Development of sudden refractory hypotension resulting from urosepsis in the post-anesthesia care unit after percutaneous nephrolithotomy for renal calculi: a case report

Gi-Ho Koh¹, Doo-Hwan Kim², Jihion Yu², Seungsoo Ha², Sang-A Lee², Jai-Hyun Hwang², Young-Kug Kim², Jun-Young Park²

Department of Anesthesiology and Pain Medicine, ¹Chosun University Hospital, Gwangju, ²Asan Medical Center, University of Ulsan College of Medicine, Seoul, Korea

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Corresponding author

Jun-Young Park

Department of Anesthesiology
and Pain Medicine, Asan Medical
Center, University of Ulsan College
of Medicine, 88, Olympic-ro 43-gil,
Songpa-gu, Seoul 05505, Korea

Tel: +82-2-3010-1415

Fax: +82-2-3010-6790

E-mail: anesthesia.pains@gmail.com

ORCID:

<https://orcid.org/0000-0003-4476-4945>

Percutaneous nephrolithotomy (PNL) is a relatively safe and effective procedure for the management of nephrolithiasis but is associated with severe complications. We report the case of a 76-year-old woman who underwent PNL for renal calculi removal. Preoperative urinalysis detected a large number of white blood cells and, on culture, *Escherichia coli* was detected. After an uneventful recovery from general anesthesia, she developed tachycardia, high fever, severe shivering, and hypotension in the post-anesthesia care unit. She was diagnosed with urosepsis associated with PNL and was transferred to the intensive care unit. Urosepsis and refractory hypotension persisted despite meticulous fluid management and vasopressor and inotropic agent administration. On postoperative day 5, she was hemodynamically stable and was transferred to a general ward. On postoperative day 12, she was discharged without any complications. Urosepsis after PNL can be catastrophic; therefore, early detection and optimal treatment are necessary to improve the postoperative outcome.

Keywords: Kidney calculi; Nephrolithotomy, Percutaneous; Shock, Septic; Anesthesia recovery period

INTRODUCTION

Urosepsis is defined as sepsis caused by complicated urinary tract infection [1]. It is commonly caused by obstruction of the urinary tract due to urolithiasis, anomalies, stenosis, or the presence of a tumor [2]. Moreover, such condition can occur after performing procedures in the urogenital tract, including those to the kidney or prostate [1].

Percutaneous nephrolithotomy (PNL) is a minimally in-

vasive procedure performed to remove stones in the upper urinary tract [3]. It is highly effective, yielding success rates of over 95% [4]; however, the overall rate of complications of PNL reported in the literature ranges from 18.3% to 83% [3,5,6].

In this case report, we describe an elderly female patient who suddenly developed urosepsis accompanied by refractory hypotension after PNL for removal of renal calculi.

CASE REPORT

A 76-year-old woman (149 cm; 50 kg) presented to the urology department with left flank pain and hematuria. Supine computed tomography of the abdomen and pelvis and kidney, ureter, and bladder X-ray revealed multiple and large staghorn calculi in the left kidney (Fig. 1). Urinalysis revealed pyuria, and urine culture showed the presence of *Escherichia coli* which was resistant to ciprofloxacin and sensitive to ceftriaxone. Preoperative electrocardiography, chest X-ray, and transthoracic echocardiography findings were normal. Blood test results were within normal range except for mild anemia.

She was admitted to our center 1 day before surgery. Ceftriaxone (2 g) was administered as a prophylactic antibiotic. General anesthesia was performed using O₂, N₂O, and sevoflurane under monitoring using pulse oximetry, electrocardiography, and noninvasive and invasive arterial blood pressure.

The stones were fragmented and extracted using the lithoclast; however, there were still stones in the lower pole. After the procedure, a Foley catheter was placed via nephrostomy. The operation time was 167 min, and there is no event during surgery.

The patient was fully awake and subsequently transferred to the post-anesthesia care unit (PACU). The heart rate

was 76 beats/min, noninvasive blood pressure was 128/58 mmHg, respiratory rate was 14–16 times/min, and saturation was 100% with no apparent respiratory discomfort. Postoperative chest radiograph revealed no hemothorax, pneumothorax, pneumonia, and atelectasis. Over the next 30 min in the PACU, shivering and tachycardia (heart rate, 110–120 beats/min) with a blood pressure of 123/50 mmHg and body temperature of 37.9°C were noted. Consequently, Demerol (25 mg) was administered. After 80 min, the patient's blood pressure was 89/55 mmHg but her heart rate (160 beats/min) and body temperature (39.2°C) were elevated. At that time, she was stuporous. The urine in the Foley catheter was clear, and there was no evidence of bleeding at the operative site. Urosepsis was suspected, and radial arterial catheterization was re-performed. After 120 min, there was an abrupt decrease in blood pressure (70/48 mmHg). Despite the administration of 2 doses of phenylephrine (100 µg), no increase in arterial blood pressure was observed. An endotracheal tube was inserted, and a continuous infusion of 0.1 µg/kg/min norepinephrine was commenced. A central vein catheter was inserted in the right internal jugular vein. Plasma solution (1 L) and 5% albumin (250 mL) were infused over an hour, and meropenem (1 g) was administered as an empirical antibiotic. During this management, the vital signs were as follows: arterial blood pressure, 78–110/48–56 mmHg; heart rate, 122–138 beats/min; and body temperature, 39.2–39.3°C. The results of arterial blood gas analysis revealed the following: pH, 7.41; PaCO₂, 38 mmHg; PaO₂, 179 mmHg; bicarbonate, 24.1 mEq/L; base deficit, -0.4 mEq/L; sodium, 138 mEq/L; potassium, 3.10 mEq/L; lactate, 0.8 mmol/L; SaO₂, 100%; hemoglobin, 8.5 g/dL; hematocrit, 25%; and glucose, 149 mg/dL. The Glasgow Coma Scale score was 11 points, PaO₂/FiO₂ was 179, and mean arterial pressure was 58 mmHg despite fluid administration and infusion of norepinephrine. Accordingly, the sequential organ failure assessment (SOFA) score of the patients was 8 points (Table 1). After 285 min, the patient was transferred to the intensive care unit (ICU).

In the ICU, norepinephrine (0.32 µg/kg/min), vasopressin (0.04 u/h), and dobutamine (3 µg/kg/min) were continuously infused. Her vital signs were as follows: arterial blood pressure, 75–98/45–56 mmHg; central venous pressure, 9–10 mmHg; heart rate, 98–105 beats/min; and body temperature, 36.9–37.2°C. Laboratory tests showed the following

Fig. 1. Kidney, ureter, and bladder X-ray image demonstrating multiple calculi in the left kidney. Large and multiple staghorn calculi in the left kidney are evident (arrows).

Table 1. Sequential organ failure assessment (SOFA) score

Variables	SOFA score				
	0	1	2	3	4
PaO ₂ /FiO ₂ , mmHg	≥400	<400	<300	<200 with respiratory support	<100 with respiratory support
Platelets counts, ×10 ³ /μL	≥150	<150	<100	<50	<20
Bilirubin, mg/dL	<1.2	1.2–1.9	2.0–5.9	6.0–11.9	>12.0
Mean arterial pressure	≥70 mmHg	<70 mmHg	<70 mmHg and Dopamine <5 or dobutamine	<70 mmHg and Dopamine 5.1–15 or epinephrine ≤0.1 or norepinephrine ≤0.1 ^a	<70 mmHg and Dopamine >15 or epinephrine >0.1 or norepinephrine >0.1 ^a
Glasgow Coma Scale	15	13–14	10–12	6–9	<6
Creatinine, mg/dL	<1.2 (110)	1.2–1.9 (110–170)	2.0–3.4 (171–299)	3.5–4.9 (300–440)	>5.0 (440)
Urine output, mL/day				<500	<200

PaO₂, partial pressure of oxygen; FiO₂, fraction of inspired oxygen.

^aCatecholamine doses are given as μg/kg/min for at least 1 hour.

results: white blood cell (WBC) count, $32.2 \times 10^3/\mu\text{L}$; platelet count, $40 \times 10^3/\mu\text{L}$; neutrophil count, 96.6%; and C-reactive protein level, 32.09 mg/dL. However, cardiac enzyme levels were normal. Portable transthoracic echocardiography indicated stress cardiomyopathy as the ejection fraction decreased from 65% to 30%. Although resistance to ciprofloxacin was noted in the perioperative urine culture, ciprofloxacin (400 mg) was administered with meropenem (1 g) for coverage of Gram-negative bacillus [1]. Vasopressors and inotropes were precisely titrated to maintain a mean arterial blood pressure of ≥ 65 mmHg [1]. Central venous pressure was maintained at 8–12 mmHg, in accordance with the Surviving Sepsis Guidelines [1]. However, despite these efforts, the patient was hemodynamically unstable. Therefore, an extracorporeal endotoxin adsorption cartridge (Toraymyxin, Toray Medical Co., Ltd., Tokyo, Japan) was applied to treat refractory severe sepsis [7].

However, on postoperative day 2, the hemodynamics began to stabilize; hence, tapering of all vasopressors and inotropics was initiated. Accordingly, the endotoxin adsorption cartridge procedure was not applied. The ejection fraction increased to 51%, and no abnormal findings were noted during follow-up transthoracic echocardiography. On postoperative day 3, all vasopressors were stopped. On postoperative day 5, her body temperature and WBC count were not fully normal, but the hemodynamics stabilized. As her condition improved, she was transferred to a general ward. On postoperative day 12, she was discharged with a 2-week course of oral cefuroxime.

DISCUSSION

Urinary tract infection can manifest in a wide clinical range from asymptomatic bacteriuria to sepsis or septic shock [1]. Sepsis is an organ dysfunction due to a dysregulated host response to infection [8]. The clinical criteria of sepsis are an increase of 2 points or more in the SOFA score [9]. Patients with a SOFA score of more than 2 points have an overall mortality of about 10% in general hospital patients with presumed infection [10]. Septic shock is a subset of sepsis and is identified with a clinical construct of sepsis with persistent hypotension requiring vasopressors to maintain mean arterial blood pressure ≥ 65 mmHg and serum lactate level > 2 mmol/L despite adequate volume resuscitation [10]. With these criteria, the hospital mortality is above 40% [10].

PNL is a relatively safe and effective procedure for managing nephrolithiasis refractory to other treatment modalities [3]. However, various complications are associated with PNL, including extravasation, blood transfusion, hemothorax, renal rupture, injury of other organs, fever, and sepsis [6,11,12]. Among these, sepsis is of particular importance as it is the most common cause of perioperative mortality among patients with PNL [11,13]. Infected renal stones, which may have a large amount of bacteria or endotoxins, are fragmented and removed during PNL. In this process, a large amount of bacteria or endotoxins can get absorbed in the systemic circulation, especially in case of bleeding [14]. In one study, the mortality rate of patients who developed

sepsis after PNL was 66% [15].

In clinical practice, prediction and prevention of urosepsis are important to decrease the morbidity and mortality rates in patients undergoing PNL [3,11,13]. Potential risk factors associated with urosepsis due to PNL have been identified [4,16-20], including female sex, chronic renal failure, anemia, hydronephrosis, stones ≥ 2.5 cm, positive preoperative urine and stone culture, positive intraoperative renal pelvis urine culture, and prolonged operative time [4,16-20]. In our case, female sex, mild anemia, positive preoperative urine culture, and multiple and large stones (≥ 2.5 cm) were found as risk factors for urosepsis. Despite knowledge of such risk factors, prediction of the incidence of urosepsis remains difficult [16-19]. In addition, there are several studies on prophylaxis for reducing the risk of sepsis following PNL. Mariappan et al. found a 3-fold reduction in the risk of urinary tract infection and sepsis with prophylactic ciprofloxacin [2]. However, urosepsis can still occur despite the administration of several prophylactic antibiotics [11]. In the present case, 2 g of ceftriaxone was administered 1 day before surgery. Although prediction and prophylaxis of urosepsis are difficult and not always possible [3,11], it is important to evaluate the risk factors for urosepsis. More importantly, suspicion and early recognition of urosepsis are vital for its optimal management [1]. In the present case, preoperative urine culture was positive; therefore, we had a clinical suspicion of infection. Later, at the PACU, because the SOFA score of our patient was 8, we diagnose urosepsis. Furthermore, it was expected that the patient would develop septic shock because of unstable vital signs despite vasopressor administration and fluid resuscitation. Therefore, we planned to transfer her to the ICU for advanced care for septic shock. Because of refractory hypotension, we still considered using an endotoxin adsorption cartridge in the ICU. To our knowledge, there are a few reports on the early recognition and proper management of rapid onset of urosepsis in the PACU.

PNL is generally a safe treatment option but is associated with severe complications. In this case, death may possibly occur if urosepsis is not detected early in the PACU. Aggressive management based on suspicion and early recognition of urosepsis, without waiting for any laboratory evidence, led to a good outcome in our patient. Therefore, an early recognition and appropriate treatment of PNL-related uro-

sepsis are needed to reduce poor outcomes.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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