Systemic Inflammatory Response Syndrome after Percutaneous Nephrolithotomy: A Randomized Single-Blind Clinical Trial Evaluating the Impact of Irrigation Pressure

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Purpose: We evaluated the impact of intraoperative irrigation pressures on the risk of systemic inflammatory response after percutaneous nephrolithotomy.

Materials and Methods: Between January 2014 and March 2015, 90 patients with renal stones planned for percutaneous nephrolithotomy were randomized between low (80 mm Hg) and high (200 mm Hg) irrigation pressure. Patient demographics, perioperative outcomes and systemic inflammatory response incidence rates were compared using the chi-square and Wilcoxon signed rank tests.

Results: Mean patient age, gender, body mass index and other perioperative outcomes were similar in both arms. High pressure irrigation was associated with a higher risk of systemic inflammatory response syndrome (46%) compared to low pressure irrigation (11%, p=0.0002). On multivariate analysis only high irrigation pressure, paraplegia or neurogenic bladder and nonquinolone perioperative medication were predictive of postoperative systemic inflammatory response syndrome.

Conclusions: High pressure fluid irrigation fluid increases the risk of postoperative systemic inflammatory response syndrome after percutaneous nephrolithotomy.

Key Words: systemic inflammatory response syndrome; nephrostomy, percutaneous; sepsis; therapeutic irrigation; pressure

Abbreviations and Acronyms

BMI = body mass index

BP = blood pressure

PCNL = percutaneous nephrolithotomy

SIRS = systemic inflammatory response syndrome

UTI = urinary tract infection

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PERCUTANEOUS nephrolithotomy has emerged as the treatment of choice for the management of 2 cm or greater renal calculi based on superior outcomes and acceptably low morbidity.[1] A common practice during PCNL is to pressurize the irrigation fluid, especially during bleeding, to gain better visualization.[2]

Irrigating fluid absorption may be one of the factors responsible for infective pyrexia after PCNL due to the release of bacteria during stone fragmentation and its subsequent systemic absorption that could lead to infective pyrexia with a small percentage of patients experiencing progression to urosepsis or septic shock.[3]

Currently there is no standard or consensus with respect to the optimal pressures needed for nephroscopy. We analyzed the effect of different intraoperative irrigation fluid pressures on the development of postoperative SIRS after PCNL.

PATIENTS AND METHODS

After institutional review board approval a prospective randomized single-blind

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clinical trial was performed. Patients treated with PCNL were excluded from analysis only if younger than age 18 years or immune suppressed.

Randomization

Successfully consented patients undergoing PCNL were randomly assigned to low pressure (80 mm Hg) or high pressure (200 mm Hg) irrigation. Randomization was performed using computer generated random numbers.

Irrigation Pressure Control

For intraoperative control of irrigation fluid pressure we used the Thermedx Fluid Smart™ System for fluid delivery (fig. 1). The irrigant temperature was maintained at 21C or higher.

Outcomes Measurement

Preoperative evaluation consisted of basic laboratory tests and urine culture while radiographic evaluation consisted of a noncontrast helical computerized tomography. Charts were reviewed to correctly identify baseline demographic variables as well as detailed medical history and postoperative outcomes while intraoperative variables were recorded prospectively during surgery. SIRS was defined as patients demonstrating two of the following conditions: heart rate greater than 90 beats per minute, respiratory rate greater than 20 respirations per minute, serum white blood cell count greater than 12,000/high power field or less than 4,000/high power field and temperature greater than 38C or less than 36C.

Technique

All patients underwent screening with a urine culture 1 week before surgery and those with a positive culture received culture specific antibiotics. All patients with a negative urine culture received 24 hours of intravenous antibiotics (according to American Urological Association Best Practice Statements) commencing at induction of anesthesia. For those who experienced SIRS postoperatively oral antibiotics were continued for 1 week after surgery.

The operating surgeons, 3 well trained endourologists with at least 10 years of experience in endourology, obtained access on the day of surgery in the majority of patients. All procedures were performed using general anesthesia, with the patient in the split-leg prone position, using a ureteral access sheath and flexible ureteroscopy for endoscopic guided access. For those patients who had a pre-placed nephrostomy tube, a ureteral access sheath was also placed at the beginning of the case and was left in place for the duration of the procedure to promote efflux of irrigant and stone debris.

After balloon tract dilation to 30Fr I.D. (Bard X-Force®) and advancement of the nephrostomy sheath under endoscopic monitoring, PCNL was commenced. A 26Fr, 25 cm Wolf® nephroscope was used and the Olympus Cyberwand® was used when necessary for stone fragmentation. At the end of procedure a 7Fr Double-J® stent was inserted retrograde under fluoroscopic guidance, and the nephrostomy sheath removed and incision sutured. Stone-free rates were defined intraoperatively using flexible nephroscopy and antegrade ureteroscopy at the end of the procedure along with high magnification fluoroscopy to evaluate for residual fragments.[4]

Figure 1. Thermedx Fluid Smart System

Statistical Analysis

Univariate analysis was performed using Wilcoxon's signed rank test and the chi-square test comparing different variables, and then a logistic regression was used to test variables during multivariate analysis.