Biomedical Research 2018; 29 (5): 1062-1065 *ISSN 0970-938X*
www.biomedres.info

Comparison of clinical effects of ultrasonic examination, CT examination, and MR examination in diagnosis of pancreatic and ampullary cancer.

Wei Tao[1], Yunsong Zheng[2], Yingcong Xiao[3*]

[1]Department of Radiological, Ningbo Municipal Hospital Hospital of T.C.M, Ningbo, Zhejiang, PR China

[2]Department of Medical Imaging, the Affiliated Hospital of Shaanxi University of Chinese Medicine, Xianyang, Shaanxi, PR China

[3]Department of Ultrasound, the Affiliated Hospital of Shaanxi University of Chinese Medicine, Xianyang, Shaanxi, PR China

Abstract

Objective: This study compares the clinical effects of ultrasonic examination, Computed Tomography (CT) examination, and Magnetic Resonance (MR) examination in diagnosing pancreatic and ampullary cancer.

Methods: A total of 60 patients with pancreatic and ampullary cancers admitted in our hospital from May 1st, 2015 to June 1st, 2017 were chosen as research objects. All patients received ultrasonic examination, CT examination, and MR examination. Results were compared with operation outcomes.

Results: The accuracy of ultrasonic examination, CT examination, and MR examination were 48.33%, 63.33%, and 88.33%, respectively. The accuracy of MR examination was higher than those of the two examinations ($p<0.05$), whereas the accuracy of ultrasonic examination and CT examination had no significant difference ($p>0.05$).

Conclusions: Among the three examinations, MR examination was the most accurate in diagnosing pancreatic and ampullary cancers.

Keywords: Ultrasonic, CT, MR, Diagnosis.

Accepted on December 7, 2017

Introduction

Pancreatic and ampullary cancers are extremely difficult to diagnose; moreover, their morbidity and mortality rates are relatively high [1]. Furthermore, these conditions are more difficult to diagnose and to treat than other malignant tumors. Duodenal nipple cancer, choledochoduct terminal carcinoma, ampullary cancer, and pancreatic cancer are common types of pancreatic and ampullary cancers [2]. These types of cancer initially evolve from obstructions in the biliary tract into obstructive jaundice, threatening life of patients. Survey data revealed that the morbidity of pancreatic and ampullary cancers increased gradually. These diseases develop quickly after diagnosis and are hard to control well even after operations [3,4]. Furthermore, the survival rate for these cancers is almost zero. To improve the prognosis of patients with pancreatic and ampullary cancers as much as possible, adopting specific treatment at early diagnosis is suggested. Ultrasonic examination, Computed Tomography (CT) examination, and Magnetic Resonance (MR) examination are common technical diagnosis methods in clinics and have high diagnosis accuracy in many diseases [5]. In this study, these medical tests were used to diagnose pancreatic and ampullary cancers, and 60 patients admitted in our hospital were chosen as research objects. Results are introduced in the following text.

Information and Method

Information

In this study, 60 patients with pancreatic and ampullary cancers admitted in our hospital from May 1st, 2015 to June 1st, 2017 were chosen as research objects. The subject models consisted of 31 males and 29 females, ages 35 to 76 with (56.23 ± 10.21) on average. Clinical symptoms were relatively insignificant. Among them, 4 patients were diagnosed with choledochestasia at early period through ultrasonic examination. Subsequently, this condition developed into pancreatic and ampullary cancers. A total of 8 patients experienced diarrhea and fever; 36 patients underwent jaundice, weight loss, and appetite loss; and 8 patients experienced discomfort in the epigastrium. Patients showed different symptoms but were all diagnosed with pancreatic and ampullary cancer.

Methods

Operation steps of ultrasonic examination: Color Doppler ultrasound instruments (Toshba Aplio300 and Philips ie2) were used, and probe frequency was adjusted to 3.5 MHz. Patients were forbidden to eat for approximately 7 to 9 h before examination. During examination, patients lay on their right or on their back. First, color Doppler ultrasound was used for routine inspection of pancreas, biliary tract, and liver, and the expansion of biliary tract inside and outside the liver. Moreover, the common bile duct was scanned. When serious gastrointestinal gases were detected in patients and organization structure around and on the low structure of the common bile duct was not observed, some measures were adopted to increase definition of images, such as pressing probe, changing positions, and increasing water intake. The sound transmission conditions surrounding the pancreas and lower section of the common bile duct were improved. The scan was continued until the terminal position of the common bile duct. Next, lesion position was observed in the (expanding) bile duct; accurate measurements of lesion size, pancreas size, and ampullary size were then determined. These procedures were performed to examine the pancreatic duct and its expansion, the space-occupying lesion at the engorged duodenal ampulla, and the head of pancreas and lower section of the common bile duct. Furthermore, the association between the space-occupying lesion and surrounding tissues was observed. Local pressing vibration was generated by coughing, which promoted vibration of gastrointestinal contents. Relationships between lesion positions and surrounding structures were also determined. Typical images were collected and stored in ultrasonic working stations.

Operation steps of CT examination

GE16-row spiral CT machine was employed. Other material and drugs included 320 mg/ml of non-ionic contrast media iodine alcohol. Empower CTA binocular high pressure injector was used. Patients took iodinated contrast agent (2% concentration) and about 800 to 1000 ml of clean water 30 min before examination; these activities were to achieve engorged duodenum and stomach. Scanning started from the diaphragmatic dome to double anus. Conditions for layer thickness, thread pitch, tube voltage, tube current, collimator width, and speed were set at 5.00 to 7.50 mm, 0.938, 110 kv, 120 mA, 4 mm × 2.5 mm (16 mm × 0.7 5mm), and 12 mm/turns, respectively. Scanning was done horizontally first. Next, intravenous injection of 80.00 to 100.00 ml of iodine alcohol contrast medium was offered by non-ionic contrast media and CT special high-pressure injector. Sodium chloride solution (0.9%, 30 ml) was injected at a rate of 2 to 3 ml/s. Scanning time during intravenous period was about 25 to 30 s after the injection, the scanning time during portal vein period was about 60 to 65 s after the injection, and scanning time during the delay period was 2 min after the injection. The original images were reconstructed continuously and thinned to 0.625 mm. Images were sent to the working station and processed by multiple post processing techniques, such as Volume Reproduction (VRT), Maximum Density Projection (MIP), surface reconstruction (CPR), and multilevel reconstruction (MAP). Axial view, sagittal view, and coronal view, were collected from the working station.

Operation steps of MR examination: Sigma Infinity 1.5 T Nuclear Magnetic Resonance produced by GE Company was applied. Hypotonic magnetic resonance image (MRI) plan scanning was performed first, followed by Magnetic Resonance Cholangiopancreatography (MRCP) scanning, and enhancement scanning, successively. Patients were forbidden to eat for about 10 to 14 h before examination. Patients were asked to lie down. Plane scanning parameters were set as follows: sequence at SSFSE, layer thickness at 5 mm, interlayer spacing at 1 mm, and matrix at 320 × 256. Moreover, TR and TE of T1WI, T2WI, and MRCP were 450, 2000, and 1988 ms, respectively, and 25, 90, and 1000 ms, respectively. Layer thickness was set to 40 mm and matrix was at 384 × 256. During MR dynamic scanning, Spoil Gradient (SPGR) sequence was applied. Measurements for TR, TE, layer thickness, interlayer spacing, and dosage were 125 to 150 ms, 1.2 to 1.4 ms, 3 to 5 mm, 1 to 2 mm, and 0.2 mmol/kg, respectively. The MR dynamic scanning was accomplished within 15 to 20 min.

Observation indexes

Ultrasonic examination, CT examination, and MR examination of the bile duct were summarized and analysed.

Operation results were used as reference standards. Accuracy of the three diagnostic examinations was calculated.

Statistical processing

Diagnosis accuracy (%, chi-square test) was processed in SPSS18.0. $P<0.05$ means statistically significant difference of data.

Results

Examination of bile duct

All three examinations were performed at an interval of two weeks. All tests showed internal and external cholangiectasis of liver. The diameter of common bile duct was ranging from 9.00 (minimum) to 26.00 mm (maximum). Detailed examination results of bile duct are listed in Table 1.

Comparison between ultrasonic examination and operation results

Accuracy of ultrasonic examination of pancreatic and ampullary cancer was 48.33% (Table 2).

Comparison between CT examination and operation results

Accuracy of CT examination of pancreatic and ampullary cancer was 63.33% (Table 3).

Comparison between MR examination and operation results

Accuracy of MR examination of pancreatic and ampullary cancer was 88.33% (Table 4).

Table 1. *Examination results of bile duct (n=60).*

Examination techniques	Display of suspicious space-occupying lesion (suspected stenosis of bile duct) (%)	Non-display of space-occupying lesion (%)	Display of space-occupying lesion surrounding ampulla (%)
Ultrasonic	0 (0.00)	23 (38.33)	37 (61.67)
CT	12 (20.00)	0 (0.00)	48 (80.00)
MR	10 (16.67)	0 (0.00)	50 (83.33)

Table 2. *Comparison between ultrasonic examination and operation results in percentages.*

Examination technique	Duodenal papillary carcinoma	Choledochoduct terminal carcinoma	Ampullary cancer	Pancreatic cancer	Total
Operation result	4 (6.67)	10 (16.67)	14 (23.33)	32 (53.33)	60 (100.00)
Ultrasonic examination	0 (0.00)	4 (40.00)	6 (42.86)	19 (59.38)	29 (48.33)

Table 3. *Comparison between CT examination and operation results in percentages.*

Examination technique	Duodenal papillary carcinoma	Choledochoduct terminal carcinoma	Ampullary cancer	Pancreatic cancer	Total
Operation result	4 (6.67)	10 (16.67)	14 (23.33)	32 (53.33)	60 (100.00)
CT examination	2 (50.00)	4 (40.00)	6 (42.86)	26 (81.25)	38 (63.33)

Table 4. *Comparison between MR examination and operation results in percentages.*

Examination technique	Duodenal papillary carcinoma	Choledochoduct terminal carcinoma	Ampullary cancer	Pancreatic cancer	Total
Operation result	4 (6.67)	10 (16.67)	14 (23.33)	32 (53.33)	60 (100.00)
MR examination	1 (25.00)	6 (60.00)	14 (100.00)	32 (100.00)	53 (88.33)

Table 5. *Comparison of diagnosis accuracy values of ultrasonic examination, CT examination, and MR examination.*

Examination techniques	Number of detected cases (n)	Accuracy (%)
Ultrasonic examination	29	48.33
CT examination	38	63.33
MR examination	53	88.33

Comparison of diagnosis accuracy of ultrasonic examination, CT examination, and MR examination

Among the three examination techniques, MR examination exhibited the highest diagnosis accuracy; p-value was smaller than 0.05. CT examination had the second highest diagnosis accuracy, followed by ultrasonic examination. Moreover, diagnosis accuracy of CT examination and ultrasonic examination had no significant difference; p-value was higher than 0.05. Detailed data are shown in Table 5.

Discussions

Pancreatic and ampullary cancers refer to malignant lesion of obstructions of the biliary tract [6]. These conditions manifest implicit morbidity and are difficult to diagnose at an early stage. However, numerous clinical diagnosis techniques, such as MR examination, CT examination, and ultrasonic examination, are available [7]. This study aims to discuss the diagnosis accuracy of these three techniques.

Ultrasonic examination can make repeated scanning and is simple to operate. One of diagnosis sensitivity indexes of biliary tract obstruction is cholangiectasis [8]. If the inner diameter of the common bile duct ranges between 7 and 10 mm, the patient individual experiences slight cholangiectasis. However, if the inner diameter of common bile duct is higher than 10 mm, then a significant cholangiectasis is observed [9]. Lastly, if the inner diameter of common bile duct is smaller than 3 mm, then no cholangiectasis is exhibited. Furthermore, ultrasonic examination is widely used in outpatient

departments [10]. The diagnosis accuracy of this method was 48.33%, which was caused by abundant influencing factors (e.g., intestinal gas and obesity). On the contrary, images collected through CT examination had high resolution and the lesions can be located. Influencing factors of ultrasonic examination did not affect CT examination. Therefore, accuracy of CT examination was relatively higher than that of ultrasonic examination, which was proved by its diagnosis accuracy (63.33%). Conversely, MR examination did not need contrast media and clearly displayed biliary systems from multiple perspectives. This medical technique possesses high accuracy in locating and diagnosing of hepatic metastases, lymphadenectasis, and blood vessel invasion.

Conclusion

In conclusion, ultrasonic examination, CT examination, and MR examination are invasive. This study proves that among the diagnosis methods, MR examination exhibited the highest accuracy in diagnosing pancreatic and ampullary cancers. However, this medical test exhibited high examination costs and requires advanced agreement from patients and family members.

References

1. Panzeri F, Crippa S, Castelli P, Aleotti F, Pucci A, Partelli S, Zamboni G, Falconi M. Management of ampullary neoplasms: A tailored approach between endoscopy and surgery. World J Gastroenterol 2015; 21: 7970-7987.
2. Polat Y. Effects of CoQ10 and zinc supplemented trainings upon some blood parameters. Biomed Res India 2017; 28: 4287-4293
3. Li YP, Yao LH, Xiong XY, Gong YC, Li ZL. Protective effect of lily polysaccharide against alloxan-induced pancreatic β-cell damage. Lat Am J Pharm 2013; 32: 880-886.
4. Chandrasegaram MD, Gill AJ, Samra J, Price T, Chen J, Fawcett J, Merrett ND. Ampullary cancer of intestinal origin and duodenal cancer-A logical clinical and therapeutic subgroup in periampullary cancer. World J Gastrointest Oncol 2017; 9: 407-415.
5. Mao S, Song G, Liu D, Gao X, Zhao Y, Li X. 50% Ethanolic extract of apple polyphenols protects pancreatic β-cells from damage by H2O2 via its anti-apoptotic effects. Lat Am J Pharm 2015; 34: 177-182.
6. Wu CL, Chao YJ, Yang TM, Chen YL, Chang KC, Hsu HP, Shan YS, Lai MD. Dual role of CD44 isoforms in ampullary adenocarcinoma: CD44s predicts poor prognosis in early cancer and CD44v is an indicator for recurrence in advanced cancer. BMC Cancer 2015; 15: 903.
7. Forati S, Yaghmaii B, Allah-Verdi B. The effect of early feeding after enema reduction of intussusception in order to investigate the rate of recurrence and side effects of reduction. Biomed Res India 2017; 28: 5642-5645.
8. Griffin JF, Poruk KE, Wolfgang CL. Pancreatic cancer surgery: past, present, and future. Chin J Cancer Res 2015; 27: 332-348.
9. Ansari NA, Ramalho M, Semelka RC, Buonocore V, Gigli S, Maccioni F. Role of magnetic resonance imaging in the detection and characterization of solid pancreatic nodules: An update. World J Radiol 2015; 7: 361-374.
10. Li Y, Sarkar FH. MicroRNA Targeted Therapeutic Approach for Pancreatic Cancer. Int J Biol Sci 2016; 12: 326-337.

*Correspondence to

Yingcong Xiao

Department of Ultrasound

The Affiliated Hospital of Shaanxi University of Chinese Medicine

PR China

Email: yingcong_xiao666@yeah.net