



## Endourology

# Combined treatment of impacted ureteral stones: Holmium laser and pneumatic ballistic

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## ABSTRACT

The treatment of impacted stones remains a challenging issue for urologists, and is usually treated clinically by a single surgical procedure. In this paper, we report a case of combined holmium laser and pneumatic ballistics for the treatment of an impacted ureteral stone. The postoperative examination showed that the stone was cleared and no complications occurred.

## 1. Introduction

Impacted ureteral stones are one of the ureteral stones which stay in one location for a long time. The formation of impacted stones is related to the size of the stone and the narrowing of the ureter. The treatment of impacted stones remains a challenging issue for urologists due to lower surgical efficacy and higher incidence of associated complications than non-impacted ureteral stones.<sup>1</sup> Herein, we report a case of combined holmium laser and pneumatic ballistics for the treatment of an impacted ureteral stone and discuss the feasibility of this approach.

## 2. Case description

A 70-year-old male patient presented to the hospital with recurrent left-sided low back pain. The renal function test showed creatinine of 1.29 mg/dL, elevated urea nitrogen, urinalysis showed elevated urine leukocytes and urine red blood cells, positive for nitrite, and the rest of the tests were unremarkable. CT examination suggested a left ureteral stone, combined with hydronephrosis, with a maximum stone diameter of 22.39 mm (Fig. 1) and a mean CT value of 1467 hu (Fig. 2).

The patient was treated surgically in a lithotomy position. An 8F red catheter was left in place and the ureteroscope was placed into the bladder under direct vision. The F3 ureteral catheter is inserted under direct vision and the ureteroscope was advanced along the ureteral catheter to the ureteral orifice. The ureteral orifice is dilated by hydraulic irrigation and the ureteroscope is gently pushed along the ureter into the stone location. When the ureteroscope went up to the middle

ureter, it was seen that the stone was severely embedded and combined with the formation of ureteral polyps, while the distal ureter of the stone was twisted and narrowed, which resulted in poor exposure of the stone and a narrow surgical field.

In this patient, pneumatic ballistic was used to push the stone away from the site of impaction to an open view of the upper ureter, followed by Holmium laser lithotripsy to crush the stone. At the end of the procedure, a double-J stent was left in place to ensure postoperative drainage. Intraoperative saline flushing was used to keep the procedure in clear endoscopic view, while also ensuring that excessive intrarenal pressure was avoided.

The operation was successfully completed in 62 minutes, the intraoperative bleeding was 10ml, and no ureteral injury was observed during the procedure. There was no carnal hematuria and fever within 3 days after the operation, and the plain film of kidney-ureter-bladder showed no residual stones in the ureter (Fig. 3). The double-J stent was successfully removed by routine cystoscopic extraction 1 month later.

## 3. Discussion

Due to the surrounding oedematous ureteral mucosa or polyps, the endoscopic view is restricted, which is difficult to crush the stones. Extracorporeal shock wave lithotripsy has the problem of lower Stone-free rate and the need for multiple treatments in the treatment of impacted ureteral stones. Open or laparoscopic lithotomy removal has a high Stone-free rate, but the problems of high invasiveness and prolong

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Fig. 1. CT scan showed left ureteral calculus with hydronephrosis.



Fig. 2. CT scan transverse section showed severe stone impaction.

hospital stays cannot be ignored. Ureteroscopic endoluminal surgery remains the clinical method of choice for the management of impacted ureteral stones.

In the present case, the stone was large and severely embedded, making in situ lithotripsy challenging. We first adopt pneumatic ballistic lithotripsy to push the stone to the upper ureter, so as to obtain a good surgical field and operating space, and then perform holmium laser lithotripsy to achieve the ideal lithotripsy effect. This is because pneumatic ballistic does not generate electricity or heat during lithotripsy, allowing the stone to be safely pushed away from the incarcerated position and ureteral stenosis, thus reducing the likelihood of complications during in situ lithotripsy. Meanwhile, Chen et al. pointed out that the ureteral stricture rate after pneumatic ballistic lithotripsy was lower than that of holmium laser lithotripsy, while there was no difference between the rates of ureteral perforation, postoperative gross hematuria and postoperative fever.<sup>2</sup> Holmium laser lithotripsy has the advantage of shorter lithotripsy time and higher lithotripsy efficiency than pneumatic ballistic lithotripsy, with smaller stones and less penetration of the ureteral mucosa by the energy generated, which usually does not lead to serious complications such as ureteral perforation when the stones are in good view.<sup>3</sup>



Fig. 3. The plain film of kidney-ureter-bladder showed no residual stones.

The patient did not experience any complications after surgery, including hematuria, fever, and ureteral injury. And the surgery time did not show any significant extension. We consider this to be due to an extended surgical field is believed to enhance surgical efficiency and augment the efficacy of stone removal. Shimpei et al. reported that obtaining a good surgical field of view is one of the keys to lithotripsy. The drawback of combined therapy is that the average hospitalization cost is higher. However, as the stone clearance rate increases, the incidence of complications decreases, and the reoperation rate decreases. Therefore, we believe that this can be considered negligible.

Few reports on the use of holmium laser and pneumatic ballistic in combination for the treatment of impacted ureteral stones have been found in the literature, according to our search. Yamashita et al. showed that there is no established technique for lithotripsy of impacted ureteral stones, but “peeling off and push back” technique is a safe lithotripsy technique for the treatment of impacted stones.<sup>4</sup> This involves using the tip of the ureteroscope or laser fibres to push the stone away from the impacted position and into the upper ureter or widened pelvis for lithotripsy. This is along the same lines as this paper, but we have chosen to use the pneumatic laser to push the stone away from the impaction, which avoids direct damage to the ureteral wall from the ureteroscope and damage to the laser fibres.

#### 4. Conclusion

Guner et al. illustrated that there was a significant negative correlation between stone diameter, stone impaction and surgical success.<sup>5</sup> A safe surgical space and exposing the stone completely is the key to treating impacted ureteral stones. The combined use of holmium laser and pneumatic ballistic is an effective and safe treatment for impacted ureteral stones, which is a procedure worthy of further investigation.

#### Consent

This study was approved by the ethics committee and informed consent was obtained.

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## Declaration of competing interest

The authors have no competing interests to declare that are relevant to the content of this article.

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