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CT Triple Phase Imaging as the Definitive Diagnostic Modality: Unravelling a Misdiagnosed Urinoma in Fragile X Syndrome

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ABSTRACT
Urinoma is an uncommon condition caused by urine leakage from any part of the urinary tract, often due to trauma, surgery, or obstruction. In this case, a rare presentation of urinoma in a 20-year-old female with Fragile X syndrome, who had no prior trauma or surgical history, posed a diagnostic challenge. Initial misinterpretation as a hematoma delayed appropriate treatment. This case highlights the superiority of CT triple phase imaging in accurately diagnosing urinomas and guiding effective management. A 20-year-old non-verbal female with Fragile X syndrome, developmental delay and a history of recurrent urinary tract infections (UTIs) presented with respiratory distress, weight loss and immobility. Initial CT abdomen-pelvis scans suggested a psoas muscle hematoma and the patient was intubated due to respiratory failure. However, a repeat CT Triple phase with contrast scan identified a left distal ureteric rupture leading to urinoma formation in the retro peritoneal space. This finding followed the discovery of a distal ureteric calculus that had been missed on earlier imaging. The diagnosis was confirmed with CT triple phase imaging, which allowed detailed visualization of the urinary tract and the urine extravasation. Interventional radiology-guided drainage of the urinoma and subsequent nephrostomy relieved the patient's high intra-abdominal pressure, leading to successful extubation. Further management included ureteric stenting, total parenteral nutrition (TPN), and monitoring for complications such as recurrent fever and pleural effusion. The patient made a steady recovery with the resolution of respiratory distress. This case underscores the critical role of CT triple phase imaging in diagnosing and managing urinomas. Compared to other imaging modalities, triple phase CT provides enhanced visualization across three phases (non-contrast, nephrographic and excretory), enabling better detection of ureteral injuries, urine extravasation and associated complications. In this case, timely use of triple phase CT guided precise interventions, such as nephrostomy and stenting and informed follow-up care. This case demonstrates the clinical utility of CT triple phase imaging as the definitive diagnostic tool for urinomas, especially in cases where other imaging modalities fail to provide a clear diagnosis. Early and accurate diagnosis using this advanced imaging technique can significantly improve patient outcomes, particularly in rare and complex presentations like this one. Radiology, Urology, General Surgery.

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Key Words
Urine extravasation, ureteral injury, ct triple phase imaging, fragile x syndrome, urinoma

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INTRODUCTION

Urinoma is an uncommon disease, caused by the extravasation of urine from any constituent of the urinary tract (kidney, ureter, urinary bladder or the urethra)., it may be confined, encapsulated fluid collections or may manifest as free fluid[1]. It is generally associated with non-obstructive causes including trauma to the kidney or collecting system. Unlike renal urine leaks, ureteral urine leaks most commonly occur as a result of iatrogenic injury following genitourinary, retroperitoneal, pelvic or gynaecologic surgery[2]. Ureteral injury is a rare, yet very serious, complication of various abdominal, pelvic, and even spinal procedures, whereas in this case no preceding trauma was reported but a long-standing history of recurring UTIs. It is often clinically unsuspected as symptoms are nonspecific and the patient may present weeks and even months after the injury. Therefore, the diagnosis of ureteral injury is often delayed, leading to more serious morbidity[3]. There are three factors necessary for urinoma (caused by urinary tract obstruction) to be developed: a tear in pelvicalyceal system, functional kidney and distal obstruction[4]. Distal obstruction can occur as a result of/or in addition to the traumatic incidents or iatrogenic origins. Obstructive processes can include ureterolithiasis, retroperitoneal fibrosis, or intra-abdominal mass effect[5]. A high index of suspicion is essential and a CT study should then include a delayed scan in order to establish the diagnosis of ureteral injury resulting in a urinoma.

Case Presentation:

Patient Information: A 20-years-old female patient with a history of fragile X syndrome, developmental delay (non-verbal), recurrent urinary tract infections (UTIs) and double incontinence, was brought to the hospital by her mother, who is her primary caregiver.

Presenting Complaints: Patient presented to the hospital on June 7, 2024, with complain of cough producing green sputum and significant weight loss. She had been immobile and had not been eating or drinking.

Initial Findings and Interventions: A CT Abdomen -Pelvis (AP) scan performed on June 8 suggested inflammatory bowel disease and a psoas muscle hematoma[6]. Patient subsequently developed respiratory distress and required intubation. A repeat CT AP with contrast on June 10 indicated an ongoing bleed with moderate intraperitoneal fluid accumulation. Patient was referred to Interventional Radiology for potential embolization, but no active bleeding vessel was identified. However, she became difficult to ventilate due to high intra-abdominal pressure[7].

Diagnosis and Further Management: An abdominal CT triple phase with contrast scan on June 11 revealed a left distal ureteric calculus, which had caused a rupture of the left ureter in the left iliac fossa, resulting in a urinoma in the left retroperitoneal space. An interventional radiology (IR)-guided drain was inserted to manage the urinoma on the same day[8]. On June 12, a left nephrostomy was placed, which alleviated the high intra-abdominal pressure and patient was successfully extubated on June 15. The abdominal drain was removed on June 19 and on June 20, a left anterograde ureteric stent was inserted. A peripherally inserted central catheter (PICC) line was placed on June 21 for total parenteral nutrition (TPN). Patient received speech and language therapy (SALT) assessments and was permitted to have only sips of water or weak squash due to difficulties with oral intake.

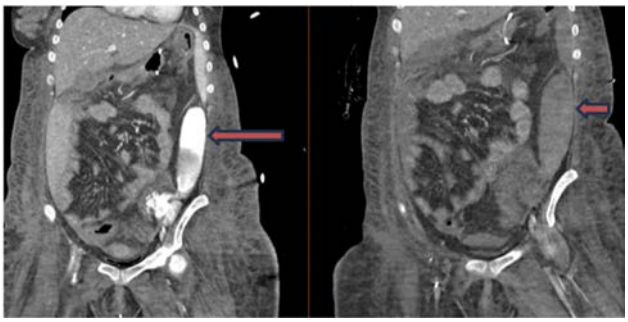

Fig. 1: Displays CT Scan Images from Two Different Days, Providing a Comparison Between Images with and without Contrast to Distinguish Between Urinoma and Suspected Hematoma

Fig. 2: Displays a Ureteric Rupture and Contrast Leakage

Complications and Additional Findings: On June 24, patient accidentally removed her nephrostomy tube, but reinsertion was deemed unnecessary by Urology. An X-ray on June 25 confirmed the correct position of the ureteric stent. Patient had previously suffered a collapsed left lung., however, a CT pulmonary angiogram (CTPA) on June 23 showed only a moderate left-sided pleural effusion with adjacent compressive atelectasis and no pulmonary embolism (PE) was detected. Patient did not require supplemental oxygen at this stage. An incidental finding of a left breast lump

led to a referral to the breast clinic, with an appointment scheduled in the local breast clinic.

Antibiotic Therapy and Current Status: Patient completed a two-week course of meropenem, but due to recurrent fever on June 26, meropenem was restarted and a stat dose of gentamicin was administered after cultures were obtained. Gentamicin was subsequently discontinued as procalcitonin (PCT) levels returned negative. Throughout her stay, Patients baseline heart rate remained high, between 120-130 beats per minute, despite adequate fluid management. Patient remains on TPN feeds due to her refusal to eat, as per the failed SALT assessment. Future assessments will be rescheduled to coincide with her parents' presence.

RESULTS AND DISCUSSIONS

Discussion on the Superiority of CT Triple Phase in Diagnosing Urinoma: Urinoma, a rare condition characterized by the extravasation of urine from any part of the urinary tract, presents a diagnostic challenge due to its often, non-specific symptoms and potential delayed presentation. The importance of timely and accurate diagnosis cannot be overstated, as delays can lead to significant morbidity. In this context, CT triple phase imaging has emerged as a superior diagnostic tool compared to other modalities, such as ultrasound and standard single-phase CT scans[9]. Here's why:

Enhanced Visualization of Urinary Tract Pathology: CT triple phase imaging includes three distinct phases: the non-contrast phase, the nephrographic phase (post-contrast) and the excretory phase. This comprehensive approach allows for better visualization of the urinary tract at different stages of contrast enhancement:

Non-Contrast Phase: Useful for detecting calcifications, such as ureteral stones, which may be causing obstruction and leading to urinoma formation.

Nephrographic Phase: Enhances the renal parenchyma, helping to identify renal injuries, masses and other parenchymal abnormalities. Excretory phase: Highlights the urinary collecting system, making it easier to detect urine extravasation, ureteral injuries and the presence of urinomas.

Superior Detection of Urine Extravasation: The excretory phase is particularly crucial in diagnosing urinomas, as it provides clear images of the contrast material as it passes through the renal pelvis, ureters and bladder. This phase enhances the detection of leaks and urinomas by showing the contrast material outside the urinary tract. In this case, the triple phase CT scan was able to identify the left distal ureteric calculus and the subsequent rupture of the left ureter, leading to the formation of a urinoma in the left retroperitoneal space[10].

Identification of Associated Complications: Urinoma can be accompanied by various complications, including infections and the formation of abscesses. CT triple phase imaging provides a detailed assessment of the surrounding tissues, helping to identify secondary complications such as abscess formation or the extent of the inflammatory response. This comprehensive view was pivotal in patents management, as it guided the intervention to drain the urinoma and subsequently place a nephrostomy to relieve high intra-abdominal pressure.

Guidance for Interventional Procedures: Accurate localization of urinomas and understanding their relationship with surrounding structures are essential for planning interventional procedures such as drainage or stent placement. The detailed imagery from a CT triple phase scan aids interventional radiologists in precisely targeting the affected area, ensuring effective and minimally invasive treatment. In this case, the CT scan findings directly influenced the decision to insert an IR-guided drain and later a nephrostomy[11].

Monitoring and Follow-Up: CT triple phase imaging is invaluable for follow-up evaluations, allowing clinicians to monitor the resolution of the urinoma and the effectiveness of interventions. It also helps in assessing any recurrent issues or new complications that might arise during treatment. Patients serial CT scans provided critical information that guided her ongoing care, including the successful management of high intra-abdominal pressure and the placement of a ureteric stent.

Case Application: In this case, the CT triple phase scan was instrumental in diagnosing the left distal ureteric calculus and the resultant urinoma. The comprehensive imaging enabled timely intervention, which included draining the urinoma and placing a nephrostomy. These steps were crucial in managing her high intra-abdominal pressure and subsequent respiratory distress. Furthermore, the detailed imaging allowed for precise planning and execution of interventional radiology procedures, which were essential for patient's recovery.

CONCLUSIONS

Insofar the aetiology is considered, occurrence of urinoma in the absence of trauma or obstruction is rare. This case stands as a classic example of an uncommon presentation. Having considered a set of

different diagnostic modalities, CT triple phase imaging offers a superior diagnostic approach for detecting and managing urinomas. Taking into account a detailed visualization of the urinary tract, detect urine extravasation, identification of probable complications, it surely becomes an indispensable tool for the interventional procedures and to monitor treatment progress CT triple phase can be marked as a diagnostic arsenal for managing this rare but serious condition.

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