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CT and MRI diagnosis of ovarian cystic adenofibroma

Yaohua Chen, Mingqing Kou[a,*]

Shaanxi Provincial People's Hospital, Xi'an, Shaanxi, 710068, China
[a]kmq9876@126.com
[*]Corresponding author

Abstract: *To investigate the CT manifestations and MRI diagnosis of ovarian cystic adenofibroma, and to understand its practical value, fifty patients with ovarian cystic adenofibroma who underwent treatment in our hospital from January 2022 to January 2023 were selected. The pathological and CT data of the patients were analyzed to understand the characteristics of CT use in the treatment of this disease. The results showed that all 50 patients had fibromas, with 43 on one side and 7 on both sides. Among them, there were 21 cases on the left, 22 cases on the right[1], and 7 cases of upward invasion into the lower abdomen. The diameter of the tumor is 1.8-13cm, with an average of (1.69 ± 0.35) cm. The tumors are either regular or irregular oval-shaped, with most of the boundaries being clear. Ovarian cystic adenofibroma is mostly solid, and in diagnosis, it is easily limited by relevant conditions to accurately determine the patient's disease situation. However, by analyzing the patient's actual medical history and comparing it with CT results, the effectiveness of CT diagnosis can be improved, and the quality and efficiency of the patient's disease can be improved too. Ovarian cystic adenofibroma can be diagnosed based on CT findings to determine the tumor location, nature, size, etc., with high accuracy. However, the diagnosis should also be based on the examination results as the gold standard.*

Keywords: *Ovarian Cystic Adenofibroma; CT; MRI Diagnosis*

1. Introduction

Ovarian fibroma is a benign tumor of female reproductive system originating from ovarian sex cord stroma, which is extremely rare. The incidence rate of this disease accounts for 2% -5% of all ovarian tumors. Ultrasound and CT scanning are the main examination methods for this disease, but their specificity is poor in specific diagnosis[2]. The correct diagnosis rate of this disease before treatment is not high, and it is often misdiagnosed as a broad ligament myoma or ovarian malignant tumor. Due to its rarity in female diseases, it is difficult to determine a diagnosis. MRI scanning of soft tissue has higher resolution, which can better reflect the three-dimensional morphology and biological characteristics of tumors[3]. Enhanced scanning can provide a more accurate assessment of the patient's lesion morphology. This method is beneficial for the qualitative and diagnostic analysis of ovarian fibroma.

2. Materials and Methods

2.1 General Information

We selected 50 patients with ovarian cystic adenofibroma who were admitted to our hospital from January 2022 to January 2023. The patients were diagnosed with ovarian cystic adenofibroma through pathological examination. The clinical data, Image findings, and pathological examination results of the patient showed that the average age of the patient was 39 years (37.8 ± 2.11) years old, ranging from 30 to 65 years old. There were 19 postmenopausal patients. The main clinical manifestations of the patients were: increased or decreased menstrual flow in 18 cases, vaginal bleeding in 8 cases after menopause, lower abdominal pain in 21 cases, B-ultrasound examination found masses in the accessory area in all patients, and ascites in 3 cases.

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2.2 CT and MRI scanning method

All patients underwent pre CT scanning preparation, followed by pelvic spiral CT plain and enhanced scans. The Siemens Somatom Definition Flash dual-source CT and Aquilion ONE CT(Toshiba Medical Systems) machine was used, with a tube voltage set at 130kV, a current of 300mA, a velocity of 0.8, a thick layer of 5mm, and a pitch of 1.375[4]. Before scanning, a dose of 1.5mL/kg of iohexol was injected into the median vein of the elbow, followed by a 0.9% NaCl30mL injection at a rate of 2.5mL/s. The average delay time in the arterial phase during scanning was 25-30 seconds, and the average delay time in the venous phase was 55-60 seconds. The scanning area ranged from the upper edge of the diaphragm to the lower edge of the pubic symphysis.

MR Scanning was performed using a Philips Ingenia 3.0TMRI scanner using a pelvic phase controlled front circle. Plain scan MRI sequences included sagittal T2WI, coronal T2WI, axial T2WI and axial T1WI, and the FOV range was 26 cm × 32 cm. The functional sequences included axial DWI(b values were 0 s/mm2 and 800 s/mm2), axial DCE-MRI and sagittal and coronal enhanced delayed scanning. The scanning and reconstruction layer thickness and layer spacing were 4 mm and 1 mm respectively. The main parameters of scanning were T2WI: TR/TE4420-4730ms /70-90ms; T1WI: TR/TE645ms/ms; DWI:TR/TE 2750ms/80ms; DCE-MRI: TR/TE3.1ms/1.5ms.

2.3 Pathological examination

Select specimens from the patient's surgical tumor resection, fix them with formaldehyde solution, embed them in conventional paraffin and slice them, perform immunohistochemical staining, select characteristic wax blocks for immunohistochemical examination and microscopic observation, and analyze their approximate pathological characteristics[5].

2.4 Image processing

Perform energy spectrum analysis on the lesion, using a single energy reconstruction algorithm to reconstruct the original data into a thin layer image with a thickness of 1.25mm, and upload the data to the GEAW4.5 professional workstation. Use GSIView analysis software and multi-plane reconstruction technology for analysis and processing. The CT imaging data of 50 patients were analyzed by senior physicians in our hospital.

2.5 Image evaluation

As shown in Figures 1-3, all CT and MR image analyses were completed by two experienced radiologists, and consensus was reached in case of disagreement. On CT and MR images, evaluate the location, size (maximum diameter), morphology, cyst wall thickness (divided into two types based on 3mm), internal structure (cyst fluid density, solid components, and degree of enhancement) of the tumor. Divide all tumors into solid (containing over 2/3 solid components), cystic solid, and cystic (containing over 2/3 cystic components). Compare the degree of reinforcement with the surrounding skeletal muscles (mild, obvious).

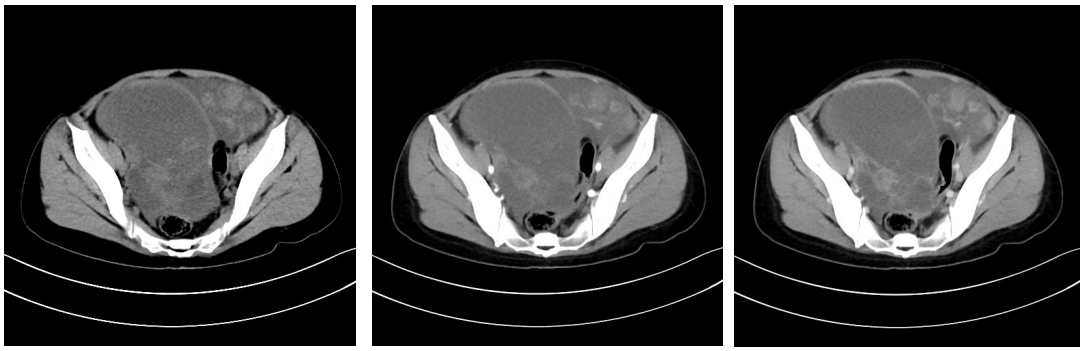

Figure 1: Ovarian CT

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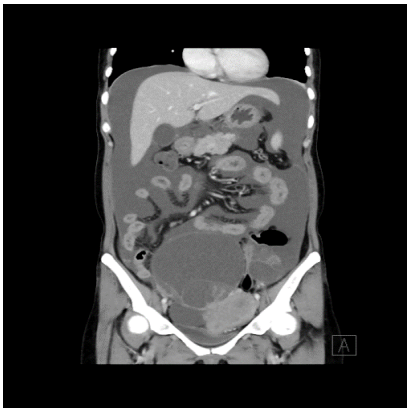

Figure 2: Abdominal CT

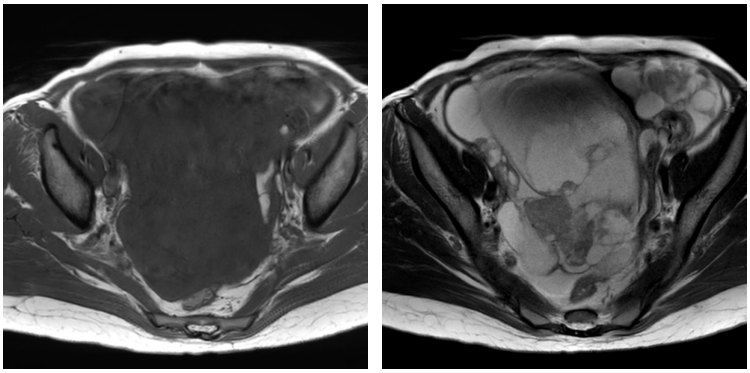

Figure 3: Ovarian MR

Female, 65 years old, with ovarian cystic adenofibroma. CT: The tumor in the right adnexal area of A-D shows cystic and solid changes, with enhanced solid components visible; MRI: Multiple cystic lesions and implementing components visible within the E-F tumor

3. Results

3.1 Preoperative CT scan imaging manifestations

Among 50 patients, 43 were unilateral and 7 were bilateral. Among them, there were 21 cases on the left, 22 cases on the right, and 7 cases of upward invasion into the lower abdomen; 27 are cystic, including 8 polycystic and 9 monocystic. Among the 23 contrast-enhanced scans, there were a total of 4 solid and solid components in the tumors, with 1 case showing significant enhancement of solid components, while the rest showed mild or no enhancement. Two tumors had bleeding and necrosis, three cyst walls showed calcification, all of which were single nodular calcification, two had "honeycomb sign", and two had a separation greater than 3mm. This study measured the cystic fluid density of single cystic tumors, with 7 cases exceeding 20HU and an average CT value of 27HU, which is similar to soft tissue tumors on plain CT. All preoperative CT scans failed to diagnose correctly. Among the 50 tumors[4], 10 were diagnosed with ovarian cystic adenofibroma, 7 with ovarian cysts, 2 with ovarian chocolate cysts, and 4 with suspected malignancy.

3.2 MR performance

Among the 50 tumors, 1 is solid, 1 is cystic solid, and 48 are cystic. Among them, 32 are polycystic and 16 are monocystic. Using the signal of the uterine myometrium as a reference for equal signal, the solid component T1WI is equal signal, while T2WI is low signal. One tumor has internal bleeding and necrosis, which was misdiagnosed as ovarian tumor pedicle torsion before surgery, and the T1WI signal is mixed. Localized thickening of the cystic wall and septum was observed in all 11 cystic tumors, with low signal intensity on T2WI, lower signal intensity than normal cystic wall, and high signal intensity in the cystic fluid. Solid nodules were found in the walls of three cystic tumors, with two showing low signal on T2WI and one showing equal signal. Enhanced scanning showed significant enhancement in

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only one of the five tumors containing solid components, while no enhancement was observed in the remaining four tumors. Preoperative MR examination failed to diagnose correctly, with 7 cases diagnosed as ovarian cystadenoma, 3 cases diagnosed as ovarian cyst, 1 case diagnosed as ovarian cystic teratoma, 1 case diagnosed with ovarian tumor pedicle torsion, and 1 case diagnosed as polycystic ovary.

3.3 Surgical results

Among 50 patients, 43 were unilateral and 7 were bilateral. Among them, there were 21 cases on the left, 22 cases on the right, and 7 cases of upward invasion into the lower abdomen; Among them, there were 9 cases of follicular thecoma, 5 cases of granulosa cell tumor, 2 cases of fibroma, 4 cases of stromal cell tumor, and 1 case of supportive stromal cell tumor; The diameter of the tumor is 1.9-14.8cm, with an average of (7.69 ± 2.24) cm; Fifteen cases of solid masses had a relatively hard texture, while six cases had cystic solid or cystic local presence. Among them, two cases showed abdominal fluid accumulation, three cases had cystic solid masses with multiple cystic necrotic areas, and three cases had granulosa cell tumors metastasizing to the abdominal cavity. The tumor site, size, morphology, and CT imaging findings were similar during surgery.

4. Discussion

4.1 Overview

Cystic adenofibroma of the ovary is an ovarian tumor originating from germ epithelial cells. It is a rare tumor. In 1936 cases of ovarian tumors reported by Cho et al., the incidence rate is only 1.7%. According to literature reports, women aged 15-65 have onset of the disease, with a bilateral incidence rate of 5.8%.

The clinical characteristics of ovarian cystic adenofibroma are non-specific. When the tumor is large, it may present with symptoms of adjacent organ compression, such as abdominal pain, bloating, urgency to urinate, changes in the menstrual cycle, and irregular vaginal bleeding. The pathogenesis of cystic adenofibroma is not yet clear, but it may be related to a history of exposure to estradiol. Papadaki et al. reported that estrogen stimulates the proliferation of tumor epithelium and interstitial fibers, and the morphology of tumors is regulated by hormones. Hermann et al. proposed that the occurrence of tumors is not caused by estrogen stimulation, but may be related to their involvement in the process of development.

4.2 Pathological manifestations

The gross pathology shows that the lesion originates from the appendix, with a smooth outer wall and a varying number of papillary or sand like protrusions attached to the inner wall, mostly with a wide base, grayish white color, and hard texture. Multiple chamber cystic ovarian cystic adenofibroma can be seen with septa inside the cyst. In solid cases, the cut texture is hard and the cut surface is grayish white, and most of the cyst fluid is clear. In cases with a small amount of bleeding, the inner cyst fluid is slightly cloudy, while in old cases, the bleeding appears coffee colored. Under light microscopy, the lesion cyst wall is composed of fibrous tissue lined with a single layer of columnar epithelium. The cyst wall nodules are composed of two components: fibrous and glandular epithelium. The fibrous components present as coarse papillary hyperplasia, covered by glandular epithelium, with some areas of glandular epithelium invaginating and forming glandular like structures in the fibrous stroma of the nipple. Local fibers can be extensively collagenized.

4.3 CT and MRI Manifestations and Comparison of Two Examination Methods

Ovarian cystic adenofibroma shows non-specific CT findings, with 4 cases failing to make a clear diagnosis of tumor malignancy before surgery. When the density of the cystic fluid is high, it is easy to misdiagnose. In this group, there were 7 cases with a cystic fluid density exceeding 20 HU, with an average CT value of 27 HU. On plain CT, the density of the cystic fluid is close to that of the cystic wall, similar to soft tissue tumors. Enhanced CT can help distinguish and clearly display the structure inside the cyst. However, in pathology, the small nipple components on the cystic wall are difficult to detect on CT due to partial volume effects. The "honeycomb sign" can be a typical sign of this tumor. Sometimes, small subcapsular cavities can be seen in ovarian cystic adenofibromas containing solid

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nodular components. Histologically, small cystic glandular like structures are scattered in dense fibrous stroma, which is very valuable for differential diagnosis of this tumor, similar to the "black sea sponge sign" on MR T2WI.

Compared with CT, MR has higher soft tissue resolution and can display the three-dimensional morphology and biological characteristics of ovarian tumors[6], which is helpful for the qualitative diagnosis and differentiation of benign and malignant ovarian tumors. Enhanced MR has unique advantages in the discovery and diagnosis of complex tumors in the adnexal region, and MR has good reproducibility and reliability in evaluating complex tumors in the adnexal region.

There are few MR reports on ovarian cystic adenomas. Outwater et al. reported that the MR features of tumors are multi chamber cystic tumors with solid components, which appear as low signal on T2WI images. Takeuchi et al. reported a case of a tumor characterized by a small cystic cavity within the solid component, which was named the "black sea sponge sign" on T2WI. Jung et al. reported the MR manifestations of 12 cases of this tumor and proposed new imaging features. No clear nodular components were found within the tumor, only thickening of the cyst wall and septum. The thickened cyst wall showed low signal on T2WI, while the low signal cyst wall showed proliferative fibrous tissue histologically. In this group, 11 cases had similar imaging findings to their descriptions, accounting for approximately 69.2%[7]. Cho et al. reported a large sample of this case, with half of the 32 tumors being cystic and half being complex cystic tumors containing solid nodular components. These features are often difficult to distinguish from ovarian cystadenoma on CT and MR images.

In summary, ovarian cystic adenofibroma has characteristic features on MR images. MR can display the fibrous components of the tumor, which are low signal on T2WI. However, exceptions should be noted. Kumatoriya et al. reported a case of endometrioid ovarian cystic adenofibroma with high signal intensity on T2WI, and histopathological results confirmed interstitial edema of fibrous tissue.

4.4 Differential diagnosis

The differential diagnosis of ovarian cystic adenofibroma is important because it contains solid components and can be misdiagnosed as a malignant tumor. The differential diagnosis of this tumor includes fibroadenoma, follicular choriocytoma, and ovarian Brenner's tumor, all of which exhibit low signal intensity on T2WI due to the presence of fibrous components. Typical cases of ovarian fibroma, due to their rich fiber content, exhibit low signal on T1WI and T2WI, which can be accompanied by Meigs syndrome (large amounts of ascites and pleural effusion, multiple basal cell carcinoma of the skin, odontogenic keratocysts, and other abnormalities), and are prone to cystic transformation. Follicular cell carcinoma often coexists with ascites, with MR features similar to solid ovarian cystic adenofibroma, but on T2WI, there may be punctate, fissure like, and patchy high signal cystic necrotic areas inside. The characteristic of ovarian Brenner's tumor is a multilocular cystic tumor with solid nodular components, or presenting as a solid small tumor. On MR, it is low signal due to the presence of a large amount of fibrous components, but irregular calcifications can be seen in the solid components [1].

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The clinical characteristics of ovarian cystic adenofibroma are non-specific. When the tumor is large, it manifests as compression symptoms of adjacent organs, such as abdominal pain, bloating, urgency to urinate, and may also manifest as changes in the menstrual cycle and irregular vaginal bleeding. The pathogenesis of cystic adenofibroma is not yet clear, but it may be related to a history of exposure to estradiol. Papadaki et al. reported that estrogen stimulates the proliferation of tumor epithelium and interstitial fibers, and the morphology of tumors is regulated by hormones. Hermann et al. proposed that the occurrence of tumors is not caused by estrogen stimulation, but may be related to participation in its development process.

Ovarian cystic adenofibroma does not exhibit specific CT findings. MRI has high soft tissue

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resolution ability. It can directly display the three-dimensional morphology and biological characteristics of ovarian tumors, which is helpful for qualitative judgment of ovarian tumors. MRI technology can accurately distinguish the benign or malignant increase of tumors, which has a unique advantage in the discovery and diagnosis of complex regional tumors. MRI technology has high repeatability and reliability in evaluating complex tumors in the reconstruction area.

The characteristic manifestations of ovarian fibroadenoma on MR and I images can be displayed as the fibrotic components of the tumor. Based on the diagnosis of this technology, medical personnel can provide specialized treatment plans to improve the patient's healing effect and provide comprehensive assistance for the patient's prognosis.

The differential diagnosis of ovarian cystic adenofibroma is important, as the probability of its occurrence is low, leading to frequent misdiagnosis. If diagnosed incorrectly, it is easy to be misdiagnosed as a malignant tumor. The differential diagnosis of this tumor includes fibroadenoma, follicular membrane, cell tumor, ovarian tumor, etc. Multiple situations should be analyzed with emphasis on fiber composition to determine the signal level of fiber composition to determine whether it is a fibroma. If there is a misdiagnosis of fibroadenoma, it has a serious impact on the patient's postoperative and other issues, resulting in the patient being unable to receive treatment in a timely manner. Therefore, accurate CT and MRI diagnostic techniques are used to complete the substantive judgment of fibroadenoma, providing corresponding conclusion data for the later treatment of medical staff.

5. Summary

In summary, the imaging manifestations of ovarian cystic adenofibroma have specificity. Familiarity with the imaging features of ovarian cystic adenofibroma is of great significance for the differentiation of benign and malignant tumors, as well as for guiding clinical surgical plans. MRI should be the preferred detection method for this disease.

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