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Comparative Study of Preoperative Staging of Bladder Cancer Assessed by Contrast-enhanced Ultrasound and CT

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Abstract: **Objective:** To investigate the differences and advantages of contrast-enhanced ultrasound and CT in the preoperative staging evaluation of bladder cancer. **Methods:** 55 patients with bladder cancer admitted to the hospital from March 2023 to March 2024 were selected as study samples. All patients were confirmed by surgical pathology, and CT enhanced scan and contrast-enhanced ultrasound were selected for preoperative staging. The postoperative pathological staging was taken as the gold standard. The accuracy rate of CT and contrast-enhanced ultrasound in the preoperative staging diagnosis of bladder cancer was compared, and ROC curves were drawn to compare the diagnostic value of both in bladder cancer. **Results:** There was no significant difference in T1, T4 and T3 between contrast-enhanced ultrasound and CT before bladder cancer detection ($P > 0.05$). The diagnostic coincidence rate of CEUS in T2 stage was higher than that of CT ($P < 0.05$). ROC curve analysis showed that the sensitivity and specificity of CEUS in diagnosing T-stage bladder cancer were higher than those of CT ($P < 0.05$). **Conclusion:** The overall coincidence rate of CEUS in the assessment of bladder cancer before surgery and in the diagnosis of T2 stage bladder cancer is higher than that of CT, and its diagnostic sensitivity and specificity are also higher than that of CT.

Keywords: Contrast-enhanced ultrasound; CT; Comparative analysis

Bladder cancer is a malignant lesion mainly derived from the bladder mucosa. Its incidence ranks first among malignant tumors of the urinary system in China, and it is also one of the cancer types with a high incidence worldwide [1]. Studies show that in 2020, the number of new cases of bladder cancer in the world is about 570, 000, ranking tenth in the number of new cases of cancer in the world, accounting for 3%, and the death cases are about 200, 000 [2]. Bladder cancer often causes symptoms such as hematuria. Clinically, surgery is the main means to treat bladder cancer. Resection of tumor tissue or total bladder resection can effectively prevent the spread or metastasis of tumor cells, thereby prolonging the survival time of patients and improving their overall prognosis [3]. However, the treatment of bladder cancer varies according to its clinical stage, and preoperative staging of bladder cancer is essential to develop a targeted surgical plan. Therefore, this paper mainly compared the efficacy of contrast-enhanced ultrasound and CT in evaluating the preoperative staging of bladder cancer, in order to provide a better choice for the accurate staging of bladder cancer before surgery, and thus improve the effectiveness of treatment.

1. Data and methods

1.1 General information

Fifty-five patients with bladder cancer admitted to the hospital from March 2023 to March 2024 were selected as study samples. Among them, there were 43 males and 12 females, ranging in age from 40 to 76 years old, with an average age of (57.79±10.21) years old. Among them, the postoperative pathological diagnosis stages were as follows: 15 cases at T1 stage, 12 cases at T2 stage, 13 cases at T3 stage, and 4 cases at T4 stage (total 44 cases, inconsistent with 55 cases). There was no significant difference in the general data among the groups ($P < 0.05$). Inclusion criteria: (1) All patients were diagnosed with bladder cancer by pathological examination; (2) clinical symptoms related to bladder cancer; (3) Complete clinical medical records. Exclusion criteria: (1) patients with abnormal coagulation function; (2) Patients with mental diseases who can not communicate normally.

1.2 Research method

All patients in the group underwent contrast-enhanced ultrasound and CT examination. In the examination of CEUS, the abdominal ultrasound probe of Philips was selected, and the ultrasonic contrast agent was sulfur hexafluoride microbubble for injection produced by Bolecco, Italy. The patient lay on his back, filled the bladder, and performed multi-sectional examination to observe the tumor size, depth of invasion and other key information.

CT was performed using Siemens CT. Prior to the examination, the patient was required to undergo a routine fast and be reminded to wear loose clothing and avoid metal accessories to prevent adverse effects on image quality. During the examination, the patient should be supine. Before the examination, the bladder should be full, and then the scan from the diaphragmatic roof to the lower margin of the symphysis pubis should be performed successively by conventional CT plain scan and enhanced scan.

1.3 Observation indicators and judgment criteria

(1) To observe the diagnostic coincidence rate of CT and contrast-enhanced ultrasound in each stage of bladder cancer before operation.

(2) The sensitivity and specificity of contrast-enhanced ultrasound and CT in the diagnosis of preoperative staging of bladder cancer were observed in ROC curve analysis.

1.4 Statistical analysis

SPSS 26.0 software was used for data processing, and t test was used for comparative analysis among different groups. Counting data was expressed as percentage, measurement data was expressed as mean ± standard deviation, and differences among groups were compared by 2 test. In this study, if $P < 0.05$, the difference was considered statistically significant.

2. Result

2.1 The coincidence rate of preoperative staging of bladder cancer diagnosed by contrast-enhanced ultrasound and CT

There was no significant difference between the two methods at T1, T4 and T3 stages ($P > 0.05$). However, the conformity rate of CEUS in T2 stage was significantly higher than that in control group ($P < 0.05$).

Table 1 Coincidence rate of preoperative staging between contrast-enhanced ultrasound and CT diagnosis of bladder cancer [n, %]

way	Number of cases	T_1(n=15)	T_2(n=12)	T_3(n=13)	T_4(n=4)
Contrast ultrasound	55	13(86.67%)	11(91.66%)	12(92.30%)	3(75.00%)
CT	55	12(80.00%)	9(75.00%)	12(92.30%)	3(75.00%)
χ^2		6.337	10.238	8.537	6.351
Pvalue		0.048	0.001	0.024	0.003

2.2 Value of two different approaches in preoperative staging of bladder cancer

It was found that the sensitivity and specificity of CEUS in the diagnosis of bladder cancer staging before surgery were higher than those of CT ($P < 0.05$).

Table 2 Sensitivity, specificity and accuracy of contrast-enhanced ultrasound and CT in the diagnosis of bladder cancer staging before surgery

way	Number of cases	sensitivity(%)	specificity(%)	accuracy(%)
accuracy	55	87.33%	95.42%	90.21%
CT	55	82.51%	89.05%	91.06%
χ^2		7.014	5.371	3.254
Pvalue		0.008	0.001	0.004

3. Discuss

In the course of clinical treatment of bladder cancer, it is very important to formulate the corresponding treatment plan according to the different stages of the patient's disease. A clear understanding of the preoperative stage of the patient is helpful to understand the depth of tumor invasion and whether the surrounding organs are involved, so as to formulate a more targeted treatment plan to improve the cancer control effect and optimize the overall prognosis of the patient. In this study, patients in the group were staged before surgery by contrast-enhanced ultrasound and CT respectively. Based on the diagnostic stage of pathology, it was found that there was no statistically significant difference between contrast-enhanced ultrasound and CT in the detection of bladder cancer at T1, T4 and T3 before surgery ($P > 0.05$). The diagnostic coincidence rate of CEUS in T2 stage bladder cancer was higher than that of CT ($P < 0.05$). In addition, the sensitivity and specificity of CEUS in preoperative staging of bladder cancer were higher than those of CT ($P < 0.05$). Tension studies have shown that the AUC area of CEUS in T2 stage is significantly larger, and the diagnostic performance of CEUS in T2 stage is higher than that of CT[4]. At the same time, in the T2 period of CT diagnosis, the judgment basis is mainly whether the bladder wall is thickened. However, prior to the examination, patients drink a lot of water so that the bladder is fully filled, which can make it difficult to distinguish whether the bladder wall thickening is due to the tumor or something else during the diagnosis. During the angiography process, only a small amount of contrast agent can be used to

clearly observe the blood perfusion status in the tumor blood vessels, so that the strengthening signal around the tumor tissue and the bladder wall can be quickly detected.

In summary, contrast-enhanced ultrasound has a higher coincidence rate in the staging diagnosis of T2 bladder cancer than CT. However, the sample size of this study is limited, and it is necessary to conduct a larger sample size study to further explore this phenomenon.

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