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Postoperative lumbar paraspinal compartment syndrome

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SUMMARY

Lower lumbar paraspinal muscles constitute a compartment as they are surrounded by distinct fascial and bony boundaries. Lumbar paraspinal compartment syndrome is a rare entity, often caused by intense exercise, but also can be a postoperative complication. We present a 60-year-old man with low back pain, numbness in the left lower back and radicular pain in the left lower extremity, which started after a surgery that involved prolonged positioning on the left side 7 years before, and persisted to the day of evaluation. There was an immediate transient rise in the creatine kinase after surgery. Electromyography showed a left lower lumbar–sacral plexopathy and a lumbar spine MRI revealed fatty infiltration of the lower lumbar–sacral paraspinal muscles. The emergence of radicular lower limb pain was likely due to the compression of the proximal portion of lumbar–sacral plexus during the acute stage of rhabdomyolysis.

BACKGROUND

Lumbar paraspinal compartment syndrome is a rare cause of rhabdomyolysis and of chronic low back pain. A universal feature is high creatine kinase (CK) (generally >5000 IU/L) and rhabdomyolysis.[1] Characteristic symptomatology includes local paraspinal muscle pain exacerbated by passive movements, that is, lateral truncal tilting, forward flexion and straight leg raising, and alleviated with the extension of the back; and tenderness and firm texture/board-like rigidity of the affected paraspinal musculature on palpation.[1–3] Timely diagnosis and appropriate surgical treatment will usually result in favourable outcomes.

CASE PRESENTATION

Our patient is a 60-year-old man with a history of diabetes and morbid obesity who presented with chronic low back pain, left lower back numbness, radicular pain, numbness in the left leg and lateral foot that started after surgery on the right ankle, for debridement of a wound and skin grafting 7 years before, the symptoms persisted to the day of evaluation. During the surgery, he was positioned on the left side. He developed rhabdomyolysis in the immediate postoperative period with a rise of serum CK to ~5000 U/L from a preoperative level of 188 U/L on postoperative day 1, increasing to a peak of ~20 000 U/L on postoperative day 3, which trended back to normal over 2 weeks. Initial lumbar spine MRI, by report, did not show significant abnormalities except for spinal osteoarthritis. He was treated with gabapentin, tramadol and underwent epidural steroid injections for his refractory back and lumbar radiculopathy pain, which only provided partial relief of symptoms. Physical examination revealed decreased sensation in the left lower flank, lower leg and lateral foot and absent left ankle reflex.

INVESTIGATIONS

Nerve conduction studies showed mildly low amplitude of the left sural sensory action potential, normal amplitude and mild slowing of the left peroneal motor nerve action potential (recorded at extensor digitorum brevis), and normal tibial motor responses as well as F wave latencies.

Needle electromyography showed neurogenic units and recruitment in the left gastrocnemius and reduced insertional activity with fibrillation potentials and positive waves in the left lower lumbar paraspinal muscles. The study was consistent with a left lower lumbar–sacral radiculopathy and a concomitant distal axonal neuropathy versus a lumbar–sacral plexopathy. MRI revealed severe atrophy and adipose infiltration of left-sided lower lumbar–sacral paraspinal muscles extending from the L3 to L4 level inferiorly through the sacral levels (large arrows in figure 1A, B).

DIFFERENTIAL DIAGNOSIS

Lumbar paraspinal compartment syndrome is a very rare cause of low back and radicular lower limb pain. More common conditions include different pathological processes caused by degenerative arthritis of the lumbar spine, including spondylolisthesis, intervertebral disk bulging and herniation, and facet joint arthropathy. Neoplastic and inflammatory infiltration of the nerve roots and plexi are other less common causes of radiculopathy and plexopathy. Another consideration in our case who had diabetes and radiculopathy symptoms in the left lower limb would have been diabetic lumbosacral radiculoplexus neuropathy, a monophasic entity that can present in even well-controlled cases of type 2 diabetes.[4]

OUTCOME AND FOLLOW-UP

The patient has been followed-up for a period of 4 years after his initial neurological evaluation. His back and radicular lower limb pain have partially responded to oral gabapentin. Duloxetine was temporarily tried and stopped due to a lack of efficacy. He has also undergone left L3 and L4 transforaminal epidural steroid injections on three occasions during the last 3 years of follow-up (figure 2).

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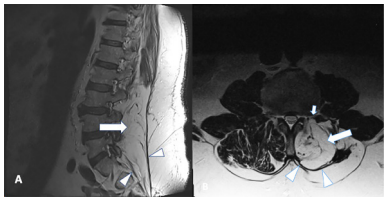

Figure 1 Sagittal T1-weighted image (A) and axial T2-weighted image (B) demonstrate adipose infiltration of the lumbar–sacral paraspinal muscles (large arrow), intact fascial boundaries of the lumbar paraspinal compartment (arrowheads) and proximity of the affected paraspinal muscles to the very proximal part of lumbar–sacral plexus, that is, ventral rami of the nerve roots (small arrow).

DISCUSSION

The chronic lower back and radicular pain in the left lower limb in our patient started after prolonged positioning on his left side 7 years before evaluation, and there was elevated CK in the postoperative period that trended to normal in 2 weeks (figure 2). Fatty infiltration of the left lumbar paraspinal muscles in a subsequent MRI study was consistent with left lower lumbar paraspinal compartment syndrome as the cause of postoperative transient rhabdomyolysis and subsequent emergence of the chronic lower back pain.

Lower lumbar and sacral paraspinal muscles constitute a compartment as they are surrounded by well-developed fascial sheaths (arrowheads in figure 1A, B) and bony structures. The lumbar paraspinal compartment is contained by lamellae of the fascial sheet posteriorly that merge with the spinous process and interspinous ligaments medially, the fascia of abdominal muscles laterally, iliac crest and sacrum caudally and the transverse spine processes ventrally.[5 6]

At least 30 previous cases of lumbar paraspinal compartment syndrome have been previously reported (table 1); with an age range of 16–67, predominantly male individuals (M/F: 28/3). This is a condition that predominantly affects athletic male individuals in the second to fourth decades, with strenuous exertion usually involving weightlifting being the cause in the majority of cases.[2 5 7–12] Other less common culprits include direct trauma due to falls[13 14] and use of vasoconstrictors cocaine, ephedrine and pseudoephedrine.[2 3 11 15] Only five (including our) cases are reported following surgical procedures.[16–18] Diagnosis of lumbar paraspinal compartment syndrome should be confirmed by direct measurement of intramuscular pressure in the acute stage.[3 5 10 12 13 19] Changes in the MRI and CT scan in the acute stage consist of swelling of the paraspinal muscles and abnormal signal intensity in T2-weighted MRI images.[2 10 13 18] The aforementioned changes can be subtle and be missed in the early stage.[18] When undiagnosed, myonecrosis and concomitant nerve injury may result in chronic back pain and persistent numbness in the lumbar/sacral dermatomes.[1 2 7 17 18] Lower back numbness and paraesthesia are caused by the involvement of dorsal rami of the nerve roots and cutaneous branches of the cluneal nerves.[15]

Radicular pain, sensory symptoms and absent reflexes in the lower limbs have previously been reported following lumbar paraspinal compartment syndrome.[15 18 20] In contrast, patients may present with loin or groin pain, suggesting renal colic.[21 22] The emergence of radicular lower limb pain in our patient can be explained by the compression of the anterior divisions (ventral rami) of the lower lumbar–sacral nerve roots, because of oedema in the paraspinal muscles associated with the acute stage of rhabdomyolysis. Although the anterior divisions course ventrally after exiting from the neural foramina, they are separated from the erector spinae only by fascial planes at certain points during their course (small arrow in figure 1B[6]). In contrast, another possible explanation of development of left lower limb plexopathy in our case would have been traction injury to the lower lumbar–sacral plexus due to positioning, unrelated to rhabdomyolysis.

Similar to the compartment syndromes involving the extremities, treatment of acute lumbar paraspinal compartment syndrome consists of surgical decompression (fasciotomy), which may improve the long term outcome.[1 8–10 13] Sixteen of the 29 previously reported cases underwent fasciotomies, 14 of whom had complete recovery of back pain days to weeks after the procedure (table 1). In contrast, the recovery was more gradual, over a period of 4–6 months in patients who had conservative treatment (management of pain, intravenous hydration and monitoring of kidney function). The favourable outcome when defined as complete recovery or mild residual symptoms was reported in only 6 of 14 of the conservatively treated patients, whereas another 6 patients, including our patient, had significant chronic low back pain when followed-up for 2 months to 8 years after the incident (table 1). Optimal surgery timelines have not been established with regard to lumbar paraspinal compartment syndrome given the rarity of this condition[13]; decompression fasciotomies have been done 2–3 days after the onset of symptoms with good long-term outcomes.[8 11 23]

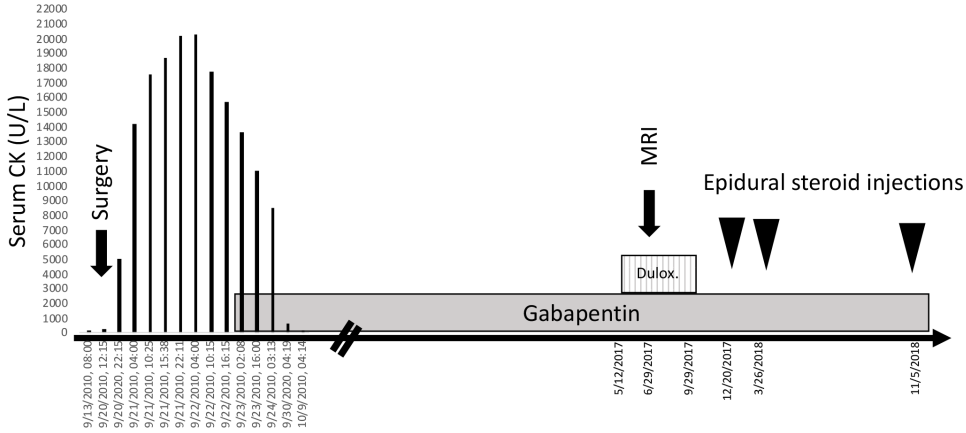

Figure 2 Timeline of events and treatments, timing of surgery, which preceded rhabdomyolysis, and of the lumbar MRI study are presented by arrows. Timing of treatment with gabapentin and duloxetine are demonstrated with grey and striped bars, respectively. Epidural injections are shown by arrowheads. CK, creatine kinase.

Table 1 Previously reported cases of lumbar paraspinal compartment syndrome

Reference	Age/sex	Setting	Fasci.	Outcome/duration of follow-up
Present case	53/M	Ankle surgery (prolonged positioning), obesity	–	Chronic back pain, radicular pain in the lower limb/7 years
[5]	24/M	Exercise (skiing)	–	Intermittent residual back pain/3 months
[7]	27/M	Exercise (skiing)	–	Mild residual back pain/4 months
[16]	55/M	Abdominal aortic aneurysm surgery	–	Slight residual back pain/3 months
[10]	21/M	Weightlifting	+	Significant improvement of back pain/7 days
[18] Case 1	57/M	Aortoiliac bypass surgery	–	Chronic low back pain/10 months
[18] Case 2	34/M	Gastric bypass surgery	–	Sensory loss in the peri-spinal region/1 year
[13]	43/F	Trauma, fall	+	Significant improvement in back pain/6 months
[9]	35/M	Exercise (skiing)	+	Complete recovery/3 months
[8]	25/M	Exercise (surfboarding)	+	Complete recovery/2 months
[15]	29/F	Weightlifting	–	Resolution of back pain/6 months
[19]	16/M	Weightlifting	+	Complete resolution of back pain/2 years
[17]	67/M	abdominal aortic surgery	–	Residual mild back pain/7 months
[3]	45/M	Cocaine	+	Complete recovery/2 weeks
[2]	30/M	Bodybuilding, anabolic steroids	–	Significant residual back pain/2 months
[11]	32/M	creatine, pseudoephedrine	+	Complete recovery/14 days
[24]	23/M	Weightlifting	–	Residual back pain only with exercise/4 months
[12]	20/M	Strenuous exercise	+	Complete recovery/1 months
[25]	16/M	Strenuous exercise	+	Complete recovery/3 months
[23]	30/M	Weightlifting	+	Complete recovery/3 months
[26]	23/M	Exercise	+	Complete recovery/1 year
[14]	43/F	Direct trauma	+	Post-operative recovery/NA
[22]	25/M	Weightlifting	–	Residual back pain/13 days
[27]	23/M	Weightlifting	+	Complete recovery/1 year
[28]	25/M	Weightlifting	–	Persistent back pain/3 days
[20]	25/M	Exercise (cross-fit)	–	Refractory back pain/5 days
[21]	24/M	Weightlifting	–	Persistent back pain/9 days
[29] Case1	30/M	Weightlifting	+	Complete recovery/6 months
[29] Case 2	31/M	Exercise	+	Complete recovery/6 months
[30]	17/M	Exercise (callisthenics)	+	Complete recovery/4 months

F, female; Fasci, fasciotomy; M, male.

Learning points

- Lumbar paraspinal compartment syndrome is a rare cause of chronic lower back pain and radicular pain in the lower limb.
- It is most commonly reported in younger male individuals after weightlifting exercises.
- It is also a postoperative complication, such as prolonged positioning on the side.
- This condition has to be considered in patients with rhabdomyolysis and back pain after heavy exercise or surgical procedures.
- Surgical intervention in the acute stage may prevent chronic back pain.

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