is it Worthwhile? Report on Six Cases

O Acesso Glissoniano Intra-Hepático para Segmentectomia Lateral Esquerda Laparoscópica: Ele Vale a Pena? Relato de Seis Casos Operados

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ABSTRACT

Background: Laparoscopic resection is considered the gold-standard approach for both benign and malignant neoplasms that arise in left hepatic lobe. Laparoscopic left lateral segmentectomy (LLLS) by means of an intrahepatic approach has emerged as an interesting alternative because it is fast and easy to perform and is associated with infrequent intraoperative bleeding. **Aim:** To report on a series of six patients who underwent LLLS by means of an intrahepatic Glissonian approach (IHGA) performed by a single surgical team at Santa Lucia Hospital, Brasilia, Federal District, Brazil. **Patients and Methods:** Six patients underwent LLLS between January 2009 and June 2011. The median age was 41 (range: 21 to 53 years). There were four women and two men. The etiologies of the lesions were: focal nodular hyperplasia (n=2), giant hemangioma (n=1) and metastasis (n=3). The mean lesion diameter was 4.6 cm (range 1.8 - 12 cm). **Results:** The mean duration of the procedure was 140 minutes (range 100-200 minutes). Mean intraoperative blood loss was 150 ml (range 50-600 ml). There was no mortality and the morbidity rate was 15%. The median hospital stay was three days (range 2-7 days). The median length of time taken to return to day-to-day activities was 12 days (range 7-30 days). **Conclusion**: LLLS by means of an intrahepatic Glissonian approach (IHGA) should be considered to be a good option for treating hepatic tumors located in the left hepatic lobe. This approach provides a safe and fast option that avoids large blood loss.

Key words: Laparoscopy. Hepatectomy. Liver neoplasms/surgery. Neoplastic metastasis.

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INTRODUCTION

The first successful laparoscopic anatomic hepatectomy was reported by Azagra et al in 1996.[1] It consisted of left lateral segmentectomy (segments II-III) by means of laparoscopy in a patient with a benign adenoma of the left hepatic lobe. After this initial procedure, laparoscopic left lateral segmentectomy (LLLS) became the mainstay for treating neoplasms located in the left hepatic lobe.[2-5,10] When performed by liver surgeons skilled in laparoscopic procedures, LLLS offers several advantages over open left lateral segmentectomy (OLLS).[2-5,10,11] Although no randomized trials have been conducted to compare LLLS with OLLS, case-controlled or cohort series have favored LLLS over OLLS in several aspects.[3,4,10] The main advantages are less postoperative pain, less use of opiate analgesia, better cosmetic results, decreased blood loss, and a shorter postoperative hospital stay.[3,4,10] With advances in laparoscopic instruments such as parenchyma transection devices, staplers and hand-assisted equipment, together with improved experience in laparoscopic liver resections, there has been increasing use of LLLS, especially in tertiary referral centers.[2-5,10] Many skilled surgeons at referral centers for laparoscopic liver resection consider LLLS to be their treatment of choice for left lobe lesions.[2,3,5] LLLS is a parenchyma-sparing procedure that can be used to treat hepatic neoplasms. Although LLLS was initially

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performed for treating benign lesions, this technique has recently also been used for treating malignant neoplasms. LLLS is an alternative of interest, compared with formal left hemihepatectomy, because when LLLS is indicated in selected cases, this leads to greater preservation of the remaining liver without comprising oncologic principles.[2-7,10,11] This is very important in the treatment of liver metastasis, because there is a high risk of hepatic recurrence after the first hepatic resection. Many patients with liver metastasis may require a second hepatectomy if recurrence occurs. Sparing or preserving hepatectomy may aid in cases in which a second resection becomes necessary, because there will be sufficient parenchymal liver for the subsequent hepatectomy, thereby avoiding postoperative liver failure.[7-14] Furthermore, since hepatocellular carcinoma (HCC) frequently arises in cases of cirrhotic liver, a more conservative procedure is also attractive since it avoids postoperative liver failure.[8-13] Classic LLLS by means of an anterior approach has generally been performed using a Pringle maneuver associated with formal hepatic transection, by means of ultrasonic devices or staplers.[2-6,10] Nevertheless, laparoscopic resection of the left liver segments using an intrahepatic Glissonian approach (IHGA), described recently in Brazil by Machado et al,[11] seems to be a very good option for accessing the left hepatic pedicle. IHGA may be safely used for performing LLLS without vascular hilar clamping. The main advantages of IHGA over the "classic procedure" are that it is faster and safer, with less bleeding. Machado et al.[11] showed that using IHGA when performing LLLS was an effective technique with good outcomes in Brazil. To our knowledge, there have not been any other reported studies using IHGA.

The aim of this study was to describe a small series of LLLS cases performed using an intrahepatic Glissonian approach. The six cases were performed by single surgical team responsible for treating liver neoplasms at a referral hospital in Brasilia, Brazil.

PATIENTS AND METHODS

Between January 2009 and June 2011, six LLLS procedures were carried out at Santa Lucia Hospital, in Brasilia, Brazil. All of the resections were performed by a single surgical team. Three of them were performed for benign hepatic lesions and the other three were for malignant lesions. The indications for laparoscopic resection of the benign liver tumors were symptomatic focal nodular hyperplasia (FNH) or hepatic hemangioma (HH). The primary site of the metastatic lesion was colorectal in one case and non-colorectal in two cases (kidney and small intestine). The surgical team considered the laparoscopic approach to be the approach of choice. For treating left lobe lesions, LLLS was chosen whenever possible (independent of tumor size or location). Abdominal ultrasonography, computed tomography and magnetic resonance imaging were obtained for all six patients. For malignant lesions, a PET-scan was also carried out. Assays for the tumor markers CEA, AFP and CA-19.9 were performed in all cases.

The surgical technique for LLLS using an intrahepatic Glissonian approach (IHGA) was based on technical principles described by Machado et al.[11] In general, the procedures were performed under pressured-controlled pneumoperitoneum using carbon dioxide, maintained at a positive pressure of 12-14 mmHg. A 30-degree optic laparoscope was used. Four or five port sites were used, depending on the case, and in accordance with the surgeon's preference and the intraoperative findings (Figure 1). After thorough inspection of the abdominal cavity, the liver was evaluated followed by identification of the lesion (Figure 2). A harmonic scalpel (Ultracision; Ethicon Endosurgery, USA) and a bipolar coagulator (Ligasure 10 mm; Covidien, USA) were used to perform the liver transection. Small vessels and biliary ducts were sealed using these devices, while major structures were sealed using metal clips. Major portal pedicles

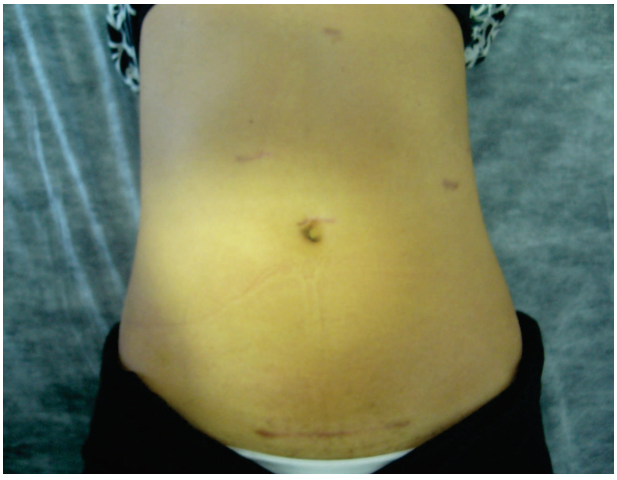

Figure 1 – *Port-site positiosn for LLLS and Pfannenstiel incision. (Late appearance: two months after the operation).*

and hepatic veins were divided using a linear stapler (Endogia – 30 or 45 mm – vascular type), as described by Machado et al.[11]

The principal techniques were standardized and identical in all of the operations. First, the pedicle of segments II and III was located by means of two small hepatotomy procedures (Figure 3), using the round ligament between segments II-III and the Arantius ligament (*ligamentum venosum*) as landmarks. The pedicle was clamped to demarcate the ischemic zone of the left lateral hepatic sector; demarcation of the ischemic zone just observed was performed quickly. After identifying the left lateral pedicle, Endogia vascular-type stapling was performed in order to section the hepatic parenchyma using a Ligasure 10 mm bipolar coagulator (five cases) or an Ultracision harmonic scalpel (one case). Finally, the left hepatic vein was sectioned using a vascular stapler, to complete the LLLS. All of the procedures, except one, were performed without the Pringle maneuver. The surgical specimen was placed into a plastic bag (Endobag) or gloves, which was then closed. The closed surgical specimen was removed by means of a Pfannenstiel incision or median mini-laparotomy. Abdominal drainage was generally not performed. Suction drains were used in only one case, the first.

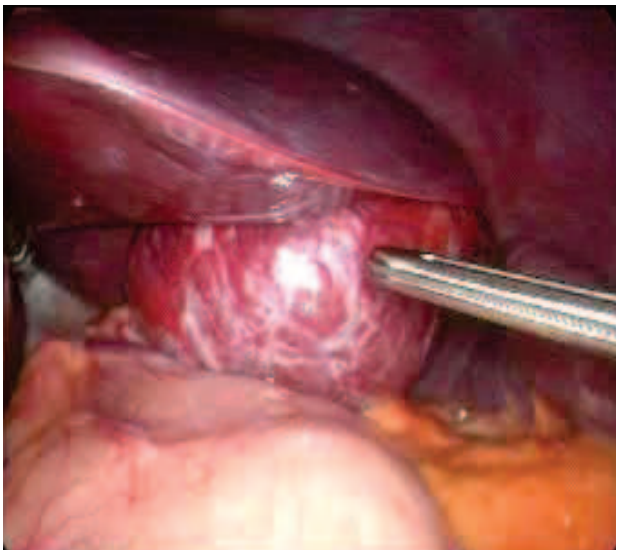

Figure 2 – *Liver evaluation - large Focal Nodular Hyperplasia (FNH) in the left hepatic lobe (segments II-III).*

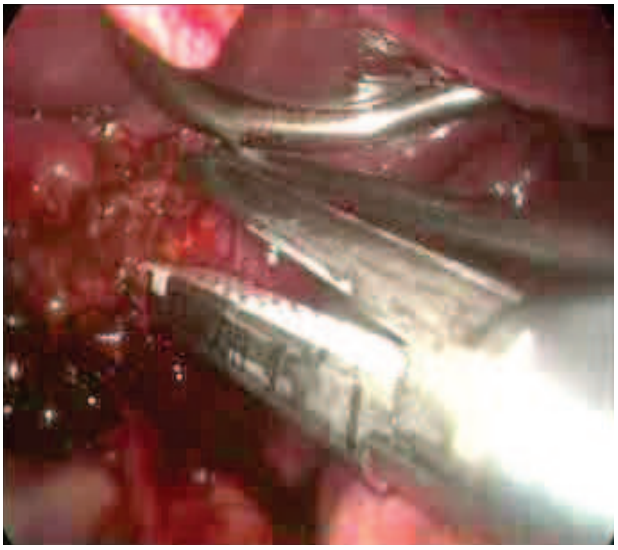

Figure 3 – *Intrahepatic Glissonian approach – Sectioning through hilar structures by means of vascular stapler (after two hepatotomy procedures).*

RESULTS

The characteristics of the six patients are shown in table 1. Preoperative imaging suggested a solid liver tumor in all six cases One patient underwent intraoperative frozen-section biopsy because the preoperative differential diagnosis included hepatocellular carcinoma; FNH was diagnosed in this case. For the patients with metastasis, the diagnosis was only confirmed through postoperative biopsy of the surgical specimen. Among the cases of benign tumors, typical features of HH and FNH were found preoperatively in two patients. All presented symptoms such as pain and discomfort. One patient had two foci of FNH. Histological examination confirmed the preoperative presumptive diagnosis in these patients.

The laparoscopic procedure was completed in five patients. There was one (15%) open conversion in this series, in the patient who had a giant (12 cm) hemangioma. The specific reason for the conversion was severe intraoperative bleeding. Five of the procedures were performed without vascular clamping (Pringle maneuver), while the open conversion case required total vascular exclusion of the liver in order to control the bleeding. In this case, a right subcostal incision was made to achieve hepatic vascular control.

Blood loss ranged from 50 to 600 ml (median 150 ml). The mean duration of the operation was 140 minutes (range 100-200 minutes). The most time-consuming operation in this series was the hepatic section using a harmonic scalpel (Ultracision, Ethicon Endosurgery, USA). The details of the hepatectomy procedures are presented in table 2.

There were no deaths in this series. There was one case of a late postoperative complication

Table 1 – *Patient Characteristics.*

Case	Gender	Age	Type of Neoplasm	Number	Diameter of largest lesion (cm)	ASA
1	female	58	FNH	1	6	1
2	female	23	FNH	2	12	1
3	male	50	CRM	3	3	2
4	female	41	NCRM (adenocarcinoma of the small bowel)	2	3	1
5	female	54	NCRM (kidney)	2	3	1
6	male	48	Hemangioma	1	12	1

FNH – Focal Nodular Hyperplasia, CRM – Colorectal metastasis, NCRM – Non-colorectal metastasis, ASA – American Society of Anesthesiologists.

(incisional hernia), which was also corrected by means of a laparoscopic procedure. Major postoperative morbidity occurred in 15%. The patient who underwent open conversion required postoperative blood transfusions (two packets of red corpuscles). There was no gas embolism. One patient (the first in this series) underwent surgical drainage of the liver bed by means of a suction drain. The drain was taken out on the second postoperative day. All six patients resumed oral intake on the first postoperative day. The median hospital stay was three days (range 2-7 days). Five patients needed low doses of common analgesics during their postoperative course (median: three days). Only one patient – the one who underwent open conversion – required narcotic analgesia. The median length of time taken to return to normal activities was 12 days (range 7-30 days). In the three patients with malignant neoplasms the histological examination showed free margins. One patient with colorectal metastasis in both lobes underwent two-stage hepatectomy: LLLS followed two months later by laparoscopic right hepatectomy. Adjuvant chemotherapy was administered to two patients. The mean length of follow-up in this series was 15 months (median 18 months; range 2-30 months). All the symptomatic patients achieved complete relief of their symptoms. In the three patients who had metastatic tumors removed there was no recurrence. These findings are shown in table 3.

DISCUSSION

Although laparoscopic hepatectomy (LH) is generally considered to be a complex laparoscopic

Table 2 - *Surgical Features.*

Feature	Number of Patients
Vascular clamping	1 (5)
Mean intraoperative blood loss in milliliters (range)	150 (50-600)
Transfusions received	1 (5)
Mean duration of operation in minutes (range)	140 (100-200)
Mean weight of the surgical specimen in grams (range)	265 (200-370)

Table 3 - Postoperative course.

	Number of patients (%)
Morbidity	1 (15%)
Mortality	0 (0%)
Median hospital stay, in days (range)	3 (2-7)
Median time taken to return to normal activities, in days (range)	12 (7-30)

procedure, LLLS is nonetheless considered by many experts to be the easiest laparoscopic anatomic hepatic resection to perform. In many published series worldwide, LLLS is one of the most-performed types of LH.[7,9] When LH started to be used in the late 1990s, the main type of laparoscopic hepatic resection was segmentectomy, or even non-anatomical resections in lesions arising in easily accessible hepatic segments such as II, III, IVB, V and VI.[7] Thus, because of anatomic accessibility, LLLS has been considered to be the ideal anatomic resection as the initial training operation for liver surgeons.[1-6] In this way, LLLS is generally the initial LH that is carried out along the learning curve.[4] LLLS offers the general advantages of LH, namely less postoperative pain, fewer peritoneal adhesions, a shorter hospital stay, and an earlier return to daily activities.[6,7,9] Additionally, in comparison with open hepatectomy, LH has less blood loss, reduced morbidity, and fewer operative complications,[1-10] The few studies that have compared LLLS and OLLS are case-control or cohort series; there have been no randomized trials to date.[3,4,10] Specifically with regard to LLLS for treating hepatic tumors, no significant difference in morbidity or mortality has been found when compared with OLLS.[2-6,10] Furthermore, the cosmetic advantages of LLLS are excellent, which is important given that most benign tumors occur in young women.[2-5] In a small cohort study Carswell et al.[4] showed that LLLS has several advantages over OLLS: LLLS was better than OLLS in comparisons of postoperative analgesia and postoperative in-hospital stay. In a small case-control study comparing LLLS and OLLS, Campos et al[3] showed that the morbidity and mortality were similar. According to these authors, LLLS is superior to OLLS because it involves both less operating time and a shorter postoperative hospital stay. Campos et al[3] also took the view that left lateral segmentectomy should be carried out laparoscopically in centers with great expertise. In a case-control study, Lesurtel et al observed that the outcomes were similar between LLLS and OLLS. Both the morbidity and the mortality rates were similar between the groups, except for blood loss, which was less in the LLLS group. The LLLS group did not present any specific complications from hepatic resection. Earlier resumption of oral intake may also be an advantage, considering that, in a general manner, hepatectomy is a major surgical procedure.[6,8,9] For these reasons, LLLS should be considered for treating lesions in segments II-III, for management both of benign and malignant liver disease.[2-7] Several authors[2-6,10,11] have taken the view that LLLS is as safe as conventional OLLS.

Laparoscopic IHGA for performing LLLS as proposed by Machado et al.,[11] is an interesting and safe alternative which spares the liver parenchyma, while adhering to the oncologic principles of the open technique. In the present series, as shown by Machado et al[11] and despite the small sample, LLLS by means of IHGA was found to be both a safe and a quick procedure, with minimal blood loss. The median operative time was shorter than in other series, perhaps because IHGA can facilitate hilar dissection of the main hepatic pedicle. In general, blood loss during LH varies, both center to center and case-by-case. Blood loss in our LLLS series was less than reported in the literature, where it ranges from 200 to 400 ml.[7] Therefore, like Machado et al,[11] we believe that IHGA leads to less blood loss than is seen in "classical" LLLS. In our opinion, a randomized trial should be conducted to resolve this question. Blood loss tends to be lower in laparoscopic hepatectomy (LH) than in open hepatectomy (OH), resulting in lower requirements for blood transfusion.[7] As in the Machado et al series,[11] there was no mortality and low morbidity. The technique used by this author to access the left pedicle by means of an intrahepatic route is, in our opinion, both simple and easy to do. As with the open approach to the left pedicle, LLLS using an intrahepatic Glissonian approach spares hepatic parenchyma and thus minimizes the intraoperative bleeding. Furthermore, with this approach a well-defined ischemic zone for segments II-III is observed, which confers greater safety.[11] Another great advantage of this technique over classical LLLS using the anterior approach is the possibility of gaining rapid and precise access to the Glissonian sheath of segments II-III, which leads to easy resection of these segments.[11]

We believe, therefore, that the Ligasure 10 mm bipolar coagulator (Covidien, USA) results in a faster procedure than when a harmonic scalpel, such as the Ultracision, is used. When compared with the

Machado et al series,[11] the procedures in the present study were faster, probably due to the technical modification of using the Ligasure 10 mm bipolar coagulator (Covidien, USA) in all but one case. One great advantage of intrahepatic Glissonian LLLS for resecting segments II-III is that it generally avoids Pringle's maneuver.[11] Pringle's maneuver has been associated with ischemia-reperfusion complications that have been linked to major postoperative morbidity.[7] In the present series only one patient with a giant hemangioma needed Pringle's maneuver, and this was because of profuse intraoperative bleeding during the surgical resection. This patient was the only case that underwent open conversion, which accounts for the 15% rate. A similar conversion rate was reported by Carswell et al.[4] In general, conversion rates from LH to open surgery have ranged from 2 to 15%.[7] These rates have been correlated with both lesion volume and lesion location. The single case requiring conversion consisted of a giant (12 cm) intrahepatic hemangioma that presented profuse intraoperative bleeding. The most frequent cause of open conversion in the literature is extensive intraoperative bleeding, which is generally very difficult to control during a laparoscopic approach.[7] As in the study by Chang et al,[5] one patient in our series developed an incisional hernia; this too was corrected laparoscopically. There were no instances of bile leakage, an experience similar to other studies.[2,3,5,7] We believe that bile leakage will be an uncommon complication in LH. According to Edwin et al,[7] this complication occurs in around 1.5% of LH cases, which is a smaller rate than in OH cases.

As with others authors,[2-5,10] we observed that there were no deaths in our series. Thus we believe that LLLS is a safe procedure. When LLLS is performed by means of IHGA, as described by Machado et al,[11] the results are excellent, with no mortality. Mortality from LH is less than 1%.[7,9] The mortality rates depend on the team's expertise, type of resection, lesion location and patients' clinical conditions.[7,9]

Uncertainty surrounds the long-term outcomes from laparoscopic liver-sparing resections to treat cancer, because the results are very preliminary. Lack of palpation sensitivity is a critical point in all laparoscopic procedures.[9-14] In some series, narrow margins have been reported more frequently. We found that there were no comprised margins in the segmentectomies performed on malignant lesions.[7] Despite the initial skepticism about the use of LLLS to treat malignant neoplasms, it is now routinely performed because this procedure is considered safe and effective.[2-7,10,11] LLLS can spare the parenchyma – which is an important consideration when treating malignant neoplasms because intrahepatic recurrence is relatively frequent.[2-7, 11] Although malignant liver tumors may recur, LLLS may be useful because it facilitates concomitant multiple resections in one-stage or two-stage hepatectomies.[11,12] In our series, as also reported by Machado et al,[12] one patient underwent two-stage hepatectomy to treat colorectal metastases in both lobes. The patient first underwent LLLS by means of an IHGA, and then, two months later, the laparoscopic right hepatectomy was performed. The postoperative course was good, and we did not observe any tumor recurrence. To date, for malignant disease, studies have suggested that there are no differences between LLLS and OLLS in relation to port-site metastasis, free margins, local-systemic recurrence or even survival rates.[2-5] However, there have been few studies, thus little formal evidence. In the present series, although there has been no tumor recurrence, the follow-up was short. Cohort series have shown that, in general, there is no difference between classical LLLS and OLLS for treating malignant disease or even HL.[2-5,8-13] These findings, however, should be considered preliminary; we should await additional studies to answer these questions more definitively. We believe that IHGA is a good option for treating left lobe tumors by laparoscopic left lobectomy. Nevertheless, new randomized trials are necessary to compare the IHGA and the classic approach to answer definitively which is superior when performing LLLS.

CONCLUSION

LLLS by means of an intrahepatic Glissonian approach is a good option for treating tumors located in the left hepatic lobe (segments II-III). This approach is both a safe and an expeditious option that avoids large blood loss.

RESUMO

Introdução: A ressecção laparoscópica de neoplasias no lobo hepático esquerdo tem sido considerada padrão-ouro para o tratamento de lesões hepáticas tanto benignas quanto malignas. Segmentectomia lateral esquerda laparoscópica (SLEL) por acesso intra-hepático tem sido uma alternativa interessante em virtude da facilidade, rapidez e pouco sangramento intra-operatório. **Objetivo –** Relatar uma série de seis casos de doentes submetidos à segmentectomia lateral esquerda laparoscópica (SLEL) por acesso intra-hepático Glissoniano realizada por uma única equipe do Hospital Santa Lucia em Brasília, Distrito Federal, Brasil. **Pacientes e Métodos** – Os doentes foram operados entre Janeiro de 2009 a Junho de 2011. A idade variou de 21 a 53 anos (med. 49). Foram quatro mulheres e dois homens. A etiologia das lesões foi: hiperplasia nodular focal (n=2), hemangioma gigante (n=1) e metástases (n=3). A média do tamanho das lesões foi 4,6 cm (variação de 1,8 a 12 cm). **Resultados -** A média de tempo cirúrgico foi de 140 minutos (variação de 100 a 200 minutos). A média de sangramento intra-operatório foi de 150 ml (variação de 50 a 600 ml). Não houve mortalidade e a morbidade foi de 15 %. A mediana de internação foi de três dias (variação de 2 a 7 dias). A mediana de retorno às atividades cotidianas foi de 12 dias (variação de 7 a 30 dias). **Conclusão** – A SLEL por acesso Glissoniano intra-hepático deve ser considerada uma boa opção tática para o tratamento dos tumores hepáticos situados no lobo esquerdo. Esse acesso representa uma opção segura e rápida que evita grande sangramento.

Palavras-Chave: Laparoscopia. Hepatectomia. Neoplasias Hepáticas/Cirurgia. Metástaseneoplásica.

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