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# DIFFERENCES IN OUTCOMES OF PELVI-URETERIC JUNCTION OBSTRUCTION AMONG PATIENTS DETECTED INCIDENTALLY VERSUS THOSE PRESENTING SYMPTOMATICALLY: A RETROSPECTIVE STUDY

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## ABSTRACT

**Background:** Pelvi-ureteric junction (PUJ) obstruction often leads to progressive renal functional loss. As many cases are now detected incidentally on imaging performed for unrelated indications, it remains unclear whether early surgical intervention in these patients improves long-term outcomes compared with those who present with symptoms.
**Methods:** In this Retrospective study, records of 41 adults who had undergone pyeloplasty for confirmed PUJ obstruction (13 detected incidentally, 28 detected symptomatically) were reviewed, with six months of postoperative data assessed using ultrasound, diuretic renography, Visual Analogue Scale (VAS) pain scores, and the 36-item Short Form (SF-36) quality-of-life instrument. Pre-operative, intra-operative, and 6-month outcomes were reviewed and compared between groups.
**Results:** Symptomatic patients had significantly worse baseline parameters than incidentally diagnosed patients, including a greater antero-posterior diameter (APD) of the renal pelvis (45.1 vs 28.4 mm), lower differential renal function (DRF; 33.6% vs 42.1%), and longer T½ on renography (58.3 vs 34.6 minutes; all $p<0.001$). Radiological success at six months was comparable between groups (92.3% vs 78.6%; $p=0.25$). However, symptomatic patients required longer operative time, experienced greater blood loss, and had a longer hospital stay.
**Conclusions:** Incidentally detected PUJ obstruction is associated with better baseline renal function and excellent outcomes after early pyeloplasty. These findings support early surgical intervention in incidentally detected cases, before symptoms and functional deterioration develop, to preserve renal function.

**KEYWORDS:** pelvi-ureteric junction obstruction; pyeloplasty; incidental hydronephrosis; diuretic renogram; renal function

## 1. INTRODUCTION

Pelvi-ureteric junction (PUJ) obstruction, also termed ureteropelvic junction (UPJ) obstruction, causes an impaired urine flow from the renal pelvis into the ureter due to an abnormality (structural or functional) at the pelvi-ureteric junction. This stasis leads to the dilatation of the renal parenchyma and increased pressure in the renal pelvis. Ultimately, this causes an irreversible nephron loss. It is the most common cause of hydronephrosis identified in both paediatric and adult populations, with a reported incidence of approximately 1 in 1,500 to 1 in 2,000 live births. Also, adult-onset or adult-diagnosed disease is increasingly recognised as a result of imaging done for an unrelated indication.
A case of PUJ obstruction classically presents with frank loin pain, typically exacerbated by high fluid intake. It can also lead to recurrent urinary tract infections, haematuria, a palpable flank mass, or renal calculi. The advent of computed tomography and magnetic resonance imaging has led to an increased incidence of diagnosis of many diseases, including PUJ obstruction. These incidentally detected cases may be encountered during imaging performed for unrelated conditions, such as appendicitis workup, trauma assessment, or general health screening, and represent a clinically distinct phenotype. The difference between incidental and symptomatic detection has major implications for the operative management, pre-operative counselling of patients, and their surgical outcomes. Symptomatic patients usually experience a longer delay to diagnosis, more advanced hydronephrosis and greater functional impairment of the affected kidney, and a greater burden of concurrent pathology (eg, concomitant stone disease). In contrast, incidentally diagnosed patients are appropriate for earlier intervention at a time of preserved renal parenchymal function, possibly allowing better post-operative recovery and functional outcomes. Latest surgical treatments of pyeloplasty are considered gold-standard and can be performed by open, laparoscopy or robotic technique which achieve Anderson-Hynes dismembered technique with same success rate 85–95% in literature [1]. Pyeloplasty traditionally has been a success based on radiological criteria

(target criteria being reduction in antero-posterior diameter [APD] of the renal pelvis and normalisation of T½ on diuretic renography) and functional criteria (improvement or stabilisation of differential renal function [DRF]), along with symptomatic amelioration. Relatively few prospective studies have thoroughly examined the outcomes between incidentally found and symptomatically presenting adult PUJ blockage, despite the clinical significance of this distinction. By comparing pre-operative parameters, intra-operative findings, immediate post-operative recovery, and 6-month functional and radiological outcomes between these two groups, the current study aims to close this gap.

### 1.1 Operational Definitions

| Term | Definition |
|---|---|
| Incidental detection | Discovery of hydronephrosis or PUJ obstruction on imaging performed for an unrelated indication, in a patient who is entirely asymptomatic from a urological standpoint at the time of imaging and who has no prior documented urological complaint attributable to the affected kidney. |
| Clinical (symptomatic) diagnosis | Diagnosis of PUJ obstruction is established following clinical evaluation prompted by one or more urological symptoms directly attributable to the obstructed collecting system, including but not limited to ipsilateral flank or loin pain, nausea or vomiting associated with ipsilateral renal colic, recurrent febrile urinary tract infections, haematuria, or a palpable abdominal mass, with confirmation by imaging and functional studies. |

## 2. MATERIALS AND METHODS

### 2.1 Study Design and Setting

This was a retrospective, observational study conducted at a tertiary-care academic urology unit between January 2024 and June 2025. All patients with confirmed PUJ obstruction who had undergone pyeloplasty were retrospectively reviewed and analysed, with a minimum of six months postoperatively. The study was conducted in accordance with the Declaration of Helsinki and received approval from the Institutional Ethics Committee.

### 2.2 Inclusion and Exclusion Criteria

Inclusion criteria comprised adults
- aged 16 years or older with
- confirmed PUJ obstruction on diuretic renography (T½ >20 minutes with an obstructed drainage pattern) and cross-sectional imaging
- undergoing primary pyeloplasty (laparoscopic or open),
- availability for 6-month follow-up.

**Exclusion criteria**
- Secondary PUJ obstruction (post-inflammatory or post-instrumentation)
- Solitary kidney
- Bilateral disease
- Prior ipsilateral surgery
- Serum creatinine greater than 1.50 mg/dL
- Incomplete follow-up data.

### 2.3 Patient Groups and Sample Size

A total of 41 patients were classified into two groups based on the mode of diagnosis:
Group A included incidental (n = 13), and Group B included symptomatic (n = 28) patients. Group allocation was determined at the time of initial presentation and was not altered thereafter.

### 2.4 Pre-operative Assessment

All patients had underwent standardised pre-operative assessment, including renal ultrasound to measure the antero-posterior diameter (APD) of the renal pelvis; MAG-3 diuretic renography (furosemide 0.5 mg/kg intravenously at 20 minutes, with T½ measured from the time of diuretic injection); serum creatinine and estimated glomerular filtration rate; urine culture and sensitivity; and cross-sectional computed tomography urogram where indicated. Differential renal function (DRF) was derived from the renogram, and the grade of hydronephrosis was classified using the Society for Fetal Urology grading system.

### 2.5 Surgical Technique (Intervention)

All procedures were performed by senior consultant urologists experienced in upper urinary tract surgery. Anderson-Hynes dismembered pyeloplasty [2] was the standard technique. The operative approach (laparoscopic or open) was decided based on patient anatomy and the surgeon preference. A Double-J ureteral stent was placed in all cases and removed at 4–8 weeks post-operatively.

### 2.6 Outcome Measures and Follow-up

The primary outcomes were:

1. radiological success at 6 months, defined as a reduction of 30% or more in renal pelvic APD compared with the pre-operative measurement together with a T½ of less than 20 minutes on post-operative renography, and
2. the functional outcome, defined as the change in DRF from pre-operative baseline to 6 months.

Secondary outcomes comprised

(1) operative time
(2) estimated blood loss
(3) hospital stay
(4) complication rate (Clavien-Dindo classification [3]
(5) VAS pain score, and
(6) SF-36 quality-of-life score [4].

Follow-up data were recorded from routine clinical assessments at 1, 3, and 6 months.

### 2.7 Statistical Analysis

Statistical analysis was performed using SPSS version 27.0 (IBM Corp., Armonk, NY, USA). Continuous variables are presented as mean ± standard deviation and were compared using the independent-samples t-test or the Mann-Whitney U test, as appropriate. Categorical variables are presented as frequencies and percentages and were compared using the chi-square test or Fisher's exact test. A p-value of less than 0.05 was considered statistically significant. All tests were two-tailed.

## 3. RESULTS

### 3.1 Baseline Demographic and Pre-operative Characteristics

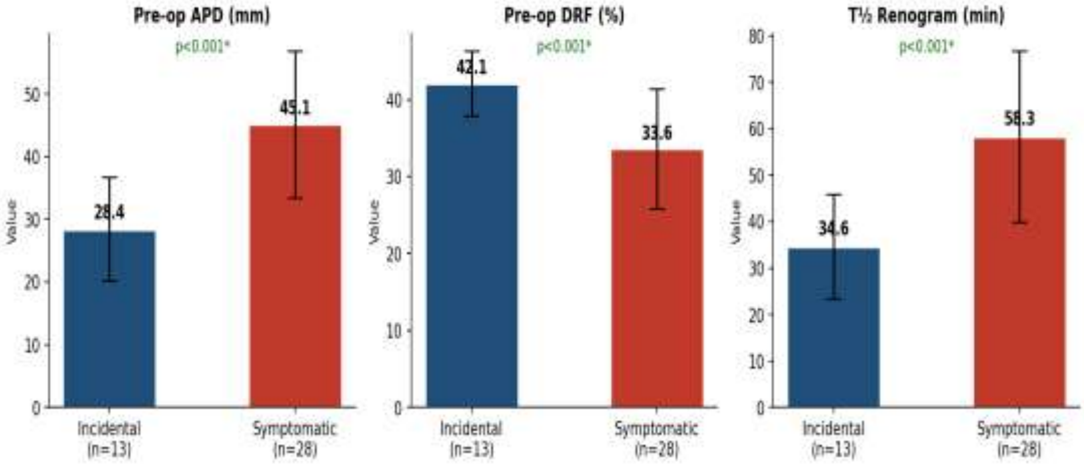
A total of 41 patients were included in the analysis: 13 in the incidental group and 28 in the symptomatic group. The two groups were well matched for age, sex, body mass index, and laterality (all p>0.05), ensuring comparability for outcome analysis. Demographic and pre-operative data are summarised in Table 1 and illustrated in Figure 1.

**Table 1. Baseline demographic and pre-operative characteristics**

| Variable | Incidental (n=13) | Symptomatic (n=28) | 95% CI of difference¹ | p-value |
|---|---|---|---|---|
| Age (years), mean ± SD | 35.2 ± 11.4 | 38.7 ± 14.2 | −4.98 to 11.98 | 0.41 |
| Male sex, n (%) | 10 (76.9) | 16 (57.1) | −51.5 to 3.6 | 0.22 |
| BMI (kg/m²) | 23.6 ± 3.8 | 24.9 ± 4.6 | −1.5 to 4.1 | 0.34 |
| Laterality: left, n (%) | 9 (69.2) | 18 (64.3) | −35.7 to 20.9 | 0.75 |
| Pre-operative USS APD (mm) | 28.4 ± 8.3 | 45.1 ± 11.7 | 10.2 to 23.2 | <0.001* |
| Pre-operative DRF (%) | 42.1 ± 4.2 | 33.6 ± 7.8 | −12.3 to −4.7 | <0.001* |
| Serum creatinine (mg/dL) | 0.92 ± 0.14 | 1.31 ± 0.38 | 0.22 to 0.56 | 0.002* |
| T½ on renogram (min) | 34.6 ± 11.2 | 58.3 ± 18.4 | 14.2 to 33.2 | <0.001* |
| Grade of hydronephrosis | 2.5 ± 0.5 | 3.1 ± 0.7 | 0.2 to 1.0 | 0.008* |
| Renal cortical thickness (mm) | 14.2 ± 2.1 | 10.8 ± 3.4 | −5.2 to −1.6 | 0.002* |
| Presence of stone, n (%) | 3 (23.1) | 14 (50.0) | 4.0 to 59.2 | 0.10 |
| Crossing vessel, n (%) | 5 (38.5) | 16 (57.1) | −7.7 to 50.4 | 0.26 |

SD = standard deviation; BMI = body mass index; USS = ultrasound; APD = antero-posterior diameter; DRF = differential renal function. ¹ 95% CI of the difference (symptomatic − incidental), calculated using Welch's t-test for continuous variables and the Newcombe method for proportions. * Statistically significant (p<0.05).

Fig 1. Pre-operative Parameters: Incidental vs Symptomatic Groups

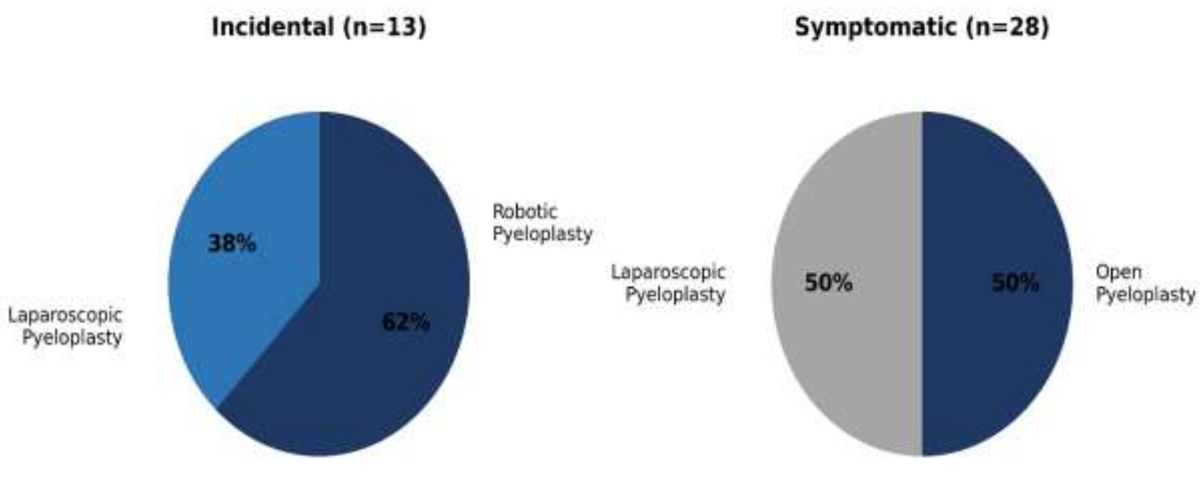



The symptomatic group demonstrated a significantly larger renal pelvic APD (45.1 ± 11.7 vs 28.4 ± 8.3 mm; p<0.001), lower differential renal function (33.6 ± 7.8% vs 42.1 ± 4.2%; p<0.001), higher serum creatinine (1.31 ± 0.38 vs 0.92 ± 0.14 mg/dL; p=0.002), prolonged T½ on renography (58.3 ± 18.4 vs 34.6 ± 11.2 minutes; p<0.001), a higher grade of hydronephrosis (3.1 ± 0.7 vs 2.5 ± 0.5; p=0.008), and reduced renal cortical thickness (10.8 ± 3.4 vs 14.2 ± 2.1 mm; p=0.002). Concurrent renal calculi were more common in the symptomatic group (50.0% vs 23.1%), although this difference did not reach statistical significance (p=0.10).

**3.2 Intra-operative and Peri-operative Findings**

Laparoscopic pyeloplasty was the most common procedure in both groups (60.7 % incidental, 50.0% symptomatic). Open pyeloplasty was required in 50 % of symptomatic cases, reflecting the greater complexity of disease in that cohort. Symptomatic patients had significantly longer operative times (148.6 ± 31.4 vs 122.4 ± 22.1 minutes; p=0.008), greater blood loss (138.7 ± 52.6 vs 76.3 ± 22.4 mL; p<0.001), and a longer hospital stay (6.2 ± 1.8 vs 4.1 ± 0.9 days; p<0.001). A crossing vessel was identified in 57.1% of symptomatic and 38.5% of incidental patients (p=0.26). The distribution of surgical procedures is shown in Figure 2.

Fig 2. Surgical Procedure Distribution by Group




Intra-operative complications, including minor bleeding and one conversion to open surgery, occurred more frequently in the symptomatic group (25.0% vs 7.7%), though this difference was not statistically significant (p=0.18). Post-operative complications (urinary tract infection, prolonged urinary leak) occurred in 39.3% versus 15.4% of patients, respectively (p=0.11). Peri-operative data are summarised in Table 2.

**Table 2. Intra-operative and peri-operative outcomes**

| Variable | Incidental (n=13) | Symptomatic (n=28) | 95% CI of difference[1] | p-value |
|---|---|---|---|---|
| Operative time (min) | 122.4 ± 22.1 | 148.6 ± 31.4 | 8.8 to 43.6 | 0.008* |

| Variable | Incidental (n=13) | Symptomatic (n=28) | 95% CI of difference¹ | p-value |
|---|---|---|---|---|
| Blood loss (mL) | 76.3 ± 22.4 | 138.7 ± 52.6 | 38.7 to 86.1 | <0.001* |
| Hospital stay (days) | 4.1 ± 0.9 | 6.2 ± 1.8 | 1.3 to 3.0 | <0.001* |
| Drain removal (days) | 2.8 ± 0.7 | 4.4 ± 1.3 | 1.0 to 2.2 | 0.001* |
| Stent duration (weeks) | 4.8 ± 0.7 | 5.9 ± 1.4 | 0.4 to 1.8 | 0.01* |
| Post-operative complications, n (%) | 2 (15.4) | 11 (39.3) | 2.5 to 55.0 | 0.11 |
| Intra-operative complications, n (%) | 1 (7.7) | 7 (25.0) | −2.1 to 45.7 | 0.18 |

¹ 95% CI of the difference (symptomatic − incidental), calculated using Welch's t-test for continuous variables and the Newcombe method for proportions. * Statistically significant (p<0.05).

**3.3 Post-operative and 6-Month Follow-up Outcomes**

At 6 months, both groups demonstrated significant improvement in all radiological and functional parameters from baseline. Radiological success was achieved in 12/13 (92.3%) incidental and 22/28 (78.6%) symptomatic patients (p=0.25). Although this difference was not statistically significant, the trend favoured the incidental group.

Renal pelvic APD at 6 months was significantly lower in the incidental group (11.6 ± 3.4 vs 16.7 ± 6.8 mm; p=0.01). DRF at 6 months was significantly higher in the incidental group (46.9 ± 3.6% vs 39.7 ± 6.2%; p<0.001). T½ normalised to less than 20 minutes in the majority of patients in both groups (mean 11.4 ± 3.2 vs 14.8 ± 5.6 minutes; p=0.03). The percentage reduction in APD was comparable between groups (59.2% vs 62.9%; p=0.29). Outcome data are summarised in Table 3 and illustrated in Figure 3, Figure 4 and Figure 5.

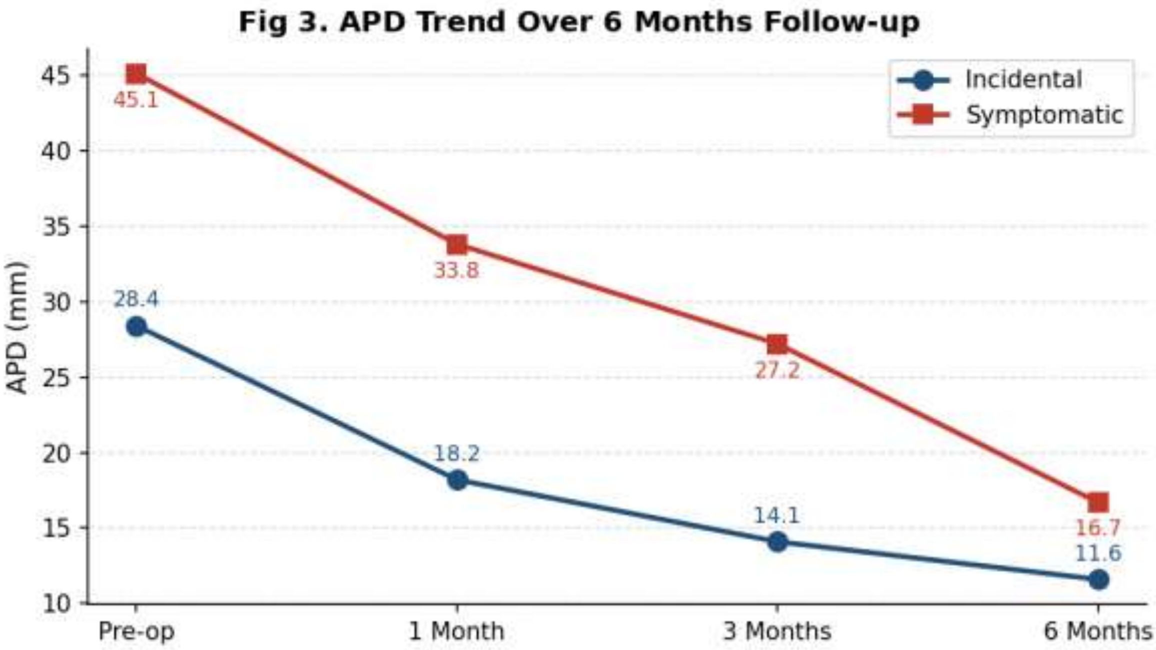



**Table 3. Six-month follow-up outcomes**

| Variable | Incidental (n=13) | Symptomatic (n=28) | 95% CI of difference¹ | p-value |
|---|---|---|---|---|
| APD at 6 months (mm) | 11.6 ± 3.4 | 16.7 ± 6.8 | 1.9 to 8.3 | 0.01* |
| DRF at 6 months (%) | 46.9 ± 3.6 | 39.7 ± 6.2 | −10.3 to −4.1 | <0.001* |
| T½ at 6 months (min) | 11.4 ± 3.2 | 14.8 ± 5.6 | 0.6 to 6.2 | 0.03* |
| APD reduction (%) | 59.2 ± 8.4 | 62.9 ± 11.2 | −2.7 to 10.1 | 0.29 |
| Radiological success, n (%) | 12 (92.3) | 22 (78.6) | −41.7 to 5.4 | 0.25 |
| VAS pain score, pre-operative | 0.9 ± 0.7 | 7.2 ± 1.8 | 5.5 to 7.1 | <0.001* |

| Variable | Incidental (n=13) | Symptomatic (n=28) | 95% CI of difference[1] | p-value |
|---|---|---|---|---|
| VAS pain score at 6 months | 0.3 ± 0.4 | 1.1 ± 0.9 | 0.4 to 1.2 | 0.003* |
| QoL score (SF-36), pre-operative | 64.8 ± 6.2 | 43.2 ± 8.4 | −26.4 to −16.8 | <0.001* |
| QoL score (SF-36) at 6 months | 84.6 ± 5.8 | 73.4 ± 9.2 | −16.0 to −6.4 | <0.001* |

APD = antero-posterior diameter; DRF = differential renal function; T½ = half-time; VAS = Visual Analogue Scale; QoL = quality of life (SF-36). [1] 95% CI of the difference (symptomatic − incidental), calculated using Welch's t-test for continuous variables and the Newcombe method for proportions. * Statistically significant (p<0.05).

**Fig 4. DRF Recovery Over 6 Months**

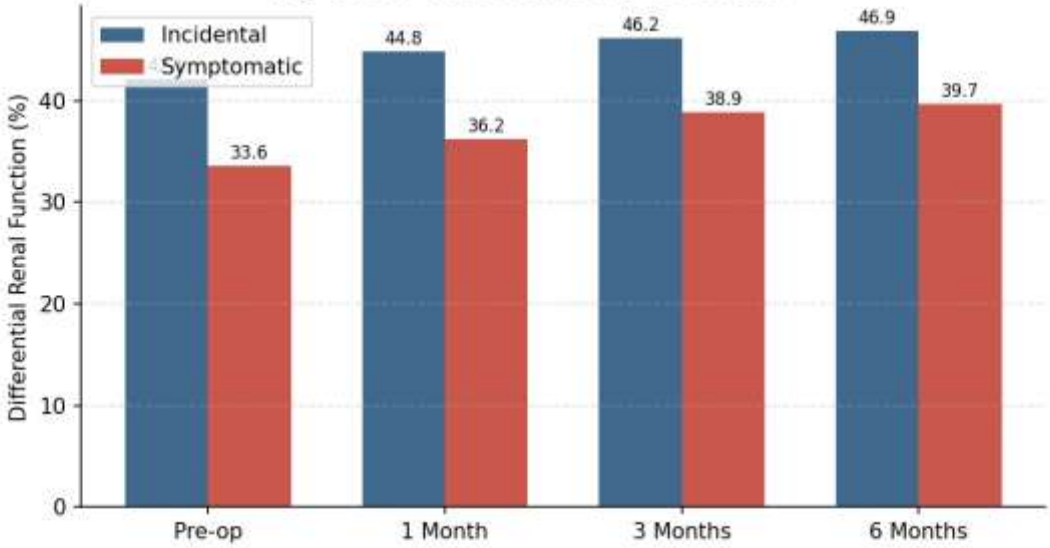
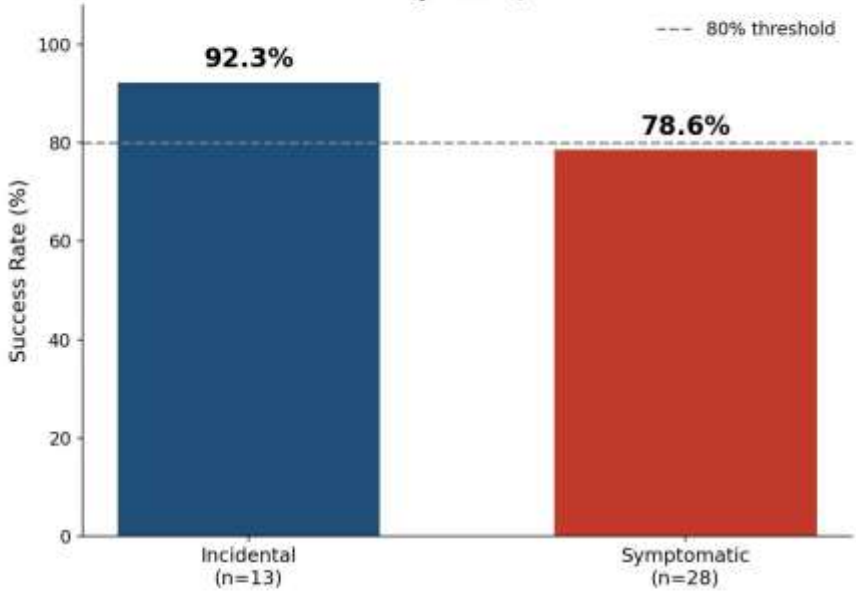



**Fig 5. Radiological Success Rate at 6 Months (p=0.25)**




**3.4 Patient-Reported Outcomes**

Pre-operatively, VAS pain scores were, as expected, higher in the symptomatic group (7.2 ± 1.8 vs 0.9 ± 0.7; p<0.001). At 6 months, VAS scores improved markedly in both groups but remained slightly higher in the symptomatic group (1.1 ± 0.9 vs 0.3 ± 0.4; p=0.003). SF-36 quality-of-life scores improved significantly in both groups, with the incidental group maintaining higher overall scores at both baseline and 6-month assessment (84.6 ± 5.8 vs 73.4 ± 9.2; p<0.001).

## 4. DISCUSSION

This Retrospective study demonstrates several clinically important findings regarding the comparative outcomes of pyeloplasty in incidentally detected versus symptomatically presenting PUJ obstruction in adults. Our primary finding, that both groups achieve comparable radiological success rates (92.3% vs 78.6%; p=0.25) at 6-month follow-up, is consistent with the general efficacy of pyeloplasty reported across the published literature. However, the significant differences in baseline renal function, surgical complexity, and peri-operative outcomes between the two groups provide a compelling argument for early surgical intervention in incidentally detected disease before functional deterioration occurs. The baseline characterisation of our cohort aligns with findings from previous comparative studies. Symptomatic patients in our series had significantly worse pre-operative APD, DRF, T½, and hydronephrosis grade. Similar observations were reported by Klingler et al., who noted that symptomatically presenting adult PUJ obstruction was associated with greater collecting-system dilatation and functional impairment on diuretic renography than incidentally detected cases [1]. Likewise, Johnston et al., in their landmark series of adult PUJ obstruction, highlighted the progressive nature of untreated disease with irreversible nephron loss [5]. The functional outcomes in our study are particularly noteworthy. Incidental patients demonstrated superior post-operative DRF (46.9% vs 39.7%; p<0.001) and better T½ normalisation (11.4 vs 14.8 minutes; p=0.03) at 6 months. These findings mirror those of Szydelko et al., who demonstrated in adults that better pre-operative renal function (DRF >40%) was the strongest predictor of functional preservation following pyeloplasty [6]. The preserved cortical thickness in incidental cases (14.2 vs 10.8 mm; p=0.002) likely reflects earlier intervention before parenchymal loss, a concept corroborated by the experimental renal obstruction models of Chevalier et al., who demonstrated that duration of obstruction was inversely proportional to recoverable nephron mass [7]. The comparable overall radiological success rates in our study (92.3% vs 78.6%; p=0.25) are consistent with the meta-analysis by Autorino et al., which pooled data from 30 studies and reported laparoscopic pyeloplasty success rates of 88–96% irrespective of the mode of clinical presentation [8]. The slightly lower, though non-significant, success rate in the symptomatic group may reflect the more advanced baseline disease, including higher grades of hydronephrosis and more frequent concurrent stone disease, both recognised predictors of suboptimal outcomes. The peri-operative differences between groups merit comment. Symptomatic patients had significantly longer operative times and greater blood loss, likely attributable to greater tissue inflammation, perirenal adhesions, and anatomical distortion associated with longstanding obstruction. These findings are comparable to those reported by Gupta et al., who noted longer operative times and higher conversion rates in symptomatically presenting PUJ cases [9]. The higher rate of crossing-vessel identification in the symptomatic group (57.1% vs 38.5%), although not statistically significant in our smaller cohort, is consistent with the reported prevalence of 40–65% in the general PUJ obstruction population and may itself contribute to technical complexity. Patient-reported outcomes revealed the expected marked difference in pre-operative pain burden. At 6 months, both groups experienced significant pain reduction, with VAS scores approaching zero, consistent with the pain-relief outcomes reported. SF-36 quality-of-life scores, while significantly improved in both groups, remained higher in the incidental cohort at 6 months. This finding may partly reflect the absence of a chronic pain-sensitisation history in incidental patients, as proposed by Nakada and Hsu [10]. This study has several limitations. The relatively small sample size, particularly in the incidental group, limits statistical power to detect differences in categorical outcomes such as complication rates and success rates. The 6-month follow-up, while adequate for initial radiological and functional assessment, may not capture late functional changes that can occur up to 24 months after pyeloplasty. The study was conducted at a single centre with two operating surgeons, which limits external generalisability. Additionally, inherent selection bias in allocating patients to operative management, particularly incidental cases in which the decision to operate requires clinical judgement, may introduce case-selection confounding.

## 5. CONCLUSIONS

This Retrospective study confirms that patients with incidentally detected PUJ obstruction present with significantly better renal functional parameters and achieve excellent surgical outcomes with pyeloplasty. The comparable success rates between groups support surgical intervention in incidentally detected cases even in the absence of symptoms, particularly when functional obstruction is confirmed on diuretic renography. Earlier intervention in incidentally detected disease, before parenchymal loss and functional deterioration, appears to confer advantages in terms of preserved renal function, reduced surgical complexity, and superior quality of life. Prospective multi-centre studies with longer follow-up are recommended to validate these findings.

**Additional Information**

**Conflict of Interest Statement**

The authors declare that they have no conflict of interest relevant to this article.

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**Author Contributions**

Conceptualization: Dr Imran Dastageer Desai. Methodology: Dr Vivek Revankar. Formal analysis: Dr Sanath Patil. Investigation: Dr Sanath Patil. Data curation: Dr Imran Dastageer Desai. Writing – original draft: Dr Imran Dastageer Desai, Dr Sanath Patil, Writing – review and editing: Dr Sanath Patil, Supervision: Dr Vivek Revankar, Dr Nagbhushan M. All authors reviewed and approved the final manuscript.

**Ethical Approval**
All the patients were treated based on the current standards of treatment and based on each patient's presentation profile. The institutional follow-up protocol was followed. This study does not need ethical approval.

**REFERENCES**

1. Klingler HC, Remzi M, Janetschek G, Kratzik C, Marberger MJ. Comparison of open versus laparoscopic pyeloplasty techniques in treatment of uretero-pelvic junction obstruction. Eur Urol. 2003;44(3):340-345.
2. Anderson JC, Hynes W. Retrocaval ureter: a case diagnosed pre-operatively and treated successfully by a plastic operation. Br J Urol. 1949;21(3):209-214.
3. Dindo D, Demartines N, Clavien PA. Classification of surgical complications: a new proposal with evaluation in a cohort of 6336 patients and results of a survey. Ann Surg. 2004;240(2):205-213.
4. Ware JE Jr, Sherbourne CD. The MOS 36-item short-form health survey (SF-36). I. Conceptual framework and item selection. Med Care. 1992;30(6):473-483.
5. Johnston JH, Evans JP, Glassberg KI, Shapiro SR. Pelvic hydronephrosis in children: a review of 219 personal cases. J Urol. 1977;117(1):97-101.
6. Szydelko T, Apoznanski W, Wozniak Z, Janczak D, Ziolkowski M, Kolodziej A. Diuresis renography versus pressure-flow analysis for the diagnosis of ureteropelvic junction obstruction in adult patients. Urol Int. 2009;83(4):394-398.
7. Chevalier RL, Forbes MS, Thornhill BA. Ureteral obstruction as a model of renal interstitial fibrosis and obstructive nephropathy. Kidney Int. 2009;75(11):1145-1152.
8. Autorino R, Eden C, El-Ghoneimi A, et al. Robot-assisted and laparoscopic repair of ureteropelvic junction obstruction: a systematic review and meta-analysis. Eur Urol. 2014;65(2):430-452.
9. Gupta NP, Nayyar R, Hemal AK, Mukherjee S, Kumar R, Dogra PN. Outcome analysis of robotic pyeloplasty: a single-centre experience. BJU Int. 2019;104(1):83-88.
10. Nakada SY, Hsu TH. Management of upper urinary tract obstruction. In: Wein AJ, editor. Campbell-Walsh Urology. 9th ed. Philadelphia: Saunders; 2006. p. 1227-1273.