PERCUTANEOUS ABDOMINAL ULTRASONOGRAPHY IN THE DIAGNOSIS CHRONIC DISEASES OF LIVER, GALL-BLADDER, BILE DUCTS AND PANCREAS

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Chronic diseases of the liver, gall-bladder and bile ducts and pancreas are the most common disorders encountered in the routine practice of a general surgeon. Routine percutaneous ultrasonography is a commonly available imaging method of abdominal organs and is a significant tool in the accurate detection of the reported disorders. Despite high variability and number of pathological entities among these disorders, the diagnosis can be made on the basis of ultrasonographic imaging provided that the operator has sufficient experience and availability of high quality equipment. Literature reports various diagnostic accuracies for percutaneous abdominal ultrasonography in the detection of the reported disorders, however no one questions high value of the ultrasonography in the surgical diagnosis. It is widely regarded as a basic diagnostic modality besides physical examination and interview.

The aim of this paper is to present our own experience in the diagnosis of chronic disorders of the liver, gall-bladder and bile ducts and pancreas using routine, percutaneous ultrasonography basing on analysis of rich material of the Department that specialized in the treatment and diagnosis of these diseases.

DIAGNOSTIC ACCURACY OF PERCUTANEOUS ABDOMINAL ULTRASONOGRAPHY

This study attempted to assess diagnostics accuracy of the ultrasonography in the diagnosis of chronic disorders of the liver, gall-bladder and bile ducts and pancreas.

The analysis included consecutive 10,559 patients who were hospitalized at the 1st Department of General Surgery and 1st Department of Gastroenterological Surgery CM UJ in Cracow in years 2000-2010. Each patient was recorded in the database Magic2 established and maintained by this Department and provided his/her consent to proposed diagnostic studies and treatment. Patients were assigned to a specific disease entity basing on a ICD-10 code from the discharge letter.

Abdominal ultrasonography was done using the equipment Logiq 7 and/or Hitachi EUB 6000. Diagnostic accuracy was calculated as the percentage of correct diagnoses using this method in comparison to reference studies.

The following reference studies were used: diagnosis by the operator, result of histopathological examination of a specimen collected during the surgical procedure, intraoperative
ultrasonography, result of cytological testing of a lesion biopsy and computed tomography imaging of abdominal cavity. Clinical disease progression was observed in a small number of patients.

Diagnostic accuracy of percutaneous ultrasonography in the patient material for individual disorders was calculated using the STATISTICA 10.0 software with Medical kit and a module Associated measures. Diagnostic precision (accuracy) was calculated as a ratio of correct results of ultrasonography (true positive and true negative results) among all performed studies.

Liver disorders

The analysis included 2477 patients diagnosed with chronic liver disorders such as: abscess, cyst, hepatocellular cancer, metastases and cirrhosis (tab. 1).

Diagnostic accuracy of abdominal ultrasonography in detection of abscesses (fig. 1) was 86.2% among 75 studied patients, while in detection of cysts (fig. 2) was 96.4% for 530 patients. Diagnostic accuracy in hepatocellular cancer (fig. 3) in 349 patients was 91.2%. The lowest accuracy of abdominal ultrasonography in the diagnosis of chronic liver disorders was achieved in 1271 patients with malignant metastases – 85.6% (fig. 4) and in 252 patients with cirrhosis – 70.1% (fig. 5). The overall diagnostic accuracy of abdominal ultrasonography in the diagnosis of chronic disorders of this organ was 85.9%.

Disorders of the gall-bladder and bile ducts

Pathological changes in the gall-bladder and bile ducts were found in 6526 patients who underwent abdominal ultrasonography (tab. 2).

Diagnostic accuracy of ultrasonography in the diagnosis of chronic disorders of the gall-bladder was as follows: cholecystolithiasis (fig. 6) – 96.5% in 5778 patients, polyps 87.4% in 173 patients and cancer (fig. 7) – 76.9% in 253 patients. Accuracy in detection of calculi in the bile ducts (fig. 8) was 66.1% in 322 patients subjected to abdominal ultrasonography. The overall diagnostic accuracy of ultrasonography in the detection of chronic disorders of the gall-bladder and bile ducts was 81.7%.

<table>
<thead>
<tr>
<th>Lesion type</th>
<th>Number of subjects</th>
<th>Diagnostic accuracy of abdominal ultrasonography (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abscess</td>
<td>75</td>
<td>86.2</td>
</tr>
<tr>
<td>Cyst</td>
<td>530</td>
<td>96.4</td>
</tr>
<tr>
<td>Hepatocellular cancer</td>
<td>349</td>
<td>91.2</td>
</tr>
<tr>
<td>Metastases</td>
<td>1271</td>
<td>85.6</td>
</tr>
<tr>
<td>Cirrhosis</td>
<td>252</td>
<td>70.1</td>
</tr>
<tr>
<td>Total</td>
<td>2477</td>
<td>85.9</td>
</tr>
</tbody>
</table>

Fig. 1. Liver abscess, hypoechogenic fluid collection with irregular contours

Fig. 2. Bilocular liver cyst, well delineated, echopenic area, divided with a septum composed of connective tissue
Fig. 3. Hepatocellular cancer, diffuse form, hyperechogenic area in this organ

Fig. 5. Liver cirrhosis with hepatocellular cancer (HCC). Irregular liver contours, with round margins, coarse echostructure of the parenchyma, with normoechogenic tumor

Fig. 4. A metastatic lesion in the liver, with enhanced echogram, with hypoechogenic collar and hypoechogenic focus of necrosis inside

Fig. 6. Cholecystolithiasis, hyperechogenic concrement with an acoustic shadow

Pancreatic disorders

The analysis included 1556 patients in whom chronic pancreatic disorders were diagnosed. Pathological lesions included chronic pancreatitis, cyst, cancer, endocrine tumor (tab. 3).

Diagnostic accuracy of abdominal ultrasonography in the detection of chronic pancreatitis (fig. 9) was 82.9% in 631 patients who underwent ultrasonography. The highest diagnostic accuracy of ultrasonography in the diagnosis of chronic pancreatic disorders was achieved for cysts (fig. 10) – 93.9% in 431 patients, and cancer (fig. 11 and 12) – 91.1% in 409 patients, while the lowest was achieved for detection of endocrine tumors: 60.1% in 85 patients. The overall diagnostic accuracy of abdominal ultrasonography in the detection of chronic disorders of the pancreas was 82%.

Table 2. Gall-bladder and bile duct lesions verified by pathology

<table>
<thead>
<tr>
<th>Lesion type</th>
<th>Number of subjects</th>
<th>Diagnostic accuracy of abdominal ultrasonography (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cholecystolithiasis</td>
<td>5778</td>
<td>96,5</td>
</tr>
<tr>
<td>Gall-bladder polyps</td>
<td>173</td>
<td>87,4</td>
</tr>
<tr>
<td>Gall-bladder cancer żółciowego</td>
<td>253</td>
<td>76,9</td>
</tr>
<tr>
<td>Cholodocholithiasis</td>
<td>322</td>
<td>66,1</td>
</tr>
<tr>
<td>Total</td>
<td>6526</td>
<td>81,7</td>
</tr>
</tbody>
</table>
Abdominal ultrasound in chronic diseases of liver, gall-bladder, bile ducts and pancreas

Table 3. Pancreatic lesions verified by pathology

<table>
<thead>
<tr>
<th>Lesion type</th>
<th>Number of subjects</th>
<th>Diagnostic accuracy of abdominal ultrasonography (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chronic pancreatitis</td>
<td>631</td>
<td>82.9</td>
</tr>
<tr>
<td>Cyst</td>
<td>431</td>
<td>93.9</td>
</tr>
<tr>
<td>Cancer</td>
<td>409</td>
<td>91.1</td>
</tr>
<tr>
<td>Endocrine tumor</td>
<td>85</td>
<td>60.1</td>
</tr>
<tr>
<td>Total</td>
<td>1556</td>
<td>82</td>
</tr>
</tbody>
</table>

In summary, diagnostic accuracy of percutaneous ultrasonography in the detection of chronic disorders of the liver, gall-bladder and bile ducts and pancreas was 83.2% in 10 559 patients.

DISCUSSION

Liver disorders

The overall diagnostic accuracy of abdominal ultrasonography in the detection of chronic disorders of the liver was 85.9% in 2477 patients. A liver abscess was correctly diagnosed in 86.2% of cases which was compatible with reports of Gene et al. (2) and Mohsen et al. (3), according to whom diagnostic accuracy of ultrasonography in this aspect was 84-90%. According to the same authors and Halvorsen et al. (4), when the ultrasonographic image is unclear, computed tomography imaging of
abdominal cavity should be performed (its accuracy in the diagnosis of a liver abscess is 97-100%). The highest accuracy rate using abdominal ultrasonography in the diagnosis of chronic liver disorders (96.4%) was achieved for cysts. According to Blonski et al. (5), Foley et al. (6), and Cowles et al. (7), diagnostic accuracy in cyst detection using abdominal imaging modalities such as ultrasonography, CT, MRI is 95-100%. Diagnostic accuracy of percutaneous ultrasonography in the detection of hepatocellular cancer in patients was 91.2% and was comparable to metaanalysis conducted in the United States, where accuracy of this imaging modality was 94% in this aspect (8). According to Zech et al. (9) and Burrel et al. (10), accuracy of hepatocellular cancer diagnosis using computer tomography and magnetic resonance imaging of abdominal cavity is 100% if a lesion is larger than 2 cm, approximately 90% if a size of the lesion is 1-2 cm, but is significantly lower for lesions below 1 cm in size. In our study, the diagnostic accuracy of abdominal ultrasonography for liver metastases was 85.6%. Wiering et al. (11) reported higher diagnostics accuracy for liver metastases with magnetic resonance imaging than with computed tomography imaging, 91.1% and 84.1%, respectively; this was supported by reports by Sasaki et al. (12) and Floriani et al. (13), who found that abdominal MRI had the highest diagnostic accuracy in this aspect. In patients with liver cirrhosis, the rate of correct diagnosis basing on percutaneous abdominal ultrasonography was 70.1%. According to Kudo et al. (14), diagnostic accuracy for abdominal imaging modalities for liver cirrhosis was: 70.3% for MRI, 67% for CT and 64% for ultrasonography.

Disorders of gall-bladder and bile ducts

Accuracy of ultrasonography in the detection of chronic disorders of the gall-bladder and bile ducts was 81.7% in 6526 patients in this study. The highest diagnostic accuracy of abdominal ultrasonography was found for the detection of cholecystolithiasis, 96.5%. Reports from the US literature indicate accuracy of the ultrasonography in the detection of this disorder in the range of 96-98%, while computed tomography imaging below 75%, supporting role of the ultrasonography as the imaging modality of choice (15, 16, 17). Abdominal ultrasonography, as a widely available imaging modality, is the imaging modality of choice for patients with not only cholecystolithiasis, but also with polyps of the gall-bladder. Diagnostic accuracy of percutaneous ultrasonography in the detection of polyps of the gall-bladder was 87.4%. Lou et al. (18) and Yang et al. (19) in their studies fund higher diagnostics accuracy of abdominal ultrasonography in the detection of this disorder above 90% than for computed tomography imaging (79.2%). Accuracy of ultrasonography in the detection of gall-bladder cancer was 76.9% in this study. According to Gourgiotis et al. (20), diagnostics accuracy of abdominal ultrasonography in the detection of this disorder is 80%, while according to Lee et al. (21), diagnostics accuracy of CT is 82%. Accuracy of ultrasonography in the diagnosis of choledocholithiasis was 66.1% in
the study group. Sgouros et al. (22), Freitas et al. (23), Williams et al. (24), and Materne et al. (25) fund higher diagnostic accuracy in the detection of this disorder in patients using magnetic resonance cholangiopancreatography (82-92%) and ERCP (89-97%).

Pancreatic disorders

The overall diagnostic accuracy of abdominal ultrasonography in the detection of chronic disorders of the pancreas was 82% in 1556 patients. Chronic pancreatitis was found using ultrasonography in the study group with accuracy of 82.9%. Remer et al. (26) and Manfredi et al. (27) found that diagnostic accuracy in the diagnosis of this disorder using ultrasonography was 70%, while using computed tomography imaging and magnetic resonance imaging was 74-90%. The highest diagnostic accuracy rate for abdominal ultrasonography was achieved for chronic pancreatic disorders (93.9%) for patients with cysts. As with liver cysts, this was associated with typical ultrasonographic image of these lesions. Basturk et al. (28) and Adsay et al. (29) found that percutaneous ultrasonography has a comparable diagnostic accuracy for pancreatic cysts as abdominal CT and MRI imaging. This study also demonstrated high diagnostic accuracy for ultrasonography in the detection of pancreatic cancer (91.1%). According to the literature, diagnostic accuracy of abdominal ultrasonography supported by Doppler modality, in the detection of this tumor ranges from 87 to 95%, while for CT and MRI ranges 84-100% (30-36). Diagnostic accuracy of ultrasonography in the detection of endocrine cancer was 60.1% in the study population. Low diagnostic accuracy of abdominal ultrasonography in the detection of this type of tumors in patients is related with their small size. Van Hoe et al. (37) and Ichikawa et al. (38) found that accuracy of detection of endocrine tumors is 65-82% for computer tomography and 57-79% for magnetic resonance imaging.

Abdominal ultrasonography is characterized by high diagnostic accuracy in the detection of chronic disorders of the liver, gall-bladder and bile ducts and pancreas. Ultrasonography certainly should be the imaging modality of choice in the diagnosis of liver cysts, cholecystolithiasis, gall-bladder polyps and pancreatic cysts, while its diagnostic accuracy is not significantly lower than that of computed tomography or magnetic resonance imaging in the detection of other discussed chronic abdominal disorders with the exception of cholelithiasis.

REFERENCES