TURKISH JOURNAL OF EMERGENCY MEDICINE

Case Report/Case Series

Access this article online

Quick Response Code:

Website: https://turkjemergmed.com/

DOI: 10.4103/tjem.tjem_224_24

Cocaine and ketamine-induced paraspinal muscle compartment syndrome

Thomas Saliba[1], Simone Giglioli[2], Sanjiva Pather[1], Daniel DeBacker[2]*

[1]Department of Imaging, CHIREC Hospitals, Université Libre de Bruxelles, Brussels, Belgium, [2]Department of Intensive Care, CHIREC Hospitals, Université Libre de Bruxelles, Brussels, Belgium
**Corresponding author*

Abstract:

Lumbar paraspinal compartment syndrome is a rare pathology, with only 40 reported cases resulting from an increase in pressure within the muscle compartment. Symptoms typically involve pain and sometimes muscular deficits. The typical patient is a man who has undergone strenuous exercise, with few cases linked to the use of recreational drugs, such as cocaine or ketamine. We report the case of a 25-year-old man presenting to the emergency room with severe diffuse back pain who had recently consumed large amounts of cocaine, ketamine, and alcohol. The patient had diffuse muscular pain, increased serum creatine kinase (CK) levels, and a negative noncontrast abdominal computed tomography (CT), leading to the suspicion of crush syndrome. Over the following days, the patient's pain became more localized to the right paraspinal region, prompting a contrast-enhanced CT. This revealed signs of muscle swelling and edema of the paraspinal muscle, leading to a suspicion of compartment syndrome, which was confirmed by an intramuscular pressure measurement. The patient underwent a surgical fasciotomy. The patient went on to have an unremarkable recovery. Lumbar paraspinal compartment syndrome is exceedingly rare. Cocaine is known to cause rhabdomyolysis both indirectly, due to behavioral disturbances, and directly due to muscle toxicity. Similarly, ketamine use has also been associated with rhabdomyolysis. The rhabdomyolysis results in greatly increased CK levels, sometimes rising up to 100 00 U/L, which should normalize over the following days. A few cases of compartment syndrome, often localized in extremities, have been reported in patients presenting cocaine or ketamine-induced rhabdomyolysis. In this patient, the muscle swelling of the paraspinal muscle resulted in compartment syndrome. Patients who experience cocaine-related rhabdomyolysis have a tendency for nonspecific symptoms, which would match our patient's initial presentation. Although radiology's contribution to the diagnosis is limited, patients suffering from back pain or nonresolving rhabdomyolysis should be submitted to imaging, which may show signs of muscle swelling and edema on CT and magnetic resonance imaging. Diagnosis of compartment syndrome should be confirmed by measurement of muscle pressure, and if elevated, the patient should be proposed for fasciotomy.

Keywords:

Back pain, cocaine, computed tomography scan, fasciotomy, ketamine, rhabdomyolysis

Submitted: 24-10-2024
Revised: 29-11-2024
Accepted: 13-12-2024
Published: 01-04-2025

ORCID:
TS: 0000-0001-6989-9577
SG: 0000-0001-9749-6978
SP: 0000-0002-2574-591X
DD: 0000-0001-9841-5762

Address for correspondence:
Prof. Daniel DeBacker, Head of Intensive Care Unit of Hopital de Braine-L'Alleud, Rue Wayez 35, Braine-L'Alleud, Belgium.
E-mail: ddebacker@ulb.be

Introduction

Lumbar paraspinal compartment syndrome is a rare diagnosis, with very few cases (40) reported.[1] It is caused by an increase in pressure within the nonelastic paraspinal muscle compartments, leading to decreased perfusion and necrosis.[1] Affected patients typically present with lower back pain and, occasionally, neuromuscular deficits.[1] Men are affected in over 90% of reports, with these cases generally being linked to weightlifting and heavy physical exercise. A few cases have been linked

How to cite this article: Saliba T, Giglioli S, Pather S, DeBacker D. Cocaine and ketamine-induced paraspinal muscle compartment syndrome. Turk J Emerg Med 2025;25:147-51.

to cocaine abuse, often associated with prolonged compression due to impaired consciousness.[2-4]

We present what is, to our knowledge, the second reported case of lumbar paraspinal compartment syndrome in a patient who had consumed drugs, including cocaine and ketamine, shortly before its onset.

Case Report

A 25-year-old male patient was brought to the emergency department by ambulance for diffuse lower back pain. The patient reported diffuse, but predominantly left sided, pain in the lower back, thighs, psoitis, and renal lodges. The patient's history revealed no known trauma, but he admitted to having consumed 10 g of ketamine, 1 g of cocaine, over five alcoholic drinks and smoking cannabis the day before. He was never unconscious and did not experience hyperkinesia or agitation.

The patient had no notable medical or surgical history except for depression and habitual consumption of ketamine, cocaine, cannabis, tobacco, and alcohol.

A blood test revealed significantly elevated creatine kinase (CK) levels of 9,842 U/L, which increased to over 20,000 U/L within the following hours. Additional findings included a lactate dehydrogenase level of 379 U/L, aspartate aminotransferase (AST) of 299 U/L, alanine aminotransferase (ALT) of 96 U/L, a slightly elevated C-reactive protein of 6.9 mg/L, and a white blood cell count of 15,000/mm^3. The toxicology report showed a mildly elevated plasma ethanol level (0.37 g/L) and a positive urine test for cocaine and cannabinoids, while results were negative for amphetamines and opioids. A noncontrast abdominal computed tomography (CT)-scan (NCACT) was performed due to the abdominal pain, with no notable abdominal findings.

The diagnosis of rhabdomyolysis due to intoxication by ketamine and cocaine alongside suspected crush syndrome was made. The patient received midazolam, morphine, clonidine, a drip containing crystalloids, as well as Vitamin B1, Vitamin B6, and bicarbonate.

The patient was transferred to the intensive care unit (ICU) for management of severe rhabdomyolysis by hyperhydration and urine alkalinization.

For the following days, the pain was predominantly located on the right dorsal side while the pain in the other muscles subsided.

After an initial peak of CK levels over 20,000 U/L, these decreased to 10 000 U/L and then oscillated around 19 000 U/L for the following 4 days. C-reactive protein (CRP) levels continued to increase, reaching 154 U/L before stabilizing. On the 4th day, a follow-up contrast-enhanced abdominal CT scan (CEACT) was ordered as the patient now presented right lumbar anesthesia in addition to persistent severe back pain and increasing CRP [Figure 1]. The CEACT revealed hypodensity and swelling of the right paraspinal muscles from L1 to L5, alongside hypodermic infiltration, when compared to the contralateral side, which was interpreted as myositis.

The increasing lower back pain prompted a discussion between the radiology and ICU staff, leading to a revision of the initial NCACT CT scan, which was retrospectively found to already show slight signs of muscle hypodensity and swelling, though no hypodermic infiltration was present [Figure 2]. A comparison of the two exams did not reveal any significant increase in the degree of muscle swelling.

The combination of rhabdomyolysis, pain, and muscle swelling seen on the CT scans raised the suspicion of compartment syndrome of the lumbar paraspinal muscles, leading to an ultrasound-guided needle pressure monitoring [Figure 3]. The right paraspinal compartment was found to have a pressure of 130 mmHg, compared to 22 mmHg on the contralateral side, confirming the diagnosis of compartment syndrome.

The patient underwent a right paravertebral fasciotomy the following day, and a muscle biopsy sent for pathology showed muscle inflammation and necrosis.

The patient experienced relief from his back pain in the immediate postoperative period, allowing for rapid rehabilitation The patient was able to walk 3 days later, with a blood test performed at this point showing

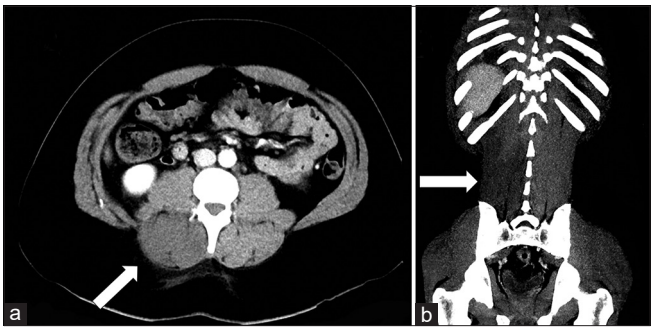

Figure 1: Contrast-enhanced computed tomography (CT) imaging of right paraspinal muscle compartment syndrome. (a) Axial contrast-enhanced CT image taken from the second scan, acquired 4 days after admission, showing slight swelling of the right lumbar paraspinal when compared to the contralateral side (arrow) and infiltration of the hypodermis; (b) Coronal maximum intensity projection contrast-enhanced CT image with tight windowing taken from the second scan, acquired 4 days after admission, showing hypodensity of the right lumbar paraspinal when compared to the contralateral side, suggestive of edema (arrow)

near-normal CRP and CK levels. He was discharged of the hospital 4 days after surgery.

Discussion

Compartment syndrome of lumbar paraspinal muscles is a rare diagnosis, with only 40 cases reported to date.[1,2] The most commonly affected patients are male weightlifters, patients who have been lying for prolonged periods, such as postoperative patients and athletes.[2] The patients will nearly universally present with back pain but can also have accompanying numbness or lower limb pain, amongst other rarer presentations.[2] The pain can be unilateral, but bilateral presentations are more common.[2] When taking the patient history, one should not neglect to enquire about any drugs or medication that could be responsible for myolysis. These patients should be highly suspicious of compartment syndrome. A blood test should be performed to search for signs of myolysis.

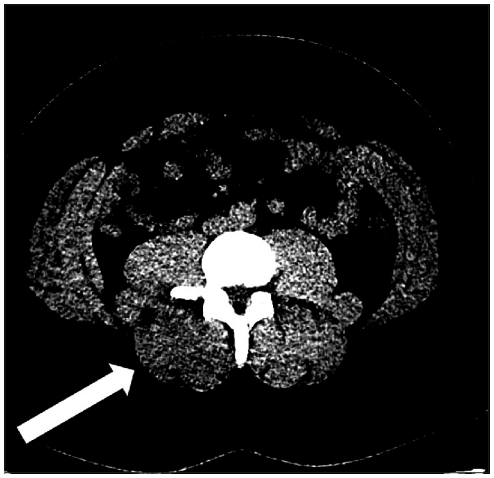

Figure 2: Axial nonenhanced computed tomography image taken at from the first scan, acquired on the day of admission. Very tight windowing shows a slightly hypodense right paraspinal muscle (arrow) when compared to the left, suggestive of edema

If the blood test is positive, these patients should undergo a CT scan or magnetic resonance imaging (MRI) to rule out alternative diagnoses and look for signs of compartment syndrome, followed by ultrasound-guided needle pressure-monitoring to confirm the diagnosis. A surgeon should be informed if there is a suspicion of compartment syndrome as surgical decompression is a mainstay treatment, resulting in better patient outcomes.

Ilyas *et al*. performed a review of 37 cases, with young men representing 92% of patients.[2] Most of the reported cases are linked to weightlifting (48.6%) and physical exertion (18.9%), followed by abdominal vascular surgery and bypass surgery (16.2%) [Table 1].[2] Interestingly, the mechanisms involved include extreme exercise involving these muscles or prolonged compression (eventually resulting in impaired perfusion). Sixty-two percent of patients presented with bilateral compartment syndrome, and all patients who underwent a compartment pressure measurement showed increased pressures, averaging 91.8 ± 44.8 mmHg.[2] The patients with compartment syndrome also exhibited significantly increased AST, ALT, and CK levels, measured at 713 ± 331 U/L, 91 ± 117 U/L, and 66,258 ± 34,684 U/L, respectively.[2] Furthermore, patients who underwent surgical fasciotomy had far better outcomes than those who underwent conservative treatment, with 95% of operative patients reporting favorable outcomes, while only 9% of patients who underwent conservative treatment did not suffer from lingering pain and discomfort when performing physical activities.[2]

Both ketamine and cocaine are associated with rhabdomyolysis. Ketamine has been associated with rhabdomyolysis.[5-7] This rhabdomyolysis was often attributed to the severe muscular activity related to agitation.

Cocaine frequently leads to rhabdomyolysis, though few cases of compartment syndrome have been reported, often

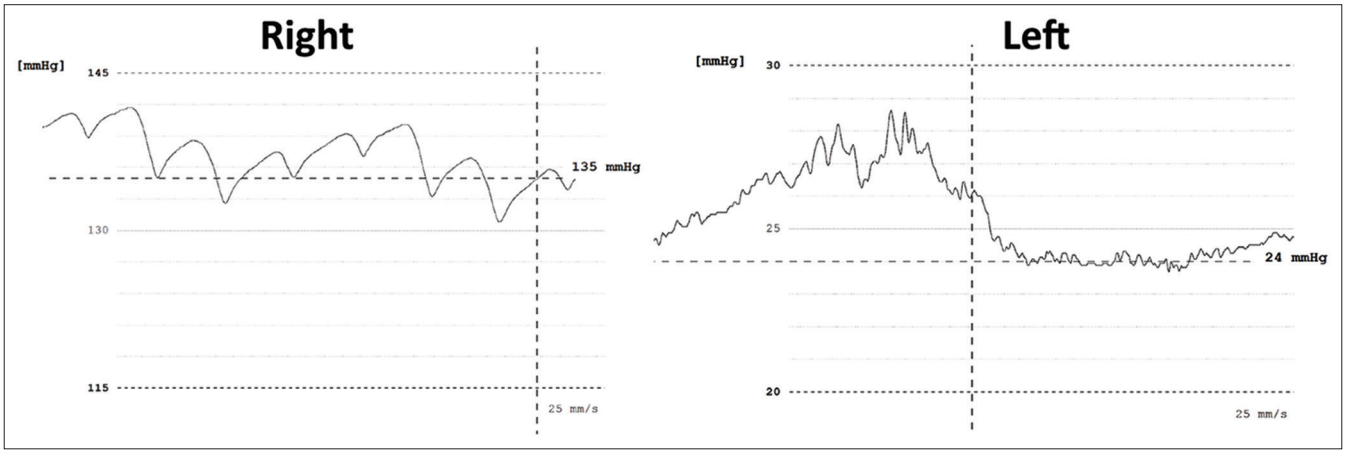

Figure 3: Pressure measurements of parasagittal muscles. Measurement of right and left paraspinal muscles (135 mmHg and 24 mmHg, respectively). All measurements were performed at end-expiration. Note that the scale differs in each

Table 1: Table summarizing the case reports of patients who suffered paraspinal compartment syndrome to date

Sex		Mechanism	Laterality	Presentation (patients may have had multiple symptoms)	Diagnostic tools (some patients underwent multiple diagnostic procedures)	Treatment	Outcome (not all patients had a follow-up)
Male	Female						
36	3	Weightlifting - 18	Unilateral - 11	Back pain -38	CT - 7	Operative - 22	Resolution - 21
		Trauma - 2	Bilateral - 24	Dark urine - 3	MRI - 28	Nonoperative - 15	Ongoing pain - 12
		Postsurgical - 7		Loin/groin pain - 3			
		Physical exertion - 7		Numbness - 11			
		Illicit drugs - 3		Dysesthesia - 1			
		Other - 2		Lower limb pain - 4			

Based on the reports of Sauliunaite and Ilyas *et al*.[1,2] MRI: Magnetic resonance imaging, CT: Computed tomography

involving extremities (legs/arms) rather than paraspinal muscles.[8,9] Various mechanisms can contribute to cocaine-associated rhabdomyolysis. In addition to its effects on the central nervous system, cocaine acts on the sympathetic nervous system, increasing the sensitivity of nerves to noradrenaline, blocking sodium and potassium channels, and blocking catecholamines re-uptake by sympathetic nerves.[8,10] One of the likely ways in which cocaine induces muscle damage is by causing ischemia due to vasoconstriction, hyperpyrexia, thrombosis, and increased muscle activity, with 24% of cocaine users presenting at the emergency department suffering from rhabdomyolysis.[8,9,11,12] In cases of cocaine-related rhabdomyolysis, CK levels have been known to increase to over 100,000 U/L.[10] Furthermore, patients who have taken cocaine often do not have the classic symptoms of nausea, vomiting, myalgia, muscle swelling, weakness, and tenderness associated with rhabdomyolysis.[10] This atypical presentation pattern is in accordance with the initially nonspecific presentation of our patient.[10] In addition to the nonspecific effects such as agitation seizures, anxiety, hyperthermia, muscle contractions, and physical restraints, cocaine also has direct toxicity both in *in vitro* and *in vivo* studies.[10,13] One potential mechanism is via the activation of caspase and p38 pathways, resulting in cytochrome C release into the cytosol and ensuing apoptosis.[13] Another mechanism is severe vasoconstriction, leading to hyperactivity of cytochrome oxidase, the final enzyme in the electron transfer chain, which causes an ischemic phase followed by reperfusion with an increase of reactive oxygen species and mitochondrial dysfunction with ensuing apoptosis.[13] Yet another mechanism may be mediated by the release of the free-radical scavenger glutathione, as well as by thiobarbituric acid reactive substances.[13] The rhabdomyolysis has been shown to occur rapidly, beginning within the 1-hour half-life of the cocaine, but continuing over the following days, as shown by the CK levels peak occurring around 24–72 h after consumption and only normalizing after around 5 days.[10,13] Whatever the causal mechanism, an interesting question is why the paraspinal muscles were mainly involved in this patient. This patient was never unconscious and had not been lying down for a prolonged period. It is possible that this patient had particularly developed paraspinal muscles due to his profession involving the transport of heavy loads. Paraspinal muscles also have a relatively small diameter, which, alongside the fact that this muscle group is bounded medially and posteriorly by osseous structures, prevents its expansion when the muscle swells. It therefore follows that this muscle group may be more susceptible to increases in intramuscular pressure and subsequent development of compartment syndrome.

Imagery of lumbar paraspinal compartment syndrome can include CT scans or MRIs. A CT scan may show muscle swelling and hypodensity, as was the case in our patient, though it should be noted that it cannot exclude compartment syndrome as findings may also be falsely negative in the initial stages.[3,14] MRI imaging usually shows increased T2 signal within the affected muscles, corresponding to edema, alongside muscle swelling.[4,14] Finally, the indication of surgical decompression is usually based on measurements of intramuscular pressure. To ensure that measurements are performed in the paraspinal muscle, this procedure can be guided by ultrasonography, as we did in this case.

Conclusions

Paraspinal muscle compartment syndrome is a rare diagnosis, often associated with strenuous physical exercise or prolonged compression. Cocaine and ketamine abuse may also contribute as a rare cause, as illustrated in this case. When suspected, a contrast-enhanced CT should be performed before confirmation by a pressure measurement. Fasciotomy may be associated with faster recovery.

Author contribution statement

- TS:
  Conceptualization
  Writing – Original Draft:
  Writing – Review and Editing.
- SG:
  Original Draft
  Methodology
  Formal Analysis: Analyzed the data and interpreted the results, contributing to the statistical aspects of the research
  Writing – Review and Editing.
- SP:

Original Draft
Writing – Review and Editing
Data Curation
Visualization.

- DDB:
  Conceptualization
  Original Draft
  Writing – Review and Editing
  Methodology
  Supervision
  Investigation
  Data Curation
  Visualization
  Project Administration.

Conflicts of interest

Thomas Saliba: none to declare, Simone Giglioli: none to declare, Sanjiva Pather: none to declare, Daniel De Backer: Edwards Lifesciences, Philips, Baxter, Viatris, Pharmazz, AOP.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his consent for his images and other clinical information to be reported in the journal. The patient understands that name and initials will not be published and due efforts will be made to conceal identity, but anonymity cannot be guaranteed.

Funding

None.

References

1. Sauliunaite V, Vecsernyés N, Coronado M. Acute lumbar paraspinal compartment syndrome after radical cystectomy. BMJ Case Rep 2024;17:e255983.
2. Ilyas H, Fagan C, Roser F, Hebela NM. Lumbar paraspinal compartment syndrome: Case report and critical evaluation of the literature. Clin Spine Surg 2022;35:301-9.
3. Ahmed T, Safdar A, Ahmed T, Ahmad T, Losonczy L. Acute paraspinal compartment syndrome in an unconscious patient. Cureus 2020;12:e7216.
4. Wik L, Patterson JM, Oswald AE. Exertional paraspinal muscle rhabdomyolysis and compartment syndrome: A cause of back pain not to be missed. Clin Rheumatol 2010;29:803-5.
5. Weiner AL, Vieira L, McKay CA, Bayer MJ. Ketamine abusers presenting to the emergency department: A case series. J Emerg Med 2000;18:447-51.
6. Zeiss R, Schweizer M, Connemann B, Malejko K. Case report: Two cases of rhabdomyolysis following esketamine treatment. Front Psychiatry 2024;15:1450092.
7. Tsai SF, Tsai JL, Chen CH. A patient with severe rhabdomyolysis and high levels of creatinine kinase had renal functions fully recovered after haemodialysis: A case report. J Int Med Res 2020;48:1-4.
8. Al-Maharmeh Q, Haddad AW, Abouzeid W, Kloub M, Haddad D. Cocaine-induced acute extremity compartment syndrome: A rare case report. Cureus 2024;16:e57297.
9. Jorens P, Gielen J, Parizel PM. Rhabdomyolysis of the left upper leg after cocaine abuse. JBR-BTR; 2006;89:158-9. Available from: https://www.researchgate.net/publication/6902575. [Last accessed on 2025 Mar 31].
10. Daubert GP. Toxicant-induced rhabdomyolysis. Critical Care Toxicology: Diagnosis and Management of the Critically Poisoned Patient. Springer, Cham; 2017. p. 679-90.
11. Madera G, Bm C, Holguín P. Acute rhabdomyolysis and acute cocaine intoxication. J Fam Med Dis Prev 2016;2.
12. Welch RD, Todd K, Krause GS. Incidence of cocaine-associated rhabdomyolysis. Ann Emerg Med 1991;20:154-7.
13. Richards JR, Mefford JM, Patel JJ, Parikh AK, Eder AZ, Elder JW. The association between cocaine use detected on drug screening and rhabdomyolysis. Toxicol Commun 2020;4:18-24.
14. Minnema BJ, Neligan PC, Quraishi NA, Fehlings MG, Prakash S. A case of occult compartment syndrome and nonresolving rhabdomyolysis. J Gen Intern Med 2008;23:871-4.