Role of Physical Parameters in Assessment of Renal Function at Dynamic Reno Graphic Studies of Patients With Renal Disease

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Abstract— Renal function assessment represent a crucial partener in management of renal disease patients. serum creatinine signify the extent of renal function and it may be used for estimation of the GFR.In this study 10 cases from urology and nephrology center diagnosed as 10 cases are patients pyelonephritis . All these cases are compared by 10 cases with normal kidney function diagnosed as donors. The comparison was between the GFR value, Split function , and $T_{1/2}$. Washout phase was proposed for evaluation of some indices including $T_{1/2}$ **.** Obtaind value of T1/2 may take values ranged >20, <15 or between 15 and 20 min which represent obstruction,no obstruction or inconclusive respectively. Functioning renal mass can be indexed in terms of GRF that rpresent the sum of filtration rate through each functioning nephrons. Some patients may need dialysis or transplantation at GFR _15 mL/min/1.73 m2 because of symptoms of uremia.

Index Terms— GFR, T1/2,kidney obstruction, dynamic Renographic.

1 INTRODUCTION

Nuclear medicine is a division of medical imaging involve uses of small quantities of radioactive material in diagnose or treatment of a diversity diseases, including and not limited for many types of cancers, neurological disorders, endocrine, gastrointestinal, heart disease and other abnormalities within the body (1). The principle of nuclear medicine studies based on observing the distribution of a pharmaceutical administered to the patient that are swallowed, inhaled, or injected into the body, where they accumulate in the organ or tissue of interest. By incorporating a radionuclide into the pharmaceutical, measurements can be made of the distribution of this radiopharmaceutical by noting the amount of radioactivity present. This is accomplished by recording the emissions from the radioactivity, with external radiation detectors (gamma camera) placed in the front of the patients.(2) stated that Kidney obstruction can occur at any point in the urinary tract starting from the calyces of the kidney to the external urethral meatus. Such obstruction may be acute, or chronic; unilateral or bilateral; and total or subtotal. Renal radionuclide studies have several useful applications in the management of patients with acute or chronic urinary tract obstruction (3) Said that T1/2 between 10 and 19 minutes means an indeterminate or equivocal cases. In renal disease patients assessment of renal function is often the critical element of management.(4) decided that serum creatinine is the most collective measure of renal function in clinical practice and it may be used to assessment of GFR; however, a number of issues (age, muscle mass, illness, certain drugs, diet, tubular secretion) can upset the serum creatinine which is a non- sensitive tool for early renal disease detection (5). For all levels of GRF, there is a range of values for serum creatinine and it can continue within normal range regardless of GFR 60–80% below normal (6). Creatinine clearance offers a more reliable, sensitive and convenient method for patients to monitor renal function over the formal methods (7 and 8). In addition, it was repeated that measurement of creatinine clearance in normal patients have been revealed to have a high coefficient of variation (standard deviation/mean) 25% (9). Measuring renal function together with scan may help in understanding and role and function of a radio-nuclide and afford a baseline nessecery to monitor variations. Recurrence may be much more important than accuracy. The two most broadly used routine for measureing clearances are camera based and plasma sample techniques. Renal depth is usually assessed from a nomogram based on weight and height (10). To the degree that a population derived nomogram fails to fit a particular individual, the clearance measurement will vary from the true clearance. Clearances of both MAG3 and OIH may be assessed using injected dose and fractional amount of radioactive material whithin a single blood sample collected almost 45 min after injection (11-13). This work introduce an assessment of renal function via serum creatinine which can be used to approximate the GFR value. In this study 10 cases from urology and nephrology center diagnosed as patients pyelonephritis . All these cases are compared by 10 cases with normal kidney function diagnosed as donors. The comparison was between the GFR value, Split function , and $T_{1/2}$.

2 SUBJECT AND METHOD

2.1 subject

All cases were done in gamma camera unit at Urology and Nephrology.In the present work 10 patients suffering from renal disorders and some other normal cases (donars for

renal transplantation) have been selected. The specification of the material and equipments used in present study are given. The examination were performed with gamma camera model Philips,Brishts view Dual head. A radionuclide generator consists of a parent daughter radionuclide pair contained in an apparatus that permit separation and extraction of the daughter from the parent. The generator used in this study is Elute (Belgium) Molybdenum-99(t1/2=66h) generator produced by β decay Tc-99m(t1/2=6h) which is eluted from an alumina chromatography column to which the Molybdenum-99 using sterile pyrogen free sodium chloride solution as an eluent. -Radiopharmaceutical used were (TcMAG3,TDMSA). The Kit contain sterile components in the lyophilized form, and which after reaction with an injected solution of pertechnetate (99mTc) a mercaptoacetyle-triglycine complex(MAG3) is formed; the complex is eliminated by the kidney, almost entirely by tubular secretion. The Kit contain sterile components in the lyophilized form, and which after reaction with an injected solution of pertechnetate (99mTc) a mercaptoacetyle-triglycine complex(MAG3) is formed; the complex is eliminated by the kidney, almost entirely by tubular secretion.

2.2 Scintigraphic procedure

1.Study Acquisition:
The patient is placed in a certain position to minimize renal depth .The camera is placed posterior to the patient under image table. The prepared radiopharmacetical,3-4 mCi, (99mTc-MAG3), was injected intravenously,A1 min count of activity to be injected is obtained by placing the syringe 30cm from the center of collimator and storing the count data.

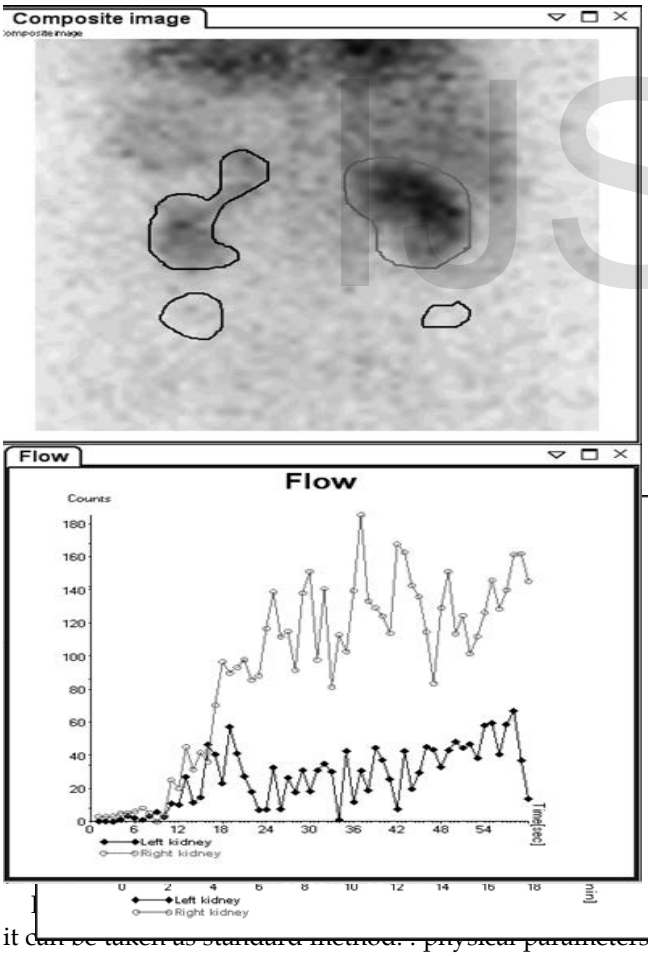
2 Dynamic(Dieutric renoghraphy.):
i) perfusion from 1sec-60sec.
ii)uptake 1-20sec(19min)
-Radiopharmaceutical dose for all adults3-5mci.
- 99m Tc-DMSA
Scintigraphy was achieved with patients in supine position posterior and anterior images were recorded 4 hours after injection of 1-3 mci 99mTc-DMSA using gamma camera.
-Static images position(posterior, anterior, both oblique).
3 Processing
i)Dynamics imaging study is a continuous sequence of static images acquired for equal increments of time(14). Dynamic images studies are used to monitor the change with the time in the distribution of radiopharmaceutical with in a single camera imaging field.
ROI for both kidney at uptake phase (2-3min).

Pyelonephritis classified as a class of urinary tract infections (UTI) affects single or both kidneys caused by a virus and/or bacterium infection. Viruses and bacteria may move to kidneys from bladder or other parts of body through the blood stream. Cystits is a urinary tract infections in bladder does not move to kidneys. Peoples with bladder infection and those with a anatomic or structural problem in the urinary tract were at risk for for pyelonephritis. Normally, Urine flows in one direction. Otherwise, urine flow may blocked in some peoples with a structural defect of UT including enlarged prostate and kidney stone. In vesicoureteral reflux (VUR) urine may also reflux or back up to one or both kidneys as a result of damage in valve that normally prevents revetrse flow. VUR usually diagnosed within childhood. Diabatics, pregnant women and weakened immune system persons are also of increased risk of pyelonephritis. (15) Vesicoureteral reflux (VR) and Acute pyelonephritis (AP) are moderately common in children, exclusively infants (16). Damaged renal areas usually exchanged by fibrous scars that led to renal failure and arterial hypertension (17) as a result of relatively high frequency of renal sequelae after AP in childs, pediatric patients who develop AP or severe reflux grades are routinely observed closely.

Although these complications are well known in children, few studies have evaluated the risk of long-term complications of AP in adults. Therefore, it is not clear whether there is a need to closely observe adult patients who develop . pyelonephritis) by comparing physical parameters to table1 (normal cases) there is reduction in GFR and with comparing mean value of donors) 1to left and right(52.399-53.879) to mean value of GFR to pyelonephritis). (37.444-52.512) we notice that there a reduction in cases of pyelonephritis).

There are 10 cases which are the donors cases "Normal cases (free from any renal diseases)", in this table there are two main parameters, T1/2, GFR, for lift and right kidneys, where T1/2 of the left kidney ranges between(4.50-15.25), and T1/2 of right ranges between (5-14). While GFR of the left kidney ranges between (40.60-70.12),and GFR of the right kidney ranges between (46.66-64.66). And there are 10 cases which are the pyelonephritis cases, in this table there are main parameters T1/2 ,GFR, for left and right kidney, where T1/2for left (2.75-31.7)and GFR(13.68-72.50). For right GFR (11.87-68.81) and T1/2(5.75-14.52).

3 Results and Discussion



it can be taken as standard method. . physical parameters play a role in assessment of renal function at dynamic Reno graphic studies of patients with renal disease The results of the current st udy T½ value to differentiate between obstruction from non-obstruction cases by compare the results with the standard values of T1/2 ,GFR, for left and right kidney, where T1/2for left (2.75-31.7)and GFR(13.68-72.50). For right GFR (11.87-68.81) and T1/2(5.75-14.52) for abnormal cases while these values differes from standard values of normal cases presents .so it means that we can take a GFR and T1/2 as an indicator to detect and monitor the renal kidney efficiency for asses normal and abnormal cases.

REFERENCES

[1] General Nuclear Medicine Copyright© 2014, Radiology Info. Org Page 1 of 9 Reviewed Feb-12-2014.
[2] Gopal B. Saha, Physics and Radiobiology of Nuclear Medicine .3 rd ed.New york 2006, 2001, 199336 Chandra R Nuclear medicine physics: the basics, 5th edn. (1998).
[3] R. Ganatra, M. Nofal; Hand book of nuclear medical practices in the developing countries;ch.31Kidneys and urinary system by Gopina-than Nair Vienna, 1992.
[4] Conway JJ: Well-tempered diuresis renography: Its historical devel-opment, physiologic and thechnical pitfalls, and standardized tech-nique protocol. Semin Nucl Med 1992; 22:74-84.
[5] Levey AS,MadaioMP, Perrone RD (1991) The kidney. In: Brenner BM, Rector FC (eds) Laboratory assessment of renal disease: clearance, urinalysis and renal biopsy. WB Saunders, Harcourt Brace, Jovanovich, Philadelphia, PA, pp 919–968.
[6] Levey AS,MadaioMP, Perrone RD (1991) The kidney. In: Brenner BM, Rector FC (eds) Laboratory assessment of renal disease: clearance, urinalysis and renal biopsy. WB Saunders, Harcourt Brace, Jovanovich, Philadelphia, PA, pp 919–968.
[7] Rosenbaum,J.L. (1970) Evaluation of clearance studies in chronic kidney disease. J Chron Dis 22:507–514.
[8] O'Reilly PH (1992) The importance of renal function for the interpretation of diuresis renography. Br J Urol 69:121–125
[9] Brochner-Mortensen J, Rodbro P (1976) Selection of routine. method for determination of glomerular filtration rate in adult patients. Scand J Clin Lab Invest 36:35–43
[10] Tonnesen KH, Munck O, Hald T, et al. (1974) Influence on the radiorenogram of variation in skin to kidney distance and the clinical importance hereof. In: Zum Winkel K, Mlaufox MD, Funck-Bretano JL (eds) Proceedings of the International Symposium on Radionuclides in Nephrourology. Thieme, Stuttgart, pp 79–86.
[11] Russell CD (1993) Optimum sample times for single-injection, multi-sample renal clearance methods.
[12] Bubeck B (1993) Renal clearance determination with one blood sample: improved accuracy and universal applicability by a new calculation principle. Sem in Nucl Med 23:73–86.
[13] Blaufox MD, Middleton ML, Bongiovanni J, Davis BR (1996a) Cost efficacy of the diagnosis and therapy of re-

novascular hypertension. J Nucl Med 37:171–177.

[14] Murray IPC, Ell PJ (1998) Nuclear medicine in clinical diagnosis and treatment. Churchill Livingstone, Edinburgh.

[15] National Institute of Diabetes and Digestive and Kidney [Diseases (NIDDK), part of the National Institutes of Health.

[16] Hoberman A1, Chao HP, Keller DM, Hickey R, Davis HW, Ellis D.,Prevalence of urinary tract infection in febrile infants. J Pediatr. 1993 Jul;123(1):17-23.

[17] Jacobson SH,Eklof O, Eriksson CG et al.(1989) development of hypertension and uraemia after pyelonephritis in childhood.twenty seven year follow up .BMJ299703.