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Anaesthetic considerations: management of pulmonary hypertension and difficult airway in a patient undergoing radical nephrectomy for renal cell carcinoma

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Dear Editor,

as the incidence of obesity and cardiovascular disease increases in the United States, anaesthesiologists are managing sicker patients with more comorbidities during urgent procedures. Pulmonary hypertension (PH), defined as pulmonary artery systolic pressure > 30 mmHg and mean pulmonary artery pressure > 20 mmHg, significantly increases the risk of perioperative morbidity and mortality [1]. Patients with PH have increased right ventricular (RV) afterload and resultant increases in RV myocardial oxygen demand. Over time, this could result in RV ischaemia and dysfunction [2]. We describe a case of a 44-year-old morbidly obese female with severe PH and RV dysfunction with a known history of a difficult airway, who underwent open radical nephrectomy for renal cell carcinoma (RCC).

A 44-year-old female with morbid obesity (BMI 62), group II/III severe PH (pulmonary artery pressure (PA): 87–92 mmHg), RV dysfunction, diastolic heart failure (NYHA III), severe obstructive sleep apnoea, chronic respiratory failure with hypercapnia and hypoxia on home BiPAP and oxygen, and a 7 cm left renal mass thought to be RCC was scheduled to undergo left open radical nephrectomy. Given her high perioperative risk, she was medically optimized via planned admission and consultation with cardiology and pulmonology services prior to surgery.

Several multi-disciplinary meetings were completed by urology, cardiology, pulmonology, and anaesthesiology prior to her surgical date. Appropriate pretests including ECGs, pulmonary function test, transthoracic echocardiography, chest X-ray, myocardial stress test, labs, and CT imaging were obtained (Figure 1).

On the day of the procedure, we obtained a peripheral intravenous line and placed a pre-induction arterial line. A dexmedetomidine infusion was started to assist with the placement of the paravertebral block. With the patient sitting upright, the T11 transverse process was identified via ultrasound and marked with a skin pen. After sterile preparation, alkalinized lidocaine was infiltrated into the superficial and deep tissue. A 17G needle was meticulously advanced 3 cm left of the midline until contacting the T11 transverse process, then slowly "walked off" cephalad until loss of resistance was achieved. A catheter was easily threaded into the paravertebral space of T10. Aspiration of the catheter was negative for blood and CSF, and standard test dose was negative for symptoms of intravascular or intrathecal injection.

We planned for an awake fibreoptic intubation given her history of difficult airway and poor respiratory reserve. Dexmedetomidine infusion was used to facilitate our awake intubation. After topicalizing the airway with nebulized lidocaine and bilateral glossopharyngeal nerve blocks, the airway was secured with fibreoptic intubation followed by immediate induction of anaesthesia.

Right internal jugular central venous and pulmonary artery catheters were placed. Opening pulmonary pres-

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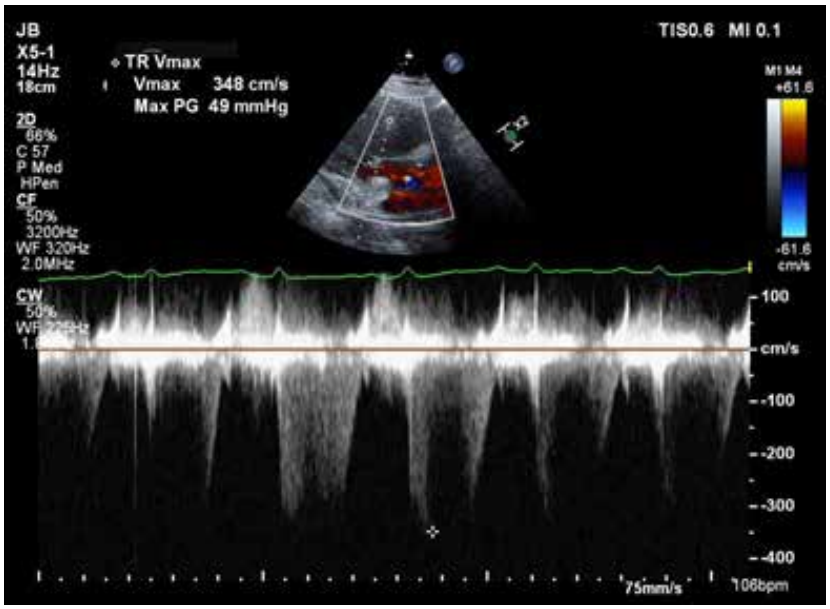

FIGURE 1. Pre-operative transthoracic echocardiography estimated elevated pulmonary artery pressures by utilizing tricuspid regurgitant spectral Doppler jet

sure was 46/24 mmHg. She remained haemodynamically stable throughout the procedure with vasopressin support. Intraoperative TEE was performed, demonstrating preserved left ventricular function, no regional wall motion abnormalities, grade 3 restrictive diastolic dysfunction, severe RV dilation with RV dysfunction, moderate tricuspid regurgitation, and confirmation of PH.

After successful left open radical nephrectomy, we activated the paravertebral catheter using 0.2% ropivacaine infusion. We also administered multi-modal analgesia with acetaminophen, ketamine, and ketorolac. After reversal of neuromuscular blockade, our patient was subsequently extubated to a non-rebreather mask. We monitored her ventilation, oxygenation, and PA pressures in the operating room for 15 minutes prior to transporting her to the surgical intensive care unit.

The paravertebral catheter ran continuous infusion of ropivacaine 0.2% throughout the post-operative period. Our patient required no opioids during the first 5 days after the procedure. We ordered adjunct scheduled pain medications of acetaminophen and ibuprofen. She was started on oxycodone on postoperative day 5 shortly after the paravertebral block was removed. The patient was discharged on postoperative day 7 without any complications during the remainder of her hospital stay.

Pulmonary hypertension, defined as a PASP > 30 mmHg or mPAP > 20 mmHg, significantly increases the risk of perioperative morbidity and mortality [1]. PH is not a distinct disease process, but rather a characterization of the haemodynamic state caused by multiple diseases [3]. These conditions are classified into 5 distinct groups by the World Health Organization (WHO).

The first group is pulmonary arterial hypertension (PAH), which is defined as PH that is not caused by a secondary process. Diagnoses that fall under group I include idiopathic PAH, hereditary PAH, drug-related PAH, connective tissue disease, portal hypertension, congenital cardiac malformations, and HIV. This group classically affects young women, but new literature suggests the number of older patients diagnosed with pulmonary arterial hypertension is on the rise.

WHO group II is PH related to cardiac disease. This includes left ventricular dysfunction and valvular disorders. Group III is lung-related diseases such as COPD, ILD, and alveolar hypoventilation syndrome. These often affect the geriatric population and are the most common cause of PH. Group IV is characterized by obstruction, such as thromboembolisms, while group V is broadly described as PH caused by uncertain multi-system disease.

While these groupings organize causes of PH in a logical manner, PH is often multifactorial. Up to 80% of diastolic heart failure patients (WHO group II) develop PH that is almost indistinguishable from pulmonary arterial hypertension (WHO group I) [3]. Nonetheless, all forms of PH are clinically significant and have slightly different implications for anaesthetic management.

Although right heart catheterization is diagnostic, patients with PH are often identified through echocardiography. PASP can be estimated using the tricuspid regurgitation jet gradient and central venous pressure (in the absence of pulmonic stenosis) [4]. In our case, we had both TEE and PA catheters to guide our management of PH. The PA catheter was requested by the intensive care unit for postoperative management.

To avoid right heart failure and cardiogenic shock, RV cardiac output must be maintained by preserving RV contractility and reducing pulmonary vascular resistance (PVR). Even transient episodes of hypotension, hypoxia, hypercarbia, and acidosis must be avoided because they would greatly increase PVR [5]. Given her history of a difficult airway and poor respiratory reserve, we opted for an awake fibreoptic intubation. We administered nebulized lidocaine and placed bilateral glossopharyngeal blocks to minimize stimulation. Dexmedetomidine infusion was used for anxiolysis during the awake intubation. We then induced general anaesthesia with propofol and etomidate.

Initial PA pressure was 46/24 mmHg. This was notably lower than her preoperative PA pressures. This could be due to general anaesthesia and our interventions to reduce PVR. Norepinephrine boluses and vasopressin infusions were used to avoid hypotension. We added vasopressin to provide systemic vascular resistance support without significantly increasing PVR [6]. Our patient remained stable without

the need for inhaled nitric oxide, epoprostenol analogues, or additional inodilators.

Adequate pain management is also important to prevent adverse haemodynamic changes in PH. Pain could result in significant increases in PVR, which would worsen her preexisting RV dysfunction [1]. In our case, a paravertebral block was performed to help minimize postoperative opioid use. Paravertebral catheters are useful in management of pain after nephrectomy [7, 8]. Although epidural catheters could have also been used for pain management, paravertebral catheters provide similar analgesia without significant hypotension and urinary retention [9]. Starting the local anaesthetic infusion via paravertebral catheter preoperatively may also assist to prevent large fluctuations in heart rate and blood pressure intraoperatively. Preprocedural ultrasound in super morbid obese patients could also be used to assess the depth and level of the transverse process. We were mindful not to give an abundance of opioids because opioids could contribute to respiratory depression and hypercarbia [10]. We used a multimodal approach with ketamine, acetaminophen, and ketorolac to further reduce opioid requirements.

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