

VARIETY OF GRAY-SCALE SONOGRAPHIC
APPEARANCE OF UNTREATED LIVER METASTASES.

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ABSTRACT

Encountered with bizarre patterns of liver metastases declined our accuracy rate so the humiliation of mistakes motivated me to re-assess the value of hepatic sonography in patients suspected of having metastatic liver neoplasms. 43 patients, who had not received any prior therapy, had been studied by gray-scale ultrasound. The echographic evidence in accordance with our experience can be categorized as follows: I) large echogenic or echopoor area, II) discrete masses with high-level echoes spreaded throughout a lobe of the liver, III) echo free mass with irregular margin, IV) diffuse alteration of the homogeneous echo pattern of the liver, V) Bull's-eye, VI) abscess like, VII) solid echogenic mass with a central hyperechoic horizontal line, VIII) echogenic mass with two lateral hypoechoic margins, IX) isodense echogenic area bounded by an hypoechoic circle. The features seen in liver ultrasonography of the entire patterns, and those seen as new criteria are presented.

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EQUIPMENT AND METHOD

A Unirad GZD 849 (Digital convertor) unit and a diasonograph 4102 (Analogue convertor) gray scale unit with 2.25, 3.5, and 5 MHz medium and long focal zones were employed. Selection of proper transducer for each patient and each examination may be difficult. Generally the highest frequency that will adequately penetrate the area of interest is suggested. Proper adjustment of the TGC with different transducer is essential in obtaining diagnostic scans. Patients in the supine position were examined in both the transverse and sagittal planes. In the sagittal examination, a single-pass technique was used while the patient's respiration was suspended in deep inspiration. The transverse scans have been most useful in confirming lesions located in the lateral segment of the left lobe. Images were obtained at 1cm intervals across the entire upper abdomen in both planes. Results were recorded on a conventional 55mm film but the diagnosis was made from the television monitor image as the author has to perform the all examinations.

RESULTS

132 Patients with strong clinical impression of having metastatic lesion studied by gray scale ultrasound. In 6 cases ultrasound failed because of gaseous distention. Incorrect diagnosis has been made in 5 cases. Only in 43 cases liver metastasis have been identified. In 78 of 132 cases no defect had been found in the liver but disclosed metastatic neoplasm in other organ. Subsequently X-ray and isotopic studies supported the ultrasonic finding.

Echography in 6 of 12 patients, who proved to have a primary adenocarcinoma of the colon, showed a large area containing fewer or more echoes than the surrounding normal liver parenchyma Fig.1. In remaining 5 cases discrete masses with high level echoes spreaded throughout the liver Fig.2 were seen. Only one case of totally echofree mass with irregular margin was noted Fig.3.

The diffuse alteration of echo architecture of the liver was not a commonly observed type in this series. This pattern has only been found in 2 cases Fig.4 in whom metastatic papillary carcinoma from the gallbladder have been proved. In 7 cases (five adenocarcinoma and two undifferentiated carcinoma both from unknown primary sites) a combination of two or more patterns was observed Fig.5. Meanwhile Bull's eye lesion either independently Fig.6 in one case of adenocarcinoma (unknown) or in association with the other echographic type were found. It is concluded that all forms of the combination may occur. These findings of ours are in common with the others (7, 13), but we have encountered with more patterns in the course of investigation.

Metastatic leiomyosarcoma, of gasterointestinal origin, to the liver was seen in 17 patients; among them abscess like lesion Fig.7 with fine echoes in the mass was observed in 5 cases. Since the lesions in these patients were superficially located, and the near field of the acoustic beam, is in fact, a very unfavorable place to position an item that merits close examination, the transducer was immersed in a degassed water bag at 37c then the mass was scanned through the water at different distance, All the masses revealed with regular walls and echo accentu-

ation in recording structures behind them. Two patients of them died either because of the progress of the disease or from secondary infection, post mortem study revealed neither necrotic area nor liquidification within the mass. In the remainder 12 cases, single or multiple high-level echogenic mass with a well defined central horizontal line was revealed in the mass in 3 cases Fig. 8 which is very unlikely to be gravity dependent layering (14,15). Moreover retrospective analysis of sonograms of liver metastatic neoplasm accumulated in our filing showed horizontal line in two cases which had been overlooked at the time of interpretation. These were not included in this series. In the last 9 patients a well demarcated high-level echogenic mass with two lateral hypoechoic margins Fig. 9,10 were noted. Once again the water bag has been used in hoping to get a hypoechoic area in the anterior surface of the mass which may be masked by the strong echoes reflected from the soft tissues of the abdominal wall and/or by the transducer's interference phenomenon. Also the attempt has been made to insonate the mass exactly at the focal zone of the transducer, but it did not change the result.

Finally in 4 patients a rounded isoechoic area with respect to the liver parenchyma bounded by an hypoechoic circle were observed Fig. 11. oat cell carcinoma of the lung was the primary site in 3 cases and ovarian carcinoma in one patient.

DISCUSSION

Of course bi-stable ultrasound examination have been highly successful in the obstetrics field for many years, with this technique evaluation of liver size, contour

and primary or secondary liver neoplasms in a limited range were also feasible. Recent technological advance of gray scale ultrasound has markedly improved diagnostic capabilities. This technique has provided an increased

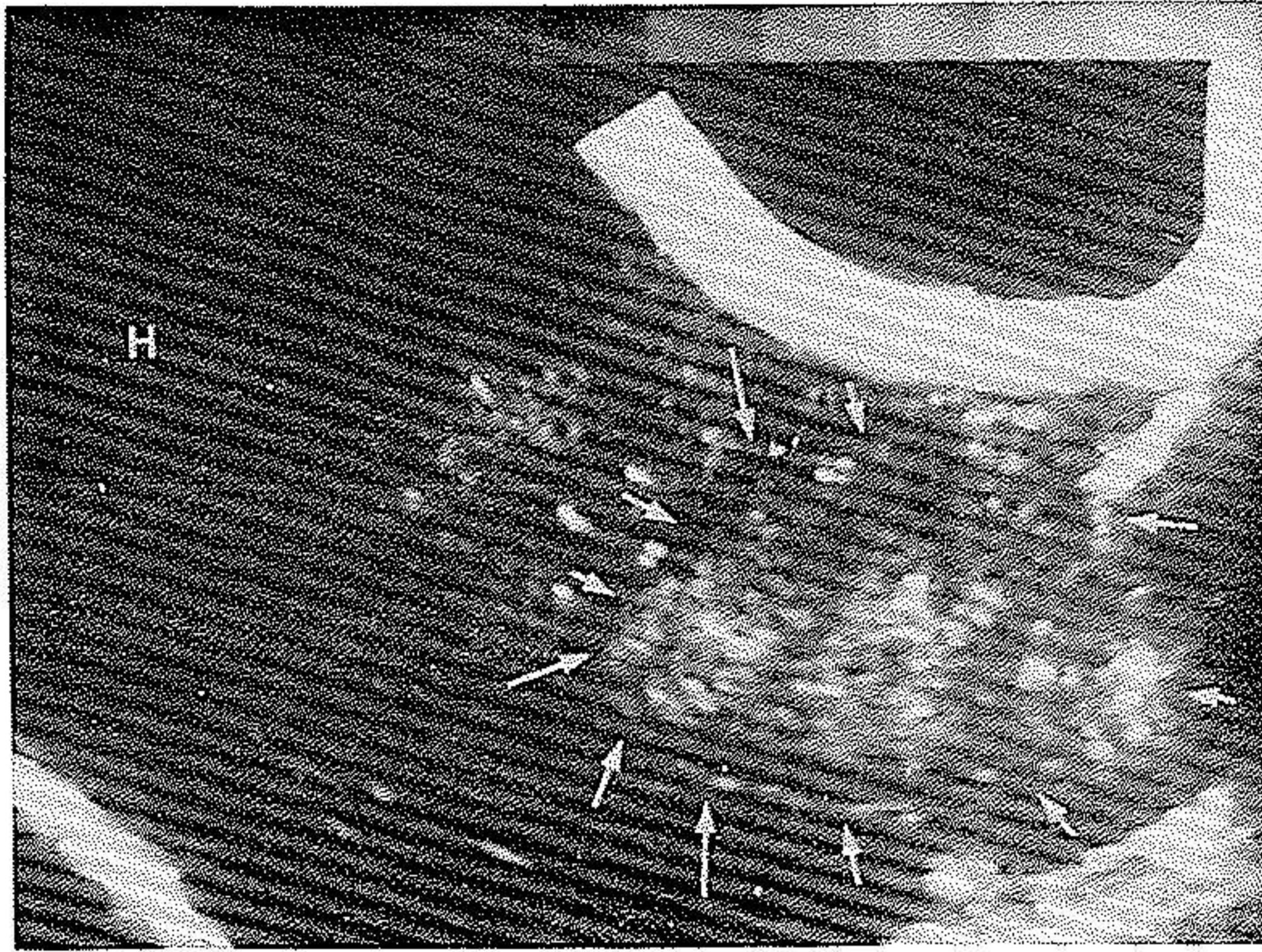


Fig.1. Pattern I. A large mass with high level internal echoes (Arrows) corresponding to a metastatic colonic adenocarcinoma is seen in this longitudinal scan which was taken through the mid-right lobe of the liver (in this and in all subsequent longitudinal scans, H indicates the direction of the patient's head).

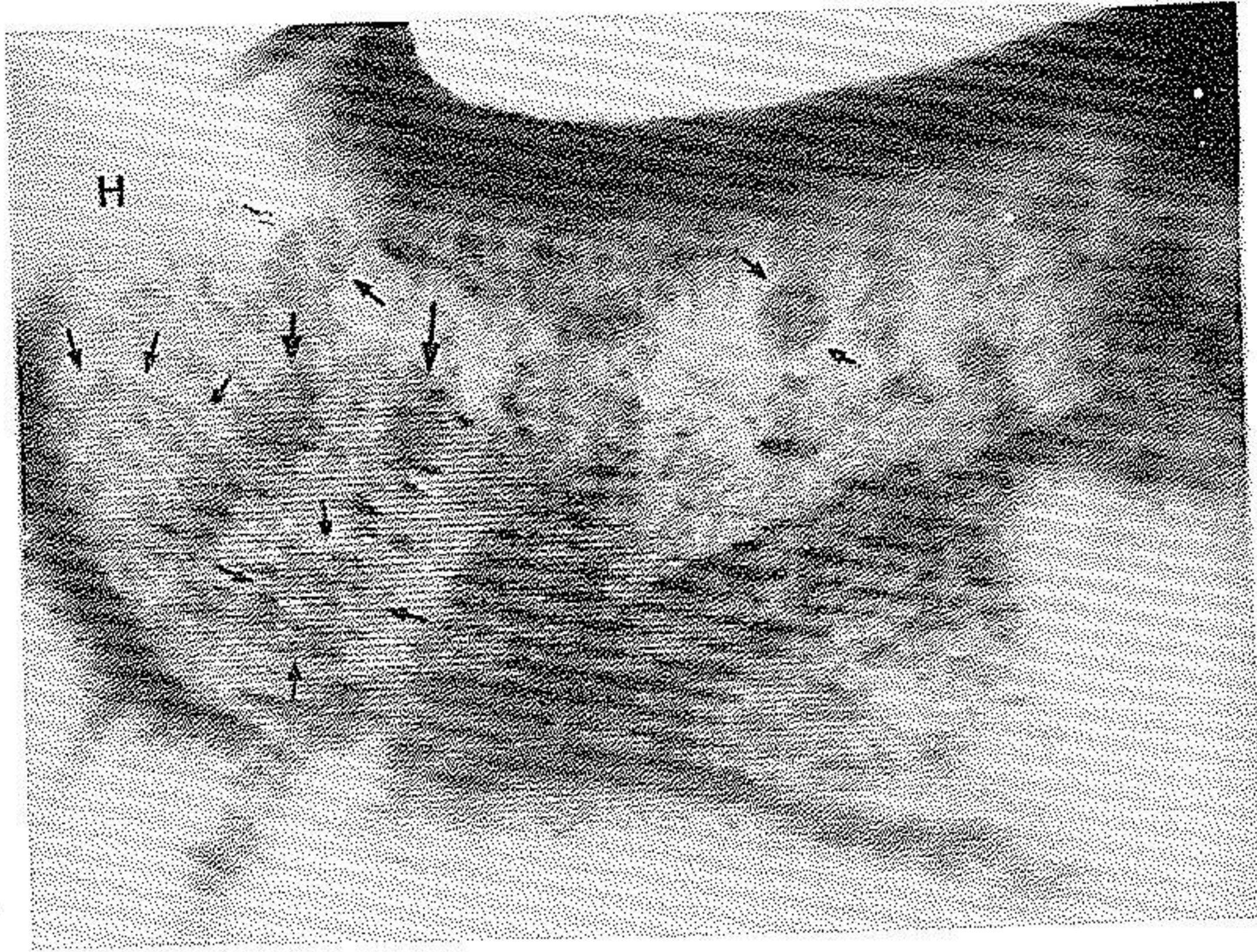


Fig.2. Pattern II. A longitudinal scan, 6cm to the right of the midline demonstrates multiple metastatic high-level echoes nodules (arrows) spreaded throughout of the area. Colonic adenocarcinoma was the primary site.

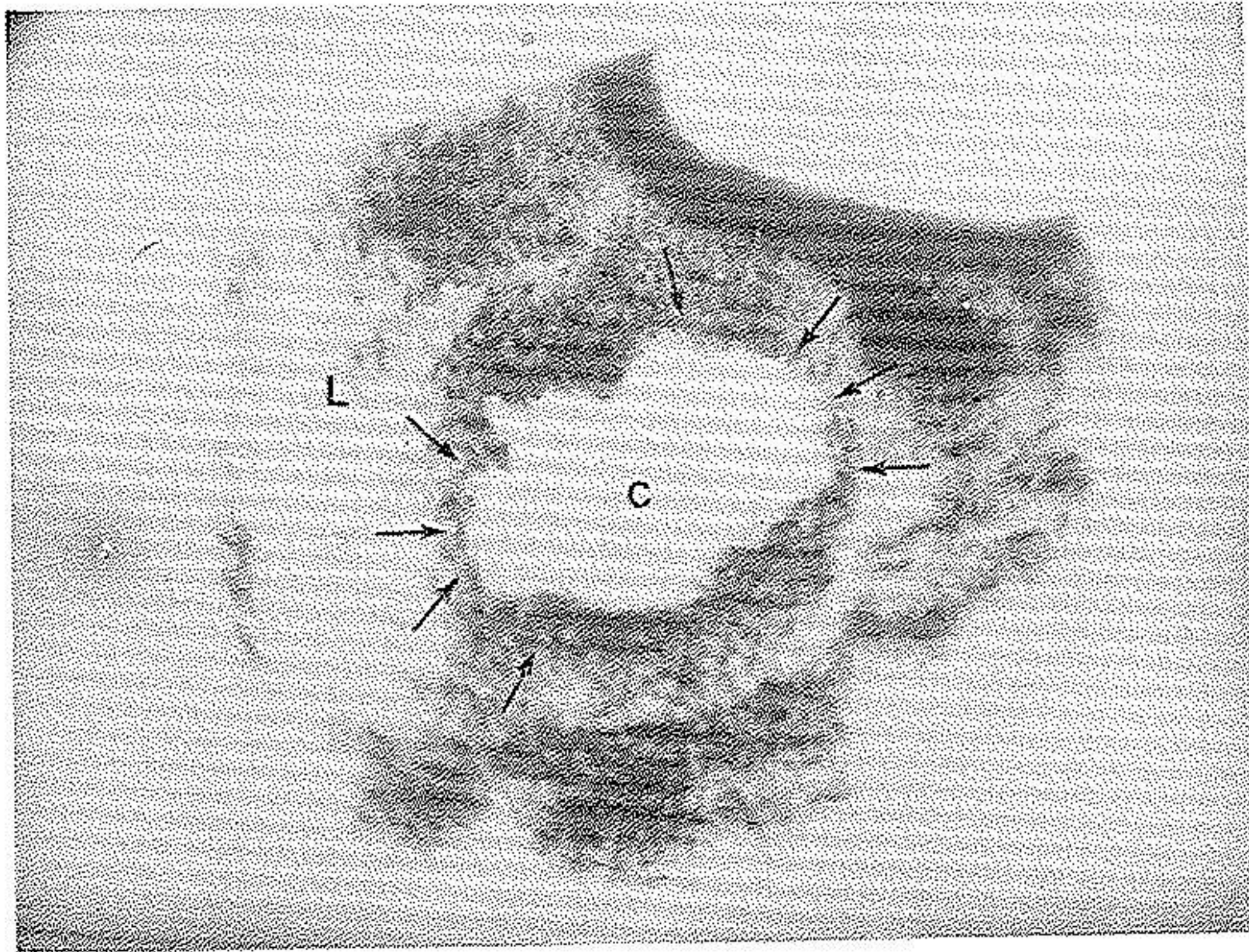


Fig.3.Patten III.Metastatic adenocarcinoma of the colon.
A longitudinal hepatic sonogram through the lateral aspect of the right lobe showing an echo - free mass(C) with irregular walls which did not change in appearance even at higher gain settings.

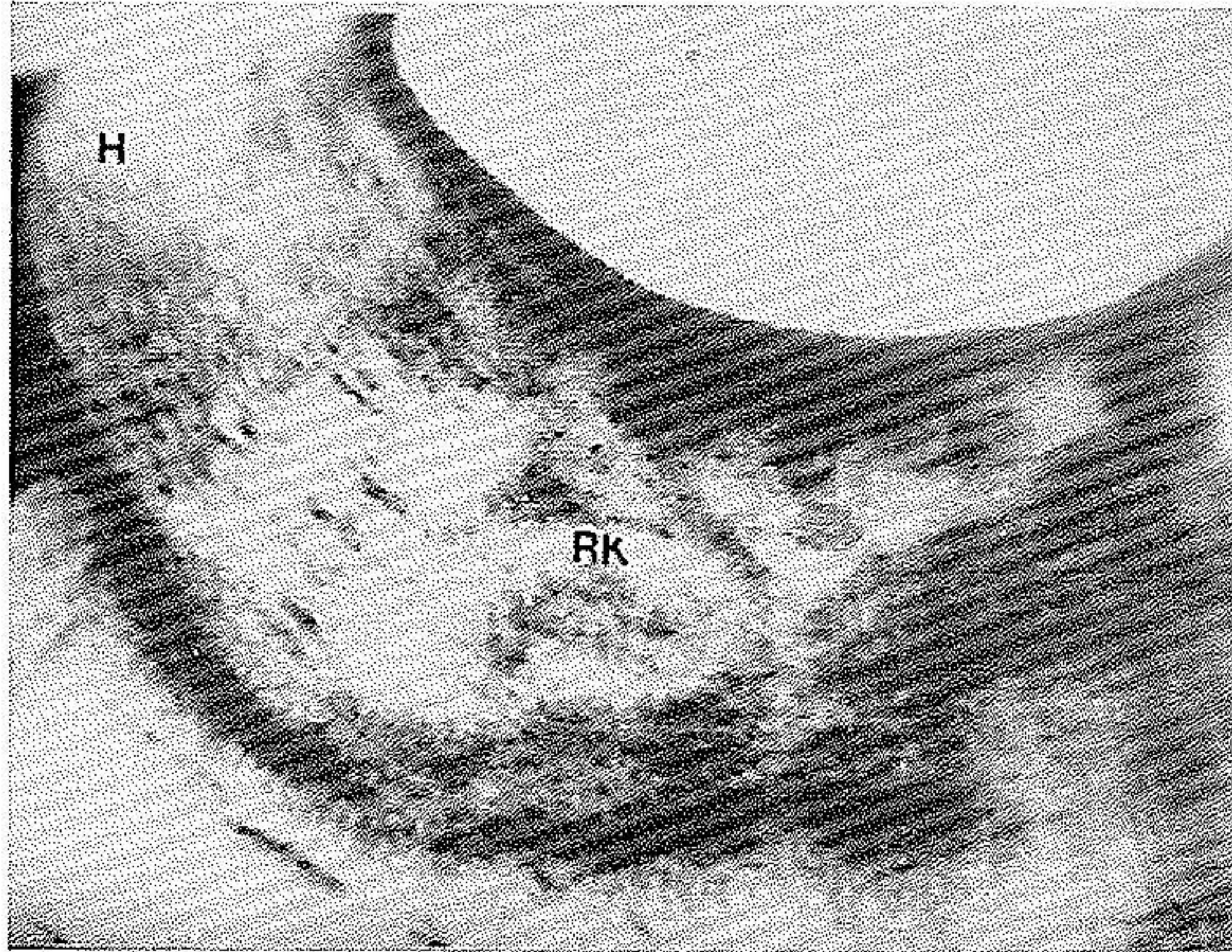


Fig.4. Pattern IV. Diffuse alteration of echo architecture of the liver is seen in this longitudinal hepatic ultrasonogram, which was taken through the mid-right lobe. The primary site of lesion was papillary carcinoma of the gallbladder. RK=right kidney.

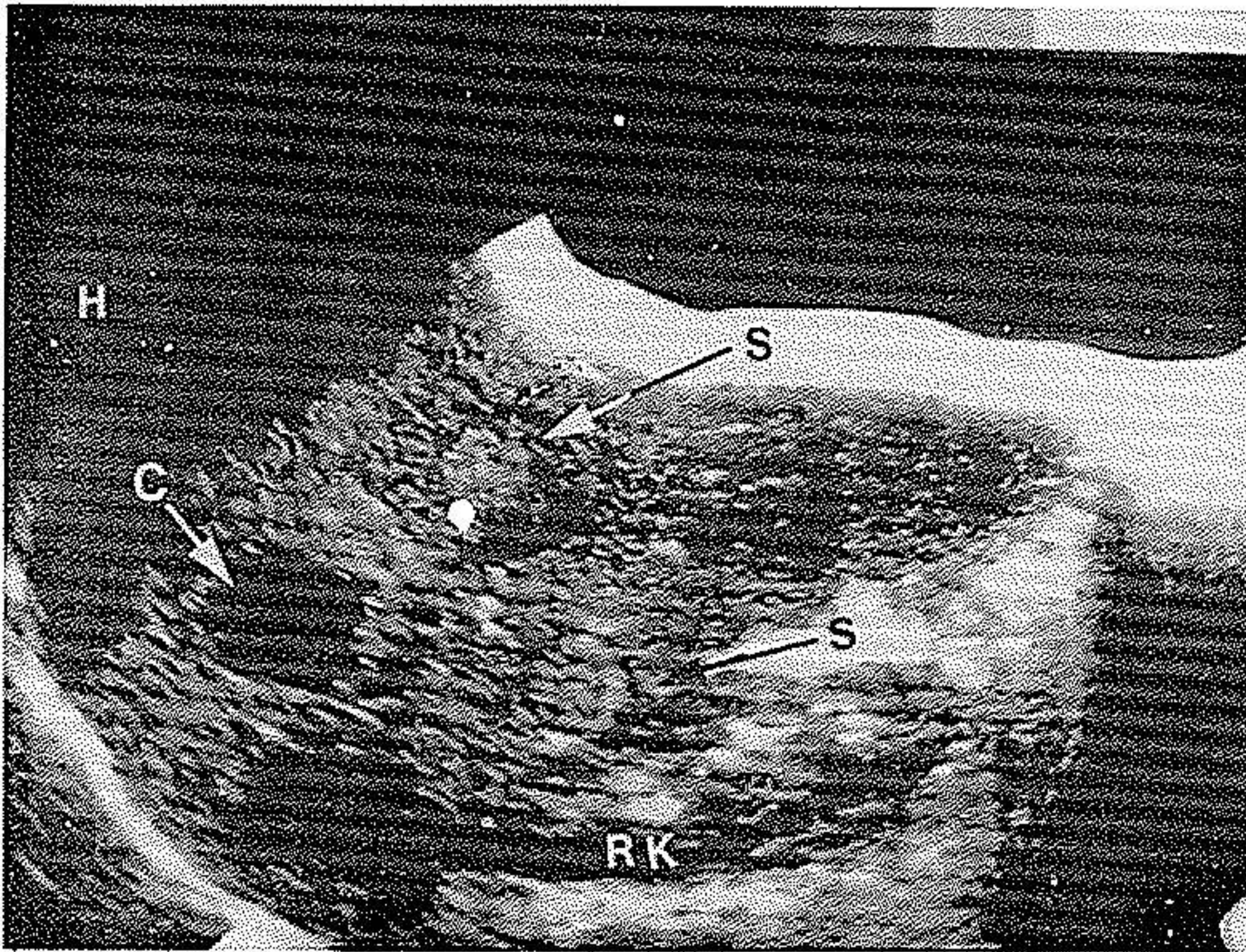


Fig.5. Longitudinal scan, 4cm to the right of the midline demonstrates a combination of pattern, cystic and solid nodules in the liver. Metastatic adenocarcinoma from an unknown primary site.

C=cystic S=solid RK=right kidney

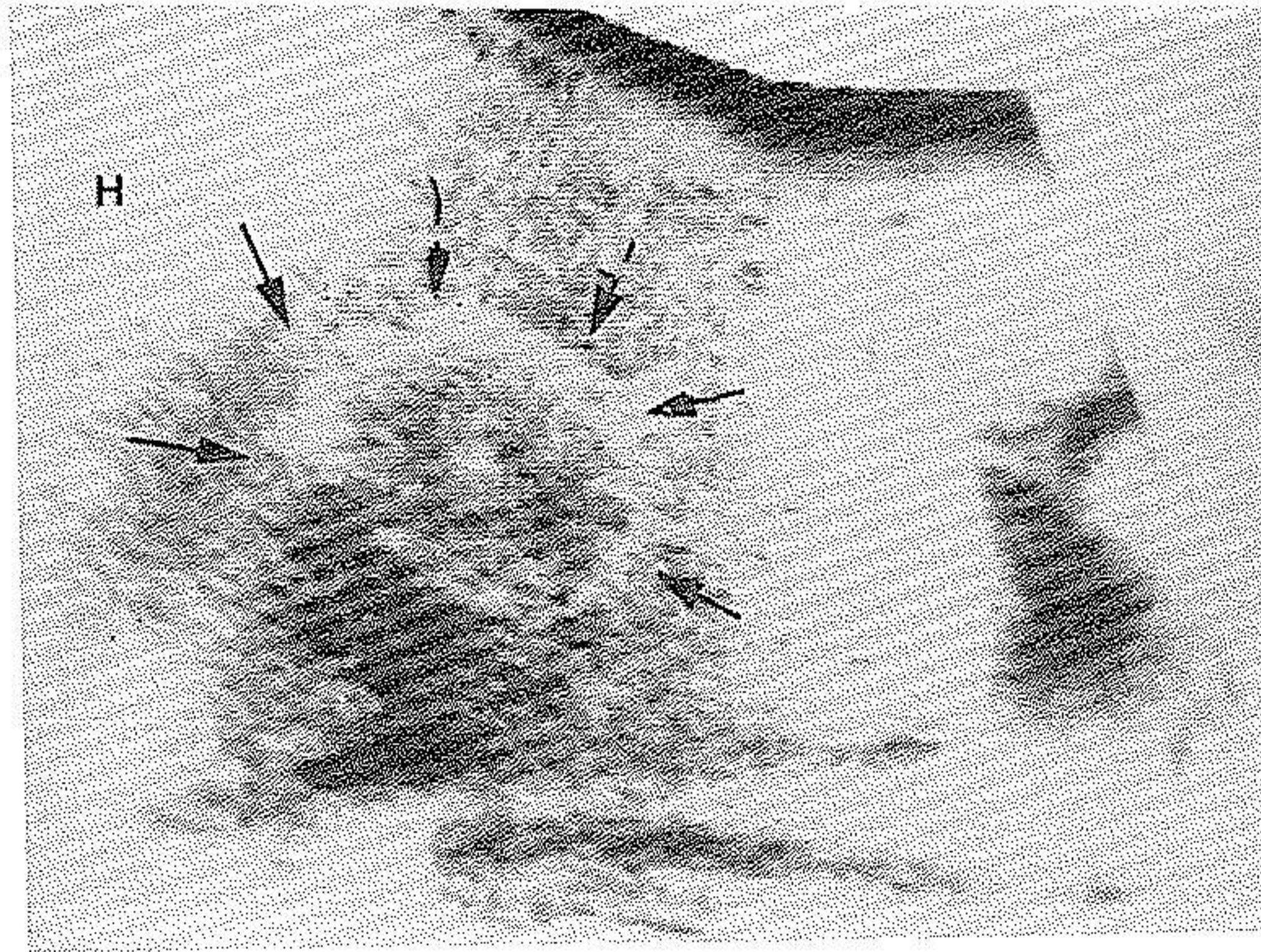


Fig.6. Pattern V. Bull's eye lesion (arrows) longitudinal scan 4cm to the right of the midline. Metastatic adenocarcinoma from an unknown primary site.

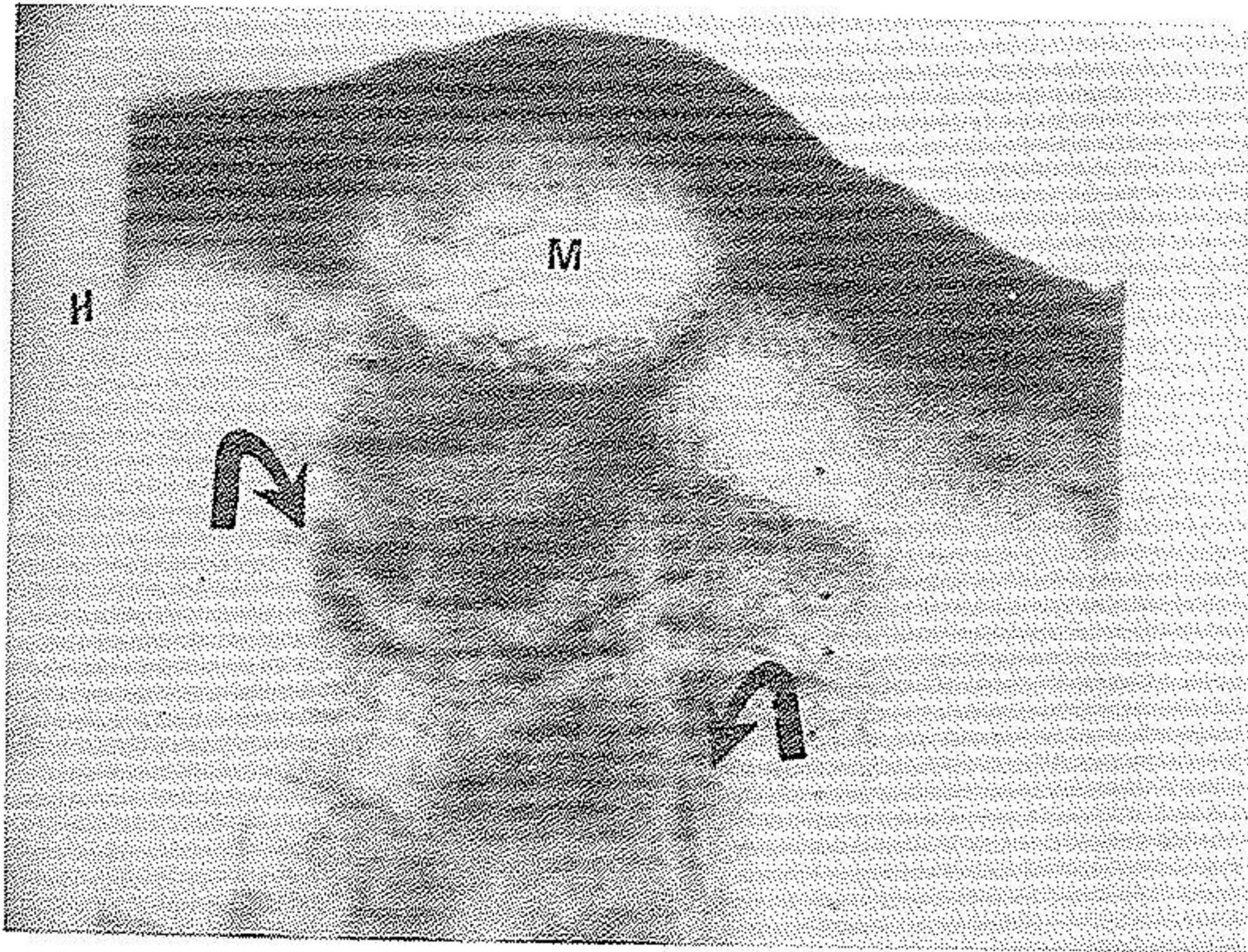


Fig.7. Pattern VI. A longitudinal hepatic sonogram 3cm to the right of the midline showing a well demarcated mass with regular walls (M) and accentuation of echoes behind the mass (curved arrows). Note the fine echoes in the mass. Metastatic leiomyosarcoma from gastrointestinal tract.

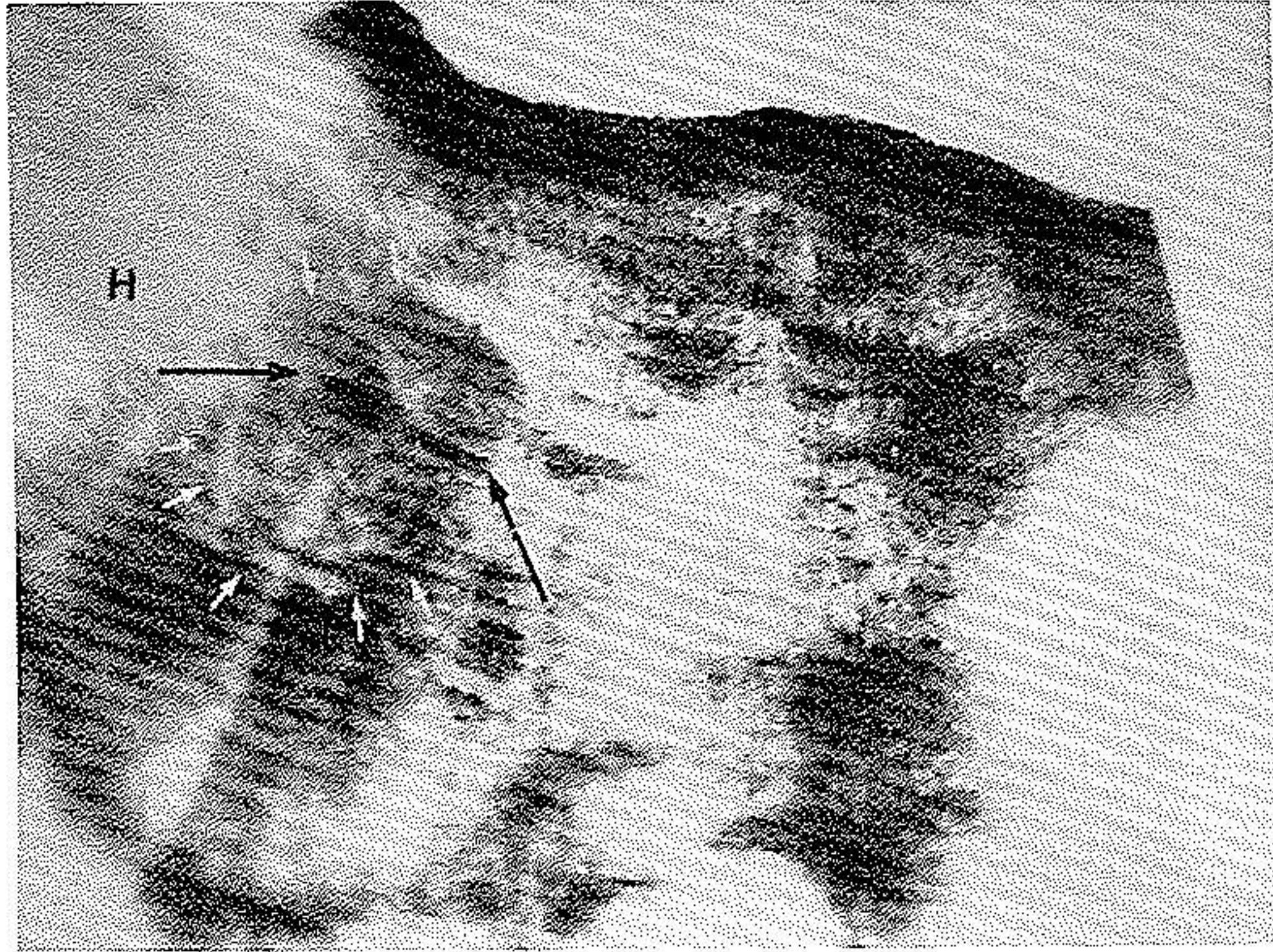


Fig.8.Pettern VII.A longitudinal ultrasonogram 6cm to the right of the midline showing a well defined solid mass(white arrows).Note the clear horizontal line(black arrows).Metastatic leiomyosarcoma from gastrointestinal tract.

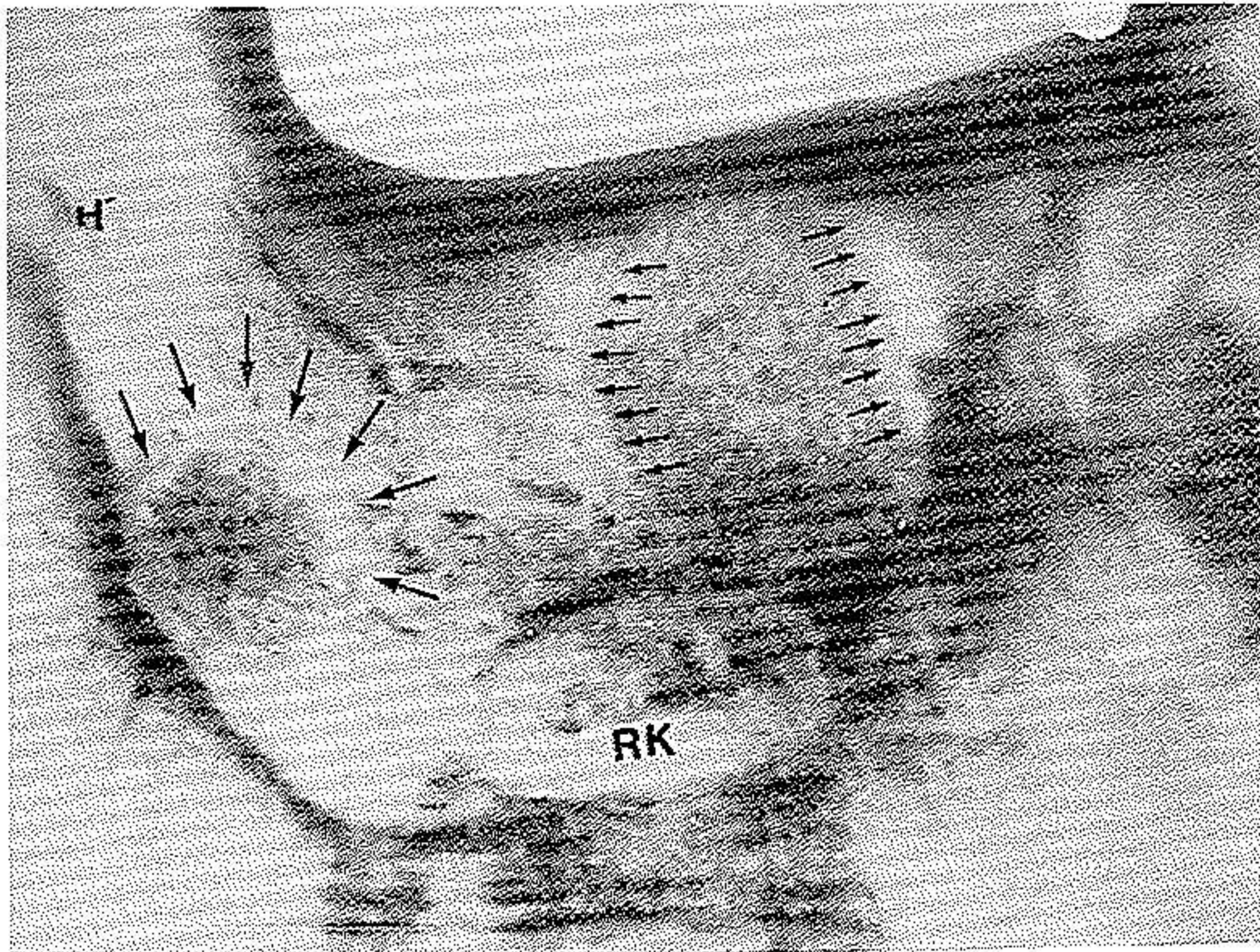


Fig.9. Pattern VIII, Metastatic leiomyosarcoma from the gastrointestinal tract. A longitudinal scan 3cm to the right of the midline showing an echogenic mass anterior to the right kidney (RK) and a small echogenic mass close to the diaphragm. A hypoechoic zone is seen in either side of the bigger mass (smaller arrows) and also a poorly defined circular hypoechoic area around the small mass is also noted (bigger arrows).

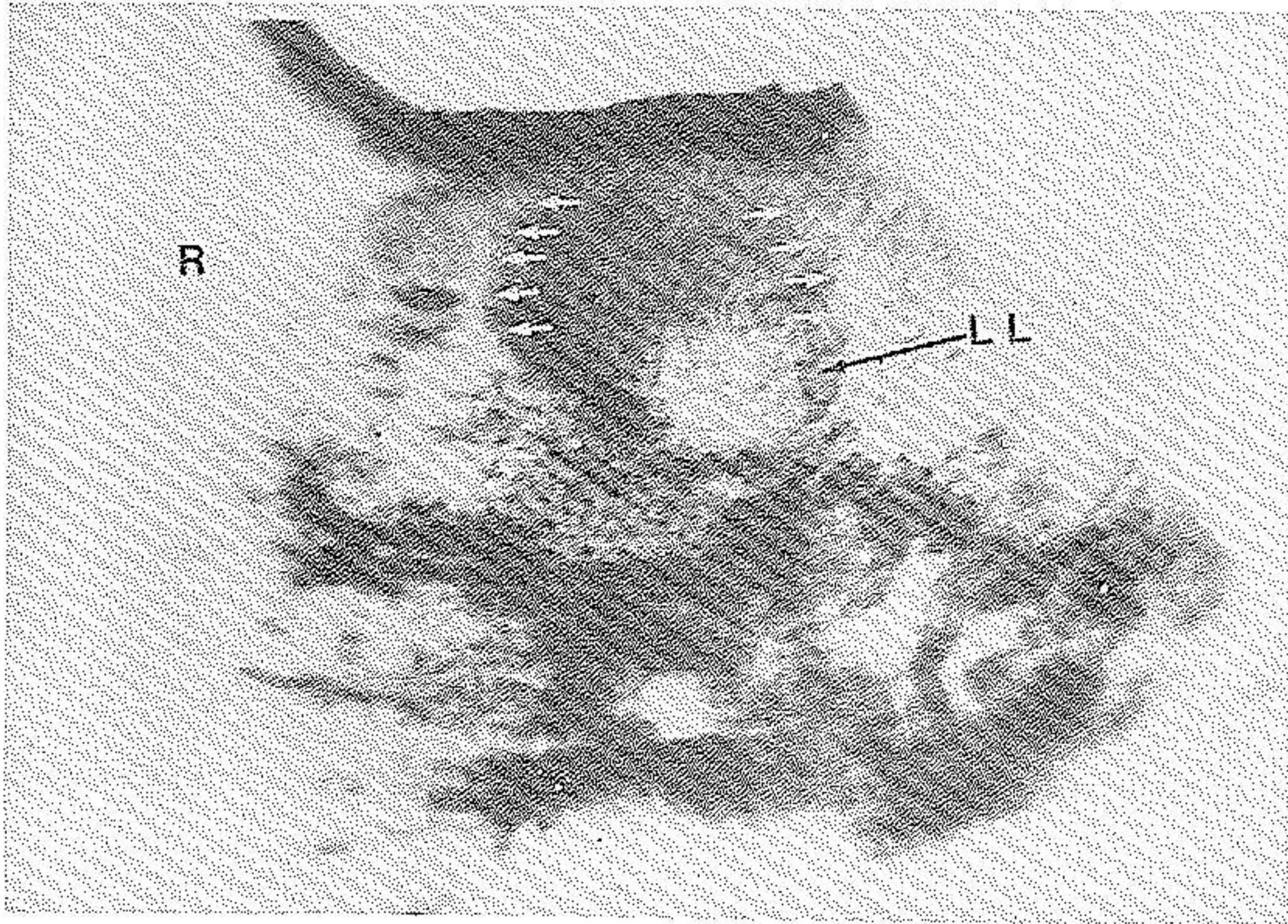


Fig.10. Transverse hepatic sonogram across the upper abdomen demonstrates a mass with high and low level internal echoes and lateral hypoechoic margins (small arrows). Metastatic leiomyosarcoma from the gastrointestinal tract.

R = patient's right side

LL=area with low-level
echoes

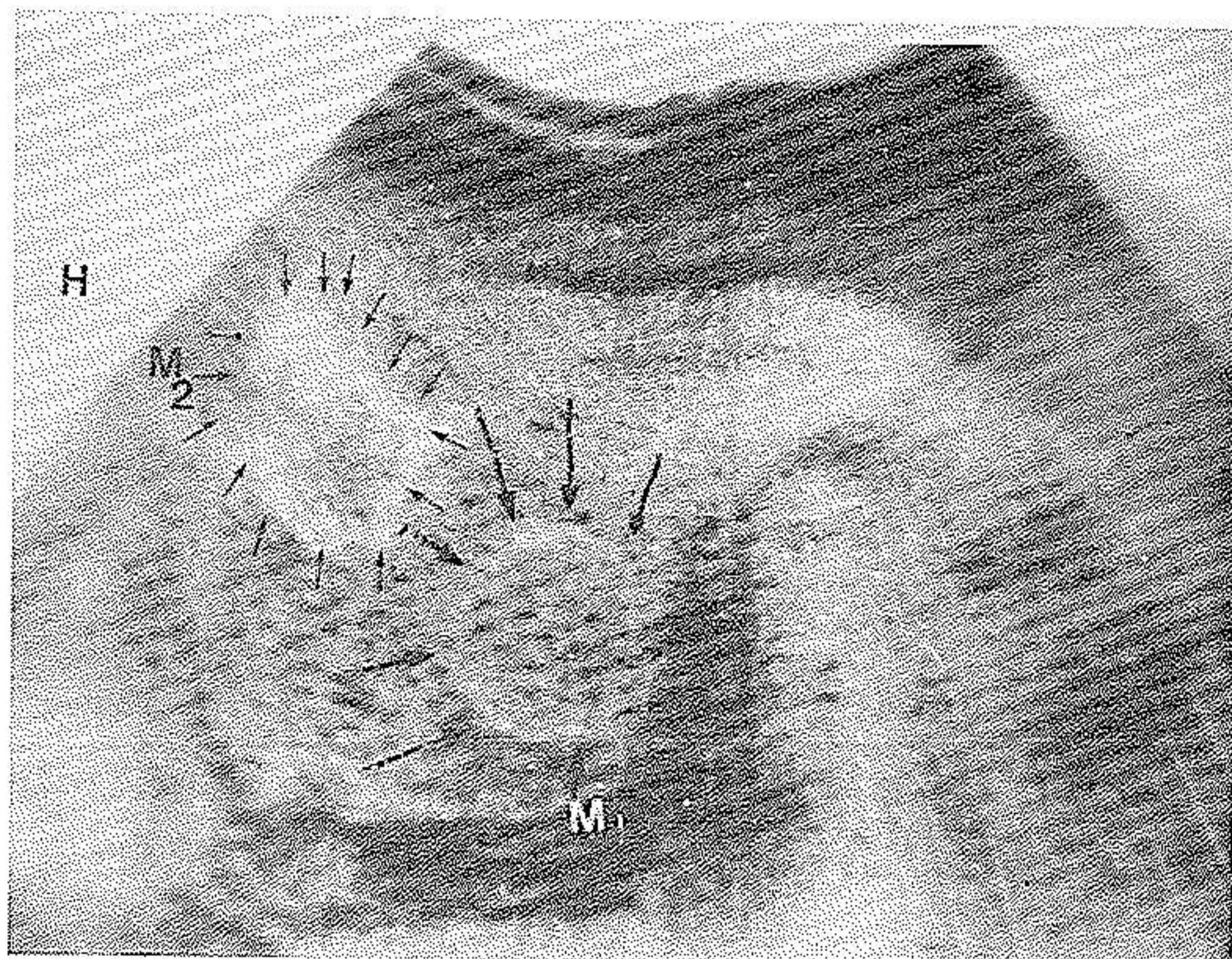


Fig.11. Pattern IX. Metastatic oat cell carcinoma from the lung. A longitudinal scan at 8cm to the right of the midline showing double isodense rounded area which are bordered by a circular hypoechoic zone. The center of the ultrasonic beam strike one of the two mass (M_1) however the other (M_2) is far from the center of the beam. (see text).

ability to identify anatomic structures which has led to improved diagnosis of liver pathology.

A chronologic list of ultrasonic imaging in the study of liver neoplasm shows Carlsen(5) describes that small metastatic lesions are likely to be less echogenic than surrounding normal parenchyma and as these lesions become larger in size they may display internal echoes from organization, degeneration or necrosis. Taylor(8,9,10,11,12) reports that untreated liver metastases reflect lower low-level echoes than normal tissue. Green(13) reports a variety of ultrasonic appearance of liver metastases which are still effective and are compatible with pathologic findings in our institution. In contrast to Carlsen's and Taylor's findings neither small metastatic lesions were generally less echogenic nor untreated secondary neoplasm has the characteristic appearance; as all patients in this series had not received therapy and showed a wide variety of pattern with different echogenicity.

In the course of examination I have encountered with new echographic patterns of hepatic neoplasms rather more than which have been reported by Green(13). Abscess like pattern exclusively found in 5 to 17 leiomyosarcoma with characteristic signs as regularity of the walls, fine low-amplitude echoes were present in the mass and posterior wall transmission; in high gain setting a rather confusing image was obtained. If these signs are not thoroughly compatible with a classic abscess it can be more close to it. Surprisingly post-mortem study in two patients didn't show necrosis or cystic formation within the mass. In these instances the history and clinical findings may be of a great help in clarifying the etiology of the mass. Solid mass with a clear horizontal line in the nodule is

a new pattern in this series, the genesial components of the line either echographically, or pathologically seems rather difficult to define, perhaps it is due to multiple reflections originated from fibrous septa within the lesion. The patients who were presented this pattern are still alive. It seems to me that several autopsies have to be performed in obtaining a reasonable interpretation to justify the existence of the line. Although gravity layering in necrotic metastatic liver neoplasm has been reported (14,15) but they have found a sharp interface between cystic and solid media quite unlikely with ours.

Metastatic leiomyosarcoma to the liver may exhibit a well defined homogeneous Fig.9 or heterogeneous Fig.10 mass with high-amplitude echoes, but more striking sign is the lateral hypoechoic margins. Nodules in the liver which return isodense echoes as compared to the surrounding liver parenchyma may be a metastatic lesion Fig.11; the nodule usually is distinguished from liver parenchyma by a hypoechoic circle.

Hypoechoic zones may be caused by refraction of echoes from the wall of the mass and their deflection away from perpendicular transmission (16,17) or perhaps due to pathologic changes in the surrounding host tissue by which the acoustic impedance will markedly change in respect to the either cells-normal liver parenchyma and Neoplastic tissue.

The ability to demonstrate hypoechoic zone in the last two patterns is highly dependent on the relationship between the mass and the acoustic beam. If ultrasonic wave at or near the center of the beam strikes the mass, hypoechoic zone will be easily perceived. Otherwise the zone may

not genuinely be displayed Fig.11(M_1, M_2). When evaluating the circular hypoechoic zone, the use of transducers of different frequencies is often required for correct diagnosis. An attempt should be made to obtain echo signals of equal amplitude from equal reflectors at all depths of the object being imaged.

To my knowledge hypoechoic margin neither in liver metastases nor in the other space-occupying lesion of the liver(18,19,20,21) has been reported. At least, the last two patterns may be considered as reliable finding. It is reasonable to suppose that these appearance will be characteristic of hepatic metastatic neoplasm and allow this entity to be diagnosed by ultrasound with a fair degree of certainty.

In some application, ultrasonography may replace current intrusive imaging techniques but in liver metastases echography offers extra information which complements other diagnostic modality. A disadvantage of ultrasonography is that it requires a relatively high degree of operator skill.

It is important to emphasize that this study is not a measure of the accuracy of ultrasonic hepatic scan in detecting metastatic disease. The study was focused to answer our ambiguity and curiosity which formed, in the course of experience, as such: there must exist more than four patterns of liver metastasis which had been reported so far.

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