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# Percutaneous Ureteric Stricture Dilation(PcUSD)

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**ABSTRACT: Ureteric stricture dilation as an interventional uroradiological technique was initiated locally in March 1991. In ureteric dilation two approaches are feasible. The retrograde cystoscopic route is undertaken by a uroradiology team in theatre, and the renal antegrade percutaneous route is undertaken in the radiology interventional suite. This study reviewed the results of percutaneous ureteric stricture dilation undertaken over the last five years. Eighteen dilations in 16 patients (10 males : 6 females) were analysed. There was an overall success rate of 61%. We found the procedure to be safe and effective with minimal complications. No mortality resulted from the procedure. The indications for its use are fully discussed.**

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## Introduction

For many years open surgery was the sole treatment for the management of ureteric strictures. In 1955, Lane[1] and later in 1970, O'Flynn[2] utilized catheters (5 French size) and bougies for dilation of tuberculous strictures with high success rates (80% and 82% respectively). Others have had similar results[3-6]. Use was made of high pressure balloon catheters of the Gruntzig type by Reimer and Oswalt in 1981[7]. Ureteric stricture dilation (USD) was initiated locally in March 1991 via the percutaneous renal antegrade route in the radiology interventional suite, and as a surgical uroradiology technique via the retrograde cystoscopic route by a uroradiology team in theatre. Surgical revision is technically more difficult and this has led to other methods of treatment such as ureteric stricture dilation with balloon catheters. The aim of this series was to follow up all cases of ureteric stricture dilated percutaneously over the last five years to assess the long-term results of the procedure.

## Methods

Since March 1991, 18 Percutaneous Ureteric Stricture Dilations were undertaken, in 16 adult patients, with a male to female ratio of 10:6. The follow up ranged from 11 to 61 months with a mean of 36 months +/- 25 months (Table 1). The mean age of the patients was 46.5 +/- 27.5 years (range 19-74 years). All these procedures were carried out under local anaesthesia with pre-operative analgesia. After the procedure, the ureter was splinted with a stent and/or percutaneous nephrostomy. The stricture distribution was almost equal on both sides (9 right :8 left). There were nine strictures at the pelvi-ureteric junction, one in the upper ureteric region, three in the mid-ureter and five in the lower ureter. The aetiologies of the strictures are depicted in Table 2.

Antibiotic cover was started from the morning before the procedure. Premedication with analgesia and sedation was usually given intravenously in the interventional suite. The technique was two-staged involving antegrade pyelography, followed by pelvi-calyceal access, stricture cannulation and dilation. All procedures were carried out under local anaesthesia via an upper or middle calyx. A high pressure balloon catheter (Gruntzig-type ranging from 4 to 10 mm diameter) was utilised for all dilations. The larger sized balloons were utilised for pelvi-ureteric junction dilation and dilation of anastomotic strictures. The procedure was terminated with the introduction of a urinary stent (F8), which was left in situ for 6 to 8 weeks.

The outcome was assessed clinically and radiologically by US scan (1 month), intravenous urography (2 months), or isotope scan with Frusemide challenge (3 months). The outcome was subdivided into four categories: primary failure, secondary failure, re-stenosis and success. Primary and secondary failure were interpreted as the return of hydronephrosis occurring within, or after, one month respectively. Re-stenosis occurred when follow up US scan at 1 month showed mild to moderate or worsening hydronephrosis and was an indication for more frequent follow-up, re-dilation or alternative treatment. A successful outcome occurred when the US scan was normal on follow-up, but the decisive examination for assessment of success was isotope renography. Further follow-up was carried out at six months and then at yearly intervals. The imaging for the diagnosis, technique and aftercare of percutaneous ureteric stricture dilation are depicted in Figures 1-4.

## Results

The period of follow up ranged from eleven to sixty-one months with a mean of thirty six months, Table1. The overall success rate of PcUSD was 61%. There were eleven successes, four re-stenoses, two primary failures

Table 1 - Summary of the data of the technique of percutaneous uteteric stricture dilation.

| Dilation Number | SITE OF OBSTRUCTION | CAUSE OF OBSTRUCTION | Diameter in mm Dilation | Length in cms. | AGE in months | Ureteric course | OUTCOME | Follow up in months |
|---|---|---|---|---|---|---|---|---|
| 1 | Mid-ureter | Radiotherapy for Ca cx | NA | >2 | <3 | Tortuous | 1ary Failure | 52 |
| 2 | PUJ | unknown | 8 | <1 | <3 | Straight | positive | 11 |
| 3 | PUJ | unknown | 5 | <1 | <3 | Straight | positive | 12 |
| 4 | lower ureter | unknown | 5 | <1 | <3 | Straight | positive | 12 |
| 5 | PUJ | unknown | 10 | <1 | <3 | Straight | positive | 18 |
| 6 | PUJ | congenital | 9 | <1 | >12 | Straight | positive | 58 |
| 7 | PUJ | unknown | 10 | <1 | >12 | Straight | positive | 60 |
| 8 | Mid-ureter | RetroPeritoneal Fibrosis | 8 | >2 | <3 | Straight | positive | 12 |
| 9 | Mid-ureter | RetroPeritoneal Fibrosis | 8 | >2 | <3 | Straight | Restenosis | 12 |
| 10 | lower ureter | Re-implantation of ureter | NA | >2 | <3 | Tortuous | 1ary Failure | 59 |
| 11 | PUJ | unknown | 10 | <1 | <3 | Straight | positive | 10 |
| 12 | lower ureter | calculus | 6 | <1 | <3 | Straight | positive | 29 |
| 13 | PUJ | congenital | 9 | <1 | >12 | Straight | positive | 56 |
| 14 | Upper ureter | calculus | 10 | 1-2 | 3-12 | Straight | Restenosis | 22 |
| 15 | PUJ | congenital | 8 | <1 | >12 | Tortuous | 2ary Failure | 61 |
| 16 | lower ureter | Re-implantation of ureter | 4 | >2 | <3 | Tortuous | Restenosis | 37 |
| 17 | PUJ | unknown | 8 | <1 | 3-12 | Straight | Restenosis | 53 |
| 18 | lower ureter | Re-implantation of ureter | 6 | <1 | >12 | Straight | positive | 12 |

Table 2 - The number of successes and the percentage success rate in relation to the aetiology of the ureteric stricture in this series.

| CAUSE of STRICTURE | Number | Successes | %Success |
|---|---|---|---|
| Congenital | 3 | 2 | 67% |
| Calculi | 2 | 1 | 50% |
| Reimplantation of Ureter | 3 | 1 | 33% |
| RPF | 2 | 1 | 50% |
| Unknown | 7 | 6 | 86% |
| Radiotherapy with Ca | 1 | 0 | 0% |
| Procedures | 18 | 11 | 61% |

Table 3 - The relationship of the length of the ureteric stricture in relation to the outcome

| | SUCCESS | FAILURE |
|---|---|---|
| Stricture less than 1cm. *Success Rate = 82%* | 9 | 2 |
| Stricture 1 - 2 cms. | 0 | 1 |
| Stricture greater than 2cms. *Failure Rate = 67%* | 2 | 4 |

and one secondary failure. The success group included six dilations for strictures of unknown cause at the PUJ, two for congenital strictures at the PUJ, one dilation for stricture secondary to calculi (LU), one for retroperitoneal fibrosis (RPF) and one after re-implantation of a ureter (LU). In the group of the failures, there were two dilations for strictures following ureteric re-implantation, one dilation for congenital PUJ stenosis, one for stricture secondary to calculi, one for RPF and one for stricture due to carcinoma treated by radiotherapy. Table 2 shows the number of successes and lists the percentage success rate in each category.

The success rate was high for PUJ stenosis (seven out of nine cases) and for stenosis of the lower ureter (three out of five cases), while only one of three cases of stenosis in the mid-ureter was successfully dilated. The only case with stenosis of the upper ureter failed to respond to dilation.

The success of the procedure was also related to the length of the stricture. Nine dilations of strictures less than one cm were successful, two unsuccessful. Only two out of six strictures two or more cm long were successful (Table 3).

When the ureteric stricture had a straight course, there were eleven successes out of fourteen cases. All four cases with a stricture which had a tortuous course failed to respond to treatment. Thus both the length and the ureteric course of the stricture were related to outcome of the procedure (Table 4).

There were only three complications of PcUSD; one patient developed a urinary tract infection with post-operative pyrexia on the following day, which resolved with antibiotics. There were two ureteric perforations at

Table 4 - The outcome in relation to the ureteric course of the stricture.

| URETERIC COURSE | SUCCESS | FAILURE |
|---|---|---|
| Ureteric course straight<br>*Success Rate = 79%* | 11 | 3 |
| Ureteric course tortuous<br>*Failure Rate = 100%* | 0 | 4 |

pelvi-ureteric region which resulted in no sequelae. Extravasation of urine occurred temporarily in these cases but no urinoma developed, presumably prevented by ureteric stenting. No haemorrhage which required transfusion developed; however in two patients pelvi-calyceal clots were noted, which resulted in post-operative pain (clot colic). If the patient was asymptomatic, discharge was allowed on the day following the procedure. No mortality resulted from the procedure.

## Discussion

When one analyses the success rates from the literature (1-16) on ureteric stricture dilation, one finds high success rates for strictures secondary to ureterolithotomy (100%), strictures from idiopathic causes (86%), post-inflammatory strictures (82%) and congenital strictures (80%) (Table 5).

Within the post-operative group other strictures that

Table 5 - The number of successes and percentage success rate reported in the literature.

| Cause of the stricture | Number | Successes | %Success |
|---|---|---|---|
| Inflammatory | 91 | 75 | 82% |
| Post-operative | 133 | 70 | 53% |
| Uretero-enteric | 71 | 26 | 37% |
| Ureteroneocystostomy | 4 | 1 | 25% |
| Post-pyeloplasty | 10 | 5 | 50% |
| Pyeloureteric surgery | 11 | 8 | 73% |
| Surgery/Gynaecology ligation | 17 | 11 | 65% |
| Post-ureteroscopy | 7 | 4 | 57% |
| Ureterolithotomy | 3 | 3 | 100% |
| Congenital | 10 | 8 | 80% |
| Calculi | 2 | 1 | 50% |
| Idiopathic | 7 | 6 | 86% |
| Carcinoma | 2 | 0 | 0% |
| Retroperitoneal fobrosis | 2 | 1 | 50% |
| Aortic aneurysm | 1 | 0 | 0% |
| TOTAL | 248 | 161 | 65% |

*Renal transplants were excluded from this assessment.*

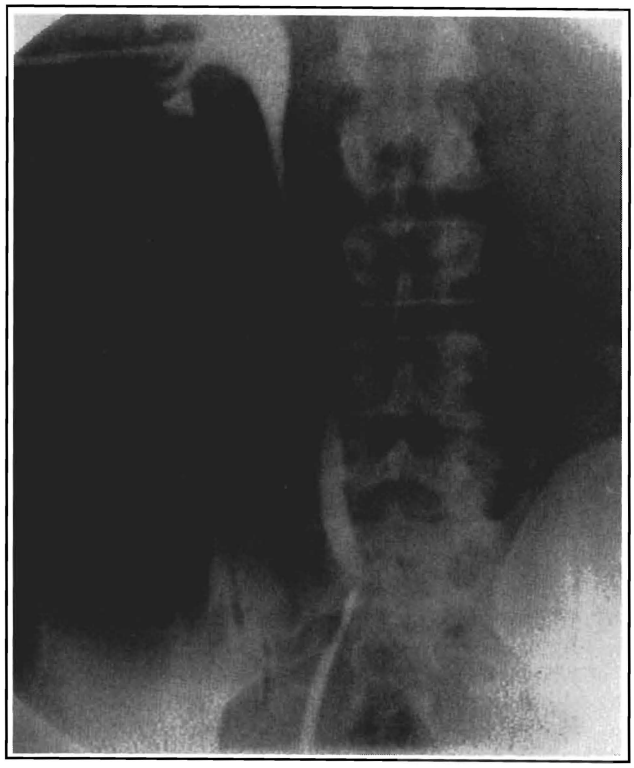

Fig 1 - Antegrade Pyelography demonstrates a middle/lower ureteric segment stenosis, which had resulted in hydronephrosis.

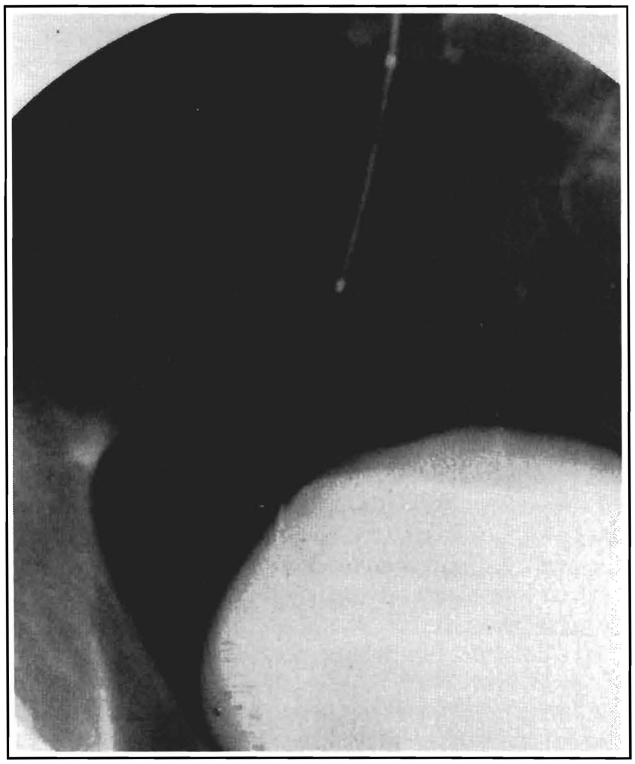

Fig 2 - PcUSD Technique. The guide wire has been passed through the stenosis in the ureter. The balloon catheter has been now positioned over the guide wire. The two densely opaque markers guide the position of the balloon.

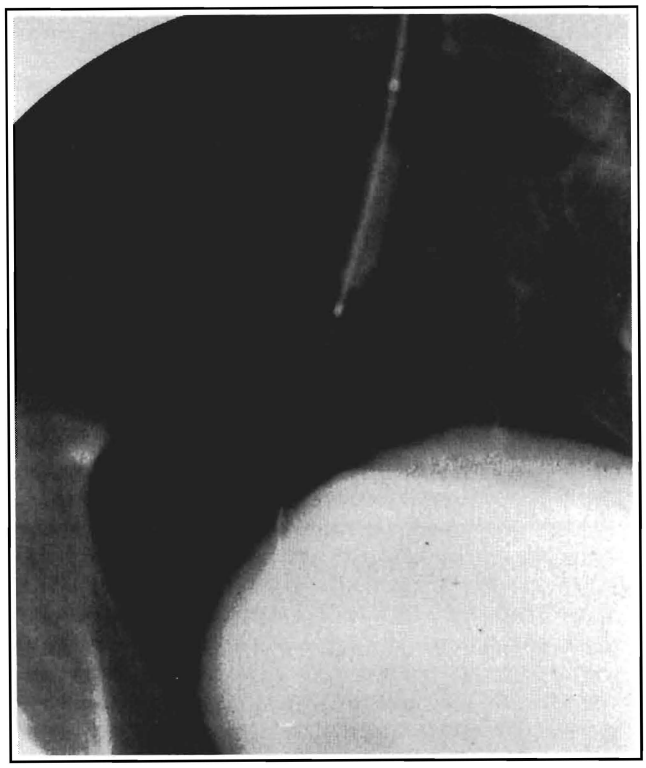

Fig 3 - PcUSD Technique. The balloon is now fully inflated with dilute contrast medium. The pressure of inflation may range from 4-12 atmospheres.

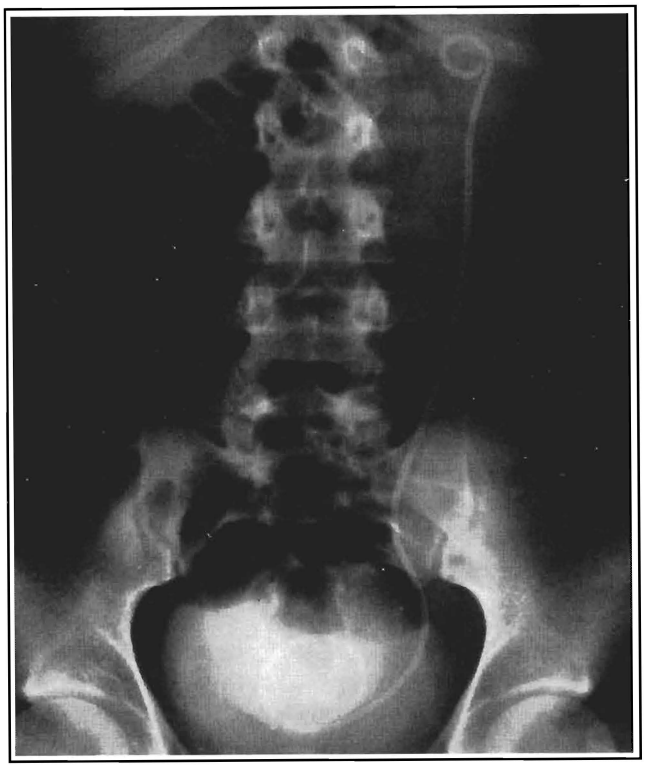

Fig 4 - After ureteric stricture dilation, a double pigtail (plastic) stent is usually inserted to by-pass the ureteric stenosis. It is placed from the renal pelvis to the urinary bladder. This image demonstrates a satisfactorily placed ureteric stent.

respond well to dilation are those secondary to pyeloureteric surgery (73%), surgical or gynaecological ligation of ureter (65%) and post-ureteroscopic strictures (57%). Moderate success rates are present with dilating post-operative strictures (53%), retroperitoneal fibrosis (50%), post-pyeloplasty (50%) and with strictures arising from calculi (50%). In general, the poor results have occurred with dilating strictures due to tumours and post-operative strictures associated with ureteroneocystostomy (25%) and ureteroenterostomy (37%). Our results for dilating strictures following ureteroneocystostomy were similarly poor (one success from three). The overall success rate in the accumulated literature is 65%. Our follow up period had a mean of about 36 months and our overall success rate was 61%. Inflammatory strictures are now rarer than in the past and a shorter follow up may be responsible for a higher success rate in the accumulated literature. Previous literature stipulates that success with ureteric stricture dilation is dependent on location[8], cause[5,8,9], chronicity[5,8-10] and on the length[11] of strictures (seven out of nine). Success is not dependent on the method or duration of the dilation[5]. Analysis of the sites of stricture in our series has demonstrated a higher success rate with dilation of strictures at the PUJ and lower ureter (three out of five) and a low success rate in the middle ureter (one out of three) and upper ureter (one out of one failure). Thus site of the stricture does influence the outcome from dilation, however this maybe related to the cause of the stricture. The chronicity of the stricture or the diameter of balloon used for the dilation bore no relationship to our results. The main risk factors for the intervention were infection, haemorrhage and perforation. Perforation on dilation was uncommon and occurred only at pelviureteric junction dilation with 10mm balloon diameter catheters but this resulted in no sequelae. In fact one has to disrupt the ureter to obtain a satisfactory result in this location.

In conclusion, Percutaneous Ureteric Stricture Dilation is a safe and appreciably successful technique. A short stricture length and a non-tortuous stricture course may be indicative of a high success rate. The numbers of the individual causes of stricture in this review are small, but the results are in keeping with larger series. From our results it can be recommended in idiopathic strictures, congenital strictures, strictures secondary to calculi, post-inflammatory stricture and some post-operative stricture. This technique should be avoided in retroperitoneal fibrosis and carcinoma.

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