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Original article

Rhabdomyolysis after bariatric surgery: a multicenter, prospective study on incidence, risk factors, and therapeutic strategy in a cohort from South Italy

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Abstract

Background: At present, prospectively collected data on rhabdomyolysis (RML) after bariatric surgery are limited.

Objectives: To evaluate the incidence, risk factors, and therapeutic strategy of RML in different bariatric procedures.

Setting: University hospitals, Italy.

Methods: Obese patients were prospectively enrolled. Preoperative demographic characteristics and clinical data, as well as type of anesthesia and type and total duration of surgery, were recorded as potential risk factors for RML. RML was defined as postoperative creatine kinase (CK) >1000 U/L. Incidence, possible risk factors, and therapeutic outcome of RML were assessed and compared with comparative groups.

Results: Four hundred eighty obese patients were included in the study. After surgery, RML was diagnosed in 62 (12.9%) patients. Muscular pain was present in 12 patients (19.3%). In RML patients, mean CK value was 1346 ± 2132.5 U/L (range 1191–37,400). Only duration of surgery was identified as an independent risk factor for RML ($P < .001$). The best cutoff value of time as a predictor was 230 minutes. Aggressive therapy with fluids and diuretics started within 24 hours after surgery was more effective in relieving RML and muscle pain than a comparative retrospective group with a delayed diagnosis and therapy.

Conclusion: After bariatric surgery, the risk of RML increases, especially when the duration of surgery is >230 minutes. CK testing should be performed in all patients after bariatric surgery to make an early diagnosis and properly start fluids and diuretics. (Surg Obes Relat Dis 2016;▮:00–00.)

Keywords: Obesity; Bariatric Surgery; Rhabdomyolysis

Obesity is a growing epidemiologic problem in the Western countries, leading to significant diseases and complications. Thus, several bariatric operations for morbid obesity have been developed to reduce excess weight. Bariatric surgery may have a significant number of potential

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complications, including infections, fistulas, obstructions, and thrombosis. Rhabdomyolysis (RML)—literally, the dissolution of skeletal muscle—is a complication that is believed to be infrequent but can lead to a fatal outcome in obesity surgery. RML is considered as a biochemical and clinical syndrome, which is characterized by necrosis as a result of damage of the sarcolemma of the muscles. When this damage occurs, it allows a release of myoglobin in blood that can lead to acute kidney injury (AKI), probably because of intrarenal vasoconstriction, direct, ischemic tubule injury, and tubular obstruction; AKI occurs in 30% of patients with RML, with a death rate of 20% in that group [1,2]. Even if there is no defined threshold value of serum creatine kinase above which the risk of AKI is markedly increased, the risk is considered to be low when creatine kinase levels are $<15{,}000$ U/L [3]; on the other hand, a rapid diagnosis of RML is required for immediate treatment to avoid renal failure. To date, the true incidence of RML in bariatric surgery is unknown, ranging from 1.4%–75%, described only in case reports or case series [4–6]. Potential risk factors are male gender, age >40, body mass index (BMI) >55, presence of hypertension, diabetes, sleep apnea, and use of statins; intraoperative risk factors include operative time and the use of propofol [7]. Because bariatric surgery candidates typically have several of these suspected risk factors, the incidence of RML could be expected to be higher than in normal weight patients undergoing surgery. However, no data on a large cohort are available on the real value of these proposed factors; concerns have also been expressed about the exact therapy that needs to be applied in obese patients to avoid kidney damage.

To clarify the impact of RML on bariatric surgery, we designed a multicenter, prospective study that investigated patients who underwent different bariatric procedures. The primary objective was to assess the incidence of RML; other objectives included the assessment of pre and intraoperative risk factors for RML and the effect of immediate postoperative management with fluids and diuretics.

Materials and methods

Study design and patient selection

In this multicenter, prospective study, 480 obese adult (18 years or older) patients were included. All patients underwent bariatric surgery from 2011 to 2014 in the Division of General and Bariatric Surgery and Division of Gastrointestinal Surgical Pathophysiology, Second University of Naples, and in the Division of General, Oncological and Bariatric Surgery, and Division of Video-assisted Gastric Surgery, Federico II University of Naples, Naples, Italy.

The Institutional Review Board approved the study protocol, and informed consent was obtained from each participant. The study was conducted according to the Helsinki declaration.

Bariatric surgery was indicated according to international guidelines [8]. Exclusion criteria from the study were as follows: age <18 years, clinical history of genetic disorders (e.g., muscle diseases), trauma, malignancies, malignant hyperthermia, heat-induced lesions, and use of anticholinergic drugs, as well as previous abdominal surgery. Patients without 1 or more clinical or laboratory records selected for the study were excluded. Patients who declined consent were excluded from the study as well.

Clinical evaluation and preoperative risk factors assessment

At first visit, detailed examination and clinical evaluation was performed. Age, gender, cigarette smoking history, clinical history or presence of hypertension, type 2 diabetes, thyroid diseases, dyslipidemia, venous insufficiency, obstructive sleep apnea syndrome (investigated with polysomnography with >2 respiratory channels), chronic lung diseases, and drug use were recorded. Anthropometric measurements were obtained in all patients (weight, height, BMI, body composition determined by conventional scale combined with quadripolar body impedance analyzer [TANITA, Amsterdam, The Netherlands]).

Intraoperative risk factors assessment

Patients underwent different minimally invasive bariatric procedures, as follows: 105 adjustable gastric banding, 124 sleeve gastrectomy, 107 Roux-en-Y gastric bypass, 42 biliopancreatic diversion (Scopinaro's or duodenal switch), and 102 modified biliointestinal bypass.

In all patients, to make uniform and dichotomize data about anesthesia as a risk factor, 2 standardized anesthetic protocols were used; the protocol was subjectively chosen by the anesthesiologist. One hour before surgery, a single dose of midazolam .05 mg/kg was administered. Induction was obtained with propofol (2 mg/kg) and remifentanil (from .5 to .25 gamma/kg/min). Intubation was facilitated with rocuronium .2 mg/kg. The anesthesia was maintained using the total intravenous anesthesia (TIVA) technique with propofol 3 mg/kg/hr and remifentanil .25 gamma/kg/min. The neuromuscular blockade was maintained with rocuronium .6 mg/kg. All doses for anesthetics drugs were by ideal weights. The mechanical ventilation was set to maintain an end-tidal level of CO_2 between 33 and 35 mm Hg. Paracetamol (1–2 g/die IV) and/or tramadol (400 mg/die IV) and/or analgesic pump (tramadol 400 mg, ketorolac 40 mg, ranitidine 300 mg/24 hr) IV was used after surgery. The second protocol differed from the previous only in the anesthesia maintenance, which was achieved with sevoflurane (expired concentration of 1.5%–3%). The total operative time was recorded starting from anesthesia induction