Role of Ureteroscopy in Treatment of Upper Tract Urothelial Carcinoma

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Abstract

Purpose of Review Upper tract urothelial carcinoma (UTUC) is uncommon accounting for less than 10% of all urothelial tumours. Ureteroscopic management (URS) is the first line treatment for low-risk disease and has been increasingly utilised due to technological advances and increasing surgical experience. This review looks at patient outcomes relating to URS, emerging technologies and the role of adjuvant intracavitary therapy in the management of UTUC.

Recent Findings URS has firmly established itself in the management algorithm for UTUC, and a good body of evidence supports its use for low-risk disease, wherein oncological outcomes are comparable to traditional nephroureterectomy (RNU). Larger tumours can now be managed using URS with a lower morbidity than radical surgery, though with higher associated local recurrence rate and risk of progression to RNU, and as a result, patient selection and close surveillance remains key. There is limited evidence for adjuvant intracavitary therapy (Mitomycin C or BCG) in UTUC although the development of novel polymers and biodegradable stents may improve drug delivery to the upper urinary tract.

Summary URS has a clearly defined role in low-risk UTUC, and its use in larger tumours appears to be appropriate in a selected cohort of patients. The efficacy of adjuvant intracavitary therapy is as of yet undetermined, though developments in delivery techniques are promising. Likewise further developments of laser technology are anticipated to further expand the role of URS.

Keywords Ureteroscopy · Upper tract urothelial carcinoma · Adjuvant intracavitary therapy · Transitional cell carcinoma · Laser · Mitomycin

Introduction

Upper tract urothelial carcinoma (UTUC) is uncommon accounting for less than 10% of all urothelial tumours. At diagnosis, 60% of UTUC are found to be invasive, and radical nephroureterectomy (RNU) has traditionally been the gold standard treatment [1]. Over the past three decades, there has been accumulating experience for the use of endoscopic management in selected cases of UTUC. Endoscopic management in UTUC can be via either a percutaneous or ureteroscopic approach. Ureteroscopic management (URS) has been increasingly utilised over the percutaneous route, and this has been due to a number of factors which include improved ureteroscope design, the advent of flexible instruments and advances in laser technology. These technological factors are coupled with increased experience and dissemination of the surgical techniques driven by concentration of cases in large-volume surgical units [2]. Whilst early experience of ureteroscopic treatment of UTUC was limited to specific patient groups such as bilateral UTUC, solitary renal unit or established chronic kidney disease, the indications for endoscopic management have been expanded over time.

The most recent EAU guidelines for UTUC published in 2020 recommends kidney sparing treatment for all low-risk tumours, with ureteroscopic management as first line for lesions that would be amenable to it [3]. Low-risk UTUC is defined as unifocal disease, tumour size of less than 2 cm,
low-grade cytology, low grade on ureteroscopic biopsy and no invasive aspect seen on cross sectional imaging [3]. The rationale for ureteroscopic management in low-risk patients is that overall survival outcomes may be superior to RNU owing to the preservation of renal function and reduced surgical morbidity. However, close surveillance is required for patients managed endoscopically as recurrences and progression to RNU are a well-documented occurrence.

We discuss the expanding role of URS for UTUC with a focus on oncological outcomes, intracavitary therapy, modality of tumour ablation and emerging technologies.

**Literature Search**

A literature search was undertaken of the Medline and Embase online databases for English language publications within the period 01 Jan. 2000-30 Aug. 2020. Search terms used were ‘upper tract urothelial carcinoma’, ‘upper tract transitional cell carcinoma’, ‘UTUC’ combined with ‘endoscopic management’ or ‘ureteroscopy’ or ‘URS’, ‘RIRS’ or ‘retrograde intrarenal surgery’, ‘laser ablation’ or ‘nephroureterectomy’ or ‘mitomycin’, or ‘MMC’ or ‘BCG’ or ‘intravesical recurrence’. Papers were identified and were screened independently by two authors (NJ + HD). Studies describing survival outcomes with < 40 patients were excluded. For studies describing intracavitary therapy, a minimum of 10 patients was required for inclusion. Forty papers were included for final analysis, and relevant studies were synthesised for a narrative review.

**Inclusion Criteria**

1. All studies in English language reporting on patients undergoing endoscopic treatment for UTUC
2. Intracavitary treatment using MMC or BCG

**Exclusion Criteria**

1. Non-English language articles
2. Narrative review articles, case reports, laboratory or animal studies
3. Grey literature and studies where outcome of interest was not presented

Search results were summarised within a Preferred Reporting Items in Systematic Reviews and Meta-Analyses (PRISMA) flow chart (Fig. 1) [4].

**Comparative Outcomes of URS and RNU**

There has been a trend towards increased utilisation of URS for UTUC over the past two decades. This was highlighted in an analysis of the National Cancer Database (NCDB) over a 10-year period (2004–2013) which revealed that the rate of endoscopic ablation increased from 9.8 to 11.5% whilst the overall rate of RNU decreased from 59.6 to 56.7% [5]. In addition, an analysis over a similar time period found that patients who were treated at an academic facility, who were older and had fewer comorbidities were more likely to receive endoscopic treatment instead of RNU [6].

There are only a small number of studies comparing outcomes of URS to RNU which include no randomised controlled trials, and therefore, the majority of the included studies were retrospective case series or comparative studies (Table 1) [7–25, 26•]. Results from comparative studies should be interpreted with caution as patients undergoing URS often have imperative indications for this approach (such as solitary kidney or bilateral tumours), are often carefully selected and likely to be of lower stage. In addition, the definitive pathological stage for patients managed exclusively by URS is not always available, thereby often preventing direct comparison to patients undergoing RNU. Additionally, the distribution of invasive UTUC stage (≥ pT2) in the RNU study arms was significantly higher in the studies that reported this data (up to 67% for RNU vs 24% for URS) further skewing the analysis.

Across the included studies, 5-year cancer-specific survival (CSS) for URS was 71.2–94.7% compared to 64–92% in the RNU group. In patients managed by URS, there was a progression rate of 8.9–53% to RNU. There are conflicting reports on the survival outcomes of patients undergoing delayed RNU following initial ureteroscopic management. Two studies utilising Surveillance, Epidemiology and End Results (SEER) data compared patients who underwent a primary RNU to those who had initial endoscopic treatment followed by RNU. The first compared 838 patients who underwent RNU with 167 who had undergone RNU following initial endoscopic treatment and found a significantly worse 5-year CSS for the latter group (HR 1.69, 95%CI 1.07–2.69) months but noted no significant difference in overall survival (OS) [6]. The second, a propensity score analysis of 453 low-grade UTUC patients, reported that whilst the delayed RNU group had similar results within the first 24 months, after this period, survival curves diverged significant, with inferior OS and CSS in those who had received initial endoscopic management. Furthermore, the CSS in those who had received delayed RNU remained similar to those who had undergone endoscopic management alone [13].

On the other hand, Gurbuz et al. analysed an international multicentre database and reported no difference in 5-year CSS in patients having a deferred RNU following endoscopic intervention (n = 175) compared to primary RNU (n = 1093), 77% vs 73% respectively (p = 0.365) [9]. Furthermore, history of ablation therapy was not associated with cancer-specific mortality (HR 0.79 [0.55–1.22] p = 0.185) [9].

Overall, whilst acknowledging the limitations of reported studies, URS outcomes may be similar in the short-term to
RNU in carefully selected low-grade tumours. The rate of progression to RNU remains high though, and close surveillance is therefore vital.

**Survival Outcomes Post-ureteroscopic Ablation**

URS allows diagnostic evaluation and primary tumour ablation with the advantages of renal preservation and lower surgical morbidity compared with RNU. The majority of these studies are retrospective single-centre series with some reporting analyses of national datasets due to the rarity of the condition. Analysis of included studies shows patient numbers ranging between 40 and 186 with a median age of 65–75.2 years. There was a wide variation in follow-up, between 11.7 and 96 months. Five-year overall survival ranged between 57 and 75%, and 5-year cancer-specific survival was 64–94.7% across the included studies (Table 1). Scotland et al. reported on one of the largest retrospective series of URS in 168 patients, reporting a mean tumour size of 16.8 mm and found a 5-year CSS of 92.6% and recurrence-free survival of 30% [26•].

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*Figure 1 PRISMA diagram outlining article selection process*
Table 1 Summary of studies reporting URS outcomes in UTUC

| Author                  | Year | Number of patients | Median age (yrs) | Follow Up (mo) | Ablation energy | 5-year CSS (%) | Progression to NU (%) | Recurrence (%) | Complications |
|-------------------------|------|--------------------|------------------|----------------|-----------------|----------------|------------------------|----------------|---------------|
|                         |      | URS RNU            | URS RNU Median   | URS RNU        |                 | URS RNU         | URS group              |                |               |
| Comparative studies (URS vs RNU) |      |                    |                  |                |                 | URS RNU         |                        |                |               |
| Roupret et al.[7]       | 2006 | 27 54              | 68               | 57.5           | Ho:YAG²         | 80.7% 84%       | 25.9% 44% 22.2% 11%   |                |               |
| Lucas et al. [8]        | 2008 | 39 77              | 68               | 65 46 65       | Ho:YAG          | 81.6% 83%       | 28.2% 44% 10% –       |                |               |
| Gurbuz et al. [9]       | 2011 | 175 1093           | 71.2 69.2 52.8   | –              | –               | –               | –                      |                |               |
| Grasso et al. [10]      | 2012 | 66 80              | 73 72.5          | 51.5           | Ho:YAG/Nd:YAG³  | LG 87% 64% (LG 93%) | 16.6% 81% 60.6% –    |                |               |
| Cutress et al. [11]     | 2012 | 73 –               | 69.3             | 54             | Nd:YAG          | 88.9% –        | 19.2% 68.5 42.5 19%   |                |               |
| Murray et al. [12]      | 2015 | 167 838            | >65 years        | 96             | –               | –               | 100%³ – – – – – – – – |                |               |
| Vemana et al. [13]      | 2016 | 151 302            | 75               | 43             | –               | 88% 92%        | –                      | –               |               |
| Bozzini et al. [14]     | 2020 | 47 31              | 11.7             | –              | Thu:YAG²        | –               | –                      | 19.2% – – – – – – |               |
| Non-comparative (URS only) |      |                    |                  |                |                 | URS RNU         |                        |                |               |
| Deligne et al. [15]     | 2002 | 61 66.2            | 39.9             | –              | Ho:YAG/Nd:YAG   | 77%            | 9% 24.6% 14.8% 2 ureteric strictures |                |               |
| Krambeck et al. [16]    | 2007 | 78 73              | 52               | –              | KTP/Ho:YAG/Nd:YAG | 71.2%        | 35.9% – 49.3% 17.8%   |                |               |
| Sowter et al. [17]      | 2007 | 40 65              | 41.6             | –              | Ho:YAG/Nd:YAG   | –              | 29.3% 74.3% – – – – – |                |               |
| Thompson et al. [18]    | 2008 | 83 71              | 55               | –              | Nd:YAG          | 85.4%          | 32.5% 55.4 44.6% – – |                |               |
| Pak et al. [19]         | 2009 | 57 65.6            | 53               | –              | –               | 94.7%          | 19% 89.5% – – – – – |                |               |
| Niu et al. [20]         | 2012 | 65 67              | 60               | –              | Nd:YAG          | –              | 27.7% 47.7 30.7% – – |                |               |
| Vancoren et al. [21]    | 2016 | 186 72.6           | 24               | Ho:YAG/Thu:YAG | –               | –              | 13.5% 49% – – CD³ ≥ III 0% |                |               |
| Scotland et al. [22]    | 2018 | 80 75.2            | 43.6             | Ho:YAG/Nd:YAG³ | 84%             | 20%            | 90.5% 30.2% – – – – – |                |               |
| Defidio et al. [23]     | 2018 | 60 –               | 24.4             | –              | –               | 77.5%          | –                      | 71.4% – – – – – |               |
| Musi et al. [24]        | 2018 | 42 68              | 26.3             | Thu:YAG        | –               | 9.5%           | 19% – CD I 138%, II 46%, III 3% |                |               |
| Defidio et al. [25]     | 2019 | 101 71.1           | 28.7             | Ho:YAG/Thu:YAG | –               | 8.9%           | 30.7% – CD I 10% – – |                |               |
| Scotland et al. [26•]   | 2020 | 168 70             | 66               | Ho:YAG/Nd:YAG³ | 92.6%           | 29.8%          | 71.4% – 7.1% – – – – |                |               |

*Compared immediate to delayed RNU
³Confocal laser microscopy performed in 23 patients
⁴Large tumours only (> 2 cm)
⁵Cancer-specific survival
⁶Nephroureterectomy
¹Upper tract
²Holmium
³Neodymium-doped
⁴Thulium
⁵Potassium titanyl phosphate
⁶Clavien Dindo
It is worth noting that the reported CSS across studies may be overestimates as histological confirmation was not universally performed and that up to 16% of visually suspected UTUC could harbour benign pathology [27]. Metastatic progression is uncommonly reported, but previous reports estimated a pooled 9% rate following URS with a 5-year metastatic-free survival of 94% for low-risk disease [27].

Upper Tract Recurrence Post-ureteroscopic Management

Recurrence following initial URS tumour ablation was 19–90.5%, and progression to RNU was noted in 8.9–53% (Table 1). A number of studies have examined risk factors predicting recurrence post URS or progression to RNU. Mohapatra et al. reported on a series of 170 patients across two institutions where 89 patients progressed to RNU. They found that ureteroscopic visualisation, biopsy grade and positive urine cytology were higher in those progressing to RNU. In addition, they calculated that the probability of not undergoing RNU was 50% at 2 years and 20% at 5 years post URS [28]. Tumour grade was also noted to achieve predictor status for recurrence-free survival in another cohort of 41 patients managed endoscopically [29].  

Tumour size is an important criterion affecting the success of URS. Defidio et al. reported a worse 5-year disease-specific survival (DSS) for UTUC >1 cm managed endoscopically (93% vs 67%) in a cohort of 60 patients [23]. Another cohort study of 92 patients managed with holmium/yttrium-aluminium-garnet (Ho:YAG) laser with a median follow-up of 52 months reported no statistical difference in progression-free survival with tumour size of < 1 cm compared to > 1 cm (68% vs. 72%). The only independent predictor of disease progression in this study was tumour grade at initial biopsy [30•]. Scotland et al. reported a retrospective cohort study of 80 patients (median FU 43.6 months) with low-grade UTUC > 2 cm managed by URS with 5-year CSS was 84%. However, 90.5% tumours recurred and 20% required RNU [22]. A more recent report involving 343 URS in 87 patients with UTUC reported a local recurrence rate of 46% at a mean follow-up time of 4.9 months after initial URS in tumours > 2 cm compared to 71% after a mean follow-up time of 9.9 months in tumours < 2 cm. This suggests that larger tumours tend to recur faster locally but only one patient in the larger tumour group required RNU after 12 months of URS management [31].

Tumour location and prior history of bladder cancer have also been associated with higher local recurrence rates in other reports although this has not been consistently documented [20, 27]. Overall, the data would suggest that tumour size and grade remain important predictors of initial success of URS. Whilst larger tumours (> 2 cm) can be treated with URS, early recurrence rates can be high, and close endoscopic follow-up remains vital.

Intravesical Recurrence Rates Post-URS

Intravesical recurrence has been reported between 10 and 60.6% of the included studies at a median follow-up time of 46–60 months. The previous pooled incidence of intravesical recurrence was reported at 34% [27]. Although intravesical recurrence is dependent on several confounding factors, including prior history of bladder cancer, tumour grade and stage, it has been suggested that the performance of URS in UTUC could also be an independent predictor for this. In a meta-analysis of 2382 patients, intravesical recurrence rates were 39.2–60.7% in patients with prior URS compared to 16.7–46% in patients who did not undergo URS but proceeded directly to RNU [32]. In the pooled analysis, a statistically significant association was found between performance of URS prior to RNU and intravesical recurrence rates.

Modality of Laser Ablation and Emerging Technologies

The holmium/yttrium-aluminium-garnet (Ho:YAG) and neodymium/yttrium-aluminium-garnet (Nd:YAG) lasers have been extensively described in the management of UTUC. The Ho:YAG laser energy is readily absorbed by water and must be used in contact with the tissue to achieve tumour ablation. The Nd:YAG laser has a greater depth of penetration (4–6 mm) and provides a deeper coagulation and ablative effect on the tumour. More recently, thulium/YAG (Thu:YAG) ablation of UTUC has been described in a number of series. Thu:YAG provides a continuous wave and a lower tissue penetration resulting in good vaporisation and coagulation properties for treating soft tissue disease, though it does appear to cause more tissue necrosis [33]. Four studies included in our review used Thu:YAG, two in combination with Ho:YAG and two in isolation [14, 21, 24, 25].

The included studies using Ho:YAG or Nd:YAG showed progression to NU in 16.6–35.9% vs 8.9–13.5% in studies using Thu:YAG and upper tract recurrence 24.6–90.5% vs. 19.2–49% for Thu:YAG [14, 21, 24, 25]. Defidio et al (2011) reported the comparative outcomes of Thu:YAG and Ho:YAG in a multicentre European study. They studied 59 patients and reported non-inferior recurrence-free survival for Thu:YAG. They however reported reduced bleeding and mucosal perforation rates and improved ablation efficiency in tumours < 1.5 cm. There was no difference in ablation.
efficiency with Thu:YAG for tumours > 1.5 cm [34]. The largest single-centre experience of Thu:YAG described outcomes of 42 patients with a median age of 68 years and median follow-up of 26.3 years. Upper tract recurrence was 19%, and 9.5% progressed to NU. The major complication rate (Clavien > 3) was 2.4% [24].

Confocal laser endomicroscopy (CLE) technology is being assessed for its use in UTUC. The technology would allow improved detection of tumours at the time of URS, and this may lead to improved tumour ablation. Vanacore et al. studied 186 pts undergoing URS with CLE (Cellvizio) technology and ablation using combination of Ho:YAG and Thu:YAG. They reported a 49% upper tract recurrence rate and 13.5% progression rate to RNU, though CLE was only used 23 of the 186 patients [21]. The novel thulium fibre laser (TFL) is emerging as an alternative to Ho:YAG and Thu:YAG. They reported a 49% recurrence and 13.5% progression rate to RNU, though CLE was only used 23 of the 186 patients [21].

Complications and Surveillance Post-endoscopic Treatment

Complications were not uniformly reported between studies and varied significantly in the studies that did provide data, ranging from 7.1 to 46% (Table 1) with the commonest serious complication reported being ureteric stricture. The incidence of ureteric stricture post URS has been reported to be between 0 and 27%.[38]. Serious and fatal complications following URS are rare, and ureteroscopic management of UTUC is safe in appropriately selected patients.

Due to the risk of upper tract recurrence, intravesical recurrence and progression rate to RNU, close surveillance is required following initial URS. Surveillance should involve both the upper tracts and the bladder. The current EAU guidelines recommend a risk-stratified approach to follow-up [3]. In low-risk tumours, a check URS is recommended at 3 months after initial endoscopic management as well as a cystoscopy and computed tomography (CT) urogram at 3 months, 6 months and then annually for 5 years. For high-risk tumours, URS and in situ cytology at 3 and 6 months are recommended following initial endoscopic therapy and in addition cystoscopy, urine cytology and CT (urogram and chest) at 3 and 6 months then annually thereafter [3].

Role of Intracavitary Therapy

Whilst the role of adjuvant intracavitary therapy is well established in urothelial carcinoma of the bladder, the data for its use in UTUC is limited. A number of agents have been utilised in this context, extrapolating from the experience in urothelial bladder cancer including Bacille-Calmette-Guerin (BCG) and mitomycin C (MMC). The data for contemporary studies reporting a minimum of 10 patients is summarised in Table 2 [11, 39–47].

All studies had a small number of patients and a variable follow-up (median 13.5–64 months). Many of the studies consisted of larger cohorts with only a small subgroup receiving adjuvant treatment and outcomes specific to adjuvant therapy often not well reported. The largest study by Rastinehad et al. (2009) reported outcomes of 50 patients with a median FU of 40.8 months who had had adjuvant BCG for Ta/T1 tumour. They reported upper tract recurrence rates of 36% and CSS of 98%, though the difference compared with those who did not receive adjuvant BCG was not statistically significant with a recurrence rate of 30.7% (n = 39)[43]. The study by Goel et al. (2003) had the longest FU with a median of 64 months and included patient with Ta/T1 tumours treated with adjuvant MMC. The authors reported a 53% recurrence rate and 88% CSS (39).

Foerster et al. (2019) reported a meta-analysis of topical treatments for UTUC which included 438 patients [48]. Topical treatment was delivered via a retrograde or antegrade approach with studies utilising BCG, MMC or a combination of both. For patients with Ta/T1 UTUC, overall pooled estimates showed that the rate of upper tract recurrence was 40%, of CSS was 94% and overall survival of 71%. Sub-analyses stratified by drug use and instillation approach did not show significant differences. For primary CIS treated with topical BCG following endoscopic management, the pooled estimate for upper tract recurrence was 34% and progression of 16%. Comparison between instillation approaches again did not show any statistically significant differences [48]. These data suggest that there may be limited benefit to intracavitary therapy as the reported recurrence and survival outcomes are similar to those groups of patients managed by observation alone [48].

Gallioli et al. reported a preliminary study on the use of adjuvant single-dose mitomycin (ASDM) immediately after therapeutic URS for UTUC in a cohort of 52 patients. They found a reduction in urothelial recurrence rate (23.5% vs. 55.5% if ASDM was not used) although recurrence-free survival rates were not statistically significant at a median follow-up time of 18 months [49]. The effect of second line topical therapy of UTUC was investigated in a cohort study of 51 patients. Response
rates were 71% following first-line topical treatment and 62% to second-line treatment for patients having adjuvant therapy for Ta/T1 tumours suggesting that this could be a useful strategy [50].

It is to be noted that the efficacy of intracavitary therapy may be hampered by the dwell time as it is difficult to keep the required agent in the upper tract due to natural drainage. Traditional treatment regimes have been based on continuous drug delivery controlled through a pump either retrograde via a ureteric catheter or antegrade via a nephrostomy. However, one possible solution is the development of a novel polymer with reverse thermal reaction combined with mitomycin (Mitogel). Uniquely, it exists as a liquid at cold temperature but becomes a viscous gel at body temperature and can remain in the upper tracts for 4–6 h thereby theoretically improving drug delivery. Initial results of the trial, published in The Lancet, evaluating the use of this compound for chemoablation of low risk UTUC showed encouraging results, reporting a 59% rate of complete response and partial response in a further 11% [51••]. Another promising development is biodegradable drug–eluting stents which can be impregnated with chemotherapeutic agents for improved drug delivery into the upper urinary tract. In vitro studies have shown a reduction of up to 75% in cancer cell lines exposed to biodegradable stents, and further studies are required to confirm this [52].

### Areas of Future Research

Although previous review suggested a paucity of evidence in management of UTUC, it seems that recent evidence and guidelines show a growing role of ureteroscopy, especially for low-risk disease [53]. Laser technique, technology and ancillary equipment will also help in facilitating this [54]. This has to be balanced with the cost of procedure and the risk of recurrent or progressive disease [55].

#### Table 2  Summary of studies looking at the outcomes of adjuvant treatment for UTUC

| Author          | Year | Patients (n) | Median FU | Pathology | Drug       | CR (%) (BCG) | Recurrence (%) | 5-yr RFS (%) | Progression (CIS) |
|-----------------|------|--------------|-----------|-----------|------------|--------------|----------------|--------------|------------------|
| Nonomura et al. | 2000 | 11           | 20*       | CIS       | BCG²       | 82%          | 27%            | –            | 27%              |
| Goel et al.     | 2003 | 10           | 64        | Ta/T1     | MMC³       | 82%          | 32%            | –            | –                |
| Palou et al.    | 2004 | 19           | 51*       | Ta/T1     | BCG/MMC²   | 58%          | –              | –            | –                |
| Kojima et al.   | 2006 | 11           | 58        | CIS       | BCG        | 82%          | 27%            | 78%          | 18%              |
| Rastinehad et al| 2009 | 50           | 40        | Ta/T1     | BCG        | 55%          | –              | –            | –                |
| Giannarini et al| 2011 | 18 (22 RU)²  | 42        | Ta/T1     | BCG        | 59%          | 24%            | –            | –                |
| Giannarini et al| 2011 | 37 (42 RU)²  | 42        | CIS       | BCG        | 40%          | 57%            | 5%           | –                |
| Cutress et al.  | 2012 | 18           | 54        | Ta/T1     | MMC        | –            | 54%            | –            | –                |
| Shapiro et al.  | 2012 | 11           | 14        | CIS       | BCG        | 73%          | 11%            | –            | 0%               |
| Horiguchi et al.| 2018 | 38           | 49        | CIS       | BCG        | 79%          | –              | –            | 43%              |
| Tomisaki et al. | 2018 | 41 (52 RU)²  | 26        | CIS       | BCG        | 90%          | 23%            | 60%          | 13%              |

*Mean of values

¹Follow up

²Complete response

³Recurrence-free survival

⁴Carcinoma in situ

⁵Bacillus Calmette–Guérin

⁶Mitomycin C

⁷Renal units
Conclusions

Ureteroscopic management has firmly established itself in the management algorithm for UTUC. A good body of evidence supports its use for low-risk UTUC where oncological outcomes are comparable to traditional nephroureterectomy.

With increased experience and with the development of ureteroscopic and ablation energy technology, it is now possible to treat tumours of larger size with lower morbidity compared to traditional nephroureterectomy. However, this comes at the cost of higher local recurrence rates and progression to radical surgery, and therefore patient selection and close surveillance remains key. There is limited evidence for adjuvant intracavitary therapy in UTUC although the development of novel polymers and biodegradable stents may improve drug delivery to the upper urinary tract. Early reports of the novel thulium fibre laser are encouraging, and this could radically change the landscape of ureteroscopic management of UTUC.

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Compliance with Ethical Standards

Conflict of Interest  Jeremy Ng, Chieng Hin, Dinul Hettiarachchilage, Paul Gravestock, Bhavan Rai, Bhaskar K Somani, and Rajan Veeratapillay have nothing to disclose.

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- Of major importance

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