

# EDITORIAL

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## Surgical Resection of Giant Liver Hemangiomas – Literature Review and Report of a Special Case

### Wycięcie olbrzymiego naczyniaka krwionośnego wątroby – przegląd piśmiennictwa i opis przypadku

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#### Abstract

Hepatic hemangiomas are the most common hepatic lesion. They have a female predominance in all age groups, are often asymptomatic, and are increasingly found incidentally on abdominal ultrasound (US) or computer tomographic (CT) examinations. Hepatic hemangiomas can be single or multiple and are vascular malformations that grow by ectasia rather than neoplasia. Large hemangiomas can produce a variety of symptoms from discomfort to life-threatening complications. The complications are rare but include compression of adjacent organs, rupture, and Kasabach-Merritt syndrome. Magnetic resonance imaging (MRI) is the best imaging method to establish the diagnosis. Treatment modalities for giant hepatic hemangiomas, such as arterial ligation, radiotherapy, and corticosteroid and interferon therapy, have been implemented without any convincing success. Surgical resection is so far the only consistently curative method of treatment. Indications for performing surgery of hepatic hemangiomas should be severe unacceptable symptoms, growth of the tumor, inability to exclude malignancy, persons with a high risk of hepatic injury, and complications. If surgery is indicated, different techniques can be used, including enucleation, hepatic resection, and laparoscopic techniques. When the diagnosis of hepatic lesions is uncertain despite thorough radiological evaluation and biochemical analysis, percutaneous biopsy is recommended, and the latest open laparotomy with biopsy and/or resection. The authors believe that considered hepatic resection of benign lesions in the liver in appropriately chosen patients is a safe procedure. A report of a special case of a giant liver hemangioma and a literature review on the diagnosis and treatment of hemangiomas of the liver are presented (**Adv Clin Exp Med 2009, 18, 1, 7–12**).

**Key words:** hepatic hemangioma, giant, surgical treatment, complications.

Hepatic hemangiomas are the most common hepatic lesion. Benign liver tumors and hepatic cysts are rarely symptomatic, but are increasingly diagnosed due to the widespread use of computed tomography (CT), magnetic resonance imaging (MRI), and ultrasound (US) for the evaluation of patients with nonspecific abdominal symptoms. Once these lesions are found, they pose a diagnostic and therapeutic challenge. Treatment depends on the pathology of the lesion, the degree of symptoms, and the natural history of the particular lesion [1]. The liver is the most common organ affected by hemangiomas, and cavernous hemangiomas are the most common primary benign tumors of the liver [1,2]. The estimated prevalence of hepatic hemangiomas in autopsy series ranges from 0.4 to 20% [3]. Their size usually remains

stable and can vary from a few millimeters to over 20 cm. Hemangiomas greater than 4 cm are referred to as giant hemangiomas [4].

Large hemangiomas can produce a variety of symptoms, such as abdominal, shoulder, and back pain, nausea, vomiting, jaundice, abdominal distension, dyspnea, thrombocytopenia, and fever, to life-threatening complications such as compression of adjacent structures, rupture, and consumptive coagulopathy, i.e. Kasabach-Merritt syndrome, which is caused by platelet trapping in the hemangioma resulting in activation of the platelets and thus a clotting cascade. This can lead to the consumption of both platelets and clotting factors, and this acute condition can be lethal [5]. Incidentally discovered hemangiomas can thus present a diagnostic challenge, as some of them

can mimic other benign and malignant hepatic lesions such as focal nodular hyperplasia (FNH), hepatic adenoma (HA), hepatocellular carcinoma (HCC), and metastasis [6]. This article presents a special case report of a giant liver hemangioma and provides a literature review on the diagnosis and treatment of hemangiomas of the liver.

## Case Report

A 42-year-old female presented with four months of feeling discomfort in the right subcostal region and radiating lumbar pain. Physical examination revealed an enlarged liver. All laboratory findings were normal. Percutaneous needle biopsy did not establish a diagnosis. Later that year exploratory laparotomy at the local hospital was performed and a huge reddish tumor was found in the right liver lobe. Peroperative biopsies showed no malignancy, thus no conclusive diagnosis was reached. The tumor was at the time considered inoperable because of its size and location. External radiation downsized the tumor somewhat, though the tumor still disabled the patient severely.

Almost twelve years later, a CT scan and US with biopsy and hepatic angiography established the diagnosis of cavernous hemangioma. Since the appearance of symptoms the liver had grown substantially and the patient's symptoms had worsened. She was transferred to the present authors' surgical department, a reference center for hepatic surgery, where the patient complained of a large, protruding, painful, tender abdominal mass as well as dyspnea and severe immobility due to varicose veins on edematous legs. The patient also had developed cardiac problems due to reduced back-flow from the inferior vena cava. Physical examination now revealed a large knotty mass in the the abdomen extending into the right lower quadrant. Blood chemistry showed unspecific elevated liver tests. Esophagogastroduodenoscopy showed a discrete esophageal varix. US showed the liver monstrously enlarged and the porta hepatis displaced 10 cm to the left. Liver segments 5–8 were replaced by a tumor of varying echogenicity. Sequential CT scans confirmed the US findings and also showed small areas of calcification, a compressed vena cava, and a recanalized umbilical vein due to high portal venous pressure. Tc-99m colloid and Tc-99m red blood cell angiography was typical of a hemangioma.

At operation the abdomen was opened with a wide bilateral subcostal incision which later was extended into the right chest. A 40-cm-large tumor was found in the right liver lobe. The tumor was

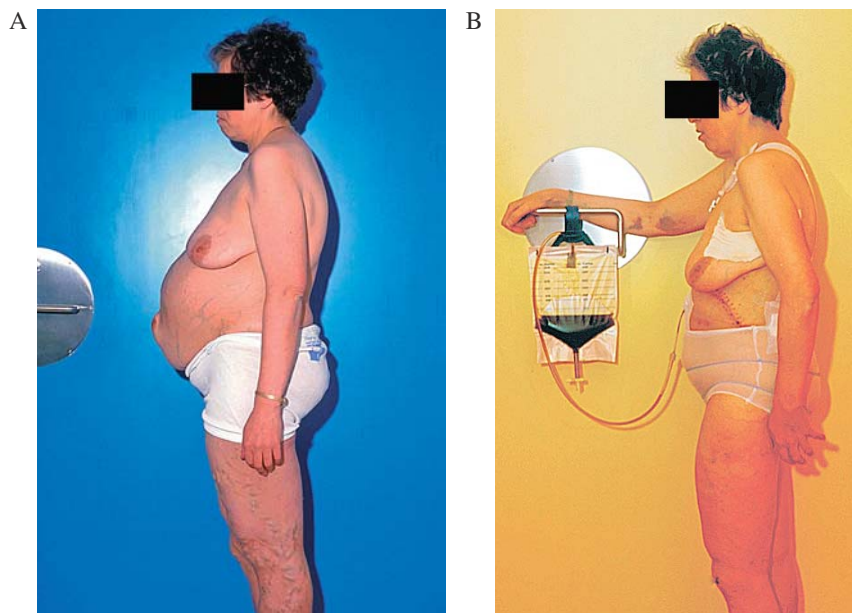
densely adherent to adjacent structures and organs. The left liver lobe was compensatively hypertrophied. The liver was mobilized and a right hemihepatectomy could be performed by classic anatomical resection. To secure a safe division of the right hepatic bile duct, a small bougie was inserted into the left hepatic duct. The operation lasted 10 hours and required 18 units of blood. The hemangioma weighed 7.5 kg and measured 32 × 24 × 14 cm after fixation. Microscopy showed a cavernous hemangioma intermingled with areas of fibrosis and organized hematomas. The postoperative course was without major complications. The patient has been followed postoperatively at her local hospital once a year.

## Discussion

Giant hepatic hemangioma is histologically a benign disease, but literature [7] and the case presented here show that very large hemangiomas may cripple the patient. Macroscopically they are often well-circumscribed, reddish, hypervascular, compressible lesions. Histologically the tumors reveal large blood-filled spaces lined by endothelial cells and separated by thin fibrous septa [5]. In general, the blood circulation within these tumor vessels is slow [3]. Most hemangiomas are probably of congenital rather than of neoplastic origin [3, 5] and there are no reports of malignant transformation. They grow by ectasia rather than by hypertrophy or hyperplasia. Hemangiomas in the liver can be solitary or multiple [8]. The tumors are sharply demarcated from the surrounding liver tissue and are rarely calcified. They vary in size, those larger than 4 cm in diameter being referred to as giant hemangiomas. Hemangiomas in the liver can be combined with hemangiomas in other organs. Hepatic hemangiomas are usually located peripherally or are subcapsular, mostly in the posterior segments of the right liver lobe [3].

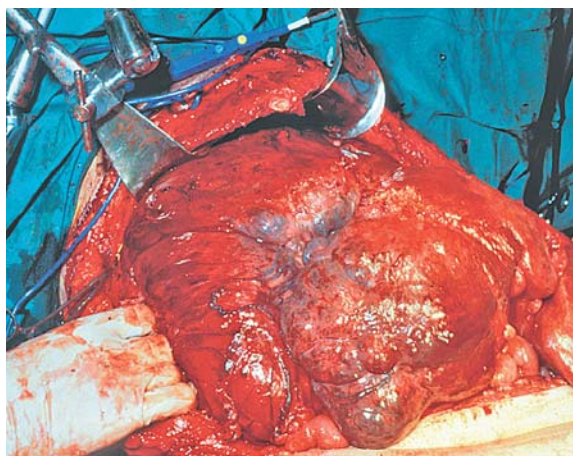
Hepatic hemangiomas are the most common hepatic tumor. Hemangiomas have a female predominance in all age groups, but are most frequently found in the third, fourth, and fifth decades of life [9, 10]. In more than 50% of cases, hemangiomas are multiple [3]. Hemangiomas have unknown etiology, although studies have suggested a possible relationship with the intake of steroidal hormones such as estrogen [11].

The two largest hemangiomas ever published weighed about 18 kilograms. One was found incidentally at autopsy in 1918 and another was successfully resected in China and reported anonymously in the Chinese Medical Journal in 1979 [12, 13]. Several studies have reported that the



**Fig. 1.** A – The patient before surgical removal of the hemangioma. Note the large protruding abdomen, the umbilical hernia, and the varicose veins on the patient's abdomen and legs. B – The patient after surgical removal of the hemangioma

**Ryc. 1.** A – Pacjentka przed wycięciem naczyniaka. Zwraca uwagę wystający brzuch, przepuklina pępkowa, żylaki na brzuchu i nogach pacjentki. B – Pacjentka po wycięciu naczyniaka



**Fig. 2.** The hepatic hemangioma presented during surgery

**Ryc. 2.** Obraz śródoperacyjny naczyniaka krwionośnego wątroby

majority of hepatic hemangiomas remain stable in size and that complications are relatively rare [14, 15]. Farges et al. [16] reported in their series of 163 patients with a mean follow up of 92 months that only nine hemangiomas increased in size while seven decreased.

As with malignant tumors, hepatic hemangiomas are usually clinically silent until they reach a considerable size [5]. Pain is related to the size of the hepatic hemangioma [10, 16, 17]. One study concluded that hemangiomas in the right liver lobe tended to be larger than those in the left liver lobe, which could indicate that tumors in the right liver lobe grow until they produce discomfort or symptoms. Discomforting symptoms such as pain, nausea, vomiting, and weight loss can be caused by the tumor's compression of adjacent organs [5]. In

a series of 87 patients with hepatic hemangioma, 54% of the patients' gastrointestinal symptoms had causes other than the hepatic hemangioma [16]. The exact mechanism of hepatic-induced pain is not fully understood. It is known that hemorrhage, infarction, and thrombosis can cause pain [5], possibly due to distension of Glisson's liver capsule.

The risk of life-threatening complications such as spontaneous rupture is low. Yamamoto et al. [18] showed in 1991 that only 28 cases of spontaneous rupture of a liver hemangioma had been published, which must be considered a low number taking into account the high prevalence of hepatic hemangiomas. Hepatic hemangiomas are therefore rarely the direct cause of intra-abdominal hemorrhage. However, even though it is a rare complication, hemorrhage should always be taken into consideration, as the mortality rate at spontaneous rupture is almost 60% [19]. In case of rupture, the treatment is acute surgery or, alternatively, vascular embolization if surgery cannot be performed [5]. Elective liver resection should be saved for patients with unacceptable pain, compression of adjacent organs, Kasabach-Merritt syndrome, or suspicion of malignancy [10].

Abdominal US examinations are performed more often today than earlier and, with the increasing use of imaging modalities such as CT and MRI, more hepatic nodules and tumors are being identified incidentally [5]. Diagnostic modalities consist of Doppler US, spiral CT, MRI, technetium-99m red blood cell scintigraphy, and angiography, which all demonstrate characteristic vascular findings with high sensitivity and specificity. Hepatic hemangiomas normally have characteristic radiologic features that make it possible to distinguish

them from other hepatic nodules. On US, the most common feature is a homogeneous hyperechoic liver nodule without any Doppler signal [3]. Depending on the size, the appearance of hepatic hemangiomas in a US scan can be variable, which limits its use. An inconclusive US examination is an indication for performing CT [2].

On CT, hepatic hemangiomas are often shown as hypodense well-defined lesions with early peripheral enhancement and slowly centripetal filling after administration of an iodine contrast medium [3]. This pattern is seen in about 50% of hepatic hemangiomas. The typical characteristic sign of hemangiomas has a positive predictive value of greater than 80% [20]. Leslie et al. report that in differentiating between hepatic hemangiomas and hypervascular metastases, contrast-enhanced CT scans have a sensitivity of 88% and a specificity of 84–100% [21].

SPECT (Tc-99m-labeled red blood cells) has a sensitivity of 97% and a specificity of 83% in suspecting hepatic hemangiomas larger than 1 cm [22]. When the specific location is in doubt, it can be useful to use a combination of SPECT and CT. If hepatic hemangiomas are small they have an atypical appearance and enhancement pattern on CT, which is why it may be necessary to perform MRI [23].

MRI is currently the method of choice in the diagnostics of hepatic hemangiomas [24, 25] and is believed to be superior to CT [26]. On an MRI scan with a combination of T2-weighted images and serial gadolinium-enhanced gradient echo imaging, hepatic hemangiomas are homogeneous, clearly demarcated, and have a very high signal intensity [3, 24]. The features considered pathognomonic on MRI are well-defined lobular margins, T2-weighted hyperintensity, and progressive nodular centripetal enhancement [24]. It is possible to suggest criteria that indicate benign tumors: size less than 4 cm, discrepancy in radiologic diagnosis, and stability in size over time [5, 27].

Several studies indicate a high risk of bleeding when percutaneous needle biopsy is performed for diagnostic reasons and recommend an operative procedure when the diagnosis is undetermined [16,28]. The present authors disagree that an operative procedure is recommended with an undetermined diagnosis; they perform percutaneous US-guided needle biopsy routinely without any complications.

There is still debate regarding the treatment of liver hemangiomas. The majority of hepatic hemangiomas are asymptomatic and can be managed with observation alone [2]. Management options range from observation with regular US examinations to a variety of radiological and surgical interventions. Arterial ligation, radiotherapy, and corticosteroid and interferon therapy have been implemented without any convincing success [2]. So far, surgical resection is the only curative treatment and is indicated in patients in whom the surgical risk is assessed as acceptable and the symptoms unacceptable [8]. Estrogen therapy may induce growth of hemangiomas [11]. Herman et al. [10] emphasized, as other authors [16, 29], that tumor size is not a definite indication for surgery as long as pain and discomfort are tolerably managed with analgesics. Operative indications can be changed so that persons with an occupational risk of hepatic injury, such as boxers and football players, may be candidates for surgery earlier [30].

If surgery is indicated, different techniques can be used, including enucleation, hepatic resection, and laparoscopic techniques. The first enucleation was performed in 1988 by Alper et al. [31]. The obvious advantages of enucleation are less operative blood loss and a reduced risk of biliary leakage [32]. One report state that enucleation is the surgical procedure of choice [5, 33]. Some authors advocate enucleation [31, 32, 34] and others liver resection [35, 36]. The choice of procedure should also be based on tumor location and the number of hemangiomas. If the hemangioma is located deep within the liver parenchyma or in posterior hepatic segments, a formal anatomical resection should be the preferred operative procedure [2]. In specialized centers, liver resection mortality has declined to rates lower than 3% [10]. Laparoscopic surgery should be reserved for minor hepatic resections and wedge resections [37].

## Conclusions

Indications for surgery in hepatic hemangiomas are severe unacceptable symptoms, growth of the tumor, inability to exclude malignancy, and persons with a high risk of hepatic injury and complications. The size of the hemangioma should not be the only indication for surgery. When the diagnosis is uncertain despite thorough radiological evaluation and biochemical analysis, percutaneous biopsy, and at the latest open laparotomy with biopsy and/or resection, are recommended.



## References

- [1] **Ochsner JL, Halpert B:** Cavernous haemangioma of the liver. *Surgery* 1958, 43, 577–582.
- [2] **Hamaloglu E, Altun H, Ozdemir A, Ozenc A:** Giant Liver Haemangioma: Therapy by Enucleation or Liver Resection. *World J Surg* 2005, 29, 890–893.
- [3] **Caseiro-Alves F, Brito J, Araujo AE, Belo-Sorares P, Rodrigues H:** Liver haemangioma: common and uncommon findings and how to improve the differential diagnosis. *Eur Radiol* 2007, 17, 1544–1554.
- [4] **Adam YG, Huvos AG, Fortner JG:** Giant haemangiomas of the liver. *Ann Surg* 1970, 172, 239–245.
- [5] **Yoon SS, Charny CK, Fong Y, Jarnagin WR, Schwartz LH, Blumgart LH:** Diagnosis, Management, and Outcomes of 115 Patients with Hepatic Haemangioma. *J Am Coll Surg* 2003, 197, 392–402.
- [6] **Wijaya J, Dieu E:** Giant hepatic haemangioma. *Intern Med J* 2005, 35, 634–35.
- [7] **Hobbs KEF:** Hepatic haemangiomas. *World J Surg* 1990, 14, 468–471.
- [8] **Nichols FD III, van Heerden Ja, Weiland LH:** Benign liver tumors. *Surg Clin North Am* 1989, 69, 297–324.
- [9] **Lerner SM, Hiatt JR, Salamandra J, Chen PW, Farmer DG:** Giant Cavernous Liver Haemangiomas. *Arch Surg* 2004, 139, 818–823.
- [10] **Herman P, Marcelo LV, Machado MAC, Pugliese V, D’Albuquerque LAC:** Management of Hepatic Haemangiomas: A 14-Year Experience. *J Gastrointest Surg* 2005, 9, 853–859.
- [11] **Gandolfi L, Leo P, Solmi L, Vitelli E, Verros G, Coleccia A:** Natural history of hepatic haemangiomas: clinical and ultrasound study. *Gut* 1999, 32, 677–680.
- [12] **Anonymous:** Cavernous haemangioma of the liver. Clinical analysis of 21 cases. *Chin Med J* 1979, 92, 61–66.
- [13] **Chung EB:** Multiple bile duct hamartomas. *Cancer* 1970, 26, 287–296.
- [14] **Okano H, Shiraki K, Inohue H:** Natural course of cavernous hepatic haemangioma. *Oncol Rep* 2001, 8, 411–414.
- [15] **Pietrabissa A, Giulianotti P, Campatelli A:** Management and follow-up of 78 giant haemangiomas of the liver. *Br J Surg* 1996, 83, 915–918.
- [16] **Farges O, Daradkeh S, Bismuth H:** Cavernous haemangiomas of the liver: Are there any indications for resection? *World J Surg* 1995, 19, 19–24.
- [17] **Belli L, Decarlis L, Beati C, Rondinara G, Sansalona V:** Surgical treatment of symptomatic giant haemangiomas of the liver. *Surg Gynecol Obstet* 1992, 174, 474–478.
- [18] **Yamamoto T, Kawarada Y, Yano T, Noguchi T, Mizumoto R:** Spontaneous rupture of haemangiomas of the liver: Treatment with transcatheter hepatic arterial embolization. *Am J Gastroenterol* 1991, 86, 1645.
- [19] **Cappellani A, Zanghi A, Di Vita M:** Spontaneous rupture of a giant haemangioma of the liver. *Ann Ital Chir* 2000, 71, 379–383.
- [20] **Nino-Murcia M, Olcott EW, Jeffrey RB Jr.** Focal liver lesions: pattern based classification scheme for enhancement at arterial phase CT. *Radiology* 2000, 215, 746–751.
- [21] **Leslie DF, Johnson CD, MacCarty RL, Ward EM, Ilstrup DM, Harmsen WS:** Single pass CT of hepatic tumors: value of globular enhancement in distinguishing haemangiomas from hypervascular metastases. *Am J Roentgenol* 1995, 165, 1403–1406.
- [22] **El-Desouki M, Mohamadiyah M, al-Rashed R, Othman S, al-Mofleh I:** Features of hepatic cavernous haemangioma on planar and SPECT Tc-99m-labelled red blood cell scintigraphy. *Clin Nucl Med* 1999, 24, 583–589.
- [23] **Kim T, Fedele MP, Baron RL:** Discrimination of small hepatic haemangiomas from hypervascular malignant tumors smaller than 3 cm with three-phase helical CT. *Radiology* 2001, 219, 699–706.
- [24] **Danet IM, Semelka RC, Braga L, Armao D, Woosley JT:** Giant haemangiomas of the liver: MR imaging characteristics in 24 patients. *Magn Reson Imaging* 2003, 21, 95–101.
- [25] **Semelka RC, Cofka CM:** Hepatic Haemangiomas. *MR Imaging of the Liver. Magn Reson Imaging Clin N Am* 1997, 7(2), 241–273.
- [26] **Mitchell DG, Saini S, Weinreb J:** Hepatic metastases and cavernous haemangiomas: distinction with standard- and triple-dose gadoteridol-enhanced MR imaging. *Radiology* 1994, 193, 49–57.
- [27] **Shimizu S, Takayama T, Kosuge T:** Benign tumors of the liver resected because of a diagnosis of malignancy. *Surg Gynecol Obstet* 1992, 174, 403–407.
- [28] **Browsers MAM, Peeters PMJG, De Jong KP:** Surgical treatment of giant haemangioma of the liver. *Br J Surg* 1997, 84, 314–316.
- [29] **Terkivatan T, Vrijland WW, den Hoed PT:** Size of lesion is not a criterion for resection during management of giant liver haemangioma. *Br J Surg* 2002, 89, 1240–1244.
- [30] **Ozden I, Emre A, Alper A:** Long-term results of surgery for liver haemangiomas. *Arch Surg* 2000, 135, 978–981.
- [31] **Alper A, Ariogul O, Emre A, Uras A:** Treatment of liver haemangiomas by enucleation. *Arch Surg* 1988, 123, 660–661.
- [32] **Baer HU, Dennisson AR, Mouton W, Stain SC, Zimmerman A, Blumgart LH:** Enucleation of giant haemangiomas of the liver: technical and pathological aspects of a neglected procedure. *Ann Surg* 1992, 216, 673–676.
- [33] **Gedaly R, Pomposelli JJ, Pomfret EA:** Cavernous haemangioma of the liver: anatomical resection vs. enucleation. *Arch Surg* 1999, 134, 407–411.
- [34] **Kuo PC, Lewis WD, Jenkins RL:** Treatment of liver haemangiomas of the liver by enucleation. *J Am Coll Surg* 1994, 178, 49–53.
- [35] **Borgonovo G, Razzetta F, Arezzo A:** Giant haemangiomas of the liver: surgical treatment by liver resection. *Hepatogastroenterology* 1997, 44, 231–244.

- [36] **Brouwers MAM, Peeters PMJG, de Jong KP, Haagsma EB, Klompmaker IJ, Bijleveld CMA, Zwaveling JH, Slooff MJH:** Surgical treatment of giant haemangioma of the liver. *Br J Surg* 1997, 84, 314–316.
- [37] **Borzellino G, Ruzzenente A, Minicozzi A-M, Giovinazzo F, Pedrazzani C:** Laparoscopic hepatic resection. *Surg Endosc* 2006, 20, 787–790.

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