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CASE REPORT

MANAGING DUAL PATHOLOGIES: NEPHRECTOMY FOR RENAL CELL CARCINOMA IN A PATIENT WITH SEVERE TRICUSPID VALVE REGURGITATION

Stanoevska M[1], Gavrilovska Brzanov A[1], Petrusheva Panovska A[1],Temelkovska M[1],Chavkoska M[2]

[1]*University Clinic for Traumatology, Orthopedics, Anesthesiology, Resuscitation, Intensive Care and Emergency Center- Skopje, Department of Anesthesiology, Resuscitation and Intensive Care Medicine, "Ss. Cyril and Methodius" University - Skopje, Faculty of Medicine*
[2]*General Hospital of Ohrid- Department of Anesthesiology and Intensive Care Medicine*

Abstract

Renal cell carcinoma (RCC) is the most prevalent form of kidney cancer.Tricuspid regurgitation is a condition marked by the reverse flow of blood from the right ventricle into the right atrium and necessitates thorough assessment to ascertain its severity and effect on heart function. In this case, we present a 57-years-old male patient with symptomatic renal cell carcinoma and a severe tricuspid valve regurgitation. The performed open nephrectomy went uneventfully. While the patient was successfully and safely managed from an anesthesiology standpoint despite his comorbidities, performing the procedure in a resource-limited setting posed significant challenges. In such environments, the lack of immediate access to advanced hemodynamic monitoring, cardiothoracic surgical support and perioperative cardiac interventions increases the complexity of managing patients with dual pathologies. Ideally, conducting nephrectomy in an operating theater equipped for simultaneous surgical interventions, addressing both the renal pathology and potential worsening of tricuspid valve regurgitation, with a cardiothoracic team on standby, would have provided a safer approach. However, in settings with constrained resources, optimizing intraoperative management, ensuring rigorous hemodynamic monitoring, and coordinating multidisciplinary teams within the available infrastructure become critical for achieving favorable outcomes.

Key Words: *renal cell carcinoma, simultaneous surgery, tricuspid valve regurgitation.*

Introduction

Renal cell carcinoma (RCC) is the most prevalent form of kidney cancer, originating from the epithelial cells of the renal tubules. It accounts for approximately 85% of neoplasms arising from the kidney (1). RCC exhibits a variety of histological subtypes and may be presented with symptoms such as hematuria, flank pain and a palpable mass. A diagnosis is often made through

imaging techniques and confirmed with a biopsy. Treatment options vary based on the tumor's stage and molecular features, and may include surgery, targeted therapy or immunotherapy (2). Surgical resection continues to be the main treatment for this condition. In cases where tumors are widespread, loco-regional therapies can still play an important role in alleviating symptoms associated with the primary tumor or ectopic hormone production. Nevertheless, systemic treatments have demonstrated limited efficacy (3).

Tricuspid regurgitation is condition which contributing factors may include valve degeneration, dilation of the annulus, or damage caused by conditions like pulmonary hypertension or infective endocarditis. The degree of tricuspid valve regurgitation (TR) indicates the extent of blood flow back from the right ventricle to the right atrium caused by inadequate closure of the tricuspid valve. Recent advancements in understanding the causes and impact of mitral regurgitation on patients' overall health have sparked renewed attention to the often “forgotten” tricuspid valve and tricuspid regurgitation (TR) (4). Although mild TR is commonly seen in healthy individuals, more severe forms of TR have been linked to significant morbidity and mortality, with up to one-third of patients with severe TR dying within a year of diagnosis.

Case Presentation

We present the case of a 57-years-old male patient, a smoker with a BMI of 26, classified as ASA class 3 and a Mallampati score of 3, without a medication or food allergies. He was admitted to the Urology Clinic for open nephrectomy due to renal cell carcinoma measuring 136x105mm revealed on a CT scan with macroscopic hematuria.

During pre-surgical preparations, the patient exhibited signs of right-sided heart failure, including neck pulsations from distended and pulsatile jugular veins and exercise intolerance. He has been receiving multiple medications, including a beta blocker, diuretics, antihyperlipidemic agents and an oral anticoagulant for an underlying condition, which will be discussed further. Auscultation revealed vesicular breath sounds and a systolic murmur over the tricuspid valve. A cardiologist was consulted immediately, and appropriate investigations were carried out. An ECG revealed atrial fibrillation with a rapid ventricular response, while a chest X-ray showed cardiomegaly. Echocardiography revealed a 50% ejection fraction of the left ventricle without segmental wall-motion abnormalities, dominant right heart failure with enlarged right-sided chambers and severe tricuspid regurgitation. Additionally, the inferior vena cava was dilated to 25mm without inspiratory collapse, and pulmonary artery systolic pressure was 75mmHg.

The left ventricle was reduced in size to 47mm (the normal size for men is below 58mm), due to the septum being displaced by the enlarged right ventricle. On the other hand, the left atrium was enlarged to 50mm (normal is below 44mm), with moderate mitral regurgitation observed.The aortic and pulmonary valves were both structurally and functionally normal, consistent with the patient's age.

The patient was further referred to cardio-thoracic surgeon, who strongly advised that surgical intervention for the tricuspid valve is warranted. However, due to the high risk of bleeding and the necessity of anticoagulant therapy required for cardiopulmonary bypass during tricuspid

valve surgery, it was decided that the primary renal condition should be treated first. This approach aimed to mitigate the risk of excessive perioperative bleeding while ensuring optimal timing for subsequent cardiac intervention. After recovery from the nephrectomy, the patient would undergo tricuspid valve replacement surgery at theCardiothoracic Surgery Clinic.
After comprehensive evaluation, the procedure was performed under general endotracheal anesthesia combined with epidural analgesia. Preoperative standard hemodynamic monitoring, which included electrocardiography, pulse oximetry and non-invasive blood pressure measurement, was conducted prior to anesthesia induction. Subsequently, an epidural catheter was placed at the Th-12 to L1 intervertebral level. Following 2 minutes of preoxygenation with 8 liters of oxygen, the patient was pre-medicated with 2mg of Midazolam, 100mcg of Fentanyl, 60mg of Lidocaine, and anesthesia was induced with 150mg of Propofol and 40mg of Rocuronium. Due to the second attempt atintubation, necessitating the use of an endotracheal tube stylet, which was successful with endotracheal tube size 8F, a new-onset tachycardia occurred, and the heart rate escalated to 140 bpm. This was managed by administering 5mg of Presolol and 150mg of amiodarone, followed by an additional 150mg, which resulted in the heart rate returning to baseline. Magnesium sulfate was also administered to provide further stabilization. Anesthesia maintenance was achieved with Sevoflurane at 0.7 MAC.Mechanical ventilation was administered using a pressure-controlled, volume-guaranteed mode with a tidal volume of 6mL/kg. The respiratory rate was adjusted to maintain an end-tidal CO_2 level within the target range of 35–45mmHg, with an FiO_2 of 50% and PEEP of 5mmHg.Analgesia was provided via a continuous epidural infusion of Bupivacaine 0.125% and 100mcg of Fentanyl, delivered at a rate of 10ml/h, ensuring effective pain control without additional opioid use. Throughout the procedure, except standard non-invasive monitoring, invasive monitoring was employed, including cannulation of the right radial artery, and a 7 French triple-lumen central venous catheter was inserted into the right internal jugular vein. Due to the severity of the condition and the patient's hemodynamic status, with a potential need for rapid therapeutic administration, a midline catheter of 5F was placed as well. Continuous hemodynamic monitoring was maintained throughout the procedure to promptly detect and manage any cardiovascular instability which was crucial, given the patient's significant comorbidities and the resource-limited setting.
In the absence of TEE, intraoperative hemodynamic management relied on central venous pressure (CVP) monitoring, invasive arterial blood pressure measurement and clinical assessments. However, due to the regurgitant flow into the right atrium, CVP is not a reliable indicator of intravascular volume status in patients with severe TR. We aimed to maintain a CVP range of 8–12mmHg with careful fluid titration to avoid excessive right ventricular (RV) volume overload, which could exacerbate systemic venous congestion and worsen hemodynamics. Additionally, systemic perfusion was optimized with a mean arterial pressure (MAP) > 65mmHg while avoiding factors that could increase pulmonary vascular resistance (PVR), such as hypoxia, hypercapnia and acidosis. Given these hemodynamic challenges, our anesthesia plan was carefully tailored to minimize stress on the failing right heart.

On the other hand, balancing right ventricular function and renal perfusion was vital to ensure adequate vascular status to maintain perfusion of the remaining kidney, given the patient's nephrectomy. Careful fluid management, guided by all available parameters, allowed us to maintain an optimal balance between right ventricular function and renal perfusion.
Throughout the 3-hours procedure, the patient remained hemodynamically stable, eliminating the need for vasopressor or inotropic support, which was particularly advantageous given the resource-limited setting. Along with the hemodynamic advantages mentioned earlier, the regional anesthesia technique also facilitated successful early extubating and contributed to a reduction in positive end-expiratory pressure, which could otherwise worsen the pre-existing right heart failure.
Following the extubating, the patient was transferred to the postoperative anesthesia care unit, where the early postoperative recovery was uneventful. Following a five-days hospital stay after the procedure, the patient was released in good health to receive treatment at home.

Discussion

Surgical resection remains the only established curative treatment for localized renal cell carcinoma and is also used to improve outcomes or provide palliation in cases of metastatic disease. Surgical options include partial nephrectomy, simple nephrectomy, and radical nephrectomy, which removes the entire kidney, the adrenal gland, surrounding tissue and usually nearby lymph nodes. In this case, a simple open nephrectomy was performed (5).
In contrast, the severity of tricuspid regurgitation (TR) is assessed using echocardiography, which evaluates factors such as the size of the regurgitant jet, enlargement of the right atrium or ventricle and clinical symptoms. Accurate grading of TR is crucial in determining the need for intervention and predicting outcomes. Tricuspid valve surgery is a viable treatment for symptomatic patients with progressive right ventricular (RV) dilation or dysfunction, as long as there is no severe left ventricular (LV) dysfunction and/or significant pulmonary vascular disease or hypertension (6).
Given that there is no universally optimal anesthetic approach for a patient with severe tricuspid regurgitation requiring surgical intervention, and symptomatic renal cell carcinoma, the primary focus is placed on addressing the primary condition, in this case, nephrectomy for renal cancer, because of the increased risk of bleeding in accordance with the cardiac surgeon's recommendations. Our goal was to safely manage this patient, taking into account all the comorbidities and the associated risks. We utilized continuous epidural anesthesia combined with inhalational anesthesia while avoiding opioids except during induction. This multimodal approach provided excellent hemodynamic stability throughout the procedure, except during tracheal intubation, where transient tachycardia was observed. The choice of continuous epidural anesthesia was particularly advantageous in this patient, as it facilitated hemodynamic stability by preventing excessive sympathetic stimulation and abrupt hemodynamic shifts.
Considering the complexity of the patient's underlying conditions, the procedure would be conducted more safely inan operatingtheater, allowing for the potential simultaneous

performance of both nephrectomy and eventual replacement of the deteriorated tricuspid valve, offering the capability for continuous cardiac output measurement and intraoperative transesophageal echocardiography. Lastly, the interventional options available in such a setting, including extracorporeal membrane oxygenation, if necessary, as well as the presence of a cardiac surgery team on standby, provide crucial support in the event of a deterioration in the patient's condition (7).

In patients with severe cardiac disease requiring surgical intervention, prioritizing cardiac surgery is often essential before addressing other organ pathologies. This approach is particularly relevant when managing patients with concomitant renal pathology requiring surgical treatment. Addressing the cardiac condition first, ensures hemodynamic stability, reducing perioperative risks associated with major non-cardiac surgery (8). However, in selected cases, performing both procedures simultaneously in an operating theater equipped for simultaneous concomitant procedures, along with the invasive monitoring and interventional capabilities described above, may provide the best clinical outcome, particularly in centers with appropriate expertise and resources (9). Performing a non-cardiac procedure, such as kidney surgery, in a patient with untreated severe cardiac disease poses significant risks, especially in settings without access to cardiopulmonary bypass (CPB) and cardiac surgery standby. In such cases, intraoperative hemodynamic instability could lead to life-threatening complications. Studies have demonstrated that patients with advanced cardiac disease undergoing major non-cardiac surgery without prior cardiac optimization have increased mortality and morbidity (10,11). The European Society of Cardiology (ESC) guidelines recommend preoperative cardiac risk stratification and optimization to minimize perioperative complications (12).

Our case is from resource-limited settings in middle-income countries, where the ability to manage complex cases is highly dependent on the expertise of anesthesiologists and surgeons. In the absence of advanced perioperative monitoring tools and immediate access to extracorporeal support, anesthetic and surgical teams must rely on advanced clinical skills to navigate high-risk procedures safely. There are some previous reports similar to ours that have highlighted the role of experienced anesthesiologists in mitigating intraoperative cardiovascular instability through tailored anesthetic management strategies and fluid optimization (13).

Despite the absence of advanced cardiac monitoring, our center, as the tertiary referral hospital, successfully managed this high-risk case with all available monitoring and expertise. This case highlights the feasibility of performing non-cardiac surgery in patients with severe TR when cardiac surgical intervention is not an option, provided that perioperative management is carefully optimized. Our experience underscores the need for a multidisciplinary approach in managing such complex cases, balancing surgical necessity with the patient's cardiovascular limitations.

Additionally, this case contributes valuable insight into the successful application of opioid reduced use in anesthesia with continuous epidural analgesia in a patient with severe TR, demonstrating that non-cardiac surgery can be safely performed even under constrained conditions (14).

Conclusion

A patient's total risk profile, institutional resources and available expertise, all must be considered when deciding whether to stage or combine procedures. In well-equipped centers, similar procedures can be performed safely, allowing for simultaneous cardiac and non-cardiac interventions. However, in resource-constrained environments, optimizing the management strategy based on available capabilities remains critical for improving patients' outcomes.

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