Lower Limb Compartment Syndrome following Laparoscopic Radical Prostatectomy

FREDERICO R. ROMERO¹, ROBERTO PILATI¹, DAVID KULYSZ¹, FABRIZIO A. V. CANALI², PAULO V. BAGGIO³, THADEU BRENNY FILHO¹

¹ Departamento de Urologia; ² Departamento de Anestesiologia; ³ Departamento de Cirurgia Vascular, Hospital São Vicente, Curitiba, PR-Brasil.

ABSTRACT

Objective - Compartment syndrome (CS) is rare after laparoscopic radical prostatectomy (LRP). We report a recently diagnosed case in our institution with the objective of discussing the pathophysiology of this serious complication, highlighting possible preventive measures. Case report – A 68-year-old man diagnosed with clinical stage T2a prostate adenocarcinoma underwent extraperitoneal LRP with bilateral preservation of neurovascular bundles. Postoperatively, he developed CS of the right leg, requiring decompressive fasciotomy. Six months after LRP, the patient recovered well, thus walking without supervision. Discussion - There are several circumstantial risk factors associated with LRP that when combined, may potentially predispose to the development of CS, including obesity, evidence of peripheral vascular disease (increasing age, hypertension, hyperlipidemia, and diabetes mellitus), thromboembolism prophylaxis with compressive leg wraps together with intermittent pneumatic device, combined general and spinal anesthesia, prolonged operative time in Trendelemburg position, and systemic hypotension due to intraoperative bleeding. Recognizing these factors preoperatively may identify patients at high risk of CS after LRP, allowing the application of preventive measures to avoid this important cause of postoperative morbidity.

Key words: Compartment Syndrome; Risk Factors; Prostatectomy; Laparoscopy; Complication.

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INTRODUCTION

Compartment Syndrome (CS) is frequently associated to limbs injury; however it may occur as a complication after prolonged pelvic surgeries. High suspicious of this condition is necessary for an early diagnosis. Frequently, CS is misdiagnosis as deep venous thrombosis or neuropraxia, mainly when disease signs are discreet and unilateral. A delayed and erroneous diagnosis could have devastating consequences for the patient such as loss of limb or even death.

CS is rare after laparoscopic radical prostatectomy (LRP), despite erroneous diagnosis and medical-legal implications possible accountability for its low incidence. There are several circumstantial risk factors associated with LRP that may result in CS.

CASE REPORT

A 68 year-old man, with a PSA of 3.8ng/ mL, was diagnosed with clinical stage T2a prostate cancer during a screening exam. He had significant comorbidities such as hypertension, diabetes, hiperlipidemia, myocardiopathy, obesity (31.2 kg/ m² of body mass index) and hepatic cirrhosis.

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Before the surgery, the legs of the patient were wrapped together with an intermittent pneumatic device to avoid DVT. Under combined general and spinal anesthesia the patient was placed in Trendelemburg position and underwent extraperitoneal LRP with bilateral sparing of the neurovascular bundles. At the moment of the anesthesic induction his blood pressure was150/ 80 mmHg, and was maintained in a lower level during the entire surgery. Operative time was 360 minutes and intraoperative bleeding was 1000 mL. The bleeding mainly occurred while controlling prostate lateral pedicle and dissecting the neurovascular bundles. Pathologic analysis revealed a Gleason 6 adenocarcinoma in a 55 grams prostate with negative surgical margins.

On the first postoperative day, the right calf was enlarged and painful during palpation and paresthesia and pain were the patient's chief complaint. Dorsalis pedis pulse in bilateral lower extremities was palpable. In order to investigate diagnosis of DVT, Doppler ultrasound was requested and depicted patency of the deep venous system. Serum creatinine values increases to 3.2 mg/dL and phosphokinase creatinine reached 23.000 U/L. In spite of Doppler study normal results, DVT diagnosis associated with secondary rhabdomyolysis and renal insufficiency for myoglobinuria was based on clinical and laboratories findings, thus appropriate treatment was initiated with a high dose of heparin.

On the following postoperative period, although dorsalis pedis pulse was palpable and serum and phosphokinase creatinine levels improved, patient's intermittent episodes of pain in the right lower limb persisted. Another Doppler ultrasound evaluation definitely excluded DVT diagnosis and depicted high resistance of the right tibial arteries. Then the patient was submitted to decompressive fasciotomy of the four compartments of the right leg on the 12th postoperative day. Muscles bulged after superjacent fascia incision was performed and revealed focal necrotic areas which were debrided. Immediately afterwards postoperative phase, it was possible to observe patient's pain relief and ability to walk under supervision. Fourteen days after fasciotomy the wounds were surgically closed.

Six months after LRP his PSA is undetectable, and he needs daily protection for mild urinary incontinence and is still recovering sexual function.

DISCUSSION

There are several risk factors during Laparoscopic Radical Prostatectomy that could reduce blood flow to lower extremities or increase blood flow resistance due to external compression, however they are usually not enough to cause CS. On the other hand, if these factors were associated to intracompartment high pressure, it is possible to add reduced perfusion pressure or other factors that may contribute to the development of CS.

Patient Positioning: CS was already reported after procedures in lithotony/hemilithotomy position especially when combined with Trendelemburg position. During LRP, Tredelemburg position helps deviating intestinal loops from pelvic operative field. Reduction of arterial perfusion pressure of lower limbs when ankle height is above heart level allows CS to develop even with slight elevation of intracompartmental pressure of the lower limbs. Reducing elevation of legs may maintain the blood flow to the muscle of the legs above ischemic level. This could be easier during extraperitoneal LRP, since the peritoneum acts as a natural retractor to intestinal loops. If accentuated elevation of the legs is essential as it happens in Transperitoneal Laparoscopic Radical Prostactetomies, Trendelemburg position should be reverted every 2 hours for a short period of time allowing an adequate perfusion of the lower limbs.

Anesthesia: a combination of general and regional anesthesia during LRP may reduce significantly intraoperative bleeding, postoperative pain and thromboembolism risk. Nevertheless, hypotension induced by vasodilation as a result of regional anesthesia may cause hypoperfusion of the lower extremities.

However, benefits of general and regional anesthesia are greater than risks, especially when considering higher incidence of deep vein thrombosis comparing to CS. Lower risk of bleeding and reduced operative time associated with regional anesthesia are protectors factors against CS. The main discussion towards regional anesthesia and CS is the delayed diagnosis and treatment of CS in several patients submitted to spinal or peridural anesthesia.

DVT Prophilaxy: compression bandages or stockings and intermittent pneumatic device in DVT prophylaxis may reduce compartments compliance and compress internal musculature which will decrease perfusion pressure of the lower extremities. Despite the fact that all compression applied is not transmitted to muscle compartments, this effect can represent an additional risk factor to local blood flow implications.

Tension applied to compressive bandages should not be excessive to avoid a tourniquet effect. There is a high risk of CS when compressive bandage or stockings are associated to intermittent pneumatic compression devices. Recognizing these factors preoperatively may identify patients at high risk to CS, allowing the application of appropriate prophylaxis to prevent DVT. Prolonged operative time: CS has been associated with prolonged surgery in Trendelemburg position as well as in dorsal decubitus position where local blood flow is affected with the weight of the legs. Laparoscopic radical prostatectomy operative time is longer than open radical retropubic prostatectomy (less than 4 hours). However, operative time is longer in obese and enlarged prostate patients.

Intraoperative bleeding: systemic hypotension decreases compartments blood flow which may cause perfusion failure mainly in patients with arteriosclerosis and controlled hypertension, in whom sclerotic vessels high chronic pressure levels are common. During LRP intraoperative bleeding is lesser than open radical prostatectomy. However, bleeding is considerably greater in patients with obesity and enlarged prostate. In case of intraoperative bleeding, volemic replacement should be appropriate to maintain the normal blood pressure of the patient.

Pheripheral Vascular Disease: moderate blood pressure fall in lower limbs is greater with evidence of PVD, reducing possible development of CS. Suspicion of PVD should be considered during anamnesis in patients with increased age, smoking history, hypertension, hyperlipidemia, diabetes and intermittent claudication; as well as during physical examination through palpation of lower limbs pulse. In case of PVD suspicion an evaluation of a vascular surgeon is necessary before planning a major pelvic surgery.

Obesity: obesity is associated with elevated compartment pressure and reduced blood pressure of the ankle. During LRP, obesity may also worsen perfusion failure as operative time and intraoperative bleeding risk are greater.

CONCLUSION

Knowledge of the factors associated to CS physiopathology during LRP preoperative may identify patients at high risk. Preventive measures may avoid this important cause of postoperative morbimortality.

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Correspondence address:

FREDERICO R. ROMERO Departamento de Urologia Hospital São Vicente Av. Vicente Machado, 467 – Sétimo andar Curitiba, PR 80420-010 Brasil Tel: 41-3322-0877 Fax: 41-3322-0377 E-mail: frederico.romero@gmail.com