Case Report

Large amounts of debris in the neuropathic bladder in persons with spinal cord injury; value of ultrasound scan in detection and management of vesical debris

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ABSTRACT

Persons with spinal cord injury are at risk for developing debris in the neuropathic bladder. Ultrasound scan of the urinary bladder helps to (1) detect debris, (2) differentiate debris from other bladder lesions, (3) alert the spinal cord physician to review bladder management, and (4) monitor the effect of various treatment regime to clear the debris. We present 4 cases to illustrate the sonographic appearances of debris in the neuropathic bladder and how treatment plans tailored to the needs of the individual patient helped to clear the debris.

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Introduction

A normal fluid-filled bladder is uniformly anechoic, with clearly defined lumen walls. Debris are seen as echogenic materials within the lumen of the urinary bladder. The debris may be floating or layering in a gravity-dependent manner in the urinary bladder. Persons with spinal cord injury often develop debris in the neuropathic bladder. The predisposing factors for the formation of debris in persons with spinal cord injury and neuropathic bladder include (1) incomplete emptying of the urinary bladder leading to retention of varying amounts

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of urine, (2) chronic cystitis, (3) suboptimal intake of fluids, and (4) individual specific factors.

Ultrasound scan of the urinary bladder helps to detect debris in the bladder, monitor the amounts of debris and assess the effect of therapeutic interventions. Four cases are presented to illustrate (1) varying sonographic appearances of debris in neuropathic bladder and (2) the value of ultrasound scans in detection of debris and monitoring the effect of therapeutic interventions.

Case reports

Case #1: Debris in the bladder mimicking vesical neoplasm

A 57-year-old man with discitis at C7-T1 was transferred to our facility for rehabilitation. Neurological examination revealed Tetraplegia at C-5 level - American Spinal Injury Association Impairment Scale D. This patient had been managing the neuropathic bladder by indwelling urethral catheter drainage. He developed urine infection; urine culture showed coliform species resistant to Amoxicillin, sensitive to Gentamicin. He was prescribed Trimethoprim 200 mg twice a day for 7 days. This patient developed blockage of urinary catheter and then hematuria. Ultrasound scan showed normal ultrasound appearance of the kidneys with no renal calculus and no hydronephrosis. The urinary bladder was distended despite patient being catheterized with bladder volume of more than 900 ml. A large echogenic mass, measuring 10 × 8.6 × 8.5 cm was seen within the urinary bladder (Figs. 1 and 2). The differential diagnosis included vesical neoplasm and vesical debris. Flexible cystoscopy showed lot of debris obscuring the vision. Possibility of bladder tumor could not be ruled out. Bladder washout with sterile sodium chloride 0.9% was administered daily.

Rigid cystoscopy was performed under inhalational anesthesia after administering Gentamicin and Daptomycin. Lots of debris were removed with Ellik evacuator. Cystoscopy showed raised areas reflecting possible catheter reaction. Cold biopsies were taken. Histology of bladder biopsies revealed urothelial mucosa showing moderate mixed inflammation including abundant eosinophils, negative for dysplasia and neoplasia.

During follow-up, the urethral catheter was removed; the patient started self-voiding. Ultrasound scan showed clearance of debris; there were no vesical calculi.

This case illustrates that huge amounts of debris may get accumulated in the neuropathic bladder silently and unnoticed by the clinical team. Presence of debris is detected by the ultrasound scan of the urinary bladder which is performed after a patient develops urinary tract infection. Ultrasound scan not only helps to detect vesical debris but also to differentiate it from a bladder tumor. Absence of blood supply to the debris is the crucial difference between vesical neoplasm and debris. In this patient, changing the management of neuropathic bladder from long-term urinary catheter drainage to a satisfactory self-voiding regime achieving complete emptying of the urinary bladder resulted in clearance of debris.

Fig. 1 – Axial and sagittal scans of the urinary bladder of Case 1: the bladder is distended and contains large amounts of debris mimicking a papillary mass.
Case#2: Numerous echogenic floating debris in a person with paraplegia performing self-catheterizations

A 50-year-old male with spinal cord injury (T-5 level) has been managing the neuropathic bladder by intermittent self-catheterizations, performed with size 12 CH catheters. He developed recurrent urine infections. Ultrasound scan of the urinary tract showed numerous echogenic debris floating in the bladder (Fig. 3). Both kidneys were of normal size; no renal calculus or hydronephrosis.

Following detection of large amounts of debris in the bladder by the ultrasound scan, this patient was advised to use larger size catheters for intermittent catheterization. This patient started using Hollister size 14 CH, Nela- ton catheters for intermittent catheterization. He performed self-catheterization every 4-5 hours while he was awake. During night, the interval between catheterizations was extended to 6 hours. This patient also increased the intake of fluids; he took antibiotics on 4 occasions, 1 week each time, between August 2021 and March 2022. Follow-up ultrasound...
scan showed almost complete clearance of debris in the bladder (Fig. 4). This patient was happy to continue to use the larger size catheter (size 14 CH instead of size 12 CH) for intermittent catheterizations and maintain increased intake of fluids. These measures together with intermittent courses of antibacterial drugs, proved successful in clearing the debris from the neuropathic bladder.

**Case#3: Large amounts of debris in a person with tetraplegia and recurrent urinary tract infections**

A 30-year-old man sustained spinal cord injury at C-6 level (American Spinal Injury Association Impairment Scale A) in 2020 in a trampoline accident. He was managing his bladder by indwelling urethral catheter drainage. This patient developed urinary tract infections with E. coli. Ultrasound scan of the urinary tract showed normal right kidney; a 4 mm calculus in the upper pole of left kidney; there was no hydronephrosis. Large amounts of debris were floating in the bladder, and these occupied almost the entire bladder (Fig. 5). This patient was advised to perform intermittent catheterizations every 2-3 hours and take special care to achieve complete emptying of the urinary bladder during each catheterization. Follow-up ultrasound scan of the urinary tract, performed 16 months later, showed a few echogenic materials floating in the bladder; no vesical calculus (Fig. 6). This case illustrates the value of removing the indwelling the urinary catheter and performing regular intermittent catheterizations. These measures achieved clearance of debris and maintained debris-free status during the follow-up period of 16 months.

**Case#4: Multiple floating debris in a person with paraplegia and frequent blockages of indwelling urinary catheter**

A 57-year-old female person sustained paraplegia at T-3 (American Spinal Injury Association Impairment Scale B) in 2019 due to spinal cord stroke. She was managing the neuropathic bladder by indwelling urethral catheter drainage. She developed urinary tract infections. Ultrasound scan of the urinary tract showed normal size kidneys; no renal calculus or hydronephrosis. Floating echogenic materials were seen in the urinary bladder. The balloon of the Foley catheter was also seen (Fig. 7). In view of the debris blocking the catheter, the urethral catheter was changed every 4 weeks instead of 6 weekly intervals. She was advised daily bladder washouts with 3.23% citric acid solution (Suby-G). With this regime, debris were cleared; blockages of the catheter by debris were no longer a problem.

Bladder washouts with appropriate solution (3.23% citric acid solution) helped to clear the debris and prevent catheter blockages in this patient. Subsequently, this patient underwent suprapubic cystostomy.

**Discussion**

The echoes observed in the bladder may be a technical artefact or a real pathology. The movement of the echoes and changing level in a gravity dependent manner indicate that the echoes in the bladder are not artefacts but debris. The debris in the neuropathic bladder may be floating or layering echoing [1].

When large amounts of debris are settled in the bladder, the appearances may mimic those of a bladder tumor [2]. But the crucial difference is the absence of vascular supply to the debris in contrast to the neo-vascularity observed in vesical neoplasm.

Persons with large amounts of debris in the bladder are at risk of catheter blockages and urinary infection. These complications can be prevented by timely interventions: (1) bladder washouts with the most appropriate solution for the individual patient, (2) increasing fluid intake, (3) intermittent
catheterizations performed more often to ensure adequate emptying of the bladder, and (iv) use of open-ended catheters and/or larger size catheters which promote drainage of debris.

Build-up of debris within the bladder is a common problem encountered by spinal cord injury patients with long-term indwelling urinary catheters. One of the methods of ameliorating this complication is to wash out the bladder at regular intervals [3]. Sterile sodium chloride solution 0.9% (physiological saline) is licensed for use as a routine mechanical irrigant to flush out debris [4].

Regular catheter maintenance can help avoid any risk of bacterial colonization, prevent, or remove encrustation and stop accumulation of debris within the urinary bladder. Sterile sodium chloride 0.9% solution, Suby-G solution (3.23% citric acid), Solution-R (6% citric acid solution), and 0.02% Polyhexamidine solution are available in the United Kingdom for bladder washouts. The choice of the solution and frequency of administration of bladder washouts depend upon the amounts of debris, presence of encrustations within the lumen of the catheter and around the balloon of Foley catheter, catheter blockages and presence of drug-resistant bacteria in the urine. A 0.02% polyhexanide irrigation solution is useful for routine mechanical rinsing together with bacterial decolonization of suprapubic and indwelling urethral catheters [5,6].

**Patient consent**

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We confirm that written, informed consent for publication of their case was obtained from the patients.

**Author contributions**

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

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