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Measurement of rabbit's Glomerular Filtration rate (GFR) by Scintigraphy

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ABSTRACT

Nuclear medicine has been rapid progress in recent decades. In this method, the administration of radioisotopes to the body and accumulation of these substances in the tissues, specific imaging is obtained, which is based on distribution of Gamma radiations exposed from these radioisotopes and recording of them. In this study we aimed to assess the physiological behavior of rabbit's kidneys by Scintigraphy and the results presented for use in future studies. In present study, six non-pregnant adult apparently healthy rabbits were selected for the attainment of the German race and their racial purity of the whereabouts of the animals was purchased. In our investigation, the mean value of total GFR was 114.01±7.6 ml/min which was consist of right and left kidney's GFR about 56.05±4.2 and 57.12±4.4 ml/min respectively. There is no significant difference in GFR obtained from right and left kidneys.

Keywords: kidney, physiology, rabbit, Scintigraphy

INTRODUCTION

Renal scintigraphic imaging is very important in nuclear medicine, In addition to the structural composition of the kidney, the physiological function of the kidneys reveal. Also, can be detected most of the kidney's severe disease [2,7,8,10]. Considering that kidneys are one of the very important body organs which with their physiological functions, excrete toxins and maintain the body water. Nuclear medicine has been rapid progress in recent decades. In this method, the administration of radioisotopes to the body and accumulation of these substances in the tissues, specific imaging is obtained, which is based on distribution of Gamma radiations exposed from these radioisotopes and recording of them. Nowadays, the Gamma cameras are used in nuclear medicine centers for this purpose. In this study we aimed to assess the physiological behavior of rabbit's kidneys by Scintigraphy and the results presented for use in future studies. Imaging of renal function includes assessment of blood flow, parenchyma and discharge of organs. The radioisotopes used in diagnostic imaging [3,10,13].

Gamma radiations, which is made by isotopes, are hit to detector made of large crystal of iodine and potassium as activator and are converted directly to light energy or photons. The picture shows the spatial distribution of isotope

in the kidney called Scintigram. Immediately after intravenous injection of a small amount of radioisotope scan makes. Scintillating counter is placed on each of the kidneys on the skin and both before and after injection of the radiopharmaceutical agent, the study will be done [3,13,14]. Scintigraphic images all show the spatial distribution of the radiopharmaceutical agents. Complications such as non-symmetric imposes exchange the kidneys, delayed absorption of radioactive material in the pelvis and uniform parenchymal may be important in diagnosis. Time-activity curves were obtained by Gamma non-visual probes called renogram. Today, computers and Gamma cameras facilitate obtaining of scintigraphic images and production time - activity curves by drawing lines and marking specific areas. All the renal failures associated with the excretion of the kidneys, renal tubular failures and failures associated with the renal perfusion can be detected by renogram [10,13]. Various intermediates labeled with technetium - 99m, which normally are used in all imaging includes: diethylenetriaminepentaacaticacid, 2.3 – Dimercaptosuccinic Acid (DMSA) and Glucoheptonate [10,14]. Technetium 99m diethylenetriaminepentaacaticacid is known as a chelating complex made of reduced diethylenetriaminepentaacaticacid. Chelating agents make complexes with radioactive or non-radioactive materials. Measurement of GFR needs to radiopharmaceutical agent which cannot attach to the protein and do not secreted or absorbed by the tubules. ^{99m} TC –DTPA has above mentioned properties and being tracked by cameras order to accumulate a sufficient number of photons is contained in its structure. Filtration pressure is net pressure that pushes fluid through the Glomerular membrane to out and is equal with Glomerular pressure minus summation of Glomerular colloid and capsular pressures. In the kidneys, a liquid similar to the Glomerular capillary plasma filtered into the renal tubules that process is called Glomerular filtration. As filtered fluid (Glomerular filtrate) passes through the tubules, it reduced in volume and composition through the tubular reabsorption processes (absorption of water and soluble substances from the tubular fluid) and tubular secretion (discharge of material into the solution tubular fluid) altered. And finally, consisted urine enters into the pelvis. By comparing the composition of plasma and urine together, as some of these changes can be realized. Thus, the route of maintenance of water, electrolytes and body important metabolites and also excretion of waste disposal reveal. Several renal diseases made different disturbances that some of them are similar in different diseases [1,4,11,16].

MATERIALS AND METHODS

In this survey we used of double-detector ADAC apparatuses model Vertex. These apparatuses were calibrated and special software was designed. Six non-pregnant adult apparently healthy rabbits were selected for the attainment of the German race and their racial purity of the whereabouts of the animals was purchased. Blood examinations such as Cr, Bun, CBC were done for assurance of kidneys normality. Height and weight of animals also were recorded. For Scintigraphy, animals were taken under anesthetic condition and were recumbence on back. Later on, ^{99m} TC-DTPA was injected from ear vein as bolus at the 2 mCi. Mie was the name of counter machine. During the action, one person was careful to constantly move that the animal does not carry out operations to disrupt the scan. Scintillator was set under the table near the kidneys. After rapid injection of radioactive agent by an insulin syringe, imaging started. Secondary activity of the insulin syringe after injection was measured by the counter device. Animals were anesthetized by ketamine at the 35 mg/kg as main drug and acepromazine and xylazine at the 1 and 5 mg/kg respectively as pre-anesthetic drug [9]. For Better to count on the animal's ear injection site was considered as a lead guard. Immediately after injection, dynamic scanning was started. The computer program was set so that images of angio phase at 1 minute and other images scans were used in subsequent periods and total duration was 30 minutes of renal nuclear imaging. Renogram was drawn by computer in regions outline interest (ROI) mode. Then GFR was measured by Gates method by computer, all renograms were printed and recorded for further studies. Finally, GFR of right and left kidneys were compared by T-test.

RESULTS

Figure 1 shows sample of captured dynamic scan by ADAC Gamma camera. Figure 2 also shows renography obtained from ADAC Gamma camera.

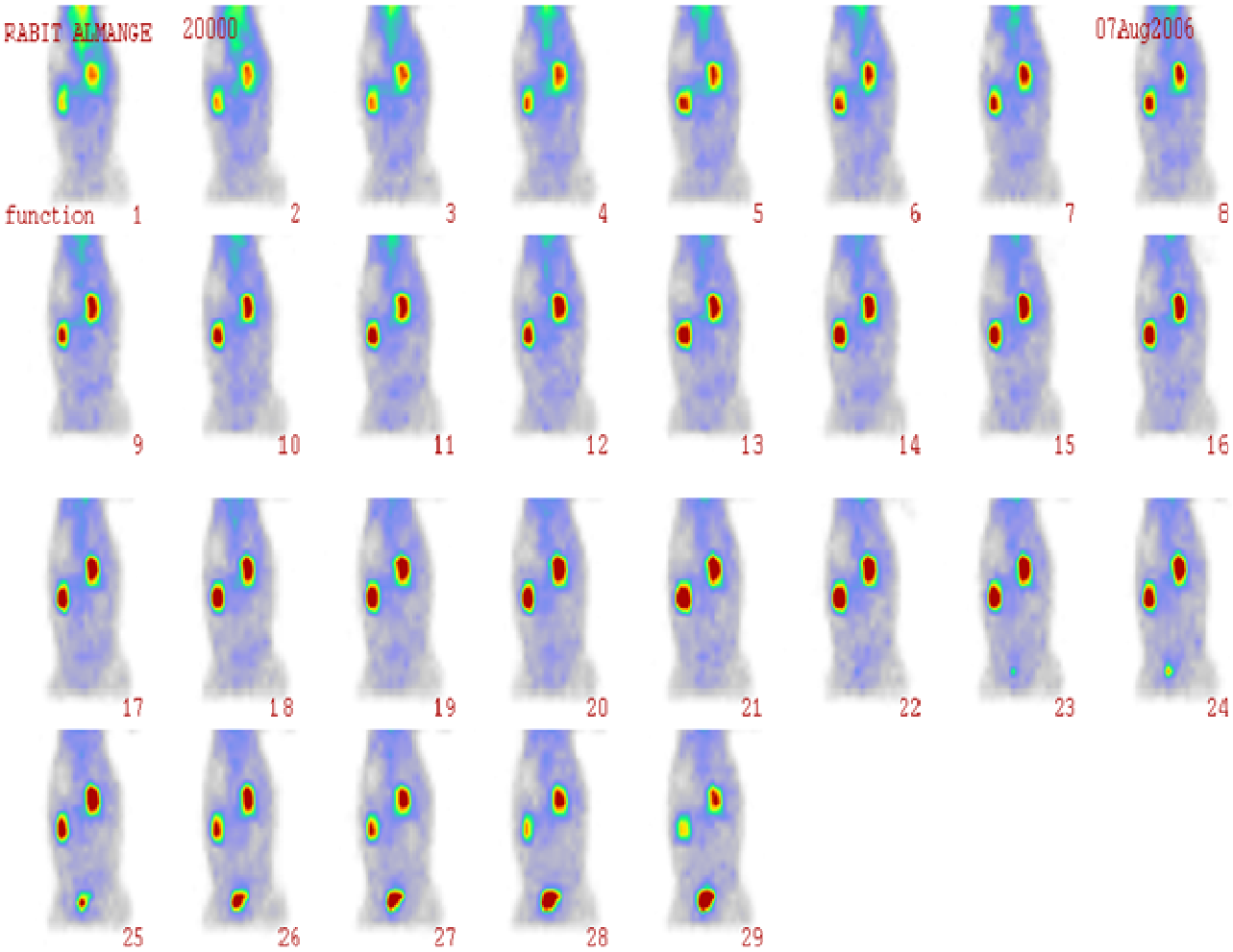

Figure 1: Renal scan obtained from ADAC Gamma camera

In our investigation, the mean value of total GFR was 114.01±7.6 ml/min which was consist of right and left kidney's GFR about 56.05±4.2 and 57.12±4.4 ml/min respectively (table 1).

Table 1: Data obtained from measurement of GFR of right and left kidneys.

Kidneys	Mean	Standard deviation
Right	56.05±4.2	114.01±7.6
Left	57.12±4.4	114.01±7.6

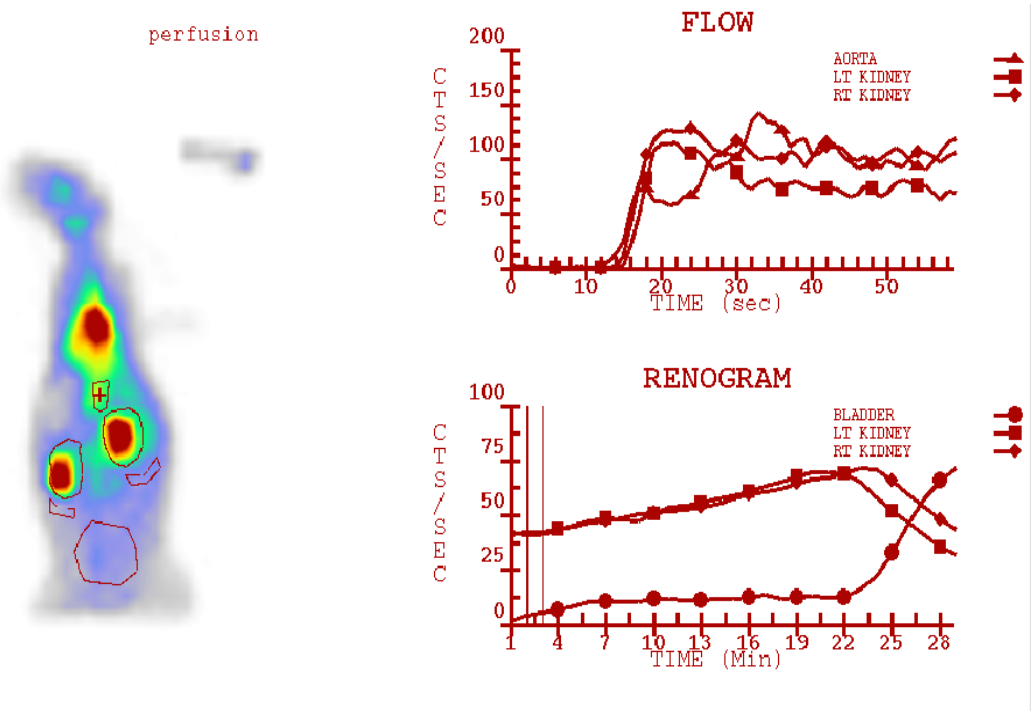

Figure 2: Renogram obtained from renal scans by ADAC Gamma camera

DISCUSSION

Size, shape and position of the kidneys are possible by radionuclide imaging. Scintigraphy has been proposed and used in evaluating the functional and physiological activities [2,10, 13, 16]. Scintigraphy is used in the animals [5, 7, 8, 15] especially on rabbits [7, 12, 16, 17]. Renal Scintigraphy is done in rabbits for many purposes. Our results, also confirmed reports by other researchers, conducted at the rabbits scintigraphy of kidneys know that is consistent with reports by researchers in this field [5, 6, 11, 14]. ^{99m}Tc-DTPA can be used in the kidneys Scintigraphy [10, 25, 31]. In the rabbit study also revealed that this drug can be used in Scintigraphy of all the animals, which compatible with the findings of other researchers [5, 6, 15]. The use of this drug, reports of side effects like kidney failure to respond to this medication, allergic and fatal side effects not being observed. In our investigation, the mean value of total GFR was 114.01±7.6 ml/min which was consist of right and left kidney's GFR about 56.05±4.2 and 57.12±4.4 ml/min respectively which is align with results of other researches. In this study, the GFR of right kidney compared with the left kidney was not significantly different ($P>0.05$). Renal Scintigraphy revel the anatomical structure and physiological functions of kidneys which is reported previously. Even with assessment of the scanned images it seems that Scintigraphy can identify certain diseases of the kidney which is supplementary in accurate diagnosis and is compatible with reports by other researchers [10, 14, 16]. The investigation revealed, Scintigraphy of rabbit's kidneys many similarities with human kidney Scintigraphy [10, 13] and computer programs such as scanning and collecting imagery and drawing ROI in this animal also applied to be a particular and does not problem created. In assessment of obtained scans it revealed that accounting the radioactive agents is achievable and is done easily by computer programs of Gamma cameras. The present study revealed the GFR can be considered as a method of using this technique and can be calculated by computer programs. In addition, drawing of rabbit's kidney renogram is performable by computer programs and applications of this technique in rabbits are possible and have no problem. Drawing of rabbits renogram like human kidney [11, 13, 14] is done by the ROI method is applicable and available. Execution and time steps of Scintigraphy by computer in rabbits are similar with those done in humans and can be assay by especial programs. Scintigraphy considers as a method useful in diagnostic imaging and veterinary science and animal physiology. And from animals like rabbits can be used in medical research work and veterinary medicine as a specific animal models used in nuclear medicine research. The use of nuclear medicine techniques in animals can be very useful in physiological researches.

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REFERENCES

[1] Annet L, Hermoye L, Peeters F, Jamar F, Dehoux JP, *Van Beers BE J Magn Reson Imaging*, **2004**, 20(5), 843-9.
[2] Armstrang P, *Diagnostic Imaging*, 4th edition, Mosby Chicago, **1999**, 234-240.
[3] Awuawanne A, *The hand book at radiopharmaceuticals*, 1st edition, Champan and hall, London, **1995**, 110-157.
[4] Blaufox M, *J. Nucl. Med*, **1991**, 32, 1301-1309.
[5] Bowen J, Sharma H, Gough DC, *Br J Urol*, **1994**, 74(1), 26-30.
[6] Chou YH, Hsu CP, *Urol Int*, **1991**, 46(2), 126-8.
[7] Dahlager JI, Bilde T, *Scand J Urol Nephrol*, **1980**, 14(1), 85-90.
[8] Ertay T, Unak P, Tasci C, Zihnioglu F, Durak H, *Appl Radiat Isot*, **2005**, 62(6), 883-8.
[9] Flecknell P, *British Small Animal veterinary Association*, **2000**, 30-31, 106.
[10] Henkink R, Boles M, Dillehay G, *Nuclear Medicine*, Mosby-year book, St louis, **1996**, 1055-1090.
[11] Liu G, Zhang C, Liu F, Wang R, Fu Z, Li G, Miao Z, *Nucl Med Biol*, **2002**, 29(4), 399-404.
[12] Mariani G, Augeri C, Pretolesi F, Mereto E, Curti G, Martinoli C, Martelli A, Derchi LE, *Acad Radiol*, **2000**,7(9), 705-10.
[13] Mettler F, *Essentials of Nuclear Medicine Imaging*, 4th edition, Saunders, Philadelphia, **1998**, 335- 356.
[14] Sutton D, *Nuclear Medicine in radiology and imaging for medical students*, Churchill living stone, Edingburgh, **1998**, 142.
[15] Takami A, Yoshida K, Tadokoro H, Kitsukawa S, Shimada K, Sato M, Suzuki K, Masuda Y, Tanada S, *J Nucl Med*, **2000**, 41(4), 763-9.
[16] Wilkinson SP, Bernardi M, Pearce PC, Britton KE, Brown NJ, Poston L, Clarke M, Jenner R, Williams R, *Clin Sci Mol Med*, **1978**, 55(3), 277-83.