

Comparison of Pre- Pyeloplasty and Post- Pyeloplasty Renal status by ^{99m}Tc -DTPA Renogram : Experience of a Single Institute

¹Humayra Tasnim, ²Md Jahir Alam, ³Rahima Akter Sharmin, ³Iqbal Hossain, ¹Nilufa Yasmeen, ⁴Sharmin Quddus, ¹Arshad Hossain, ⁵Fatema Tuz Zohra, ⁶Istiaq Ahmed, ²Mahbuba Zaman, ⁷Md Alamgir Kabir, ⁸Md Shahidul Islam Khan

¹Medical Officer, ²Scientific Officer, ³Senior Medical Officer, ⁴Director and CMO, ⁷Senior Experimental Officer,

⁸Technical Officer, Institute of Nuclear Medicine and Allied Sciences (INMAS), Mohakhali

⁵Senior Medical Officer, Institute of Nuclear Medical Physics (INMP), AERE, Savar

⁶Lecturer, Department of Microbiology and Immunology, Gonoshasthaya Samaj Vittik Medical College.

Correspondence Address : Dr. Humayra Tasnim, Medical Officer, INMAS, Mohakhali, Dhaka, Email: humayrasharna101@gmail.com

ABSTRACT

Background: Radionuclide scanning for the functional assessment of kidney is a very helpful procedure. ^{99m}Tc DTPA renogram with diuretic challenge can evaluate the improvement or decline of individual renal function and GFR at pre operative and postoperative period in case of pelviureteric junction obstruction (PUJO).

Patients and methods: This prospective, longitudinal study was carried out among 25 patients with age ranging from 4 to 57 years at Institute of Nuclear Medicine and Allied Sciences (INMAS), Mohakhali who were referred for the estimation of pre and post pyeloplasty renal status.

Results: Mean age of study subjects were 24.54 ± 17.96 years with male predominance (56 %). Left kidney was mostly affected (68%). The pre and post pyeloplasty parenchymal and excretory functions were compared and found to be improved about 56% parenchymal and 64 % in excretory functions respectively. Pre-operative mean glomerular filtration rate (GFR) was 33.49 ± 22.40 ml/min which improved to 44.81 ± 25.99 ml / min (33.80%) postoperatively.

Conclusion: Comparison of pre pyeloplasty and post pyeloplasty renal status by ^{99m}Tc DTPA renogram with diuretic challenge appears to be an authentic and beneficial work up that causes very little radiation exposure to patients but provides important clinical clues for further management and follow up.

Keywords: Pelviureteric junction obstruction, ^{99m}Tc DTPA renogram, pre pyeloplasty, post pyeloplasty, Glomerular filtration rate

Bangladesh J. Nucl. Med. Vol. 28 No. 1 January 2025

DOI: <https://doi.org/10.3329/bjnm.v28i1.79529>

INTRODUCTION

Pyeloplasty is a widely used surgical method for the correction of pelviureteric junction obstruction (PUJO). This pathological condition can occur in approximately 1 out of 1000 adults & 1:500 to 1:1250 live births throughout the world (1). It refers to the narrowing of the pathway of urine excretion at the junction of renal pelvis

joining the ureter. It can be congenital or acquired. Congenital causes are the most common and can be diagnosed during prenatal ultrasonography (2). It can be presented with various symptoms, such as recurrent loin pain, pyelonephritis, nephrolithiasis, lump or swelling in the kidney area etc. Asymptomatic patients are usually discovered during routine scan for any other conditions. In babies it commonly occurs in boys & mostly on left side (3).

Patients with significantly impaired renal parenchymal and excretory function are considered for surgical intervention. Other indication for pyeloplasty is to relieve the pain & correction of the pathologies secondary to obstruction such as stone or infection. This procedure has a high success rate of more than 95% and recovery usually within 72 hours (3).

^{99m}Tc -DTPA renogram with diuretic challenge is a routine nuclear medicine technique at the Institute of Nuclear Medicine and Allied Sciences (INMAS), Mohakhali for the differential functional evaluation of kidneys. Many patients with PUJO are referred here in the peri-operative period because the success of pyeloplasty procedure is determined by clinical improvement and parameters of ^{99m}Tc -DTPA renogram.

PATIENTS AND METHODS

This was a cross-sectional observational study, conducted among 25 patients who were referred to INMAS, Mohakhali for ^{99m}Tc -DTPA renogram with diuretic challenge from November 2023 to June 2024 to evaluate renal function before and after pyeloplasty. All these

patients undergone a preliminary ultrasound scan and identified with different pathologies causing PUJO. A written informed consent was taken after explaining the overall procedure, risks and outcome. The scan was done with SIEMENS Symbia Invento Bold. At first pre syringe count was taken, then dynamic sequential images of the kidneys were obtained in the posterior position immediately after intravenous (I/V) administration of 2-5 mCi dose of ^{99m}Tc -DTPA. The dose was calculated according to age, height and body weight. The study was continued for 30 minutes. Diuretic was given at 11- 13th minute. Lastly post-syringe count was taken. Then all the

images were processed by a nuclear medicine physician. After this initial scan, the patients underwent Anderson Hynes (A-H) pyeloplasty within a few days/ weeks. Another scan was done about 3 to 6 months after the surgery. All the statistical data were analyzed by IBM SPSS software (version 25).

RESULTS

Total 25 patients were included in this study, age ranging from 4 - 57 years with mean age 24.54 ± 17.96 years. Most of the patients were in above 20 years age group (Figure 1). Male to female ratio was 14:11.

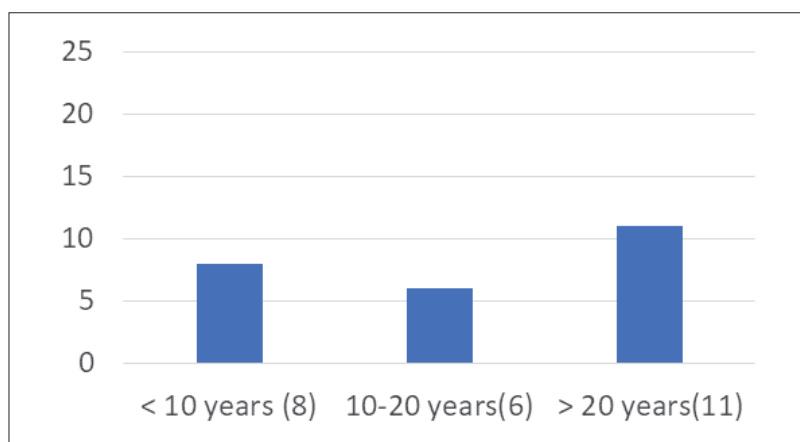


Figure 1: Age distribution of patients (n=25), attending INMAS, Mohakhali for DTPA renogram

Left kidney was affected in most of the cases (68%). No bilateral cases were identified in the present study.

Pattern of ^{99m}Tc -DTPA renogram findings for both pre pyeloplasty and post pyeloplasty parenchymal function of the affected kidneys are summarized in table 1. Parenchymal functional improvement was observed in majority of the cases after pyeloplasty.

Table 1: Frequency of different parenchymal functional status pre and post intervention

Parenchymal functional impairment	Pre-pyeloplasty	Post-pyeloplasty
Normal	2	13
Mild	11	6
Moderate	2	6
Severe / Gross	10	3

Pattern of obstruction correction is shown in Table 2. Again, most of the study subjects demonstrated various degrees of correction of obstruction post pyeloplasty.

Table 2: Distribution of obstruction level assessment pre and post intervention

Status of obstruction	Pre-pyeloplasty	Post-pyeloplasty
Complete obstruction	25	9
Partial obstruction	0	5
No obstruction	0	11

Table 3 shows the spilt uptake and GFR in the operated kidneys, indicating improvement.

Table 3: Change of uptake and GFR pre and post intervention

Status of obstruction	Pre-pyeloplasty	Post-pyeloplasty
Mean Uptake (%)	3.8 ± 2.44	4.40 ± 3.50
Mean GFR (ml/min)	33.49 ± 22.40	44.81 ± 25.99

DISCUSSION

Kidneys are the major excretory organs for elimination of metabolic waste products from our body (4). They perform a multitude of essential functions to maintain homeostasis of other organs. Any insult can cause their functional impairment, which can be evaluated with 99m-Tc DTPA renogram. This nuclear medicine technique can shed light on the status of renal blood flow, parenchymal and excretory function, as well as GFR (5).

Pelviureteric junction obstruction can lead to an increase in back-pressure on the kidney, leading to hydronephrosis and progressive damage to the kidney function. It is therefore important to understand how to diagnose and treat this condition (6). The initial renal function and GFR evaluated by 99m-Tc DTPA renogram of the diseased kidney can help us to determine the treatment protocol (7).

The present study involving 25 patients with a mean age of 24.54±17.96 years matches the patient profile of a study by the department of Urology, National Institute of Kidney Diseases and Urology (NIKDU) and Bangladesh Institute of Research and Rehabilitation for Diabetes, Endocrine and Metabolic Disorders (BIRDEM) in 2021 (8). There was also male preponderance, similar to the work of Chandrasekharam et al. of All India Institute of Medical Sciences (9). Besides, it was observed that left kidney was affected by various pathologies most of the time, which resonates with the findings of Maged Abd Elgalil Hamed in a study including 42 patients suffering from chronic unilateral obstruction (10). The left kidney

is more towards the middle of the body than the right kidney; this could affect passage of calculus between the aorta and the superior mesenteric artery. This narrow space can affect blood flow and urine drainage, which might increase the risk of calculi ("nutcracker syndrome") (2). Different kidney flow patterns may cause one kidney to accumulate more minerals, leading to the formation of stones, with the left kidney being more affected in some cases.

In this study, parenchymal function improvement after pyeloplasty was 56%. Irene M. McAleer reported this improvement to be about 43% among 79 patients (11). Again, post-operative renogram demonstrated nearly 64% correction of obstruction post pyeloplasty, which is close to Kjell J. Tveter from University Hospital of Oslo, Akershus, Norway (13).

In the current study, pre-operative mean GFR was 33.49 ± 22.40 ml/min which increased post operatively to 44.81 ± 25.99 ml/min. The percentage of improvement was 33.80% which is less than a study conducted at Institute of Nuclear Medicine and Allied Sciences (INMAS), Dhaka (15).

Limitation of the present study includes small patient population, and a short period of follow-up. Larger multicentric prospective trials can provide better insight on this matter.

CONCLUSION

PUJO is not an uncommon renal pathology. It has a significant impact on renal function if left untreated and

unmonitored. Anderson-Hynes pyeloplasty is a widely practiced treatment choice to alter the disease course and set the motion to improvement, which can be effectively assessed by 99m-Tc DTPA renogram.

REFERENCES

1. Sahu P, Singh S, Ahuja A, Sharma U, Mattoo S, Bhardwaj M. Unusual and rare cause of PUJ obstruction with a brief review of the literature. *Journal of Clinical Urology*. 2023 Jul;16(4):374-9.
2. Hanna MK, Jeffs RD, Sturgess JM, Barkin M. Ureteral structure and ultrastructure. Part II. Congenital ureteropelvic junction obstruction and primary obstructive megaureter. *The Journal of urology*. 1976 Dec 1;116(6):725-30.
3. Talabi AO, Salako AA, Sowande OA, Badmus TA, Aladekomo TA, Babalola RN, Onyeze CI, David RA, Adejuyigbe OA. Management of pelviureteric junction obstruction at a tertiary teaching hospital in southwestern Nigeria: A retrospective analysis of case records. *East and Central African Journal of Surgery*. 2018 Jul 16;23(1):27-31.
4. Rickard M, Chua M, Kim JK, Keefe DT, Milford K, Hannick JH, Dos Santos J, Koyle MA, Lorenzo AJ. Evolving trends in peri-operative management of pediatric ureteropelvic junction obstruction: working towards quicker recovery and day surgery pyeloplasty. *World journal of urology*. 2021 Sep 1:1-8.
5. Finco DR. Kidney function. In *Clinical biochemistry of domestic animals* 1997 Jan 1 (pp. 441-484). Academic Press.
6. Ziessman HA, O'Malley JP. *Nuclear medicine: the requisites*. Elsevier Health Sciences; 2013 Mar 21.
7. Hashim H, Woodhouse CR. Ureteropelvic junction obstruction. *European Urology Supplements*. 2012 Apr 1;11(2):25-32.
8. (Ransley PG, Dhillon HK, Gordon I, Duffy PG, Dillon MJ, Barratt TM. The postnatal management of hydronephrosis diagnosed by prenatal ultrasound. *The Journal of urology*. 1990 Aug 1;144(2):584-7.
9. Al Misbah T, Chowdhury AM, Enayetullah I, Ahmed AB. Improvement of Renal Function after Pyeloplasty Determined by 99mTc DTPA Renogram. *Bangladesh Journal of Urology*. 2021;24(2):155-60.
10. Chandrasekharam VV, Srinivas M, Bal CS, Gupta AK, Agarwala S, Mitra DK, Bhatnagar V. Functional outcome after pyeloplasty for unilateral symptomatic hydronephrosis. *Pediatric surgery international*. 2001 Sep;17:524-7.
11. Hamed MA. New advances in assessment of the individual renal function in chronic unilateral renal obstruction using functional CT compared to 99mTc-DTPA renal scan. *Nuclear Medicine Review*. 2014;17(2):59-64.
12. McALEER IM, KAPLAN GW. Renal function before and after pyeloplasty: does it improve?. *The Journal of urology*. 1999 Sep;162(3 Part 2):1041-4.
13. Almodhen F, Jednak R, Capolicchio JP, Eassa W, Brzezinski A, El-Sherbiny M. Is routine renography required after pyeloplasty?. *The Journal of urology*. 2010 Sep 1;184(3):1128-33.
14. Tveter KJ, Nerdrum HJ, Mjølnerød OK. The value of radioisotope renography in the followup of patients operated upon for hydronephrosis. *The Journal of Urology*. 1975 Nov 1;114(5):680-3.
15. Sultana T, Hossain MS, Sultana S, Akhter A, Sharmin S, Rahman F, Hossain S, Hossain M, Afrin R, Biswas SK, Begum R. Evaluation of Surgical Outcome of Pelviureteric Junction Obstructive Patients by 99mTc-DTPA Renography. *Bangladesh Journal of Nuclear Medicine*. 2024 Jun 23;27(1):16-20.