



Original Article

RHABDOMYOLYSIS AFTER HAND ASSISTED LAPAROSCOPIC DONOR NEPHRECTOMY: CALGARY'S EXPERIENCE

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Abstract

Background: Rhabdomyolysis is a post-operative complication resulting from skeletal muscle injury during the surgery. The true incidence of rhabdomyolysis in laparoscopic living donor nephrectomy is unknown due to a paucity of evidence in the literature. Rhabdomyolysis can have serious short-term and long-term consequences for the living kidney donors. There have been a number of risk factors identified that may increase the risk of rhabdomyolysis.

Materials and Methods: Our program has offered a hand assisted laparoscopic donor nephrectomy approach for our donors since 2001. We have performed 209 kidney transplants using this approach. The institution's database was searched for post-operative complications. Three donor patients with post-operative rhabdomyolysis were identified.

Results: All three patients were young healthy males. The operative times were all greater than four hours. Fortunately, all three patients were recognized early and received treatment promptly. Dialysis was not required and no long-term renal dysfunction occurred.

Conclusion: Rhabdomyolysis is an uncommon post-operative complication following hand assisted laparoscopic living donor nephrectomy. We have a high index of suspicion for rhabdomyolysis to promptly recognize this rare but potentially serious complication after any operation lasting greater than 4 hours. Creatinine Kinase levels have been implemented at our centre for all living kidney donors.

Keywords-laparoscopic nephrectomy, rhabdomyolysis

Introduction

The first laparoscopic nephrectomy was performed in 1991¹. The surgical techniques have been continually refined and its application has grown to include living donor kidney transplantation in 1995².

The availability of laparoscopic techniques is associated with increased living donation rates.

Rhabdomyolysis is a postoperative complication from skeletal muscle injury that can result in acute renal failure secondary to excessive myoglobinuria³. This is likely due surgical positioning and patient muscle mass resulting in muscle compression, edema and subsequent ischemia attributable to elevated compartment pressure^{4,5}. There are numerous complications associated with rhabdomyolysis including metabolic acidosis, disseminated intravascular coagulopathy, respiratory failure and

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electrolyte abnormalities^{6,7}. Rhabdomyolysis after laparoscopic and open renal surgery is recorded in the literature. There is a paucity of literature describing rhabdomyolysis in renal transplant donors. The true incidence is not known but thought to be very low.

Although this appears to be an uncommon complication it can have important implications. Early recognition and treatment are critical to minimize long-term morbidity. There have been a number of risk factors identified in the literature. These include increased body mass index (BMI), male gender, 45 degree flank position with the use of a kidney rest, prolonged operative times and others (Table-I)⁸.

We report 3 cases of rhabdomyolysis in patients who underwent hand assisted laparoscopic donor nephrectomy.

Table-I
Risk Factor for Rhabdomyolysis Post-operatively^{4,5,8,12,13-16}

1.	Male gender
2.	Increased BMI or increased muscle bulk
3.	Prolonged procedure time
4.	Use of a kidney rest
5.	Concomitant surgery
6.	Hypovolemia
7.	Existing renal dysfunction
8.	Diabetes
9.	Hypertension

Case 1

A 24 year old previously healthy male with an unremarkable past medical history and taking no prescription medications donates his left kidney to one of his parents. His BMI was 31.1. He underwent a hand assisted laparoscopic left nephrectomy in modified right lateral decubitus with right lateral flexion. He was supported by a body bean bag with pillows between his knees and arms. The surgical time was 4 hours and 59 minutes. There were no overt intra-operative complications. He described left low back pain on post-operative day zero. He had previously injured his back playing ice hockey two weeks prior to the surgery. The back pain resolved spontaneously but he began having right flank and right upper leg pain with associated paresthesias on post-operative day one. Blood work revealed an elevated creatinine kinase (CK) that peaked at 35 000 IU/L on post-

operative day 2. The serum creatinine elevated from 97 umol/L at admission to a peak of 189 umol/L on post-operative day one. The alanine aminotransferase (ALT) increased from 17 IU/L at admission to 298 IU/L on post-operative day five. The urinalysis was positive for myoglobin. He was treated with aggressive intravenous fluid resuscitation with crystalloids and pain management. He was discharged home on post-operative day 6 with a creatinine 129 umol/L, ALT 227 IU/L and CK 9721 IU/L. He has done well since discharge without any signs of renal impairment.

Case 2

A 33 year old previously healthy male with an unremarkable past medical history and taking no medications donates his left kidney to a sibling. His BMI was 23.0. He underwent a hand assisted laparoscopic left nephrectomy in modified right lateral decubitus with right lateral flexion on top of a gel pad. His left arm was supported in a sling. Pillows were placed between his legs for support. The surgical time was 5 hours and 2 minutes. There were no overt intra-operative complications. He described an intense right lower back pain in the recovery room. An obvious spasm was observed and palpated in the right low back. Blood work revealed an elevated creatinine kinase that peaked at 43 000 IU/L on post-operative day one. The serum creatinine increased from 84 umol/L at admission to a peak of 139 umol/L on post-operative day one. The ALT increased from 20 IU/L at admission to a peak of 498 IU/L on post-operative day seven. The urinalysis was positive for myoglobin. He was treated aggressively with crystalloid intravenous fluids and also received 3 ampules of bicarbonate. His pain requirements were also addressed with a patient controlled analgesia device. He was discharged home on post-operative day seven with a creatinine 103 umol/L, ALT 498 IU/L and CK 9500 IU/L. He has done well since discharge but still describes a mild ache in his right lower back. There are no signs of renal impairment.

Case 3

A 30 year old previously healthy male who was in the process of quitting smoking donates his left kidney to a sibling. He was taking varenicline for smoking cessation. His BMI was 30.1. He underwent a hand assisted laparoscopic left nephrectomy in modified right lateral decubitus with right lateral flexion. A kidney rest was utilized with a gel pad for cushioning. His left arm was supported in a sling. Pillows were placed

between his legs for support. The surgical time was 4 hours. There were no overt intra-operative complications. He described left lower quadrant and right lower quadrant pain on post-operative day one. Blood work revealed an elevated creatinine kinase that peaked at 14 000 IU/L on post-operative day one. The serum creatinine increased from 87 $\mu\text{mol/L}$ on admission to a peak of 138 $\mu\text{mol/L}$ on post-operative day one. The ALT increased from 23 IU/L on admission to a peak of 138 IU/L on post-operative day two. The urinalysis was positive for myoglobin. He was treated with crystalloid intravenous fluids and pain management. He was discharged home on post-operative day 3 with a creatinine 123 $\mu\text{mol/L}$, ALT 138 IU/L and CK 5 022 IU/L. He has done well since discharge without any signs of renal impairment.

Discussion

Since being introduced in 1991, laparoscopic nephrectomy techniques have evolved to include more broad applications. In 1995, this method was successfully applied to living donor nephrectomy by *Ratner et al*². Laparoscopic living donor nephrectomy has increased the volunteer pool as it is associated with less post-operative pain and shorter hospital admission. This has been critical as the number of deceased donors has been low and is currently 14.5 per one million people in Canada⁹.

Our site has been performing kidney transplants since 1971. Our program has employed a hand assisted laparoscopic donor nephrectomy approach for our donors since 2001. We have performed 209 kidney transplants using this approach. The average operative time is 174 +/-32 minutes¹⁰. All three of our cases involved left nephrectomy as it is our sites preference to perform left nephrectomies laparoscopically and right nephrectomies are performed as an open procedure.

Diagnosis of Rhabdomyolysis

Clinical awareness is critical to diagnosis. Patients describing pain out of proportion or pain remote from the surgical site should raise suspicion. The clinician must be aware of patients complaining of muscle aches, nausea and vomiting and describing pigmented urine. The patients should be examined for muscle spasm, increased tone and ecchymosis. Laboratory findings include increased creatinine kinase, hyperphosphatemia, hyperkalemia, hypocalcemia, hyperuricemia, and metabolic acidosis. Urine

myoglobin should also be tested. The clinician must follow the urine output and serum creatinine kinase. In our center we include CK as part of our routine blood work postoperatively.

Treatment of Rhabdomyolysis

Following diagnosis, aggressive treatment needs to be instituted to prevent renal complications. Initial treatment involves aggressive intravenous hydration to ensure adequate volume status and renal perfusion. A bicarbonate infusion can be considered to alkalinize the urine but this is controversial¹¹. Diuresis at 200-300ml/hour is the goal at our center. The use of furosemide or other diuretic agents can be considered to assist in flushing the myoglobin from the renal tubules. Dialysis may be required more often in our patient population due to the solitary kidney.

Pain management is also important as rhabdomyolysis can be extremely painful. The use of a patient controlled analgesia device probably is the best initial therapy. Effective pain management will allow the patient to mobilize more effectively and likely decrease the incidence of other postoperative complications such as pneumonia, deep vein thrombosis and pulmonary embolus.

Prevention of Rhabdomyolysis

Understanding the risk factors will minimize the incidence of rhabdomyolysis. Ensuring optimal positioning is paramount, especially in patients with an increased body mass index. This can be achieved either using a bean bag or padding. Once the patient is positioned, we advocate soliciting opinions from the OR staff to ensure everyone is satisfied. The amount of flexion in the table should be minimized and reversed as early as possible.

Conclusion

Rhabdomyolysis is an uncommon post-operative complication following hand assisted laparoscopic donor nephrectomy. We present three cases that occurred at our site. All three patients were young healthy males with increased muscle bulk. The operative times were also prolonged. Fortunately, all three patients were recognized early and received treatment promptly with intravenous hydration. Dialysis was not required and no long-term renal dysfunction occurred. Effective pain management is critical to ensure early mobilization to minimize other post-operative complications. We have a high index

of suspicion for rhabdomyolysis to avoid or at least promptly recognize this rare but potentially serious complication after any operation lasting greater than 4 hours. Since the symptoms may be subtle and would likely have gone undiagnosed as rhabdomyolysis, routine CK levels have been implemented at our center in the postoperative period.

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