Review Article

Metallic Ureteric Stents in Malignant Ureteric Obstruction: A Systematic Review

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The effectiveness of metallic stents in the management of malignant ureteric obstruction is unclear. This systematic review evaluates the use of 4 commercially available metallic stents (Resonance, Memokath 051, Uventa, and Allium URS). Twenty-one studies met eligibility criteria. Overall success rates ranged from 88% for the Allium stent to 65% for Memokath 051. Resonance demonstrated the lowest migration rate (1%). Uventa had the lowest obstruction rate (6%). Metallic ureteric stents offer a viable alternative in the management of malignant ureteric obstruction. Further high quality studies are required to assess cost effectiveness and refine specific indications based on etiology and level of the ureteric obstruction. UROLOGY ■■: ■■–■■, 2018. Crown Copyright © 2018 Published by Elsevier Inc.

Malignant ureteric obstruction (MUO) is a frequently encountered cause of obstructive uropathy. The etiology is often extrinsic compression, with gynecological and colorectal malignancies more commonly implicated than urological cancers. Median survival is 6-8 months.[1,2]

Given the poor prognosis, management of MUO aims to relieve symptoms and optimize renal function to facilitate chemotherapy treatments. Historically a variety of open, minimally invasive, and endourological techniques have been used. Current first-line management is either retrograde insertion of a ureteric stent or percutaneous nephrostomy.[3,4]

Traditional management with polymer double-J stents is effective in relieving obstruction in the short term. Unfortunately, they require regular replacement, are prone to occlusion, tumor ingrowth, and encrustation, and are a source of sepsis. A number of studies have examined the use of tandem polymer stents, reporting good success rates even when a single polymer stent has failed. However, they still require regular exchange, exposing an already comorbid patient group to further hospital admissions and anesthesia.[3,5] Polymer stents strengthened with metallic coils are also available (eg Silhouette), but currently clinical evidence is lacking.[6]

Metallic ureteric stents are designed to be more effective in maintaining lumen patency, reducing frequency of exchange and stent related lower urinary tract symptoms.[7] They are increasingly being used when traditional approaches have failed, or even as a novel first-line. Available contemporary models include Resonance, Memokath 051, Uventa, and Allium URS (Table 1; see Supplementary Material 1 for design details); however, to date, a comprehensive review focusing on the strengths and weaknesses of these 4 stents has not been performed. This systematic review evaluates the migration, obstruction, and success rates of these 4 stents in the management of MUO and their individual suitability for use in various clinical scenarios before making recommendations for practice and future research.

MATERIALS AND METHODS

Reporting of this review follows recommendations defined in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses statement.[8]

Review Design

This study was prospectively registered on the PROSPERO International Prospective Register of Systematic Reviews (CRD42017072529). A data extraction tool was developed a priori to aid collection of relevant information on study design, participant demographics, characteristics of interventions, and outcome measures.

Study Eligibility Criteria

English language empirical studies (randomized and nonrandomized comparative and noncomparative studies) describing the use of metallic ureteric stents for MUO in adults were included. Review articles, unpublished studies, letters, bulletins, comments, and conference abstracts were excluded.

Information Sources and Search

Two authors (C.K. and H.A.) performed a comprehensive search of the PubMed and Embase databases in April 2017. A hand-search

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Table 1. Metallic stent comparison table

	Resonance	Memokath 051	Uventa	Allium URS
*Unit Cost	£400	£1500	£2635	£1700
Available sizes	6fr: 20 cm, 22 cm, 24 cm, 26 cm, 28 cm, 30 cm	Single cone 3 cm, 6 cm, 10 cm, 15 cm Dual cone 8 cm, 12 cm, 20 cm	6 cm, 7 cm, 8 cm, 9 cm, 10 cm, 12 cm, 14 cm, 16 cm, 18 cm, 20 cm	10 cm 12 cm
Dwell Time License	12 mo	12 mo	12 mo	36 mo
Structure	Full-length closed metal coil with inner safety wire	Segmental tight wire coil of NiTinol with proximal +/-distal anchoring cones	Segmental Nitinol mesh with outer and inner polymer membrane	Segmental Nitinol mesh with outer polymer membrane +/- distal anchoring coil
Manufacturer	Cook Medical	Pnn Medical	Taewoong Medical	Allium Medical Solutions

* Prices can vary depending on volume of purchase and individual agreements. These costs are based on 2017 UK prices as reported by company representatives.

of reference lists of identified existing review articles was also undertaken. The following key words were used: "ureteric obstruction", "ureteral obstruction", "malignancy", "hydronephrosis", "malignant stricture". Search terms included a combination of "resonance", "allium", "uventa", or "memokath" with each of the key words (eg, "resonance AND malignancy").

Study Selection and Data Collection

Two authors (C.K. and H.A.) reviewed abstracts of potentially relevant articles. Duplicates, studies with follow-up articles and articles not meeting eligibility criteria were excluded. The full text of each remaining article was obtained and further screened for inclusion. Disparities were discussed until agreement was reached.

Data Items

Certain information was extracted from each study, including stent type, success rate (defined as no obstruction, improved renal function and no further intervention required for the duration of follow up), indwelling time, migration rates, obstruction rates, level of obstruction, and underlying malignancy. Relevant data were included for analysis. In some cases it was not possible to extract eligible data from available datasets; these studies have been included but are clearly indicated (Supplementary Table S1).

Risk of Bias Assessment

Each study was assessed using the Methodological Index for Non-Randomized Studies instrument, a validated tool designed to assess the quality of nonrandomized comparative and noncomparative surgical studies.[9]

Data Analysis

Random effects meta-analysis was performed using the metaprop package in Stata 12. This program was developed specifically for meta-analyses of binomial data, allowing improved computation of 95% confidence intervals, even when rates or proportions approach 0% or 100% in small samples. Score confidence intervals were calculated, incorporating the Freeman–Tukey double arcsine transformation of proportions.[10] Heterogeneity was assessed using the I^2 test.

EVIDENCE SYNTHESIS

Study Selection

The search identified 1857 relevant publications. After non-English language, duplicates and publications in an ineligible format were removed, 836 publications remained. Abstracts were unavailable for 51 studies; 785 were included for abstract review. Thirty reports of 27 different study populations met eligibility criteria. After full-text review, 6 further papers were excluded (these were quality of life questionnaires, concerned cost-analysis, or were reports of single cases) (Fig. 1). Twenty-one studies were finally included (Supplementary Table S1).

RESULTS

Resonance

Ten studies examining the role of the Resonance stent in MUO met eligibility criteria. Of these, 4 papers studied patients with obstruction of exclusively malignant etiology.

Wah et al reported their experiences placing 17 antegrade stents into 15 patients. Patients were assessed with regular renal function tests and interval ultrasound scans. 6 patients with 7 stents also underwent nephrostogram on day 1. Three of these patients showed sluggish urine flow, and so were managed with percutaneous nephrostomies. The remaining 12 patients maintained stent patency for the duration of follow-up. Of note, 3 patients whose stents had failed had bulky pelvic malignancy causing high intravesical pressure.[11]

Goldsmith et al placed 37 stents in 25 patients. They report a 35% failure rate (12 stents) at median follow-up of 13 weeks. Cox regression analysis for predictors of stent failure found significantly increased risk in patients with bladder invasive prostate cancer on cystoscopy. None of the 6 stents placed for proximal ureteric obstruction failed.[12]

Abbasi et al placed 35 Resonance stents in 27 ureteral units in 20 patients over a 12-month period. One stent migrated, and 5 patients developed symptoms of obstruction.