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2nd Department of Radiology, Medical University of Lublin

WITOLD KRUPSKI, EWA KURYS-DENIS, JANUSZ ZŁOMANIEC

Imaging diagnostics in patients with implantation of biliary stents

Introduction of new methods of treatment requires the use of appropriate diagnostic methods which would enable a correct qualification to radical or palliative surgery treatments, as well as an assessment of efficacy and a monitoring of treatment.

Biliary stenting has been introduced in treatment of patients with obstructive jaundice, mainly as a palliative procedure or as a preoperative preparation in patients with high bilirubin blood levels, high operation risk and in case of a necessity of postponing a radical, surgery procedure. Biliary stenting is a low-invasive technique of biliary ducts alleviation in case of obstructive jaundice in neoplasmatic diseases or scary narrowing of biliary ducts (5, 17).

Techniques of stenting include percutaneous drainage, placing a stent into the common bile duct through the Vater ampulla, in the course of endoscopic procedures and stenting the biliary ducts with the use of self-expanding stents (3, 4). Endoscopic stenting as a palliative procedure is useful in non-resecable pancreatic head tumours. It also assures alleviation of biliary ducts in case of obstructive jaundice.

Despite that, stents become obstructed in around 10% of patients with malignant narrowing of biliary ducts, which leads to complete bile blockage (10, 14). It results in cholestasis and requires immediate stent replacement. The verification of clinical picture of obstruction, efficacy of drainage or diagnosis of possible complications are very often needed with the use of imaging methods (2, 13). The efficacy of biliary ducts alleviation with stenting depends on the stent diameter and its appropriate localization.

The aim of this work was to evaluate the diagnostic value of ultrasonography and computed tomography in palliative patients treated with stent implantation into the biliary tracts.

MATERIAL AND METHODS

The material includes 16 patients aged 41–78, diagnosed in years 1996–2006 at the 2nd Department of Diagnostic Radiology, Medical University of Lublin.

Abdominal CT examinations were performed with the cross-sectional, sequential technique using the Somatom ART scanner, in 5 mm slices, or with the spiral technique using the Somatom Emotion scanner, in axial 5 mm slices and the pitch of 1–1.5.

CT examinations were done before and after the intravenous administration of contrast medium in a dose of 1ml / kg. US examinations were done using Siemens G 50 and Hitchachi EUB 410 equipment.

RESULTS

CT and US examinations performed on 16 patients with biliary stents imaged exactly the entire biliary tracts, stents and enabled precise localization of their endings.

In 3 cases the cholestasis was caused by scary transformation and in 13 cases – by tumours. One patient, who had been previously operated on because of Klatskin's tumour and who had developed a narrowing of biliary tracts in the course of sclerosing cholangitis, had 2 self-expanding stents implanted. The patient had also undergone bisegmental liver resection because of biliary cirrhosis. CT examination in this patient showed self-expanding stents placed in the common bile duct and both left and right liver bile ducts. An enlargement of hilar, intrahepatic bile tracts and a presence of gas in bile ducts was also diagnosed (Fig. 1A). Moreover, CT examination showed a parahepatic abscess (Fig. 1B).

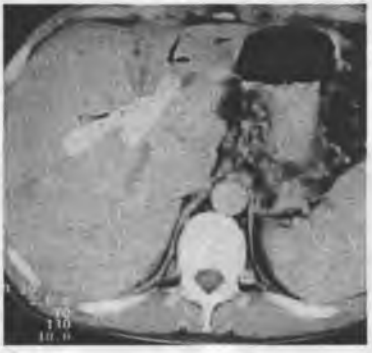

Fig. 1A. CT – Patient aged 37 with sclerosing cholangitis, after bisegmental liver resection because of bile cirrhosis. Condition after implantation of 2 self-expanding biliary stents. Enlarged intrahepatic bile tracts (cholestasis). Presence of gas in the enlarged bile ducts – areobilia (pneumobilia)

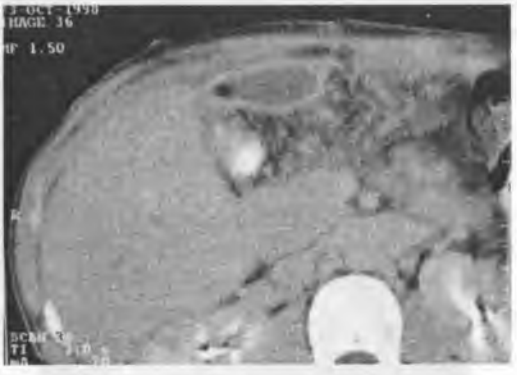

Fig. 1B. CT – Liver abscess

Eight patients had biliary stents placed in the common biliary duct under the use of endoscopy. CT examinations in those case showed the stents localizations. The degree of the common bile duct enlargement and intrahepatic bile ducts could be estimated (Fig. 2A). Planar MPR reconstructions made it easier to estimate the exact stent course, shape and localization, especially the localization of the stent's endings placed in the abdomen (Fig. 2B). Spatial VRT reconstructions, on the other hand,

enabled the exact stent position, the especially important localization of the stent's endings, as well as the degree of intrahepatic bile ducts enlargement (Fig. 2C).

Fig. 2A. CT – Patient aged 49. Pancreatic head carcinoma. Liver with numerous, round, hypoechogenic metastasis. Enlarged intrahepatic bile tracts. Metallic stent placed in the enlarged common bile duct

Fig. 2B. CT – MPR reconstruction. Visible stent of high density. Hypodensity tumour of the pancreatic head encircling the lower part of the stent. The higher part of the stent is visible inside the liver. Enlarged intrahepatic bile tracts

Fig. 2C. CT – VRT (volume rendering technique) reconstruction. Visible stent of high density. Hypodensity tumour of the pancreatic head encircling the lower part of the stent. The higher part of the stent is visible inside the liver. Enlarged intrahepatic bile tracts. Liver with numerous, round, hypoechogenic metastasis

In 1 case, a patient had 2 stents implanted. CT examination revealed those 2 metallic stents placed in the enlarged, common bile duct (Fig. 3A). Highly enlarged common bile duct together with the enlarged gallbladder, with dick walls, containing a high density bile and air bubbles in its lumen. Those findings enabled a diagnosis of gallbladder empyema (Fig. 3B). Both stents placed in the enlarged common bile duct were also visible on US examination (Fig. 3C). Hyperechogenic content of gallbladder with dick walls was consistent with a diagnosis of a gallbladder empyema (Fig. 3D). In other 7 cases, the patients had percutaneous alleviating stents implanted which were also easily visible on CT images (Fig. 4).

Fig. 3A. CT – Patient aged 78. Condition after endoscopic implantation of 2 biliary stents into the common bile duct. Enlarged intrahepatic bile tracts (cholestasis)

Fig. 3B. CT – Gallbladder empyema (thick gallbladder walls, high density content, presence of gas bubbles)

Fig. 3C – US – Two stents in the enlarged common bile duct

Fig. 3D – US – Thick, hyperechogenic gallbladder walls and high density content – gallbladder empyema

Fig. 4. CT – Patient aged 35 – Hepatocellular carcinoma. Enlarged intrahepatic bile tracts. Percutaneous stent in the enlarged bile tracts. Free liquid in the peritoneum

DISCUSSION

Computed tomography together with ultrasonography constitute good diagnostic methods to assess the presence of foreign bodies, such as stents, and to evaluate the degree of enlargement of intra- and extrahepatic bile tracts.

Our CT examinations were performed using partially a conventional and spiral technique. Because the quality of images obtained in both conventional and spiral imaging, using the same slice thickness and with a pitch of 1–1.5 is similar (8), our material could be analysed together.

The most common complication in patients with implanted biliary stents is inefficient drainage caused by the stent obstruction (1). The cause of obstruction can be bile or blood leakage, bile infection or stent dislocation (12). The diagnosis of bile tracts enlargement is made at a different moment. Symptoms of progressing obstruction can be observed in a large range of time, from 8 days to 15 months after stenting, with the mean time of 5 months (11).

Obstruction and progressing cholestasis usually require the fast disposal or exchange of the stent, more rarely the change of localization or implantation of a new, additional stent (7). Preoperative elimination of malignant bile ducts obstruction with the use of percutaneous drainage decreases the patients' mortality from 1 to 30% (15).

Spontaneous alleviation may result from a leakage near the catheter's skin implantation. Bile leakage near the catheter is usually a result of inefficient drainage and causes the protein loss. Enlargement of bile ducts may be minimal or even unremarkable on images when an alleviating leakage and serious bile tracts strictures are present. It might represent a serious limitation of the symptom of intrahepatic bile tracts enlargement as a parameter of stent obstruction. Bile leakage after withdrawing the cholesystomic catheter also represents a serious complication (16).

Bile tracts infection is an equally common complication, both after the percutaneous or endoscopic stent placement. An infection can also be a result of a partial or complete stent occlusion (15). It must be noted however, that an occlusion may be limited to a non-drained segment, and this is why the assessment of bile tracts should be done independently of hepatic segments.

During infections, developing bacteria form a material may occlude the stent lumen. The blockage of the stent lumen by dense bile or amorphous rests of organic material also plays an important role in the mechanism of stent occlusion. Tumour growth and more rarely stent dislocation may also cause the stent occlusion (6).

Bile leakage into the peritoneum, possible in the place of bile tracts puncture, can cause its inflammation. Long-lasting bile tracts obstruction may result in bile liver cirrhosis, liver abscess or bile tracts inflammation.

Because implanted biliary stents, similar to abdomen anatomic structures, have a spatial configuration oriented differently than the axial CT cross-sectional plane, using planar reconstructions oriented in the stent plane and in the plane of the assessed anatomic structures becomes necessary.

Secondary image reconstruction in CT, including planar and volume reconstructions should be a routine work (9). Volume VRT reconstructions enable a favourable visualization of stents and their location in relation to the adjacent organs, as well as determination of the range of bile tracts enlargement (9).

CONCLUSIONS

1. Computed tomography and ultrasonography enable a clear identification of stents placed in biliary tracts, determination of location of their endings in the enlarged common

bile duct or main hepatic bile ducts.

2. Determination of the stent ending in the duodenum remains difficult both in CT and US.

3. Efficacy of the drainage can be determined with the degree of intrahepatic biliary tracts enlargement.

4. CT and US are also of great value in diagnosis of stenting complications, such as abscesses, cholangitis and gallbladder infections.

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SUMMARY

Introduction of new methods of treatment requires the use of appropriate diagnostic methods. In cases of patients with obstructive jaundice, stents placed in biliary ducts have been introduced. The verification of clinical picture of obstruction, efficacy of drainage or diagnosis of possible complications are very often needed with the use of imaging methods. The aim of this work was to evaluate the diagnostic value of ultrasonography and computed tomography in palliative patients treated with implantation of self-expanding, alleviating stents into the biliary tracts. The material consists of 16 patients aged 41–78 with obstructive jaundice who underwent biliary stenting and US and CT examinations. In 3 cases the cholestasis was caused by scary transformation and in 13 cases – by tumours. One patient had self-expanding stents implanted, 8 patients had biliary stents placed in the common biliary tract under the use of endoscopy and 7 patients had percutaneous alleviating stents implanted. We conclude that computed tomography and ultrasonography enable a clear identification of stents placed in biliary ducts, a determination of location of their endings, appreciation of the degree of intrahepatic biliary ducts enlargement, as well as the efficacy of their drainage. These two methods are also of great value in diagnosis of stenting complications, such as abscesses, cholangitis and gallbladder infections.

Diagnostyka obrazowa pacjentów ze stentami w obrębie dróg żółciowych

Wprowadzanie nowych metod postępowania leczniczego wymaga stosowania odpowiednich metod diagnostycznych. W leczeniu pacjentów z żółtaczką zaporową wprowadzono do leczenia stenty zakładane do dróg żółciowych. W wielu przypadkach weryfikacja obrazu klinicznego niedrożności stentu metodami obrazowymi oraz skuteczności drenażu i rozpoznania ewentualnych powikłań jest koniecznością. Celem pracy jest ocena wartości ultrasonografii i tomografii komputerowej w diagnostyce pacjentów leczonych paliatywnie zakładaniem do dróg żółciowych odbarczających stentów. Materiał obejmuje 16 chorych w wieku 41–78 lat z żółtaczką zaporową, z założonymi stentami do dróg żółciowych, u których wykonano badania USG i TK. W trzech przypadkach przyczyną cholestazy były zmiany bliznowate, natomiast w 13 nowotwory. Jeden pacjent miał założone stenty samorozprężalne, ośmiu pacjentów zakładane endoskopowo do PŻW stenty żółciowe, a pozostałych siedmiu pacjentów przezskórne stenty obarczające. Stwierdzono, że tomografia komputerowa i ultrasonografia umożliwiają dobrą identyfikację stentów w obrębie dróg żółciowych, określenie lokalizacji ich końców, określenie stopnia poszerzenia wewnątrzwątrobowych dróg żółciowych i skuteczności drenażu, są też wartościowe w diagnostyce powikłań, takich jak ropnie, zakażenia dróg żółciowych i pęcherzyka żółciowego.