ANGIOGRAPHIC, ULTRASOUND AND ISOTOPIC SCANNING IN THE EVALUATION OF HEPATIC MASSES

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SUMMARY

Twenty four patients with hepatic masses, who were submitted to angiography, echography and nuclear medicine tests, are presented. The sensibility of all the three methods is compared. The angiography is the most sensible and accurate diagnostic aid, followed by the ultrasound.

RESUMO

Avaliação de massas hepáticas por meio de angiografia, ultrasonografia e cintigrafia

Apresentam-se 24 casos de massas hepáticas nas quais as técnicas de angiografia, ecografia e medicina nuclear foram efectuadas. Compara-se a sensibilidade dos 3 métodos. A angiografia é o mais sensível meio complementar de diagnóstio seguido pelo ultrasom.

INTRODUCTION

Angiography, ultrasound and radionuclide scanning are three diagnostic aids in the evaluation of hepatic masses. Selective hepatic angiography is the single most important radiological examination for evaluation of hepatic masses. [1] It gives information concerning presence, localization, extent, nature and hepatic vascular anatomy.

CLINICAL MATERIAL

We selected 24 patients with hepatic masses in which hepatic angiography ultrasound and isotopic scanning were performed. All the patients had exploratory laparotomy with pathological diagnosis.

The clinical data are summarized on Table 1.

In the group of malignant primary hepatic tumors we included 7 hepatomas, 1 hepatoblastoma and 1 cholangiocarcinoma. Case 1 was an assymptomatic 27 years old black female with a mass in the right upper quadrant (RUQ) for 3 years. The angiogram showed extensive neovascularity supplied by the right hepatic artery (Fig. 1) originated from the superior mesenteric artery (SMA) that was displaced to the left side. The left hepatic artery was normal (Fig. 2) and at laparotomy an hepatoma limited to the right lobe was confirmed and right lobectomy was done. On the remaining hepatomas and hepatoblastoma both lobes of the liver were involved (Fig. 3, 5). In case 4 on late films of the hepatic arteriogram there was filling defect on the portal vein due to tumor invasion (Fig. 4). In all of our malignant primary tumors hepatic artery was dilated. Encasement was showed only in the case of cholangiocarcinoma (Fig. 8). The arteriogram on this case showed in the late phase (Fig. 9) heterogenous tumor staining with central lucency due to necrosis that was found at laporatomy.

The echography performed showed a solid mass on the liver in 5 out of the 7 hepatomas and in the case of hepatoblastoma.

^{99m}Tc performed showed a defect in the liver in 4 out of the 7 hepatomas and in the case of hepatoblastoma.

In the case of cholangiocarcinoma both ultrasound and nuclear medicine were negative.

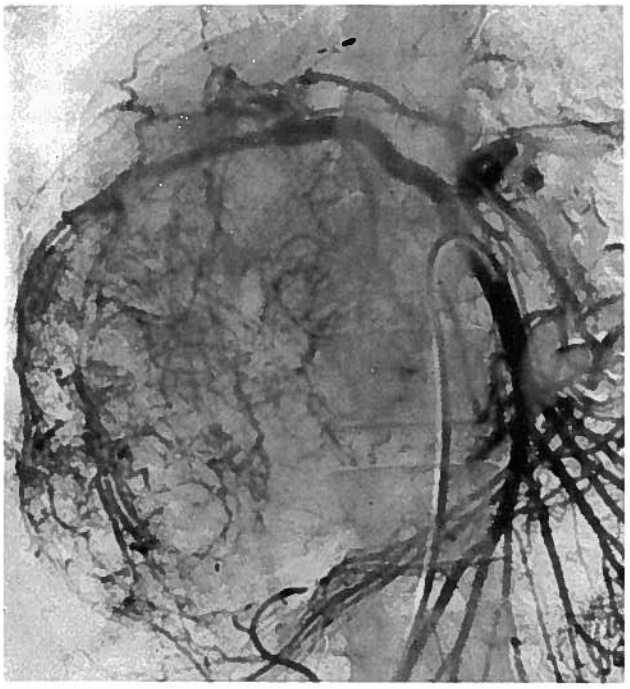

Figure 1: (case 1) - Subtraction of the right hepatic angiogram: dilated right hepatic artery extensive neovascularity supplied by the R hepatic artery originated from the S.M.A. (hepatoma).

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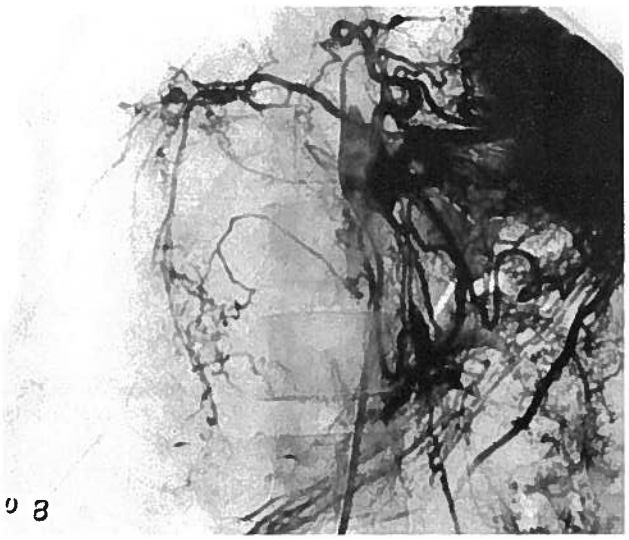


Figure 2: (case 1) - Subtraction of the left hepatic angiogram: left hepatic normal originated together with the splenic artery.

Figure 3: (case 4) - Right hepatic angiogram (arterial phase): dilated right hepatic artery, extensive neovascularity (hepatoma).

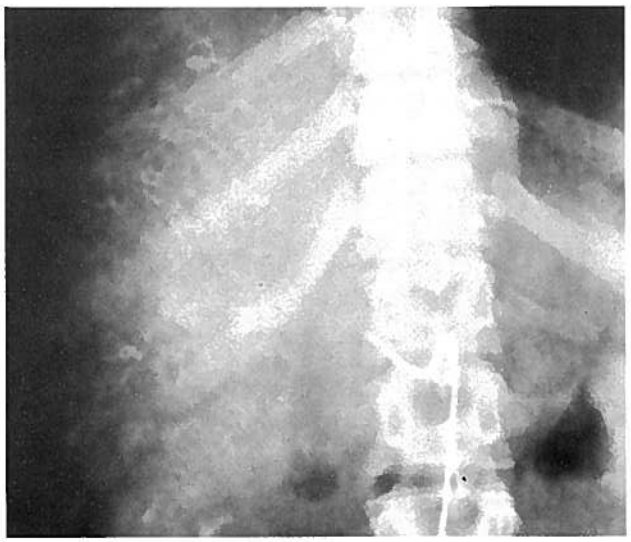
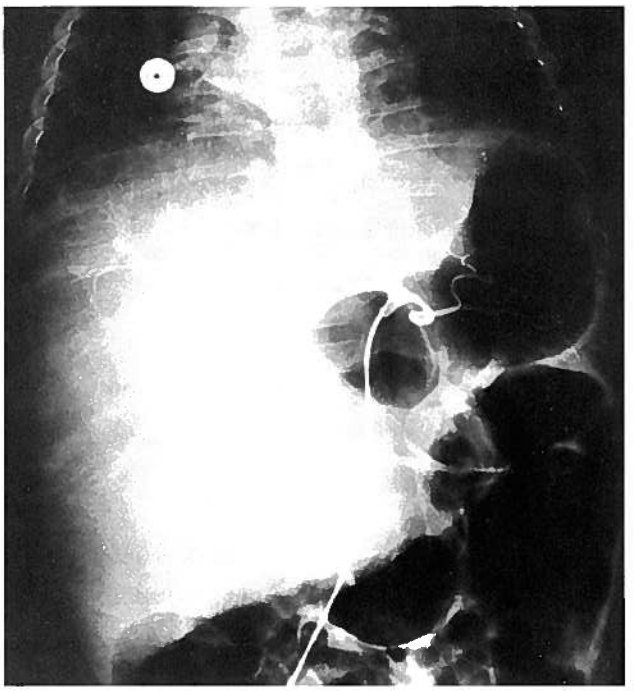


Figure 4: (case 4) - Right hepatic angiogram (venous phase): invasion of the portal vein with filling defect (hepatoma).



Figuré 5: (case 8) - Celiac axis arteriogram: tumor vessels originating from both hepatic arteries (hepatoblastoma).

Case 10 was a 9 year old black male who had an epigastric mass that on angiography (Fig. 10) showed extensive neovascularity supplied by the hepatic artery and on exploratory laporotomy a mass limited to the left lobe was found that was diagnosed pathologically as hepatic adenoma. The right hepatic angiogram was normal. Ultrasound (Fig. 11) on this case showed a solid mass and the ^{99mm}Tc showed a filling defect thought to be localized in the right lobe of the liver (Fig. 12).

Case 11 was a 27 year old female who had been under birth control pills for 7 years, and the angiogram (Fig. 13) showed an avascular artery, and which pathological diagnosis was focal nodular hyperplasia (FNH). The other case (case 12) of FNH was hypervascular on Angiography.

The ultrasound and the nuclear medicine were positive in only one of the cases of FNH (case 11) (Figs. 14, 15).

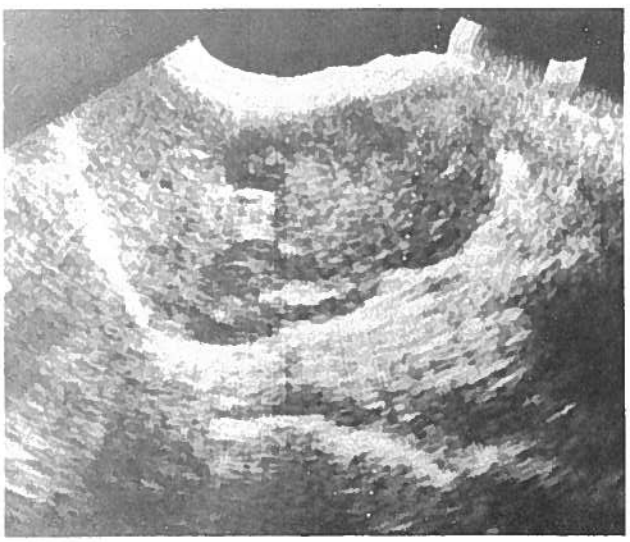


Figure 6: (case 1) - Hepatic echography: echogenic occupying space lesion (hepatoma).

TABLE 1 **Clinical Presentation**

SE	AGE/Color Sex	Nosologic Group	Pathological Diagnosis	Symptoms & Signs
1	27/BF	Primary tumor	Hepatoma	RUQ mass 3 years, no symptoms
2	30/BF	Primary tumor	Hepatoma	RUQ mass + pain 6 months
3	69/BM	Primary tumor	Hepatoma	RUQ mass, no symptoms
4	58/WM	Primary tumor	Hepatoma	RUQ mass 1 year
5	36/WM	Primary tumor	Hepatoma invading stomach + left adrenal	LUQ pain, nausea, vomiting 3 weeks LUQ mass
6	48/BM	Primary tumor	Hepatoma	RUQ mass 2 years
7	53/BM	Primary tumor	Hepatoma	RUQ mass 1 year + pain
8	3/WM	Primary tumor	Hepatoblastoma invading retroperitoneal space	Anemia + RUQ mass
9	71/BF	Primary tumor	Necrotic adenocarcinoma biliary tract	RUQ pain + mass, nausea
10	9/BM	Primary tumor	Adenoma	Epigastric mass
11	27/BF	Primary tumor	Focal nodular hyperplasia	LUQ pain, fever (39°) acute anemia
12	29/BF	Primary tumor	Focal nodular hyperplasia	RUQ mass
13	60/BM	Secondary tumor	Met. adenocarcinoma L colon	Melena, anemia
14	24/BF	Secondary tumor	Met. renal cell carcinoma	2 years earlier nephrectomy
15	65/BF	Secondary tumor	Met. Colon Leiomyosarcama	Colectomy 2 years earlier
16	53/BF	Secondary tumor	Met. adenocarcinoma colon	Colectomy 1.5 year earlier
17	58/WM	Secondary tumor	Colon adenocarcinoma	Rectorrhagy
18	76/BM	Cyst	Giant cyst liver	RUQ mass
19	7/BM	Inflammatory	Granulomatous inglammation visceral larva migrans	
20	74/BF	Inflammatory	Vesical hydrops - inflammated BF	RUQ pain + mass
21	42/BM	Inflammatory	R subphrenic abscess	Gun shot wound chest + abdomen, pancreatic injury, splenectomy
22	55/BF	Inflammatory	Hepatic abscess	Vague abdominal pain, nausea, vomiting.
23	45/WF	Traumatic	Subcapsular hematoma	Pain RUQ; trauma 2 months earlier
24	32/BF	Degenerative	Cirrhosis, regenerative nodule	Choriocarcinoma 6 months earlier

Five of our patients had hypervascular metastasis on angiography. One of them (case 14) was a 24 year old female who had nephrectomy due to renal cell carcinoma 2 years earlier, and the angiogram (Fig. 16) showed encasement of the right hepatic artery and neovascularity supplied by both hepatic arteries and in the late phase (Fig. 17) there were two small dense nodules, lucent in central portion. The primary tumor in the other 4 patients was in the colon. Case 15 had a colectomy 2 years earlier due to leiomyosarcoma of the colon, the angiogram (Fig. 18) shows a spherical vascularized lesion spoke wheel pattern supplied by the right hepatic artery and in late films presents as a spherical rim stain. Ultrasound performed in these patients was negative in 3 and showed 2 solid masses in 2 of them. ^{99m}Tc was positive in only one of the cases with metastases in which there was a filling defect.

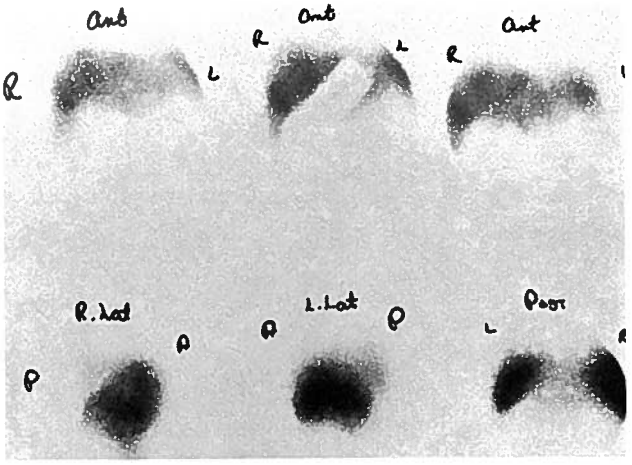


Figure 7: (case 1) - ^{99m}Tc scan of the liver: decreased uptake in right lobe of the liver (hepatoma).

The hepatic cyst (case 18) showed on angiography (Fig. 19) as an avascular mass with displacement of the aorta, celiac axis and SMA. On ultrasound there was a cystic structure (Fig. 20) and on ^{99m}Tc a defect was shown.

In 4 patients angiogram was done for clinical suspicion of tumors, however open biopsy showed inflammatory processes. Case 19 is a 7 year old male with RUQ pain and an avascular mass on hepatic angiogram, (Fig. 21). The ultrasound was negative and there was incresed uptake by gallium. The pathological examination proved to be a granulomatous inflammation caused by visceral larva migrans.

The case of vesical hydrops and colecistites (case 20) showed on angiogram (Fig. 22) dilatation of the cystic artery and on late phase a dilated gallbladder with a thickened wall. The ultrasound showed a dilated gallbladder with stones and thickened wall. The nuclear medicine was negative.

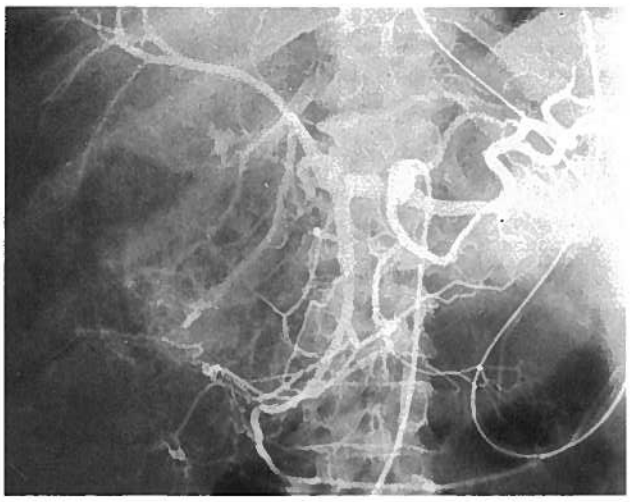


Figure 8: (case 9) - Celiac axis angiogram (arterial phase): dilated and encased cystic artery from which originate tumor vessels (cholangiocarcinoma).

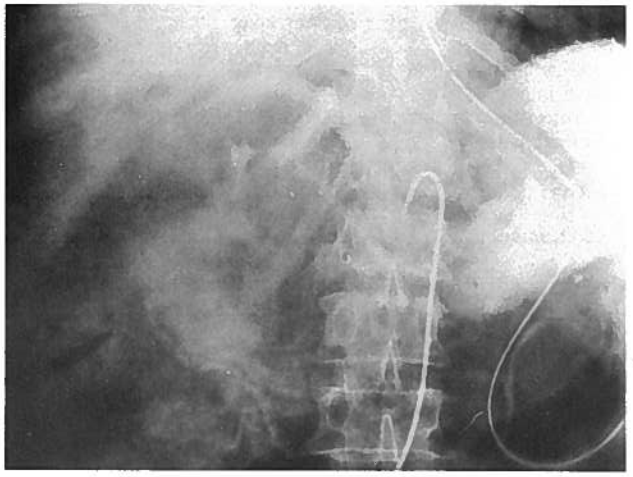


Figure 9: (case 9) - Celiac axis angiogram (late phase): heterogenous tumor staining with central lucency to the right of L_1 and L_2 (cholangiocarcinoma).

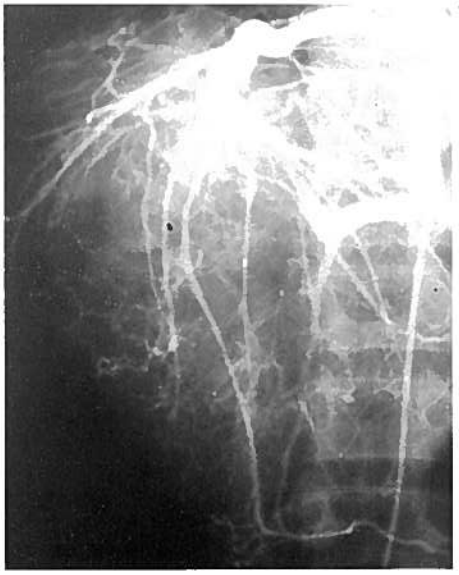


Figure 10: (case 10) - Celiac axis angiography shows a dilated left hepatic artery with extensive neovascularity (hepatic adenoma).

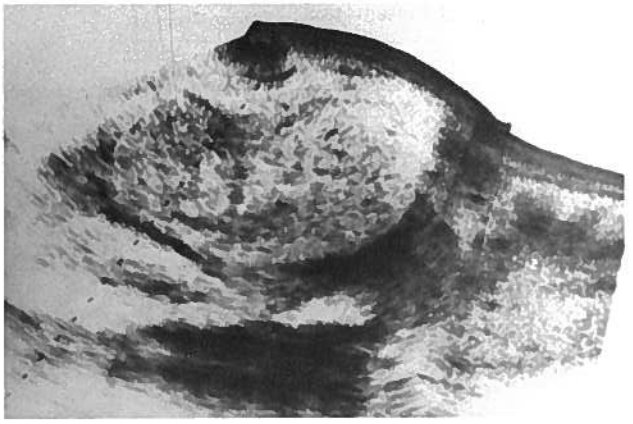


Figure 11: (case 10) - Hepatic echography shows a solid mass (hepatic adenoma).

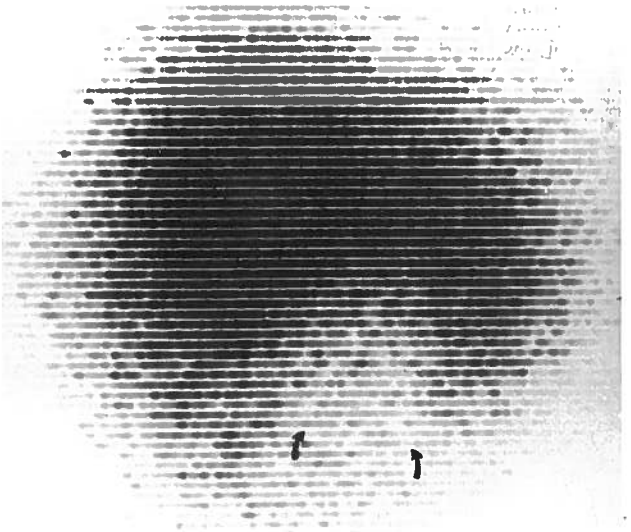


Figure 12: (case 10) - ^{99m}Tc scan of the liver: decreased uptake lower surface of liver. (Hepatic adenoma).

Figure 13: (case 11) - Hepatic angiogram: avascular mass in the left lobe of the liver with displacement of the branches of the left hepatic artery. (Focal nodular hyperplasia).

Figure 14: (case 11) - Hepatic echography: complex mass with solid + cystic compound in the left lobe liver (focal nodular hyperplasia).

The patient with a subphrenic abscess (case 21) formed following a gun shot wound penetrating the abdomen and chest showed on angiogram an avascular area on each side of the falciforme ligament. On ultrasound (Fig. 23) there was a complex mass with solid and cystic compound and the ^{99m}Tc showed defect under the diaphragmatic dome (Fig. 24).

Case 22 showed on angiogram (Fig. 25) an avascular mass with a peripheral rim. On ultrasound there was a complex mass, and the nuclear medicine was negative. Two exploratory laparotomies were negative although the microscopic examen of the several biopsies taken during the second laparotomy showed acute inflammatory cells in the portal space.

The patient with an organizing subcapsular hematoma (case 23) had an hepatic arteriogram (Fig. 26) which showed medial displacement of the hepatic branches and some neovascularity and on the parenchymatous phase there was an external avascular space separating the liver from the abdominal wall. The ultrasound on this patient showed a complex mass and the ^{99m}Tc showed a defect on the right lobe.

A patient had a choriocarcinoma (case 24) 6 months early and a right upper quadrant mass. The celiac axis angiogram (Fig. 27) showed cockscrew appearance of the hepatic branches typical of cirrhosis and a central avascular round lesion due to a regenerative nodule. The ultrasound and the nuclear medicine were negative.

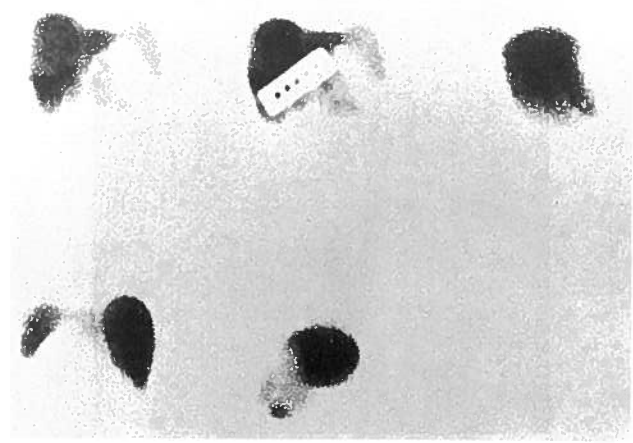


Figure 15: (case 11) - ^{99m}Tc scan: filling defect in the left lobe of the liver (focal nodular hyperplasia).

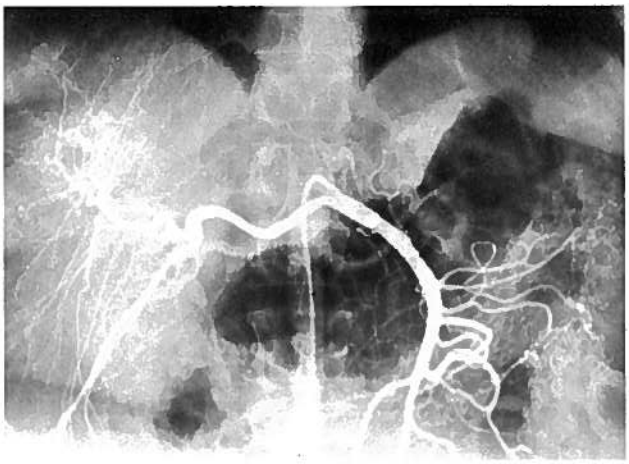


Figure 16: (case 14) - Right hepatic artery originating from superior mesenteric artery (arterial phase) encasement of the right hepatic artery and neovascularity (metastases from renal cell carcinoma).

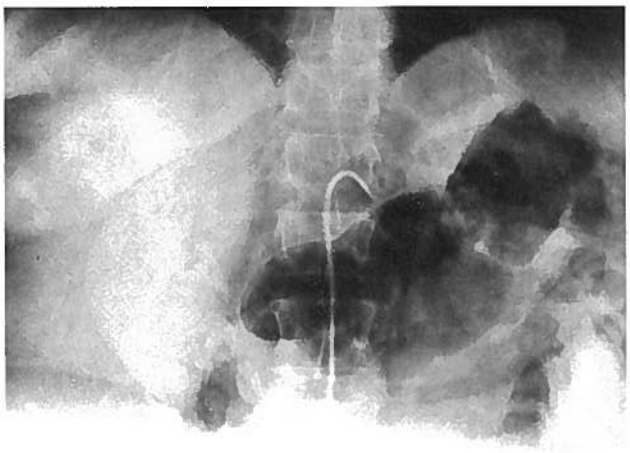


Figure 17: (case 14) - Parenquimatous phase of the right hepatic arteriogram: 2 dense nodules of 1 cm and 3 cm in diameter, lucent in central portion (metastasis from renal carcinoma)

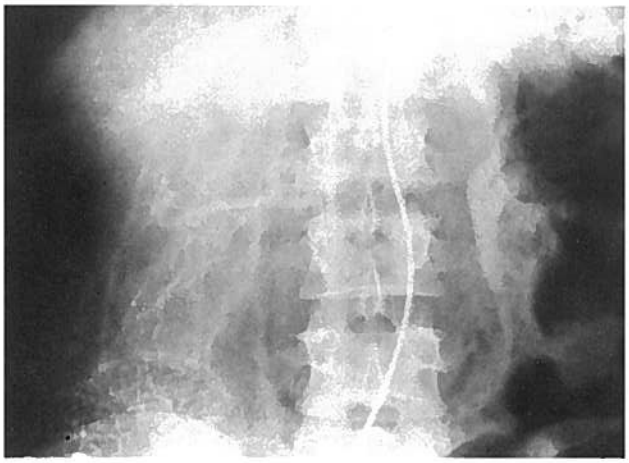


Figure 18: (case 15) - Celiac axis angiogram (late phase): spherical vascularized lesion spoke wheel pattern supplied by the right hepatic artery and overlying the right ileum (metastasis leiomyosarcoma).

TABLE 2 **Sensibility of angiography, ultrasound and nuclear medicine on hepatic masses**

Diagnosis	Number of cases	Angiography %	Ultrasound %	Nuclear medicine %
Hepatoma	7	100	71	57
Hepatoblastoma	1	100	100	100
Cholangiocarcinoma	1	100	0	0
Hepatic Adenoma	1	100	100	100
Foc. Nodular Hyperplasia	2	100	50	50
Metastases	5	100	40	20
Cyst	1	100	100	100
Infection	4	100	75	50
Subcapsular Hematoma	1	100	100	100
Cirrhosis	1	100	0	0

Figure 19: (case 18) - Abdominal aortography: avascular mass with displacement of the aorta, celiac axis and superior mesenteric artery to the left (hepatic cyst).

Figure 20: (case 19) - Hepatic echography: occupying space lesion with some echoes (loculated liver cyst).

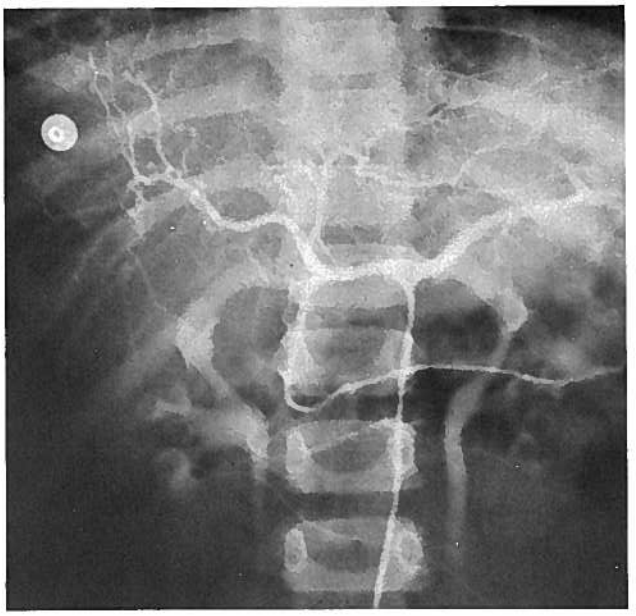


Figure 21: (case 19) - Celiac axis arteriogram: medial displacement of the branches of right hepatic artery by a peripheral avascular lesion (granulomatous inflammation by visceral larva migrans). Metalic mark.

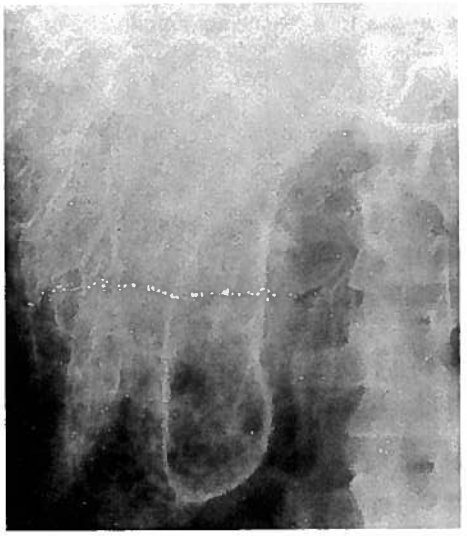


Figure 22: (case 20) - Celiac axis arteriogram (late phase): dilated gallbladder with thick wall (colecistites + vesical hydrops).

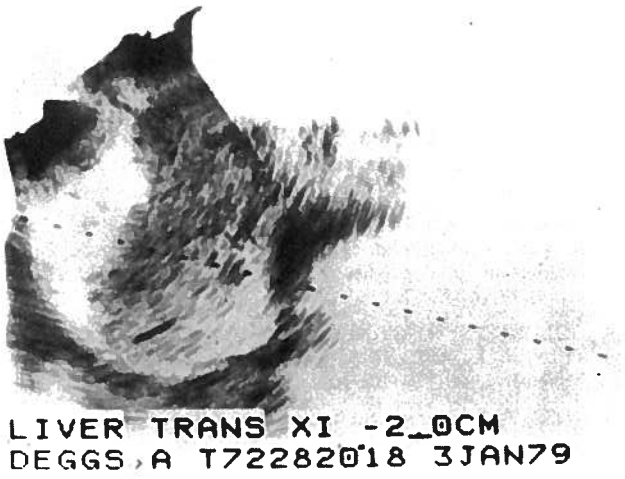


Figure 23: (case 21) - Hepatic echography: complex mass with solid and cystic compound under the diaphragmatic dome (subphrenic abscess).

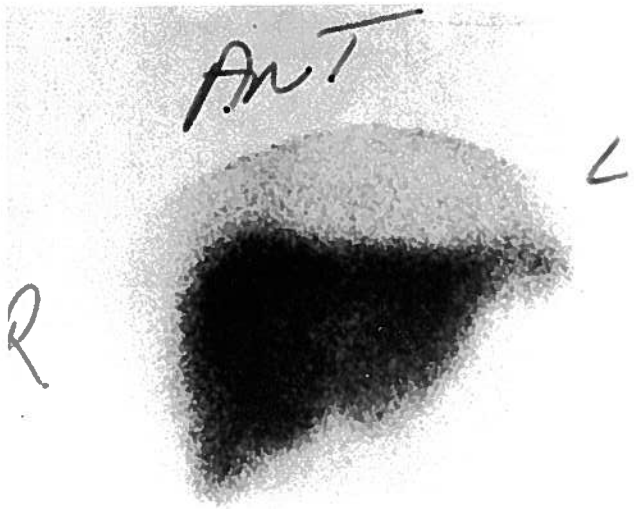


Figure 24: (case 21) - ^{99m}Tc scan: decreased uptake under the right dome (subphrenic abscess).

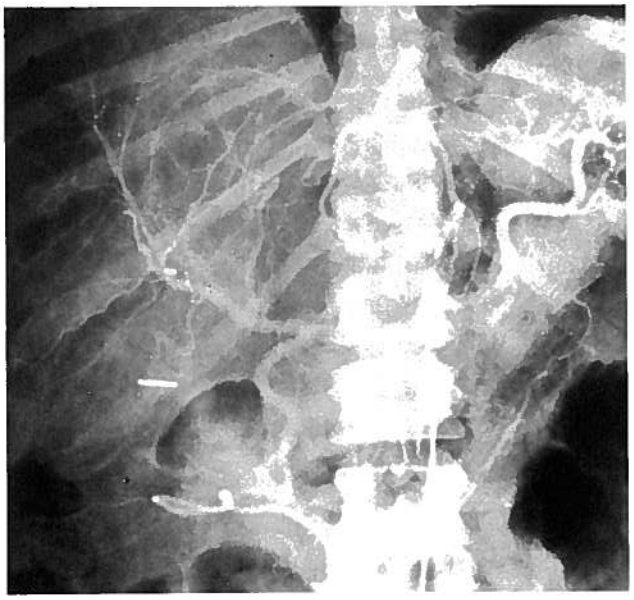


Figure 25: (case 22) - Celiac axis arteriogram: avascular space occupying lesion in the liver with a peripheral rim (hepatic abscess).

Figure 26: (case 23) - Celiac axis arteriography: medial displacement of the hepatic branches and some neovascularity. External avascular space separating the liver from the abdominal wall (organizing subcapsular hematoma).

Figure 27: (case 24) - Hepatic arteriography: cockscrew appearance of the hepatic branches and a central avascular space occupying lesion in the middle portion of the liver displacing the vessels surrounding it (cirrhosis + regenerative nodule).

DISCUSSION

The comparative sensibility of all the 3 methods is shown on Table 2.

The mass was visualized by angiography in all of the cases. The angiographic diagnosis was wrong in 2 cases. The avascular focal nodular hyperplasia was diagnosed as hepatic adenoma and the liver cyst detected by angiography was a hamartoma.

The correct diagnosis was made in all cases of malignant primary tumors of the liver. The diagnostic criteria found in these tumors was arterial dilatation, neovascularity and tumor stain. Arterial encasement was only present in the case of cholangiocarcinoma, as has been described.[2]

In the cases of metastasis there was neovascularity with tumor stain in late phase and peripheral rim in some. There was no arterial dilatation, however, one of the cases showed encasement of the hepatic artery.

In the remaining cases the correct dignosis was suggested amongst other possibilities. In the case of organizing subcapsular hematoma, in spite of the tumor vessels, the diagnosis was suggested due to the avascular lateral mass between the lateral wall and the liver.

Angiography is a very important diagnostic method and may provide more data than even exploratory laparotomy, since angiography shows deep lesions, not easily seen by the surgeon. Such happened in the case of hepatic abscess in which 2 laparotomies performed were negative. It can give preoperative information on the extent and vascular anatomy of the liver.[3, 4]

Ultrasound and radionuclide scanning are useful methods, but in most of the cases are not diagnostic. In either of the procedures the different space occupying lesions cannot be accurately diagnosed.[5] Ultrasound can give information in differentiating between solid tumors and fluid-containing cysts or abscesses.[5] However, in a case of complex or solid mass, the etiologic diagnosis is difficult. Similarity occurs with isotope scanning. Radioisotope scanning should be used as a routine screening for the presence of metastases in a known case of cancer, although in cases of doubt angiography should be performed.

REFERENCES

1. BASS, E. M.: The radiological diagnosis of hepatoma with special emphasis on angiography. *S. Afr. Med. J.* 1975; 49: 745.

2. POLLARD, J. J.; FEISCHLI, D. J.; NEBESAR, R. A.: Angiography of hepatic neoplasms. *Rad Clinics of North America* 1970; Vol VIII: 31.

3. MARKS, W. M.; JACOBS, R. P.; GOODMAN, P. C.; LIM, R. C.: Hepatocellular carcinoma: clinical and angiographic findings and predictability for surgical resection. *Am J. Roentgenol*, 1979; 132: 7.

4. GOLDSTEIN, H. M.; NEIMAN, H. L.; MENA, E.; BOOKSTEIN, J. J.; APPLEMAN, H. D.: Angiographic findings in benign liver cell tumors. *Rad.* 1974; 110: 339.

5. ROSS, F. G.: Ultrasound in the diagnosis of liver disease. *Proc Roy Soc. Med.* 1974; 67: 221.

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