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‘Growing mushroom on the back’ following minimally invasive spine fixation: The theory of iatrogenic compartment syndrome revisited

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The authors report a case of lumbar para-spinal muscle herniation following percutaneous thoraco-lumbar pedicle screw fixation. This is suggested to be due to subclinical iatrogenic increase in the intra-compartmental pressure. The possibility of ‘iatrogenic paraspinal compartment syndrome’ following minimally invasive spine techniques has been discussed previously by other authors. Nevertheless, no such case has been reported so far in the literature. The awareness of this potential complication might be helpful for spinal surgeons for early detection and management.

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1. Introduction

Paraspinal compartment syndrome is a rare condition resulting from increased intra-compartmental pressure within a closed fibro-osseous space. Left untreated, this would lead to reduced perfusion presenting with ischemic pain and eventually irreversible damage of the neuromuscular tissue. Iatrogenic para-spinal compartment syndrome following minimally invasive spine surgery has been described recently although no such clinical cases have been presented so far.

2. Case report

A nineteen-year-old male patient who was involved in high speed Road Traffic Collision (RTC) presented as polytrauma case. Following trauma protocol survey, he was found to have spinal fracture at L1 with no focal neurological deficit. Additionally, he sustained angulated closed fracture of the tibia–fibula at the junction of middle-distal thirds with no neurovascular compromise distally.

His spinal fracture was assessed by Compound Tomography which reported unstable burst-compression type fracture of L1 with disruption of the right lamina and pars interarticularis. There was approximately 60% loss of vertebral body height with displaced fragments centrally leading to 50% loss of central canal diameter Fig. 1.

The fracture was assessed further with spinal MRI which showed significant ligamentous disruption at T12/L1 level confirming the instability of the fracture.

Accordingly, the patient underwent minimally invasive spinal fixation using percutaneous pedicle screws for T12–L2 vertebra including only one short ‘rescue’ screw at L1 on the intact pedicle on right side. The procedure was uneventful and postoperative CT scan confirmed satisfactory position of the hardware. The entry-site skin wounds were carefully closed with 2/0 Vicryl for lumbar fascia and 2/0 Ethylon for skin.

Postoperatively, the patient was able to mobilise with crutches on day one and started rehabilitation and physiotherapy immediately. On the second day he started complaining of lower back pain on mobilising but this was relieved with rest and alleviated with analgesics. He was subsequently discharged home 5 days later with no reported complications. His skin sutures were removed by his general practitioner on day 10 postoperatively.

Over the following two weeks, the patient became aware of a small ‘lump’ protruding at the site of his right L2 skin incision. No discharge, fever or swelling was reported. This was managed by his GP who documented ‘protruding granulation tissue’ at one of the stab wounds.

Six weeks postoperatively he presented for his neurosurgical follow-up appointment. By this stage he had returned to his normal daily activities including cycling. He reported intermittent back pain with exertion with no neurological manifestations. He was concerned about a ‘growing lump’ on his back which he thought was of the size of a ‘button mushroom’.

The clinical assessment of the concerned lesion revealed a 25 × 10 mm rounded pink fleshy lesion protruding from the skin incision at L2 level on the right side. No surrounding cellulitis or any signs of obvious local skin infection was present. No discharge was noted.
and direct palpation of the wound did not express any underlying collection (Fig. 2).

He was admitted and underwent enhanced MRI of his thoraco-lumbar spine. This has shown non-specific enhancement surrounding the right L2 pedicle screw consistent with non-specific postoperative changes. No obvious collection was seen on the MRI scan. The protruding mass was assessed to be muscle herniation through skin (Fig. 3).

Accordingly he underwent urgent exploration of his wound, partial resection of the herniating muscle and washout of the wound. No evidence of any purulent collection was detected intraoperatively and the protruding muscle tissue was not necrotic. No evidence of CSF leak or instability of the pedicle screw was detected either. The wound was then re-closed in a single layer with size 1 Ethylon.

Urgent gram stain reported moderate number of white blood cells – mainly polymorphs – but no organism was detected. Subsequent cultures did not grow any organisms. The histological examination of the protruding muscle showed chronically inflamed fibromuscular tissue and associated granulation tissue with purulent reaction. Gram stain of the exposed tissue revealed scanty number of gram positive cocci that was suspected to be ‘skin contaminant’. Due to the re-opening of the wound, the patient received a short course of intravenous antibiotics and had serial follow-up assessments of his wound which has healed completely within few weeks. No long-term sequelae have been reported up to date.

3. Discussion

Minimally invasive spine (MIS) techniques are favoured for minimising muscle dissection, smaller incisions, shorter recuperation time and comparable fusion rate to open fixation techniques. It has been associated also with better functional outcome and lower postoperative pain [3]. This has led to expanding the indications to include spinal infections, neoplasms, deformity in addition to spinal trauma cases.

The reported complications of MIS fixation appear to suggest that muscle trauma is more associated with open techniques as a result of direct muscle dissection and prolonged retraction. Nevertheless, some authors have demonstrated significantly higher CPK (Creatine Phospho Kinase) levels in the immediate postoperative periods following MIS fixations compared to the traditional open techniques [1]. The underlying mechanism for this elevation of CPK has been suggested to be due to ‘iatrogenic paraspinal compartment syndrome’ rather than direct trauma, the latter obviously is more likely to be seen with open techniques.

The preservation of muscle attachment to the posterior elements of the spine would lead to significant expansion in the intra-compartmental volume following the insertion of the spinal fixation hardware in addition to reactive muscle swelling or bleeding. The small percutaneous fascial incisions might not be adequate to release this additional volume effectively leading to iatrogenic increase in the paraspinal compartment pressure. This is even more likely following a tight closure of the fascial incisions.

In this reported case, it appears that part of paraspinal muscles has herniated through the wound. Although this might be simply attributed to inadequate wound closure and/or probably low grade infection delaying wound healing; the authors would suggest that it is better explained by increased compartmental pressure postoperatively.

Poor wound healing would not – on its own – explain the muscle herniation as this is not seen normally in wound dehiscence following open techniques where the lumbar fascia has been opened completely effectively releasing the para-spinal muscle compartment.
This theory of raised intracompartment pressure following percutaneous pedicle screw fixation might be supported further by the fact that this patient was very lean (body weight 62 kg) and consequently would have smaller muscle compartment to accommodate the additional volume of the metalwork. Additionally, it appears that he has returned to a very active lifestyle very soon after surgery. The patient has given history of intermittent dull ache on exertion, which might suggest intermittent/chronic increase in the intra-compartment pressure.

Lumbar paraspinal compartment syndrome is well documented in literature. The majority of cases affect young physically active men with history of severe physical exertion (weight lifting, skiing, etc.) or history of trauma. Other cases following non-spinal surgery or due to drug abuse were also reported [4].

Acute lumbar paraspinal compartment syndrome is diagnosed by the acute onset back pain in the context of raised CPK and Myoglobulin and confirmed by raised intra-compartment pressure on direct measurement. However cases of ‘chronic paraspinal compartment syndrome’ are more difficult to diagnose with biochemical markers (CPK and Myoglobulin) being within normal limits. Clinical history usually suggests intermittent post-exertional back pain. Direct measurement of compartment pressure may reveal intermittently raised pressure.

4. Conclusion

Up to date, no cases of clinical paraspinal compartment syndrome following MIS techniques have been reported. The authors suggest that the muscle herniation in the reported case was a marker of increased intra-compartment pressure. Knowledge of this potential complication would be helpful for spinal surgeons in the future.

References