



Anaesthetic Considerations in Managing Renal cell Carcinoma in a Resource-Poor Setting

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Abstract

Introduction: Renal Cell Carcinoma (RCC) accounts for 2% of global cancer diagnoses and deaths, its incidence is increasing globally. In Africa, the incidence of RCC is relatively low but many patients present late with advanced-stage disease and consequently, poorer prognosis. Anaesthetic care of these patients is important. **Materials and Methods:** This is a ten-year retrospective study conducted at the University of Port Harcourt Teaching Hospital. Ethical approval for the study was sought and gotten from the hospital's ethical committee. The information gotten includes the type of anaesthesia and method of postoperative pain management. The data collected was analyzed and presented in a table. **Results:** 84% had general anaesthesia while 16% had regional anaesthesia, all the patients had multimodal method of pain management. **Conclusion:** Perioperative management for renal surgery varies significantly depending on the disease and patient groups, the anaesthetic must take into consideration the various surgical approaches and be prepared to assist the surgeon.

Keywords: Renal cell carcinoma, anaesthesia, analgesics, radical nephrectomy, partial nephrectomy.

Introduction

The kidneys are two bean-shaped retroperitoneal organs located in the lumbar region protected by the flank muscles ^[1] and involved in the excretion of metabolic waste products. Renal Cell Carcinoma (RCC) accounts for 2% of global cancer diagnoses and deaths, its incidence is increasing especially in the developed world ^[2]. Globally, RCC is the ninth and fourteenth most frequently diagnosed cancer in men and women respectively, accounting for 2.2 percent of all new cancer diagnoses ^[3]. Prognosis of RCC is largely dependent on the stage at diagnosis and survival is poor in late-stage disease ^[3]. In Africa, the incidence of RCC is relatively low and many patients present late with advanced-stage disease and consequently, poorer prognosis ^[4-6]. In Nigeria, most patients pay for treatment out of pocket because of a poorly functioning health insurance scheme ^[7-9]. Hence, most patients cannot afford the newer novel drugs used in the management of RCC, so surgical treatment remains a mainstay of management in many hospitals in Nigeria ^[4,5].

Perioperative acute kidney injury accounts for 30-40% of all in-hospital cases of acute kidney injury and is associated with significant morbidity and even mortality ^[10]. Anaesthesia for RCC is important to the anaesthetic as most drugs are excreted by the kidneys and nephrectomy will significantly reduce the nephron dose of these patients. Anaesthesia and surgical stress can also significantly affect renal function and body fluid regulation directly and indirectly. Routine anaesthetic assessment is therefore required for this patient with particular attention to renal function. The mechanism of action of some anaesthetic agents is due to redistribution and metabolism, and is not dependent on renal excretion, the biotransformation of these agents results in pharmacologically inactive forms of the parent compound which are water soluble and excreted in the urine ^[11].

The importance of proper perioperative management of patients cannot be overemphasized especially during nephrectomies. We are unaware of any publication in Nigeria focusing on the anaesthetic challenges in managing patients with renal cell carcinoma. We, therefore, present the measures undertaken to prevent complications during nephrectomy for patients with RCC.

Materials and Methods

This study was a 10-year retrospective study carried out at the University of Port Harcourt Teaching Hospital, Port Harcourt, Rivers State, Nigeria from January 2012 to December 2021. Ethical approval for the study was sought and gotten from the hospital's ethical committee. All patients who had Nephrectomy for RCC were evaluated. Data from all patients listed in the medical records department as having been treated for renal malignancy during the study period were retrieved. Also, data were obtained from ward admission registers, theatre, and discharge records. The preoperative investigations, the anaesthetic technique and the post-operative analgesia were considered. Patients who had nephrectomy for suspected malignancy and the histological report were benign were excluded from the study.

We then performed a literature review using Medline, PubMed, and Google Scholar search engines and discussed the anaesthetic concerns of nephrectomy in patients with RCC.

The data from the folders were collected and entered using Microsoft Excel 2016 version and transferred into the statistical package for social sciences (SPSS) for windows (version 25) (IBM SPSS Inc. Chicago, IL) for analysis. A ninety-five per cent confidence interval and a p-value less than 0.05 was considered significant. Frequencies, percentages, mean and standard deviation were used to summarize the data as appropriate. Categorical data

were presented in the form of frequencies and percentages using tables. Continuous variables were presented in means and standard deviation. Results were presented in tables and charts.

Results and discussion

Table 1: Number of patients that had general anaesthesia compared to regional anaesthesia.

Choice of anaesthesia	Frequency(n)	Percentages(%)
Regional anaesthesia	6	15.4
General anaesthesia	33	84.6
Total	39	100

Table 1 shows that more patients (84.6%) had general anaesthesia compared to regional anaesthesia.

3.1 Nephrectomy

Nephrectomy is the surgical removal of the kidney. It may be simple for benign diseases or radical for malignant diseases. Radical nephrectomy entails the removal of the Gerota's fascia and its content, including the kidney, perirenal fat, ipsilateral adrenal gland and lymph nodes [12]. It involves the removal of a significant number of nephrons. Partial Nephrectomy involves the removal of the diseased part of the kidney with a margin of normal tissue. It is a nephron-sparing surgery and involves sparing a large quantity of nephrons [12-14]. Partial Nephrectomy in an ideal patient preserves kidney function without increasing the risk of recurrence [15]. Some authorities have claimed that after partial nephrectomy or radical nephrectomy, there are compensatory changes in renal parenchymal mass and function but this depends on the age and glomerular filtration rate of the kidney left [16]. However, partial nephrectomy is technically more challenging and most patients present with tumours not amenable to partial Nephrectomy. Follow-up is also very difficult for patients in Africa because of poor compliance.

3.2 Pre-operative assessment

A preoperative visit was carried out to create rapport, allay anxiety, obtain good history, and proper examination. Patients with chronic renal failure who presented with hypertension may result from increased activity of the renin-angiotensin system, which may result in accelerated ischemic heart disease and peripheral vascular disease. These patients were adequately treated before surgery. Patients with oedema secondary to proteinuria, hypoalbuminaemia, and pericarditis usually in those with uraemia and autonomic neuropathies were also treated [2].

Urinalysis is most readily available, informative and inexpensive, it informs us of the presence of haematuria, Casts, bacteria, and white cells found on microscopy. Urine specific gravity is an index of renal tubular function, the ability to excrete concentrated urine indicates a good tubular function, whereas urinary osmolality fixed at that of plasma is indicative of renal disease, proteinuria greater than 150mg per day is abnormal and indicates severe glomerular damage. Glycosuria usually indicates the presence of diabetes mellitus.

A full blood count may reveal anaemia due to excessive haematuria (which is a sign and symptom of RCC) or reduced erythropoietin production by failing kidney function. Plasma creatinine and urea concentration provide information on the general kidney function, and creatinine clearance measures the glomerular filtration rate (GFR).

Chest x-ray, and echocardiogram (ECG), will be needed to rule out metastasis and other comorbidities. All patients should have blood grouped and crossed matched, due to the risk of significant intraoperative haemorrhage.

All co-morbidities should be ascertained and patient-optimized before surgery. Hypertension should be controlled, urinary tract infection treated with appropriate antibiotics and diabetes mellitus, a common cause of renal issues, should be

managed. These patients may also have fluid and electrolyte disturbances, this should be corrected as soon as possible and dialysis may be required. Preoperative iron or erythropoietin therapy may be used to increase haemoglobin levels for elective surgery, transfusion may not be required as these patients have chronic compensated anaemia, which can lead to cardiac failure.

3.3 Mechanism of action of drugs in patients with impaired renal function

Some drugs are eliminated unchanged in the urine. Non-depolarizing muscle relaxants are largely excreted by the kidneys, and the termination of a single dose is redistributed rather than excreted, but when maintenance doses are used it is excreted, therefore doses should be smaller than for patients with normal renal function and interval increased. A clinical monitor of a train of four will also help in this regard. Exceptions to this are atracurium and cisatracurium which are metabolized by ester hydrolysis and Hoffman elimination to inactive products [1].

Suxamethonium is metabolized by pseudocholinesterase and although levels of this enzyme are reduced in uraemia, values are rarely so low as to cause a prolonged block. Renal excretion is also of major importance for the elimination of cholinesterase inhibitors and elimination is impaired in renal function, to the same extent as of non-depolarizing muscle relaxants, other drugs largely excreted unchanged in the urine include atropine and glycopyrrolate but a single dose will not cause difficulties [1].

Most induction agents bound to albumin are usually affected by the reduction in albumin levels in uraemic patients, this results in an increase in the free fraction of the drug, and a reduction in the dose required to produce anaesthesia. Inhalational anaesthetic agents are preferred for maintenance, as they are excreted via the respiratory system.

Opioids are extensively metabolized in the liver, so the pharmacokinetics are largely unaltered by renal disease. However, both morphine and pethidine have active metabolites which are excreted by the kidneys and may accumulate in renal failure, doses should be reduced or avoided [1].

3.4 Intra-Operative

Table 1 shows that 84% had general anaesthesia while 16% had regional anaesthesia. The preferred form of anaesthesia is general anaesthesia, tracheal intubation and muscle relaxation with intermittent positive pressure ventilation for renal cell carcinoma, but in some occasions, a regional block may be performed with sedation in patients with lung metastasis or unfit for general anaesthesia as was carried out above. Four patients had lung metastasis and so were unfit for general anaesthesia.

Wide bore canular should be inserted due to the risk of haemorrhage for adequate hydration and transfusion if required. Induction is either with intravenous or inhalational agents, tracheal intubation facilitated with suxamethonium, and maintenance should be with inhalational agents, preferably halothane, and isoflurane. Atracurium or cis atracurium is the long-acting muscle relaxant of choice, especially for patients with impaired renal function [2,3].

Positioning is either supine or flank position. The flank has an effect on the respiratory system, causing a decrease in ventilation of the lower lung, while perfusion is increased resulting in ventilation-perfusion mismatch, and a decrease in thoracic compliance, tidal volume, vital capacity and functional residual capacity. This may result in low arterial oxygen saturation, which can be managed by increasing the inspired oxygen concentration or applying a small amount of positive end-expiratory pressure (PEEP) [2].

Using the kidney bridge or breaking the table may kink or compress the inferior vena cava, especially in the right lateral position, causing a decrease in venous return and therefore cardiac output. Adequate monitoring of the cardiovascular parameters is required during patient positioning. The patient should be well

secured on the table using straps and support to avoid rolling over during surgery.

Proper monitoring of these patients is important, especially the cardiovascular and respiratory systems due to problems of patient positioning [12]. The decision of invasive or non-invasive monitoring depends on the patient's preoperative state and the mass size. The surgery may take a few hours; therefore, temperature monitoring is important, and using forced air warmer, warm blankets, and heated mattresses may be used. Patients with end-stage renal disease may benefit from central venous pressure monitoring to monitor fluid input and output. Increased risk of major haemorrhage, therefore blood should be grouped and crossed matched, and invasive monitoring will be beneficial [3].

The kidney is a very vascular organ. Bleeding can occur from the renal artery, inferior vena cava or aberrant arteries. Blood conservative measures cell salvage, acute normovolaemic haemodilution and anti-fibrinolytic drugs. If secondary haemorrhage occurs postoperatively, it may require re-exploration to identify the cause.

3.5 Postoperative

Open surgeries are associated with postoperative pain, and adequate analgesia is required. All patients will benefit from a multi-modal mode of analgesia, epidural analgesia is very useful in managing postoperative pain except if there is coagulopathy, thrombocytopenia or haemodialysis with anticoagulation [4]. Controlled analgesia, a mixture of low-dose local anaesthesia and opioids provides adequate pain relief. Our centre uses a combination of plain bupivacaine and plain lidocaine. Local infiltration of the wound site with a long-acting local anaesthetic agent provides temporary pain relief and can also be used especially for those that had laparoscopic surgery. Non-steroidal anti-inflammatory drugs are relatively contraindicated because of their nephrotoxic properties. Paracetamol and oral opioids are useful adjuvants and can be used in patients with normal renal function [17].

Renal function will still be monitored postoperatively. Sometimes due to flank positioning, there may be myoglobinuria which can lead to AKI. Management involves the judicious use of fluids and diuretics [18,19]. In our centre all patients ambulate a day after the surgery with support. We also commence chest physiotherapy on the first postoperative day. This helps to prevent orthostatic pneumonia and lung collapse.

Conclusion

Perioperative management for renal surgery varies significantly depending on the disease and patient groups, the anaesthetics must take into consideration the various surgical approaches and be prepared to assist the surgeon.

List of Abbreviations

RCC: Renal Cell Carcinoma
IBM: International Business Machines Corporation
SPSS: Statistical Package for Social Sciences
GFR: Glomerular Filtration Rate
ECG: Electrocardiogram
PEEP: Positive End Expiratory Pressure
AKI: Acute Kidney Injury

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Disclosure of conflict of interest

The authors declare no conflict of interest

Statement of ethical approval

Ethical approval was sought and obtained from the hospital's ethical committee.

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