



EPIDURAL ANAESTHESIA FOR OPEN PROSTATECTOMY IN A PATIENT WITH IMPAIRED RENAL FUNCTION

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ABSTRACT

IJ, a 57-year-old known hypertensive presented to the Urology unit of Federal Medical Centre Umuahia, Nigeria with haematuria and lower urinary tract symptoms. Seventeen days prior to his presentation, he had acute urinary retention which was relieved by urethral catheterization. Ultrasound of the abdomen revealed bilateral parenchymal disease of the kidneys. Based on clinical and investigation findings, a diagnosis of benign prostatic hypertrophy (BPH) in a patient with renal disease was made.

Retropubic prostatectomy was performed with epidural anaesthesia. Intraoperatively, he experienced shivering which was managed successfully. Postoperatively, he developed urinary tract infection and malaria which were successfully treated. Anaesthetic challenges specific to patients with renal impairment scheduled for prostatectomy under regional anaesthesia in a resource limited setting are discussed.

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INTRODUCTION

Benign prostatic hypertrophy refers to the proliferation of the glandular and stromal elements of the prostate.^[1,2] Obstruction to urine flow as a result of BPH can lead to renal impairment. Although there is a decline in renal function with ageing, elevated levels of serum creatinine in the elderly implies a severe reduction in renal function greater than the expected age related decline.^[3,4,5]

Renal impairment may delay the excretion of drugs therefore regional anaesthesia becomes advantageous in this situation. Epidural anaesthesia is associated with a more gradual reduction in arterial blood pressure compared to spinal anaesthesia thereby providing less perioperative morbidity.^[6,7]

Case Presentation

IJ was a 57-year-old retired civil servant who was admitted to the Urology unit of the Federal Medical Centre (FMC), Umuahia, Nigeria with a history of persistent haematuria of one-week duration. This was associated with lower urinary tract symptoms. A self-retaining urethral catheter was introduced for an episode of acute urinary retention which occurred 17 days prior to presentation. He had no history of trauma, drug ingestion nor syncope. He was noticed with persistently raised blood pressure (160/100mmHg) and was

commenced on nifedipine 20 mg daily and vasoprin 75 mg daily.

Physical examination revealed an elderly man in no obvious distress who was afebrile, anicteric and not pale. He had bilateral pitting pedal oedema up to the ankle joints and an indwelling urethral catheter in-situ. His pulse rate was 72 beats per minute, full volume, regular and blood pressure was 160/100 mmHg. The apex beat was at 5th intercostal space lateral to the midclavicular line and his heart sounds were normal. Respiratory rate was 24 breaths per minute and breath sounds were vesicular. Rectal examination revealed an enlarged prostate with benign features. A diagnosis of BPH in a patient with renal disease was made. The urethral catheter was attached to a urinary bag for continuous bladder drainage and relief of back pressure to the kidneys. And, strict monitoring of the fluid intake and output was observed.

Prostatic ultrasound scan (USS) showed an enlarged prostate with a volume of 46.96 cm³ and a thickened bladder wall. Abdominal USS showed that both kidneys were echogenic and enlarged with dilations of the calyces. Features were in keeping with obstructive uropathy and bilateral parenchymal disease. Serum electrolytes urea and creatinine estimation showed elevated creatinine & urea (creatinine 750µmol/L; urea 25mmol/l). Urine microscopy, culture, and sensitivity

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revealed heavy growth of proteus and he was commenced on oral cephalexin 500 mg 12 hourly, based on sensitivity result. At the pre-anaesthetic visit, history and investigation results were as previously documented. There was no history of recent upper respiratory tract infection or use of anticoagulant. There was no backache, neurological disease nor bleeding disorder. He was afebrile, anicteric, not pale nor dehydrated. Other findings on physical examination were as documented above except that the blood pressure had decreased to 130/90 mmHg. Airway assessment was revealed a Mallampati 2 classification and the physical status according to American society of anesthesiologist (ASA) classification was class 2.

The planned anaesthetic technique was explained to the patient with emphasis on preservation of consciousness, analgesia and local-anaesthesia-induced weakness of the lower limbs during the perioperative period. He was re-assured of full return of function of the lower limbs after 4 hours. Informed consent was then obtained for epidural anaesthesia and surgery. Two units of red blood cells were screened, grouped and cross-matched for possible intraoperative transfusion. Oral feeding was stopped at midnight preceding the surgery. Oral diazepam 5 mg was administered along with morning dose of antihypertensive drugs except lisinopril on the day of surgery. On patient's arrival in the theatre, the base-line vital signs were: pulse rate 86 beats per minute, blood pressure 140/90 mmHg, temperature 36.8°C, arterial oxygen saturation while on room air was 100% and five lead ECG showed normal sinus rhythm. Intravenous access was secured with a 16-gauge intravenous cannula on the left hand and he was preloaded with 500mls of warm normal saline over a period of 30 minutes. He was placed in a sitting position while epidural catheter was sited. When no sign of subarachnoid injection of the local anaesthetic was seen, 12mls of the 0.5% plain bupivacaine was injected into the epidural space through the catheter while maintaining verbal contact with the patient. The filter of the epidural catheter was flushed with normal saline and attached to the catheter. The skin puncture site was covered with a piece of sterile gauze and strapped with adhesive tapes. The catheter was also strapped to the left shoulder and at two other places on his back. The patient was returned to the supine position. Loss of pain sensation as determined by pin prick test after 15 minutes of the procedure revealed loss of sensation up to the 8th thoracic (T8) dermatome. A precordial stethoscope was applied. The blood pressure was recorded at 5-minute intervals until it became stable and thereafter at 10-minute intervals. The patient experienced shivering after 30 minutes of induction of epidural anaesthesia which was promptly controlled with tramadol 25mg. The Pulse rate, oxygen saturation, ECG and temperature were monitored continuously throughout the duration of anaesthesia. Intravenous midazolam (1 mg) was administered for anxiolysis and intravenous ceftriaxone and metronidazole were given as antibiotic prophylaxis prior to commencement of surgery.

Duration of surgery was 90 minutes. Intra-operative monitoring showed pulse rate that RANGED between 70 and 104 beats per minute, blood pressure between 108-160 mmHg systolic, 65-90 mmHg diastolic and arterial oxygen saturation between 97-100%. The intra-operative temperature ranged between 36.6 and 37.1°C and ECG showed normal sinus rhythm. The estimated blood loss was 350mls and the patient received a total of 2 litres of 0.9% saline. Intra-operative urinary output was 800mls.

Prostatectomy was performed via retropubic approach. Intravenous frusemide 40 mg was administered following the closure of the incised prostatic capsule to encourage diuresis. Urethral and suprapubic catheters were passed for continuous bladder irrigation with normal saline. One hour postoperatively, when irrigation fluid was clear of blood and full return of motor function in the lower limb was observed, the patient was returned to the ward. He was commenced on intravenous fluid 5% dextrose in 0.9% saline 8 hourly for 24 hours. Oral feeding was started on the first postoperative day and was tolerated well by the patient. Intravenous ceftriaxone 1gram daily and intravenous metronidazole 500mg 8-hourly was given as postoperative antimicrobial cover for 72 hours. Analgesia was supplemented with diclofenac suppository 100mg 12 hourly, intramuscular pentazocine 30 mg 8hourly and iv paracetamol 600 mg 4 hourly. Blood pressure, pulse rate, respiratory rate and peripheral temperature were monitored every 4 hours for 72 hours.

Serum E/U/Cr estimation done on the second postoperative day revealed elevated urea (180 mmol/L) and creatinine (550 mmol/L). The postoperative PCV was 32%. Irrigation of the bladder and intravenous fluids were discontinued on the second postoperative day. He was also encouraged to ambulate early. Physiotherapy of the chest and limbs were also started on the second postoperative day. He was encouraged to take oral fluids (water) liberally up to 4 litres daily from the third post-operative day. The blood pressure rose consistently from the fourth post-operative day up to 180/100 mmHg. Patient was reviewed by the physician and recommenced on oral nifedipine 20mg and captopril 12.5mg 12 hourly, respectively.

Urine microscopy, culture and sensitivity done on the 7th post-operative day revealed heavy growth of staphylococcus aureus. He was started on oral ciprofloxacin 500 mg 12-hourly for 5 days based on the sensitivity result. Urinary catheters were removed on 7th postoperative day with patient voiding satisfactorily and surgical sutures were removed on the 9th postoperative day. He was then discharged to be reviewed in the out-patient clinic.

DISCUSSION

Benign prostatic hyperplasia represents an over-growth of prostatic glandular tissue and smooth muscle. The cause is unknown but hormonal factors may play an important role since BPH does not occur in Eunuchs or Castrated men.^[2] It is the most important cause of obstructive uropathy in the elderly.^[2,8] Chronic obstruction leads to hypertrophy and dilatation of the bladder, followed in time by hydronephrosis. If obstruction is not relieved, renal impairment may result. Urinary tract infection due to mixed bacterial flora following residual urine gives rise to symptoms such as suprapubic pain, frequency of urination, urgency, haematuria, dysuria and fever.^[9] Ascending spread of infection may cause pyelonephritis. The kidneys are usually enlarged following obstructive uropathy as against shrunken kidneys seen in pyelonephritis.^[9,10] In developing countries most of the patients present late with acute urinary retention. Urinary tract infection (UTI) may worsen a pre-existing renal impairment and should be treated before surgery.^[10]

The diagnosis of BPH with bladder outlet obstruction could be made from history and physical/ancillary examinations. Rectal examination reveals varying degrees of prostatic enlargement. Elevated serum level of prostatic specific antigen (PSA) is a

pointer to patients that will need biopsy to rule out prostate cancer.^[11] Ultrasound scan which reveals residual urine, hypertrophy of the detrusor, hydronephrosis, hydroureters and enlarged prostate is suggestive of back pressure in the urinary tract with possible impairment of renal function.^[12]

Renal function might be reduced by one percent per year above the age of 30 years.^[17] Renal blood flow also decreases by about 1.5% per year and is accompanied by gradual loss of functioning glomeruli above the age of 40 years.^[3] With advancing age, there is loss of muscle mass and reduced muscle metabolism which reduces the production of creatinine. A low level of creatinine is therefore expected in the middle aged and elderly but it is often kept within normal limits by the age-related decline in glomerular filtration rate (GFR). A slightly raised creatinine level in middle age and in elderly patients may indicate a significant degree of renal impairment.^[3] The kidneys normally exhibit a large reserve in function. Over 50% of renal function is lost before changes are observed.^[4] When serum urea and creatinine are both elevated, creatinine clearance test is often recommended. Creatinine clearance test is accomplished by a 24 hours urine collection. The normal value for creatinine clearance is 95-140 ml per minute. When the creatinine clearance has not been performed, and if the renal function is stable, creatinine clearance which is a rough estimate of glomerular filtration rate (GFR) can be approximated by noting the serum creatinine levels. A doubling of creatinine level represents a halving of GFR. Thus a patient with a stable serum creatinine level of 2mg/100mls will have a GFR of approximately 60ml/minute.^[13]

Increased renin secretion secondary to decreased perfusion of the juxtaglomerular apparatus may lead to increased secretion of angiotensin II with consequent sustained elevated blood pressure. Uncontrolled hypertension increases preoperative morbidity and mortality and, a resting diastolic blood pressure of ≥ 110 mmHg is not acceptable for elective procedures.^[14] Preoperative control of blood pressure is therefore indicated and the antihypertensive should be continued up to the morning of surgery. Hypertension together with anaemia may precipitate heart failure. A thorough cardiac risk assessment which includes history, physical examination and relevant investigations such as chest X-ray and 12-lead ECG is mandatory.

Contraindication to surgery might include senility, poor cardiopulmonary state and severe renal failure. Renal impairment can be slowed or even reversed by relief of obstruction to urine flow, effective treatment of urinary tract infection and control of hypertension.^[5,8] One of the goals of pre-anaesthetic visit is to allay anxiety. Pre-medication with anxiolytics is often indicated in hypertensives. Midazolam if available is preferred because it has shorter duration of action and less hangover effect compared to diazepam. In the pre-anaesthetic visit a thorough review of patient's history, physical examination and laboratory investigations are required for a successful anaesthesia. Physical examination will include general examination for anaemia that could be secondary to depression of bone marrow, poor diet and decreased erythropoietin production by the kidneys. Oedema may occur because of various degrees of fluid imbalance seen in patients with renal impairment. Examination of the respiratory system for pulmonary oedema due to fluid imbalance is important and, any neurological deficit should be

noted. The level of serum potassium is important because hyper or hypokalaemia can occur in patients with renal diseases. Hypokalaemia is common in patients on diuretic therapy and may cause intraoperative cardiac arrhythmias and can also depress neuromuscular function.^[15] Hyperkalaemia occurs typically in renal failure, frequently in association with metabolic acidosis. This should be corrected before surgery as it can predispose the patient to delayed myocardial conduction or possibly, asystolic cardiac arrest.

The goals of anaesthetic management in a patient with renal impairment are to assess the extent of the renal impairment, ensure that the patient's condition is improved in the time available before surgery and to conduct anaesthesia and postoperative care using drugs and techniques which have the least detrimental effect on the kidneys. The anaesthetic technique therefore must be such that will not worsen the pre-existing condition of the patient. Therefore all the drugs that are mainly metabolized by the kidneys should be avoided or used cautiously in reduced doses if inevitable.^[4] Regional technique with one drug instead of general anaesthesia with use of many drugs is therefore preferred. Regional anaesthesia for prostatectomy reduces blood loss compared general anaesthesia.^[16] There is less perioperative morbidity when these regional techniques are used for prostatectomy and lower abdominal surgical procedures compared general anaesthesia.^[6,7,8] Epidural anaesthesia is an acceptable alternative to spinal anaesthesia with the possible advantage of a more gradual reduction in blood pressure than observed with spinal anaesthesia.^[7] Doses of local anaesthetic required to achieve epidural anaesthesia decreases with aging probably because of epidural adhesions and narrowed intervertebral foramina resulting in greater epidural spread of local anaesthetic agent.^[17] Placement of epidural catheter permits subsequent intermittent or continuous administration of local anaesthetic drug for postoperative analgesia.

It is common practice to attempt to minimize hypotension during spinal or epidural anaesthesia by preloading the patient with 500-1000mls of a crystalloid solution. This may partly compensate for the relative hypovolaemia induced by increased capacitance of the circulation.^[18] This was the reason the patient was preloaded with 500mls of crystalloid for a period of 30mins. Hyperplastic prostate is highly vascular and operative bleeding is usually significant. The blood loss is mixed with irrigation fluid making estimation of blood loss less accurate and difficult. If facilities for transurethral resection of the prostate (TURP) is available, it is preferred (for glands less than 100g) as it is associated with reduced blood loss, decreased morbidity and shorter hospital stay however, it is expensive and cannot be afforded by many, especially in resource limited settings.^[19] Retropubic approach is more contemporary than the trans-vesical approach and offers better control of bleeding and preserves sphincteric function than the trans-vesical approach, thus reducing the risk of haemorrhage and incontinence.^[20]

Intraoperative administration of frusemide improves diuresis thus reducing the risk of clot retention. It also maintains adequate urine output, prevents volume overload and improves renal function.^[4] Prophylaxis against renal failure with solute diuresis appears to be effective and beneficial in high risk patients undergoing major surgical procedures. Intravenous fluid should be given concomitantly to prevent intravascular volume depletion. Low dose dopamine may also be beneficial

by increasing renal blood flow via activation of vasodilatory dopaminergic receptors in the renal vasculature.^[4]

Intraoperative hypothermia cause shivering which could be associated with emotional and metabolic stress and increase in oxygen demand. Prompt treatment is therefore necessary. The mechanism of shivering may be multifactorial. Heat loss might increase as a result of increased peripheral blood flow following spinal anaesthesia.^[7] Local anaesthetic agents may also induce shivering by its action on the kappa receptors on the spinal cord; this could be treated with opioids.^[21,22] Low dose ketamine is also useful in the treatment of post-spinal shivering.^[23] To ensure safety, the minimum monitoring standard which included pulse, blood pressure, precordial, five-lead electrocardiogram, temperature probe and urinary catheter we reemployed. Although more sophisticated equipment may aid monitoring and increase safety, none of them however supersede the vigilance, knowledge and skill of the anaesthetist.

Close monitoring of urinary output and intravascular volume is critical in this patient. Although an adequate urinary output does not ensure preservation of renal function, urinary output greater than 0.5mg/kg/hour is desirable.^[4] Blood pressure was controlled before surgery in this patient. As rapid changes in blood pressure was not expected intraoperatively, invasive monitoring of blood pressure was not employed. Renal impairment may occur during the postoperative period and the patients could present with postoperative renal failure therefore postoperative monitoring is essential. Hypovolaemia is an important factor in the development of acute postoperative renal failure. Prevention of renal complications is emphasised in the management of these patients because mortality rate of postoperative renal failure could be as high as 50-60%.

Most opioids currently in use in anaesthetic management are inactivated by the liver with the exception of morphine and meperidine.⁴ Significant accumulation of active metabolites of these drugs generally do not occur however, pentazocine was safely employed for postoperative analgesia in this patient.

CONCLUSION

The successful anaesthetic management of a patient with impaired renal function is quite challenging. The goals of anaesthetic management in such patients are to assess the extent of the medical problem, ensure that patient's condition is improved in the time available before surgery and to conduct anaesthesia and postoperative care using techniques which have least detrimental effect on the medical condition. Regional anaesthesia is preferred because of the reasons mentioned above. To ensure safe anaesthesia, continuous close monitoring of haemodynamic parameters, urinary output, avoidance of hypotension and adequate fluid replacement is mandatory. The close monitoring should also continue postoperatively to avoid postoperative renal failure.

Conflict of interest: None

Sponsor: None

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