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ORIGINAL ARTICLE

Efficiency of Abdominal Ultrasound and Computer Tomography in Diagnostic and Differential Diagnostic of Focal Liver Lesions

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SUMMARY
Introduction. The liver is a parenchimal abdominal organ with wide variety of primary benign or malignant tumors as well as metastatic tumors.
Aim of the study. Was to evaluate the informativity and usefulness of abdominal ultrasound (US) and computer tomography (CT) imaging results in diagnostics of focal liver lesions.
Material and methods. The study was conducted in Pauls Stradins Clinical University Hospital. Retrospective analysis of 126 patients with focal liver lesions was performed in the time period of 5 years (2009 till 2014). The medical records of patients with focal liver lesions were analyzed. Primary diagnosis detected by US or CT was evaluated and compared with final morphology after surgical operation or liver biopsy. The obtained results were expressed in percent and analyzed. Sensitivity and specificity of CT scan to detect malignant hepatic lesions was estimated and expressed as percentage with 95% confidence interval.
Results. A total of 126 patients with diagnosed liver lesions were included in the study. 96 patients were in the group with performed liver CT scans, with median age of 58.9 years. 30 patients were included in the group with liver US, with median age of 60.1 years. Liver biopsy under US control was performed for 95 patients, but surgical operations with liver resections for 31 patients. 86 patients had malignant liver lesions, but 40 had benign liver lesions. In the US group primary and final diagnosis agreement was in 26 (87%) cases, but diagnosis disagreement in 4 (13%) cases. Diagnosis disagreement was found in 26 (27.1%) cases in the CT group, but agreement was in 70 (72.9%) cases. Overall sensitivity of CT to detect malignant hepatic lesions was 95.2% (95%CI 86.7-98.3%) and specificity was 64.7% (95%CI 47.9-78.5%).
Conclusions. CT is a good imaging method for detection of focal liver lesions. In case of unclear diagnosis, percutaneous liver puncture biopsy is recommended. It is mandatory to develop a unified CT scan and US investigation protocol to improve the quality of investigation as well as further treatment tactics.
Key words: focal liver lesions, computer tomography (CT), ultrasound (US), liver operation, liver biopsy

INTRODUCTION

Focal liver lesions are solid or cystic masses or areas of tissue that are identified as an abnormal part of the liver. Different focal liver lesions including benign liver tumors, primary malignant tumors and metastasis from other organ malignancies frequently affect the liver. A radiological test is the most important aspect in the evaluation of a liver lesion (11). These lesions are more often detected during the last years, because of increasing use of different imaging modalities such as ultrasonography (US), computer tomography (CT) and magnetic resonance imaging (MRI). Recent study in USA showed that from 1996 to 2010 the use of US had doubled (134/1000 in 1996 to 230/1000 in 2010) but CT examinations had tripled (52/1000 to 149/1000) (22). Liver incidentalomas are found in 7.2%-33% of all patients investigated by a CT scan (4). Ultrasonography is the first screening method in the description of hepatic tissue and lesions, due to its safety, quick performance and cost-effectiveness (8). US is widely used as a screening method for benign and malignant liver lesions. According to recent studies, US showed limited sensitivity of approximately 60% in detecting early stage HCC for cirrhosis patients. Dynamic CT or MRI are advised to be used as the primary imaging test (9). Unfortunately, the histological nature of a hepatic tumor is rarely proven by one method of imaging, and even with sophisticated technologies regarding the benign or malign behavior of a tumor some doubts remain in 10–40% (6). Differential diagnosis between benign and malignant liver lesions, detectable with radiology imaging methods, is very important in the optimal management and treatment of the patient with focal liver lesions. Patients with benign focal liver lesions such as focal nodular hyperplasia, hemangioma and hepatic adenoma are mostly candidates for observation, rather than for resection as is proven in the study of memorial Sloan-Kettering Cancer Center (15). The diagnosis of malignant liver tumors like hepatocellular carcinoma (HCC), cholangiocarcinoma (CHC) and colorectal cancer liver metastases (CRC MTS) timely detected by radiology imaging, is very important for surgical treatment. Complete resection of liver lesions remains the only potential curative treatment modality for primary or metastatic liver disease. Major liver resections are required for treatment of malignant

tumors as well as big benign primary liver tumors (giant hemangiomas and adenomas) in order to achieve optimal therapeutic results (5).

AIM OF THE STUDY

The aim of the study was to evaluate the informativity and usefulness of abdominal Ultrasound (US) and Computer tomography (CT) imaging in the diagnosis of focal liver lesions.

MATERIAL AND METHODS

The study included patients, who were treated for focal liver lesions in Pauls Stradins Clinical University Hospital between January 2009 and August 2014. This was a retrospective study. All the patients had liver lesions diagnosed in US or CT. The final diagnosis was obtained by morphological analysis of either liver core biopsy or operation material. Liver biopsy is an invasive procedure aimed to obtain a liver tissue sample for evaluation of liver disease, and usually is performed as a percutaneous needle biopsy supported by US or CT (1). US specialists at our hospitals' Institute of Diagnostic Radiology performed biopsies for patients with normal hemoglobin level, platelet count higher than 80.000/l, INR less than 2 and Prothrombin time no longer than 40 seconds. In case of multiple liver lesions, biopsy was performed from the best-achievable lesion.

Surgical operations, mainly liver segmental resections, were performed in the Clinic of General Surgery. The final morphological diagnosis was determined after microscopical examination of biopsy and operation material. Patients were divided into two groups – one group with primary diagnosis detected in the US, second group – in contrast enhanced CT. Primary radiological diagnosis was compared with final histopathological diagnosis and then patients were divided in three groups according to final diagnosis – benign, primary or secondary malignant lesion. We analyzed the demographic data, count and the biggest size of focal liver lesions in each group. Vascularity and density of lesions, borders and presence of calcinoses in liver lesions were analyzed in CT scan descriptions that were performed before operation or liver biopsy. As liver CT and US investigations were done by different radiologists in different medical centers, there was no standardized form of liver lesion description. Such a standardized form is not used in Latvia at all. In some cases only the number and size of lesions was described, but other radiologists describe the vascularity, density and borders of the liver lesion. Usually the US and CT description is presented in a free descriptive form, so we used as much information as we could get from patient case reports. Sensitivity and specificity of a CT scan to detect malignant hepatic lesions was estimated and expressed as percentage with 95% confidence interval.

RESULTS

A total of 126 patients with diagnosed liver lesions were included in the study. Demographic data are given in table 1. All patients had morphologically proven diagnosis from the liver biopsies or operation material. One group of 96 patients had liver CT scans with description of focal liver lesions, but the other group of 30 patients had liver lesions, that were detected in the US. Information from these two imaging methods is quite different, but as all patients had morphological diagnosis, we analyzed the results from both groups. The most typical diagnosis written in CT or US description was liver lesion or liver tumor. The amount of liver lesions varied from one to multiple liver lesions (figure 1), but the most frequent finding was a single liver lesion (in 50 cases). Sizes of the lesions were from 0.7 cm till 17.7 cm and in 38 cases size of the lesion was smaller than 5 cm (figure 2). Analyzing the 30 patient group with focal liver lesions detected by US, we found out, that in 26 cases (87%) the primary diagnosis was the same as the final diagnosis proven by pathologists in liver puncture biopsy material (figure 3). Diagnosis disagreement was found in 4 (13%) cases. Instead of metastases of other localization malignant tumors, the final diagnosis was primary malignant liver tumor (2 cases) and liver abscess (1 case). The forth case of disagreement was hepatocellular carcinoma (HCC) mixed with metastases of gastrointestinal stromal tumor (GIST).

The other group of 96 patients had primary diagnosis detected by CT. All patient case reports were analyzed and they were divided into three groups according to final diagnosis:

1) 34 cases(35.4%) with primary benign liver lesions,
2) 25 cases (26%) with primary malignant liver lesions,
3) 37 cases (38.5%) with secondary malignant liver lesions (metastases).

Patient primary diagnosis according to CT was compared with final morphological diagnosis (Table 2). In 70 cases (72.9%) the primary diagnosis detected by radiologists was the same as the final diagnosis proven by pathologists. Diagnosis disagreement was found in 26 (27.1%) cases, 13 of which showed primary detected malignant liver lesions finally turning out to be benign liver lesions. The highest rate of final diagnosis disagreement was in the group of primary CT detected HCC. Analyzing the group of these 33 patients, we found that in 10 cases lesions in the liver were described as HCC, but final diagnosis revealed 4 cases of benign liver lesions and 6 cases of liver metastases of another malignant tumor. Six liver lesions were described as unclear single liver lesions in the CT, but final diagnosis showed four cases of benign liver lesions, and two cases of liver metastasis (GIST and HCC). In nine cases of primary CT detected liver metastases, all together 38 in the group, final diagnosis disagreement was found in nine cases – eight were benign liver lesions and one was HCC. Primary diagnosis of a benign liver lesion was detected in 19 CT scans, with diagnosis disagreement in one case, where final diagnosis was HCC. Overall sensitivity of the CT to detect malignant hepatic lesions was 95.2% (95%CI 86.7-98.3%) and specificity was 64.7% (95%CI 47.9-78.5%).

DISCUSSION

Radiologic imaging is one of the most important aspects in diagnostics of focal liver lesions (11). In case of focal liver lesions differential diagnosis between benign and malignant origin is very important for further treatment tactics. Benign liver lesions in most cases remain a subject for observation, with low risk of misdiagnosis, complications or malignant transformation (15), contrary to HCC, where surgical resection is the most suitable option for treatment and its safety has been demonstrated during the last few decades (19). In order to ensure optimal management for the patient with a focal liver lesion, correct diagnosis is essential. At present, biopsy is the gold standard in oncology (12). There are two types of liver biopsy: needle core biopsy (NCB) and fine needle aspiration (FNA). Recent studies have shown that the diagnostic value of these methods is comparable (23). FNA specificity is 98%-100% and sensitivity is 67%-100%, which mostly depends on the skills of the radiologist and cytopathologist. Accuracy with NCB is 62%-93% (16). Another study has shown that the respective diagnostic accuracies of 85.4% and 83% for FNA and NBC increased to 89.1%, if both methods are used together (14). Although percutaneous liver biopsy under US supervision is an easy, safe and effective procedure, some complications or technical failures may occur in up to 5% of the patients, like pain requiring hospital admission, bleeding, pneumothorax and failure to obtain tissue (3). Other aspect is tumor dissemination outside liver along the needle track, which in literature is described with a prevalence rate of 0.003% - 5% (16) (2.7% following HCC biopsy) (21). Liver biopsy can be contraindicated in cases of coagulopathy, which is one of the typical symptoms for patients with chronic liver disease or liver cirrhosis, and in some cases percutaneous liver biopsy is technically impossible, due to liver lesion localization near big blood vessels or in technically unattainable places. Considering all previously said, sensitivity and specificity of US and CT is very important for diagnosis and further treatment of focal liver lesions, because these imaging methods are not expensive, are easily accessible and non-invasive.

US is the primary screening test, because it is a quick and cost-effective method for examination of liver parenchyma and can be done as frequently as needed, especially for HCC screening in case of liver cirrhosis (18). US evaluation of focal liver lesions is used worldwide, because of its accuracy in the detection of liver lesions and its utility in guiding of percutaneous liver biopsies. As US is used as a screening method in different clinical situations, a lot of focal liver lesions are found as incidental findings (20). Using US as a screening method for HCC showed limited sensitivity of approximately 60% for early-stage detection of HCC in patients with cirrhosis (9). In our study 30 patients with primary diagnosis detected by US were evaluated and in 4 (13%) cases the final diagnosis was different from primary diagnosis, which is considered as being a good result. US results are not truly comparable with CT results, because US was done for 30 patients and usual description of US was benign or malignant lesion of the liver. Usually these lesions were found during US screening of abdominal organs and afterwards patients were additionally investigated (liver biopsy).

With the development of new technologies, CT imaging has expanded its role in hepatobiliary pathology diagnostic. It is used in detection of liver lesions, as well as for vascular mapping, assessment of tumor vascularity and planning of surgical operations. CT is still the main imaging method for evaluating the liver (24). According to clinical guidelines of American College of Gastroenterology for diagnosis and management of focal liver lesions, in case of suspected benign (hemangioma, focal nodular hyperplasia (FNH)) or malignant liver lesions (HCC, CHC) MRI or triple-phase CT should be obtained for clarification of diagnosis. Percutaneous liver biopsy is indicated in unclear cases of hepatocellular adenoma (HA) or HCC and in cases of non operable HCC to establish the diagnosis. Main components of evaluating focal liver lesions are detailed patient clinical history, physical examination, radiologic imaging, which is the most important aspect, and pathology (11). CT has high sensibility (93%) and specificity (100%) for detecting hepatic metastases (18). Meta-analysis of 20 years literature showed the comparable sensitivity between CT and magnetic resonance imaging (MRI) (74.4% and 80.3% respectively) for the detection of colorectal liver metastases (17). MRI is a better diagnostic method than US and CT for differencing the nature of regenerative nodules from HCC in patients with cirrhosis (2). In case of sub centimeter liver lesions information from contrast-enhanced liver CT is limited, these are interpreted as too small to characterize (7). MRI is described as an invaluable problem-solving method for characterization of focal liver lesions, with sensitivity and specificity of 94% and 82-89% respectively (13). In our study we observed, that the size of the lesion is not affecting the sensitivity of CT, because none of the patients with final diagnosis disagreement had lesions smaller than 1 cm. Four patients had lesions with size ≤ 2 cm. Analyzing the radiological diagnosis of these small lesions, we found that only in one case, when liver cirrhosis was detected final histopathological diagnosis revealed liver metastasis of stomach cancer. According to clinical and practical guidelines for the diagnosis and treatment of HCC, sensitivity and specificity of contrast - enhanced CT for detection of HCC is 44-87% and 95-100% (10). In our study overall sensitivity of CT to detect malignant hepatic lesions was 95.2% (95%CI 86.7-98.3%) and specificity was 64.7% (95%CI 47.9-78.5%). These data are quite similar to other results found in literature.

In summary – the main goal of liver CT imaging is detection of liver tumors, characterization and mapping of liver arteries and veins for further liver surgery, as well as to exclude metastasis and tumor spreading in abdominal cavity (18). The use of MRI in differentiation of focal liver lesions could reduce the final diagnosis disagreement (13).

CONCLUSIONS

CT is a very precise imaging method for detecting focal liver lesions. It helps to differentiate between benign and malignant liver tumors. . In case of unclear diagnosis, percutaneous liver puncture biopsy is recommended. It is mandatory to develop a unified investigation protocol for CT and US investigations. This would help in interpretation of the results and in choosing the most appropriate treatment options.

Table 1. Demographic and clinical data

	CT (n=96)	US (n=30)
Male	47 (49%)	18 (60%)
Female	49 (51%)	12 (40%)
Middle age	58.9 (15-84)	60.1 (18-84)
Biopsy	65	30
Operation	31	-
Malignant	62 (64.6%)	24 (80%)
Benign	34 (35.4%)	6 (20%)

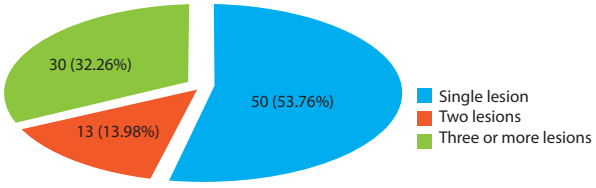

Fig. 1. Number of liver lesions

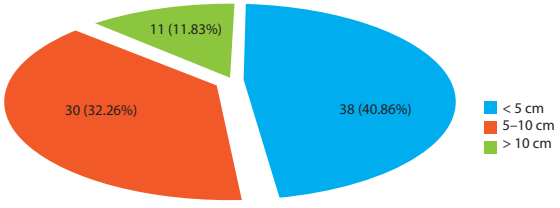

Fig. 2. Size of liver lesions

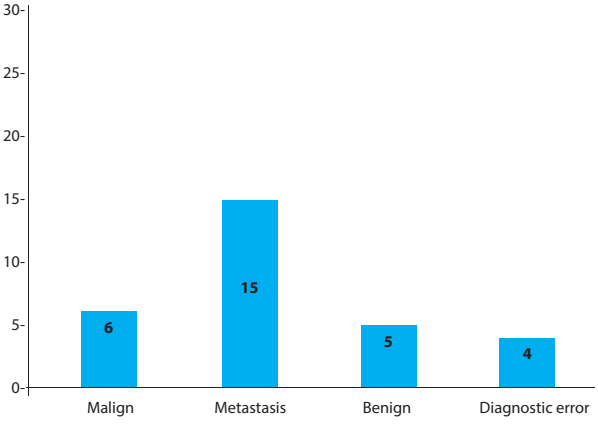

Fig. 3. Final findings of focal liver lesions detected by US (n=30)

Table 2. CT diagnosis / Final diagnosis (n=96)

CT result	Final diagnosis			
	Benign liver lesions	Primary malignant liver lesions	Secondary malignant liver lesions (metastases)	Total
Benign liver lesions	18	0	1	19
Primary malignant liver lesions	4	23	6	33
Secondary malignant liver lesions (metastases)	8	1	29	38
Unclear liver lesions	4	1	1	6
Total	34	25	37	96

Conflict of interest: None

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