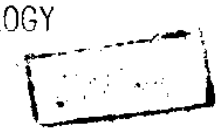
AIN SHAMS UNIVERSITY
FACULTY OF MEDICINE
DEPARTMENT OF UROLOGY

RADIO-ISOTOPES IN UROLOGY



ESSAY

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BY

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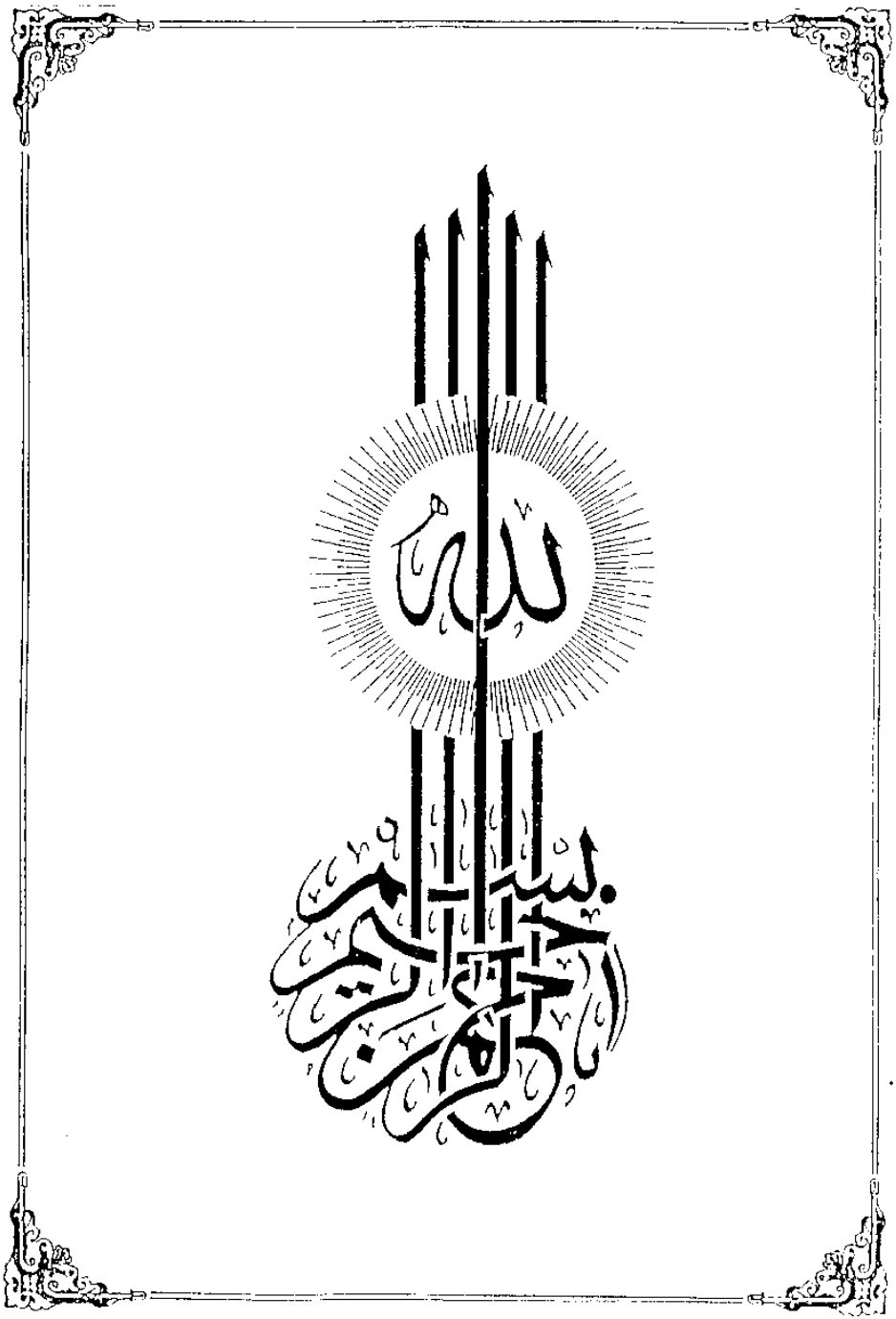

THIS WORK

IS DEDICATED TO

MY BELOVED PARENTS

ACKNOWLEDGMENT

To the ALMIGHTY GOD, to HIM, WHO created heavens and earth, to HIM, WHOSE knowledge is beyond all knowledge, WHO guides us to the path of rightfullness, I kneel to express the very humble gratitude of one of HIS very humble subjects.

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Mohammed Soliman

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C O N T E N T S

INTRODUCTION

I N T R O D U C T I O N

RADIOISOTOPES IN DIAGNOSTIC UROLOGY

* In 1956 : Taplin and Winter produced an activity-time curve on a chart recorder of the renal scintillations following I.V. Injection of ^{131}I-labelled diadrast and thereby established the first practicable isotope renogram.

* 4 years later : Mc Afee and Wagner (1960), using ^{203}Hg-labelled neohydrin and a rectilinear scanner, obtained the first detailed isotope images of the kidney. When diadrast gave way to the superior Hippuran (Tubis et al., 1960) and ^{203}Hg to the less radio toxic ^{197}Hg (Sodee, 1964), the new speciality of nuclear medicine was welcome as a significant advance in investigative urology.

* The almost inevitable advances in science and technology made available a new generation of radionuclides such as Iodine ^{123}I and technetium ^{99}m and the gamma camera computer system to replace the old rectilinear scanner.

* At last, Nuclear medicine has began to achieve the potential it showed 20 years ago and establish itself as one of the most important and valuable investigative methods available to the clinical urologist.

The current spheres of importance of nuclear medicine to urology can be divided into three groups :

Radioisotope Imaging:

Excretion urography remains the standby for the initial examination of the urological patient, it provides the anatomical details particularly when combined with nephrotamography. There are nevertheless certain situations where standard radiology required some complementary procedures to clarify urographic abnormalities .

* 1) Space Occupying Lesions:

Ultrasound is often called upon space occupying lesions to distinguish between solid and cystic lesions.

Its accuracy varies from 71% to 98% (Barrnett and Morley , 1971) while Sherwood has achieved figures of 98% accuracy in cystic lesions and 86% in tumours.

Radioisotopic gamma camera imaging also has a place here. Using a gamma camera, it is possible to acquire a dynamic pictures of passage of ^{99m}Tc-gluconate through the aorta, renal arteries and intrarenal vasculature following intravenous injection. By this method we can delinate

mass lesions of the kidney particularly those more than 1 - 2 cm in diameter. Also the use of renal cortical agents can delineate the differentiation between hypertrophied column of Bertin from renal tumor.

Using both radioisotope scanning and ultrasound showed high degree of accuracy and together gave complementary accurate information in 82% of cases(Velchik,1985).(Fig.1,2,3). So the combination of the two procedures carries more diagnostic weight and reduces the need for arteriography which can be reserved in:

- Cases still equivocal.
- In patients in whom some idea of the anatomy of the renal vasculature is required.
- or in cases where embolisation is indicated.

* 2) <u>Parenchymal Disorders</u>:

The standard urogram gives better collecting-system detail than cortical detail. Radiopharmaceuticals such as ^{99m}TC-gluconate allow imaging by the fact that after injection they are retained in the cells of convoluted tubules , making parenchymal visualisation the outstanding characteristic of the radionuclide scan.

Gamma camera imaging can be of great value in the following:-

- Localising ectopic kidneys.
- Assessing the isthmus of horse-show kidneys.
- Locating renal tissue not seen on urography (e.g. pelvic organs).
- Evaluating grafts after renal transplantation.
- Assessing parenchymal involvement in renal abscesses and carbuncles (O'Reilly et al., 1980).

Other radiopharmaceuticals such as D.M.S.A.(dimercapto succinic Acid) can be used and characterised by:

(a) Long injection - to - scanning time.

(b) Higher level of fixation than gluconate.
(50% of it retained in the kidneys after 1 h. and 70% of it retained after 2h.

(c) Gives very sharp cortical images with little background after two hours.

(d) Gives a detailed assessment of functional parenchymal mass and cortical scarring in pyelonephritis.

Other radiopharmaceutical is gallium-67 which has the ability to concentrate in lymphoid tissue is used in

(a) Assessment of perinephric abcess and pyelonephritis.

(b) Demonstration of genito urinary T.B.

(Hurwitz et al.,1976).

* 3) Prostatic Lymphoscintigraphy:

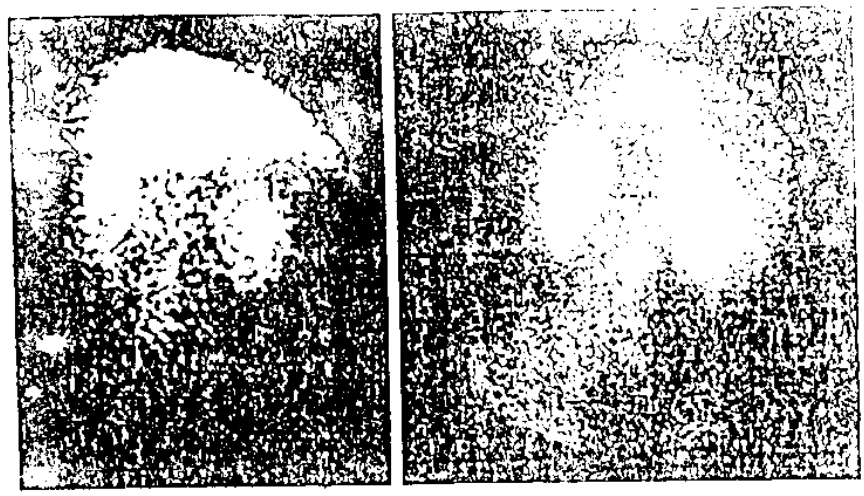
Using radionuclides in demonstration of nodal metastasis in carcinoma of prostate. The technique involves the injection of ^{99m}TC-labelled antimony sulphide into the prostatic capsule transperineally or transrectally followed by gamma camera imaging of the pelvis 3hrs or later (Stone et al., 1979)-(Gardiner et al., 1979).

This technique was objected due to the possibility of disseminating tumour cells also the injection should be in the capsule rather than parenchyma.

The radionuclide attempts in assessing prostatic regional lymphatics should be continued because of:

(a) Increasing interest in radical - beam radiotherapy for treatment of prostatic cancer.

(b) The presence of regional nodal metastasis has an adverse effect on the prognosis after total prostatectomy and radiotherapy.



(a) (b)

Fig.(1): a- Normal vascular renal scan using ^{99m}Tc-gluconate.
b- Normal parenchymal renal scan using ^{99m}Tc-gluconate.

Fig.(2): a- Vascular ^{99m}Tc-gluconate scan showing vascular right lower pole.
b- Parenchymal study showing right lower pole space-occupying lesion-vascular lesion.

Fig. (3): a- Vascular ^{99m}Tc-gluconate scan showing a vascular right upper pole.

b- Parenchymal study showing space-occupying right upper pole-avascular lesion.

(III) Imaging of Testicular Blood Flow:

Images of blood to the testicles are obtained after I.V. injection of 5 - 15 mc. of ^{99m}Tc pertechnetate, (Kogan and Hatter, 1988).

(IV) Bone and Tumour Scanning:

The bone scan is much more efficient in detecting early metastatic neoplastic involvement than x-ray studies. Tumour scanning with gallium-67 citrate to detect neoplasm and abscess or infection (Powell and Barnett , 1984).

Haskin et al., 1961 , administered 5 µci of ^{32}P per Kgm. of body weight to 29 patients 24 hours later a miniture Geiger counter was inserted rectally. Count rates greater than 50% above supposidly normal tissue were considered indicative of malignancy of the 29 men, pathology showed nine to have a malignancy, while the P^{32} count indicated eight.

^{99m}Tc polyphosphate bone scan has been widely used. The scan is much more sensitive than osteography in demonstrating metastases (Smith, 1984).