



Case report: Rhabdomyolysis in morbidly obese patients: anesthetic considerations

Présentation de cas: Rhabdomyolyse chez les patients obèses morbides: considérations anesthésiques

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Abstract

Purpose We report the presentation and management of rhabdomyolysis involving shoulder girdle and upper arm muscles in a morbidly obese patient after prolonged laparoscopic surgery.

Clinical features A 41-yr-old morbidly obese woman presented for laparoscopic abdominal hysterectomy. She had hypertension and type II diabetes which were controlled on regular medications. She also had obstructive sleep apnea. Her clinical examination and investigations revealed no abnormality except morbid obesity (body mass index $54 \text{ kg}\cdot\text{m}^{-2}$) and left ventricular hypertrophy on transthoracic echocardiogram. Standard general anesthesia was administered under baseline non-invasive monitors. Succinylcholine was used to secure the airway during anesthetic induction. Surgery was performed with the patient positioned with a 15° head-down tilt, and it took six hours to complete the procedure as technical difficulty was encountered due to her body habitus. Her trachea was extubated and she was transferred to the postanesthetic care unit (PACU) without incident.

In the PACU, the patient complained of severe bilateral arm pain and weakness an hour after surgery. On physical examination, she exhibited limited movement of her arms against gravity while complaining of tenderness in her shoulder girdle muscles and both arms. Clinical suspicion of rhabdomyolysis based on her signs and symptoms was confirmed by an elevated serum creatinine kinase (CK) of $18,392 \text{ IU}\cdot\text{L}^{-1}$ and serum potassium of $5.3 \text{ mmol}\cdot\text{L}^{-1}$. Intravenous crystalloids and mannitol were administered for 24 hr for renal protection, and her clinical symptoms and serum CK levels improved over seven days. The patient was discharged to home on the tenth postoperative day, and she continued to improve over the three-month follow-up period.

Conclusions Morbidly obese patients who undergo prolonged surgery are at risk for rhabdomyolysis, and early diagnosis and therapy are required to prevent severe complications.

Résumé

Objectif Nous rapportons la présentation et la prise en charge d'un cas de rhabdomyolyse touchant la ceinture scapulaire et les muscles des bras supérieurs d'une patiente obèse morbide après une chirurgie laparoscopique prolongée.

Éléments cliniques Une femme obèse morbide de 41 ans s'est présentée pour une hystérectomie abdominale par laparoscopie. Elle souffrait d'hypertension et de diabète de type II, lesquels étaient contrôlés par un traitement médicamenteux régulier. Elle souffrait également d'apnée obstructive du sommeil. L'examen clinique et les analyses n'ont révélé aucune anomalie hormis une obésité morbide (indice de masse corporelle $54 \text{ kg}\cdot\text{m}^{-2}$) et une hypertrophie ventriculaire gauche à l'échocardiogramme transthoracique. Une anesthésie générale standard a été administrée, surveillée par des moniteurs non effractifs de base. Nous

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avons utilisé de la succinylcholine pour prendre en charge les voies aériennes pendant l'induction de l'anesthésie. On a positionné la tête de la patiente inclinée de 15° vers le bas pendant la chirurgie, et il a fallu six heures pour terminer l'intervention en raison de difficultés techniques liées à son habitus corporel. Sa trachée a été extubée et elle a été transférée en salle de réveil sans incident.

En salle de réveil, la patiente s'est plainte de forte douleur bilatérale aux bras et de faiblesse une heure après la chirurgie. Lors de l'examen physique, elle a fait preuve d'une mobilité limitée de ses bras contre la gravité tout en se plaignant d'une sensibilité aux muscles de sa ceinture scapulaire et aux deux bras. Une suspicion clinique de rhabdomyolyse fondée sur les signes et symptômes manifestés par la patiente a été confirmée par un niveau élevé de créatine kinase (CK) sérique de 18 392 IU·L⁻¹ et de potassium sérique de 5,3 mmol·L⁻¹. Des cristaalloïdes et du mannitol ont été administrés par voie intraveineuse durant 24 h afin de protéger ses reins, et ses symptômes cliniques et niveaux de CK sérique se sont améliorés sur une durée de sept jours. La patiente a reçu son congé le dixième jour postopératoire, et son état a continué à s'améliorer au cours de la période de suivi de trois mois.

Conclusion *Les patients obèses morbides subissant une chirurgie prolongée courent le risque de manifester une rhabdomyolyse; un diagnostic et un traitement rapides sont nécessaires afin de prévenir les complications graves.*

Rhabdomyolysis (RML) is a skeletal muscle disorder that challenges filtering capacity of the kidney by releasing toxic cell constituents into the systemic circulation. Its incidence ranges from 1.4-75% after bariatric surgery.^{1,2} Acute renal failure (ARF) secondary to RML occurs in 20-50% of patients causing mortality in up to 20%.³ We describe the presentation of RML after prolonged laparoscopic surgery which manifested as persistent postoperative myalgia of shoulder girdle muscles and was refractory to standard multimodal analgesics. Early diagnosis and management using a multidisciplinary approach prevented development of potentially catastrophic complications. The patient provided written informed consent for publication of this article.

Case

A 41-yr-old morbidly obese American Society of Anesthesiologists (ASA) physical status III patient was scheduled for laparoscopic abdominal hysterectomy because of atypical endometrial cells on biopsy. She had

multiple comorbidities, including hypertension, type II diabetes, and obstructive sleep apnea. There was no history of acid reflux, decreased urine output, fibromyalgia, radicular pain, numbness, or limb weakness. On polysomnography, she had an apnea hypopnea index of 14. Her medications included metformin 500 mg twice daily and amlodipine 5 mg once daily. The patient was prescribed continuous positive pressure therapy but did not comply. She denied previous hospitalization and surgery. Her general physical examination revealed no clinical abnormality except morbid obesity (body mass index 54 kg·m⁻²). Her airway examination suggested a potentially difficult airway with a Mallampati grade 3 and a short neck with limited extension. Preoperative laboratory tests showed a preoperative hemoglobin of 126 g·L⁻¹, a serum creatinine of 71 mmol·L⁻¹, and left ventricular hypertrophy. A preoperative chest roentgenogram showed cardiomegaly, and a transthoracic echocardiogram revealed an ejection fraction of 55-60%.

The patient was fasted for eight hours, and antihypertensive medication was continued on the day of surgery. Antibiotic prophylaxis and thromboprophylaxis were administered with cefazolin 2 g *iv* and heparin 5,000 IU *sc*, respectively. Baseline vital signs in the operating room included a heart rate of 65 beats·min⁻¹ and blood pressure of 140/92 mmHg. In anticipation of difficult airway management, the patient was positioned on a Troop® elevation pillow with her upper body elevated in a semi-recumbent position. A difficult airway cart was readily available. After instituting standard non-invasive monitors (pulse oximetry, non-invasive blood pressure, electrocardiogram), a modified rapid sequence tracheal intubation was performed using fentanyl 250 µg, propofol 300 mg, and succinylcholine 160 mg. Tracheal intubation was successful on first attempt using a video laryngoscope and a 7-mm endotracheal tube. Mechanical ventilation was delivered with intermittent positive pressure ventilation with a tidal volume of 650 mL, respiratory rate of 10 breaths·min⁻¹, and positive end-expiratory pressure of 5 cm H₂O. General anesthesia was maintained with a mixture of air / oxygen, desflurane, rocuronium, hydromorphone 3 mg, and fentanyl 500 µg. The Troop pillow was removed after securing the airway, the patient's head was positioned on soft gel foam, and she was secured to the operating table to avoid slipping. Her arms were positioned at her sides, and soft gel pads were applied around her hips, elbows, and shoulder regions. Surgery was performed with the patient in a head-down tilt of approximately 15°. Peak airway pressure ranged from 22-30 cm H₂O, and oxygen saturation ranged from 94-96%. The surgical team maintained an intra-abdominal pressure of 8-10 mmHg and used a 10-mm bowel fan to move the abdominal fat and bowels away from the surgical field. The duration of surgery was six

hours with 600 mL of blood loss. Intravenous crystalloids 3 L were administered intraoperatively. During the procedure, urine output was 350 mL and observed to be clear. The patient's trachea was extubated uneventfully, and she was transferred without incident to the postanesthetic care unit (PACU) for subsequent monitoring.

In the PACU, she complained of severe bilateral arm pain and weakness an hour after surgery. Nevertheless, she had a heart rate of 106 beats·min⁻¹, non-invasive blood pressure of 146/90 mmHg, and a respiratory rate of 20 breaths·min⁻¹ with arterial oxygen saturation of 95%. She was given fentanyl 100 µg *iv* and hydromorphone 2 mg *iv* over one hour along with oral acetaminophen 1 g for muscle pain. On physical examination, there was limited movement of her arms against gravity along with tenderness over the shoulder girdle muscles and both arms. The differential diagnosis included succinylcholine-induced postoperative myalgia, pain secondary to repeated measurement of non-invasive blood pressure monitoring, and RML of shoulder girdle muscles and upper arms. The clinical diagnosis of RML was confirmed by a serum creatinine kinase (CK) of 18,392 IU·L⁻¹, and we informed the patient of her diagnosis. Other investigations showed a hemoglobin of 99 g·L⁻¹, serum potassium of 5.3 mmol·L⁻¹, blood urea of 5.2 mmol·L⁻¹, and serum creatinine of 82 µmol·L⁻¹ (Table). Her urine was dark in color with an output of > 0.5 mL·kg⁻¹·hr⁻¹. The patient received a bolus of 0.9% normal saline 2,000 mL *iv* over two hours followed by an infusion of 0.9% normal saline at a rate of 150 mL·hr⁻¹ for 48 hr, titrating the volume to urine output. Mannitol 20 g was administered after a bolus dose of saline. Peak CK levels occurred at 24 hr postoperatively and declined progressively over a week. Her temperature also normalized within 24 hr of admission to the PACU. The renal function remained stable during the entire perioperative period (Table). Postoperative analgesia was maintained with oral acetaminophen 1 g every six hours,

patient-controlled analgesia hydromorphone *iv*, and oral Hydromorph Contin.

Clinical symptoms improved over seven days, and the patient was discharged on the tenth postoperative day. She was given advice regarding weight reduction strategies, her need for regular physiotherapy, and follow-up. On discharge, she could move both arms up to 60° against gravity. She was advised to continue oral oxycodone IR (immediate-release) 10 mg every four hours *prn* and OxyContin CR (controlled-release) 30 mg every 12 hours *prn*. At follow-up three months following her procedure, she was able to lift her arms to 70° against gravity without any pain.

Discussion

This case report emphasizes the presentation and management of RML involving shoulder girdle and upper arm muscles in a morbidly obese woman after a prolonged laparoscopic hysterectomy. Rhabdomyolysis is a clinical and biochemical disorder that may be difficult to diagnose without a high degree of clinical suspicion.⁴ These patients may be clinically asymptomatic or manifest with muscular pain, numbness, distal muscle weakness, and meralgia paresthetica depending on the degree of muscle involvement.⁵ Muscular pain is a predominant symptom in more than a third of patients with elevated serum CK. Mortality secondary to RML in the postoperative period has been rarely described after bariatric surgery.^{2,6}

Perioperative complications frequently occur in morbidly obese patients.^{7,8} The excessive weight increases the compressive pressure leading to skeletal muscle ischemic necrosis and the release of muscle toxins into systemic circulation. In a prospective cohort study involving 49 obese patients undergoing bariatric surgery, the authors described prolonged surgery (more than four hours), extreme surgical positions, ASA physical status III-IV, and

Table Laboratory investigations showing elevated creatinine kinase in the immediate postoperative period and a gradual decrease with resuscitation

Lab investigations	Preop	PO6hr	POD1	POD2	POD3	POD4	POD5	POD6	POD7
Hb (g·L ⁻¹)	111	99	93	84	87	84	85	86	92
Platelets (X 10 ⁹ ·L ⁻¹)	389	389	359	424	436	440	492	484	472
Serum sodium (mmol·L ⁻¹)	3.6	5.3	4.0	4.0	3.8	3.8	4.1	3.8	3.8
Serum potassium (mmol·L ⁻¹)	3.6	5.3	4.0	4.0	3.8	3.8	4.1	3.8	3.8
Blood urea (mmol·L ⁻¹)	4.2	5.2	4.7	3.3	3.4	3.6	3.2	3.5	4.8
Serum creatinine (µmol·L ⁻¹)	70	82	59	59	58	51	47	49	58
CK (IU·L ⁻¹)		18,392	11,103	6,504	4,805	2,447	1,004	490	259

Preop = preoperative; PO = postoperative; POD = postoperative day; Hb = hemoglobin; CK = serum creatinine kinase

the presence of diabetes or hypertension as risk factors associated with development of RML.⁶ These findings confirm earlier studies in animals that showed the occurrence of myonecrosis when an intracompartmental pressure of 30 mmHg was applied for four to eight hours.⁹

The previous reports of RML described its occurrence in bariatric surgery involving mainly muscles of the gluteal region, as these procedures were performed in the supine position over a lumbar pad.⁶ Our patient developed RML involving shoulder girdle muscles and upper arms probably due to morbid obesity, maintenance of a 15° Trendelenburg position over six hours, and prolonged unrelieved pressure by excessive fat over shoulder girdle and upper arm muscles. The occurrence of microangiopathy with increased platelet aggregation and altered arteriolar permeability as seen in diabetic patients could have increased the risk of muscular ischemia in our patient.⁶ In addition to the abovementioned factors, the use of succinylcholine for rapid sequence intubation could have contributed to the development of RML. Myoglobinemia without development of massive RML has been documented in children after a single dose of succinylcholine, although this condition is rare in adult patients without underlying neuromuscular disease. The authors of such a case postulated that the anesthetic technique using halothane and the repeated dose of succinylcholine could have caused myoglobinemia.¹⁰

The level of plasma CK reflects the severity of muscle cell lysis.¹¹ Patients with serum CK > 20,000 IU·L⁻¹ are at risk of developing ARF.¹² Though our patient was at risk of developing ARF with an elevated CK of 18,392 IU·L⁻¹, early diagnosis of RML along with maintenance of adequate urine flow with the liberal administration of fluids and diuretics minimized the risk.

Perioperative precautions, such as padding pressure areas, use of a pneumatic mattress, supporting the abdominal apron in the neutral position, positional changes during the operation (using AirPal® patient transfer pads), the use of an experienced operative team in order to reduce surgical time, aggressive fluid replacement, and early ambulation have been shown to minimize the incidence of RML.^{13,14} In some cases, surgical time may be reduced by planning a two-staged procedure. In cases where RML is suspected, high urine output should be promoted with the administration of intravenous fluids and diuretics before, during, and after surgery.¹⁵ The addition of mannitol not only increases renal blood flow and the rate of glomerular filtration but also scavenges free radicals that are formed during RML. Similarly, as an osmotic agent, it increases urinary flow and prevents obstructive myoglobin casts. Dialysis is recommended when ARF has been established or severe hyperkalemia and acidosis are present.¹⁶

In conclusion, morbidly obese patients with coexisting diabetes or hypertension along with prolonged surgery are at risk for developing RML. A multidisciplinary approach, limited surgical time, adequate protection of pressure points, and early diagnosis and intervention may prevent development of potentially catastrophic complications.

Conflicts of interest None declared.

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