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**Unusual complications of spinal surgery: A report of life-threatening vascular injury**

Ross FJ *et al*. Unusual complications of spinal surgery

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**Abstract**

Kyphoplasty and lumbar spine fusion are rarely associated with significant vascular damage and internal bleeding. However, anaesthesiologists must maintain vigilance in order to detect rare, but potentially life-threatening haemorrhagic complications of these procedures which may present intra-operatively or in the immediate post-operative period. We present two cases of life-threatening haemorrhagic complications of spine surgery, one from T12 kyphoplasty and the other from a redo lumbar laminectomy and fusion. In both cases, prompt recognition of vascular injuries with internal or covert bleeding which presented shortly after surgery allowed timely and life-saving treatment.

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**Key words:** Post-operative complication; Spinal surgery; Kyphoplasty

**Core tip:** Kyphoplasty and lumbar spine fusion are rarely associated with significant vascular damage and internal bleeding. However, life-threatening complications can occur at any time during the perioperative period. Rapid diagnosis and quick action can save life and this can be achieved by the awareness of the possibility of such complications. The clinical presentation can be deceiving, especially during the perioperative period when multiple factors can mask the real problem (use of narcotic or sedative agents) and the best way to ensure rapid diagnosis is high index of suspicion and the application of imaging technology as in our cases.

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**INTRODUCTION**

The lumbar and thoracic spine lies in close proximity to many important vascular structures which are vulnerable to surgical injury. Aggressive surgical exploration or even misplacement of a kyphoplasty needle may result in serious vascular injuries with life-threatening bleeding. In this article we describe two cases where such injuries occurred and were discovered in the early post-operative period.

**CASE REPORT**

***Case 1***

This patient presented with impending respiratory failure and hypoxia in the post-anaesthesia care unit within less than 60 min after uneventful kyphoplasty. This was a 66-year-old female with a history of severe back pain from osteoporotic compression fracture presented for T12 kyphoplasty. Her past medical history was significant for obesity, asthma, type II diabetes mellitus, and hypertension. She denied any history of easy bruising or bleeding or use of any blood thinning medications. Her physical exam was unremarkable and she had no pre-operative neurologic deficits. Kyphoplasty was performed under general anaesthesia as is the typical practice at our institution. During kyphoplasty she was haemodynamically stable and maintained adequate oxygenation throughout the case, after which she was extubated and taken to the post-anaesthesia care unit (PACU). Shortly after arrival to the PACU the patient began to experience respiratory distress with hypoxia for which she was emergently intubated. The differential diagnosis included; pulmonary edema due to fluid overload or left-sided heart failure, pneumothorax due to barotrauma and/or residual muscle paralysis. Chest X-ray showed a new right-sided pleural effusion with collapsed lung. Immediate follow-up computed tomography (CT) scan (Figure 1) revealed a tension haemothorax and due to development of haemodynamic instability, she was taken to the OR for drainage and thoracotomy. After drainage of the haemothorax the thoracotomy failed to reveal any source of active bleeding. The procedure was complicated by three brief episodes of asystolic cardiac arrest which were successfully treated with epinephrine and cardiac massage. Exploratory laparotomy was also performed to evaluate for an abdominal source of bleeding, but none was found. During the surgical procedure she received 4 units of packed red blood cells (PRBCs). The incisions were closed and the patient was taken to the intensive care unit (ICU) for further management. She had no further bleeding in the ICU and was extubated on postoperative day-3. The rest of her postoperative course was uneventful aside from a persistent oxygen requirement and she was discharged home on postoperative day-10 with supplemental home O2.

***Case 2***

This patient presented with severe cardiovascular instabilities within less than 24 h after uneventful lumber spine procedure. The patient was a 51-year-old female with a worsening facet arthropathy above the site of her prior L3-L5 spinal fusion presented for re-do L2-3 laminectomy, exploration of fusion, removal of instrumentation, and extension of fusion from L2-L5 for persistent refractory back pain. Her past medical history was significant for rheumatoid arthritis, hypertension, mitral valve prolapse, bipolar disorder, gastroesophageal reflux disease (GERD), alcohol abuse and smoking. She previously had several orthopaedic surgeries including cervical fusion, L3-L5 laminectomy and fusion, and right shoulder surgery. Physical exam was unremarkable and neurologic exam revealed no objective deficits at the time of surgery. During the surgery as the surgeon was exposing the transverse process, bleeding was noted which was presumed to be coming from a small branch of the lumbar segmental artery. After cauterization, adequate haemostasis was apparently obtained. Vital signs were stable throughout. She was also noted intraoperatively to have a dural tear which was repaired prior to surgical wound closure. Initial intraoperative labs showed haemoglobin of 13.1 g/dL and repeat laboratory tests 4 h later, near the end of the surgery, showed haemoglobin of 11.0 g/dL. The estimated blood loss was 850 mL and she received 1 L of albumin and 2 L of crystalloids without blood products. After completion of the procedure, surgical haemostasis was obtained and the surgical incision was closed. The patient recovered uneventfully from anaesthesia in the post-anaesthesia care unit and was transferred to the surgical floor. Overnight she became hypotensive and tachycardic without signs of external bleeding through the surgical wound or in the drains. She was transferred to the ICU for further management. Her haemoglobin reached a nadir of 4.8 g/dL despite transfusion of 4 units of packed red cells (PRBCs). She also began to complain of abdominal pain and new onset of right leg weakness and numbness consistent with femoral nerve compression. Non-contrast CT scan revealed a large retroperitoneal hematoma extending from the right perinephric region into the pelvic sidewall (Figure 2). She was taken emergently to the operating room for evacuation of the retroperitoneal hematoma and ligation of a lumbar artery which was found to be the source of the bleeding. Her abdomen was packed and she was returned to the ICU for continued management. The next day she was taken back to the operating room for removal of packing and definitive closure. Postoperatively she developed a mild consumptive coagulopathy which eventually resolved and she was transferred to the surgical floor on postoperative day-10 and discharged home on postoperative day-13. During her hospital course she received a total of 8 units of PRBCs, 3 pools of platelets, 1 unit of fresh frozen plasma, and 1 pool of cryoprecipitate.

**DISCUSSION**

The lumbar and thoracic spine lies in close proximity to many important vascular structures which are vulnerable to surgical injury. The descending aorta is situated to the left of the spine in the thoracic region and descends anteromedially to the spine before bifurcating into the common iliac arteries around the 4th lumber vertebra. The segmental arteries which supply the spinal column, paraspinal muscles, dura, nerve roots, and spinal cord arise from the posterior aspect of the descending aorta and travel along the surface of the vertebral bodies. Aggressive surgical exploration or even misplacement of a kyphoplasty needle may result in penetration through the anterior longitudinal ligament into the retroperitoneal space or abdominal cavity where vascular laceration may occur[1].

Despite the close proximity to various arterial and venous structures, vascular injury during spine surgery is rare and constant vigilance on the part of both intraoperative and postoperative care providers is required to prevent a possibly fatal outcome associated with such injuries. Analysis of the Food and drug Agency and Manufacturer and User Facility Device Experience safety database revealed only a single documented episode of haemothorax after kyphoplasty. In this case, the episode was mild and resolved with chest tube drainage. In that particular case the patient had been on blood thinners previously, but the prothrombin time was within normal limits at the time of surgery[2]. A meta-analysis of complications after kyphoplasty and vertebroplasty revealed that the most common complications were cement leakage (8.1%), pulmonary embolism (0.17%), spinal cord compression (0.16%), and radiculopathy (0.17%)[3]. The 30-d perioperative mortality was found to be 0.13%, which may be overestimated due to the inclusion of patients with metastatic or primary bone malignancy. Thus, haemorrhagic complications of kyphoplasty appear to be exceedingly rare as reported in the literature, particularly in patients without bleeding predisposition or anticoagulant use. We suspect that in this case, the kyphoplasty needle transgressed anterior to the vertebral body at some point during the initial needle placement causing a small injury to an anterior arterial structure resulting in a slow haemorrhage that was not apparent intra-operatively. Review of the intra-operative fluoroscopy images demonstrated proper needle placement at the time of cement injection. Though not evident in our case, intraoperative fluoroscopy may reveal a developing haemothorax, allowing more prompt surgical intervention to repair a lacerated vessel.

Serious complications after lumbar laminectomy and fusion are also rare, though more common than during kyphoplasty and with perioperative mortality rate of around 0.3%. Reported complications include dural tear (5.9%), deep wound infection (1.1%), superficial infection (2.3%), and DVT (2.8%)[4]. The incidence of vascular injury during lumbar disc surgery is estimated to be between 0.039% and 0.14%. The right common iliac artery the vessel most frequently injured overall. Specific vessels are vulnerable to injury at different spinal levels including the aorta and inferior vena cava at L2-L4, and the iliac vessels at L4-L5 and L5-S1. The L4 lumbar artery, internal iliac vessels, median sacral, inferior mesenteric, superior rectal artery, and superior mesenteric artery are also at risk during lumbar spine surgery[5]. In our case the culprit lumbar segmental artery was identified during the initial procedure but bleeding was thought to have been adequately controlled prior to closure. A review of vascular complications during a 12-year period at a single hospital reported that arterio-venous fistula and pseudoaneurysm formation occurred, when a transperitoneal approach rather than posterior approach was used[6]. Vascular injuries often present as hypotension and tachycardia during surgery and have a fairly high mortality rate at 10% (or as high as 38% for injuries involving the aorta). Once suspected, these injuries are generally treated by emergent laparotomy with surgical repair of the lacerated vessel, though endovascular repair may be possible in some cases[5]. Prior spine surgery is likely a risk factor for such injuries as in our second case.

Anaesthesiologists and surgeons should maintain a high index of suspicion for vascular injury when hypotension and/or tachycardia are encountered during or shortly after spine surgery. It is important to note that neither case presented here demonstrated any evidence of haemodynamic instability intra-operatively even on careful retrospective anaesthesia record review. Thus, it is important for post anaesthesia care unit providers as well as the medical professionals who care for patients after spine surgery to be aware of the small but not insignificant risk of hidden vascular damage so that prompt resuscitation and vascular repair are possible. The awareness of the possibility of this kind of complication will allow rapid diagnosis and proper management which can save patient’s life and/or prevent serious outcome.

**COMMENTS**

***Case characteristic***

The two patients that the authors presented in this case report underwent uneventful surgical spinal procedures but showed serious signs of hemodynamic instabilities in the early postoperative period.

***Clinical diagnosis***

The presentation in the thoracic kyphoplasty case (1st case) was an impending respiratory failure and hypoxia within the 1st hour of after the surgery. While the lumber spine decompression case (2nd case), the presentation was hours later with severe hypotension, tachycardia, abdominal pain and right leg weakness (signs of femoral nerve compression.

***Differential diagnosis***

In the 1st case the differential diagnosis included; pulmonary edema due to fluid overload or left-sided heart failure, pneumothorax due to barotrauma and/or residual muscle paralysis and for the 2nd case was acute abdomen for surgical or non-surgical causes.

***Laboratory diagnosis***

In the two cases there is no laboratory testing that can confirm the diagnosis except for the falling haemoglobin value and in particular the 2nd case from massive retroperitoneal bleed (4.8 g/dL).

***Imaging diagnosis***

In the thoracic kyphoplasty case an urgent chest X-ray was helpful in revealing the hemothorax which was confirmed by the CT chest. While in the lumber spine case, the CT abdomen established the accurate diagnosis of retroperitoneal bleeding.

***Treatment***

Both patients underwent an urgent surgery (thoracotomy in the 1st case and laparotomy in the 2nd case) to control the bleeding, and to establish an exact aetiology of the source of the bleeding.

***Related reports***

The reported cases of vascular injuries in lumber laminectomy and decompression procedure especially the ones that presented in the postoperative period are extremely uncommon and only appeared in the neurosurgical literatures and not in the anesthesia literatures. While, bleeding complication in post-kyphoplasty is extremely rare and only one published case report was found.

***Experiences and lessons***

It is important for post anaesthesia care unit providers as well as the medical professionals who care for patients after spine surgery to be aware of the small but not insignificant risk of hidden vascular damage so that prompt resuscitation and vascular repair are possible. The awareness of the possibility of this kind of complication will allow rapid diagnosis and proper management which can save patient’s life and/or prevent serious outcome.

***Peer review***

The article reports two cases of hemorragic complications during spinal surgery, correctly managed with good results.

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**Figure 1 Computed tomography scan of the thorax for the kyphoplasty case, showing right-sided hemothorax.**

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**Figure 2 Computed Tomography of the abdomen for the lumber spine decompression case, showing retroperitoneal hematoma.**