Surgical Technique

Hybrid lithotripsy for a staghorn renal calculus: a novel minimally invasive approach.

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Keywords:
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Abstract

Objective: To present a new approach to treat a large renal calculus. Using a combination of extracorporeal shockwave lithotripsy and intracorporeal laser lithotripsy through flexible ureteroscopy.

Case presentation: A 60-year-old female presented with history of 2 occasions of acute left pyelonephritis and treated with intravenous antibiotic. IVP revealed normal nephrograms, incomplete double collecting system with mild dilatation of calyx at lower moiety of left kidney and staghorn stone, measured about 3.59 cm in longest diameter was noted. Therefore a combination of two procedures; shock wave lithotripsy or retrograde intrarenal surgery was set. After urine was sterile, the patient underwent surgery under general anesthesia. Shockwave lithotripsy was set first, followed by retrograde intrarenal surgery. There was no major perioperative complication. The patient came follow up 2 weeks after surgery, there were multiple small fragments in the calyx. However, no auxiliary procedure was required. Last follow up was 4 months after surgery, there was no residual stone in the lower calyx. Stone analysis revealed pure struvite stone.

Conclusion: Hybrid lithotripsy is a new approach to treat large renal calculus. Favorable outcomes were achieved with less invasiveness and acceptable stone free.

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เทคนิคการผ่าตัด

การรักษาโรคนิ่วในไตชนิดเขากวาง ด้วยการผสมผสานของวิธีการสลายนิ่วจากต่างแหล่งพลังงาน

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คำสำคัญ:
นิ่วในไตชนิดเขากวาง
การสลายนิ่วจากต่างแหล่งพลังงาน

บทคัดย่อ

วัตถุประสงค์: เพื่อนำเสนอแนวทางใหม่ในการรักษานิ่วไตขนาดใหญ่ โดยการใช้ extracorporeal shockwave lithotripsyร่วมกับ flexible ureteroscopic laser lithotripsy

กรณีศึกษา: ผู้ป่วยหญิงอายุ 60 ปีมีประวัติของโรคกรวยไตอักเสบเฉียบพลัน 2 ครั้งในช่วง 2 เดือน ผู้ป่วยได้รับการรักษาด้วยยาปฏิชีวนะทางหลอดเลือดดำ การตรวจหาสาเหตุของการติดเชื้อโดยการทำ intravenous pyelography พบว่าไตทั้งสองข้างทำงานปกติ พบนิ่วชนิดเขากวางที่ขั้วล่างของไตขวา ขนาดความยาวประมาณ 3.59 ซม. ผู้ป่วยได้รับคำแนะนำให้รับการผ่าตัดเอานิ่วออกด้วยวิธี percutaneous nephrolithotomy (PCNL) ก่อนการผ่าตัด ผู้ป่วยได้รับการตรวจปัสสาวะอีกครั้ง ผลการเพาะเชื้อจากปัสสาวะพบว่ามีเชื้อ Proteus จึงคิดว่านิ่วอาจเป็นชนิด struvite ซึ่งมีความนิ่ม จึงได้มีการพิจารณาถึงวิธีการผ่าตัดอีกครั้งด้วยการใช้ flexible ureteroscope โดยวิธี retrograde intrarenal surgery (RIRS) อย่างไรก็ตาม นิ่วที่มีขนาด 3.59 ซม. อาจไม่สามารถทำให้หมดได้ภายในครั้งเดียวด้วยวิธีดังกล่าว ดังนั้น จึงได้มีการรวมวิธีดังกล่าวกับการใช้ extracorporeal shockwave lithotripsy (ESWL) เพื่อให้นิ่วหมดในการทำหัตถการเพียงครั้งเดียว ภายหลังการทำหัตถการไม่พบภาวะแทรกซ้อนที่รุนแรงนอกจากรอยช้ำจากการทำ ESWL ผลการรักษาที่ 2 สัปดาห์หลังการทำหัตถการ พบมีเศษนิ่วขนาดเล็กเหลืออยู่ภายในไต การติดตามผลครั้งสุดท้ายที่ 4 เดือนหลังจากการทำหัตถการไม่พบเศษนิ่วเหลืออยู่อีก ผลการวิเคราะห์ชนิดของนิ่วพบว่าเป็นชนิด struvite

สรุป: การใช้วิธีผสมผสานระหว่าง ESWL และ RIRS เป็นวิธีการใหม่ในการรักษานิ่วในไตที่มีขนาดใหญ่ ได้ผลดีในแง่ของอัตราการปราศจากนิ่วด้วยการทำหัตถการเพียงครั้งเดียว และไม่มีผลแทรกซ้อนที่รุนแรงกับผู้ป่วย

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Introduction

Nowadays treatment of choice for kidney stone larger than 2 cm in the lower pole of kidney is percutaneous nephrolithotomy (PCNL)[1]. In the minimally invasive surgery era, attempting to treat this situation by less invasive procedures neither shock wave lithotripsy (SWL) nor ureteroscopy has achieved good result[2]. Therefore a combination of these two minimally invasive procedures were utilized to achieve more stone free rate while less invasiveness still existed.

Case presentation

History

A 60-year-old female presented with history of 2 occasions of acute left pyelonephritis in 2 months. She neither had symptoms of hematuria nor passing stone. She was treated with intravenous antibiotic. Her urine cultures for bacteria were negative during the attack of infection.

Film

She was investigated the cause of infection, IVP revealed normal nephrograms and prompt excretion of both kidneys. Incomplete double collecting system of both kidneys were noted. Mild dilatation of calyx at lower moiety of left kidney and staghorn stone, measured about 3.59 cm in longest diameter was noted. The rest of pelvicalyceal system or ureter showed no abnormal dilatation (Figure 1).

Urine study

She was scheduled for PCNL and underwent routine investigations before surgery. Regarding to the investigations, she was suitable to have major surgery. However, her last urine culture was positive for Proteus spp. required treatment with antibiotic to have sterile urine before the procedure. According to bacteriologic study, thus struvite stone was concerned. Therefore, the procedure was reconsidered from PCNL to the minimally invasive surgery according to struvite stone, which has a soft composition. However, according to 3.59 cm. stone in lower pole, one minimally invasive procedure, either shock wave lithotripsy (SWL) or retrograde intrarenal surgery (RIRS) may not achieve stone free in one session of surgery.

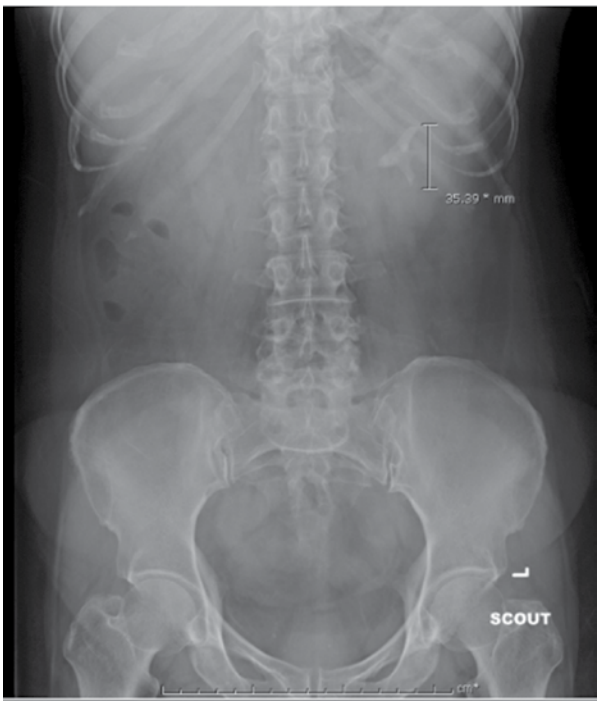

Figure 1.1 Before surgery

Figure 1.2 Contrast study

Plan of surgery

The procedure was planned to have a combination of two minimally invasive surgery included SWL and RIRS. We have reviewed the literature but there was no report about this technique to treat this similar situation.

Surgical technique

The patient had been pre-stented with 6 Fr ureteral stent for 4 weeks before hybrid lithotripsy. The procedure was performed under general anesthesia. SWL was set first, with ramped up technique, rate was 60 shock-wave/ minute, and total of 2,500 shock-wave was used (Siemens, Modularis Variostar, Germany). At the end of SWL, there were some large fragments (>5 mm.) found under fluoroscopy. After SWL, patient was re-position from supine to lithotomy position. Flexible ureteroscopy was performed, ureteral access sheath was used, size 12/14 Fr. Stone in the lower moiety was reached. There were stone fragments after SWL in the calyx. The small fragments which did not require more laser lithotripsy were irrigated through the access sheath, while the larger fragments were fragmented again with holmium laser lithotripsy. The laser setting was 1 Jule and 20 Hertz through 200 micron laser fiber (Luminis, Versalpulse). Large fragments were extracted with nitinol basket through the access sheath. Under flexible ureteroscopy, there was no fragment larger than 2-3 mm. had been visualized. There were some small fragments remained in the kidney, they were determined to pass spontaneously. 6 Fr ureteral stent was retained to prevent obstruction from those small fragments. There was an echimosis at left flank after SWL, the patient was admitted for observing 2 days after the procedure, however, no major complication occurred.

Follow up

The patient was scheduled to follow up at 2 weeks after surgery. At that time, there were multiple small fragments in the calyx (Figure 2). However, no auxiliary procedure was required. She was counseled to drink more than 3 litre of water per day and follow up in next 4 weeks. At that time, there was a small fragment diameter 3x2 mm. in lower calyx and conservative treatment was ensured (Figure 3). Last follow up was 4 months after surgery, there was no residual stone in the lower calyx (Figure 4).

Figure 2. Two weeks after surgery

Figure 3. Six weeks after surgery

Figure 4. Four months after surgery

Discussion

According to the AUA guideline[1], kidney stone larger than 2 cm should be suitable to treat with PCNL, this principle bases on to have the highest stone free rate. However, even though PCNL is one of the endoscopic procedures which usually has been minimally invasive procedure, but PCNL is the most invasiveness compares to SWL or URS. In this period, regarding to advance technology, ureteroscope has been developed far from the beginning as well as advancement in laser technology. But these both instruments are seldom utilized to treat large kidney stone, according to require more experience of the surgeon to achieve high stone free rate. Therefore, it has not been an attractive procedure for most of urologist. SWL is the least invasive procedure to treat kidney stone, but its efficacy to have stone free is low especially for large kidney stone[2]. Therefore, the guideline recommended to have the procedure which is more invasive to treat large kidney stone. However, the factor to have stone free rate is not only the size of the stone, but for our opinion, stone composition is also that factor. Thus selecting the surgical modality should be considered both of size and composition. This patient had urine pH 7.5 and Proteus bacteria that commonly found in struvite stone and struvite stone itself usually soft, easy to break up. Thus the patient has large but soft kidney stone. There was a dilemma to select the procedure, more or less invasive procedure. PCNL may achieve high stone free rate but may have more complication. SWL may achieve the least stone free rate as well as the least complication, whereas URS may require more than one time of surgery to have stone free for this setting[3]. After discussed and informed the patient, we have planned to use a combination of SWL and URS. The patient underwent pre-stented to ensure that 12/14 Fr access sheath would be able to insert within the ureter to facilitate passing of fragments. To have these 2 procedures together, the problem is which one should be done first, SWL or URS. SWL before and URS after, the vision may not clearly seen regarding to bleeding after SWL, but residual large fragment can be reached by the flexible ureteroscopy and fragmenting with the laser as well as almost fragments can be cleared through the access sheath. Therefore, this approach may achieve higher stone free rate compares to doing URS beforehand that the pros would be clear vision only. Thus we performed SWL first, and then flexible ureteroscopy. SWL was done with ramped-up technique, 2,500 shock-wave was delivered. At the end of SWL, there was some residual fragments in the kidney. During ureterosopy, there was slightly red urine, however, irrigant fluid made the vision clear without difficulty. Those large fragments remaining after SWL were reached by the flexible ureteroscopy,

and laser lithotripsy were performed until the significant fragment was no longer seen. 6 Fr ureteral stent was placed in the ureter to prevent obstruction from the fragments and it was removed 2 weeks after surgery. The patient came follow up as discussed before. Stone free was noted at 4 months after the procedure. Stone analysis was struvite as the expectation. Regarding from soft composition of the struvite, it was not difficult to break up with SWL, but large size of the stone may not be cleared by SWL alone. There are two problems of utilizing SWL to break up large stone, high total energy is required that may affect acute kidney injury and burden of stone fragments may cause ureter obstruction. Therefore this combination approach is able to diminish total energy as doing with small stone, while major stone fragments can be cleared through ureteroscopy. However, this combination approach was success with soft stone, thus hard and large stone may not suitable to apply with this approach.

Conclusion

Hybrid lithotripsy, a combination of SWL and fURSL is safe and feasible to treat soft and large kidney stone. Stone free was achieved with one time of surgery, while major complication was not existed.

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