



Mini-invasive treatment of hepatic hemangioma: new efforts for an uncommon task

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Abstract: The hepatic hemangioma (HH) represents an extremely common liver disease, however not requiring in the great majority of cases any kind of management. In peculiar cases, observation should be considered. Surgery is anecdotal, mainly in light of the evidence that spontaneous or post-traumatic rupture represent rare conditions. Surgery is indicated only in peculiar conditions, like the presence of abdominal pain otherwise not explicable, and the complications of HH. In this uncommon condition, the mini-invasive approach should play a relevant role, mainly in consideration of the fact that HH represents a benign condition. Consequently, a less invasive approach appears to be coherent in this field. Approximately 500 cases of laparoscopic surgery/locoregional therapy have been reported so far, showing promising results. Even more anecdotal are the reported cases of robotic resection. Only 10 cases of robotic surgery for HH have been reported. Therefore, it is impossible to give definitive conclusions on the role of robotic surgery in this field. When the mini-invasive approach is chosen as the first-step technique to use for the cure of a patient, surgery should be done exclusively in high-volume centers specialized in mini-invasive surgery.

Keywords: Hepatic hemangioma (HH); mini-invasive liver surgery; robotic surgery; laparoscopic surgery

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Introduction

Hepatic hemangioma (HH) represents the most common benign tumor of the liver. HH consists of clusters of blood-filled cavities lined by endothelial cells and fed by arterial supply. Concerning their dimension, HHs are defined as small (≤ 3 cm), medium (3–10 cm) and giant (> 10 cm) (1).

HH diagnosis is more commonly observed in adult age, with a higher prevalence during the 3rd–5th decade. HH incidence ranges 0.4–20% in the entire population. Regarding gender distribution, a higher frequency is observed in women (female: male =5:1).

The causes of HH development are not known. In some families, HH appears to be congenitally determined, suggesting a possible genetic connection. Some HHs are

positive for estrogen-receptors, thus explaining for their growth during puberty, pregnancy, oral contraceptive use, and androgen/steroid administration (2).

In the majority of cases, HH does not show any sign or symptom, being classified as hepatic “incidentalomas”, due to their incidental diagnosis on imaging studies performed for other reasons.

In the symptomatic cases, HH is connected with upper abdominal pain, abdominal discomfort, sense of fullness, nausea, vomiting, post-prandial bloating (3).

Possible HH complications depend on size and location. Among them, we can remember (I) spontaneous or traumatic rupture; (II) compression of adjacent structures leading to gastric obstruction and jaundice; (III) intratumoral or intraperitoneal bleeding; (IV) Kasabach-

Merritt syndrome, a condition including giant HH, anemia, thrombocytopenia, hypofibrinogenemia and prolonged prothrombin time; (V) fibrosis, thrombosis, and sclerosis (4).

Imaging diagnosis of HH includes several different examinations. Conventional ultrasounds usually represent the first diagnostic step. Small HH typically presents hyperechoic homogeneous aspect, showing well-defined margins and a posterior acoustic enhancement. In case of larger tumors, the lesion appears inhomogeneous and with mixed echogenicity because of necrosis, hemorrhage or fibrosis phenomena. Contrast-enhanced ultrasounds improve the microvasculature definition, making a real-time perfusion image of the tumor. The typical HH presents a peripheral enhancement in the arterial phase followed by a complete centripetal filling in the late phases.

At computed tomography, HH appears as a hypodense, well-defined tumor with peripheral enhancement after contrast injection and progressive centripetal homogeneous filling. Magnetic resonance shows a homogeneous tumor appearing as hypointense on T1-weighted and hyperintense on T2-weighted imaging.

Tc-99m RBC scintigraphy consents to obtain the most specific diagnosis of HH. HH appears “cold” in the early dynamic phase and intense in the late phase. Although the high diagnostic ability of scintigraphy, it presents reduced availability, higher costs, and longer length of procedure respect to the other imaging methods.

Lastly, biopsy with histological sampling has a significant risk of bleeding due to its vascular nature, especially in case of large, subcapsular lesions, even leading to mortality. Besides this risk, biptic approach is used only in extremely atypical tumors (5).

Indications for surgical management

According to the recent Guidelines of the European Association for the Study of the Liver on the management of liver benign tumors, the conservative approach represents the most appropriate approach in case of typical HH cases (evidence level II-2, grade of recommendation 1) (6).

Consequently, the surgical referral of HH cases is limited only at patients with Kasabach-Merritt syndrome, growing lesions or lesions symptomatic by compression (evidence level III, grade of recommendation 1) (6).

Typically, pain represents the main indication for the treatment of HH. A study showed that 58% of HH cases presented abdominal pain at baseline, and, in 50% of patients, this pain was the reason for referral that led to the

diagnosis of HH (7). However, only in 12.6% of the cases the pain was effectively attributable to HH. In fact, in many cases other diseases cause the HH symptoms, especially inflammatory bowel disease at early stage, cholelithiasis, and peptic ulcer disease. Therefore, a correct evaluation of the patient is extremely important for avoiding unnecessary invasive procedures.

Traditionally, HH treatment had been advocated due to the concern for a possible rupture. Nevertheless, this paradigm has been challenged in the last 25 years, mainly in consideration of the very small amount of rupture cases reported in the literature. To date, less than 50 patients presenting a spontaneous HH rupture have been published (8). Tumor size is not per se a valid indication for HH resection, being not directly correlated with a higher risk of rupture. The malignant transformation of HH is practically inexistent, and the surgeons should reassure the patients on this aspect.

On the opposite, the correct indication for surgical approach remains connected with the HH complications. HH rupture, HH intralesional bleeding, Kasabach-Merritt syndrome, and vessels or organs compression represent indications for surgical treatment (9).

In the presence of a clear indication, HH should be treated by hepatic resection or enucleation, but in recent years, other therapies have been used for the management of HH, like liver transplantation, radiofrequency ablation (RFA), microwave ablation (MWA), trans-arterial embolization, radiotherapy, and chemotherapy.

The first HH was resected by Hermann Pfannenstiel in 1898. Since then, hepatic resection has been predominantly adopted for the surgical treatment of this tumor. However, more recently the enucleation has progressively substituted the more aggressive resective approach. Although no randomized trials comparing the two techniques exist, enucleation appears to be superior in terms of safety, blood loss, and post-operative complications (10). Hepatic resection remains the main indication in case of HH deeply located in the liver parenchyma, in the presence of a large lesion occupying an entire lobe, or in case of multiple hemangiomas.

The use of laparoscopic surgery

Recently, a growing evidence has been reported on the use of minimally invasive surgery for the management of HH. Laparoscopic approach presents several advantages respect to open surgery, like blood loss reduction, shorter hospital

Table 1 Reported cases of laparoscopic resection/ablation using a laparoscopic approach

First author (Ref.)	Year	N	Age (mean), years	Gender (M/F)	Treatment	Tumor size, cm (mean)	Blood transfusion	Overall complications	LOS, days (mean)
Fan (15)	2006	27	42	9/18	RFA	5.5	No	1	3.7
Kim (11)	2014	9	36	1/8	LR	11.0	9	NO	11.0
Bai (20)	2015	24	46	8/16	LR	9.7	10	1	9.6
Gao (21)	2015	27	50	11/16	RFA	9.4	No	2	3.6
Gao (13)	2016	121	49	40/81	RFA	9.1	No	26	4.1
Wang (19)	2017	44	48	14/30	LR	10.0	4	15	7.3
Zhang (18)	2017	36	45	5/31	LR	13.9	6	16	9.2
Jinhuan (17)	2019	58	47	136/45	LR	12.2	–	16	7.3
Chen (14)	2019	94	43	38/56	MWA	8.3	No	39	3.4
Liu (16)	2019	73	48	22/51	LR	6.5	14	3	4.0

M, male; F, female; LOS, length of stay; RFA, radio-frequency ablation; LR, liver resection; MWA, microwave ablation.

length of stay, better cosmetic results and a faster return to normal life (11).

Louisville consensus statements suggested considering the laparoscopic hepatic resection as an option for tumors placed in the left lateral and inferior segments of the right lobe (12). Consequently, mainly in case of HH located in these segments, the mini-invasive approach looks to be particularly attractive.

Moreover, during the last few years, other techniques such as RFA (13) and/or MWA (14) ablation associated with a laparoscopic approach have shown excellent results, showing the feasibility of the laparoscopic approach also for performing alternative loco-regional therapies.

According to the published literature, 10 studies have been reported focusing on the mini-invasive approach of HH (11,13-21) (*Table 1*). A total number of 513 patients has been reported, of whom 244 (47.6%) treated with laparoscopic hepatic resection/enucleation, 175 (34.1%) with mini-invasive RFA, and the remaining 94 (18.3%) with MWA. Mean age reported among the studies ranged 36–50 years, showing that the population of HH patients undergoing surgery is typically young. As expected, a higher prevalence of female cases was observed (352/161, 68.8 *vs.* 31.2%).

The mean dimension of the major lesion widely ranged (5.5–13.9 cm), however always being superior respect to the lower threshold limit of resectability of 5.0 cm. Intra- and post-operative blood transfusions were required in 43 (8.4%) patients. Any grade of complication after surgery was

reported in 119 (23.2%) patients, confirming that, although the mini-invasive approach and the treatment of a benign disease, the management of the liver always requires great attention. Interestingly, 51/244 (20.9%) complications were reported in the resected cases, 29/175 (16.6%) in the RFA, and 39/94 (41.5%) in the MWA patients.

Overall, the post-operative length of stay was short, with a value ranging 3.4–11.0 days. As expected, the values were longer in the resected cases (7.3–11.0 days) respect to RFA (3.6–4.1 days) and MWA (3.4 days).

The use of robotic surgery

Until now, only few reports have been reported concerning the robotic treatment of HH (22-27). However, this procedure should represent a very attractive approach for the management of a benign liver lesion. In fact, the robotic surgery of the liver can enhance the laparoscopic skills through a 3D view and a seven-degree of freedom of the instruments (23). The advantages of robotic surgery are represented by the smaller incision, a great accuracy, the decreased blood loss, the reduced pain after surgery, and the shorter hospital stay. Robotic approach should be considered as a valid surgical approach mainly in the case of anterior and superficial HHs, or for the management of large hemangiomas located in the central segments (28).

After a systematic review of the literature, we identified only six articles reporting a robotic approach for HH (22-27) (*Table 2*). In all the cases, only case reports, small

Table 2 Reported cases of laparoscopic resection using a robotic approach

First author (Ref.)	Year	N	Age (mean), years	Gender (M/F)	Treatment	Tumor size, cm (mean)	Blood transfusion	Overall complications	LOS, days (mean)
Giulianotti (22)	2010	1	32	F	LR	10.0	No	No	10
Efthimiadis (27)	2017	1	38	F	LR	9.6	No	No	2
Giulianotti (23)	2011	4	–	–	–	–	–	–	–
Ceccarelli (24)	2013	1	–	–	–	–	–	–	–
Felli (25)	2015	2	–	–	–	–	–	–	–
Boggi (26)	2015	1	–	–	–	–	–	–	–

M, male; F, female; LOS, length of stay; LR, liver resection.

cases-series or anecdotal cases reported in surgical series focused on hepatic surgery have been observed. Moreover, in many cases no detailed aspects of the patient have been reported, further reducing the opportunity to investigate the role of robotic surgery in this field. Overall, 10 patients have been described in literature. Only in two cases, more detailed aspects have been reported (22,27). In both these cases, a right hepatectomy was performed. No blood transfusions nor complications were reported, with the patients discharged after 2 and 10 days, respectively.

Conclusions

HH represents an extremely common liver disease, however not requiring in the great majority of cases any kind of management. In peculiar cases, observation should be considered. Surgery is anecdotal, mainly in light of the evidence that spontaneous or post-traumatic rupture represent rare conditions.

Surgery is indicated only in peculiar conditions, like the presence of abdominal pain otherwise not explicable, and the complications of HH. In this uncommon condition, the mini-invasive approach should play a relevant role, mainly in consideration of the fact that HH represents a benign condition. Consequently, a less invasive approach appears to be coherent in this field. Approximately 500 cases of laparoscopic surgery/locoregional therapy have been reported so far, showing promising results. Even more anecdotal are the reported cases of robotic resection. Only 10 cases of robotic surgery for HH have been reported. Therefore, it is impossible to give definitive conclusions on the role of robotic surgery in this field.

When the mini-invasive approach is chosen as the first-step technique to use for the cure of a patient, surgery

should be done exclusively in high-volume centers experienced in mini-invasive surgery.

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Footnote

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