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Anaesthetic management of hypocalcemia in a radical nephrectomy and inferior vena cava thrombectomy following multiple blood transfusion - A Case Report.

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Abstract

Introduction: Renal neoplasms involve inferior vena cava (IVC) and distant metastasis can extend to the renal vein, inFra hepatic and intrahepatic rarely up to the right atrium. Considerable morbidity and mortality exist in these surgeries, even with advanced preoperative diagnostic modalities, improved Anaesthesiology, and perioperative care, due to intra-operative massive bleeding and embolization in surgical manipulation of thrombus, leading to the cardiovascular, and cerebral embolic effects.

Presentation:A 42-year-old male patient, moderately built weighing 70kg, came with complaints of backache for 4-5years, a history of weight loss, a history of one episode of haematuria and the patient was diagnosed as renal cell Carcinoma. Computed tomography (CT) scan showed a mass in the left midpole of kidney infiltrating into the left renal vein and inferior Ven cava upto inFra hepatic level and involvement of iliac fossa.

Discussion: Liver mobilization depending on the degree of the thrombus varies among individual patients during surgical excision of tumor. Exposure of the IVC was restricted to the inFrahepatic region,the combination of hemorrhage during thrombectomy, venous occlusion, and embolic events in many situations result in substantial hypotension and hemodynamic instability.Resuscitation of haemorrhage by multiple blood transfusion, causing hypocalcaemia delays the post-operative recovery.

Conclusion: In this case report,we are presenting a case of radical nephrectomy and inferior venacava Thrombectomy, massive blood transfusion during surgery causing acute hypocalcaemia and post-operative complications. Anaesthetic management of

hypocalcaemia, diagnosis and management of post-operative complication.

Keywords: Hypocalcaemia, massive blood transfusion, IVC thrombus,radicalnephrectomy.

Introduction

Renal cell carcinoma arising from the kidney as primary neoplasm involves perirenal structures over a time duration. Renal neoplasms involve inferior vena cava(IVC) and distant metastasis can extend to the renal vein, inFra hepatic and intrahepatic rarely upto the right atrium. Renal cell carcinoma (RCC) is one of the top 10 cancers in the United States, and a 10–15% incidence of renal vein and inferior vena cava thrombus was noticed. The most effective therapeutic option in a patient with renal cell carcinoma and IVC thrombus including inFrahepatic extension is radical nephrectomy and IVC thrombectomy. Considerable morbidity and mortality exist in these surgeries, even with advanced preoperative diagnostic modalities, improved Anaesthesiology, and perioperative care, due tointra-operative massive bleeding and embolization in surgical manipulation of thrombus, leading to the cardiovascular, and cerebral embolic effects. These surgeries require massive blood transfusion and fluid administration leads to hypocalcemia and other electrolyte imbalances. Hypocalcemia due to high citrate dosage in massive transfusion leads to delayed postoperative recovery and complications.

This is a case of renal cell carcinoma with inFra hepatic IVC thrombus for radical nephrectomy and IVC Thrombectomy managed with multiple blood transfusions.

Case report

A 42-year-old male patient, moderately built weighing 70kg, came with complaints of backache for 4-5years, a history of weight loss, a history of one episode of haematuria and the patient was diagnosed as renal cell Carcinoma. Computed tomography (CT) scan showed a mass in the left midpole of kidney infiltrating into the left renal vein and inferior venacava upto inFrahepatic level and involvement of iliac fossa. The patient was scheduled for left radical nephrectomy and IVC thrombectomy.

The patient was evaluated preoperatively as per the department protocol. The patient was a known case of insulin dependent diabetes mellitus, newly diagnosed and was on regular medication, tablet Vildagliptin 50mg twice daily. Blood investigations of the patient showed mild anemia, raised serum creatinine and HbA1c of 6.6%. Electrocardiography showed right bundle branch block and sinus rhythm. Echocardiography showed good left ventricular systolic function with an ejection fraction of 60%, trivial tricuspid, and mitral regurgitation.

The airway assessment revealed adequate mouth opening (Mallam Pati classification II), inter incisors distance of 3 fingers width and thyromental distance of 5cm with adequate neck extension. The patient was assessed and anticipated to intraoperative bleeding, with preoperative preservation of blood and blood components. The patient was Premedicated with anxiolytics and antiacids before the day of surgery.

The patient was shifted to the operation theatre.The baseline monitors such as peripheral oxygen saturation, standard 5-lead electrocardiography, and noninvasive blood pressure were connected.

The patient was secured with two 18-gauge IV (intravenous) cannulas for venous access. The patient was pre-oxygenated for 3 minutes and premedicated with Glycopyrrolate 0.2mg, Midazolam 1mg, Fentanyl

50mcgi.v.and was induced General Anaesthesia with Propofol 100mg intravenously.

After confirmation of mask ventilation, inj. Succinylcholine 100mg was administered, intravenously. The airway was secured with endotracheal intubation post laryngoscopy using the oral endotracheal tube of the size of 8.0mm internal diameter. The air entry equally to both the lungs was confirmed with the five-point auscultation method. Inj.

Cis-atracurium.i.v was given to achieve muscle relaxation. The patient was anticipated to have intraoperative bleeding and secured a left radial arterial catheter and central venous catheterization to the right internal jugular vein, to monitor arterial blood pressure and central venous pressure respectively.

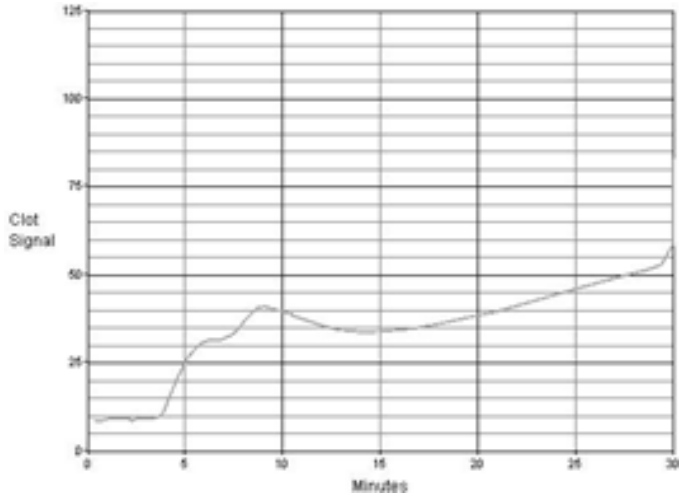
Ventilation was maintained over volume-controlled mode, with a tidal volume of 480ml, a fraction of inspired oxygen (FiO2) of 40%, a respiratory rate of 14 cycles per minute, and an EtCO2 monitored throughout surgery. Maintenance of depth of anesthesia by sevoflurane 2%, and intermittent inj.Cisatracurium 1mg i.v.

The surgical access of renal mass, perirenal dissection, and the intervention of IVC thrombus by clamping IVC superior and inferior to the thrombus and right renal vein led to severe blood loss of and hemodynamic instability. The patient was resuscitated with volume expanders including twenty-three units of Normal saline, nineteen units of Plasmalyte, and six units of Ringer lactate.

The blood loss was replaced by massive blood transfusion and other blood components including twenty units of packed red cells, thirteen units of fresh frozen plasma, and five units of platelets.Hemodynamics was stabilized by vasopressors and inotropes infusion.

The patient coagulation status was assessed by Son clot signature analysis.

Graph 1:



Sono clot signature analysis intra-operatively resulted, in an ACT value of 226 seconds (normal value in the range of 90-120 seconds).

Intraoperative arterial blood gas analysis reveals hypocalcaemia of 0.59mmol/L,0.90 mmol/L,0.57 mmol/L, 0.52 mmol/L, 0.49 mmol/l, and 0.47 mmol/L of serum ionized calcium levels monitored each hourly. A calcium gluconate infusion of 2gm was administered, hyperkalemia was treated by levo salbutamol nebulization, and insulin infusion was for hyperglycemia. The patient was given albumin infusion intravenously in correction to hypoalbuminemia. The patient was planned for postoperative mechanical ventilation. Serum electrolytes correction was given to the patient intravenously in the postoperative period.

Table 1:

	POD 0	POD 1	POD 2	POD 3	POD 4
Serum calcium(mmol/L)	1.25	1.45	1.57	1.57	1.75
Serum Sodium(mEq/L)	146	147	147	146	146

Serum Potassium(mEq/L)	5.4	4.1	4.2	4.1	4.1
Serum Chloride(mEq/L)	105	116	117	114	114
Serum creatinine(mg/dl)	0.85	1.36	2.26	1.81	1.57

POD= Post Operative Day.

The patient had an episode of desaturation, and tachycardia on the second day of postoperative time period,and was diagnosed as pneumothorax using chest X-ray radiography, the pneumothorax occurred earlier unilaterally andthen bilaterally, the pneumothorax was managed by inserting intercostal drainage. The patient continued on mechanical ventilator support, recovered from pneumothorax, tapered ventilatory support, and the patient was extubated. The patient gradually recovered, hemodynamically stable and shifted to ward. The patient had shown improvement in serum calcium 2.1mmol/L and in General physical condition and was discharged and asked for a follow-up.

Discussion

Renal cell carcinoma is the most common type of renal cancer, usually occurring between the age of 50 and 70yrs.Certain etiology of renal cell carcinoma are smoking, being overweight, pain medications like aspirin, ibuprofen, or acetaminophen for a long time. Other causes like hepatitis C infections, occupational exposures to dyes, acquired cystic kidney disease, inherited disorders such as hereditary leiomyomatosis and renal cell carcinoma, especially Von Hippel-Lindau disorder.

Common complications of primary tumors, are associated paraneoplastic syndromes, and metastasis include Hypertension, Hypercalcemia, Budd Chiari syndrome, hepatic vein thrombosis, and Acute and chronic renal failure. Poor prognostic markers are elevated Lactate dehydrogenase, low haemoglobin level, and elevated corrected serum calcium levels.Transfusion of packed red cells was an independent predictor of severe hypocalcemia and ionized calcium decreased in a dose-dependent relationship with transfusion of the packed red cell[(1)].

The surgical strategy of Renal cell carcinoma and thrombus formation depends on the extension of the tumor and thrombus [(2)].

Level 0:

Definition

Tumor thrombus is limited to the renal vein, clinically detected, and during thrombus assessment.

Surgical strategy

Radical nephrectomy of renal cell carcinoma

Level I:

Definition

Tumor thrombus extends into IVC with <2 cm above the renal vein Surgical strategy: Tumor thrombus could be extruded to the renal vein and then radical nephrectomy

Level II:

Definition

Tumor thrombus extends into IVC >2 cm above the renal vein but below the hepatic veins.

Surgical strategy

The traction of the liver is required; blocking up the section of IVC underneath the hepatic vein.

Level III:

Definition

Tumor thrombus which extends above the hepatic veins but below the diaphragm.

- IIIa: retro hepatic IVC below major hepatic veins
- IIIb: retro hepatic IVC reaching the Ostia of major hepatic veins

- IIIc: retro hepatic IVC and extending above major hepatic veins, but below the diaphragm
- IIId: suprahepatic and supradiaphragmatic IVC, reaching intrapericardial IVC, but infra-atrial (outside the right heart) [3].

Surgical strategy

The mobilization of the liver; vena-venous bypass is required

Level IV:

Definition

Tumor thrombus is above the diaphragm,including atrial thrombus.

Surgical strategy

Intraoperative extracorporeal circulation is requisite.

Liver mobilization depending on the degree of the thrombus varies among individual patients. Exposure of the IVC was restricted to the inFra hepatic region and applying proximal venous clamp which was analyzed for the space between thrombus extension and origin of hepatic veins preoperatively by imaging techniques. The renal vein opposite the tumor, the infrarenal IVC, and the IVC between the origin of the hepatic veins and the limit of thrombus extension were all consecutively clamped [4].

The combination of hemorrhage during thrombectomy, venous occlusion, and embolic events in many situations result in substantial hypotension. Hemorrhage and embolism-related hypotension may be quickly identified by the surgical team or by intraoperative transesophageal echocardiography (TEE), invasive blood pressure monitoring, and central venous pressure monitoring [5].

Surgical complications such as thrombus or air embolism, massive intraoperative bleeding, and hemodynamic instability are more concerned in view of postoperative complications and recovery [6].Hemorrhage with hypotension associated with Thrombocytopenia, impaired clotting factors, and low fibrinogen level.Hemorrhage is due to activation of blood coagulation byHematological ornon-hematological malignancies through the release of procoagulant factors, activation of the anti-fibrinolytics, which in most patients favors the formation of peripheral clots, and risk of bleeding during surgeries [7]. Hypercoagulable state causes consumptive coagulopathy and hypocalcaemia.Patients with tumor-related factors,vascularity changes, and hypervascularization of the tumor itself is an increased risk of bleeding [8].

Hemodynamic changes due to the procedure of IVC thrombectomy, increase in SVV as IVC is clamped, and decreased MAP and CI. There is an increased necessity for the utility of vasopressors and post-operative hypervolemia [9]. Massive fluid resuscitation is more significant, hypothermia, hypotension, acidemia, and massive transfusion alonelead to dilutional coagulopathy.

Citrate toxicity is more concerned in massive blood transfusions, as citrate binds serum calcium and lowers the ionized plasma calcium concentration. Citrate is metabolized by the liver, which is slowed by hypothermia and hypotension due to massive transfusion and increased bleeding [10]. Massive transfusion causes increased circulatory citrate, citrate metabolized to bicarbonate causing alkalosis, reflex increased production of 2,3 DPG. Hypoalbuminemia due to hemorrhage or dilutional changes of fluid resuscitation also causes hypocalcaemia.

Patients with hypocalcemia have a varying degree of neuromuscular excitability features such as Paresthesia, muscle spasms, cramps, tetany, and circumoral

numbness are the most typical symptoms of hypocalcemia[11].

Laryngospasm, neuromuscular agitation, cognitive decline, personality changes, longer QT intervals, electrocardiographic abnormalities that resemble myocardial infarction, cardiac arrhythmia,and heart failure are further symptoms of hypocalcemia [12,13]. Patients with hypocalcaemia may exhibit Chvostek's and Trousseau's symptoms.

The trousseau's sign is the carpopedal spasm seen in hypo calcemic patients after the administration of an inflated blood pressure cuff over systolic pressure for 3 minutes[14].

Chvetok's sign is a facial twitch elicited by tapping on the facial nerve just anterior to the earlobe, just below the zygomatic arch with the mouth slightly open.

Lethargy, confusions, laryngospasms and seizures, and reversible heart failure are signs of severe hypocalcemia.

Mechanical ventilation weaning and extubationare delayed due to hypocalcaemia, as hypocalcaemia causes fatigue of respiratory muscles and laryngospasm and hypercapnic respiratory failure. Correction of hypocalcaemia is more significant in the recovery of the patient from ventilator support[15].

The most common causes of hypocalcaemia is vitamin D deficiency, endocrine disorders such as hypoparathyroidism due to thyroid surgery, autoimmune diseases and genetic causes. Primary tumor metastasis, heavy metal occupational exposure, citrated blood transfusion, critical illness, renal disorders and end-stage liver diseases also causes hypocalcemia [14].

The onset of acute hypocalcimedin major surgery is life threatening and increases risk of Perioperative adverse events such as cardiac arrythmias and seizures. Serum calcium has to be corrected by intravenous administration of 10% of calcium gluconate (90mg per 10ml of 10% calcium gluconate) 10 -20ml diluted in 5% dextrose over 10-20 minutes [11].

Conclusion

The patientswho undergo surgery for radical nephrectomy and IVC Thrombectomy must have multi-Speciality evaluation. The risk of intraoperative bleeding, haemodynamic instability, coagulopathy, dyselectrolytemia, complications of fluid resuscitation, and multiple blood transfusions. Calcium and other electrolytes correction are important in weaning ventilator and extubation. Unanticipated hypocalcemia worsens the postoperative outcome.

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Abbreviations

IVC= Inferior venacava

TEE=Transesophageal echocardiography

SVV=Stroke volume variation

MAP=Mean arterial pressure

CI=Cardiac Index

References

1. Douville NJ, Davis R, Jewell E, et al. Volume of packed red blood cells and fresh frozen plasma is associated with intraoperative hypocalcaemia during large volume intraoperative transfusion. Transfus Med. 2021;31(6):447-458. doi:10.1111/tme.12798

2. Bluet ML, Leibovich BC, Lohse CM, Cheville JC, Zincke H. The Mayo Clinic experience with surgical management, complications and outcome for patients with renal cell carcinoma and venous tumour

Thrombus. BJU Int. 2004;94(1):33-41. doi:10.1111/j.1464-410X.2004. 04897.x

3. He via V, Ciancio G, Gómez V, Álvarez S, Díez-Nicolás V, Burgos FJ. Surgical technique for the treatment of renal cell carcinoma with inferior vena cava tumor thrombus: tips, tricks and oncological results. Springer plus. 2016; 5:132. Published 2016 Feb 20. doi:10.1186/s40064-016-1825-1.

4. Wang Y, Wang X, Chang Y. Radical nephrectomy combined with removal of tumor thrombus from inferior vena cava under real-time monitoring with transesophageal echocardiography: A case report. Medicine (Baltimore). 2020;99(11): e19392. doi:10.1097/MD.0000000000019392.

5. Garg H, Kaushik D, Hui D, et al. Haemodynamic changes during radical nephrectomy with inferior vena cava Thrombectomy: A pilot study. BJUI Compass. 2022;3(5):327-330. Published 2022 Apr 28. doi:10.1002/bco2.154.

6. Gharde P, Rastogi A, Kumar S, Choudhary SK. Management of acute intra-operative ThromBo embolism in renal cell carcinoma. Anesth Essays Res. 2015;9(3):417-419. doi:10.4103/0259-1162.158011.

7. Noble S, Pasi J. Epidemiology and pathophysiology of cancer-associated thrombosis. Br J Cancer. 2010;102 Suppl 1(Suppl 1): S2-S9. doi: 10.1038/sj.bjc.6605599

8. Lison S, Weiss G, Spannagel M, Heindl B. Postoperative changes in procoagulant factors after major surgery. Blood Coagul Fibrinolysis. 2011;22(3):190-196. doi:10.1097/MBC.0b013e328343f7be

9. Ratti F, Cipriani F, Rein eke R, et al. Intraoperative monitoring of stroke volume variation versus central venous pressure in laparoscopic liver surgery: a randomized prospective comparative trial. HPB (Oxford). 2016;18(2):136-144. doi: 10.1016/j.hpb.2015.09.005

10. Li K, Xu Y. Citrate metabolism in blood transfusions and its relationship due to metabolic alkalosis and respiratory acidosis. Int J Clin Exp Med. 2015;8(4):6578-6584. Published 2015 Apr 15.

11. Cooper MS, Gittoes NJ. Diagnosis and management of hypocalcaemia [published correction appears in BMJ. 2008 Jun 28;336(7659): doi: 10.1136/bmj. a334]. BMJ.2008;336(7656):1298-1302. doi:10.1136/bmj.39582.589433.BE

12. Onwudiwe, Oyiyechukwu& Barakat, Shadi. (2022). Hypocalcemia: An Unusual Presentation: Case Report. Journal of Clinical Research and Reports. 12. 01-02. 10.31579/2690-1919/286.

13. Shoback D. Clinical practice. Hypoparathyroidism. N Engl J Med. 2008;359(4):391-403. doi:10.1056/NEJMcp0803050

14. Fong J, Khan A. Hypocalcemia: updates in diagnosis and management for primary care. Can Fam Physician. 2012;58(2):158-162.

15. Roussos C, Koutsoukou A. Respiratory failure. Eur Respir J Suppl. 2003; 47:3s-14s. doi:10.1183/09031936.03.00038503