

Long-term Results of Surgery for Liver Hemangiomas

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Background: Elective surgery for liver hemangiomas is still controversial.

Hypothesis: Long-term results show that elective surgery for liver hemangiomas is safe and effective.

Setting: A tertiary care university hospital in Istanbul, Turkey.

Patients: Forty-two patients underwent surgery for liver hemangiomas between January 1988 and December 1998; 41 were symptomatic. The primary indications for surgery were abdominal pain in 33 patients, diagnostic uncertainty in 6, and enlargement in 3. The median largest dimension of the major lesion was 10 cm (range, 7-45 cm).

Main Outcome Measures: (1) Patients' assessment of the effects of surgery on preoperative symptoms, (2) determination of whether any other pathological conditions were missed in the preoperative evaluation, (3) operative mortality and morbidity, and (4) recurrences.

Design: Retrospective cohort study.

Results: Enucleation was the most frequent operation (33 patients). Hospital mortality and morbidity were 2.4% (bleeding from the biopsy site on a lesion evaluated as inoperable at laparotomy; 1 patient) and 12% (5 patients), respectively. Thirty-three patients could be followed up for a median of 53 months (range, 6-135 months). Of the 32 preoperatively symptomatic patients, surgery was successful in symptom control in 28 (88%) (complete resolution or significant amelioration). No other cause of pain could be identified during follow-up in the other patients. Control ultrasonography revealed no recurrences.

Conclusions: Elective surgery is indicated in a small subset of patients with hemangiomas because of abdominal pain, enlargement, and diagnostic uncertainty. The results of surgery in symptom control are gratifying in approximately 90% of patients. Recurrences are rare. Enucleation can be performed rapidly and safely in most patients and should be preferred to resection.

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HEMANGIOMA, the most common hepatic tumor, is present in 0.7% to 7% of the population.¹ Although most authors agree that elective surgery is indicated in a small subset of patients for abdominal pain, diagnostic uncertainty, and enlargement,²⁻⁸ the role of surgery is still controversial.⁹

Four surgical methods are available: liver resection,² enucleation,¹⁰ hepatic artery ligation,¹¹ and liver transplantation.^{8,12} Of these, resection and enucleation are most commonly used. In 1988, our group described the method of enucleation and reported the first successful results in 9 patients.¹⁰ In this article, we report the long-term results of elective surgery (enucleation in most patients) in 42 new patients. Following the experience of Iwatsuki and Starzl,³ this is the second largest surgical series of hemangioma in the literature. Patients were evaluated to (1) assess

the effects of surgery on preoperative symptoms ascribed to the hemangioma, (2) determine whether any other pathological conditions were missed in the preoperative evaluation, (3) determine operative mortality and morbidity, and (4) monitor whether there were any recurrences.

RESULTS

Enucleation was the preferred operation, as seen in the following tabulation.

Procedure	No. of Patients
Enucleation	33
Right hepatic lobectomy	2
Left hepatic lobectomy	1
Left lateral segmentectomy	3
Hepatic artery ligation and biopsy	1
Laparotomy	2
Total	42

Median operative blood loss was 400 mL (range, 100-1400 mL). One patient underwent resection for an intraparenchymal

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PATIENTS AND METHODS

PATIENTS

Hemangioma was the final diagnosis in 171 patients referred to our clinic between January 1988 and December 1998, for liver tumor, hepatocellular carcinoma, or hemangioma. Elective surgery was performed in 42 of these patients (25%).

Median patient age was 50 years (range, 35-65 years). Eleven patients were men and 31 were women. Twenty-eight patients had a single hemangioma, 9 had 2 hemangiomas, 3 had 3 hemangiomas, 1 had 5 hemangiomas, and 1 had 6 hemangiomas. The median largest dimension of the main lesion was 10 cm (range, 7-45 cm).

The primary indications for surgery are given in the following tabulation.

Indication	No. of Patients
Abdominal pain	33
Diagnostic uncertainty	6
Enlargement	3

Actually, 41 patients had abdominal pain, but this was the primary indication in 33 patients. These patients reported persistent pain and discomfort that interfered frequently with their daily lives. They had no concomitant medical problems that could increase the operative risk. Patients were given detailed results of the diagnostic workup (described in the following paragraph) and were told of the potential risks and benefits of the operation. Informed consent was obtained from all patients. The asymptomatic patient had a hepatic lesion discovered incidentally during ultrasonography performed for hematuria. Because results of radiological investigations could not exclude a malignancy, laparotomy was performed.

All symptomatic patients have been examined for right upper quadrant or epigastric pain with computed tomography, ultrasonography, endoscopy (in appropriate patients), and, recently, magnetic resonance imaging. In 36 patients, no other cause of pain other than the hemangioma could be identified. In 4 patients, cholecystolithiasis coexisted with a giant hemangioma. Because the respective roles of the 2 findings could not be differentiated, the gallbladder and the hemangioma were both removed. One patient had a coexisting 10-cm simple cyst, which was unroofed.

mal lesion that was operated on for suspicion of malignancy. In 1 patient, the portal vein branch to the left lateral segment containing the hemangioma was lacerated during enucleation. Repair was not possible, and left lateral segmentectomy was performed. In 4 patients, the hemangioma occupied a lobe or the left lateral segment almost completely. The vascular structures of the liver tissue peripheral to the hemangioma could not be preserved and therefore resection was performed. One patient had a 35-cm lesion that was evaluated as inoperable at laparotomy. Hepatic artery ligation and biopsy were performed. After surgery, the patient bled from the biopsy site and died despite reoperation (mortality, 2.4%).

There was no suspicion of malignancy in the remaining 129 patients. These patients either had abdominal symptoms that could not be ascribed to the hemangioma(s) (ie, hemangioma was an incidental finding in whole-abdomen ultrasonography or computed tomography performed for various reasons) or had mild and usually transient symptoms in the right upper quadrant and epigastric area, but no specific finding except the hemangioma(s). Therefore, hepatic surgery was not performed.

SURGICAL TECHNIQUE

Enucleation was performed essentially according to the technique described previously.¹⁰ Briefly, after complete mobilization of the liver, the Pringle maneuver was performed. The plane between the liver parenchyma and the hemangioma was entered and the lesions were enucleated by ligating and dividing the vascular structures in this plane. Total vascular exclusion of the liver was performed in 2 patients.

Liver resection was performed under the Pringle maneuver by crushing the liver parenchyma with clamps and ligating and dividing the tubular structures.

Small lesions (1-2 cm) in deep intraparenchymal regions were not removed.

FOLLOW-UP

The medical records of the patients were evaluated retrospectively. Also, all patients were invited for a final interview and ultrasonographic evaluation. The following questions were asked: (1) How would you describe the changes, if there are any, in your complaints after the operation: (a) complete resolution, (b) amelioration, (c) aggravation, or (d) persistence? (2) Did you undergo treatment for an abdominal problem at another institution between the operation and this interview? (The latter question was asked to the patients who did not regularly attend outpatient follow-up.) Ultrasonography was performed to detect whether there were any recurrences and to monitor the lesions that were not removed. Most examinations were performed by a single radiologist (M.T.). Some patients who lived in distant cities were interviewed by one of us (I.Ö.) on the telephone and had ultrasonography performed by a local radiologist who was given the discharge summary of the patient.

Five early complications occurred (early morbidity, 12%).

Complication	No. of Patients
Diaphragmatic injury	1
Bleeding	2 (1 death)
Right hepatic duct injury	1
Intra-abdominal collection	1

One diaphragmatic injury occurred during separation of the right lobe containing the hemangioma from the diaphragm and was repaired with silk sutures. In the second patient who had intra-abdominal hemorrhage, bleeding stopped with conservative treatment. The right hepatic duct injury was repaired with Roux-en-Y hepaticojeju-

nostomy. The intra-abdominal collection was drained percutaneously. Three incisional hernias were diagnosed during follow-up and repaired with polypropylene grafts.

Thirty-three patients could be followed up. The median interval between the operation and the final evaluation was 53 months (range, 6-135 months); 32 patients were symptomatic before surgery. The results of surgery in symptom control are given below.

Outcome	No. of Patients
Complete resolution of symptoms	24
Significant amelioration	4
Persistence	3
Resolution; recurrence 2 years later	1

Complete resolution or significant amelioration was achieved in 88% of the patients. In patients who reported persistence and reappearance of symptoms after surgery, no other cause of pain could be identified.

Control ultrasonography revealed no recurrences. There were no changes in the dimensions of the 10 hemangiomas left in 5 patients during median follow-up of 38 months (range, 17-64 months). Four patients had a single hemangioma and 1 patient had 5 hemangiomas.

COMMENT

The major indication for elective removal of hepatic hemangiomas at the Hepatopancreatobiliary Surgery Unit, Istanbul Faculty of Medicine, University of Istanbul, Istanbul, Turkey, is abdominal pain. Symptomatic patients should be investigated for other causes of upper abdominal pain before the complaints are ascribed to the hemangioma. However, patients with symptomatic liver hemangiomas should not be denied treatment on the physician's premise that the hemangioma cannot be the cause and the pain must be "psychological."² In surgical series^{2,7,8,13,14} in which patients were carefully evaluated, 90% to 100% were relieved of their complaints after surgery. Similarly, surgery relieved or significantly alleviated the symptoms in 28 of our patients (88%) and no other pathological findings emerged during follow-up. Although it may be argued that the evaluation method in this and other published studies lacks standardization and that patients who undergo surgery may have a tendency to be satisfied with treatment, the high success rate should convince the skeptic.

Other indications for surgery include diagnostic uncertainty, enlargement, occupations and hobbies that entail abdominal trauma (eg, boxing and karate), and the extremely rare Kasabach-Merritt syndrome.

With the advent of tagged red blood cell scintigraphy and magnetic resonance imaging, diagnostic uncertainty has become rare.¹⁵⁻¹⁷ The reported sensitivity, specificity, and accuracy of scintigraphy are 89%, 100%, and 95%, respectively. The corresponding figures for magnetic resonance imaging are 90%, 92%, and 90%, respectively. With the combined use of various imaging techniques, the diagnosis can be established in most patients.^{9,18} However, exceptions to pathognomonic signs do occur,^{19,20} but these are rare. Still, 100% diagnostic ac-

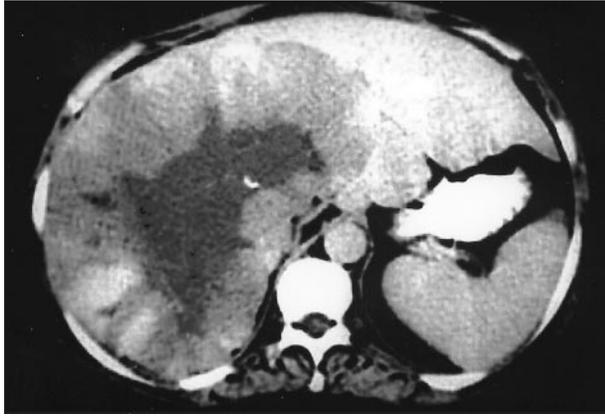
curacy with imaging techniques is impossible.^{18,21} One approach may be to use the laboratory and imaging techniques to the fullest extent and perform laparotomy in the still dubious patients.¹⁸ In the Hepatopancreatobiliary Surgery Unit, we perform 2 independent imaging techniques (usually ultrasonography and magnetic resonance imaging), standard liver biochemistry tests, and tumor marker measurements (α -fetoprotein, carcinoembryonic antigen, and cancer antigen 19-9). If the results of these tests are compatible with the diagnosis of hemangioma in an asymptomatic patient, we include the patient in the follow-up program. In the last 3 years of the study, we did not have any patients who underwent surgery for diagnostic uncertainty.

Enlargement of a hemangioma is said to occur with ectasia of the existing blood channels rather than with neovascularization.¹³ Enlargement will of course raise the suspicion of malignancy. However, malignant transformation in the natural history of a true hemangioma has not been demonstrated. Because hemangioma is an extremely common tumor and angiosarcoma is an extremely rare tumor,²² the possibility of malignant transformation can hardly be the sole indication for surgery. On one hand, enlargement, especially early enlargement, may alert the physician in a recently diagnosed liver mass that was evaluated as a hemangioma and included in the follow-up program (ie, the initial diagnosis may be wrong). On the other hand, nonmalignant enlargement of hemangiomas occurs in a small subset of patients (3 [2%] of our 171 patients). Even when the diagnosis is definite, it is prudent to follow up patients with large hemangiomas at regular intervals.

We believe that the possibility of abdominal trauma is a logical indication for surgery. To our knowledge, the validity of this indication has not been confirmed in a trial, and our series does not include a related patient. However, even the normal liver may be injured in seemingly innocent sports²³ (eg, subcapsular hematomas due to bicycle handles during mountain bicycling). Therefore, patients with large hemangiomas should be offered surgery for their safety.⁵

The surgeon has 4 modalities: liver resection, enucleation, hepatic artery ligation, and liver transplantation. The most commonly used methods are resection and enucleation. Liver transplantation is reserved for the rare indications of Kasabach-Merritt syndrome⁸ and acute rupture in a liver that cannot be salvaged.⁸ In the era of "safe" liver surgery, hepatic artery ligation should be reserved for unresectable lesions. This method has been shown^{11,24} to arrest the growth of some lesions and even effect partial regression of others. However, the experience is limited, and the procedure is ineffective in some patients. For example, in one of our patients, the diameter doubled (from 12 to 25 cm in 7 years) despite the ligation performed at another institution when the lesion had initially increased to 16 cm.

There are proponents for both resection^{3,8,25} and enucleation.^{7,10} In the single comparative study,⁶ results from 10 patients who underwent enucleation for hemangiomas were compared with those from 10 other patients who underwent resection for various benign lesions. The outcome was similar in many aspects but the blood transfusion requirement was less in patients who



Computed tomogram of a very large hemangioma removed by enucleation under total vascular exclusion of the liver.

underwent enucleation. Our group prefers enucleation for the following reasons:

1. Dissection along the plane between the hemangioma and the liver parenchyma and ligation of the transverse vessels is much simpler than resection through solid hepatic parenchyma.¹⁰

2. We did not observe a single bile leak in our enucleation patients, and it has not been reported.^{6,7} On the other hand, this is a relatively infrequent but recognized complication of liver resection.^{6-8,13,26} The most probable reason for this difference is that there are no bile ducts in the enucleation dissection plane.

3. Enucleation avoids unnecessary loss of healthy parenchyma for the treatment of a benign lesion.

4. Theoretically, the risk of recurrence may be lower: recurrence of the hemangioma after complete removal has been reported as single cases.^{4,26,27} The observations of Moreno-Gonzales et al⁴ and Conter and Longmire²⁷ are interesting: in both reports, very small hemangiomas in the remnant liver (described as “a few small punctate hemangiomas” and “more small angiomatous areas,” respectively) developed into recurrent hemangiomas after removal of the large lesion. Moreno-Gonzales et al proposed the provocative hypothesis that the growth factors induced by the initial resection may have caused this recurrence. Experimental data²⁸ show that liver resection enhances the growth of microscopic tumors in the remnant liver. Theoretically, enucleation may be superior to resection because it does not cause loss of hepatic parenchyma and probably does not induce growth factors. Size is not a limiting factor for enucleation, and very large lesions can be removed using this technique (**Figure**).

It must be emphasized that recurrence and growth of remaining lesions are rare. In the 33 patients evaluated by ultrasonography in this study, no recurrence has been detected. Also, the lesions that were left behind did not progress during follow-up (4 enucleations and 1 resection), in accordance with the experience of others.^{5,7,8}

In conclusion, elective surgery is indicated in a small subset of patients with hemangiomas. The current indications are abdominal pain, enlargement, and, in a small but real subset, diagnostic uncertainty. The results of

surgery, especially with respect to symptoms, are gratifying in approximately 90% of patients. Recurrences are rare. In our experience, enucleation can be performed rapidly and safely in most patients and should be preferred to resection.

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