



Comparison of Hand-Assisted Retroperitoneoscopic Nephroureterectomy and Open Nephroureterectomy for Management of Upper Urinary Tract Urothelial Carcinoma

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Background: We compare intraoperative profiles and outcomes of hand-assisted retroperitoneoscopic nephroureterectomy (HARNU) with bladder cuff excision with traditional open nephroureterectomy (ONU) to treat upper urinary tract urothelial carcinoma. **Methods:** Between January 2000 and December 2005, 65 patients underwent nephroureterectomy and bladder cuff excision for upper urinary tract urothelial carcinoma in Tri-Service General Hospital (TGSB). Of these, 34 were treated using HARNU and 31 with ONU. Both groups were reviewed for operative time, estimated intraoperative blood loss (EBL), tumor stage, postoperative pain, time to oral intake and ambulation, and postoperative hospital stay. **Results:** The average operative time for HARNU was 238.6 min versus 310.8 min for ONU. The average EBL was 181.6 ml versus 242.6 ml. There was no significant difference in tumor stage between the two treatment groups. The average time to oral intake was 0.8 days for HARNU versus 1.6 days for ONU; time to ambulation 2.5 days versus 3.3 days; and hospital stay 8.2 days versus 10.8 days. No major surgical complications occurred in either group. **Conclusion:** While ONU still represents the gold standard for the treatment of upper urinary tract urothelial carcinoma, our experience suggests that HARNU results in a shorter operative time, less blood loss, shorter postoperative hospital stay, more rapid oral intake, and an early return to ambulation; and is an effective and safe alternative technique for upper urinary tract urothelial carcinoma.

Key words: hand-assisted, nephroureterectomy, urothelial carcinoma

INTRODUCTION

The standard procedure for management of upper urinary tract urothelial carcinoma is nephroureterectomy with excision of the bladder cuff. However, the morbidities of open surgery, such as wound pain, considerable blood loss and lengthy hospital stay, are inevitable. Both pure laparoscopic and hand-assisted laparoscopic surgery have been developed in the past decade. Performing pure laparoscopic nephroureterectomy requires more extensive training, but with the advent of hand-assisted devices, the difficulties can be minimized. Hand-assisted retroperitoneoscopic nephroureterectomy (HARNU) has been per-

formed in our hospital since January 2000. We compared the results in our hospital of HARNU with contemporary results of traditional open nephroureterectomy ONU.

METHODS

The study was performed by means of an extensive retrospective chart review. Between January 2000 and December 2005, 65 patients underwent nephroureterectomy and excision of the bladder cuff for upper urinary tract urothelial carcinoma at our hospital. Patients with infectious renal disease, loss of renal function or other malignancy of renal origin treated with nephroureterectomy were excluded from the study. Of the 65 patients, 34 patients were treated with HARNU and 31 with ONU.

All 65 patients were hospitalized and the surgery was performed by four surgeons. All ONU and HARNU procedures were performed by retroperitoneal approach under general anesthesia. For HARNU, the patients were placed in a lateral position and prepared as usual. An 8 cm Gibson incision was made for entry of the hand-assisted device. Two 12 mm ports were made for the laparoscopic camera

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Table 1 Comparison of patient characteristics between HARNU and ONU groups

Characteristic	No. HARNU(%)	ONU(%)
Patients (n)	34(52.3)	31(47.7)
Mean age (yr)	66.4 ± 10.26	69.4 ± 10.69
Sex		
Male	9(26.5)	19(61.3)
Female	25(73.5)	12(38.7)
Lesion sides		
Right	19(55.9)	18(58.1)
Left	15(44.1)	11(35.9)
Bilateral	0	2(6.0)

and the working instruments. A pneumoretroperitoneum was created with CO₂ and the pressure maintained at 12-15 mmHg to create the operative space. After the nephroureterectomy procedure, the entire distal ureter and bladder cuff were excised by an open method through the Gibson incision created for the hand-assisted device. The entire nephroureterectomy and bladder cuff specimen was removed en bloc through the Gibson incision without opening the urinary tract.

Data regarding the estimated blood loss (EBL), operative time, postoperative analgesic use, time to oral intake, time to return to ambulation, postoperative hospital stay, and tumor stage were reviewed and compared. The operative time was measured from the first incision of the skin to the point when the wound was closed.

Statistical data were analyzed with SPSS software v.12 (SPSS Inc., Chicago, IL). Nonparametric analysis was used due to a relative small sample size. A *p* value less than 0.05 was considered statistically significant.

Both treatment groups showed similar demographic data with respect to age and site of tumor (Table 1). The average operative times of the HARNU and ONU groups were 238.6 min (range 145-400) and 310.8 min (range 130-430) respectively, indicating that the mean operative time was 23.2% shorter in the HARNU group.

The distributions of tumors of different pathological stages were T1 47.7%, T2 18.5%, T3 30.8%, and T4 3%. For the patients undergoing HARNU, 19 had T1 disease, 6 had T2, 8 had T3, and 1 had T4. In the ONU group, 12 patients had T1 disease, 6 had T2, 12 had T3, and 1 had T4. These data are summarized in Table 2. There was no

Table 2 Pathological T stage in HARNU and ONU groups

Stage	No. HARNU(%)	No. ONU(%)
T1	19(55.9)	12(38.7)
T2	6(17.6)	6(19.4)
T3	8(23.5)	12(38.7)
T4	1(3.0)	1(3.2)

Table 3 Operative time, intra-operative EBL, days to oral intake, days return to ambulation, dosage of morphine and postoperative hospital stay of HARNU and ONU groups

Parameter	HARNU(mean,range)	ONU	* <i>p</i> -value
Operative time (min)	238.6 (145-400)	310.8 mins (130-430)	0.207
Intraoperative estimated blood loss (ml)	181.6 (40-600)	242.6 ml (100-800)	0.042
Days to oral intake (days)	0.8 (0-3)	1.6 (1-6)	0.378
Days return ambulation (days)	2.5 (1-4)	3.3 (1-5)	0.046
Dosage of morphine (mg)	6.4 (0-16)	12.1 (2-36)	0.035
Postoperative hospital stay (days)	8.2 (6-11)	10.8 days (6-28)	0.007

*Mann-Whitney U Test

significant difference in tumor stage between the HARNU and ONU groups.

In the 5-year follow-up period, 1 patient developed systemic metastasis after HARNU, and 3 after ONU. Six patients presented with bladder recurrence in the HARNU group and 5 in the ONU group. The patient in the HARNU group who subsequently developed systemic metastases was in stage T3 at surgery. Of the patients in the HARNU group who developed bladder recurrence, 3 presented with stage T1, 1 with T2, and 2 with T3. In the ONU group, recurrence occurred in 1 stage T1, in 1 stage T2, and in 3 stage T3 tumors. Up to the present, with a maximum follow-up of 5 years duration, 32 (94%) patients have survived in the HARNU group and 22 (71%) in the ONU group.

The average intraoperative EBL was 181.6 ml (range 40-600) in the HARNU group versus 242.6 ml (range 100-800) in the ONU group, indicating a reduction of 25.1% in the HARNU group (*p* = 0.042). The mean demand dosage of morphine for postoperative pain control was 6.4 mg (range 0-16) for HARNU and 12.1 mg (range 2-36) in ONU, indicating that this parameter was 47.1 % lower in the HARNU group (*p* = 0.035). The postoperative time to oral intake was 1.7 days (range 1-4) in HARNU and 2.6 days (1-6) in ONU, a reduction of 34.6% in HARNU (*p* = 0.378). The average time to ambulation was 32% lower in HARNU (2.5 days (range 1-4) compared with 3.3 days (range 1-5) (*p* = 0.046)), and the mean postoperative hospital stay was also lower for HARNU (8.2 days (range 6-11) versus 10.8 days (range 6-28), a reduction of 24.1% (*p* = 0.007)) (Table 3). No major complications were found

Table 4 Major and minor complications of HARNU and ONU groups

	HARNU(%,n)	ONU(%,n)
Major Complications	None	None
Minor Complication(%)		
Pulmonary atelectasis	8.6 (3)	22.6 (7)
Wound infection	5.9 (2)	9.7 (3)
Ileus	35.3(12)	16.1 (5)
AUR	11.8 (4)	19.4 (6)
(Re-catheterization)		

in either group, while minor complications ranged from 9.7% to 22.6% in the ONU group and from 8.6% to 35.3% in the HARNU group (Table 4).

DISCUSSION

Laparoscopic surgery has made significant advances in many urological applications. Over the last decade, successes in increasing numbers of complex and advanced surgeries have been reported. While laparoscopic adrenalectomy has been the gold standard for surgical management of adrenal disease, the standard treatment for upper urinary tract urothelial carcinoma has traditionally consisted of open nephroureterectomy and bladder cuff excision. However, recent investigations have introduced laparoscopic procedures to nephroureterectomy with disease control results comparable to the traditional open procedure, and have demonstrated their benefits in patient recovery¹⁻³. Hand-assisted devices to aid in laparoscopic surgery have been developed since 1997. A hand in the operative field can provide tactile sensation for the operator, and allow blunt dissection and tissue traction. Stifelman et al.⁴ and Kawauchi et al.⁵ have described their experiences of HARNU with bladder cuff excision and showed satisfactory outcomes.

Complications after HARNU have been reported in 4.8-8% of patients, in comparison with the 29% that has been reported in ONU procedures^{1,2}. In the current study, the most common complication in the HARNU group was postoperative ileus, which was treated conservatively with nasogastric tube decompression, usually for one to two days. Pulmonary atelectasis seemed to be the most common problem postoperatively in the ONU group. No surgery-related mortality was noted in our series. We consider that the HARNU technique described here combines the advantages of laparoscopic surgery with the open bladder cuff excision method. Klingler et al.⁶ reported that this modified laparoscopic nephroureterectomy combined with laparoscopic radical nephrectomy and open ureterectomy

seemed to be a safe alternative procedure for dealing with upper urinary tract urothelial carcinoma, and offered similar cancer control to open procedures. Most advocates of the hand-assisted technique emphasize the shorter learning curve of the procedure as well as the possibility of palpation.

The morbidity of ONU is more significant, especially that resulting in prolonged patient convalescence and hospitalization. To this point, HARNU has significantly improved patient convalescence and it leads to less blood loss, less postoperative pain, shorter postoperative hospital stays, and a more rapid recovery than following ONU procedures^{2,7,8}. Because we rapidly appreciated the advantages of HARNU, the majority of our cases of nephroureterectomy were completed by this technique. In our series, the operative time was 23.8% longer in the ONU group than in the HARNU group, consistent with previous studies⁹⁻¹¹. Two individual incisions, one on the flank for nephroureterectomy and another Gibson incision for bladder cuff excision, are needed in the traditional ONU procedure, and it takes considerable time to change the patient's position and to approach and close the two incisions. In our series, the mean EBL, postoperative use of analgesic agents, the mean times to oral intake and return to ambulation, and the total hospital stay all favored the HARNU group, although these outcomes revealed similar variation to previous studies^{4,5,9-11}. Because some disposable laparoscopic instruments and trocars are not covered by national health insurance in Taiwan, patients receiving HARNU have higher medical costs than those receiving ONU.

Of our 34 HARNU patients, 12 had pathological stage T1 tumors, 6 had stage T2, 12 had stage T3, and 1 had stage T4. The estimated 5-year survival rate was 94% in the HARNU group and 71% in the ONU group. The difference in survival may be due to the relatively shorter follow-up period in the HARNU group, as the first use of the HARNU technique in our hospital was in August 2002. It may also be that recent patients undergoing ONU were relatively poor candidates for HARNU, and some patients in the ONU group were at a more advanced stage before surgery.

For patients with early stage and smaller sized tumors, laparoscopic nephroureterectomy is a relatively easy technique. Depending on the advantages of the handassisted technique, laparoscopic surgery might not be contraindicated for high grade and advanced upper urinary tract malignancies. The HARNU technique should be used with caution in a patient with previous abdominal surgery, poor pulmonary and cardiovascular function, and evidence of an extremely large tumor, because of the higher possibility of postoperative complications. However, the absolute

contraindications are the same as those for traditional laparoscopic surgery. Because of the relatively small sample numbers in our study, we need more experience and available data to justify the HARNU procedure as a replacement for standard procedures for advanced stage urothelial malignancies of upper urinary tract.

CONCLUSION

Open nephroureterectomy with excision of bladder cuff still represents the gold standard procedure for the treatment of upper urinary tract urothelial carcinoma. The hand-assisted laparoscopic technique (HARNU) described here allows urologists a welcome bridge to ease the passage from open to minimally invasive surgery. For more experienced surgeons, the hand-assisted technique provides shorter operative times, less blood loss, less pain, shorter postoperative hospital stay, and shorter convalescence when compared with traditional nephroureterectomy. The hand-assisted procedure is an effective and safe alternative for dealing with upper urinary tract urothelial carcinoma. However, longer follow-up and further data are necessary to assess the efficacy of this procedure.

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