The Value of MRI and CT in the Diagnosis of Retroperitoneal Tumours

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Abstract: *Objective:* This study aimed to investigate the effectiveness and value of MRI and CT in the diagnosis of retroperitoneal tumours. *Methods:* 60 patients with retroperitoneal tumours admitted to our hospital between July 2022 and March 2023 were selected as the study subjects. All of them received MRI and CT examinations. The detection of the two examination methods was compared and analyzed using the pathological findings as the standard. *Results:* The detection rate of MRI (58/60, 96.67%) was significantly higher than that of CT (50/60, 83.33%), and the difference was significant ($P = 0.015 < 0.05$). *Conclusion:* Both MRI and CT have important application values in the diagnosis of retroperitoneal tumours. MRI has advantages in observing soft tissue structures, nerve tissues, etc., and can provide more detailed anatomical structure information, which can help differentiate the retroperitoneal tumours and locate them accurately. CT, on the other hand, has unique advantages in observing the skeletal structure and the density of certain tumours, etc. It can quickly obtain comprehensive imaging information, which helps to determine the extent and invasion of the tumour.

Keywords: MRI; CT; Retroperitoneal tumour

1. Introduction

Retroperitoneal tumours are tumours that originate from the posterior wall of the abdominal cavity or metastasize to the peritoneum and are classified into two types: benign and malignant. These tumours lack obvious clinical manifestations in the early stage, which often makes it difficult for doctors and patients to detect them in time. Due to the relatively low overall prevalence of retroperitoneal tumours, they are easily misunderstood as other diseases or overlooked, resulting in delayed diagnosis and treatment. In particular, some benign tumours may not cause symptoms for a long period of time, increasing the risk of being overlooked. Retroperitoneal tumours occur relatively infrequently, and this disease is not considered to be common in clinical practice; however, despite their low incidence, retroperitoneal tumours are unique due to the variety of tissue types they involve [1]. These tissues include benign ones, such as cystic tumours and adenomas, and malignant ones, such as sarcomas and carcinomas. The complexity of these tumours multiply the challenges

of diagnosis and treatment. Once a patient is diagnosed with a retroperitoneal tumour, his or her health is at serious risk. These tumours can cause compression of adjacent organs, blood vessels and nerves, resulting in pain, dysfunction and even life-threatening conditions. Due to the vast space of the retroperitoneum and the hidden location of the tumour, diagnosis often requires advanced imaging techniques. Therefore, retroperitoneal tumours not only pose a threat to the physical health of patients but may also have a significant impact on psychological and social functions. At this stage, surgical pathology is considered the most reliable method of tumour identification. Nonetheless, this process involves making an incision in the patient and confirming the type of tumour and, therefore, has certain operational drawbacks. Although effective, this method poses non-negligible challenges and risks, especially for the patient's body and postoperative recovery. Therefore, screening and diagnosis of retroperitoneal tumours is crucial, and the detection rate can be improved with the help of imaging techniques such as MRI and CT so that timely and effective therapeutic measures can be taken to reduce the deterioration of the condition and the risk of complications. In clinical practice, magnetic resonance imaging (MRI) and computed tomography (CT) are frequently used imaging tests. These two examination methods have numerous advantages in assessing the patient's condition, such as noninvasiveness, ease of operation, and reproducibility [2–3]. Through MRI and CT examinations, doctors can obtain detailed information about internal tissue structure, which helps to diagnose and formulate appropriate treatment plans accurately. The wide application of MRI and CT technologies provides important technical support for medical diagnosis and provides patients with more comprehensive and detailed medical services.

In clinical practice, Magnetic Resonance Imaging (MRI) is a non-invasive imaging method that produces three-dimensional images of the inside of the body with high resolution by utilizing a magnetic field and harmless radio waves. Compared to traditional X-rays and CT scans, MRI is able to show soft tissue structures such as the brain, spine and joints more clearly. This technique does not require radiation, so there is no risk of radiation to the patient and it is suitable for the diagnosis of certain specific conditions. On the other hand, Computed Tomography (CT) is an imaging method in which multiple X-ray images are taken at different angles and then reconstructed by computer into volumetric data with high resolution. CT scans have high imaging speed and accuracy and can be used to evaluate a variety of diseases, such as tumours, bone fractures, and cerebrovascular disease. Because of the fast-imaging speed of CT scanning, it is particularly important for diagnosing patients in emergency situations. Based on this, this study aims to investigate the effect and value of magnetic resonance imaging (MRI) and computed tomography (CT) in the diagnosis of retroperitoneal tumours and to promote the application and dissemination of imaging technology in clinical practice.

2. Data and methods

2.1. General information

The study subjects were 60 patients with retroperitoneal tumours between July 2022 and March 2023, of which 41 were male and 19 were female. The age range was from 32 to 58 years old, and the mean age was 48.36 ± 8.67.

Inclusion criteria: (1) All participants presented with different degrees of symptoms such as abdominal mass, abdominal pain and abdominal distension; (2) Those who had a complete record of their medical history; (3) All participants were examined by MRI and CT, and the pathological findings were in line with the clinical diagnostic criteria for retroperitoneal tumours [4]; (4) All participants and their families had fully understood the content of the study and had signed an informed consent form.

Exclusion criteria: (1) Patients with other serious diseases or co-morbidities affecting the results of the study; (2) Patients with psychiatric and cognitive disorders, unable to communicate normally; (3) Women in

pregnancy; (4) Patients with contraindications to MRI or CT examination; (5) Patients with systemic disorders.

2.2. Methods

2.2.1. MRI detection

Before MRI detection, patients are required to take off metal objects, such as jewelry and watches, and put on medical clothing. The medical staff will ask if metal implants or other factors may affect the MRI detection. The patient is asked to lie down on a specialized test bed, ensuring that the body is aligned with the magnetic field and remains still. The medical staff will assist in adjusting the posture to ensure that a clear image is obtained. Once the test begins, the patient is wheeled into the MRI machine, which emits a magnetic field and harmless radio waves to obtain images of the inside of the body. During the scanning process, the medical staff may ask the patient to hold their breath or keep their body still to minimize image blurring. After the scan is completed, the physician analyzes and interprets the MRI images to assess the location, size, morphology, and other characteristics of the retroperitoneal tumour and compares them with pathology results to assist in clinical diagnosis and treatment decisions.

2.2.2. CT detection

Before CT detection, patients must remove metal objects from their bodies and put on medical garments. The medical staff will ask the patient if they have any metal implants or other factors that may affect the test. Next, the patient is asked to lie down on the CT test bed in the correct body position and remain still. The medical staff will help the patient adjust his or her posture to ensure that a clear image is obtained. Once the test begins, the CT machine rotates around the patient and emits X-rays to obtain tomographic images of different parts of the body. During the scan, the patient is required to remain still and not move. After the scan is completed, the doctor will analyze and interpret the CT images to assess the morphology, size, location and other characteristics of the tumour and make a comprehensive analysis with other test results.

2.2.3. Observation index

The results presented by two different imaging methods, MRI and CT, are compared.

2.3.4. Statistical methods

SPSS 26.0 software was used for statistical analysis of the data, and the count data were expressed as n (%), and the chi-square test was performed, with $P < 0.05$ indicating statistical significance.

3. Results

3.1. Tumour types of study subjects

After MRI, CT and expert consultation, the tumour types of 60 cases of retroperitoneum are shown in **Table 1**.

Table 1 Tumour types of patients

Type	Neurogenic tumour	Lymphoma	Malignant fibrous histiocytoma	Lymphangioma	Mature teratoma	Other
Number of cases (n)	20	15	13	4	3	5

3.2. MRI and CT detection results

The MRI detection rate (58/60, 96.67%) was significantly higher than the CT detection rate (50/60, 83.33%),

and the difference was statistically significant ($\chi^2 = 5.926$, $P = 0.015 < 0.05$). Refer to **Table 2**.

Table 2 Comparison of MRI and CT detection results

Detection method	Detected	Not detected	Detection rate (%)
MRI ($n = 60$)	58	2	58 (96.67%)
CT ($n = 60$)	50	10	50 (83.33%)
χ^2	-	-	5.926
P	-	-	0.015

4. Conclusion

MRI and CT scanning, as common clinical imaging diagnostic techniques, play a good application in determining the location of tumours, observing tumour characteristics, analyzing the type and extent of tumours, and judging the characteristics of tumour growth [5–6]. These two imaging techniques can provide accurate tumour localization information, help doctors understand the morphology and size of the tumour and enable detailed observation and analysis of the tissue structure and blood supply of the tumour. Through MRI and CT scans, doctors can better assess the degree of malignancy of the tumour, thus providing an important basis for the development of personalized treatment plans. At the same time, these imaging techniques can also track the dynamic changes in tumour growth, which can help monitor the effectiveness of treatment and predict the development trend of the tumour.

Computed tomography (CT scan) is an imaging technique that generates detailed cross-sectional images by rotating X-rays through different parts of the body. CT scan uses X-rays in different directions to obtain density information of tissues in the body and then generates high-resolution images through computer processing. CT images can show the bone structure, soft tissues and blood vessels and are important diagnostic tools in detecting tumours, bone fractures, hemorrhages and other lesions, Bleeding and other lesions have important diagnostic significance. In CT diagnosis of retroperitoneal tumours, it is necessary to pay close attention to the characteristics and location of the lesions. Benign tumours usually show clear boundaries, uniform density, regular morphology and obvious fat gaps in the image, on the contrary, malignant tumours have blurred boundaries, are difficult to distinguish from the surrounding organs and tissues, and sometimes appear to be displaced by organ compression. In addition, benign tumours usually do not invade the surrounding organs, while malignant tumours may cause some organs to be invaded. Localization signs are also important for diagnosis; compression and displacement of organs and whether the bowel is located behind the tumour can provide important information. A comprehensive analysis of the characteristics and location of the lesion helps the doctor to accurately diagnose the nature of the tumour and the patient's condition.

Magnetic Resonance Imaging (MRI) is a medical imaging technique that uses a magnetic field and radio waves to produce detailed images of the body's internal structures. Using a powerful magnetic field and harmless radio waves, MRI can produce high-resolution images showing the structure and lesions of various tissues in the body (e.g., brain, spine, joints, abdomen, etc.). MRI images have excellent contrast and can clearly show soft tissue structures to help doctors diagnose tumours, injuries, and diseases. Compared with CT scanning, MRI technology can more clearly show the fluid, hematoma and oedema within the tumour, etc. It also has higher imaging resolution, which is conducive to a finer examination of the tissue components and thus more accurately determines the nature of the retroperitoneal tumor. In addition, MRI also has the function of evaluating the clinical staging and prognosis of retroperitoneal tumours, which helps to provide comprehensive

diagnostic information through detailed observation of tumour morphology, lymph node metastasis, etc., and provides important support for the formulation of treatment plans and prognosis assessment of patients. MRI provides richer histological information, which helps doctors to have a more comprehensive understanding of the biological characteristics of the tumour, and provides a more reliable basis for the formulation of treatment plans for patients. Therefore, when diagnosing retroperitoneal tumours, combining the features and advantages of MRI can improve the diagnostic accuracy and therapeutic effect of the condition. Various studies have shown that combining both options can achieve better diagnostic results [7–8].

In this study, the detection rate of MRI scan was significantly higher than that of CT scan, and the CT image was significant in describing the characteristic tumour components, which were more clearly demonstrated by the influence of low-density fat. In clinical diagnosis, the presence of fat is of positive significance in determining the extent of the lesion [9]. In CT scans, patients with lesions with clear margins and distinct segregation sometimes observe fat signals, which may show weak and heterogeneous enhancement, while the degree of tumour differentiation may affect the results of CT display [10]. CT flat scans show that the borders of the tumour and the peritoneal mass are clearly visible and regular in shape. However, when CT enhancement scans were performed, the margins of the tumour were blurred and the retroperitoneum showed a soft tissue mass with irregular morphology accompanied by large areas of necrosis. This irregular feature may suggest the malignancy of the lesion, and surgical pathology can be used to ultimately confirm the diagnosis and assess the nature and progression of the tumour [11].

In summary, the organic combination of MRI and CT can provide patients with more accurate diagnostic results, and provide more powerful support for the development of treatment plans and prognosis assessment. Therefore, for the diagnosis of retroperitoneal tumours, the combination of MRI and CT imaging has important application value, which can help to improve diagnostic accuracy and therapeutic effect and bring better clinical prognosis and quality of life for patients.

Disclosure statement

The author declares no conflict of interest.

References

[1] Yang F, 2020, A Retrospective Study of Imaging Diagnosis, Surgery and Postoperative Complications of Retroperitoneal Tumours, thesis, Southern Medical University.

[2] Liu Y, 2020, Discussion on the Application Value of Ultrasound in the Differential Diagnosis of Pelvic Mass and Pelvic Retroperitoneal Tumour. Imaging Research and Medical Application, 4(19): 242–243.

[3] Huang R, 2020, Analysis of the Clinical Value of CT and MR in the Diagnosis of Retroperitoneal Primary Tumours. Imaging Research and Medical Application, 4(9): 149–150.

[4] Wang J, 2022, Pathologic Diagnosis and Differential Diagnosis of Retroperitoneal Tumours. Surgical Theory and Practice, 27(6): 500–505.

[5] Qian L, Lu C, Ge Y, 2019, Application of Specific CT Signs in the Differential Diagnosis of Primary Retroperitoneal Tumours. Imaging Research and Medical Application, 3(17): 115–116.

[6] Jia X, Li W, 2019, CT Diagnosis of Primary Retroperitoneal Tumour. Electronic Journal of Cardiovascular Diseases of Integrative Medicine and Western Medicine, 7(24): 91.

[7] Zhou X, Li H, Deng X, 2019, CT Diagnosis and Differential Diagnosis of Primary Common Abdominopelvic and Retroperitoneal Tumours. Imaging Research and Medical Application, 3(15): 41–43.

[8] Feng Y, Zhang W, Li Q, et al., 2020, Study on the Diagnostic Value of Primary Retroperitoneal Tumours by MR-DWI and MSCT. Journal of Hebei Medical University, 41(11): 1326–1330.

[9] Jia H, 2019, Application Value of Multislice Spiral CT in the Diagnosis and Differential Diagnosis of Primary Retroperitoneal Tumours. Systemic Medicine, 4(6): 111–113.

[10] Lin J, Diao D, Liao W, et al., 2022, CT Three-Dimensional Reconstruction and 3D Printing Technology in Complex Retroperitoneal Tumour Surgery. Colorectal and Anal Surgery, 28(2): 119–123.

[11] Wang Z, Ren W, Zhang H, et al., 2022, CT-Guided Iodine-125 Particle Implantation for Retroperitoneal Tumours. Hebei Medicine, 44(3): 388–391.