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Case Report

Milk of calcium in renal calyces, renal pelvis, and ureter in a person with tetraplegia ☆,☆☆,★

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ABSTRACT

Milk of calcium is a colloidal suspension of precipitated calcium salts which lies in a dependent manner and imaging reveals a horizontal upper edge. We report a 44-year-old male person with tetraplegia, who had been staying in bed for prolonged periods due to ischial and trochanteric pressure sores. Ultrasound scan of the kidneys revealed numerous variable-sized stones in the left kidney. CT of abdomen showed stones in the left kidney with dense layering of calcific material in a dependent distribution assuming the shape of the renal pelvis and the calyces. CT images in axial and corresponding sagittal views showed milk of calcium exhibiting a fluid level in the renal pelvis and calyces and the ureter. This is the first report of milk of calcium detected in the renal pelvis and calyces as well as in the ureter of a person with spinal cord injury. Following insertion of a ureteric stent, the milk of calcium in the ureter drained partly but the renal milk of calcium persisted. The renal stones were pulverized by ureteroscopy and LASER lithotripsy. Follow-up CT of kidneys performed 6 weeks after surgery showed the milk of calcium in the left ureter had drained, but there was no significant change of the left sizeable branching pelvi-calyceal stone regarding its extension and density.

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★ The challenges in the management of renal and ureteric milk of calcium are discussed.

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Introduction

Milk of calcium is a viscous colloidal suspension of calcium carbonate, phosphate or oxalate, or a mixture of these compounds [1]. Formation of milk of calcium in the urinary tract requires poor urine flow and relative patient inactivity. This is illustrated in the case of a 7-year-old boy who sustained burns over 15% of his body and remained immobilized. On the 26th day of immobilization, this boy developed abdominal pain. Investigations revealed milk of calcium in the ureter. MacMillan et al. [2] postulated that the etiology of milk of calcium in the ureter might be related to the lack of ambulation and relative inactivity following burns in this previously active 7-year-old boy. Obstruction, itself, should not occur due to milk of calcium in an active person. Kay et al. [3] cited the analogy of a salt-shaker to explain the formation of milk of calcium. If a salt-shaker is held upside down, salt crystals jam the outlet and, if shaken, the salt flows.

Only very few cases of milk of calcium in kidney have been reported in persons with spinal cord injury [4]. We report a person with tetraplegia in whom milk of calcium was detected in the ureter, renal pelvis, and renal calyces during a routine evaluation of the urinary tract by noncontrast CT. Axial and corresponding sagittal views of CT images showed the gravitational effect of milk of calcium. This case report is probably the first to document simultaneous occurrence of milk of calcium in the ureter, renal pelvis, and calyces in a person with spinal cord injury. We present CT images to show the characteristic findings of milk of calcium and discuss the challenges in the management of renal and ureteric milk of calcium.

Case presentation

A 24-year-old Caucasian male person sustained C-6 tetraplegia following a road traffic accident in 2001. In 2016, he developed grade IV pressure sore in the right ischial region and then a grade IV pressure sore in the left ischial region in 2021. Currently, the right ischial pressure sore was measuring 2 cm × 2 cm with a depth of 2 cm; the left ischial/trochanteric sore was 5 cm × 5 cm wide with a depth of 5 cm. This sore was managed by vacuum-assisted closure dressing.

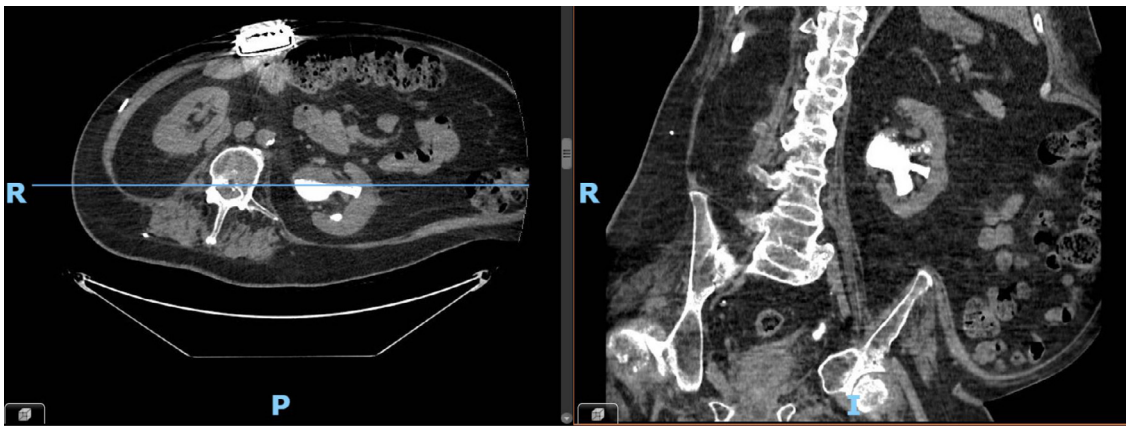

Fig. 1 – CT of abdomen (axial view and corresponding coronal image): The coronal image shows the calcific material assuming the shape of the renal pelvis, and the calyces in the dependent position. The axial view shows horizontal layering of milk of calcium in the renal pelvis and renal calyx.

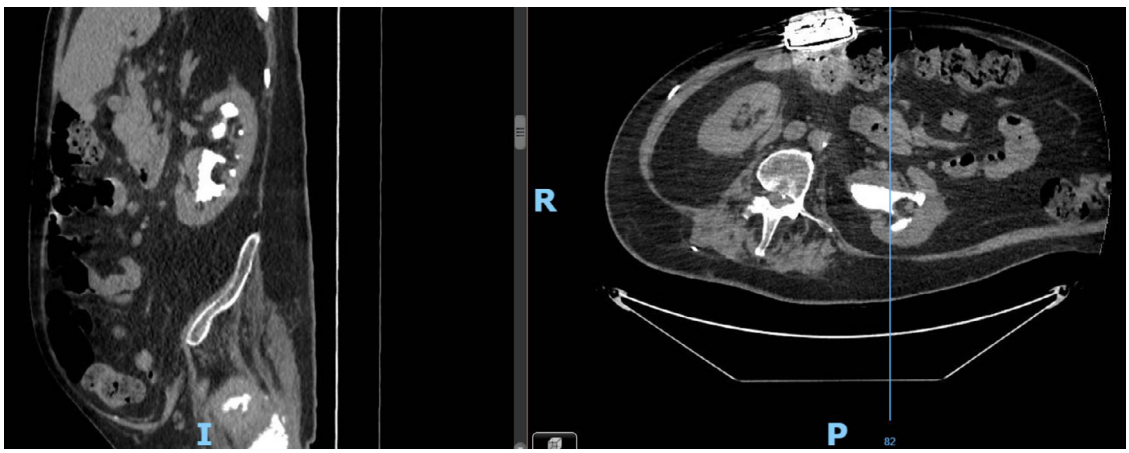

Fig. 2 – CT of abdomen (sagittal view and corresponding axial image) shows horizontal layering of calcific material in the renal pelvis and calyx in the dependent position.

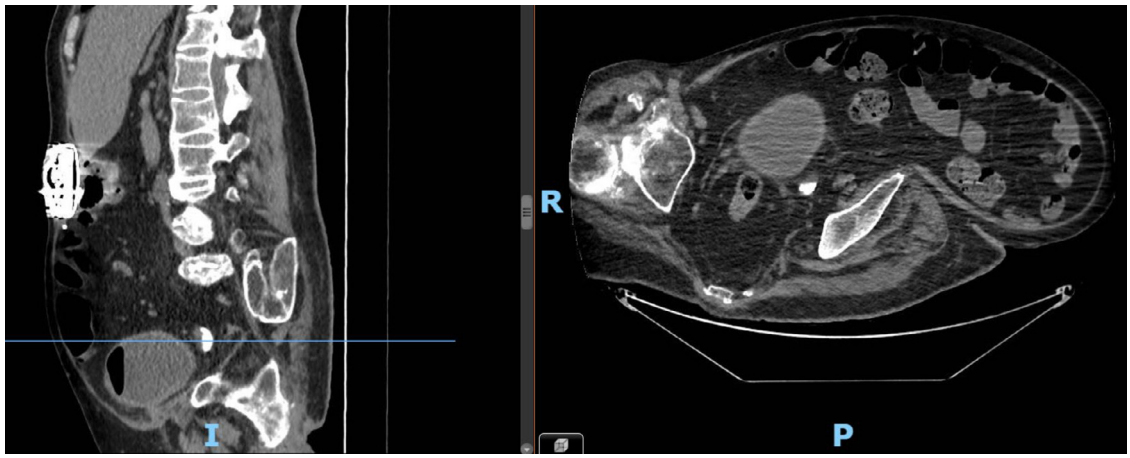

Fig. 3 – CT of abdomen (sagittal view and corresponding axial image): The sagittal image shows the horizontal layering of calcific material in the left ureter. The axial view also shows similar horizontal layering of milk of calcium in the left ureter.

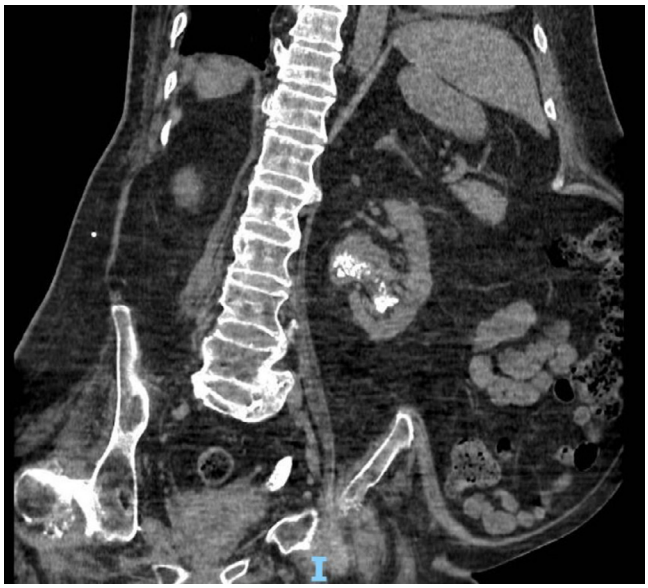

Fig. 4 – CT of abdomen (coronal view) shows small, discrete calcified material lying in the most dependent part of renal pelvis and calyces.

This person had been staying in bed for long periods to facilitate healing of the pressure sores. He developed bypassing of the urethral catheter. An ultrasound scan of the urinary tract was performed to look for stones in the urinary bladder. Ultrasound scan revealed numerous variable-sized stones largest reaching 3 cm were seen in the left kidney. CT of abdomen showed stones in the left kidney with dense layering of calcific material in a dependent distribution assuming the shape of the renal pelvis, and the calyces (Fig. 1). The images revealed a characteristic horizontal upper edge (Fig. 2). A dense calcific material revealing a horizontal upper edge was seen in the lower third of left ureter also (Fig. 3). Further, the small, discrete calcified material was seen lying in the most dependent part of renal pelvis and calyces (Fig. 4).

Left ureteric stent was inserted to facilitate passage of the gravel and to relieve obstruction to the flow of urine. CT performed 3 weeks later showed some drainage of the milk of calcium from the lower ureter (Fig. 5). But the images showed continued presence of milk of calcium in the left renal pelvis (Fig. 6) and calyces (Fig. 7). The milk of calcium was typically located in dependent position within the dilated renal pelvis and calyces; and exhibited a horizontal fluid level.

Twenty-one weeks later left ureteroscopy, LASER stone fragmentation of the stones in the renal pelvis, upper, and middle calyces were carried out. Dusting was achieved. LASER time exceeded 90 minutes.

CT of kidneys performed 6 weeks after surgery showed the milk of calcium in the left ureter had drained but there was no significant change of the left sizeable branching pelvi-calyceal stone regarding its extension and density (Figs. 8 and 9).

Discussion

We report a unique case of simultaneous occurrence of milk of calcium in the ureter, renal pelvis, and renal calyces in a person with tetraplegia. The predisposing factor was physical inactivity. This person had pressure sores and therefore, was staying in bed. Concurrent illness, eg, chest infection also contributed to the prolonged bed rest.

Serial CT images of the kidneys revealed the effect of ureteric stenting and LASER lithotripsy upon the milk of calcium in different locations. CT of kidneys, performed 6 weeks after ureteroscopy and lithotripsy, showed no significant changes of the left sizeable branching pelvi-calyceal stone and the milk of calcium in the kidney. However, the milk of calcium in the ureter drained partly 3 weeks after ureteric stenting and cleared completely as seen in the postlithotripsy CT images.

Management of renal milk of calcium depends upon the individual patient's clinical condition. Milk of calcium of the kidneys is not synonymous with nephrolithiasis, as management of these 2 entities differs [5]. Treatment for renal milk

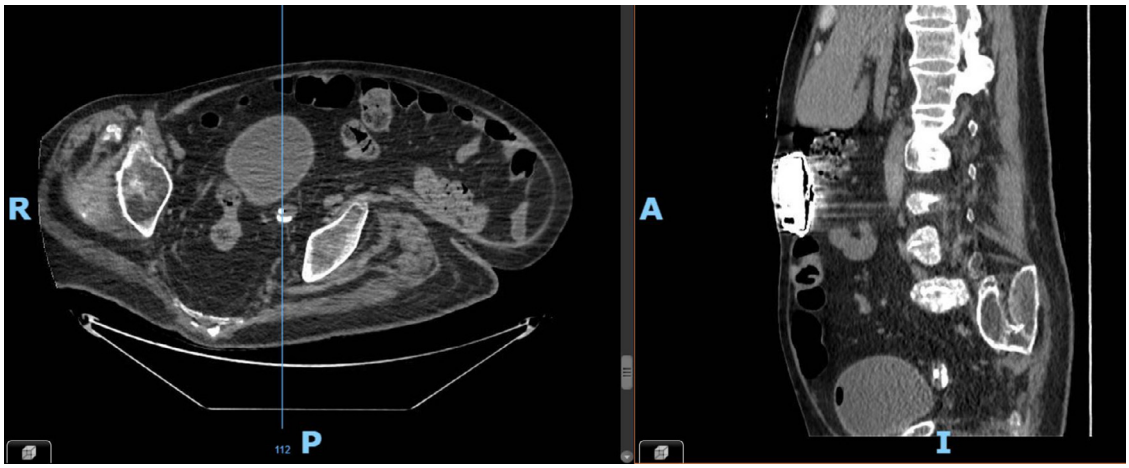

Fig. 5 – CT of abdomen (axial view and corresponding sagittal image) performed 3 weeks after ureteric stenting: The sagittal image shows the horizontal layering of calcific material in the left ureter. The axial view also shows similar horizontal layering of milk of calcium in the left ureter. The amount of calcific material has decreased to some extent following ureteric stenting.

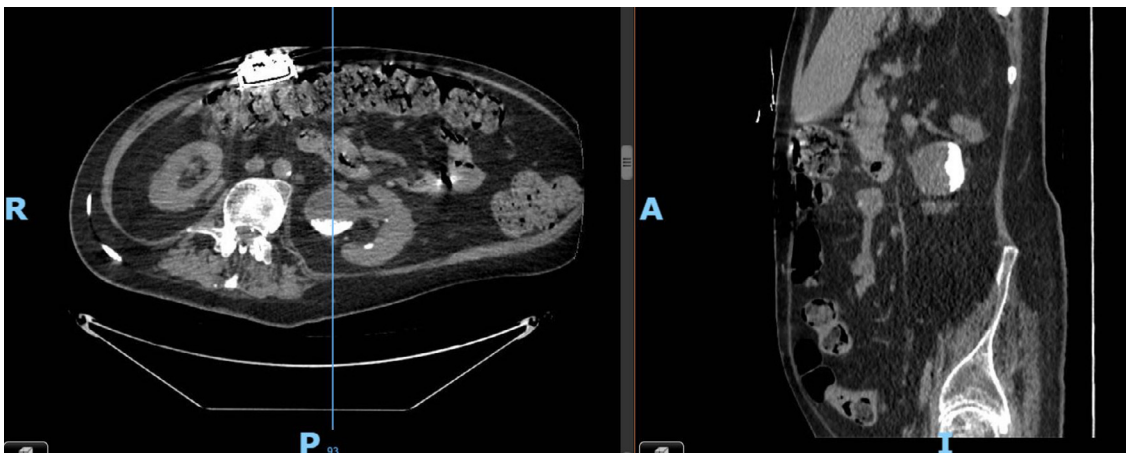

Fig. 6 – CT of abdomen (axial view and corresponding sagittal image) performed 3 weeks after ureteric stenting: The sagittal image shows the horizontal layering of calcific material in the left renal pelvis. The axial view also shows similar horizontal layering of milk of calcium in the left renal pelvis.

of calcium is mostly conservative. However, those cases with obstructive nephropathy may need percutaneous endourological marsupialization or irrigation of the milk of calcium via flexible ureteroscope. Renal milk of calcium has been managed by percutaneous nephrolithotomy with suction and retrieval of soft stones without the need for disintegration [6].

In contrast to nephrolithiasis, the use of extracorporeal shock wave lithotripsy is unwarranted because shock wave lithotripsy will only crack solid stones and not liquid material, as seen in milk of calcium [5]. It is important to recognize and differentiate milk of calcium from a renal stone to avoid unwarranted surgery or extracorporeal shock-wave lithotripsy [7]. Ouegnin et al. [8] stated that extracorporeal lithotripsy in milk of calcium syndrome is illogical, inefficient, and probably more hazardous than useful. Although the calcium content in renal milk of calcium will account for a difference in acoustical impedance, there can be no cleavage, nor any fracture plane generated by extracorporeal shock wave lithotripsy within the fluid-calcium salt deposits [9].

As regards milk of calcium in the ureter, simple endourological procedures like double J stenting would be helpful in spontaneous clearance of ureteric milk of calcium [10]. Ureteric stenting will relieve the back pressure effect on the proximal collecting system and will be helpful in subsequent passage of milk of calcium from the ureter.

We managed our patient by stenting the left ureter to promote drainage of the milk of calcium and to relieve any obstruction. Subsequently, ureteroscopy was done and stones were pulverized by LASER lithotripsy. Hopefully, when the pressure sores have healed and the patient becomes active (hoisted from the bed to the chair, sits up on his chair for the day, and moves about in his electric wheelchair outdoors), the pulverized milk of calcium will drain freely alongside the ureteric stent. Of course, drinking plenty of fluids will help to

Fig. 7 – CT of abdomen (sagittal view and corresponding axial image) performed 3 weeks after ureteric stenting: The sagittal image shows the horizontal layering of calcific material in the left renal cayces. The axial view also shows similar horizontal layering of milk of calcium in the left renal calyx.

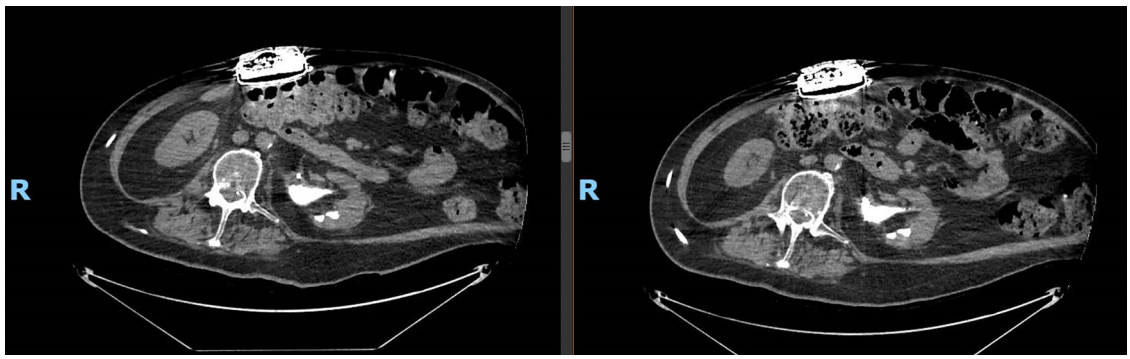

Fig. 8 – CT of abdomen axial views (left panel: 1 week before LASER lithotripsy. Right panel: 6 weeks after LASER lithotripsy of left renal stones) show no significant change of the milk of calcium in left renal pelvis and calyces. The horizontal layering of milk of calcium is seen in the renal pelvis and calyces.

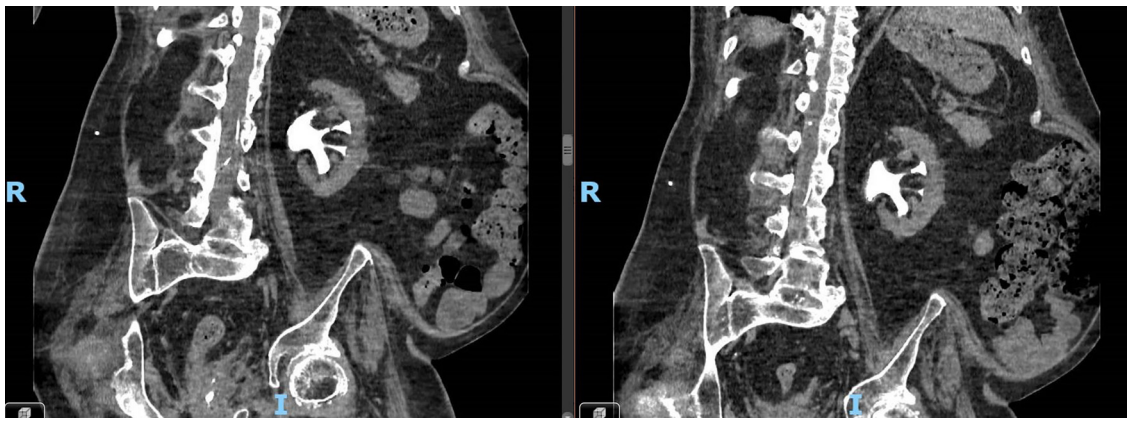

Fig. 9 – CT of abdomen coronal views (left panel: 1 week before LASER lithotripsy. Right panel: 6 weeks after LASER lithotripsy of left renal stones) show no significant change of the left sizeable branching pelvi-calyceal stone regarding its extension and density.

achieve a urine output of at least 2 L and facilitate the clearing out of the gravel.

Perhaps, we may include the formation of renal and ureteric milk of calcium to the long list of hazards of bed rest and physical inactivity [11,12]. Asher [13] composed an appropriate physician's prayer:

> *"Teach us to live that we may dread unnecessary time in bed.*
>
> *Get people up and we may save our patients from an early grave."*

Author contributions

SV wrote the draft; all authors reviewed the final manuscript.

Patient consent

This patient has tetraplegia. He gave verbal consent; his mother provided the written informed consent for publication of this case along with the images.

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