

Dual-Energy Computed Tomography for the Diagnosis of Urethral Foreign Body: A Case Study

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Abstract

Foreign body insertion in the urethra and bladder is not uncommon and has been reported in many studies to date. However, since foreign bodies are often accidentally introduced into the urethra and bladder during masturbation, they take a variety of shapes and sizes. Furthermore, patient self-reports are typically unreliable as many patients feel ashamed; thus, appropriate preoperative diagnosis is critical. Diagnosis of foreign body insertion in the urethra and bladder is performed using imaging modalities such as abdominal X-ray and computed tomography (CT). However, single-energy CT (SECT) is not sufficient in detecting foreign bodies in some cases. In the present study, we report a successful preoperative identification of urethral foreign body in a patient using dual-energy CT (DECT).

Keywords

Dual-Energy CT, Urethral Foreign Body

1. Introduction

Foreign body insertion in the urethra and bladder is not uncommon and has been reported in many studies to date [1]. However, since foreign bodies are often accidentally introduced into the urethra and bladder during masturbation [2], they take a variety of shapes and sizes [3]. Furthermore, patient self-reports are typically unreliable as many patients feel ashamed [4]; thus, appropriate preoperative diagnosis is critical [5]. Diagnosis of foreign body insertion in the

urethra and bladder is performed using imaging modalities such as abdominal X-ray and computed tomography (CT). However, single-energy CT (SECT) is not sufficient in detecting foreign bodies in some cases. In the present study, we report a successful preoperative identification of urethral foreign body in a patient using dual-energy CT (DECT).

2. Case

Patient: 67-year-old man;

Chief complaint: Difficulty urinating;

Family history, medical history: None.

History of present illness: The patient inserted a foreign object for an unknown reason two years prior to the visit to our hospital. He had previously visited his local clinic since he was unable to remove the object by himself. Although an attempt was made to remove the object endoscopically, the procedure was not successful. The patient stopped visiting the clinic for follow-ups; however, he revisited the clinic when he started developing difficulty urinating.

Clinical findings at the initial visit: None to note

Imaging findings: A kidney, ureter, and bladder (KUB) X-ray showed the presence of a metal object (**Figure 1**). Since the object could have been a radiolucent material, we subsequently performed DECT to confirm the nature of the object. DECT revealed the presence of three foreign objects; these included two soft objects that could not be detected with SECT due to metallic artifact (**Figure 2**), as well as a metal object (**Figure 3**).

Treatment course: The patient reported that he could not remember exactly what the objects were as they were inserted two years ago. After obtaining the



Figure 1. KUB.

patient's consent, we planned to remove the objects via a transurethral approach. The procedure was performed under spinal anesthesia. An incision was made in the urinary meatus, and a metal stick was removed. Next, a cap and grip portion of a ballpoint pen were removed. A thin stick was identified further into the urethra and bladder, and was subsequently removed (**Figure 4**). At the end of the procedure, cystoscopy was performed to confirm that there were no remaining objects in the urethra or bladder and that there was no significant damage to the urethra. The patient had a smooth postoperative recovery and was discharged with a urinary catheter. The catheter was removed 2 weeks later, and the patient did not develop urinary difficulties after the procedure.

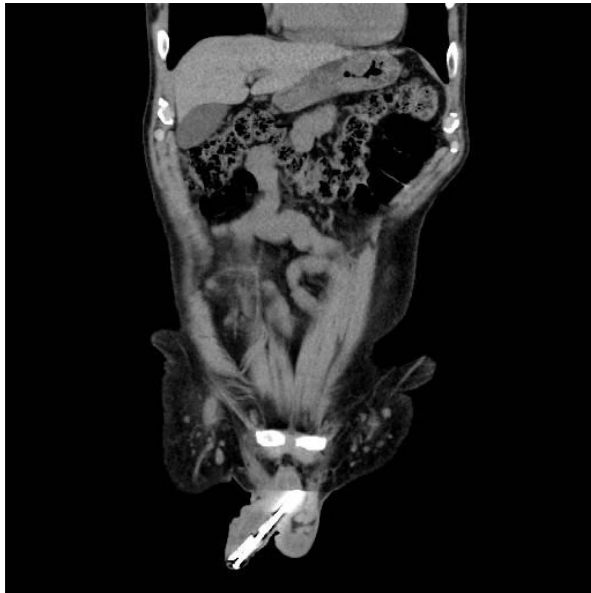


Figure 2. SECT.

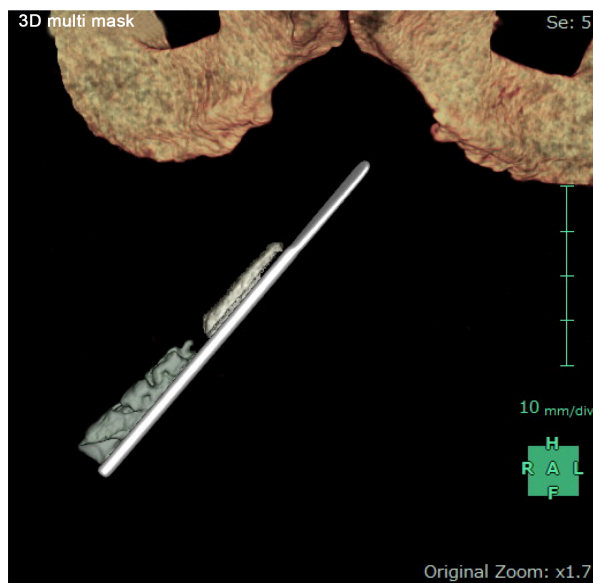


Figure 3. DECT.

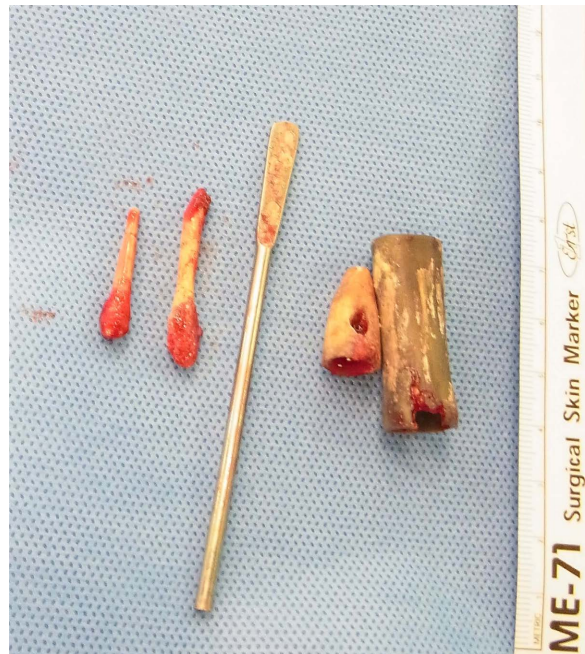


Figure 4. Removed foreign objects.

3. Discussion

Finding of a foreign body in the urethra is not uncommon in routine clinical practice, and many cases have been reported to date [1]. Foreign bodies can have various shapes and sizes [3], and patient self-reports are typically unreliable as many patients feel ashamed [4]; thus, appropriate preoperative diagnosis is critical [5]. Preoperative diagnosis is often made based on imaging findings on ultrasonography, abdominal X-ray and conventional abdominal CT. Given that foreign body insertion is habitual, accurate diagnosis becomes critical in some cases. In particular, conventional imaging examinations may not be sufficient if a patient has more than one foreign object. Ultrasonography is simple and solves the problems of exposure and cost, but there are variations depending on the operator's procedure. In addition, spatial resolution and qualitative diagnostic ability are inferior to CT, so it may not be a necessary test. As far as we examined, no literature was found on ultrasound in foreign bodies of the urethra. For this reason, we have been evaluating foreign substances by abdominal X-ray examination and SECT for some time, but if there are multiple foreign substances like this time, the information is insufficient with conventional imaging tests. In this case, preoperative imaging was performed using DECT. As a result, we were able to identify soft foreign objects that could not be detected by SECT due to metallic artifact caused by the presence of metallic object. Thus, DECT was useful in the diagnosis of foreign body insertion and preoperative simulation of foreign body removal has become easier.

DECT is a technique that uses two separate X-ray energy spectra, allowing objects that have different attenuation properties at different energies to display specific patterns to be detected on imaging [6]. The principle of DECT was first

described in 1976 [7], and a prototype CT system based on this principle was developed in 1986; however, the system was not used in clinical practice due to technical artifacts. More recently, it has regained attention as a result of technical developments such as helical CT and multi-slice CT. DECT can be used to differentiate objects by enhancing or suppressing a specific object, as well as to image arbitrary X-ray energies in low-high ranges in a technique called virtual monochromatic imaging [8]. At our hospital, we use an application called Aquilion ONE Prism Edition from Canon.

In the present study, multiple foreign objects were left in the urethra for a long period of time. When comparing the abdominal X-ray images with SECT, a radiolucent object was identified on SECT. However, the image was not sufficient in identifying the details of the object due to metallic artifact. Additional image processing with DECT revealed that there were three objects in the urethra. This technique resulted in highly accurate preoperative diagnosis, allowing us to reduce the operative time and improve the safety and reliability of the procedure.

The ability of DECT to differentiate various materials has been applied in the components analysis of urinary stones in the field of urology, with a reported diagnostic accuracy of over 80% [9]. We anticipate that DECT will become widely applicable in various cases in the future.

4. Conclusion

In the present study, we discuss the literature and report the case of successful urethral foreign objects removal in a 67-year-old man as a result of DECT-based preoperative diagnosis.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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