ANESTHETIC MANAGEMENT OF ANATROPHIC NEPHROLITHOTOMY

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ABSTRACT: Anatrophic nephrolithotomy is a urological procedure that is rarely performed in this minimally invasive endo urological era. However, it still remains an option in the management of complex staghorn calculus. A near complete removal of the large calculus in a single sitting will be more cost effective than multiple sittings required for minimally invasive procedures. We report anesthetic management of anatrophic nephrolithotomy which in many ways similar to the principles of renal transplantation.
KEY WORDS: Anatrophic nephrolithotomy, anesthetic management.

INTRODUCTION: Anatrophic nephrolithotomy is a procedure that is used for the removal of large renal calculi, specifically branched or staghorn calculi. The original description of anatrophic nephrolithotomy was by Smith and Boyce in 1968 [1]. The operation they described was based on the principle of placing the nephrotomy incision through a plane of the kidney that was relatively avascular, between the anterior and posterior segmental arteries. This approach would avoid damage to the renal vasculature with resulting atrophy of the renal parenchyma, hence the term anatrophic [1]. Anatrophic nephrolithotomy is a procedure that is rarely performed in this minimally invasive endo urological era. We report a case of anatrophic nephrolithotomy, which in many ways similar to the management for renal transplantation.

CASE REPORT: A 46year old 80Kg male who had right sided staghorn calculus was scheduled to undergo anatrophic nephrolithotomy. His complete haemogram, ECG, serum electrolytes and coagulation profile were within normal limits and serum creatinine was 1.1mg/dL. A combined epidural and general anaesthetic technique was planned for the proposed surgery and the patient consented for the same. The patient received premedication with ranitidine 150mg, ondansetron 4mg and glycopyrrolate 0.2mg iv. After securing a 16G peripheral IV access, instituting minimal mandatory monitoring a 20G epidural catheter was secured in T11-T12 interspace and fixed at 10cm for managing postoperative pain. The right radial artery was cannulated for invasive blood pressure monitoring, right internal jugular vein cannulated for central venous pressure monitoring and nasopharyngeal temperature monitoring. The patient was induced with fentanyl 100mcg and thiopentone 275mg, endotracheal intubation with No.8.5 endotracheal tube was facilitated with atracurium 40mg. Anesthesia was maintained with 50% oxygen and 50% nitrous oxide with 1-2% isoflurane on circle system. Surgery began with the patient in left lateral position with a kidney bridge. After opening the Gerota's fascia and mobilising the kidney, hilar dissection carried out to secure the renal pedicles. Before

clamping the renal artery 20gm of mannitol was infused and cooling of the kidney was began by placing ice around the kidney. After adequate cooling with iced slush for 10mins, nephrotomy incision placed at the expected location of the vascular line (Brodel's line) and the stone was removed piecemeal. A double-J stent placed from renal pelvis to bladder, calicorrhapy done and the parenchyma was sutured with interrupted sutures. The total ischaemia time was 45mins. The patient remained haemodynamically stable with a systolic pressure > 120 mmHg and a mean systemic pressure > 70 mmHg throughout the procedure. The CVP was maintained between 10-15cm H_2O throughout the procedure. Post clamp release arterial blood gas was normal. Total surgical time was 90mins during which patient received 2L of crystalloids. The approximate blood loss during the surgery was 500-600mL. There was a slight drop in the nasopharyngeal temperature from 37°C to 36.5°C at the end of procedure. The epidural catheter was connected to a continuous pump at 5mL/hr (0.0625% bupivacaine, 2mcg/mL fentanyl) to provide postoperative analgesia. Patient had good urine output in the immediate postoperative period and in the subsequent days. It was 1600mL in the immediate postoperative period and 1700mL, 2400mL and 1800mL on 2nd, 3rd and 4th postoperative days respectively. Serum creatinine which increased from 1.1mg/dL to 2.5mg/dL on third postoperative day, gradually returned to preoperative values on the seventh postoperative day. The patient had an uneventfully hospital course and was discharged on the 8th day.

DISCUSSION: At present, there is no clear threshold to define whether a staghorn calculus is amenable to open surgery or to minimally invasive procedure; and the surgeon's judgement, experience, and instrument availability are the important factors in this regard [2]. Despite advances in endo urological procedures, large complex calculi may need to be managed with open surgery. Anatrophic nephrolithotomy provides a 91-94% stone free rate [3] and may be a cost-effective alternative to multiple endo urological treatment sessions, but it is associated with some postoperative morbidities and prolonged recovery [4].

For anatrophic nephrolithotomy the kidney is approached through the standard flank incision. After gaining access to the retroperitoneal space the Gerota's fascia is carefully incised and the kidney mobilised with care taken not to disrupt the renal capsule. The renal hilum dissected to identify the renal artery and its branches. The avascular line is identified by temporarily clamping the posterior segmental artery and injecting 20 mL of methylene blue intravenously, which results in the blanching of the posterior renal segment while the anterior portion turns blue. Maximal renal parenchymal preservation and minimal blood loss results by placing the nephrotomy incision along this plane [5]. Use of Doppler stethoscope may also aid the identification of area of kidney with least blood flow. Administration of 25g of mannitol intravenously before clamping of renal artery promotes postischemic diuresis and prevents formation of intratubular ice crystals formation. The main renal artery is clamped and the kidney is cooled by placing iced slush within a barrier surrounding the kidney. The kidney is cooled for 10 to 15 minutes before the nephrotomy incision, which allows safe ischemic times of 60 to 75 minutes with minimal renal parenchymal damage [5]. The renal capsule is then incised over the previously identified avascular plane and all of the calyceal extensions are identified and incised. After removal of all stone fragments, the renal pelvis and calyces are copiously irrigated [5]. A "double-J" stent is passed from the renal pelvis into the bladder and the calyceal system reconstructed. After the capsule is closed and haemostasis has been achieved, the renal artery unclamped and the kidney is observed for good hemostasis and return of pink color and good turgor [5].

The anesthetic technique for anatrophic nephrolithotomy is in many ways similar to that of renal transplantation and a close coordination between the surgical and anesthesia team is the key in the optimal perioperative management of these patients. The major anesthetic consideration is maintenance of renal blood flow. The typical haemodynamic goals are systolic pressure > 90mmHg, mean systemic pressure > 60mmHg, and CVP > 10mmHg are similar to renal transplantation. These goals are usually achieved without use of vasopressors, using isotonic fluids and adjustment of anesthetic doses. The haemodynamic goals can vary from center to center, but a close communication between surgeon and anesthesiologist is imperative. There are no serious complications; however pulmonary complications like atelectasis and pneumothorax, and transient acute tubular necrosis secondary to compromise in renal blood flow can occur. Our patient had a transient elevation of serum creatinine in the immediate postoperative period, which returned to normal later.

In conclusion, the introduction of extracorporeal shock wave lithotripsy and other minimally invasive procedures has dramatically reduced the number of open procedures for urolithiasis. The optimal management option for large complex staghorn calculi is still controversial. Anatrophic nephrolithotomy still remains an option for such complex stones. This case report presents the key surgical and anesthetic points to consider during its performance.

Acknowledgements: None
Financial disclosure: None to declare
Funding/Support: None

REFERENCES:

1. Smith MJV, Boyce WH. Anatrophic nephrotomy and plastic calyrhaphy. J Urol 1968;99(5):521-7.
2. Segura JW, Preminger GM, Assimos DG, Dretler SP, Kahn RI, Lingeman JE et al. Nephrolithiasis Clinical Guidelines Panel summary report on the management of staghorn calculi. The American Urological Association Nephrolithiasis Clinical Guidelines Panel. J Urol. 1994;151(6):1648-51.
3. Assimos DG, Wrenn JJ, Harrison LH, McCullough DL, Boyce WH, Taylor CL et al. A comparison of anatrophic nephrolithotomy and percutaneous nephrolithotomy with and without extracorporeal shock wave lithotripsy for management of patients with staghorn calculi. J Urol. 1991;145(4):710-4.
4. Kaouk JH, Gill IS, Desai MM, Banks KLW, Raja SS, Skacel M. Laparoscopic anatrophic nephrolithotomy: feasibility study in a chronic porcine model. J Urol. 2003;169(2):691-6.
5. Anoia EJ, Resnick MI. Open stone surgery. In: Stoller ML, Meng MV, editors. Urinary stone disease: The practical guide to medical and surgical management. Totowa, New Jersy: Humana Press; 2007. p. 639-50.

Figure 1. Staghorn calculus removed piecemeal.