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Case Report

Abdominal Compartment Syndrome During Unilateral Biportal Endoscopic Spinal Surgery: A Case Report

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Abstract: Background: Abdominal compartment syndrome (ACS), a serious complication of organ failure, which is caused by acute and persistent increase of intra-abdominal pressure (IAP). Ascites is often ignored as a rare complication of unilateral biportal endoscopic (UBE) surgery. However, intra-abdominal hypertension (IAH) caused by massive ascites can lead to multiple organ dysfunction, which leads to the occurrence of ACS with a very high mortality rate. Case Presentation: In this case, the patient was a 74-year-old man who underwent UBE decompression for severe lumbar disc herniation. During the surgery, the airway pressure and stroke volume variation (SVV) were incerased gradually. when increasing saline pressure. Subsequently, the patient was diagnosed with ACS and treated with emergency diuretics and performing ultrasound-guided abdominal paracentesis to reduce abdominal pressure. After emergency treatment, the patient's IAH symptom was significantly relieved and his airway pressure and hemodynamics was rapidly improved. Conclusion: The possibility of ACS should be considered in the presence of persistently elevated airway pressure during UBE surgery. Without early diagnosis and timely management, ACS would have a high mortality rate. Considering the severity of ACS during surgery, we recommend taking measures to monitor intra-abdominal pressure during UBE surgery.

Keywords: Unilateral Biportal Endoscopy, Abdominal Compartment Syndrome, Lumbar Disc Herniation, Ascites

1. Introduction

The unilateral biportal endoscopic (UBE) technique is a minimally invasive spinal surgery that has been applied in cervical, thoracic, and lumbar spine surgery [1-3]. Compared with the interforaminal endoscopic surgery, the UBE technique has many advantages such as wide surgical field, low residual nucleus pulposus rate and rapid post-operative recovery. Besides, it has great advantages for severe disc herniation [4]. Surgical complications of UBE mainly include dural tearing, incomplete decompression, and transient paralysis [5]. However, there are still few reports of abdominal complications during UBE surgery, such as ascites after surgery [6].

Abdominal compartment syndrome (ACS) is a serious complication of organ failure caused by acute and persistent increase of intra-abdominal pressure (IAP) [7, 8]. Intra-abdominal hypertension (IAH) caused by massive ascites can lead to severe physiological disorders and multiple organs failure [9]. Therefore, it is necessary for surgeon to diagnose ACS as soon as possible and take Corresponding treatment [10].

This report is the first case to report a new clinical presentation of ACS due to excessive abdominal pressure during UBE spinal surgery. This is rarer and more critical than the development of ascites complications during UBE surgery.

2. Case Description

A 74-year-old male came to our hospital for complaining low back pain with radiating pain in the left lower extremity for 2 months and agreed to operate surgery. Routine lumbar magnetic resonance imaging (MRI) showed severe central left protrusion of the L3/4 disc into the posterior spinal canal and

compression of the cauda equina (Figure 1A and B). Preoperative laboratory blood tests showed no significant abnormalities. Therefore, we operated surgery for the patient. During the operation, there were a series of changes in patient's monitoring parameters, including a progressive increase in airway pressure first, and a subsequent gradual increase in stroke volume variation (SVV) and decrease in tidal volume. We stopped the procedure after ruling out the patient 's postural compression of cardiac and airway spasm. We immediately changed the patient from prone position to supine position and found that the patient had abdominal hypertonicity, cyanosis of both lower limbs, and cold limbs (Figure 1C). The patient was immediately diagnosed with ACS while we immediately contacted the general surgeon and sonographer for urgent consultation. Furosemide (20 mg) was administered intravenously and arterial blood gas analysis was repeated 1 minute after termination of the procedure, but results showed normal electrolytes. The sonographer examined the patient 's abdomen, lower back, and chest using an ultrasound machine and found a large liquid dark area in the right upper abdominal cavity. The sonographer selected and marked two anchor points from the liquid dark area of the body surface, while general surgeons performed B-ultrasound-guided paracentesis catheter drainage at these two marker points (Figure 1D and E). After emergency treatment, the patient's airway pressure decreased to normal and hemodynamics were stable.

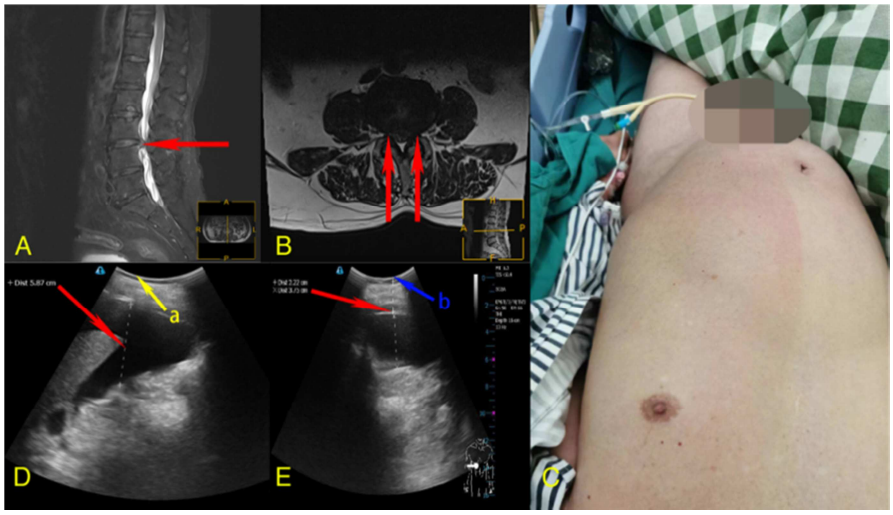

Figure 1. *A. Sagittal MRI of the lumbar spine: shows L3-L4 disc degeneration with severe posterior intraspinal disc herniation and compression of the thecal sac and cauda equina. B. MRI Axial view: slices through L3-L4 disc showed central left protrusion of disc in posterior spinal canal and narrowing of foramina on both sides. C. After changing position to supine position, the patient was found to have cyanosis of both lower extremities and very high abdominal tone. D. Anchor point a is lower, this point corresponds to the liquid area 20 mm away from the body surface, and the anteroposterior diameter of dark area is 59 mm. E. Anchor point b is relatively superior, this point corresponds to liquid area 22 mm far away from body surface, and the anteroposterior diameter of dark area is 38 mm.*

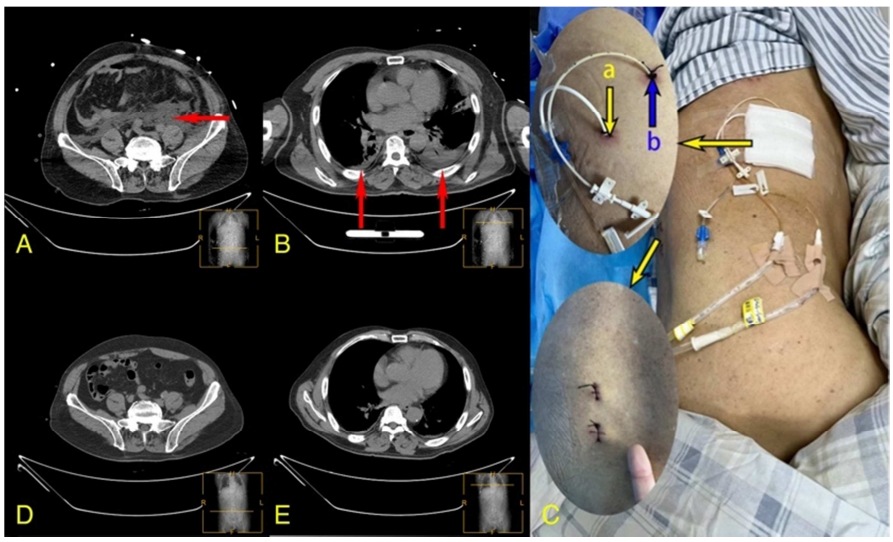

Figure 2. *A. CT scan of whole abdomen: shows a large amount of fluid density in the retroperitoneum, abdominal cavity, and pelvic cavity (arrow points). B. Thoracic CT scan: small bilateral pleural effusion. C. Patient 's access port and surgical port condition on postoperative day 3. Yellow arrows point to the first drain at point a and blue arrows point to the second drain at point b. D. CT scan of the whole abdomen revealed disappearance of fluid density in the abdominopelvic cavity and retroperitoneum. E. Chest CT scan showed bilateral pleural effusions almost disappeared.*

Subsequently, the patient was sent for an emergency abdominal and chest enhanced CT scan which showed an abdominopelvic, retroperitoneal effusion and a small bilateral pleural effusion (Figure 2A and B). After three days of close monitoring, the patient was transferred back to the general ward. Subsequently, we examined the patient's surgical incision and two catheters and no abnormalities were observed (Figure 2C). 5 days after surgery, the patient underwent abdominal and chest CT scan, which showed that the abdominal, pelvic and retromembranous effusion was significantly reduced than before (Figure 2D). In addition, bilateral pleural effusions were almost absorbed (Figure 2E). On the same day, the patient felt well and was discharged from hospital.

3. Discussion

In this paper, we report the first case of ACS due to abdominal effusion during UBE. Recent studies have pointed out that the retroperitoneal region lies anterior to the level of the L3 transverse process, so if we access to the intertransverse ligament deeply during UBE, we may inject large amounts of saline into the retroperitoneal space [11]. Saline with higher hydrostatic pressure may leak from the retroperitoneal space into the abdominal cavity through the peritoneum, resulting in peritoneal effusion [12]. This may be the mechanism leading to hydroperitoneum in UBE surgery.

ACS was defined as persistent IAP > 20 mmHg associated with new organ dysfunction or failure [13]. Multiple intra-abdominal or extra-abdominal etiologies can lead to ACS, such as abdominal trauma, hemoperitoneum, sepsis, or severe burns [14]. The main clinical manifestations of ACS include airway pressure and intracranial pressure increasing, cardiac output decreasing, and oliguria or anuria due to renal perfusion decreasing [15]. Some studies point to pulmonary dysfunction as the earliest clinical manifestation of ACS [16]. Delays of recognition and treatment of IAH and ACS can greatly increase morbidity and mortality [17]. Recognition and intervention of ACS as soon as possible can help to reduce mortality [18].

ACS is a result of IAH in extreme cases, but the diagnosis and treatment of ACS is often lagging behind, which will significantly increase the risk of organ failure and death in patients [19]. Therefore, early diagnosis and intervention of ACS patients are essential [20]. The most frequently affected systems in ACS are the respiratory system, circulatory system, and kidney [21]. IAP can pass through the diaphragm to the chest and compress the lung parenchyma, leading to progression to pulmonary dysfunction [14]. IAH also compresses the inferior vena cava, reducing venous return and increasing the risk of heart failure [22, 23]. Routine measurement of IAP is essential for early diagnosis and treatment of IAH and ACS [10]. Many different methods have been used to measure IAP, such as transvesical, gastric, and rectal [24]. Although more and more IAP measurement techniques have emerged, transcysterometry is still recommended as a standard IAP measurement technique [8]. In the early course of ACS, nonsurgical interventions are effective in reducing IAP and complications of surgical decompression [25]. However, surgical decompression remains an important treatment modality for ACS patients who are difficult to treat or persistently aggravated by non-surgical treatment [26]. The advent of percutaneous catheter decompression (PCD) technology has been suggested as a minimally invasive alternative to open abdominal decompression because of its high efficiency and minimally invasive nature [27]. In this patient, we placed two intra-abdominal drainage catheters precisely by PCD technique to decrease the IAP.

4. Conclusions

ACS is a disease with a high risk of mortality, and early diagnosis and timely treatment are very important to improve patient outcomes. ACS often leads to organ dysfunction, such as respiratory failure, hemodynamic abnormalities, and impaire renal function. It is crucial to consider IAH or ACS when patients present with clinical manifestations of persistently elevated airway pressure and SVV. Continuous intra-abdominal pressure monitoring during surgery is necessary for patients undergoing UEB surgery. Compared with open decompression, PCD techniques appear to be effective in reducing intra-abdominal pressure and effectively avoid many complications of laparotomy.

Conflicts of Interest

All authors declare no conflicts of interest.

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