Antegrade Ureteric Stenting: Prospective Experience In Managing 30 Patients; Indications, Complications And Outcome.

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Abstract

BACKGROUND:
Over the past three decades there has been a remarkable increase in interventional uro-radiological procedures in the developed countries. Long-term drainage of the obstructed upper urinary tract may be achieved by percutaneous nephrostomy or ureteric stenting. In the past most ureteric stents were inserted retrogradely at cystoscopy and these procedures have required the use of general anaesthesia. With the development of nephrostomy service in most hospitals throughout the world antegrade ureteric stenting procedures are being carried out by interventional radiologists in the radiology department without the need for a general or spinal anaesthesia.

AIMS / MATERIALS AND METHODS
To review the records of all 30 patients who had insertion of antegrade ureteric stents for ureteric obstruction between December 2007 and February 2010 in order to document the following:
- The causes of obstruction
- The side (left, right or both sides) and site of the ureteric obstruction (upper, mid or lower ureter)
- The sex and ages of the patients
- Success or failure of the procedure
- Complications of procedure
- The management of the complications

RESULTS
Antegrade ureteric stenting was successful in 27 out of 30 (90%) patients. Out of 40 antegrade stenting procedures carried out 35 (87.5%) were successful at first attempt and another two were successful during a second attempt making it a total of 37 (92.5%) successful procedures. There were hardly any complications.

CONCLUSION
Antegrade ureteric stenting is a safe procedure with minimal complications. Every radiology unit should have a trained interventional radiologist capable of performing antegrade ureteric stenting.

KEY WORDS Antegrade Ureteric Stenting, Nephrostomy; ureteric obstruction, chiba needle. Seldinger technique; Terumo guide wire:

Introduction

Patients requiring temporary or long term urinary drainage for upper urinary tract obstruction may be managed by a number of procedures including percutaneous nephrostomy insertion, antegrade ureteric stenting, retrograde ureteric stenting, ileal conduit construction, ureterostomy procedure as well as uretero-ureteric anastomosis. The first two aforementioned procedures can be performed with use of local anaesthesia, sedation and analgesia in the radiology department but the remaining procedures require the use of general anaesthesia in the operating theatre and require the patients to be fit to undergo general anaesthesia. The management of ureteric obstruction depends upon the underlying pathology, type/cause of obstruction/stricture and also the patient’s preference and whether or not the patient is fit to under-go anaesthesia. Percutaneous nephrostomy (PCN) can provide temporary or permanent drainage of an obstructed urinary system. Patients with benign / malignant ureteric strictures are often treated with ureteric stenting via an antegrade, retrograde or combined approach. Sometimes retrograde ureteric stenting may be abandoned in theatre due to the inability of the surgeon to advance the guide-wire retrogradely beyond the point of obstruction; in such cases the only options left are insertion of a percutaneous nephrostomy plus or minus an attempt at insertion of the ureteric stent antegradely. Long-term urinary drainage in patients with ureteric obstruction due to benign or malignant strictures or due to other extra-ureteric causes of ureteric obstruction is often treated with ureteric stenting at the same time as insertion of a nephrostomy or at times as a follow-up procedure by inserting the ureteric stent antegradely through the
The insertion of a ureteric stent renders the patient tubeless and avoids the use of a nephrostomy bag which has to be changed regularly and also avoids nephrostomy tube associated problems thus provides better quality of life. It is also possible for a ureteric stent to be inserted in a patient who is temporarily not fit to undergo general anaesthesia. This paper reviews our experience in the use of antegrade ureteric stenting through a percutaneous nephrostomy between December 2007 and February 2010.

Materials and Methods

Patients
The clinical records, laboratory results and radiological records from the PACS system of all the thirty patients (19 male; 11 female) aged 31 to 90 (mean age 71.8) years who underwent insertion of antegrade ureteric stenting for obstruction of the upper urinary tract were reviewed. The following data were recorded for each patient: the indication for the procedure / cause of obstruction, the side and site of obstruction, the sex and age of the patient, the outcome (success/failure) of the procedure, complication(s) of the procedure and the management of the complication (see illustrations 1 and 2 for breakdown and age distribution).

Materials and Methods

Percutaneous nephrostomy

Techniques
Two different ultrasound-guided techniques: the Seldinger technique and the ‘one-step’ technique can be used for the insertion of percutaneous nephrostomy.

The patients are placed in prone or prone-oblique position for the procedure. Antibiotics are routinely administered to the patients prophylactically and with suspected pyonephrosis and renal stone disease, Analgesia is given (for example Pethidine intramuscularly or by Intravenous titration method) as well as an anti-emetic, Coagulation screen is also done and the procedure is carried out if the INR is 1.4 or below.

The selection criteria for each technique, depends upon the configuration of the renal collecting system. The ‘Seldinger technique’ is the method of choice for non-dilated collecting systems and cases with suspected pyonephrosis. This technique is performed with ultrasound scan and fluoroscopic guidance. The ‘one step’ (Bonanno) technique is used without fluoroscopic guidance for moderate-to-severe dilated collecting systems.

The ‘Seldinger’ technique entails ultrasound-guided puncture of the dilated renal collecting system with a 19-G sheathed needle, the insertion of a 0.0038’ heavy-duty J guide-wire and serial dilatation of the tract with 6 to 10 F dilators up in order to accommodate 8 to 12 F nephrostomy catheters with or without fluoroscopic guidance (Illustrations 3 to 5 [Figures 1a – 1c]); dilatations up to 5 of 6 F are suitable for stent insertion and dilatations up to 10 F are suitable for per-cutaneous nephrolithotomy. With fluoroscopic guidance Urografin contrast (about 5 mls) is routinely administered to confirm the position of the ‘19 G’ sheathed needle preceding the insertion of the guide-wire. Quite often either Locking-Loop Pigtail (LLP) catheters (Cook Inc, USA) or All Purpose Drainage (APD) catheters (Boston Scientific, USA) are used for nephrostomies.

The second technique called the ‘one stab technique’ or the ‘Bonanno technique’ involves the use of ultrasound-guided ‘one-stab’ technique using a 6 F Bonanno catheter (Beckton Dickinson UK Ltd). This 6 F pigtail Teflon catheter is mounted on a hollow 18 G needle that has a sharp bevelled edge. Under ultrasound guidance the needle tip is inserted into the guided pelvi-calyceal system, upon obtaining urine backflow the catheter is slid over the needle into the collecting system.

The nephrostomy catheter is secured to the skin by a catheter fixation disc covered with adhesive dressings and connected to a closed urinary drainage bag system.

Ureteric stenting

Technique – antegrade approach
Benign/Malignant strictures or extra-luminal ureteric obstructions may be negotiated using a combination of wires and catheters that a passed through a nephrostomy tract under fluoroscopic control to traverse the ureteric narrowing. Usually an angled tip hydrophilic tip Terumo wire is used to negotiate through the ureteric obstructing point and then gradually passed into the urinary bladder. Successful entry into the bladder is confirmed fluoroscopically. In most cases a 6 F torque-controlled manipulation catheter is used to cannulate the stricture or constricting area and bladder (illustration 6 to 13 [Figures 2a -2h] illustrate some of the steps in the procedure), nevertheless, in difficult cases a 4 or 5 F hydrophilic-coated Cobra catheter is used. The Terumo wire is then removed and replaced by a stiffer wire (e.g. Amplatz superstiff wire; Boston Scientific, USA) over which the ureteric stent is inserted. At times when a benign stricture is encountered it can be
treated by a balloon catheter dilatation or a PTFE-coated Van Andel dilator. Quite often in our unit a 6 to 8 F (Meditech, USA, Boston Scientific, USA) or 7 F (Optimed Technologies Inc, germany) ureteric stent is used. These stents are subsequently electively changed by the urologist retrogradely every 3 to 6 months to avoid stent encrustation.

Analysis
The indication(s) for the procedures were recorded as well as the total number(s) involved. The following details were also worked out and recorded:

- Total number of male and female patients as well as the total number of procedures undertaken
- Total number of procedures on each side
- Total number of successful procedures and failures including reason(s) for the failures
- Total number of complications and treatment of the complication(s).

Results

Thirty patients underwent insertion of antegrade ureteric stents. In all the 30 patients underwent a total of 40 antegrade ureteric stent insertions. One patient who previously had salvage cystectomy and bilateral ureterostomies following radical radiotherapy for carcinoma of urinary bladder involving the lower ureters developed stricture at the right uretero-ileoal conduit anastomosis he underwent insertion of right nephrostomy which was followed by antegrade ureteric stent insertion. The first attempt failed because the stricture was too tight to negotiate but a subsequent attempt two weeks later was successful. Since then he had two further antegrade stent insertion procedures which were successful (a total of 4 procedures in one patient). Another patient who previously had salvage cystectomy and ileal conduit construction for bladder tumour developed right sided hydronephrosis due to a 1.8 cm x 5 cm large tumour mass surrounding the upper right ureter obstructing the renal pelvis. It was possible to insert a nephrostomy tube however, it was impossible to negotiate the stricture with a guidewire. The patient was left with a nephrostomy to protect the right kidney whilst waiting for a definitive surgical treatment.

Another patient who previously had cystectomy and ileal conduit construction for bladder tumour developed right sided hydronephrosis due to a 1.8 cm x 5 cm large tumour mass surrounding the upper right ureter obstructing the renal pelvis. It was possible to insert a nephrostomy as a first step to the antegrade ureteric stenting. The procedure was abandoned. After this another excretory urography was done which revealed no evidence of obstruction but there was evidence of a diverticulum at the right vesico-ureteric junction and hence there was no need for any stenting procedure.

Another patient developed right hydronephrosis after she had hysterectomy and removal of an ovarian cyst. A right nephrostomy was inserted and a nephrostogram revealed a total occlusion of the ureter at the sacro-iliaec joint region and it was impossible to negotiate the stricture with a guidewire. The patient was left with a nephrostomy to protect the right kidney whilst waiting for a definitive surgical treatment.

As stated above a 74 years old patient who had previously colonic resection for adenocarcinoma of colon was noted to have obstruction of the right upper urinary tract on excretory urography. A 1 staged antegrade ureteric stenting was attempted at the end of a successful nephrostomy insertion. The nephrostogram revealed a tortuous ureter and multiple levels of obstruction due to retroperitoneal disease even though it was possible to negotiate these obstructions a major stricture at the level of the vesico-ureteric junction could not be negotiated and the patient was left with a nephrostomy. Five days later a 2nd attempt at antegrade stenting was done and this time the obstruction at the vesico-ureteric junction was negotiated to enable insertion of a 6Fr 26 cm ureteric stent. Ultrasound scan and CT scan revealed evidence of liver metastasis and abdominal / retroperitoneal lymphadenopathy.

As stated above a 74 years old patient who previously had salvage cystectomy and bilateral ureterostomies subsequently developed stricture at the uretero-cutaneous junction. Insertion of right nephrostomy was straight forward but it was not possible to negotiate the stricture at first attempt and the patient was left with a right nephrostomy. Two weeks later a further attempt at antegrade stenting
was possible and the stricture was negotiated. The patient has had two further antegrade ureteric stenting procedures.

- All the remaining 35 antegrade ureteric stenting procedures (87.5%) were successful without the need to abandon any of the procedures.
- Twenty seven out of 30 patients (90%) had successful insertion of antegrade ureteric stent.
- All together 37 out of the 40 antegrade stenting procedures (92.5%) were successful after a maximum of two attempts.

With regard to complications there were no immediate complications in that no patient developed any sepsis or any significant bleeding. Nevertheless, one patient developed obstruction of the ureteric stent 9 days later with further hydronephrosis after initial resolution of the previous hydronephrosis. This patient required another insertion of a nephrostomy which yielded some pus and thus confirmed that the stent was blocked by pus. The radiologists commented that in each case that the procedures were uneventful and the nursing records have not documented any case of severe post procedure pain.

Some of the causes of the ureteric obstructions noted were as follows (see Illustration 1 table 1):

- Retroperitoneal fibrosis: 3- bilateral obstructions;
- Pelvi-ureteric junction obstruction: 2 (Left); 1 (Right)
- Carcinoma of prostate: 1 (Right – single functioning kidney)
- Bladder tumour: 1 (Right); 1 (left);
- Ovarian tumour: 1 (Right obstruction);
- Uterine tumour (Carcinoma of uterus): 1 (Right)
- Endometriosis / ovarian mass: 1 bilateral obstruction;
- Metastasis from bowel cancer: 1 (Right);
- Renal pelvis stone (PUJ): 1 (Right);
- Tumour at R Pelvi-ureteric junction 1 (Right);
- Tumour in lower pole of kidney: 1 left;
- Upper ureteric stricture: 1 (Left);
- Uretero-ileal conduit junction obstruction 1 (Right);
- Retroperitoneal tumour encasing aorta: 1 (bilateral obstruction);
- Complete ureteric obstruction following hysterectomy and ovarian cyst excision: 1 (Right);
- Stricture of ureter middle 1/3 of ureter
- Obstruction of lower end of ureterostomy by stricture at cutaneous level 1
- Diverticulum at vesico-ureteric junction: 1 (Right);
- High grade B Cell Non Hodkgins Lymphoma / stricture lower ureter: 1 (Right);
- Pelvic mass /renal failure: 1 (left);
- Distal ureteric stricture/renal failure at vesico-ureteric junction: 1 (Left);
- Distal ureteric stricture: 1 (bilateral)

The age distribution

The age distribution of the patients is outlined as follows: Age less than 30 nil, 30 to <40 years 1, 40 to <50 years 1, >50 to <60years 2, 60 to <70 years 6; 70 to <80 years 10, 80 to <90 years 9, 90 years and above 1 patient (Illustration 2 [see table 2]). Age did not affect the outcome of the antegrade stenting procedures. Patients in the various age groups tolerated the stenting procedures well and there was no evidence of any peculiar complication related to any age group.

Sex distribution

Nineteen male patients and 11 female underwent the antegrade stenting procedures. There was no peculiar pattern of complications pertaining to either the male or female patients. All the patients tolerated the procedure well

One staged or two staged procedures

Even though most of the antegrade stenting procedures were carried out as 2 staged procedures; the first stage was the insertion of the nephrostomy and the second stage which is the antegrade ureteric stenting was carried out on another day as a separate procedure. The one staged procedure involved insertion of the nephrostomy followed by the antegrade stenting procedure at the same sitting at the end of insertion of the nephrostomy. 35 of the procedures were done as two staged procedures and five were performed as one staged procedure. Whether or not the procedure was one staged or 2 staged did not affect the outcome of the procedure. However, all patients with renal failure, had nephrostomy as the primary procedure and the 2nd stage of the procedure (the stenting), was carried out after the renal function had improved.

Management of Complications

There was only one patient who developed obstruction of his antegrade stent by pus and this was treated by insertion of nephrostomy which ensured all the pus was drained and the patient’s infection quickly settled. All the patients who required definitive treatment subsequently underwent the appropriate subsequent treatment after they had recovered from their renal failure (for example trans urethral resection of bladder tumours). Those patients whose primary pathology precluded definitive curative treatment all were scheduled to have regular change of the ureteric
stents by the retrograde method at periodic intervals.

Discussion

Percutaneous nephrostomy was first described by Goodwin and associates in 1955 and is an important technique for providing temporary or permanent/long-term drainage of an obstructed upper urinary tract or for establishing diversion of urine flow.

Complications associated with antegrade ureteric stenting include complications associated with insertion of nephrostomy as well as complications associated with manipulation of guide wire and stent in the ureter (the antegrade stenting procedure). Usually PCN is a relatively safe procedure when performed by skilled and well trained interventional radiologists. However, complications have been reported following nephrostomy insertions as follows:

- Major complications are reported to occur in 4-8% of cases and these include: significant bleeding that requires blood transfusion, septicemia and inadvertent puncturing of the pleura or viscera such as liver, colon and spleen.

- Minor complications occur in 3 to 15% of cases and these include: retroperitoneal urine extravasation and significant macroscopic haematuria causing clot colic and/or catheter blockage necessitating further investigations.

The most common reported early complication associated with antegrade ureteric stenting is septicemia which occurs in up to 60% of patients. Other associated complications include: failure to stent; stent blockage; stent encrustation.

Hausegger and Portugaller reported their experience regarding percutaneous nephrostomy and antegrade ureteral stenting as follows:

- The majority of cases of PCN were performed to relieve urinary obstruction, which was of benign or malignant nature and another indication was for urinary fistulas.
- PCN was performed under ultrasound/or fluoroscopic guidance with a success rate of more than 90%. The complication rate was approximately 10% for major and minor complications together and 4 to 5% for major complications only.
- Percutaneous antegrade double-J stent insertion was usually performed if retrograde ureteric stenting had not been successful. However, especially in malignant obstructions, the success rate for antegrade stenting was higher than for retrograde transvesical double-J stent insertion. They commented that in the case of severe infection and bleeding after PCN JJ-stent insertion may be contraindicated as long as there is no sufficient concomitant drainage via PCN.
- They recommended that lower urinary tract dysfunction should be excluded before stent placement and they also found that in their series the complication rate was 2 to 4%.

Antegrade insertion of ureteric stent is conventionally performed as a two stage procedure for various reasons but more recently ‘a one stage approach’ has been adopted. Watson and Patel evaluated the success rate and cost efficiency of primary antegrade ureteric stenting (antegrade ureteric stent insertion as a single procedure without a preliminary drainage). A policy of primary stenting was tested in 38 patients (50 ureters) with obstructive hydronephrosis, of acute or chronic onset and of benign or malignant origin. Patients with suspected pyonephrosis were excluded. Patients who were successfully stented (group 1) were compared to a group who were stented as a traditional two-stage procedure (group 2). The end point assessments in this evaluation were screening time, equipment used, procedure-related costs, bed occupancy and technical and clinical success rate. Using these cost and outcome measures a cost-efficiency analysis was performed comparing the two strategies. With regard to the results 40 out of 50 (80%) ureters were considered primary stent successes. The average procedure-related bed occupancy was 2 days (range 1 to 2 days). Simple equipment alone was successful in 16 cases, Van (forty-six pounds (£46) per case). The mean screening time was similar for the two groups (13.5 minutes vs Andel dilatation catheters and peel-away sheaths were frequently used (23 ureters). Expensive equipment was rarely necessary (four cases) and average extra equipment cost was small (15.3 min, P > or = 0.05). There was a minimum saving of eight hundred pounds (£800) per successful primary stent. The cost-effectiveness of a primary antegrade stenting strategy was one thousand two hundred and twenty nine pounds (£1229) vs two thousand and ninety three pounds (£2093) for secondary stenting. Watson and Patel concluded that in carefully selected patients, the majority of obstructed ureters can be primarily stented using simple equipment; the reduced hospital stay and overall success rate significantly improves the cost competitiveness of antegrade ureteric stenting.

Chitale and associates retrospectively retrieved data from case notes and radiology data base for patients who underwent one stage and two stage antegrade ureteric stenting for decompression of obstructed upper urinary tract. They followed this up with telephone survey of regional centres about the
prevalent local practice for antegrade stenting. Outcome measures like hospital stay, procedural costs, requirement of analgesia and antimicrobials and complication rates were compared for the two approaches. With regard to the results, a one-stage approach was found to be suitable in most cases with many advantages over the two stage approach with comparable or better outcomes at lower costs. Some of the limitations of the study include: retrospective data collection, more than one radiologist performing the stenting procedures, and non availability of interventional radiologist falsely raising the incidence of two stage procedures. Chitale and associates concluded that in the absence of any clinical contra indications and subject to availability of an interventional radiologist support, one stage antegrade ureteric stenting should be the preferred approach to ureteric stenting in comparison with a two stage approach in the management of upper urinary tract obstruction.

Conclusions

Our experience over a period of 26 months between December 20007 and February 2010 would confirm that antegrade ureteric stenting is a safe procedure with minimal complications. The procedure is usually done without the need for general anaesthesia and is well tolerated by adult patients of all age groups and sex. Every radiology unit should have a trained interventional radiologist who is capable of performing antegrade ureteric stenting.

References


Author details

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Illustrations

Illustration 1

Illustration

Illustration 1: Table 1 Examples of causes of obstruction and sites of obstruction found in the study

<table>
<thead>
<tr>
<th>Diagnosis/Cause of obstruction</th>
<th>Number of patients</th>
<th>Number of patients</th>
<th>Number of patients</th>
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<td></td>
<td>Bilateral</td>
<td>Right</td>
<td>Left</td>
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<tr>
<td>Retroperitoneal fibrosis</td>
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<td>Pelvi-ureteric Junction obstruction</td>
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<td>2</td>
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<tr>
<td>Carcinoma of prostate</td>
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<td></td>
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<tr>
<td>Bladder tumour</td>
<td>1</td>
<td>1</td>
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<tr>
<td>Metastasis from bowel cancer</td>
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<td>Renal pelvis stone (PUJ)</td>
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<td>Tumour at pelvi-ureteric junction</td>
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**Illustration 2: Table 2  Age distribution of patients**

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<td>9</td>
<td>1</td>
<td>30</td>
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</tbody>
</table>
Illustration 3: Figure 1a: Right lower calyx puncture with a Chiba needle

Illustration 4: Figure 1b: Amplatz guide-wire is advanced into right renal pelvis
Illustration 5: Figure 1c: Nephrostomy tube size 6 Fr in situ
Illustration 6: Figure 2a: Left Nephrostomy tube in situ
Illustration 7: Figure 2b: Terumo Guide-wire has been inserted into left lower pole calyx, renal pelvis and left ureter (guide wire can be seen in upper ureter; lower ureter not shown in this picture)

Illustration 8: Figure 2c - Terumo guide-wire has been inserted in to the left ureter and down to the bladder (another view of figure 2b)
Illustration 9: Figure 2d - Left Ante-grade ureteric stent has been inserted in to the urinary bladder (lower two thirds of stent in picture)
Illustration 10: Figure 2e - Left Ante-grade ureteric stent has been inserted into the urinary bladder over a stiff guide-wire (see arrow)
Illustration 11: Figure 2f- Guide-wire has been inserted into right lower pole calyx and into upper right ureter

Illustration 12: Figure 2g - Right ante-grade ureteric stent has been inserted over a stiff guide-wire
Illustration 13: Figure 2h - Bilateral ante-grade ureteric stents in situ
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