

The Effect of Kidney Morcellation on Operative Time, Incision Complications, and Postoperative Analgesia after Laparoscopic Nephrectomy

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ABSTRACT

Introduction: Compare the outcomes between kidney morcellation and two types of open specimen extraction incisions, several covariates need to be taken into consideration that have not yet been studied.

Materials and Methods: We retrospectively reviewed 153 consecutive patients who underwent laparoscopic nephrectomy at our institution, 107 who underwent specimen morcellation and 46 with intact specimen removal, either those with connected port sites with a muscle-cutting incision and those with a remote, muscle-splitting incision. Operative time, postoperative analgesia requirements, and incisional complications were evaluated using univariate and multivariate analysis, comparing variables such as patient age, gender, body mass index (BMI), laterality, benign versus cancerous renal conditions, estimated blood loss, specimen weight, overall complications, and length of stay.

Results: There was no significant difference for operative time between the 2 treatment groups ($p = 0.65$). Incision related complications occurred in 2 patients (4.4%) from the intact specimen group but none in the morcellation group ($p = 0.03$). Overall narcotic requirement was lower in patients with morcellated (41 mg) compared to intact specimen retrieval (66 mg) on univariate ($p = 0.03$) and multivariate analysis ($p = 0.049$). Upon further stratification, however, there was no significant difference in mean narcotic requirement between the morcellation and muscle-splitting incision subgroup ($p = 0.14$).

Conclusion: Morcellation does not extend operative time, and is associated with significantly less postoperative pain compared to intact specimen retrieval overall, although this is not statistically significant if a remote, muscle-splitting incision is made. Morcellation markedly reduces the risk of incisional-related complications.

Key words: *nephrectomy; laparoscopy; pain*

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INTRODUCTION

Since its first report in 1991 (1), laparoscopic nephrectomy has progressively gained acceptance among urologists (2-5). Steps within this procedure are continuously being evaluated and modified to achieve better outcomes. Although a variety of

techniques and devices have been developed for specimen entrapment and retrieval (6,7), no consensus on the best method has been established, but rather the choice is likely surgeon dependent or unproved factors. Specimen morcellation is associated with a smaller incision, better cosmesis, and fewer incision-related complications than open specimen extraction

incisions (8,9), but is associated with a longer operative time with a controversial benefit in regard to pain control. Morcellating a specimen containing tumor is felt to make accurate pathologic staging more difficult, but this has not yet been proved to be clinically detrimental due to the development of better clinical staging due to higher resolution imaging tests (10,11), and the application of nomograms and standardized protocols for pathologic evaluation of fragmented specimens (12). The potential increased risk of tumor spill and port-site metastasis after morcellation has yet to be proven clinically significant (13,14).

Previous studies evaluating the effects of tissue morcellation on morbidity and life quality have not shown a statistically significant difference regarding postoperative pain, hospital stay and recovery period when compared to intact specimen removal (15,16). Unfortunately, these studies did not take into consideration other variables that could potentially affect the relationship between morcellation and operative time and post-operative pain, such as age, sex, body mass index, benign versus malignant renal conditions and overall complications. Our objective was to more accurately assess and compare the operative time, analgesia requirements, incision related complications, and overall length of stay in patients with morcellated and intact specimen extraction by entering additional variables into the analysis.

MATERIALS AND METHODS

We retrospectively reviewed the charts of 153 consecutive patients who underwent transperitoneal, 4-port laparoscopic nephrectomy for benign or malignant disease at our institution from September 1999 through June 2004. Our technique for laparoscopic nephrectomy with the use of a blunt-tip, radial dilating trocar (Step®, US Surgical, Norwalk, CT) for all ports was published previously (17). We routinely infiltrated the peritoneum under the laparoscopic port site with 3 mL of 0.25% bupivacaine and the extraction incision (when used) with 10 mL of 0.25% bupivacaine. Patients who underwent hand-

assisted nephrectomy, nephroureterectomy, donor nephrectomy, and cases requiring open conversion were excluded from the study. All specimens were placed within a medium or large size LapSac (Cook Urological, Spencer, IN) prior to specimen retrieval. All specimens could be placed within a medium or large LapSac.

In 107 patients the kidney specimen was morcellated, while 46 patients underwent intact specimen removal, either through a muscle-cutting incision connecting two port sites ($n = 16$) or through a remote, muscle-splitting incision, either midline infra-umbilical or Pfannestiel incision ($n = 30$). For morcellated specimens, the mouth of the LapSac was pulled up through a port site that previously had a 12-mm port, and ring forceps were used to extract pieces of the tissue until all was removed. For the open extractions, after making the incision into the peritoneum, the LapSac was grasped and removed with the specimen intact. The choice to morcellate or not and the type of incision chosen was made by the primary surgeon either at the time of surgery or in discussion with the patient preoperatively, and generally was based upon prior incisions and personal cosmetic concerns and not necessarily based upon kidney size or underlying pathology.

Operative times, analgesia requirements (morphine equivalents administered during the postoperative period), length of hospital stay, and postoperative complications (incision and non-incision related) were evaluated and compared to a number of variables, including age, gender, body mass index, type of renal pathology (malignant versus benign), estimated blood loss and specimen weight. The dosage of narcotics required during the postoperative hospital stay was converted to morphine sulfate equivalents using of an equianalgesic table (18). Univariate analysis and multivariate regression were performed for statistical evaluation and significance was defined as a p value ≤ 0.05 .

RESULTS

Patient demographics are presented in Table-1. There was no significant difference in patient age,

sex, and laterality. There was a significant difference in the type of renal pathology, as 28 of 107 (26%) patients who underwent kidney morcellation had a benign pathology compared to only 3 of 46 (6.5%) within the intact specimen group ($p = 0.01$). The benign pathology consisted of patients with xanthogranulomatous pyelonephritis, chronic pyelonephritis, ureteropelvic junction obstruction, severe renal artery stenosis, and kidney tuberculosis. Patients undergoing radical nephrectomy whose final pathology were oncocytoma or angiomyolipoma were considered pre-operatively to have a potentially malignant disease and were therefore included in the cancer group.

The results of the univariate analysis are shown in Table-2. There was no significant difference between the mean operative time of the morcellation group (255 min) and the intact specimen group (247 min) ($p = 0.65$). No additional variables were significantly correlated to operative time, and thus a

multivariate model was unnecessary. The postoperative length of stay was similar between the two groups: 2.1 and 2.3 days in the morcellated and non-morcellated groups respectively ($p = 0.53$).

The complications are listed in Table-3. The purpose of the list of complications is to determine the potential effect of a surgical complication on operative time, length of stay, and analgesia requirement. There were 18 complications in the morcellated group and 4 in the intact group. Detailed analysis revealed that the complications were completely unrelated to the incision in all cases except for 2 (4.4%) In contrast, there were no complications related to the specimen retrieval site in the morcellated group (0%; $p = 0.03$).

Univariate analysis indicated the mean narcotic requirement differed between the treatment groups (41 and 66 mg in the morcellated and non-morcellated patients, respectively, $p = 0.03$). Regression revealed that age and length of stay were

Table 1 – Patient demographics.

Variables	Morcellation (n = 107)	Intact Specimen (n = 46)	p Value
Mean age (years)	60 (range 42 - 79)	57 (range 37 - 81)	0.22
Body mass index	28	29	0.62
Sex (male/female)	65/42	24/22	0.32
Laterality (right/left)	49/58	21/25	0.99
Type of renal pathology (benign/malignant)	28/79	3/43	0.01
Specimen weight (grams)	397 (range 312 - 604)	510 (range 298 - 680)	0.10

Table 2 – Univariate analysis of the morcellated and intact specimen retrieval groups.

Variables	Morcellation (n = 107)	Intact Specimen (n = 46)	p Value
Operative time (minutes)	255 (range 128 - 310)	247 (range 134 - 304)	0.65
Incision related complications	0 (0%)	2 (4%)	0.03
Mean morphine equivalents required (mg)	41	66	0.03
Length of stay (days)	2.1 (range 1.2 - 5.0)	2.3 (range 1.2 - 5.2)	0.53

Table 3 – Intraoperative and postoperative complications in the morcellated and intact specimen retrieval groups.

Morcellation (n = 107)	Intact Specimen Retrieval (n = 46)
Intraoperative	Intraoperative
Retroperitoneal bleeding (3 cases)	Bladder injury during specimen retrieval (1 case)
Diaphragmatic injury (1 case)	
Liver injury during Veress needle (1 case)	
Small bleeding renal artery stump (1 case)	
Airway trauma during intubation (1 case)	
Groin hematoma (1 case)	
Postoperative	Postoperative
Right upper pulmonary lobe collapse (1 case)	Acute renal failure (1 case)
Pulmonary embolism (1 case)	Incisional hernia/small bowel obstruction (1 case)
Pulmonary edema (2 cases)	Dehiscence (1 case)
Respiratory failure (1 case)	
Myocardial Infarction (1 case)	
Arrhythmia (1 case)	
Superficial vein thrombosis (1 case)	
Prolonged ileus (1 case)	
Abdominal wall hematoma* (1 case)	

*The abdominal wall hematoma was unrelated to the morcellated specimen retrieval site.

correlated with postoperative analgesia, with a higher average narcotic requirement associated with younger patients and a longer hospital stay. Multivariate analysis demonstrated that the effect of morcellation on postoperative analgesia remained significant between the treatment groups while controlling for significant covariates ($p = 0.049$). After stratification of the intact specimen group, no significant difference in the average narcotic requirement was found between the muscle cutting (79 mg) and muscle-splitting incision (61 mg) subgroups ($p = 0.60$). The two subgroups were individually compared with the morcellated specimen group. Analysis revealed a difference in postoperative analgesia between the morcellated group and the muscle cutting subgroup ($p = 0.046$ and $p = 0.05$ for univariate and multivariate, respectively), however, no significant difference was found between morcellation and the muscle splitting patients ($p = 0.06$ and $p = 0.14$ for univariate and multivariate analysis, respectively).

DISCUSSION

The introduction of laparoscopic nephrectomy and kidney morcellation in 1991 (1) was responsible for a substantial reduction in postoperative pain, hospital stay, and for a shorter recovery period compared to standard nephrectomy (5,6). Although the advantages of laparoscopic nephrectomy are widely recognized, the ideal method for specimen removal is ill defined. It remains controversial as to the true effect that specimen morcellation has on operative time, postoperative pain, and the accuracy of malignancy staging through pathological evaluation (15,16).

It has been argued that morcellation should not be undertaken in cases of nephrectomy for cancer as this inhibits accurate tumor staging. While traditional staging can clearly not be performed in a morcellated specimen, the clinical effect of this is unknown. An in vitro study on pathological validity

of morcellated kidneys affected by renal tumors, including cases of perinephric fat invasion, revealed identical histology, grade, and stage when intact specimen evaluations were compared to a second analysis of the same specimens after morcellation (19). Additionally, advances in abdominal imaging tests (10,11), and mathematical models developed to guide pathologic sampling and analysis of morcellated specimens (12) can substantially increase the reliability of diagnosis and staging of renal malignancies.

In regards to operative time, as shown by previous studies and confirmed by our analysis (15,16), morcellation following laparoscopic nephrectomy is not associated with longer operative times when compared to intact specimen retrieval. While morcellation may be a time consuming procedure, especially in patients with history of recurrent urinary tract infections, xanthogranulomatous pyelonephritis, and/or renal scarring, this is clearly offset by the time required to open and close an additional incision. Additionally, conditions such as obesity and inadvertent injury of subcutaneous vessels during an incision may account for even longer operative times. In addition, many of the patients in the morcellated group underwent nephrectomy for xanthogranulomatous pyelonephritis, chronic pyelonephritis, tuberculosis, and other end-stage kidney disorders, which caused the kidneys to have a severe scar around them, making surgery much more difficult and time consuming.

While the overall length of hospital stay was not statistically significantly different between the two groups, this was true despite the higher number of complications in the morcellated group that certainly led to longer hospital stays. This difference in complication rate in this review probably has a number of explanations including random chance. Certainly, the complex nature of many of the kidneys removed for non-cancerous causes, which compromised 36% of the morcellated group, could have contributed to the difference in complication rate. The only two incision-related complications were in the intact group.

Recent publications failed to prove the benefits of morcellation regarding postoperative pain

intensity (15,16). However, these studies did not consider the possible effects of other variables on postoperative pain. In our study, patient age and length of stay were strongly correlated to postoperative pain. To generate a nonbiased assessment of the effect of morcellation on narcotic requirement, we used a multivariate regression model. Analysis revealed that older patients required lower dosages of morphine for postoperative pain control. This fact is consistent with a number of studies that demonstrated an increased pain threshold in the elderly patients that is felt to be due to a variety of physiologic changes (20).

For further analysis, we divided the intact specimen retrieval group into those who underwent a muscle cutting (i.e. connecting two ports) compared to muscle splitting (i.e. Pfannenstiel, low midline, or Gibson-type) incision. When comparing the two subgroups of intact incisions, there was no significant difference between the narcotic requirements. When comparing the narcotic requirements of each subgroup separately to that of the morcellated group, while there was a statistically significant difference between the muscle cutting group and the morcellated group, this was not significantly different in the muscle splitting group. It seems likely therefore that postoperative pain following laparoscopic nephrectomy may not be influenced by a single variable but more likely by a combination of retrieval incision location and length.

A potential weakness of the study is the retrospective nature of the review. Therefore, certain information that could further give insight to better outcomes, such as the change in surgical and laparoscopic experience over time, an actual accurate measurement of incision length, true analog pain scale results, and accurate time to return to daily activities could not be entirely assessed and for this reason were not included. A prospective randomized trial with multivariate statistical analysis is mandatory to help even better define these conclusions.

CONCLUSIONS

Kidney morcellation after laparoscopic nephrectomy does not extend operative time and is

associated with a lower rate of incision-related complications. Patients who underwent kidney morcellation had a significantly lower postoperative narcotic requirement when compared to those in the intact specimen retrieval group. However, the difference in the mean analgesia requirement was not statistically significant between the morcellated group and those with a remote, muscle-splitting incision. Postoperative analgesia is likely influenced by a combination of factors.

CONFLICT OF INTEREST

None declared.

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EDITORIAL COMMENT

The present study approaches the fairly controversial area of specimen morcellation after laparoscopic nephrectomy, especially in malignant disease. Reviews of scientific literature reveal the many advantages of morcellation over intact removal, such as reduction of incision length with consequent reduced usage of postoperative analgesia, and shorter hospital stays (1); however, care must be taken with this technique in order to avoid sac perforation and possible subsequent dissemination of tumor cells within the abdominal cavity, as well as trocar site implantation (2-5) and inadvertent lesion of intra-abdominal structures (6). Intact removal increases the size of the incision by 5-7 cm in those procedures considered minimally invasive, thus altering the aesthetic result and increasing postoperative pain (7). However, intact removal of the surgical specimen falls within the principles of oncologic surgery, thus reducing the risk of metastatic implants and aiding anatomical and pathological staging of the specimen

(8). Another relatively controversial aspect found in scientific reviews regards the amount of time necessary in morcellation of renal specimens, which some authors have reported as an average of 18 minutes (with durations varying from 6 to 34 minutes) (1); others claim an average time of 33 minutes (ranging from 18-115 minutes) (9).

The authors of the study in question have presented an excellent casuistry (153 laparoscopic nephrectomies) and have approached the main controversial aspects of morcellation, analyzing those variables, which may be related to operative time, postoperative analgesia, length of hospital stay, and complications associated with the incision.

It is a well-delineated retrospective study, which utilized a uniform methodology for the groups examined, with adequate statistical analysis of all variables involved (sex, age, body mass index, laterality, type of renal pathology, and weight of operative specimen). On the other hand, when the

authors report the routine use of 0.25% bupivacaine for infiltration in incision and trocar sites, the amount of anesthetic used is not specified, and this may cause some alteration in the analysis of postoperative pain, as greater incisions will require a larger infiltration of local anesthetic.

The subject approached is controversial and sheds new perspectives in the field of specimen removal subsequent to laparoscopic nephrectomy, clarifying several myths about the prolonged time necessary for morcellation, as well as those regarding the risks inherent to the method.

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