A novel and ergonomic patient position for laparoscopic kidney surgery

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Introduction: *Flank positioning with the patient's ipsilateral arm elevated over the head on an arm board is often used during laparoscopic kidney surgery. There have been reports of brachial plexus neuropraxia, rhabdomyolysis and other complications related to this positioning. Herein we describe our modified positioning technique for laparoscopic renal surgery.*
Method: *Beginning in November 2003, all patients undergoing laparoscopic renal surgery have been positioned in the 30 degree modified flank position. The ipsilateral arm is not elevated on an arm board but lies in an ergonomic "sling" position with the elbow flexed slightly greater than 90 degrees. The chest, hips, and knees are secured with tape to allow for extreme table rotation which creates a "true" flank angle relative to the horizontal.*
Results: *Over 1240 cases have been performed utilizing this method, with no events of rhabdomyolysis or neuropraxia secondary to positioning. All patients up to a body mass index (BMI) of 67 kg/m2 have successfully undergone laparoscopic renal surgery with this method without any limitation encountered secondary to positioning.*
Conclusions: *This novel technique allows for more ergonomic arm positioning as well as significantly decreased pressure on the contralateral down side. The use of extreme table rotation eliminates the need for conventional flank positioning which employs table flexion, arm boards, and axillary rolls. This technique allows for rapid, easy, and safe positioning with no related complications in 1240 laparoscopic kidney cases.*

Key Words: laparoscopy, nephrectomy, patient positioning, renal cell carcinoma

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Introduction

Flank positioning traditionally involves positioning the patient in the lateral decubitus position with the kidney rest elevated and the table in the flexed position. The

patient's ipsilateral arm is elevated over the head on an airplane stand, with the patient resting on a contralateral axillary roll.[1] In addition to the cumbersome nature of positing patients in the traditional flank position, the nonanatomic nature of the position may lead to complications. There have been reports of brachial plexus neuropraxia, rhabdomyolysis, and other complications related to this positioning.[2,3] Herein we describe our experience with over 1240 patients in the modified flank positioning technique for laparoscopic renal surgery.

Methods

With IRB approval a retrospective review was performed of those patients undergoing laparoscopic renal surgery from November 2003 to March 2008. This represents the total time period in which the modified flank position has been employed, and 1240 laparoscopic kidney cases were identified. These surgeries were performed using a standard transperitoneal approach, using either pure laparoscopic or hand assisted techniques. This modified flank position was not utilized for extraperitoneal kidney surgery. Intraoperative and postoperative course was reviewed to determine if any postoperative complications resulted from the positioning.

The patient is placed supine with a 10 lb bump placed under the operating table cushion to raise the ipsilateral side 30 degrees, Figure 1. Table flexion and bean bags are not utilized. The upper arm on the surgical side is not elevated on an arm board but lies in an ergonomic "sling" position with the elbow flexed slightly greater than 90 degrees. This ipsilateral arm position approximates the angles created in an orthopedic sling for clavicular fractures. The hand is rested directly on the mid chest and padded for protection. The contralateral arm is extended on an arm board. The legs are positioned with the lower leg flexed and the superior leg straight, with pillows in between. The chest, hips, and knees are secured with tape to allow for extreme table rotation which creates a "true" flank angle relative to the horizontal, Figures 2, 3 and 4.

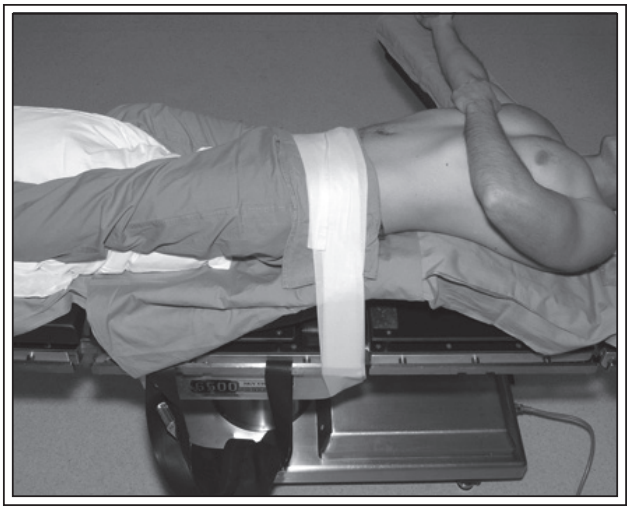

Figure 1. Patient placed supine with 10 lb bump placed under the ipsilateral cushion.

Figure 2. The chest is taped across the nipple line to secure the patient to the table. The ipsilateral arm is not included.

Figure 3. Ipsilateral arm padded and secured in the sling position.

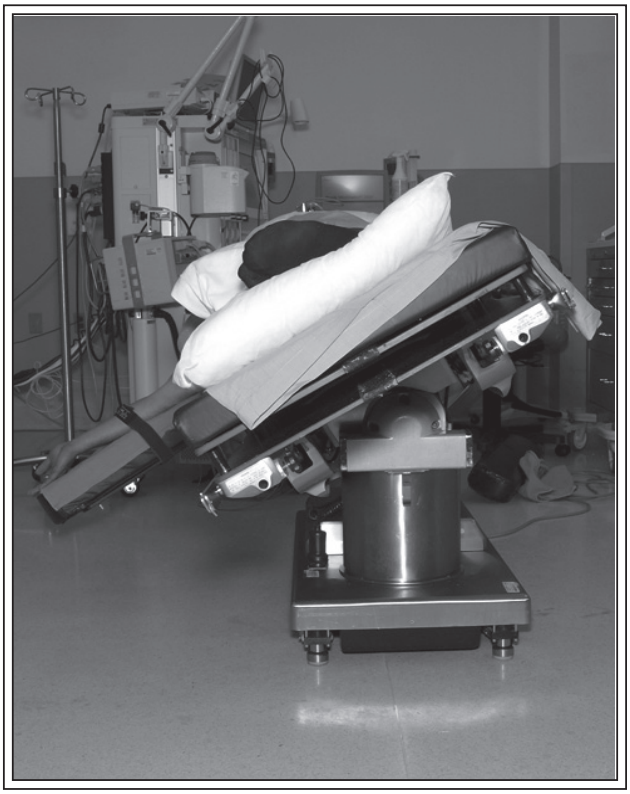

Figure 4. Modified flank position. Extreme table rotation creates a "true" flank angle relative to the horizontal.

Results

One thousand and forty cases were identified; 524 radical nephrectomies, 488 donor nephrectomies, 136 partials, and 93 nephroureterectomies. The mean patient age was 54.8 ± 17.3 years, the mean patient BMI was 27.4 ± 5.4 kg/m^2, mean EBL was 114 ± 165 ml, and mean operative time was 137 ± 42 min. Out of 1040 cases, there have been no events of rhabdomyolysis or neuropraxia secondary to positioning. Furthermore there were no complications related to the modified flank position in regards to issues with decreased ventilation or limited pneumoperitoneum secondary to limits on chest or abdominal excursion. In addition, subjectively, placing the ipsilateral arm in the sling position leads to decreased interference with the laparoscopic instruments outside of the body.

There have been no patient characteristics to preclude modified flank positioning including prior extremity or joint replacement. All patients, regardless of body habitus, up to a BMI of 67 kg/m^2 have successfully undergone laparoscopic renal surgery with this method without any limitation encountered secondary to positioning.

Discussion

Traditional positioning for laparoscopic nephrectomy is in the lateral decubitus position and involves flexion of the table with a kidney rest, ipsilateral arm airplane, a contralateral axillary roll, and often a bean bag.[1] This method of positioning is cumbersome to arrange, and can be associated with significant side effects. Brachial plexus and other peripheral nerve injuries have been described due to hyperabduction of the ipsilateral arm while in an airplane position,[2-4] as well as compression injury to the contralateral side down.[4] In addition to keeping the head in a neutral position, limiting arm abduction to less than 90 degrees decreases the risk of brachial plexus injuries.[2,6] Rather than suspending the ipsilateral arm, our novel positioning employs an ergonomic, arm positioning to avoid stretch and tension on the upper extremity and potential nerve damage. This arm positioning mimics the angles created when placing the arm in an orthopedic sling for clavicular fractures. Furthermore, subjectively, placing the ipsilateral arm in the sling position leads to decreased interference with the laparoscopic instruments outside of the body which leads to increased range of motion intracorporally.

Lateral decubitus positioning for laparoscopic nephrectomy has also been associated with rhabdomyolysis.[3,5,7] This is secondary to excessive weight on a small area for a prolonged period of time.[8] In traditional flank positioning, these locations are under the contralateral axillary roll and buttock. These areas of direct pressure can incite a compartment syndrome and muscle ischemia. Adequate padding of these areas does decrease tissue pressure in these compartments, but only by 16% relative to hard surfaces. The decreased perfusion pressure is further exacerbated by decreased cardiac output secondary to table flexion and kidney bridge elevation.[7] Factors including: exaggerated flank positioning, hypovolemia, long operative time, medical comorbidities and obesity are associated with development of rhabdomyolysis.[3,5,7] Furthermore, prolonged operative times in the lateral decubitus position may lead to unilateral pulmonary edema (down lung syndrome).[8,9] Our modified flank position utilizes extreme table roll to yield a near "true" flank angle relative to the floor. This allows for adequate exposure intra-abdominally, but avoids pressure points such as the contralateral axillary roll, which may lead to rhabdomyolysis. Furthermore, there is no decrease in cardiac output secondary to table flexion and kidney rest elevation.

In addition to deleterious effects on cardiac output in the traditional flank position, respiratory parameters are also adversely affected. Delaney has shown that lung elastance and resistance increases when transitioning patients from the supine to the traditional laparoscopic nephrectomy lateral decubitus position with table flexion. This was felt to be due to stretching of the chest wall from both body position, and possibly also from ipsilateral arm stretch.[10] The modified flank position avoids the chest stretching as there is no stretch on the ipsilateral arm, and no table flexion. Since the abdomen is free to expand without straps and position limitations, adequate pneumoperitoneum is achieved. We have not encountered any issues with hypercapnia, high peak pressures, or otherwise with ventilation, as there is adequate chest expansion and diaphragmatic excursion into the abdomen.

Conclusions

This novel technique allows for more ergonomic arm positioning as well as significantly decreased pressure on the contralateral down side. The use of extreme table rotation eliminates the need for conventional flank positioning which employs table flexion, arm boards, and axillary rolls. This technique allows for rapid, easy, and safe positioning with no related complications in 1240 laparoscopic kidney cases. □

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