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Case Report

Anaesthesia Section

Hybrid Airway Management in an Elderly Patient with Chronic Kidney Disease on Maintenance Haemodialysis undergoing Lower Limb Orthopaedic Surgery: A Case Report

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ABSTRACT

Chronic Kidney Disease (CKD) is defined as kidney damage leading to a decline in Glomerular Filtration Rate (GFR) for three or more months. CKD affects multiple organ systems and poses significant perioperative risks due to impaired sodium and water excretion, fluid overload, pulmonary complications, cardiovascular dysfunction, electrolyte imbalance, and neurological manifestations. Perioperatively, patients with CKD exhibit increased incidences of hypotension, arrhythmias, pulmonary oedema, sepsis, and need for vasopressors or mechanical ventilation, resulting in markedly elevated morbidity and Intensive Care Unit (ICU) mortality compared to non CKD individuals. This case report describes a 69-year-old hypertensive male with End-Stage Renal Disease (ESRD) on haemodialysis, who presented with a right femoral neck fracture for hemiarthroplasty. His medical history included hypertension, CKD stage V, prior bladder carcinoma treated with intravesical Bacillus Calmette-Guérin, and recent deranged renal function requiring intensive dialysis. Preoperative evaluation revealed American Society of Anaesthesiologists-Physical Status (ASA-PS) class IV, Mallampati grade III with restricted neck movement and oral fibrosis, anaemia, electrolyte imbalance, and preserved left ventricular systolic function with diastolic dysfunction. General anaesthesia was induced with thiopentone, fentanyl, and midazolam. Initial airway management using a Guedel's airway was ineffective; oxygenation was subsequently secured with a second-generation supraglottic device, followed by successful intubation using a McCoy laryngoscope after administration of rocuronium. The patient was extubated on postoperative day 2 in critical care unit and later shifted to the ward after receiving 2 units of blood transfusion and 2 cycles of haemodialysis. This case highlights the anaesthetic challenges in ESRD patients with difficult airways and multiple co-morbidities, emphasising the need for careful planning and multidisciplinary management.

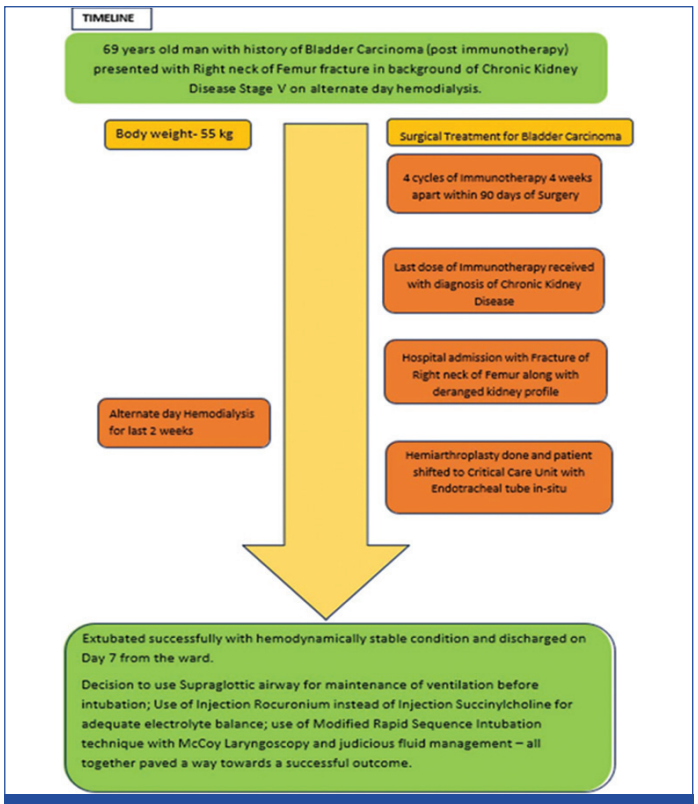
Keywords: Anaesthesia, Fracture, McCoy laryngoscope, Ventilation

CASE REPORT

A 69-year-old hypertensive, non diabetic, euthyroid male patient suffering from CKD stage V on alternate-day maintenance haemodialysis, and a history of bladder carcinoma 2 years back (post-immunotherapy), presented with right neck of femur fracture [Table/Fig-1] sustained 3 months ago. He had been hypertensive for 11 years and was receiving cilnidipine 20 mg once daily, prazosin 5 mg once daily, and clonidine 100 µg 3 times daily. He was diagnosed to renal impairment 4 years ago and had been receiving haemodialysis for the one past year.

There was a history of fall at home causing traumatic right femoral neck fracture, and he was scheduled for right-sided hemiarthroplasty. Patient received 4 cycles of immunotherapy with injection Bacillus Calmette-Guérin (last dose 2 years ago) for bladder carcinoma and had undergone transurethral resection of bladder tumour at that time. During the two weeks prior to surgery, he received intermittent haemodialysis due to deranged renal function tests and severe electrolyte abnormalities.

He had ASA-PS class IV. On the day of surgery, bilateral basal air entry in the lungs was decreased. There was no history of chest pain, palpitation or syncope. Clinical examination revealed Mallampati score III, restricted neck movement, inadequate mouth opening (<2 fingers), oral mucosal fibrosis, and thyromental distance <6 cm [Table/Fig-2]. Laboratory investigations revealed low haemoglobin, deranged renal function tests, and electrolyte imbalance [Table/Fig-3]. Electrocardiogram showed sinus tachycardia [Table/Fig-4]

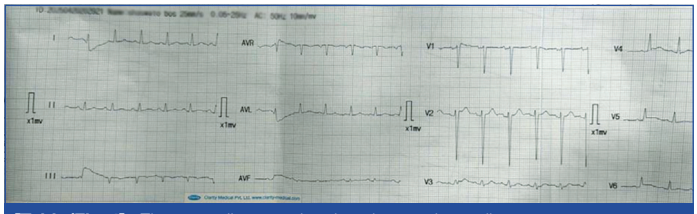


[Table/Fig-1]: Timeline of the case report.

[Table/Fig-2]: Assessment of airway and neck movement.

Test	Result	Reference range
Haemoglobin (Hb) (g/dL)	7.2	13.0-17.0
Haematocrit (Hct) (%)	22	38-50%
White Blood Cells (WBC) (/µL)	10.1×10³	4.0-11.0×10³
Platelets (PLT) (/µL)	160×10³	150-400×10³
Neutrophils (%)	68	40-70
Lymphocytes (%)	26	20-40
Monocytes (%)	5	2-8
Eosinophils (%)	1	1-4
Basophils (%)	0	0-1
Mean Corpuscular Volume (MCV) (fL)	90	80-100
Mean Corpuscular Haemoglobin (MCH) (pg)	21	27-33
Sodium (Na^+) (mmol/L)	135	135-145
Potassium (K^+) (mmol/L)	5.3	3.5-5.1
Chloride (Cl^-) (mmol/L)	111	98-107
Bicarbonate (HCO_3^-) (mmol/L)	24	22-28
Blood Urea Nitrogen (BUN) (mg/dL)	105	7-20
Creatinine (mg/dL)	3.9	0.7-1.2
Glucose (Fasting) (mg/dL)	95	70-100
Calcium (Ca^{2+}) (mg/dL)	7.0	8.5-10.5
Alanine Aminotransferase (ALT) (U/L)	25	7-56
Aspartate Aminotransferase (AST) (U/L)	22	10-40
Alkaline Phosphatase (ALP) (U/L)	80	44-147
Total Bilirubin (mg/dL)	0.8	0.1-1.2
Albumin (g/dL)	2.6	3.5-5.0
Total Protein (g/dL)	5.0	6.0-8.3
Total Cholesterol (mg/dL)	180	<200
LDL Cholesterol (mg/dL)	110	<130
HDL Cholesterol (mg/dL)	55	>40 (men); >50 (women)
Triglycerides (mg/dL)	130	<150
HbA1c (Glycated Haemoglobin) (%)	5.4	4.0-5.6
C-Reactive Protein (CRP) (mg/mL)	9.2	<3.0
Thyroid Stimulating Hormone (TSH) (µIU/mL)	2.0	0.4-4.0
Vitamin D (25-OH) (ng/mL)	21	30-100
Ferritin (ng/mL)	100	30-400 (men)

[Table/Fig-3]: Preoperative laboratory findings.



[Table/Fig-4]: Electrocardiogram showing sinus tachycardia.

and 2-dimensional echocardiography depicted 62% left ventricular ejection fraction with grade 1 diastolic dysfunction and no regional wall motion abnormalities.

After admission to the operation room, standard anaesthesia monitors were attached and oxygen supplementation was given through nasal cannula at 4 L/min. Peripheral intravenous lines were placed followed by placement of an arterial line and central venous line for administration of fluids and drugs and for invasive blood pressure and central venous pressure monitoring, respectively. Patient received preoxygenation with 100% FiO_2 for 3 minutes, and ramping was done to facilitate intubation.

General anaesthesia was given with intravenous injection ondansetron 0.1 mg/kg, midazolam 0.05 mg/kg, fentanyl 1 mcg/kg, and thiopentone 4 mg/kg, intravenously until loss of response to verbal command. Due to inadequate chest rise, Guedel's airway no. 4 was introduced in order to prevent tongue fall-back and for overall airway protection. This manoeuvre failed to improve ventilation; therefore, 2nd-generation Laryngeal Mask Airway (LMA) (i-gel) was introduced after removal of the Guedel's airway for proper oxygenation and maintaining ventilation [1].

Injection rocuronium 1.2 mg/kg was given as muscle relaxant, and patient was intubated using McCoy Laryngoscopy blade with 7.5 mm ID cuffed endotracheal tube [2] [Table/Fig-5a]. After confirmation of the tube by 5 point auscultation, tube was fixed and patient was placed on volume-controlled ventilation with 50% FiO_2, tidal volume 425 mL, respiratory rate 14/min, PEEP 4 cm H_2O, and an I:E ratio of 1:3.

Anaesthesia was maintained with oxygen, nitrous oxide, isoflurane, injection vecuronium 0.06 mg/kg, injection paracetamol 15 mg/kg for analgesia, and maintenance fluid consisting of 0.9% normal saline at 20 mL/hr throughout the procedure.

After completion of surgery, the patient was reversed and extubated, then shifted to Critical Care Unit for postoperative monitoring. He was subsequently extubated on postoperative day 2. There were no major complications during the perioperative period, as revealed by the vital parameters shown in [Table/Fig-5b,c]. He received 2 units of packed red blood cells and underwent 2 cycles of haemodialysis, and eventually stepped down to the ward for further management.

[Table/Fig-5]: a) Patient intubated with McCoy laryngoscope blade; b) Intraoperative vitals; c) Postoperative Day 2 vitals postextubation.

DISCUSSION

The CKD patients usually present with structural or functional abnormalities of the kidneys lasting for more than 3 months, with fewer than 40% of nephrons functioning. Classification aids risk stratification and is based on eGFR and the presence of proteinuria as per KDIGO (Kidney Disease: Improving Global Outcomes) classification [1]. CKD affects multiple organ system, posing threats and complications during perioperative period [2].

Impaired sodium and water excretion in CKD leads to increased hydrostatic pressure and clinical manifestations of fluid overload, such as pulmonary oedema and pleural effusion. Reduced lung compliance, decreased functional residual capacity, and increased ventilation-perfusion mismatch may result in hypoxia and hypotension in the perioperative setting. Increased baroreceptor sensitivity and sympathetic overactivity, along with circulating inflammatory mediators, hypercoagulability, arterial calcification, and endothelial dysfunction, increase the risk of ischaemic heart disease, myocardial depression, and arrhythmias. Convulsions due to uraemia, electrolyte imbalance, chronic metabolic acidosis, and hyperkalaemia are common in CKD patients [3]. Renal impairment therefore significantly affects perioperative management and outcomes due to the systemic effects associated with the disease [4].

Patients on chronic haemodialysis are prone to co-morbidities and have a higher rate of anaesthetic complications than the general population. Cardiovascular disease, coagulopathy, frailty, and polypharmacy are high in this group. ICU mortality is reported to be 50% higher than in individuals without CKD [5,6]. They are more susceptible to perioperative complications like hypotension, pulmonary oedema, arrhythmia, neurological injury, haemorrhage, and sepsis [7,8]. Requirement for perioperative vasopressors and mechanical ventilation is also significantly increased in chronic dialysis patients [9]. Adverse drug reactions are often attributed to the reduced drug clearance, which is usually proportional to GFR. Patients with CKD frequently suffer from aspiration risk, primarily due to gastroparesis. In this scenario, a modified rapid sequence induction with rocuronium instead of succinylcholine, followed by tracheal intubation, is preferable. Succinylcholine may be used if serum potassium levels are below 5 mEq/L. Rocuronium and vecuronium are viable options, although their effects may last longer. However, for minor, short-duration procedures in patients without symptoms of gastroesophageal reflux, spontaneous ventilation using a supraglottic airway device (e.g. i-gel) is a suitable option [10].

Propofol and thiopental are considered safe agents for induction of general anaesthesia. By contrast, etomidate is preferred in patients with Ischaemic Heart Disease (IHD) or impaired ventricular function due to its cardiovascular stability. For maintenance, desflurane is considered a safe, and isoflurane undergoes minimal metabolism, making it unlikely to harm the kidneys. Atracurium and cisatracurium are often used neuromuscular blocking agents for their organ-independent clearance, but CKD-associated acidaemia can affect their metabolism [11]. For the anaesthetic management of a 19-year-old male patient with Down syndrome, hypothyroidism with CKD stage 4 who underwent a major lower limb orthopaedic surgery, Naik et al., [12] used atracurium for general anaesthesia. Kore et al., [13], in their study of a 10-year-old female with CKD and right renal agenesis complicated by Dilated Cardiomyopathy (DCM) undergoing lower limb surgery, achieved induction using etomidate and used cisatracurium as the muscle relaxant.

In the current case, hybrid airway management consisted of use of Guedel's airway no. 4 followed by introduction of an i-gel (after removal of the Guedel's airway) for proper oxygenation and maintaining ventilation, and subsequent intubation using McCoy Laryngoscopy blade with 7.5 mm ID cuffed endotracheal tube. Thick tongue, high glottis and oral mucosal fibrosis (owing to smoking) made the airway management in this patient. Anaesthetic management in CKD require careful perioperative planning and appropriate drug selection considering the altered metabolism and excretion, maintain optimal hydration with goal-directed fluid therapy, avoiding nephrotoxic drugs and agents, and close monitoring of electrolytes and acid-base balance, which are crucial for preventing perioperative renal deterioration [1]. This case highlights the importance of individualised and meticulous anaesthetic planning keeping in mind the critical condition of the patient who is a known case of CKD on frequent haemodialysis, hypoalbuminaemia, a past history of bladder carcinoma postimmunotherapy, and an anticipated difficult airway planned for a major surgery.

Preoperative evaluation focused on optimising renal function, correcting anaemia and electrolyte imbalances, assessing cardiovascular risks, reviewing medications, and timing for surgery in relation to dialysis timing [14,15]. Intraoperatively, careful fluid management to avoid overload, use of renal-safe anaesthetic agents, and vigilant monitoring of electrolytes, especially potassium was done. Anaesthetic concerns were also followed postoperatively in regards to aseptic care, pain management, and close monitoring of renal, fluid, and cardiovascular status [16]. A multidisciplinary approach along with methodical perioperative management including doctors from the departments of Nephrology, Endocrinology, Orthopaedic Surgery, and Critical Care significantly improved the outcome in this patient.

CONCLUSION(S)

The CKD poses significant challenges for anaesthetists due to various physiological and pharmacological factors that complicate anaesthesia management. With the prevalence of CKD increasing, thorough preoperative evaluation, careful intraoperative monitoring, and comprehensive postoperative care are essential to minimise complications and enhance patient outcomes. Key concerns include increased perioperative risks, the complexity of anaesthetic management, increased ICU admissions and healthcare costs, as well as ethical and logistical issues related to dialysis. As the number of CKD patients continues to grow, anaesthetists must be equipped to manage these high-risk cases effectively.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) has/have given his/her/their consent for their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published, and that efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

REFERENCES

[1] Chowdhury S, McLure H. Chronic kidney disease and anaesthesia. BJA Education. 2022;22(8):321-28.
[2] Stewart P, Harris D. Anaesthesia and chronic renal failure [Internet]; Available from: https://resources.wfsahq.org/wp-content/uploads/uia11-ANAESTHESIA-AND-CHRONIC-RENAL-FAILURE.pdf.
[3] Hong WK, Kim S, Gong HS. Fracture management in chronic kidney disease: Challenges and considerations for orthopedic surgeons. Clin Orthop Surg. 2024;16(2):173.
[4] Wagener G, Brentjens TE. Anesthetic concerns in patients presenting with renal failure. Anesthesiology Clinics. 2010;28(1):39-54.
[5] Chan M, Ostermann M. Outcomes of chronic hemodialysis patients in the intensive care unit. Crit Care Res Pract. 2013;2013:01-07.
[6] Strijack B, Mojica J, Sood M, Komenda P, Bueti J, Reslerova M, et al. Outcomes of chronic dialysis patients admitted to the intensive care unit. J Am Soc Nephrol. 2009;20(11):2441-7.
[7] Deng J, Lenart J, Applegate RL. General anesthesia soon after dialysis may increase postoperative hypotension - A pilot study. Heart Lung Vessel. 2014;6(1):52-59.
[8] McAdams-DeMarco M, Law A, King E, Orandi B, Salter M, Gupta N, et al. Frailty and mortality in kidney transplant recipients. Am J Transplant. 2015;15(1):149-54.
[9] Deutsch E, Bernstein RC, Addonizio VP, Kussmaul WG. Coronary artery bypass surgery in patients on chronic hemodialysis. Ann Intern Med. 1989;110(5):369-72.
[10] Guruswamy V, Barbour R. Anaesthesia for children with renal disease. BJA Education. 2015;15(6):294-98.
[11] Dzanibe P, Pillay D. Anaesthetic considerations in chronic kidney disease. School of Clinical Medicine, University of Kwazulu-Natal; 2025. [cited 2025 Sep 05]. Available from: https://anaesthetics.ukzn.ac.za/wp-content/uploads/2025/06/2025-04-11-Anaesthetic-Considerations-for-CKD-P-Dzanibe.pdf.
[12] Naik S, Prahalad P, Kate S. Anaesthetic management of a case of down syndrome with chronic kidney disease undergoing major orthopaedic surgery. J Anaesthesia and Pain. 2023;4(2):35-37.
[13] Kore S, Sharma V, Garud I. Anesthetic challenges in a pediatric patient with chronic kidney disease complicated by dilated cardiomyopathy undergoing non-cardiac surgery. Cureus. 2024;16(9): e70477.
[14] Levin A. Clinical epidemiology of cardiovascular disease in chronic kidney disease prior to dialysis. Semin Dial. 2003;16(2):101-05.

[15] Sarnak MJ. Cardiovascular complications in chronic kidney disease. Am J Kidney Dis. 2003;41(5 Suppl):11-17.

[16] Whelton A. Nephrotoxicity of nonsteroidal anti-inflammatory drugs: Physiologic foundations and clinical implications. Am J Med. 1999;106(5):13S-24S.

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