Comparative Study between Simplified Modified Ripping, Coagulation and Pluck (RCP Technique) of Mural Part of Ureter and Open Resection of Mural Part in Radical Nephroureteroectomy

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ABSTRACT:

BACKGROUND:

In radical nephroureterectomy for high risk upper tract urothelial cancer UTUC, mural part of the ureter need to be removed otherwise recurrence will occur in up to 75% .

OBJECTIVE:

To compare results of modified transurethral ripping, coagulation and pluck technique with the traditional open resection of the mural part of the ureter in the radical nephroureterectomy for upper TUC.

PATIENTS AND METHODS:

Seventeen patients with high risk upper tract urothelial cancer were managed by radical nephroureteroctomy ,7 of them the mural part was removed by open resection while for 10 patients the mural part was managed by transurethral ripping by Collins knife then the meatus was closed by ball electrode coagulation before plucking of the ureter during nephroureteroctomy which was done by open method in 8 patients and by laparoscopic way in two patients.

RESULTS:

There is a statistically significant difference in the outcomes of endoscopic procedure (ripping, coagulation and plucking of mural ureter) in comparison to the results of open resection for mural part of ureter ,where the mean operative time for bladder cuff excision reduced from 75±6 to 10.5± 2 minute ,mean total operative time reduced from 190±2 to 100 ± 7 minutes ,hospital stay from 7 ± 0,6 days to 4.5 ± 0.6 days, and bowel recovery period reduced from 3.5 ± 1 to 1.5 ± 0.4 days

CONCLUSION:

Retrograde modified ripping-coagulation and pluck of mural part of the ureter in radical nephroureterectomy for high risk UTUC is rapid ,safe ,simple and applicable with all type of radical nephroureterectomy procedures, whether open or by minimal invasive procedures and it applies all means for oncological safety.

KEYWORDS: Urothelial cancer

INTRODUCTION:

Upper tract urothelial cancer UTUC is either of low risk or high risk type, (it is high risk UTUC when there is hydronephrosis , tumor more than 2cm, high grade cytology or high grade ureteroscopic biopsy or multifocal disease). [1]

The standard treatment for patients with high risk UTUC and a normal contralateral kidney is open nephroureterectomy (ONU) with ipsilateral bladder cuff excision regardless tumors location. [2]

Due to the fact that the high rate of ureteral stump recurrence, reported to occur between 30% and 75%, the standard surgical procedure to treat high risk upper urinary tract transitional cell carcinoma (UTUT) is nephroureterectomy with mandatory bladder cuff excision (BCE). [3]

The open technique is regarded as the 'gold standard' treatment, in which all other techniques yet developed should be compared with.[4] Although , controversy still exists concerning which modality of choice for managing the mural part of the ureter and bladder cuff during nephroureteroctomy NU.[5]

Nephroureteroctomy either done by open surgical method which can be performed with either one incision by a transperitoneal approach or with two incisions by a flank approach

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combined with a lower abdominal incision for distal ureter and the bladder cuff. [6] or can be done by **Laparoscopic nephroureterectomy :** which became a common treatment for the UTUC with decreased perioperative morbidity and mortality . The oncological outcomes and survival rates are similar to that of ONU. [7] **while Robot-assisted laparoscopic nephroureterectomy** is regarded as a good and accepted option because it is a minimal invasive techniques but more advanced data are still under evaluation.[8]

Management of the mural part of the ureter

1. Open removal Technique:

It can be done either after an open procedure or after laparoscopic procedure by using a modified Pfannenstiel , Gibson incision or lower midline incision .[9-11] ·Advantages: This approach achieve the oncological principles and minimizing the risk of tumour spillage. It also can achieve the visual confirmation of complete resection of mural part of the ureter and careful histological examination of resected tissue. [12]

Disadvantages: The 'blind' combined extravesical clamping of the ureter may compromise the contralateral ureteric orifice (UO) and does not inevitably document adequate bladder cuff retrieval .History of prior pelvic irradiation ,or obesity or pelvic surgery may make the open procedure more difficult to perform in those patients. [13]

2. Pure Laparoscopic Technique: While achieving the oncological principles as above, this method is more technically difficult to perform .[14]

3. Laparoscopic extravesical stapling of the distal ureter and ureteric unroofing:

Advantages: It may shorten operative time and facilitates a minimally invasive procedure and maintaining a closed urinary tract, which prevent tumour spillage.

Disadvantages: difficulty in judgement might result in either mural part of the ureter being left behind or inadvertent injury to the contralateral UO. In addition, the stapled margin cannot be assessed histologically, and the staple line may be a source of stone formation in the future . [15]

4. Trans vesical laparoscopic detachment and ligation technique : This technique of securing the distal ureter and bladder cuff using transvesically placed laparoscopic ports was described by Gill et al .[16]

Advantages :This technique confirms the general oncological principles of controlled and complete unblock specimen extraction. The ureteric catheter and Endoloop occlude the ureter orifice , so reducing urine leakage .

Disadvantages :This may be a difficult technique to be done by most urologists, and the operative time is usually lengthened by 60–90 min. [17]

5. Intussusception technique or ureteric stripping : The main limitation of this procedure is a failure to document an adequate excision of the intramural part of the ureter and bladder cuff, potentially resulting in a risk of tumour recurrence and a failure rate of 18.7%. [18]

6. Transurethral Resection of the Ureteral Orifice (Pluck Technique)

Standard technique : The 'pluck'technique, was used in 1952 by McDonald et al. who described the technique of endoscopic resection of the distal part of the ureteral orifice (TURUO) into the perivesical fat, then nephroureterectomy was performed by a single flank incision. The ureter was placed on soft traction to pull it away from the bladder (so that the term "pluck"). [19]

Keeley et al. were the first who use the pluck technique in laparoscopic nephroureterectomy, making the procedure essential for the laparoscopic approach. [20]

Pluck Technique modifications

Many modifications on the pluck technique have been described to minimize the risk of tumour spillage. Endoloop (polydioxanone) can pass through the cystoscope to do ligation and occlusion of the UO.[21]

Mueller *et al* . recently had described a new technique with the injection of the Tisseel into the ureter after confirming that there is no bladder tumours and by introducing an 8 Fr olive-tipped ureteric catheter into the UO .[22]

Vardi *et al* stated a modification to the pluck technique, by inserting a flexible cystoscope per urethra and then a 5 Fr electrode to incise a circumferential 1-2 cm cuff of bladder around

the UO using a cutting and coagulating current. The opening in the in bladder is not closed. .[23]

OBJECTIVE:

Aim of the study is to compare results of modified transurethral ripping, coagulation and pluck technique with the traditional open resection of the mural part of the ureter in the radical nephroureterectomy for upper TUC.

PATIENT AND METHODS:

Seventeen patients with high risk upper tract urothelial carcinoma were included in this prospective study. They were 11 males and 6 females, all were presented with hematuria and their lesions were checked by ultrasound and CT Urography. All with normal contralateral kidney function, they were evaluated medically and were managed by radical nephroureterectomy. They were divided into two groups, first group (group A) were 7 patients in which the mural part was managed by open resection, while the other 10 patients (group B), the mural part was removed by simplified modified ripping by endoscopy.

In group A, initial cystoscopy was done to check for any synchronous bladder tumor , then open nephroureteroctomy and the last step is open resection of mural part of ureter was done though Gibsons incision and finally in supine position for removal of the whole kidney and ureter as one sample, with closure of the bladder, and single shot of Mitomycin C was given intravesically and the bladder catheter was preserved for 10 days .

In (Group B),the 10 patients were managed firstly by cystoscpy of the patient in lithotomy position,with the introduction of a guide wire to the mural part of ureter as a guide for ripping by a 24 F monopolar resectoscope, using Collins knife to do circular incision 1 cm around ureteric orifice, the incision was then deepen till showing the extra vesical fat. Then the ureteric meatus was coagulated using roller ball to fulgurate and close the ureteric meatus and pushing the ureter outside the bladder by the ball. The bladder was drained by Foley catheter. Then the second step is to do nephroureteroctomy, either by open method (in 8 pts) or laparoscopically (in 2 pts).

In the open nephroureteroctomy, Morris incision was done and dissection to reach the ureter and ligate it ,then pulling the lower ureter upward including the mural part , the sample was removed en block without closure of the bladder leaving it for spontaneous closure with bladder catheter.

In 2 patients,the nephroureterectomy was done laparoscopically throuch transperitoneal approach, where the first step is to reach the ureter and close it, then nephrectomy followed by plucking of distal part of ureter which is already closed by coagulation , after that the bladder is closed by extra vesical approach and the kidney and ureter were removed through a small iliac incision. Bladder was managed by single Mitomycin installation and catheter remained for 10 days.

RESULTS:

Seventeen patients with high risk upper tract urothelial carcinoma were managed by radical nephroureteroctomy ,for 7 patients their mural part was managed by open resection while 10 patients their mural part was managed endoscopically by ripping and coagulation of ureteric meatus. There was no significant difference of patients characters regarding patients demographic features (age and gender and smoking) as in table(1) .Hematuria was the leading symptom in all patients for both groups, and loin pain presented in 4 patients in group A and 3 in group B.

Multifocal tumors were seen in 2 patient in group A and, 2 patients in group B. Concurrent growth was proved by imaging and cystoscopy for 2 patients only in group B. Tumor characteristic were shown in table(2).

All tumors were Transitional cell carcinoma. There was a high statistically significant difference (p value <0.0001) between group A and group B in regard to mean operative time for bladder cuff excision, mean operative time for all the procedure, hospital stay, bowel recovery and duration of urethral catheterization as shown in table (3) .

Table 1:Demographic features and smoking history of the patients.

Age	**Group A(7 Patient)**	**Group B(10patient)**
	65+14.7 Year	65+15 year
Gender	Male 4 (57.1)%	6 (60%)
	Female 3(42.9)%	4 (40%)
Smoking history	Yes 6 (85.7)%	7 (70%)
	No 1 (14.3)%	3 (30%)

Table 2: Tumor characteristics and diagnostic evaluation

Tumor characters	**Variable**	**A**	**B**	**P value**
Side of mass	Left	5	5	**0.6**
	Right	2	5	
	Bilateral	0	0	
Haematuria		7	10	**0.9**
Flank pain		4	3	
Image	Ultrasound	7	10	**0.9**
	CTU	7	10	
Primary tumour location	Renal pelvis	4	7	**0.9**
	Upper Ureter	2	2	**0.8**
	Mid Ureter	1	0	**0.9**
	Lower Ureter	1	1	**0.8**
Tumour size mean±SD		4.5±0.6 cm	4.5±0.5 cm	**0.7**
Multifocal tumor (>1 tumors focus)		2	2 cm	**0.6**
Synchronous bladder mass (concurrent bladder TCC)		0	2	**0.5**

Table 3: Operative time and postoperative period.

Variable	**Group A**	**Group B**	**P value**
Mean, Operative time for bladder cuff excision (min.)	75±6.8	10.5±2.6	**0.0001***
Mean, Operative time for All the procedure (min.)	190±22.5	100 ±7.5	**0.0001***
Hospital stay mean (days)	7±0.6	4.5±0.6	**0.0001***
Bowel recovery (days)	3.5±1.1	1.5±0.4	**0.0001***
Duration of catheterization (days)	8.5±0.9	14.5±0.7	**0.0001***

There were no statistically significant difference in (p value) between group A and group B in regard to wound complications, blood transfusion, post-operative major complications .In current study, there were no intraoperative or early postoperative major complications; like retroperitoneal extravasation requiring prolonged drainage associated with these RCP method apart from mild haematuria which resolved spontaneously .In group(A) patients, one of them had post-operative hernia .

DISCUSSION:

Current procedure of radical nephroureteroctomy is in aretrograde fashion, where the first step is to deal with the mural part of the ureter, then with the ureter and lastly with the renal pedicle.

RCP technique fulfill all the surgical measures to decrease recurrence rate in radical nephroureterectomy, that early closure of the meatus by ball electrode (coagulation) after ripping, this step prevent any exit of urine or blood containing malignant cells to retroperitoneal space. And this step was reinforced by early ureteric clipping by minimally invasive procedure or by open method before vascular renal pedicel control.[25]

The second step is removal of the sample by closed en block fashion without opening of the lumen in all types of the procedures.

In general, following those surgical principles, intravesical recurrence in open radical nephroureteroctomy or endoscopic ways are equivalent.[3,26-29]

Hayashi M.et.al removed the specimen block by open or laparoscopic method.[29] After dealing with renal pedicle, ureteric clipping was done and by reposition, another operator do ripping around ureteric meatus, so the ureter can be plucked from above , by this operation the ureter remain opened for the operative period, and need repositioning of the patient in addition to leave the bladder for spontaneous healing (i.e. proceed by ante grade fashion).[30] Leaing Wang j.et al did coagulation for ureteric meatus with 1-2 cm around it , then laparoscopic nephroureteroctomy done, they but have difficulty to deal with distal ureter in 31 patients out of 45 patients during pluck technique. [30]

Mueller TJ, et al. initially did transurethral ureteric closure by injection of 5 ml of Tisseel into the ureter then checking of ureteric blockage by intravenous 5 ml indigo carmine to confirm ureteric closure, this procedure followed by ripping around ureteral meatus, then laparoscope plucking , it is a time consuming procedure with the mean average operative time was 308 minutes.[22]

Jose G valdirin et al.[31] Obstruct the last 6cm of the ureter by fulguration with bug bee of 6Fr electrode, and fulgurate the meatus and its surrounding mucosa. This is the first step, and the second step is nephroureterectomy by open or laparoscopic way to do double clip and cut the ureter at entry to the bladder, 3-4cm below the limit reached by thermal ablation of the ureteral wall.[30] In this procedure, the mural part remain in situ but coagulated, That is to say the ureter was cut and not plucked. This technique is not so safe. and is contra indicated in cases of pelvic ureteral tumors.[30]

In Ripping coagulation method, the dealing with the mural part is significantly rapid procedure it needed a mean time of 10.5 minutes, while in open dealing with mural part require a mean of 75 minutes to be completed. This time reduction for dealing with the mural part, lead to reduction in the whole operative time, anesthetic time, complications, bowel activity recovery and hospitalization.

Regarding the simplicity of RCP technique, all the required instruments are available in all urological units, and need no special experience, the basic principle of expertise is evident for all urologist, and it is an applicable method with all types of nephroureteroctomy approaches whether open, laparoscopic, or robotic approach.

RCP technique has special preference over open resection because, of less operative and anesthesia time ,less blood loss ,no surgical wound for the mural part removal and less wound complications. It complete minimally invasive procedures, while dealing with the mural part of ureter by laparoscopic or robotic method, the other ureteric orifice is not visualized during removal of mural part, so it may be injured, while with RCP every step will be under vision.

CONCLUSION:

RCP technique=Ripping, coagulation and plucking of ureter (RCP) is the most optimum method in radical nephroureterectomy because it is technically simple, safe , short time procedure, applicable with all types of procedure whether open or minimally invasive procedures and in this way **,** all oncological principles to decrease cancer recurrences are applied.

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