

## Endourology

## Shock wave lithotripsy for a renal stone in a tetraplegic patient as a trigger for life-threatening posterior reversible encephalopathy syndrome

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## ABSTRACT

Shock wave lithotripsy (SWL) is considered a non-invasive treatment for urinary stones and usually advocated for frail patients with spinal cord injury (SCI). We report a life-threatening complication, called posterior reversible encephalopathy syndrome (PRES), in a tetraplegic person who underwent SWL for a small renal stone. Based on our experience, we recommend performing SWL with caution in SCI patients and in tertiary referral hospitals that can promptly manage similar severe complications.

## 1. Introduction

People with spinal cord injury (SCI) present a well-known increased risk of developing urinary stones. In these frail patients, the treatment strategy is governed by the golden rule: as effective as needed, as non-invasive as possible. Therefore, renal stones in SCI patients are often treated with shock wave lithotripsy (SWL) if technically feasible.

We report our experience with SWL in a tetraplegic person affected by a small renal stone. The procedure was complicated by a life-threatening condition, called posterior reversible encephalopathy syndrome (PRES).

## 1.1. Case presentation

A fifteen-year-old boy became tetraplegic after a traumatic SCI C2 American Spinal Injury Association (ASIA) scale grade A. The impairment was complete without motor and sensory function left below the injury level. He underwent early spinal fixation surgery. He developed a neurogenic overactive bladder, treated with antimuscarinic drugs and periodical botulinum toxin injections into the detrusor. He had no other comorbidities.

Ten months after the trauma, he was deferred to our tertiary referral center for a 10 mm stone at the level of the left ureteropelvic junction (Fig. 1), provoking recurrent urinary tract infections and renal colics,

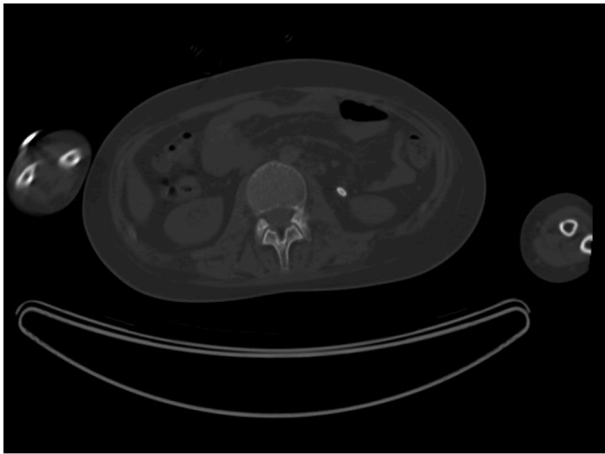
triggering dysautonomic crises.

To start with, the patient underwent a left double J ureteral stenting. After 10 days, a left SWL was performed under sedation. The operative time (OT) was 31 min. Upon awakening, we registered hypertensive crisis, nausea, facial clonus, temporary blindness and loss of consciousness. A magnetic resonance imaging scan of the head documented a cerebral vasculopathy (Fig. 2). All these features were consistent with a rare condition, called posterior reversible encephalopathy syndrome (PRES), which demanded prompt transfer to the intensive care unit. The patient required a synchronized intermittent mandatory ventilation for 24 hours. The treatment was based on the following medicines: urapidil, clonidine, diazepam, levetiracetam, and hyoscine bromide. The patient recovered completely and was discharged after 34 days.

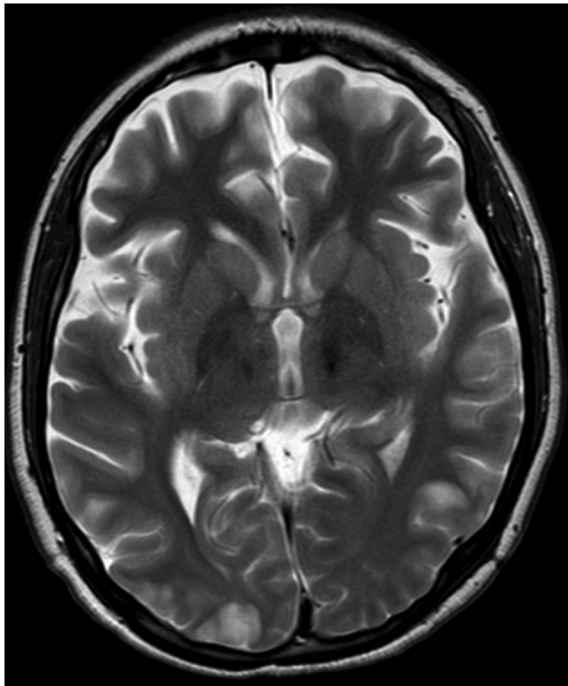
After one month from SWL, an ultrasound (US) exam documented the patient was not stone-free. Therefore, he underwent a retrograde intrarenal surgery (RIRS). The procedure was performed by a skilled surgeon under general anesthesia. We administered peri-operative antibiotic prophylaxis with cefazolin. We used an 8 Fr flexible fiberoptic ureteroscope and a 11/13 Fr ureteral sheath. Lithotripsy was performed with a Holmium:YAG laser (energy: 1 J; frequency: 30 Hz). The litholapaxy was performed with a 1.5 Fr tipless nitinol basket. At the end, we placed a 7 Fr ureteral catheter, which was removed after 48 hours. The OT was 136 min. Neither intra- nor post-operative complications occurred. The US exam after 4 weeks proved the patient was

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**Fig. 1.** Computed tomography scan showing a 10 mm stone at the level of the left ureteropelvic junction. The image analysis revealed a stone density <1,000 Hounsfield units.



**Fig. 2.** The head magnetic resonance imaging after the shockwave lithotripsy documented vasogenic edema, a radiological spectrum consistent with a potentially fatal cerebral vasculopathy, called posterior reversible encephalopathy syndrome.

stone-free.

## 2. Discussion

Urolithiasis is a well-documented complication of SCI people with a significant morbidity, and even mortality.<sup>1</sup> This is due to urine stasis, vesicoureteral reflux, indwelling catheterization, foreign bodies (e.g. hair introduced during intermittent catheterizations), urinary tract bacterial colonization with urea-splitting organisms (e.g. *Proteus*) associated with an increased urine pH, and prolonged immobilization resulting in bone resorption and subsequent hypercalciuria. SCI people present a risk of developing a renal stone ranging 7–20% over a 10-year period: this risk is about 6 times greater than the general population.<sup>2</sup>

The European Association of Urology (EAU) Guidelines on Neurogenic Bladder recommend upper urinary tract imaging every 6–12 months. However, there are no strong-rated recommendations regarding the management of incidentally found renal stones in SCI patients, as the available literature on this subject is reduced and characterized by retrospective case series enrolling small single-center samples.<sup>3</sup>

In SCI patients with large renal stones, percutaneous nephrolithotomy (PCNL) may be adopted with stone-free rates (SFRs) equal to 62–96%.<sup>4</sup> In case of <10 mm ureteral stones and <20 mm renal calculi not located in the lower pole, SWL and semirigid/flexible ureteroscopy (URS) are associated with comparable overall SFRs, even if some authors argue URS is associated with higher complication rates (specially infections) and a longer hospital stay. Therefore, SWL is usually advocated in frail patients because of reduced morbidity. Most publications on SWL in SCI patients are outdated, with SFRs ranging from 44 to 73%. Several problems may affect the SFR of SWL in this population: among them, urinary drainage is limited and may delay the passage of stone fragments.

SWL was considered feasible in our frail patient, as the stone diameter was about 10 mm, the location was the ureteropelvic junction, and the radiological image analysis revealed a stone density <1,000 Hounsfield units. However, the procedure was followed by PRES, a grade IV complication according to the Clavien-Dindo scale.

PRES is an acute neurological disorder characterized by headache, visual field deficits, impaired consciousness, seizures and focal neurological deficits. Neuroimaging shows a distinctive parieto-occipital pattern with a symmetric distribution of changes reflecting vasogenic edema. This syndrome is associated with cytotoxic medication, eclampsia, sepsis, renal disease or autoimmune disorders.<sup>5</sup> In our case, PRES was probably linked to the pain. Indeed, the pain perception is altered in SCI patients, specially with a lesion above T6. This impairment may manifest as a dysautonomic crisis, characterized by headache, tachycardia, tachypnea, hyperthermia, convulsions, severe hypertension, myocardial infarction and hemorrhagic stroke.

Later, the patient underwent a RIRS to reach the stone-free status, paying attention to maintain renal pressures as low as possible to avoid infective complications.

Our case report outlines the importance to develop accurate treatment guidelines for various diseases, such as urolithiasis, in SCI patients, addressing their special challenges and needs, which are usually not considered in the current guidelines developed on general population. We believe the stone treatment of SCI patients should be performed by high-volume stone centers in tertiary referral hospitals with intensive care units and other subspecialties (e.g. interventional radiologists, neurologists etc.) to manage appropriately these frail patients and face with potentially serious complications.

## 3. Conclusion

To our knowledge, this study reports the first case of PRES induced by SWL in a tetraplegic patient affected by a renal stone. SWL is considered a non-invasive procedure indicated in case of frail patients. According to our experience, SWL should be performed with caution in SCI patients, who are at risk for life-threatening dysautonomic crises, and even PRES.

## Consent

The patient's parents have provided their consent to the authors for the publication of this case report.

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### Author contributions

Gianluca Sampogna: Data curation, Writing – Original draft Matteo Maltagliati: Data curation, Writing – Original draft Bernardo Rocco: Resources, Writing – Reviewing and Editing Salvatore Micali: Resources, Writing – Reviewing and Editing Emanuele Montanari: Conceptualization, Validation Michele Spinelli: Methodology, Supervision

### Declaration of competing interest

The authors have no conflicts of interest to declare.

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