

# Sonographic and 99m Tc DTPA Renal Scan Changes in Pre and Post Percutaneous Nephrostomy in Unilateral Hydronephrotic on U/S and Non-Functioning on IVU Kidneys

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15 patients who presented with unilateral non-functioning kidney on IVU and with age range 21-69 years with mean of 45 were studied. 11 patients (70.35%) were male and 4 patients (29.70%) were female with 2.31:1 ratio. 3, 5, 4, 2, and 1 patients were from 21-30, 31-40, 41-50, 51-60 and above 61 years age group respectively. 11 (73.73%) had some disease, 3 (20%) PUJ obstruction and 1 (6.6%) ureteric stricture as cause. 11 (73.3%) had no hydronephrosis and 4 had minimal hydronephrosis after PCN. Total mean GFR was 94.2, 94.4, 97.3 and 98.5 ml/min in pre PCN, 2 weeks, 4 weeks and 65 weeks respectively, showing significant improvement. Final results in obstructive kidney showed no improvement in 4 (26.6%) mild (<25%) in 1 (6.6%), good (<50%) in 2 (13.3%) and excellent (<50%) in 8 (53.3%) patients. Both ultrasound and 99m Tc DTPA renal scan can play a vital role not only in diagnosing hydronephrotic and non functioning kidney but also saving 11 (73.3%) patients from emotional as well as physical trauma of nephrectomy

**Key words:** Hydronephrotic non-functioning kidney, PCN, renal scan,

Urinary tract obstruction is a relatively common cause of renal disease that may be seen as nonfunctional kidney on I.V.U. The signs and symptoms can usually be improved after relief of obstruction. The prediction of recoverability of kidney function after relief of obstruction is of great value to urologists and radiologist can help them in this regard<sup>4</sup>. This recoverability of renal function is inversely related to duration of obstruction. While at least partial restoration of kidney function has been reported after long standing partial ureteric obstruction.

P.C.N has been found to be a safe and effective method of providing temporary relief by urinary diversion in cases of obstructive uropathy<sup>3</sup>. This procedure not only decompresses the upper urinary tract but also provides an access for serial antegrade pyelography, stent placement and ureteric stricture dialation. Contraindications to P.C.N are few and include Haemorrhagic diathesis, tuberculosis or neoplastic involvement of kidney.

Dynamic renal scan is a series of continuous integrated images detected and recorded on a gamma camera after a bolus injection of the radiopharmaceutical 99m technetium diethylene Triaminepentacetic acid (99m Tc DTPA)<sup>5</sup>. 99m Tc DTPA has a clearance rate approximately 5% less than that of inulin, therefore, it yields an estimate of G.F.R within 5% of true G.F.R. It is inexpensive, has a low radiation dose and can be used for renal imaging. An activity time curve is derived and an external arm provides an accurate measure of G.F.R. Renography is of particular value in assessing renal function in hydronephrosis due to pelviureteric obstruction and aids in distinguishing true obstruction from an adynamic dilation of upper urinary tract obstruction<sup>2</sup>.

In present study an attempt has been made to assess the recoverability of renal function by temporarily relieving upper urinary tract obstruction by P.C.N and

comparing sonographic and 99m Tc DTPA Renal scan finding in pre and post P.C.N in subsequent follow up. An attempt has also been made for age, sex incidence and cause of unilateral non functional kidney on I.V.U.

## Aims and objectives

- 1) To evaluate sonographic and 99m Tc DTPA renal scan changes in pre and post percutaneous nephrostomy in unilateral non-functional kidney on I.V.U.
- 2) To see age, sex incidence and cause of unilateral obstructed kidney.
- 3) To assess recovery potential in complete unilaterally obstructed kidney after relief of obstruction by P.C.N.

## Material and methods

This study was carried out in 15 patients in Mayo Hospital, Lahore. Following criteria was made:

- 1) Patients of both sex.
- 2) Patients with unilateral moderate to marked hydronephrosis as seen on ultrasonography.

Following patients were excluded from this study.

1. Patients showing non opacified or very poorly opacified kidney (of either side) on I.V.U.
2. Patients with chronic renal failure (Serum Creatinine of more than 2mg)
3. Patients with diabetes or hypertension of more than 5 years.
4. Patients with parenchyma renal disease

## Investigations

After taking history regarding symptoms with duration of each complaint, each patient was examined and following investigations were done.

- (1) Urine C/E
- (2) Blood C/E

- (3) BUN & Serum creatinine
- (4) Blood sugar & serum electrolytes
- (5) X-ray plain abdomen and pelvis
- (6) Renal ultrasonography
- (7) Dynamic renal scan (99m Tc DTPA)

Renal ultrasonographic examination included following findings

- (1) Size in both longitudinal and transverse axis
- (2) Cortical thickness
- (3) Echogenicity and corticomedullary differentiation
- (4) Degree of hydronephrosis
- (5) Any other abnormality

*Dynamic renal scan*

99m Tc DTPA scan was done before P.C.N and after percutaneous nephrostomy on 2<sup>nd</sup>, 4<sup>th</sup> and 6<sup>th</sup> weeks respectively. No specific preparation is required before renal scan study. Patient emptied his/her urinary bladder before commencing the scan. Patient was asked to lie on table in prone position and gama camera was placed just above the lumbar spine. Then a dose of (10 m Ci) of 99m DTPA was injected intravenously. Injection counts of radioactivity was calculated by noting pre and post injection counts in the syringe.

The images of radioisotope scintigraphy were taken according to following frames. The scan study provided information regarding

- (1) The relative function of both kidneys
- (2) The G.F.R of both kidneys as well as total G.F.R
- (3) The perfusion index
- (4) Peak time and peak value of the Renogram curve

*Percutaneous Nephrectomy*

The procedure was explained and consent of patient was taken. The procedure was done under ultrasound guidance. The patient was placed in prone position. The skin of lumbar region was cleaned with pyodine and after draping, the puncture site was selected just below the tip of 12<sup>th</sup> rib, five fingers away from midline. After infiltration of anesthesia with 2% xylocaine, a small nick was given in the skin at puncture site with surgical blade No.11 A 20cm long 18 gauge trocar needle was introduced through the nick and needle advance forwards under ultrasound guidance. The hydronephrotic kidney was entered through lower pole at the posterolateral aspect. The needle obturator was withdrawn and efflux of urine was confirmed through the passage of trocar cannula inside hydronephrotic sac. Then a soft J shaped 100cm guide wire was passed through cannula needle, keeping the guide wire in place, the cannula needle was removed and nephrostomy tract was dilated with Teflon dilators upto 10Fr then a 7 Fr polythelene feeding tube was inserted with help of guide wire.

After removing guidewire the nephrostomy was secured to the skin with 2/0 silk. The tubing was connected with a J.M.S urine bag. Volume of urine obtained after nephrostomy in first hour was noted and a

specimen was taken for routine examination. Any complication during this procedure was also recorded.

*Indications of P.C.N.*

- (A) Diagnostic
  - i Antegrade Pyelography
  - ii Intrapelvic Pressure measurement
- (B) Therapeutic
  - i Obstruction
  - ii Infection
  - iii Urinary fistula

*Complication of P.C.N.*

- (1) Misplacement of Nephrostomy Tube
- (2) Mild haematoma
- (3) Blockage of Nephrostomy

*Follow up*

All patients undergoing P.C.N were followed up for six weeks at two weeks interval and then definite treatment was decided.

**Results**

Table 1. Distribution of patients according to sex

Sex	n=	%age
Male	11	73.37
Female	4	26.3

Table 2. Distribution of patients according to age

Age group in years	n=	%age
21-30	3	19.8
31-40	5	33.3
41-50	4	26.6
51-60	2	13.3
61-69	1	6.67

Table 3. Cause of obstruction

Diagnosis	n=	%age
Calculus Disease	11	73.3
P.U.J Obstruction (Congenital)	3	19.8
Ureteric Structure	1	6.67

Table 4. Pre PCN renal ultrasound

	n=	%age
Enlarge kidney >12cm	12	93.3
Right. Kidney	9	59.4
Left kidney	6	39.4
Moderate hydro	4	26.7
Gross hydro	11	73.3
Cortical thickness <1cm	10	67.7
Echogenicity Increased	13	86.7
Calculus	11	73.3

Table 5. Total G.F.R. Measured by 99m Tc DTPA renal scan at various occasions

Time	Minimum	Maximum	Mean - m./min
Pre-PCN	68.2	120.6	94.4
2 <sup>nd</sup> Week	64.3	124.2	94.25
4 <sup>th</sup> Week	70.5	124.1	97.3
6 <sup>th</sup> Week	71.2	125.8	98.5

Table 6 Mean G.F.R measured by 99m Tc DTRA renal scan in obstructed kidney

Time	Minimum	Maximum	Mean- m./min
Pre-PCN	2.6	29.10	15.85
2 <sup>nd</sup> Week	2.5	29.6	16.5
4 <sup>th</sup> Week	2.4	37.1	19.75
6 <sup>th</sup> Week	2.2	39.9	21.5

Table 7 Mean G.F.R measured by 99m Tc DTRA renal scan in normal kidney

Time	Minimum	Maximum	Mean- m./min
Pre-PCN	65.2	106.1	85.65
2 <sup>nd</sup> Week	58.9	104.9	82.9
4 <sup>th</sup> Week	61.2	100.	80.75
6 <sup>th</sup> Week	55.1	103.7	79.9

Table 8. Final results in GFR BY 99m Tc DTPA renal scan in obstructed kidney after 6 weeks follow up

Improvement (%) Increase in Baseline GFR	n=	%age
No	4	26.6
Mild (<25%)	1	6.67
Good (<50%)	2	13.3
Excellent (<50%)	8	53.3

Table 9 Fate of obstructed kidney after 6 weeks follow up

Fate	n=	%age
Nephrectomy	4	26.6
Pyeloplasty	1	6.6
Ureterolithotomy	1	6.6
Pyelolithotomy	9	60.6

Table 10. Sonographic finding after 6 weeks follow up

	n=	%age
Size of kidney enlarged	3	19.8
Cortical thickness	3	19.8
Echogenicity	7	46.7

## Discussion

Radiologist can help a urologist in preservation of kidney function with aid of ultrasound and renal scan. It was believed in past that outflow obstruction if present for long time, the kidneys are unlikely to have any reserve power of recover, after obstruction is removed<sup>1</sup>. Therefore, nephrectomy had been performed commonly in patients with advanced unilateral hydronephrosis.

The ability of completely obstructed human kidney to recover useful function after relief of obstruction is related to duration of obstruction<sup>4</sup>. Maximum period of obstruction, within which recovery is possible, however is not well defined and most reports are based on experimental animal work. Clinical studies based on Radiographic findings are few in number.

This was aim of study to see recoverability of renal function after draining obstructed kidney by PCN in unilateral obstructed kidney which was shown as non-functioning kidney on I.V.U. It is impossible to determine clinically the duration of obstruction or to quantify the

degree of obstruction to urine flow. Duration of symptoms varied from one week to two years in our study.

All the patients were selected for this study by non-visualization of obstructed kidney on I.V.U.

In past I.V.U has been regarded as cornerstone of urological diagnosis<sup>6</sup>. Thus radiologically non-functioning obstructed kidney was regarded as damaged and therefore should be removed surgically. So nephrectomy was recommended in such cases which has non functioning kidney on IV.U one month after obstruction. Quantitation of renal function has been performed for many years. Various methods has been developed and renal scintigrams<sup>9</sup> are often used which has resulted in nuclear medicine studies of kidneys<sup>8</sup>. Nuclear is becoming a very powerful diagnostic tool. Renal scan is often obtained to determine differential renal function in patients undergoing evaluation for possible urologic surgery.

The imaging performed using one or a combination of different radiopharmaceutical that reflect different parameters of renal function. 99m Tc DTPA (Diethelene triamine pentacetic acid) has been used in kidney as GFR agent<sup>5</sup>. It was tested by comparing its clearance to that of inulin. DTPA is well suited for camera method because of its nearly ideal physical properties for imaging and its low radiation dose.

A widely used technique is that of 99m Tc DTPA renogram with diuretic stimulus. The failure to drain after diuretic suggests obstruction. 99m Tc DTPA radionuclide diuretic renography is physiological test which provides information on the function of kidney and their response to out flow disorders<sup>7</sup>. It also supplied morphological information on kidneys and urinary tract. It is easier to perform and more accurate than IVU. With computer acquisition, relative renal functions may be determined by measuring the radioactivity in each kidney during the initial accumulation phase. However nuclear medicine study in kidney can not predict the degree of functional recovery of kidney until the raised intrapelvic pressure is relieved.

A radionuclide scan (99m Tc DTPA) was done pre and post drainage nephrostomy in all patients. The mean GFR in obstructed kidney was 15.85±1.3 in pre PCN. It was 16.5±1.61, 19.75±2.10 and 21.51±2.52 at 2<sup>nd</sup>, 4<sup>th</sup> and 6<sup>th</sup> weeks respectively. This improvement in GFR was highly statistically significant. In 4 patients (26.6%) there was no improvement in GFR after 6 weeks of nephrostomy drainage and nephrectomy was done in those patients. 1 patient (6.6%) mild improvement, 2 (13.3%) had good improvement and 8 (53.3%) had excellent improvement.

Ultrasonography is an excellent modality to help in procedure of PCN. It has success rate of 95% while performing PCN under ultrasound guidance. Advantages of ultrasonography are speed of performance, minimum strain imposed on patients and possibility in tumour anurea to create a definite urinary bypass. Ultrasound not only gives size and location of kidney but also depth from skin.

Antegrade phelography was done in 15 (100%) patients and we were able to locate the cause and site of obstruction in all cases. In all patients who had enlarged size of kidney and hydronephrosis in Pre, PCN, 11 (73.3%) had no hydronephrosis while 4 had only minimal hydronephrosis.

### Conclusion

Following conclusions were made.

- 1) on IVU we can not assess the exact functional status of kidney because in our study 11 (73.6%) patients, who were having no-functioning kidney on IVU had enough GFR on 99m Tc DTPA scan and under went for reconstructive surgery.
- 2) The recoverability was very poor in long standing stone disease. Majority of patients undergoing nephrectomy were suffering from long standing stone disease and Pyonephrosis.
- 3) 99m Tc DTPA was found, more cheap, easily reliable and convenient method for determination of total and differential GFR.
- 4) 11 patients who were advised nephrectomy in periphery on basis of IVU did well after reconstructive surgery. So we were able to save patients from emotional as well as physical trauma of nephrectomy.
- 5) Maximum improvement in GFR was noted upto 6 weeks of PCN so it is advisable to go for definite procedure after 6 weeks.
- 6) Ultrasound examination plays a vital role in pre and post PCN assessment in unliteral obstructed kidney which is cheap and reliable.

- 7) Both ultrasound and renal scan are important in diagnosing non functioning kidney on IVU and saving the patient from nephrectomy.
- 8) Male 11(73.6%) patients out numbered female 4(26.4%) with 2.31:1
- 9) 31-40 years age group is the commonest followed by 41-50 years group.
- 10) 11 (73.6%) patients had stone disease followed by 3 (19.8%) patients of obstruction at PUJ and 1(6.67%) patient of ureteral stricture.

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