

# Development of Ureteroscopic Laser Endopyelotomy for Treatment of Pelvi-Ureteric Junction Obstruction at University of Benin Teaching Hospital: Preliminary Report and Overview of Literature.

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## ABSTRACT

**Objective:** Laser endopyelotomy approach to management of pelvi-ureteric junction obstruction, PUJO was recently introduced to our hospital as minimally invasive endoscopic option for suitable patients presenting with pelvi-ureteric junction obstruction.

**Case Description:** The first patient, a 40 years old female presented with chronic left flank pain. Renal tract ultrasound scan, CT Urogram confirmed left PUJO with satisfactory residual renal function. She was treated by laser endopyelotomy and stent insertion. The second patient, 18 years old female presented with chronic bilateral flank pain. Renal ultrasonography, intravenous urogram and renogram confirmed bilateral PUJO worse on right side. She had bilateral endopyelotomy and insertion of stents.

**Conclusion:** The patients preferred minimally invasive endoscopic approach to open pyeloplasty in management of PUJO. The procedures were uncomplicated and initial good outcomes achieved.

**Keywords:** PUJO, LASER, Endopyelotomy, Pyeloplasty

## INTRODUCTION

Pelvi-ureteric junction obstruction, PUJO is a cause of upper urinary tract obstruction in children and adults. Traditionally, the causes may be classified as congenital, acquired, intrinsic or extrinsic obstruction. The annual incidence was estimated at about 1 in 20,000 (Eden et al., 2007)

The congenital causes include mucosal folds, incomplete canalization and non-functional aperistaltic area in proximal ureter, while extrinsic causes may be aberrant crossing vessels, kidney

malrotation and abnormal insertion of ureter. Acquired causes of PUJO may be scarring from infection, inflammation from stones, previous instrumentation, and urothelial tumours.

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Historically it was managed by open pyeloplasty which remains the gold standard. Minimally invasive approaches have subsequently been introduced. Balloon dilatation and percutaneous or ureteroscopic endopyelotomy, EP using a cold knife laser were initially introduced (Park et al., 1998; Richstone et al., 2008; Keeley et al 1996; Williams et al 2007). Percutaneous antegrade endopyelotomy and retrograde ureteroscopic endopyelotomy with diathermy were introduced in 1983 and 1986 respectively (Inglis et al 1986; Wickham & Kellet, 1983). Laser endopyelotomy, LEP was introduced over the following decade and is now well established with good outcomes up to 3-5 years (Rassweiler et al., 2007; Wu et al 2011; Feng et al., 2015). The other approaches that have been introduced are laparoscopic and robotic pyeloplasty. While open, laparoscopic and robotic pyeloplasty have a success rate of greater than 90%, endopyelotomy success rate is variably less at 42-90% depending on approach (Khan et al 2014). In our institution, PUJO was only previously managed by open pyeloplasty. We have recently introduced the technique of laser endopyelotomy, LEP and present the initial three cases performed in two patients with overview of the literature.

## CASE REPORTS

### Patient A

A 40-year-old female referred from Kaduna presented with chronic left flank pain and recurrent urinary tract infection. Serum creatinine was normal, 0.8mg/dl. Renal tract ultrasound scan and CT Urogram revealed narrowing with impaired drainage at the left pelvi-ureteric junction and proximal pelvi-calyceal dilatation suggestive of PUJO. In addition, there was a solitary 9mm calculus in the lower pole of the left kidney, a likely complication of prolonged urinary stasis. She was offered options of endoscopic management by laser endopyelotomy and open pyeloplasty. She elected for the former. She had rigid cystoscopy, left retrograde ureteropyelogram, ureteroscopy, laser endopyelotomy and insertion of stent. The procedure and recovery were uneventful. Post-operative CT IVU revealed marked reduction in hydronephrosis, and serum creatinine remained normal. She achieved complete pain relief. Follow-up surveillance radioisotope diuretic renogram with Technetium-99m mercaptoacetyltriglycine, MAG3 and laser lithotripsy of the left renal calculus are pending.

### Patient B

She was 18-year-old female student resident in Benin City who presented with chronic bilateral

flank pain, recurrent urinary tract infection and raised creatinine, 1.6mg/dl. Renal ultrasonography and intravenous urogram, IVU revealed gross bilateral hydronephrosis with impaired drainage at PUJ, worse on right side with relatively thinner renal cortex. MAG3 diuretic renogram revealed impaired drainage with split renal function of right 39.5% and left 60.5%. With support of parents, she declined open pyeloplasty and was initially offered bilateral ureteral dilatation and insertion of stents. This relieved her pain. There was improvement of hydronephrosis in both kidneys by about 50% as shown by ultrasound. Renal function improved with serum creatinine dropping to 0.9mg/dl from 1.6mg/dl. Six months later she had cystoscopy, bilateral ureteroscopy, laser endopyelotomy and re-insertion of stents. The procedure and recovery were uneventful. She remains pain free though has experienced E. Coli urinary tract infection on two occasions requiring antibiotics. Surveillance MAG3 diuretic renogram studies is pending.

## STANDARD TECHNIQUE

Informed consent was obtained including explanation of intra-operative risks of bleeding and conversion to open pyeloplasty if uncontrollable. Short to moderate term risks of infection, stent-related symptoms and recurrence of stenosis was discussed. Under endotracheal tube general anaesthesia with muscle paralysis, the patient was placed in lithotomy position. Prophylactic antibiotics was administered. A preliminary cystoscopy was performed. Under fluoroscopy guidance, a retrograde ureteropyelogram was performed to confirm level, length of stenosis and degree of hydronephrosis and free drainage. Subsequently, a sensor safety wire was passed through the pelvi-ureteric junction, PUJ and coiled in the renal pelvis. Over a working guidewire, a flexible ureteroscope (Olympus Medical Systems URF-P7 flexible fibre ureterorenoscope) was passed up the ureter to just below the PUJ and confirmed with fluoroscopy. A 272 micron laser fiber was passed through the working channel of the ureteroscope. Using holmium:yttrium-aluminium-garnet, (Ho:YAG) 35Watt laser machine low power setting (energy 1.5Joules, frequency 10Hertz and Power 10 Watts) the PUJ was gradually incised under direct vision in the lateral position taking care to avoid any areas with pulsations. The muscle fibres of PUJ were incised in layers until fat was seen. On completion, retrograde study was performed to exclude extravasation of contrast. 8F double J ureteral stent was placed under fluoroscopic guidance. Post-operative routine nursing observations

including urine output was recorded. Extended antibiotic prophylaxis was given to the patients for 5 days. The patients were fit for discharge home in a satisfactory condition on the first post-operative day.

Supplementary Figures 1 – 4 are images to illustrate the key stages of the procedure as follows:



**Figure 1:** Guide-wire coiled within renal pelvis

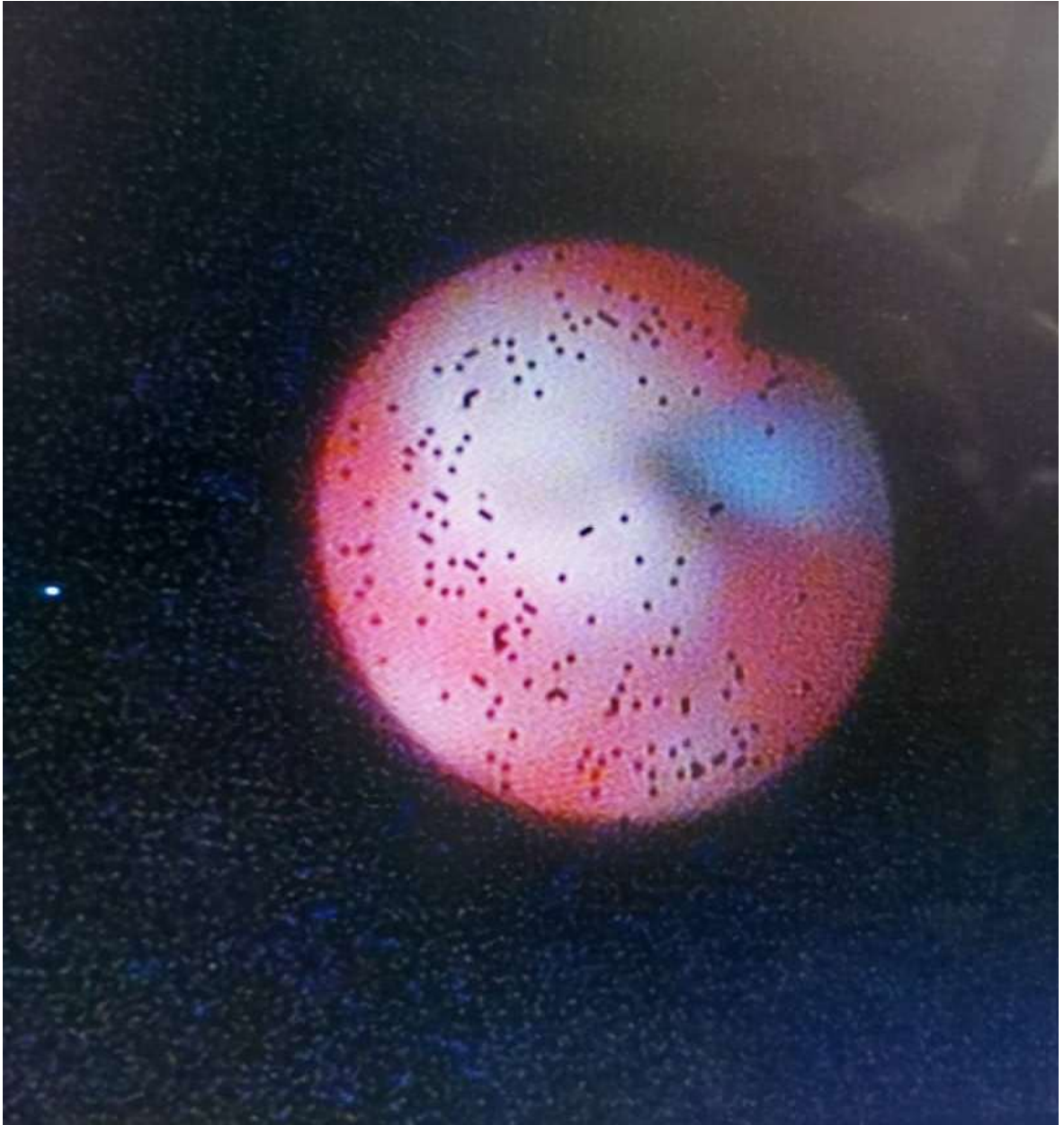


Figure 2: Laser fibre incising PUJ



**Figure 3:** Appearance of PUJ post incision





**Figure 4:** Upper end of stent within renal pelvis

#### **DISCUSSION**

Minimally invasive approaches have become the standard of initial management of patients with congenital, acquired and recurrent PUJO causing mild-to-moderate and severe hydronephrosis (Strother & Mucksavage, 2016). Open pyeloplasty is well established in our institution. Endoscopic, laparoscopic and robotic approaches are not available. However, with the recent acquisition of Holmium laser machine by the hospital, it became possible to introduce LEP as an alternative endoscopic option to patients with PUJO considering surgical treatment. It gives advantages of short hospital stay and convalescence which

patients find attractive (Khan et al 2014). The two female patients reported in this study declined open pyeloplasty. Matin SF et al reported minimal complications of less than 5%, improvement in symptoms of 65.4% and 73.1% radiographic success rate from Holmium LEP with overall outcomes better in patients with primary PUJO (Matin et al., 2003) Patients with gross or severe hydronephrosis have worse outcomes than those with mild-moderate hydronephrosis (Renner et al., 1998). Ureteral stents inserted during the LEP were usually removed within about six weeks of the procedure. The patients presented in this study had gross hydronephrosis. To mitigate the risk of early

failure in such cases (Renner et al., 1998), it is planned to leave stents in place for up to 9-12 months following which further stenting or removal will be decided based on assessment of symptoms and drainage from diuretic MAG<sub>3</sub> renogram and retrograde ureteropyelographic studies. In a systematic review of the literature on LEP published up till March 2016, Elmussareh et al (2017) concluded that the evidence for LEP as treatment for PUJO is mostly based on small case series and cohort studies; therefore, randomized controlled studies are required to properly compare LEP with pyeloplasty (Renner et al., 1998).

### CONCLUSION

Laser endopyelotomy has been successfully introduced in our institution as an option for management of PUJO. A prospective database to record long-term outcomes has been established. The results will be published after enough patients have been treated and follow-up data up to three years is available.

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