Don't get caught out! A rare case of a calcified urachal remnant mimicking a bladder calculus

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ABSTRACT

Computer tomography through the kidneys, ureters and bladder (CT KUB) is the mainstay investigation of suspected renal tract calculi. However, several pathologies other than renal tract calculi can cause apparent urinary bladder calcification. We describe the case of a 45 year old man who presented with left sided renal colic. Prone CT KUB performed on admission revealed a calcified urachal remnant mimicking a urinary bladder calculus in the dependent portion of the urinary bladder, confirmed by reviewing the multi-planar reformatted images. This is the first reported case in the literature of this phenomenon. We discuss the importance of using multi-planar reformatted images (MPR) and maximum intensity projection images (MIP), as well as careful review of previous imaging, in making the correct diagnosis. We also discuss the differential diagnoses that should be considered when presented with urinary bladder calcification.

CASE REPORT

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A 45 year old man presented to the emergency department with one week history of constant left sided abdominal pain, worse on micturition. He had a low grade pyrexia. Urinalysis was positive for microscopic haematuria. His relevant past medical history was significant only for a presentation with renal colic 3 years earlier, investigated with a prone CT KUB which was interpreted as normal. A CT KUB scan with the patient lying prone was performed to exclude renal calculus.

This revealed a tiny non-obstructing calculus in an interpolar minor calyx of the right kidney (Figure 1). The kidneys were normal in size and contour. No calculi were demonstrated in the left kidney or in either ureter.

In the anterior wall of the bladder, a small calcific density was demonstrated, initially thought to be a bladder calculus in a dependent portion of the bladder on the prone CT (Figure 2a). However, upon review of the multi-planar reformatted images (MPR), in particular maximum intensity projection (MIP) sagittal images, the calcification was confirmed to lie at the site of attachment of a urachal remnant (Figure 2b).

Careful review of the CT KUB performed during the patient's initial presentation 3 years earlier, revealed the anterior bladder wall calcification was unchanged (Figure 3), mitigating against both bladder calculus and, in the absence of associated abnormal soft tissue mass, against calcification within a urachal carcinoma.

No cause was found on the imaging to explain the patient's left sided abdominal pain, which settled with simple analgesia.

DISCUSSION

We report a case of incidental calcified urachal remnant mimicking a bladder calculus diagnosed in a patient with left sided renal colic by reference to MPR images from prone CT KUB and by comparison to the patient's previous radiological

investigations. The presence of calculi within a vesicourachal diverticulum has only been described once before, where the calcific densities were clearly demonstrated within a diverticulum distinct from the urinary bladder wall [1]. As such, this is the first case to describe calcification within a urachal remnant so close to its insertion into the urinary bladder that it mimics a bladder calculus on axial imaging.

The urachus is a vestigial remnant of the allantois (derivative of yolk sac) and the cloaca (precursor of the foetal bladder). This midline structure extends towards the umbilicus from the anterior urinary bladder dome. Normally, it involutes before birth and only a fibrous band, with no known function, persists. Occasionally, the urachus may persist and result in a variety of clinical problems. Such urachal anomalies occur at an incidence of 1 in 5000 births, being two-fold more common in men than women. They usually manifest in childhood. There are no known risk factors, but they may occur in association with other congenital renal tract anomalies. Four congenital urachal anomalies can occur, including patent urachus, urachal cyst, umbilical-urachal sinus, vesicourachal diverticulum. In the absence of concomitant infection, most patients with urachal anomalies are asymptomatic. When symptomatic, they can be treated by surgical excision. Prognosis is good as they are usually benign.

In our case, the patient presented with left sided loin pain. CT KUB has replaced the abdominal radiograph as the first-line investigation for patients presenting with renal colic [2]. However, conventional radiography may have a role in monitoring radio-opaque renal calculi during treatment with lithotripsy. An ultrasound of the renal tract may be performed to assess for hydronephrosis / hydroureter if there is the suspicion of an obstructed urinary system which would warrant decompression. However, it is not the first line investigation of uncomplicated renal colic. Other uroradiological investigations, such as CT urography are indicated in the investigation of haematuria to exclude upper tract urothelial malignancy but are not the initial investigation of choice for renal colic. There is no established role for MR in this context.

CT KUB does not involve the administration of intravenous contrast medium. Some argue it should be performed with the patient in the prone position to facilitate differentiation between calculi impacted within the vesicoureteric junction from calculi free within the bladder [3]. Our patient was imaged prone. The calcification was demonstrated on axial images to be in an apparent dependent position at the posterior aspect of the anterior bladder wall (Figure 2). Given these appearances and clinical presentation, this could have easily been mistaken for a calculus lying within the dependent portion of the bladder had the axial images only from the prone CT been interrogated. Reviewing the study on bone windows helps identify calcific calculi and should be routinely performed when interpreting a CT KUB, particularly when measuring the average attenuation and dimensions of calculi which have implications for patient management, e.g. conservative, lithotripsy or surgery. It will also provide opportunity to exclude any bone lesion in the imaged skeleton. Likewise, MPR images are routinely at radiologists' disposal and should be reviewed in conjunction with the standard axial images in CT KUBs to accurately delineate the entire renal tract anatomy [4]. Maximum intensity projection images can be useful, especially in the coronal plane, to help identify the ureters, particularly in the distal portion which may be difficult to appreciate on axial images alone due to lack of intra-abdominal fat or normal peristalsis. In our case, review of the sagittal MIP images revealed the calcific density was localised to a linear soft tissue structure extending from the anterosuperior aspect of the bladder, consistent with a urachal remnant. If the calcified remnant were large enough it may be demonstrated as a calcific density on conventional radiography and cast an acoustic shadow on ultrasonographic evaluation. A contrast enhanced CT was not indicated but had it been performed, there would not have been any enhancement of the area of interest. MR appearances of a calcified urachal remnant have not previously been described. Neither scintigraphy nor PET-CT would be indicated in the evaluation of this entity because the commonly used tracers are excreted in urine, which would obscure the area of interest.

In the context of renal colic and haematuria, a focal calcific density within dependent portion of the bladder most likely represents a renal tract calculus that has been passed. The CT KUB may identify further concomitant calcific calculi in the renal tract which may support this diagnosis.

However, other pathological entities should be considered. Bladder calculi can form de novo, a phenomenon associated with urinary stasis from bladder outlet obstruction [5]. In this scenario the calculi will be free to move within the bladder and will adopt of dependent position on prone CT KUB. The CT may also demonstrate bladder divertucula and bladder wall hypertrophy to provide clues to this etiology. Bladder calculi may be detectable on plain radiographs if of sufficient size and density. Calcific calculi may cast acoustic shadows on ultrasound. They do not demonstrate enhancement following the administration of contrast. On MR, it is conceivable that, if heavily calcified, it may result in a signal void. Blooming from renally excreted tracer in the bladder would preclude the assessment of bladder calculi on scintigraphy and PET-CT.

Primary bladder tumours are important causes of bladder calcification, most commonly transitional cell carcinoma [5]. CT is not the first line investigation for primary bladder malignancy, but if the bladder is distended CT can demonstrate focal bladder wall thickening. In older male patients, the prostate can calcifiy, enlarge and indent the bladder, giving the impression of posterior bladder wall calcification [5]. In the appropriate patient demographic, schistosomiasis should be considered as a cause of urinary bladder calcification. It is the most frequent cause of bladder wall calcification worldwide. However, this calcification is usually arcuate and associated with calcification in other areas of the urinary tract [6]. Another infection that can result in urinary bladder calcification is tuberculosis. Calcification of the upper renal tract is usually observed prior to spread to the distal ureters and bladder [7]. Inflammation within the bladder can proceed to calcification. This has been documented in cyclophosphamide-induced cystitis [5]. Amyloidosis is another inflammatory condition that has been associated with urinary

bladder calcification, albeit rarely [8]. Whilst sarcoidosis commonly causes calcification, bladder wall calcification has not been described in this context.

Urachal carcinoma is a rare pathology. Calcification within such tumours has previously been described [9]. If large enough, a calcified urachal carcinoma may be detectable as a calcific entity on plain film and may demonstrate acoustic shadowing on ultrasound. The presence of enhancing abnormal surrounding soft tissue on CT would help raise the suspicion. As the urachus is related to the anterior dome of the bladder, a calcified urachal carcinoma may appear dependent on prone CT. The imaging appearances on urachal carcinoma on MR, scintigraphy and PET-CT have not been extensively described to date. However, calcification of a urachal remnant at its insertion into the bladder wall, mimicking a bladder calculus, as illustrated in our case, has never been documented before in the literature.

TEACHING POINT

Calcification at the insertion of a urachal remnant into the urinary bladder is a rare differential diagnosis in patients with a calcific density lying in a dependent portion of the bladder on prone CT (KUB). Careful review of multiplanar reformatted images as well as review of the images of previous relevant investigations rather than simply referring to the prior report, can help make the diagnosis.

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FIGURES

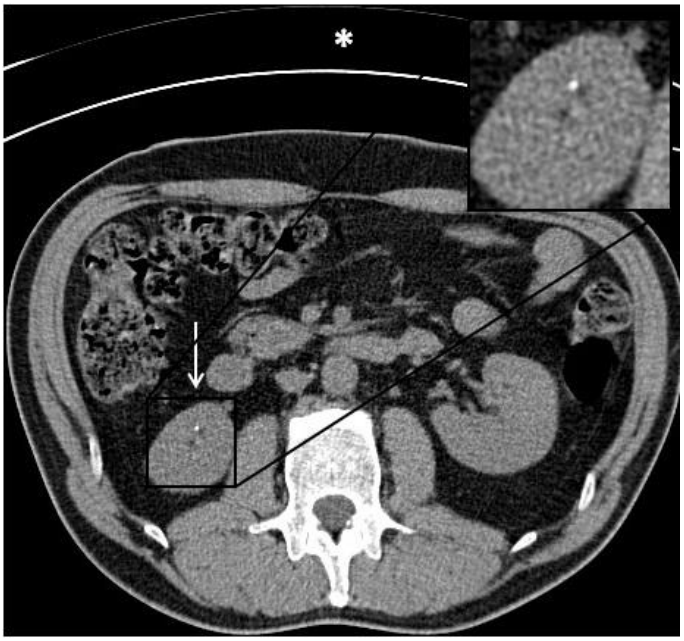

Figure 1: 45 year old man with left flank pain revealing a tiny non-obstructing calculus in the right interpolar region. Axial unenhanced CT of the abdomen and pelvis (window level 35 HU, window width 350 HU) with the patient in the prone position (* indicates the CT table top) demonstrates a small calcific density (white arrow) within the interpolar region of the right kidney with no evidence of proximal obstruction. The area of interest is magnified in the upper right corner (Protocol: 120 kV, 95 mAs, 3 mm slice thickness).

Figure 2: 45 year old man with left flank pain revealing a calcified urachal remnant. A) Axial unenhanced CT of the abdomen and pelvis (window level 35 HU, window width 350 HU) with the patient in the prone position (* indicates the CT table top) demonstrates a small calcific density (white arrow) lying within the dependent portion of the urinary bladder in keeping with a calculus free within the bladder. The area of interest is magnified in the lower right corner. (Protocol: 120 kV, 95 mAs, 3 mm slice thickness). B) Sagittal maximum intensity projection reformatted image from an unenhanced CT of the abdomen and pelvis (window level 145 HU, window width 429 HU) with the patient in the prone position (* indicates the CT table top) demonstrates a small calcific density (white arrow) is localised to the region of the anterior urinary bladder wall at the site of insertion of the urachus, consistent with a calcified urachal remnant. The area of interest is magnified in the upper right corner. (Protocol: 120 kV, 95 mAs).

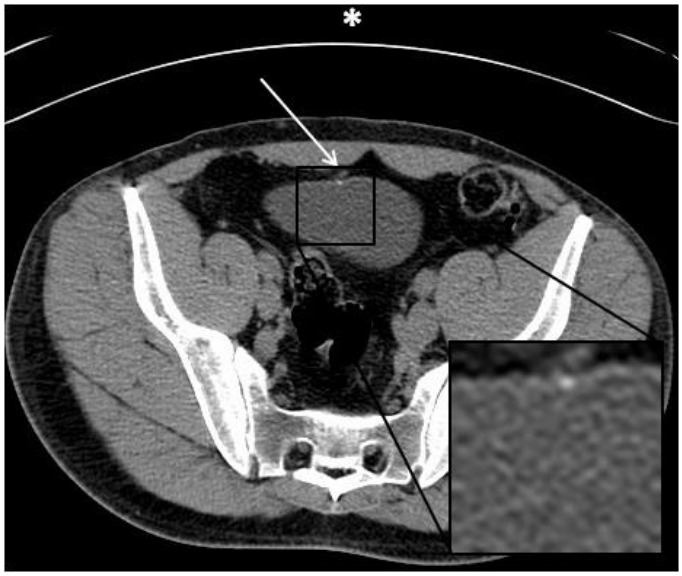

Figure 3 (left): 42 year old man with renal colic revealing a calcified urachal remnant. Axial unenhanced CT of the abdomen and pelvis (window level 35 HU, window width 350 HU) with the patient in the prone position (* indicates the CT table top) performed 3 years earlier. The image reveals the same small calcific density (white arrow) in the anterior aspect of the urinary bladder, unchanged on subsequent imaging 3 years later confirming the diagnosis of calcified urachal remnant. The area of interest is magnified is the lower right corner (Protocol: 120 kV, 95 mAs, 3 mm slice thickness).

Etiology	The urachus is a vestigial midline remnant of the allantois and cloaca, which extends from the anterior urinary bladder dome towards the umbilicus. Lack of involution can occur. Precise etiology is not clear but is causes varying degrees of persistent patency of the median umbilical ligament with a resultant spectrum of anomalies, including patent urachus, urachal cyst, umbilical-urachal sinus, vesicourachal diverticulum
Incidence	1 in 5000 births (but not all are symptomatic)
Gender ratio	Male : female ratio = 2:1
Age predilection	Usually present in childhood
Risk factors	No known risk factors but may be associated with other congenital anomalies of the renal tract
Treatment	Surgical excision if symptomatic
Prognosis	Congenital urachal anomalies are benign and carry good prognosis
Findings on imaging	X-ray – may contain foci of calcification US – cystic / echogenic mass CT – soft tissue density mass lying between anterior dome of the bladder and the umbilicus

Table 1: Summary table for congential urachal anomalies, such as patent urachus, urachal cyst, umbilical-urachal sinus, vesicourachal diverticulum

Differential	**Calcified urachal remnant**	**Urachal carcinoma**	**Bladder calculi**
X-ray	Calcific density if large enough	Calcific density if large enough	Calcific density if large enough
US	Calcification may cast an acoustic shadow	Soft tissue mass, calcification may cast an acoustic shadow	May cast acoustic shadows if large enough, mobile and will assume a dependent position
CT	Calcific focus within an otherwise normal urachal remnant	Replacement of normal urachal remnant with abnormal soft tissue mass	Possible evidence of nephrolithiasis or recent passage of stone, bladder diverticulae predispose to in situ formation
MRI – T1/T2/DWI	Not described in the literature	Not described in the literature	Calcific foci may cause signal void
Pattern of contrast enhancement	No / little enhancement	The abnormal soft tissue mass may show enhancement	No enhancement
Scintigraphy	Not indicated due to urinary excretion of tracers	Not indicated due to urinary excretion of tracers	Not indicated due to urinary excretion of tracers
PET	Not indicated due to urinary excretion of FDG	Not indicated due to urinary excretion of FDG	Not indicated due to urinary excretion of FDG

Table 2: Differential diagnosis table for causes of dependent calcification within the urinary bladder

ABBREVIATIONS

CT (KUB) - computed tomography of the kidneys, ureters and urinary bladder
MIP - maximum intensity projection
MPR - multi-planar reformatted

KEYWORDS

Urachus; Calculus; Urachal remnant; Computed tomography

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