The value of retrograde cystography CT scan in the diagnosis of bladder diverticulum

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Purpose

Bladder diverticulum is prone to be misdiagnosed due to the little specificity in diagnostic imaging and insufficient clinical knowledge. Current enhanced CT scan is the most commonly used diagnostic method of bladder diverticulum. Although it can show the size, shape, and opening of diverticulum, while affected by delayed effect and is expensive, thus it increases the financial burden of patients. There are also many other examination methods, but most of them are cumbersome and expensive, some are even limited and traumatogenic, so they have little diagnostic and applicable value.

Our research found that Retrograde cystography CT scan can accurately diagnose bladder diverticulum, clearly show the size, location, shape and opening of bladder diverticulum.

The purpose of this study was to investigate the value of retrograde cystography CT scan in the diagnosis of bladder diverticulum and try to popularize the retrograde cystography CT scan as a kind of diagnostic method of bladder diverticulum is characterized by simple, effective, accurate and cheap through our research.

Methods and Materials

The retrograde cystography CT examination due to the low cost was chosen by 70 patients with bladder diverticulum voluntarily, age: 63.1 ± 6.0 years old, 39 male and 31 females. Before this examination, all of the 70 patients accepted CT plain scan, 17 accepted enhanced scan and 22 accepted type Ultrasound examination, 4 accepted X-ray cystography.

Methods of Retrograde cystography CT examination:

Preparation before radiography: clean enema, tell patients to completely urinate and clean the orificium urethrae externum and warm 0.9% saline to 36~37 # so that the contrast agent could uniformly disperse.

Methods: Insert the catheter under the fluoroscopy of X-ray, exhaust the urine, and diagnose whether there existed urinary tract obstruction based on clinical symptoms. For those patients without urinary tract obstruction, reversely infuse 500 ml 0.9% saline into the bladder, clamp the catheter, and use the Philips MX800 double row spiral CT scanner if the effect was satisfactory with the patients in supine position, under such condition:
voltage 120 kV, current 250 mA, slice thickness 5 mm and slice spacing 5 mm, the scanning area ranged from the iliac spine to 20 mm below of symphysis pubis; after the scan is completed, 40ml 76% infuse compound diatrzoatc meglumlne, the contrast agent into bladder through the catheter, and tell the patients to turn their position to facilitate the uniform dispersion of contrast agent. 2 mm thin slice scan was performed from the layer of vesical diverticulum while the parameters such as scanning range, slice thickness and slice distance were unchanged; the size, location, shape, and opening of bladder diverticulum and the flow of contrast agent were primarily observed. Remove clamp of catheter after the examination and drain the saline and contrast agent. Tell those patients with urinary tract obstruction to orally take iodine water contrast agent (76% compound diatrzoatc meglumlne 20 ml +1000 ml warm water)30 min before the examination, other processes and scanning parameters were the same as those without obstruction.

Results

The examination methods and diagnosis of these 70 patients are listed in table 1:

Tables

Table 1 The comparison of inspection methods and diagnosis of patients with bladder diverticulum.

<table>
<thead>
<tr>
<th></th>
<th>ultrasound</th>
<th>Bladder X-ray cystography</th>
<th>CT scanning without cystography</th>
<th>Retrograde cystography CT</th>
<th>Enhanced CT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity#case</td>
<td>22</td>
<td>4</td>
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<td>70</td>
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<tr>
<td>Diagnosis#case</td>
<td>3</td>
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<td>48</td>
<td>70</td>
<td>12</td>
</tr>
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<td>Diverticulum</td>
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<td>General (with limitations)</td>
<td>Good</td>
<td>Favourable</td>
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<td>Opening pattern</td>
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</tr>
</tbody>
</table>

All of the 70 patients accepted CT plain scan and diagnosed accurately 48; 17 patients were scanned by enhanced CT and diagnosed accurately 12; 22 patients were examined by type Ultrasound diagnosis and diagnosed accurately 15; 4 patients were examined by bladder X-ray angiography and diagnosed accurately3 but all of the 70 patients were examined by retrograde cystography CT and diagnosed accurately 70. the size, location, shape and openings of bladder diverticulum were clearly shown through
retrograde cystography CT, but were poor shown through ultrasound and CT plain scan and enhanced CT.

**Images for this section:**

**Table 1:** Table 1 The comparison of inspection methods and diagnosis of patients with bladder diverticulum.

<table>
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Table 1: Table 1 The comparison of inspection methods and diagnosis of patients with bladder diverticulum.
Conclusion

Previous studies reported that bladder diverticulum might occur at any age, and more often in older female[1,2,3,5]. Patients 60 years of age and older are more likely to develop diverticulosis[4]. 50 patients were female among the 70 patients with an average age of 63.2 years old, which was in line with the literature; most of them were single lesion, and there was no multiple case in this group of patients; There is still not much known about the bladder diverticulum, but some risk factors have been identified. Aging is the primary risk factor[5]. Low dietary fiber intake is the other most significant risk factor, Obesity has been gaining recognition as a possible contributing factor in the bladder diverticulum[6,7]. Bladder diverticulum doesn't have any clinical manifestations[8], or only shows as rare characteristic two-phase urination [9], of course small-bowel obstruction caused by a giant bladder diverticulum[10]. However, roughly 5% to 20% of patients with diverticulum will develop inflammation and subsequent sequelae [11,12] Once there is inflammation, the condition is called diverticulitis. It is thought that a micro- or macroperforation is the precipitating factor in the development of diverticulitis. Irritative symptoms of bladder such as frequent micturition, urgency of urination, pyuria or dysuria might occur during bladder diverticulitis infection, hematuria can be seen when diverticulitis is combined with calculus or tumours. Lower abdominal mass is palpable in body examination, and there is tenderness around the bladder and low abdominal region when it was accompanied by infection. All of the patients had no obvious clinical manifestations, this disease was found by follow-up CT after colon cancer operation in 1 patient; by type-B ultrasound examination in 1 female patient due to low back pain; and as for others it was found when saw doctors for lower abdominal palpable mass.

Bladder diverticulum CT plain scan shows that there existed cystic mass around the bladder, which are in regular shape, mostly are round or oval, closely linked with the bladder and seemed like a part of it; the mass could be single or multiple, but mostly are single, the wall was generally thin, which would thicken if accompanied with infection; the density was homogeneous , the CT value of cyst contents was as same as that of urine within the bladder; the bladder enlarged and the shape was not regular(Figure 1-3). Cystic mass was filled after the contrast agent was infused into bladder; which has a channel between with the bladder, namely the opening of diverticulum (Figure 4-6). When the opening of ureter locates in the diverticulum, contrast agent primarily fills the cystic mass then the bladder. Ureter expansion and hydronephrosis occur if the diverticulum greatly oppressed the ureter.

The traditional inspection method, cystoscopy, can directly observe the shape and size of bladder diverticulum and discover diverticulum combined calculus or tumours, yet it is not available for the observation of such secondary performances as expansion of ureter, hydronephrosis and repression on bladder surrounding organs which induced by great oppression of diverticulum on bladder ureter. Besides, the range and extent of tumour
invasion can not be observed and determined and the largest defect is that it is an invasive examination. Ultrasound is inexpensive and is a non-invasive conventional preferred method which is simple and easy to execute in the diagnosis of prostatic proliferative hypertrophy and bladder diseases in the elderly \cite{13,14}, and can show the shape and size of bladder diverticulum, but is incapable to show clearly diverticular openings or distinguish the diverticulum with other cystic lesions. Bladder X-ray cystography is prone to be influenced by inspection techniques, photography time, body position and bladder filling extent, especially when a small amount of contrast agent slowly transport into the bladder when urinary tract is obstructed, in which case the bladder filling is not satisfactory and diverticula can not be displayed. With no interference of overlapping of tissue, in addition to good spatial resolution and soft-tissue resolution, CT can clearly show the size, location and shape of the bladder diverticulum as well as its complications \cite{15}; it can also timely detect early tumours in the diverticulum \cite{16}. But through no bladder CT plain scan examination, diverticula openings can not be shown clearly or be differentiated from other cystic lesions. Three phase enhanced CT scans can show the location, shape, size and opening of bladder diverticulum, and in particular, combined diverticular cancer; it also have certain diagnostic value in the identification of other urinary tumours or pelvic diseases and determination of the extent of tumour invasion and lymph node metastasis \cite{17}, but when the opening of diverticulum is small, contrast agent is slowly infused and disperses not uniformly, which cause the delay time be affected. Besides, CT contrast agents are expensive, which will increase the financial burden of patients, thus it is not an economical and practical inspection method.

Retrograde cystography CT examination can clearly show the location, shape, size and opening of bladder diverticulum. The inspection is non-invasive and cheap, simple and easy to operate, and is applicable to those patients whose not suitable for cystoscopy such as the elderly and weakling as well as the patients with urethral stricture, thus it has important value in the guidance of surgery program. CT radiography can also discover the presence of obstructive lesions (the bladder neck, prostate, posterior urethra) \cite{18}.

Bladder diverticulum is a rare disease and prone to be misdiagnosed, retrograde cystography CT scan can accurately diagnose bladder diverticulum, clearly show the size, location, shape and opening of bladder diverticulum and provide accurate and detailed information for clinical practice, thus it is a simple, effective and economical inspection method in the diagnosis of bladder diverticulum.

**Images for this section:**
Fig. 1: Figure 1 Bladder increases significantly and has irregular shape;
**Fig. 2:** There is a cystic mass in the left behind of bladder which connects with the bladder, interior density is same as that of bladder, and is equal to that of water;
**Fig. 3:** Figure 3 There is a cystic mass in the left behind of bladder which connects with the bladder, interior density is same as that of bladder, and is equal to that of water.
Fig. 4: Figure 4 The bladder is filled with uniform contrast agent.
Fig. 5: Figure 5 The cystic mass and bladder are simultaneously filled by contrast agent.
Fig. 6: Figure 6 The cystic mass is connected with the bladder by a certain channel, the opening of diverticulum and left side of uterine is oppressed.
References


**Personal Information**

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