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Malignant Ascites: Sonographic Signs of Peritoneal Carcinomatosis

Christian Goerg and Wolf-B. Schwerk

This study was performed in 65 patients with cytologically proved malignant ascites to describe and classify direct and indirect sonographic signs of peritoneal carcinomatosis. Abdominal sonography revealed tumour-associated abnormalities which account for malignant ascites in 60 cases (92%). This includes visualisation of peritoneal metastases (n = 16, 25%); matting together of bowel loops (17, 26%); distribution of fluid (19, 29%); echoes within the fluid space (3, 5%); omental matting (8, 12%); associated masses (21, 32%); lymphoadenopathy (31, 48%); and hepatic metastases (26, 40%). Sonography enables the physician to demonstrate direct and indirect signs of peritoneal carcinomatosis in almost all tumour patients with ascites and is therefore useful in determining whether the cause of ascites is malignant or benign disease.
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INTRODUCTION

PHYSICIANS WHO deal with cancer patients are frequently required to determine the aetiology of an abnormal intraperitoneal fluid. Clinical signs and symptoms often are too non-specific to be of definitive value. The conventional way to make an accurate diagnosis of ascites associated with malignancy is cytological examination of needle-aspirated ascites fluid. But other less invasive diagnostic procedures need to be developed to determine whether the course of intra-abdominal fluid collection is a malignant or benign disease.

The evaluation of ascites was one of the earliest uses of abdominal ultrasound [1], and several unspecific sonographic signs such as thickening of the gall bladder wall [2], matted bowel loops [3], loculated fluid [4] or echoes within the fluid [5] have shown that sonography is useful in determining whether the cause of ascites is malignant or benign disease. Furthermore, high resolution ultrasound enables to identify near-field structures of the abdominal wall and visualisation of peritoneal masses [6, 7].

We conducted this retrospective study to describe and classify

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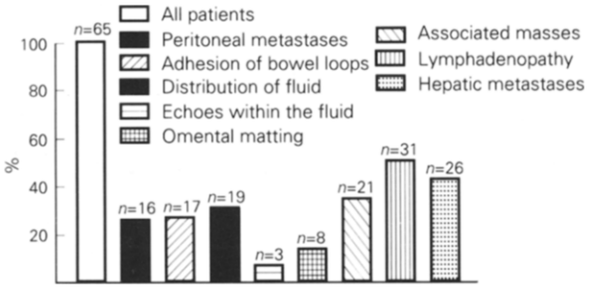

Fig. 1. Sonographic findings in malignant ascites.

frequency and value of different sonographic finding in 65 patients with cytologically proved malignant ascites.

PATIENTS AND METHODS

In 65 patients with malignant ascites abdominal ultrasound was performed and evaluated for sonographic signs of peritoneal carcinomatosis. 52 (80%) of the patients were known to have tumours prior to performing sonography. There were 34 men and 31 women. Ages ranged from 15 to 78 years, with an average of 56 years. The types of tumours in this patient population were: colorectal cancer (n = 18), ovarian cancer (9), gastric cancer (8), malignant lymphoma (6), pancreatic cancer (6), sarcoma (3), hypernephroma (3), primary hepatocellular cancer (2), others (4) and tumour of unknown origin (6).

The following sonographic parameters were determined: direct visualisation of peritoneal metastases; indirect signs (multiseptate ascites, echoes within the fluid space, omental matting, adhesion of bowel loops); and coexistance of abdominal tumour (lymphadenopathy, hepatic metastases, associated masses).

Matting together of bowel loops and adhesion of the omentum to bowel–mesentery structures were evaluated by varying probe pressure during real-time examination.

Malignant ascites was confirmed by sonographic guided paracentesis in all 65 patients. Other forms of proof include computed tomography (n = 18), surgery (15), necropsy (8) and sonographic guided fine needle biopsy of abdominal tumour lesions (8).

All patients were studied with an electronic real-time scanner with curved-array transducers (LSC 7000, Picker International, Highland Heights, Ohio). Scans were obtained with 3.5 MHz and 5 MHz transducers. The gain setting was adjusted so that the near-field structures were optimally seen.

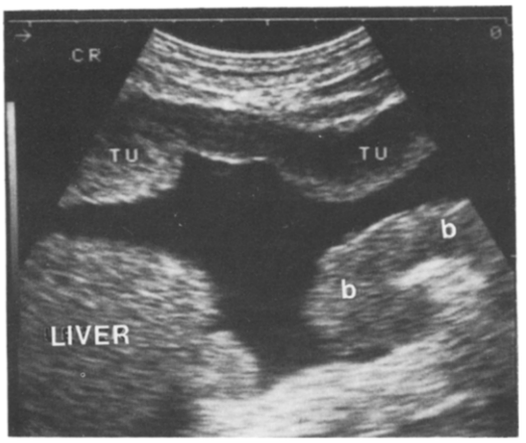

Fig. 3. Sheet-like tumour involvement (Tu) of the parietal peritoneum in a patient with malignant melanoma. b = bowel loops.

RESULTS

In 60 of 65 cases (92%) with cytologically proven malignant ascites by paracenthesis we found abdominal abnormalities which account for malignant ascites (Fig. 1). Objective signs for abdominal malignancy which include peritoneal metastases, associated masses, lymphadenopathy or hepatic metastases were present on their own or in combination in 61 patients (94%). The more subjective signs such as adhesion of bowel loops, distribution of fluid, echoes within the fluid or omental matting were mostly seen in combination with objective findings for malignancy and were documented on their own in only 4 patients (16%). 45 patients (69%) had two or more signs of peritoneal carcinomatosis. 16 patients (25%) showed direct signs of peritoneal carcinomatosis. In these cases we detected peritoneal masses which appeared nodular (n = 6) (Fig. 2) or sheet-like (n = 10) (Fig. 3). 14 were located on the parietal peritoneum and 2 were on the visceral peritoneum (Fig. 4). In all patients with peritoneal masses additionally abdominal tumour formations were diagnosed on ultrasound. 3 patients (5%) had diffuse, and

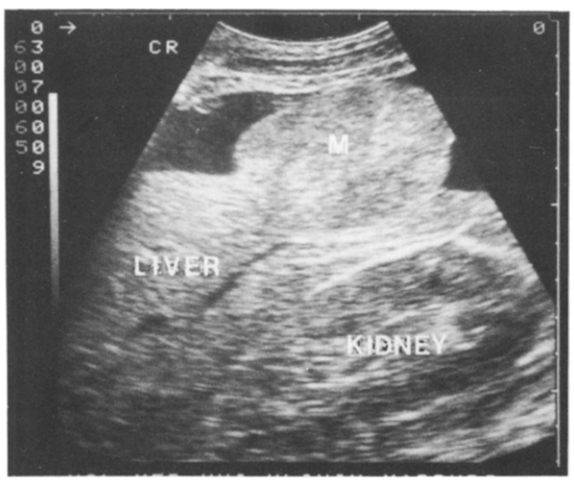

Fig. 2. Nodular tumour lesions (M) of the visceral peritoneum in a patient with malignant melanoma.

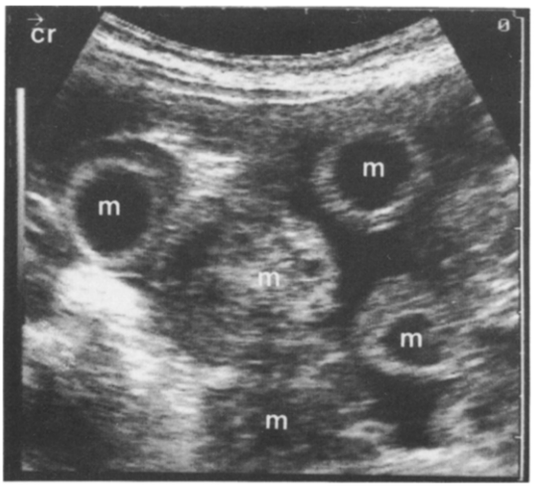

Fig. 4. Nollular tumour lesions partly with dental lignefaction of the visceral peritoneum (m) in a patient with carcinoma of the ovary.

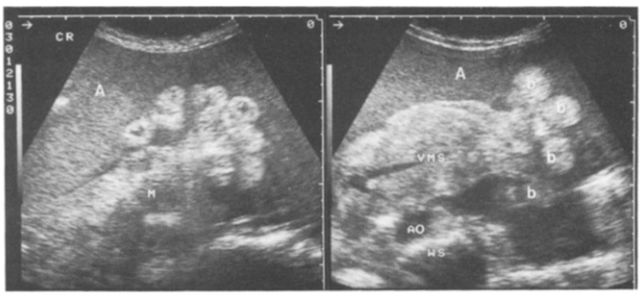

Fig. 5. A 44-year-old man with malignant lymphoma and several indirect signs for peritoneal involvement. Left: longitudinal sonogram showing multiple echos through ascites fluid (A) and echogenic bowel mesentery pattern (m) with attachment of bowel loops to the mesentric root. Right: transverse scan showing a "frozen mesentric root" due to adhesions of bowel loops and histological proven lymphomatous involvement of the mesenteric structures. b = bowel loops, VMS = superior mesentric vene, AO = aorta.

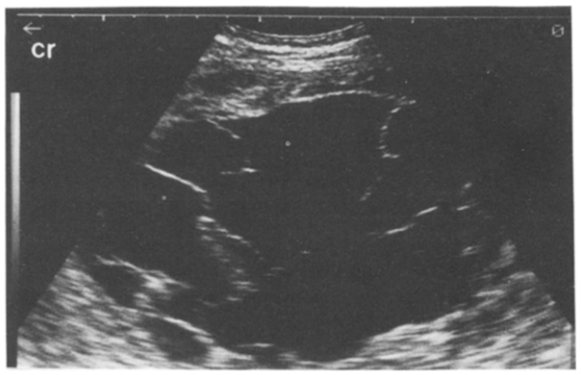

Fig. 6. Numerous septations with ascites fluid in a patient with carcinoma of the colon.

5 had high amplitude echoes within the fluid spaces in real-time examination, exhibiting "swirling" with respiration and peristalsis. Paracentesis revealed hemoperitoneum (n = 2) and chylous ascites in 1 patient with malignant lymphoma (Fig. 5). Multiseptate ascites distributed throughout the abdomen was recognised in 19 patients (29%) (Fig. 6). Evaluation of the omental pattern revealed pathologic processes with diffuse

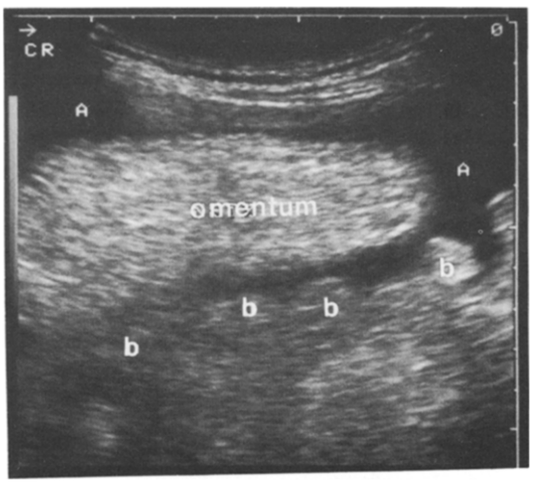

Fig. 7. Diffuse enlargement of lesser omentum due to histologically proven sarcoma.

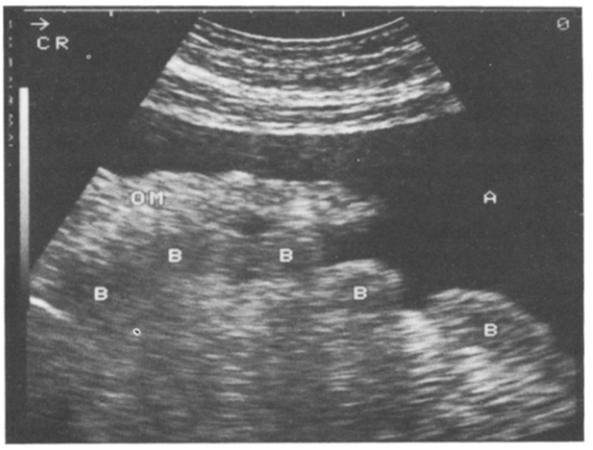

Fig. 8. Matting together of bowel loops (B) with attachment of lesser omentum (om) in a patient with ascites (A) and hypernephroma.

enlargement and attachment to bowel structures during real-time sonography in 8 cases (12%) (Figs 7, 8).

Loops of small bowel are usually draped around the mesentery, which assumes a vertical or "standing" position due to the buoyancy of the fat in the mesenteric fluid. An abnormal bowel–mesentery pattern (Fig. 9) with matting together of the bowel loops was found in 17 patients on real-time examination (26%). In 21 cases (32%) abdominal masses suggested neoplastic fluid (Fig. 10). Most often lymphadenopathy (n = 31, 48%) and hepatic metastases (n = 26, 40%) were additionally found in patients with malignant ascites (Fig. 11). In 5 patients (8%) abdominal paracenthesis and examination of the fluid revealed malignant cells without further sonographic signs for malignant ascites.

DISCUSSION

Ascites fluid is common in many pathological conditions ranging from abnormal cardiogenic and metabolic states to inflammatory processes and neoplasms. Attempts to achieve a complete separation of patients with malignant and non-malignant ascites by means of a simple laboratory test have so far failed. Ultrasonography is an ideal method of demonstrating

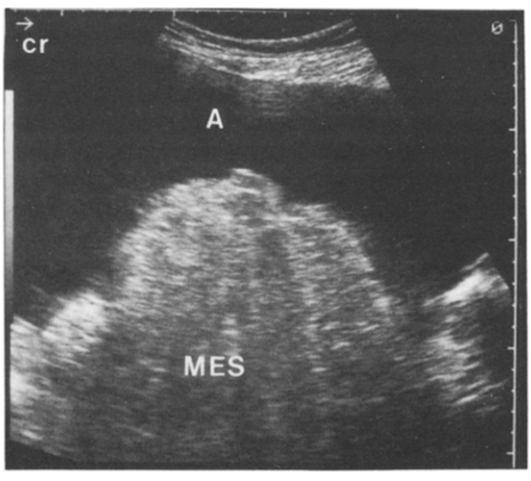

Fig. 9. Compressed omental-bowel structures which assumes a "frozen" mesentery (MES) in a patient with adenocarcinoma of occult primary.

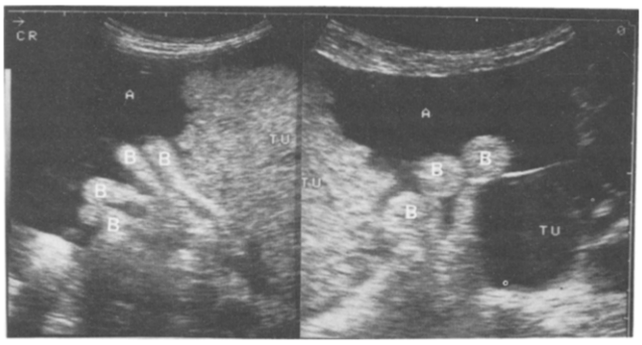

Fig. 10. Tumour masses (TU) due to histologically proven carcinoma of the ovary with secondary compression caused by large amount of ascites (A).

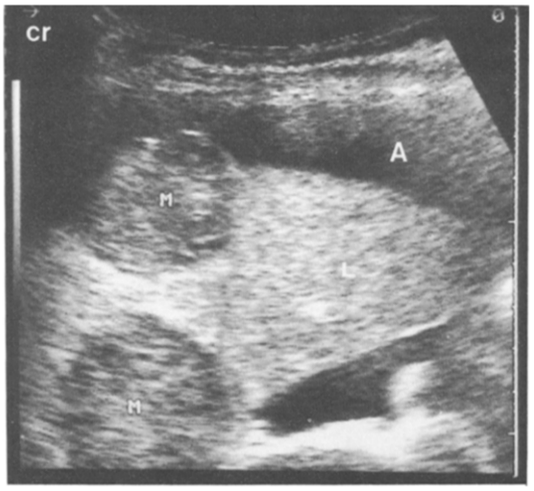

Fig. 11. Ascites (A) and hypoechoic metastases (M) of the liver (L) in a patient with carcinoma of the ovary.

fluid within the abdominal cavity. Previous articles have described and illustrated sonographic features of ascites that may help in differentiating simple transudates (secondary to cirrhosis, congestive heart failure, renal disease) from exudates (secondary to malignancy, peritonitis) [1–3]. From our results, direct and indirect sonographic signs for peritoneal carcinomatosis which account for malignant ascites could be differentiated. Ultrasonographic scanning of a peritoneal metastasis requires a careful gain setting, because the structures in a very near field are usually not well delineated. High-resolution linear array transducers are unusually most satisfactory for evaluating the near field in contrast to sector transducers which are often not satisfactory due to noise in the near field and a narrowed field of view. In the presence of ascites, the peritoneal line is clearly delineated against the echo-free ascites fluid and nodules or sheet-like masses can be visualised in a quarter of patients with malignant ascites [8]. In nearly all other patients, sonography recognised several indirect signs of peritoneal carcinomatosis which included echoes within the fluid, adhesions of bowel loops, matting of omental structures and multiseptate ascites.

In contrast to direct visualisation of peritoneal masses, these signs are unspecific and also seen in patients with peritonitis and exsudative ascites [3, 4]. So, sonographic distinction between benign and malignant fluid collections only on the basis of indirect signs is often difficult unless ancillary features are present [9–11]. This would include demonstration of hepatic metastases, lymphadenopathy and associated intraabdominal masses. In conclusion, the results presented in this study generally confirm earlier studies regarding the value of sonography for characterisation of malignant ascites. Of note is the percentage of 25% with direct visualisation of peritoneal metastases in a near-field gain setting. In almost all other patients the evidence of indirect sonographic signs which account for exsudative ascites in combination with coexisting abdominal masses enables the determination, with a high degree of certainty, of the cause of abdominal fluid.

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