

Life-threatening abdominal compartment syndrome during retroperitoneal surgery: A case report

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Abstract

Introduction: This report presents an unusual anesthetic crisis due to acute abdominal compartment syndrome (ACS) during retroperitoneal surgery. Only one previous case has been reported in the literature, however due to insidious nature it is likely to be under reported or unrecognized. Given the morbidity and mortality associated with late recognition of ACS, this complication needs to be considered by the anaesthetist in the differential diagnosis of the deteriorating patient in this context.

Case Report: A 54yr old female underwent rigid ureteroscopy for disintegration of right-sided calculi. During the procedure, her peak airway pressures gradually increased and she became increasingly difficult to ventilate with associated haemodynamic instability. The patient rapidly became hypoxic (SpO₂ 70-80%) and developed profound hypotension (60mmHg). Once the procedure was aborted and the patient was exposed from beneath the drapes, it became evident that her abdomen was tense and grossly distended. A prompt decompressive laparotomy immediately improved her ventilation and haemodynamics. It was revealed that the ACS was secondary to iatrogenic pyeloscopy fluid extravasation from the retroperitoneal space.

Conclusion: This case demonstrates a number of learning points. ACS needs to be considered in the differential diagnosis of the haemodynamically unstable patient undergoing surgery with limited access to patient examination. Failure to recognize and appropriately treat acute intra-operative ACS can be fatal. Prevention and timely intervention is associated with marked improvements in cardiopulmonary function and overall patient survival. Monitoring the total pyeloscopy fluid input and output (balance) could assist in the early diagnosis of ACS.

Key Words: Abdominal compartment syndrome, Cardiopulmonary arrest, Laparotomy, Lung compliance, Ureteroscopy.

Introduction

This case presentation illustrates an unusual life-threatening anaesthetic crisis secondary to acute abdominal compartment syndrome (ACS) leading to pre-cardiopulmonary arrest during rigid

ureteroscopy and laser of a stag horn calculus. The ACS was secondary to extravasation of pyeloscopy fluid from the retroperitoneal space into the peritoneal space. It was relieved by prompt decompressive laparotomy. Intra-operative acute ACS leading to

impairment of pulmonary function and ventilation (through decreased compliance) and a reduced cardiac output (through aorto-caval compression) is a rare event.

This case demonstrates a number of important learning points that may improve

patient safety. Firstly, acute ACS needs to be considered in the differential diagnosis of the haemodynamically unstable patient during the course of endoscopic or perurethral urological surgery, especially if they develop reduced respiratory compliance. Secondly, failure to recognize and appropriately treat acute ACS may be fatal. Timely surgical intervention is

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associated with a rapid improvement in cardiopulmonary function and a reduction in morbidity and mortality [1]. Moreover, prevention and timely intervention are associated with marked improvements in organ function and overall patient survival [1]. Finally, monitoring the total pyeloscopy fluid input and collection (balance) in selected patients could help in diagnosing iatrogenic fluid extravasation into the peritoneum before ACS occurs.

Case Report

A 55-year-old woman underwent a rigid ureteroscopy and laser disintegration of a large right-sided staghorn calculus under general anaesthesia. Her previous medical history included type two diabetes mellitus and obesity (BMI 31.5). She was classified as ASA II according to the American Society of Anesthesiologist's physical status classification. There was no history of lung disease. Four days prior to the case of interest, she had undergone a right percutaneous nephrolithotomy (PCNL). However, due to the complex nature of the stone, this procedure was aborted after 3.5 hours of lasering with incomplete calculus disintegration. A nephrostomy tube was left in situ with a plan to complete the procedure with rigid ureteroscopy. Open surgery was offered to the patient, however she preferred to continue endoscopically. Induction of general anaesthesia was carried out with IV propofol 2 mg kg⁻¹, fentanyl 1.5 g kg⁻¹, and rocuronium 0.5 mg kg⁻¹ was administered to facilitate tracheal intubation with a size 7.5 cuffed tracheal tube. Anaesthesia was maintained with inspired concentrations of sevoflurane 1.5-2.0%, oxygen 50% in air and with volume controlled ventilation. The patient was positioned in lithotomy. The case proceeded uneventfully for approximately two hours and 15 minutes. 0.9% sodium chloride was used as a surgical field irrigation fluid, although the exact quantity used was unmeasured. Concerns subsequently developed around persistent sinus tachycardia (110 bpm) and hypertension (systolic BP of 170-180 mmHg). Morphine (17 mg in divided doses) and ketamine (20 mg) was given without improvement. The patient remained tachycardic and hypertensive despite adequate anaesthetic depth, paralysis and analgesia. A gradual

increase in peak airway pressures (PAW) was also noted. The circuit was checked and isolated, ventilation via air viva was trialed, the ETT was suctioned, cuff deflated and reinflated and eventually the ETT was changed. The patient remained tachycardic and hypertensive with PAW >35 cmH₂O. The surgeon was notified and the procedure abandoned as oxygen saturations began to decline into the 80s with an associated decrease in systolic blood pressure. An arrest code was called. The patient was exposed from beneath the drapes revealing an overtly distended, tense abdomen with generalised cyanosis and minimal chest wall movement. A diagnosis of acute abdominal compartment syndrome was made. The surgeon immediately performed a decompressive laparotomy to relieve the intra-abdominal pressure. The laparotomy released a significant quantity of clear fluid and faeculent material (which may have been secondary to bowel injury during laparotomy). More specifically, there appeared to be a large subhepatic fluid collection (approximately one litre) which likely contributed to the respiratory and haemodynamic compromise and required evacuation. The subsequent unsplinting of the diaphragm resulted in an immediate improvement in mechanical ventilation. The patient became hypoxaemic (SpO₂ 70-80%), and severely hypotensive (60/40 mmHg). Cardiac compressions were commenced and two divided doses of adrenaline 50 mcg administered intravenously. Compressions were ceased as the patient continued to maintain a palpable pulse. An arterial blood gas was measured, revealing a pH:6.88, pCO₂:76 mmHg, pO₂:53 mmHg, lactate:8.2 mmol/L and a glucose of 26.2 mmol/L. Saturations improved, however remained below 90%. An urgent chest image intensifier (I.I) was performed to exclude intra-thoracic pathology. The I.I. image was inconclusive. A transthoracic echocardiogram found no obvious pneumothorax, a right apical fluid collection, normal biventricular and valvular function, relative hypovolaemia and no pericardial effusion. The patient's parameters continued to improve post-laparotomy and the general surgeon commenced a repair of a partial thickness small bowel laceration prior to transfer to the intensive care unit. The patient was weaned from mechanical

ventilation the following day in ICU with no neurological sequelae, however, subsequent procedures to repair her abdominal wounds and later a definitive nephrolithotomy were required.

Discussion

Abdominal compartment syndrome (ACS) is defined as a sustained Intra-abdominal Pressure (IAP) >20 mmHg that is associated with new organ dysfunction or failure and that abdominal decompression has beneficial effects [2]. The syndrome is governed by the laws of compliance. ACS impairs functioning of the cardiovascular and pulmonary systems. It may present initially with a compensatory rise in pulse and blood pressure before deteriorating to shock as vascular structures compress [2,3]. The mechanical effect of raised intra-abdominal pressure; impedes diaphragmatic excursion and lung compliance, reducing functional residual capacity and increasing the oxygen debt [4]. Clinical signs of elevated intra-abdominal pressure in patients receiving mechanical ventilation include increases in peak airway pressures during volume ventilation and decreases in tidal volumes when pressure modes are used [1,5]. A literature review of retroperitoneal surgery confirmed the low incidence of this complication, this may however, be due to under reporting or a failure to recognize the condition. Only one case of acute abdominal compartment syndrome leading to haemodynamic instability during PCNL was thought to be secondary to a technical error of placing the dilator through into the peritoneal cavity. It was serendipitously recognized post-operatively and did not require crisis management [6]. In the case under consideration, it is unclear how the pyeloscopy fluid entered the peritoneum. We can only speculate that an iatrogenic conduit was somehow created. Current surgical opinion suggests that the high pressures within the renal pelvis resulted in extravasation of fluid around the nephrostomy tract. This eventually led to rupture of Gerota's fascia and fluid leak into the subhepatic space. Secondly, a rupture of the renal pelvis during the ureteroscopy could account for the findings; however this would have been detected immediately at the time of the second operation. Other possibilities such as perforation with the

dilator were considered highly unlikely given the size of the stone and the lower pole placement of the dilator. The measurement of total pyeloscopy fluid that goes in and out of the patient during a retroperitoneal procedure is not performed routinely. Whether or not this could assist in the early diagnosis of fluid extravasation into the peritoneum before ACS occurs is debatable. Factors such as previously failed PCNL, obesity, co-morbidities and length of procedure could be considered an indication to maintain vigilant pyeloscopy fluid balance or regular abdominal inspection in selected patients.

Conclusion

This case highlights the importance of anaesthetists considering ACS in haemodynamically unstable, deteriorating patients with sub optimal access to comprehensive examination. Only one previous case has been reported in the literature, however due to insidious nature, it is likely to be under reported or unrecognized. Given the morbidity and mortality associated with late recognition of ACS, failure to rapidly recognize and appropriately treat acute intra-operative ACS can be fatal. Prevention and timely intervention is associated with marked improvements in cardiopulmonary function and overall patient survival.

Clinical Message

- Acute abdominal compartment syndrome (ACS) should be considered in the differential diagnosis of the haemodynamically unstable patient undergoing retroperitoneal surgery.
- Adequate access to the patient for examination during surgery is essential in early diagnosis of ACS.
- Monitoring the total pyeloscopy fluid input and collection (balance) in selected patients could help in diagnosing iatrogenic fluid extravasation into the peritoneum before ACS occurs.
- Prevention and timely intervention is associated with marked improvements in cardiopulmonary function and overall patient survival.

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