

THE SPECIFIC ROLE OF EXCRETION UROGRAPHY EXAMINATION  
IN  
PATIENT MANAGEMENT  
AT  
KENYATTA NATIONAL HOSPITAL

A ONE YEAR PROSPECTIVE STUDY

A DISSERTATION SUBMITTED IN PART-FULFILMENT FOR THE  
DEGREE OF MASTER OF MEDICINE  
IN  
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UNIVERSITY OF NAIROBI

by

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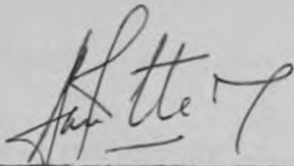
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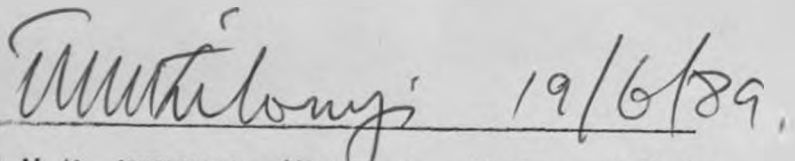


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TITLE:

THE SPECIFIC ROLE OF EXCRETION UROGRAPHY  
EXAMINATION IN PATIENT MANAGEMENT

AT

KENYATTA NATIONAL HOSPITAL

A ONE YEAR PROSPECTIVE STUDY

## SUMMARY:

A total of 484 patients who underwent excretion urography examination at Kenyatta National Hospital in one year period were studied. These were 235 (48.6%) males and 249 (51.4%) females. 265 (55.4%) were out-patients and 216 (44.6%) were in-patients.

The commonest indications for requesting excretion urography were as follows: Inflammatory conditions of urinary tract (13.6%); abdominal masses non-renal (21.8%); Incontinence (8.9%); Hypertension (8.9%); Symptoms and signs of renal stone (8.7%) etc. Rare indications for requesting the examination were as follows:-  
Haematuria (2.7%); Surgical procedures involving urinary tract (2.3%); Suspected bladder malignancy (1.2%); abdominal colicky pain non-renal (1.2%); Renal failure (1.0%); Enuresis (0.8%) etc.

Indications which showed high number of normal urograms include; Enuresis (100.0%); abdominal colicky pains non-renal (83.3%); renal calculi (71.4%); hypertension (72.1%) etc. Patients with urograms which were normal or did not add any new information required further clinical evaluation to ascertain cause of their symptoms and signs. Indications which had a high number of urograms, with results not leading to change in already established management were as follows; renal failure (80.0%); prostatism (68.8%); Incontinence (62.8%) etc. Indications which showed high number of abnormal urograms were as follows: Renal failure (100.0%); Haematuria (92.3%); Renal masses (79.5%) etc.

Indications which showed high proportional for further radiological investigation(s) after urography, were as follows: Haematuria (38.5%); renal masses (35.9%); abdominal masses (20.5%) obstructive uropathy (20.5%).

## INTRODUCTION

Excretion urography (Ex.U.) is the most frequently used radiological examination for evaluation of urinary tract diseases. It has the advantage of demonstrating the whole of urinary tract proximal to the urethra. Urinary tract consists of renal parenchyma and pelvis, ureters, bladder and urethra.

By using excretion urography, anatomical (morphological) analysis of urinary tract and the relation of urinary tract to other abdominal organs, adjacent to it can be made. Using the same examination with little modification in technique, renal function abnormalities can be also be detected. Since most of urinary tract can be visualized, and renal function abnormalities can reasonably be detected, indications for requesting this examination are so numerous. Whenever there is suspected urinary tract pathology; renal function abnormality, or any other pathology which may interfere with urinary tract, this examination is usually requested.

The purpose of this study, is to determine what is the role of excretion urography in patient management at Kenyatta National Hospital knowing its so many indications and it being a basic routinely done examination of the urinary tract.

The objectives of this study are as follows:-

BROAD OBJECTIVE:-

The specific role of excretion urography examination in patient management at Kenyatta National Hospital, a one year prospective study.

Specific Objectives:-

- (1) To find what are the commonest indications for excretion urography examination at Kenyatta National Hospital and for each indication to determine the proportion of normal, and abnormal findings.
- (2) To find out in what particular indications further radiological investigations were requested after excretion urography examination and to determine their proportion.
- (3) To determine the effect of Excretion Urography examination findings per indication on clinical management of the patients.

REVIEW OF LITERATURE

There are numerous conditions which may require excretion urography examination during the course of patient management. It is also known that, excretion urography is a basic, routinely done examination of the urinary tract.

Mellins et al (17) did a study on the indications for excretion urography, in a total of 1,622 patients as a study population. The indications can be in form of symptoms, signs, or laboratory findings. Mellins et al listed them accordingly as follows:-

<u>Symptoms</u>	<u>Signs</u>	<u>Laboratory findings</u>
		<u>Part I</u>
None	None	Not yet back
Pain-abdominal	Fever	
back	Eodema	Negative
flank	Hypertension	Microhaematuria
testicular	Abdominal bruit	Pyuria
Dysuria	Mass - abdominal	Proiteinuria
Gross haematuria	- frank	Hypercalcaemia
Nocturia	- pelvic	10 <sup>5</sup> organisms
Enuresis	- testicular	Alkaline phosphatase
Oliguria	Pros-tatic - tenderness	Acid phosphatase
Pneumaturia	- nodule	Cylindruria
Polyuria	- enlargement	Bence-Jones protein
	Priapism	Adrenal hormones
	Phimosiis	
Frequency		
Dribbling	Paraphimosiis	Polycythemia
Urinary retention	Hydrocele	Hyposthenuria
Hesistancy	Spermatocele	Isosthenuria
Urgency	Varicocele	Hyperuricemia
Incontinence-Stress	Hypospadias	Uricosuria
-Urge	Epispadias	Other
		<u>Part II</u>
Haematuria	Others	BUN Value
Impotence		Creatinine Value
Weight loss.		



In this study, they employed the use of likelihood ratio 'L' which is true positive ratio (sensitivity) divided by false positive ratio. Indications with 'L' greater than one increase the likelihood of an abnormal urogram and those with 'L' less than one decrease the likelihood of a normal urogram. Out of a total of 1,622 patients investigated; 442 were follow-up patients and 1,180 new patients.

Their results showed that, haematuria (gross or microscopic), flank pain, and pyuria are the only indications with 'L' values significantly higher than one, in the follow-up group. For the rest, 'L' was about one demonstrating that on average indications did not affect the likelihood of abnormal urograms. For new patients; Haematuria, nocturia, elevated creatinine, elevated BUN, and proteinuria are indications which had 'L' significantly higher than one. (17). Most indications did not show 'L' values which are significantly lower than one due to the fact that, patients were originally screened by a primary physicians, then consultants before the requests were made.

From this study, one can deduce that there are specific symptoms and signs once present, you are almost liable to get an abnormal finding in urogram e.g. Haematuria.

There are also, certain laboratory findings for example, increase in creatinine or BUN levels which once present you are more likely to get an abnormal urogram. So when Excretion Urography is done on a patient with one of these findings you are almost certain you are going to pick an abnormality.

Kreel et al investigated 1,476 patients who were subjected to excretion urography examination in a 15 months period. (14). They listed the indications for Excretion Urography in these patients as follows: urinary infection-19%, abdominal pains other than renal colic-19%, haematuria-10%, prostatism-10%, hypertension-8%, confirmation of abnormality-7%, renal colic-5%. The above indications accounted for a total of 78%. The rest of indications which were grouped as 'others' accounted for 22%.

The percentage (mean values) of abnormal urograms picked from above indications were as follows: prostatism-92%, renal colic-58%, haematuria-43%, urinary infection-30%, hypertension-21%, abdominal pains other than renal colic-20%. From these figures we can deduce that, abnormal urogram was a common finding in prostatism and less common in abdominal pains other than renal colic.

For the patient with abdominal pains, one is likely to get a normal urogram; bearing in mind the cost of excretion urography investigation, one will attempt to do other investigations first rather than embarking on Excretion urography in such a patient.

Kleel et al (14) investigated 156 patients who underwent excretion urography because of haematuria, using four categories of evidence presented for haematuria as follows:-

- (a) Those with red cells present in MSU specimen showed 71% abnormal urograms.
- (b) Frank history of haematuria with no laboratory MSU results showed 34% abnormal urograms.
- (c) Occult blood identified in a urine specimen in the ward by a nurse or general practitioner showed 38% abnormal urograms.
- (d) No history or laboratory evidence of haematuria in case notes showed 42% abnormal urograms.

They concluded that urograms from those with the strongest evidence of haematuria were about twice as likely to show abnormalities compared to urograms from those with less strong evidence. This also stresses the importance of laboratory findings in pointing out the outcome of excretion urography investigations. (14).

Another association between patient history, examination and laboratory findings (BUN and urinaryysis) was shown by McRoberts et al (5) in their paper read before the American Urological Association in New York. They evaluated 601 patients who had had routine excretion urography, prior to transurethral resections, as a remedy to benign prostatic hypertrophy (BPH). Normal urographic findings were obtained in 492 patients, i.e 81.86% of the 601 patients, (leaving aside abnormality seen in urograms due to prostate gland impression on the bladder). Of the remaining 109 patients (18.14%), 17 were found to have congenital abnormalities (2.8%), none warranting further treatment. This left only 92 with acquired abnormalities of upper urinary tract i.e. 15.3%. Obstruction was the commonest of these occurring in 38 cases (6.3%) of the total patients and 41.3% of those with acquired abnormalities. Renal masses (all of them being simple cysts) were 30 cases, about 5% of total patients examined. The rest 24 cases (4%) had kidney or bladder calculi, some bilateral small kidneys and one malignant neoplasm. The only really significant statistical association occurred between the B.U.N. and upper urinary tract obstruction as identified through Excretion Urography when BUN values were elevated above 40 mg/dl, the kidneys of 60% of the patients showed variable degree of obstruction.

More important, when severe obstruction (enough to delay surgery) was observed, the BUN value was always elevated by much greater value. They observed that excretion urography which is almost routinely ordered, seems to add little information to evaluation of renal function that cannot be obtained from less expensive laboratory tests. (5).

A study done at KNH by Kitonyi covering 200 patients who underwent Excretion Urography examination showed abnormal findings in 67 patients accounting for 33.5% of the excretion urography examinations done. (13). 66.5% urograms were reported as normal. Normal urograms can be as important as an abnormal ones because urography can also be done to remove a suspected abnormality among a list of differential diagnoses. Abnormalities seen in the above examinations were mainly hydronephrosis, hydro-ureter and hydro-calicosis, which accounted for 19.4% of the abnormal excretion urograms, prostatic enlargement 19.9%, intra abdominal mass(es) with renal tract changes 16.4%, poor renal function 7.2%, renal tract calculi 6%, and others accounted for 32.8%.

From the above review, one can see that, indications from either patient history and examination or laboratory results with strongest clinical evidence of renal pathology will always lead to an abnormal urogram, where as the reverse is also true.

The purpose of this study, is to see what effect or influence the findings of excretion urography examination (per indication) has on patient management.

## MATERIALS AND METHODS:

### Target Population:

Target population involved patients who underwent excretion urography examination in the Xray Department of Kenyatta National Hospital, during study period. Study period was from 1st January, 1988 to 31st December 1988. It involved all categories of patients, numbering 484.

### METHOD:

A. Request Form: Information contained in the patient's request form, used for booking excretion urography examination was analysed and recorded on a record sheet. (see Appendix A). Eligible Request Form was one countersigned by a Consultant Radiologist or Registrar in Radiology Department. (see Appendix B). The recorded information is as follows:-

- (i) General information: General information about the patient which was recorded in the record sheet included; Name, Sex, Age, Patient registration number, out-patient, in-patient or patient referred from other Health facilities, and X-ray Number.
- (ii) Indication for Requesting the Examination: An indication for requesting excretion urography examination from the referring Doctor was also recorded in the record sheet.

Indication was either in form of:-

- (a) Symptoms, e.g. loin pains, blood in urine etc.,
- (b) Physical signs, e.g. abdominal mass, raised blood pressure etc; or
- (c) Diagnosis, e.g. renal calculus, Carcinoma of bladder.

(iii) Relevant clinical findings and investigations:

Relevant clinical information concerning previous patient management was also noted in the record sheet. Relevant investigations done prior to excretion urography examination were also recorded e.g. Urinalysis and culture, BUN, Ultrasound, Radiographs etc.

B. Excretion Urography examination as done at Kenyatta National Hospital.

(i) Dosage

Dosage of contrast medium was determined using the weight of the patient. The maximum permissible dose was 0.8 grams of Iodine per Kilogram body weight. Practically patients dosage can be divided into **two** arbitrary levels. These are known as Normal dosage levels, high dosage levels. Most patients were subjected to Normal dosage levels, as determined by BUN results.



Taking as an example a patient who weighs 70 kilograms, these levels will be determined as shown below:-

Normal dosage level: This will be dosage of contrast medium which delivers quantity of Iodine between 12 and 30 gms of iodine.

e.g. 50mls of Conray 420-21gms, 50mls of urovison-16.25gms.

High dosage level: High dosage of contrast medium, will be that amount of contrast medium delivering over 30gms of iodine; however administered.

(ii) Methods of administration:

(a) Intravenous injection: This was the commonest method used in this study. By this method you could deliver a bolus of contrast media fast through a peripheral vein. It is a cheap method.

(b) Drip infusion method: This method was only used twice in this study. The reasons being it offers no much advantage compared to the above mentioned method (19). It is expensive; and what actually matters is the dosage of contrast and not method of introduction.

(iii) Intravenous urography technique: The following is a summary of excretion urography technique which was used during this study.

Patient preparation:- Following booking, the patient is given instructions which are also contained in a special designed form. (see appendix C). Preparation starts three days prior to examination and includes:-

- (a) Low residue diet, e.g. boiled rice, potatoes, porridge.
- (b) Mild laxatives - taken at 8p.m for three consecutive days.
- (c) Porridge (Uji) at 6p.m, no supper a day before examination.
- (d) Nil by mouth: for at least 6 hours before examination.

TABLE A: Characteristics of Urographic contrast media used in this study:-

Contrast medium	Volume mls per ampule	Iodine percentage	Weight of Iodine per ampule gms	Constituents
CONRAY * 280	20	28	5.6	Meglumine iothalamate
	50	28	14.0	Meglumine iothalamate
480	20	42	8.4	Sodium iothalamate
	50	42	21.0	Sodium iothalamate
UROGRAFIN 30% * 60% 76%	250	15	37.5	Mixtures of sodium and methylglucamine diatrizoate in the ratio of 10:66
	20	29	5.8	
	20	37	7.4	
UROVISON	25	32.5	8.125	Mixtures of sodium 40% and meglumine 18% diatrizoate
	50	32.5	16.25	
UROMIRO 300 *	20	30	9.91	65% concentration of meglumine iodamide
	30		14.865	
	50		24.775	
	100		49.55	

Special instructions were given to certain groups of patients e.g. diabetics, young children and infants.

Filming procedure:-

Immediately before injection of contrast media, the patient is instructed to void the bladder. Then he/she lays on the couch in supine position. Plain abdominal film is then taken.

(i) Plain abdominal radiograph (Scout film):

This radiograph was inspected by a Registrar or Radiologist prior to injection of contrast medium; aim being to correct any errors in patient positioning or exposure factors, to determine the need for additional radiographs e.g. oblique, laterals etc, to rule out radio opaque calculi and to see any further findings which may be associated with the patient's symptoms.

Contrast medium was then injected. Dosage and its determinants have already been discussed above. After injection timing was varied according to the indication. The routine procedure was done as follows:-

(ii) Immediate film: This was taken immediately after injection, to see the nephrogram.

- (iii) Five minute film: Taken after five minutes to see, renal outline, parenchyma and pelvi-calyceal system
- (iv) Ten minute film: Taken after 10 minutes to see mostly, the above mentioned factors. Then compression was applied.
- (v) Fifteen minute film: Taken after 15 minutes to show distension of pelvi-calyceal system after application of compression, then compression was released.
- (vi) Full length film (KUB): This was taken at twenty minutes after release of compression, to show kidneys ureters and bladder.
- (vii) Bladder view: This was taken to show the bladder when distended.
- (viii) Post Void (after micturation) film: This is to show amount of residual urine after micturation and bladder mucosal pattern.
- (ix) Additional views:
  - (a) Oblique views: These views were used in a problem - solving setting in selected patients. For example in visualizing calyceal anatomy, displaying papillary abnormalities, assessing filling defects and visualizing parenchymal abnormalities in relation to the calyces.

- (b) Prone views: These were used to visualize ureters properly, especially in suspected cases of flow - dependent obstruction at pelvi-ureteric junction (p.u.j), and elsewhere.
- (c) Delayed films:- In patients who showed poor or no function especially due to ureteral obstruction, delayed radiographs were done. It is known that a delay of up to 24 hours may be necessary to detect site and cause of obstruction (10). Sequence followed at Kenyatta National Hospital for delayed films is 1 hour, 2 hours, 3 hours, 6 hours, 12 hours, and 24 hours; but this sequence can be changed accordingly.

C. REACTIONS:

During the study period, no major or moderate reactions was seen following contrast media injection. Only minor reactions were observed. This was also shown by work done by Kitonyi at this same centre (13). Common reactions were nausea, vomiting, others include sneezing, urticaria and shivering.

D. VIEWING AND REPORTING:

This was done gradually during every procedure. Finally excretion urography films were analysed by a qualified Radiologist, together with Registrar doing this study. When the findings were equivocal other consultant Radiologists were consulted, or films were sent to 'Holy hour' daily evening - case review sessions for discussion. The final Radiological report was then analysed, and then classified depending on the indication and the findings as follows:-

- (a) Normal findings:- No abnormality seen.
- (b) Abnormal findings: In this case, there was an abnormality seen, which radiologically was either relevant or not relevant to the indication for requesting the examination. In other words, abnormality seen may have been a factor in causation of patient's symptoms and signs, but not necessarily leading to a change in patient management.

E. Radiological advice: Radiologist's advice if any, in change or further radiological investigation/s included in his report was also recorded in record sheet.

F. Patient follow-up after excretion urography examination.

After excretion urography examination and reporting patients were followed up, to see if the findings had any influence on their management in the wards or clinics.

In case of those in wards maximum period after examination was within two weeks. For those in out-patient clinics next visit after the examination.

#### Patients Grouping:

For simplicity and convenience in analysing data acquired from this study patients were grouped into the following groups:-

1. Inflammatory changes in urinary tract.
  - Urinary tract infection
  - Pyelonephritis
  - Glomerulonephritis
  
2. Abdominal mass(es):
  - Benign or Malignant mass(es) with suspected urinary tract involvement.
  - Pelvic mass(es) (benign or malignant).
  
3. Incontinence:
  - All types of incontinence, (leakage) of urine.
  
4. Hypertension:- This includes all cases of hypertension referred. Includes renal vascular, phaeochromocytoma, renal parenchyma diseases.



5. Renal calculi:- This includes all patients who were referred because of symptoms and signs of renal stone, even the already diagnosed one.
6. Obstructive uropathy:- This includes all patients suspected to have urinary obstruction, at any level of urinary tract.
7. Renal mass(es):- This includes all patients with renal mass(es) cystic, solid, benign or malignant.
8. Prostatism: This includes all patients with signs and symptoms of benign prostatic hypertrophy and other prostate anomalies.
9. Nephrotic syndrome.
10. Congenital or developmental anomalies of urinary tract e.g. ectopic kidney etc.
11. Haematuria.
12. Developmental abnormalities of external genitalia.  
This includes, ambiguous genitalia, hypospadiasis and other forms of malformation of external genitalia.

13. Surgical complications involving urinary tract.  
In this group, ureteric implantation, diversion etc plus other surgical procedures which involved the urinary tract.
14. Cases suspected to have malignancy of bladder.
15. Extra abdominal mass(es) - Includes malignant disease, not within the abdomen, to rule out renal involvement by metastasis.
16. Abdominal pains (colicky) non-renal: All acute abdominal pains which were non-renal.
17. Renal failure - Both acute and chronic.
18. Enuresis/nocturia.
19. Others; Includes miscellaneous group with several indications which are not included in any of the above groupings.

#### LIMITATIONS OF THE STUDY:-

1. Most patients referred for excretion urography examination, were first scrutinized at different levels of patient management, in clinics; wards and finally by Registrar or Consultant Radiologist; as such unless there was good indication, the examination was not done.

There is already a bias, because not all requested examinations went through as some were rejected.

2. Problems of tracing:

- (i) Disappeared patients: Excretion urography examination was done on certain patients. These patients and their films disappeared, probably because the patient had his or her own Radiologist in mind to consult.
- (ii) Case notes: Sometimes it was rather difficult to trace patient's case notes in Records office or even in the wards. Some were kept in Doctor's offices especially those which belong to private patients, more so for out-patients.
- (iii) Films (Radiographs):- Some films after being reported on, were not traceable, as such it became rather difficult to correlate Radiological findings and effect of those findings on patient management.
- (iv) Referred patients:- Few patients referred from other clinics or hospitals were untraceable after excretion urography examination.

3. Effect on patients management:- On follow up, after excretion urography examination, it was found, there was no comment in some patients casenotes, from which to deduce its effect on further patient management.
4. Limited number of patients in some indications. These lead to very high percentage proportions due to small sample size. During discussion indications with limited size had to be taken into consideration.
5. There were patients with more than one indication. In these patients indication which was more specific to renal tract abnormality was chosen.
6. There were urograms with more than one abnormality seen. Abnormality which was more specific to patients history, symptoms and signs was given more priority for this study.

#### MEDICOLEGAL CONSIDERATION

This study was done on genuine patients, who had to undergo excretion urography as part of their investigations while attending hospital. Normal method of excretion urography was used, every stage was done as expected in this particular examination, hence ethical problems did not arise. The protocol of this study was submitted to appropriate authorities and was approved.

RESULTS:

TABLE 1: Shows number of patients per sex and whether in-patient or out-patients. Percentage out of the total is also indicated in brackets.

Sex	Number of patients	in-patients	out-patients
MALE	236 (48.6%)	90 (18.6%)	145 (30.0%)
FEMALES	249 (51.4%)	126 (26.0%)	123 (25.4%)
TOTAL	484 (100%)	216 (44.6%)	268 (55.4%)

TABLE 2: Shows number of out-patients in age groups, with the findings of excretion urography.

Age	Sex	Number of patients	Percentage	Findings of Excretion Urography	
				Normal	Abnormal
0-10	M	21	7.8	12	9
	F	3	1.0	2	1
11-20	M	10	3.7	2	8
	F	14	5.2	7	7
21-30	M	26	9.7	13	13
	F	35	13.0	19	16
31-40	M	14	5.2	8	6
	F	33	12.3	18	15
41-50	M	13	4.9	7	6
	F	26	9.7	9	17
51-60	M	24	9.0	6	18
	F	6	2.1	3	3
61-70	M	22	8.2	12	10
	F	7	2.6	4	3
71-80 <sup>+</sup>	M	15	5.6	5	10
	F	-	-	-	-
Total		268	100.0	126	142

TABLE 3: Shows number of in-patients in age groups, with the findings of excretion urography.

Age	Sex	Number of patients	Percentage	Findings of Excretion Urography	
				Normal	Abnormal
0-10	M	33	15.3	11	22
	F	16	7.4	3	13
11-20	M	16	7.4	8	8
	F	20	9.2	5	15
21-30	M	19	8.7	6	13
	F	29	13.2	12	17
31-40	M	9	4.1	5	4
	F	21	9.6	5	16
41-50	M	6	2.8	4	2
	F	22	10.1	11	11
51-60	M	5	5.1	-	5
	F	11	2.8	5	6
61-70	M	-	-	-	-
	F	6	2.9	1	5
71-80 <sup>+</sup>	M	2	0.9	-	2
	F	1	0.5	-	1
Total		216	100.0	76	140

TABLE 4: Showing number of patients, percentage out of total patients, excretion urography findings, and their percentage proportional per indication in brackets.

Serial No.	INDICATIONS	Number of patients	Percentage	Excretion Urography findings	
				Normal	Abnormal
1	Inflammation	66	13.6	38 (57.6)	28 (42.4)
2	Abdominal mass(es)	63	12.8	26 (41.3)	37 (58.7)
3	Incontinence	43	8.9	11 (25.5)	32 (74.5)
4	Hypertension	43	8.9	26 (60.5)	17 (39.5)
5	Symptoms and signs of renal stone	42	8.8	27 (64.3)	15 (35.7)
6	Obstructive uropathy	39	8.2	10 (25.6)	29 (74.4)
7	Renal mass(es)	39	8.2	8 (20.5)	31 (79.5)
8	Prostatism	32	6.6	7 (21.9)	26 (78.1)
9	Nephrotic syndrome	28	5.8	12 (42.9)	16 (57.1)
10	Developmental anomalies of UT	15	3.2	3 (20.0)	12 (80.0)
11	Developmental anomalies of Genitalia	14	2.9	11 (78.6)	3 (21.4)
12	Haematuria	13	2.7	1 (7.7)	12 (92.3)
13	Surgical procedures involving UT	11	2.3	5 (45.4)	6 (54.6)
14	Suspected bladder carcinoma	6	1.2	2 (33.3)	4 (66.7)
15	Extra abdominal malignancies	6	1.2	5 (83.3)	1 (16.7)
16	Abdominal pain (non-renal)	6	1.2	5 (83.3)	1 (16.7)
17	Renal failure	5	1.0	0	5 (100.0)
18	Enuresis	4	0.8	4 (100.0)	0
19	Others	8	1.7	3 (37.5)	5 (62.5)
	TOTAL	484	100.0	204 (42.2)	280 (57.8)



TABLE 5: Effect of excretion urography findings on patient management with percentage proportion in brackets per indication.

Serial No.	INDICATION	Number of patients	Effect on patient management		
			Further clinical evaluation	No change in management	Further Radiological Investigation
1	Inflammations	66	42 (63.4)	17 (25.8)	7 (10.6)
2	Abdominal masses	63	16 (25.4)	31 (49.2)	16 (25.4)
3	Incontinence	43	12 (27.9)	27 (62.8)	4 (9.3)
4	Hypertension	43	31 (72.1)	5 (11.6)	7 (16.3)
5	Symptoms and Signs of Renal calculi	42	30 (71.4)	9 (21.4)	3 (7.1)
6	Obstructive uropathy	39	12 (30.8)	19 (48.7)	8 (20.5)
7	Renal Masses	39	12 (30.8)	13 (33.3)	14 (35.9)
8	Prostatism	32	7 (21.9)	22 (68.8)	3 (9.4)
9	Nephrotic syndrome	28	15 (53.6)	8 (28.6)	5 (17.9)
10	Developmental anomalies of UT	15	4 (26.7)	10 (66.7)	1 (6.7)

TABLE 5: Effect of excretion urography findings on patient management with percentage proportion in brackets per indication.

— CONT —

Serial No.	INDICATION	Number of patients	Effect on patient management		
			Further clinical evaluation	No change in management	Further Radiological Investigation
11	Developmental anomalies of external genitalia	14	8 (57.1)	5 (35.7)	1 (7.1)
12	Haematuria	13	6 (46.1)	2 (15.4)	5 (38.5)
13	Surgical complications involving UT	11	2 (18.2)	8 (72.7)	1 (9.1)
14	Suspected bladder carcinoma	6	2 (33.3)	2 (33.3)	2 (33.3)
15	Extra abdominal malignancies	6	4 (66.7)	1 (16.7)	1 (16.7)
16	Abdominal pain (non-renal)	6	5 (83.3)	-	1 (16.7)
17	Renal failure	5	1 (20.0)	4 (80.0)	-
18	Enuresis	4	4 (100.0)	-	-
19	Others	8	4 (50.0)	2 (25.0)	2 (25.0)
	TOTAL	484	217	185	92

N.B:- See explanation below.

NB: Explanation to table 5:-

- (i) Further clinical evaluation: In this case, excretion urography findings were normal or no new additional information was added. In other words, that particular patient needed further clinical evaluation to ascertain the cause of his or her symptoms and signs.
  
- (ii) No change in management: In this case, Excretion urography findings were those expected in that particular indication. In other words excretion urography findings encouraged clinicians to continue with same line of patient management.

## DISCUSSION

During the study period, a total of 484 patients subjected to excretion urography examination were studied. Study group included 235 male patients and 249 female patients, making 48.6% and 51.4% of the total patients respectively. Out-patients were 268, where as in-patients were 216, 55.4% and 44.6% of the total patients respectively. This is shown in Table No. 1.

Out-patients showed a high proportion of normal urograms (47%) compared to in-patients (35.2%). In-patients showed a high proportion of abnormal urograms (64.8%) whereas in out-patients abnormal urograms accounted for 53%. This can be attributed to complete 'work-up' of inpatients in terms of investigations prior to requesting excretion urography examination. It was also noted in the course of study, that in most out-patient clinics excretion urography examination was requested together with other preliminary investigations, commonly during the first or second visit.

There was marked sex difference in certain age groups. (refer to tables 2 and 3). Patients covering age group from 0 to 10 years, showed high number of male patients than female patients, both in in-patients and out-patients.

The same occurred in age groups above 50 years; In out-patients there was a high number of male patients, while in in-patients there was a high number of female patients. This could be explained by the fact that in certain age groups, certain kinds of diseases are common. For example in age group 0 to 10 years, posterior urethral valves causing obstructive uropathy affects males only. Hence preponderance of males over females.

In age groups above 50 years, (in males) benign prostatic hypertrophy (BPH) was a common presentation in out-patient clinics, whereas for females, carcinoma of cervix in advanced stages was a common indication for urography examination in 'in-patient' females.

Table 4 shows indications, arranged in 19 categories, starting with commonest indication, to the least common indication for requesting excretion urography. The following indications accounted for 87.2% of excretion urography examination done:-

- (i) Inflammatory conditions of urinary tract.
- (ii) Abdominal masses (mainly malignancies) to rule out urinary tract involvement.
- (iii) Urinary incontinence and leakage.
- (iv) Hypertension (renal or vascular).
- (v) Symptoms and signs of renal calculi.

- (viii) Symptoms and signs of prostatism.
- (ix) Nephrotic syndrome.
- (x) Developmental anomalies of upper urinary tract.
- (xi) Haematuria.

1. Inflammatory conditions: In this study consisted of urinary tract infection (non-specific) which had a total of 33 patients. Pyelonephritis both acute and chronic - 19 patients; acute glomerulonephritis - 9 patients; chronic glomerulonephritis - 5 patients.

In this study, patients with the above indication were 66, accounting for 13.6% of the total. This value was the highest. Kreel et al (14) on a similar study showed that the same indications accounted for 19.6% which was also the highest among all his indications.

The proportion of normal urograms was high 57.6%, as it takes longer for manifestation of urinary tract infection to be seen radiologically. Geoffrey et al (8) recommend that excretion urography should not be done in otherwise healthy patients with recurrent urinary tract infection unless there are other associated factors, eg. unexplained haematuria, obstructive symptoms, neurogenic bladder, dysfunction, renal calculi, analgesic abuse, diabetes mellitus.

Excretion urography is important only when the patient has recurrent bacterial invasion especially due to congenital or acquired anomalies (8) (20). Abnormal urograms formed about 42.4% of all urograms. Patients who required further radiological investigations in this indication were about 10.6%. Further investigations requested included ultrasound, cystography, micturating cystourethrography etc.

Most patients required, further clinical evaluation by clinicians as urograms did not add any new information, these accounted for 63.4%; while those who continued with same management accounted for 25.8%.

## 2. Abdominal masses (benign and malignant)

This group of indications, involved all abdominal and pelvic masses whether benign or malignant. Effects expected to be found at excretion urography due to abdominal or pelvic mass includes the following:-

- (i) Mass effect:- displacement of urinary tract organs, extrinsic impression etc.
- (ii) Infiltrations:- especially in malignant masses.
- (iii) Obstruction:- Compression of urinary tract causing obstruction and its complications.

This formed second most common indication for excretion urography at Kenyatta National Hospital, with 63 patients accounting for 12.8% of total patients.

Abnormal urograms were 49.2%; normal urograms 50.8%. In this indication about a quarter of patients 25.4% required further radiological investigations, mainly in form of sonography after excretion urography. Further clinical evaluation by clinicians to ascertain the cause of patients symptoms and signs was required in 25.4% of the cases. Imray T. Et al (12) strongly recommends excretion urography be part of pre-operative evaluation in most patients with pelvic mass lesion.

Abdominal masses included (number of cases shown) lymphomas (not specified)-7; Hodg•kins-5; Burkitts-3; Neuroblastoma-1; Embryonal sarcoma-1; Carcinoma of colon-1; Appendicular mass-1; Undetermined-10.

Pelvic masses included the following:-  
Carcinoma of Cervix-17; Uterine masses-2 (Endometrial carcinoma and chorio-carcinoma); Fibroids-5; Ovarian masses-6; Ovarian Burkitts-1; Ovarian cyst-1; Undefined pelvic mass-1; Prolapse (uterine)-1.

3. Incontinence: This indication was third commonest in the list of indications for requesting excretion urography. It comprised of different causes of incontinence as follows:-

(i) Urinary incontinence (stress or urge)-10.



- (ii) Fistulas (vesicovaginal-VVF, Rectovaginal-RVF, Uretero vaginal-UVF) - 30.
- (iii) Automatic, neurogenic bladder-1.
- (iv) Vesico-umbilical fistula 1.
- (v) Perineal fistula - 1.

The most common cause of incontinence, was vesico vaginal fistula in women, mainly caused by prolonged labour. This formed approximately 70% of cases in this group. Patients were brought for pre or post-operative screening, to see if there was any leakage of urine. There were a total of 43 patients making 8.8% of study population.

Abnormalities which were expected to be seen in these patients are mainly those of ascending infection; its complications and leakage of urine.

Kreel et al's study (14) made no mention of incontinence as a major indication for requesting excretion urogram, probably obstructed labour is not a common problem in Europe.

Majority of cases showed abnormal urograms 60.5%, these showed mainly features of urinary tract infection and its complications, obstruction.

These features were expected, hence no change in management following excretion urography occurred in high proportion of patients with this indication. 25.5% of cases showed normal urograms. These were mainly those brought for post-operative check of the integrity of repair done on them, also included are a few cases of stress and urge incontinence. About 9.4% of patients were further referred for ultrasonography investigation to see effects of infection on kidneys especially if the kidneys showed poor function, or no function at all.

4. Hypertension: This indication was among common indications for requesting excretion urography examination at Kenyatta. 44 patients making 8.8% of study group were studied. Reasons for requesting excretion urography were:

- (i) Renal hypertension: - Vascular constriction or parenchymal causes.
- (ii) Phaeochromocytoma: This is a common adrenal tumour which presents with paroxysmal hypertension, headache, sweating, palpitations, anxiety and tremor. Its location in adrenal gland, makes excretion urography mandatory as part of work-up for patients suspected to be having phaeochromocytoma. It can occur anywhere especially along sympathetic nerve chain, apart from the adrenals.

Proper selection of patients for excretion urography is critical (in renovascular hypertension) because evaluation must be limited to the population at risk. Selection is based on criteria such as inappropriate age of onset or sudden worsening of hypertension, abdominal bruits, and the results of infusion tests using drugs such as angiotensin II analogs and angiotensin converting enzyme inhibitors. (2,7). Although excretion urography was formerly considered adequate as a screening test, its high false/negative rate of 21.8%, particularly in bilateral disease, makes it of little value for routine use (24). Levit et al (15) showed that urography was a poorer screening test than either aortogram or radionuclide renogram. It was negative in almost half the patients (46%) and failed to detect 40% of patients who benefited from surgery.

Amplatz K. (1) noted that, the radiographic changes in renal hypertension on routine excretion urography are subtle and in many instances equivocal. He advocates a modified excretion urography instead of routine method usually done.

In this study, this indication showed, high proportion of normal urograms 60.5%. The above mentioned reasons can be used to explain this. About 16.3% of patients required further radiological evaluation either by ultrasonography or renal arteriography depending on their excretion urography findings.

Most patients required further clinical evaluation by clinicians since urograms did not add any new information. In Kreels et al's study (14) only 5% of 130 hypertensive patients investigated by urography had renal abnormalities which might have had a causal role in their hypertension.

5. Renal calculi: This indication included all patients who presented with symptoms and signs of possible renal calculi. Also included were those who were already known to have calculi. Number of patients was 42, making about 8.7% of the study population.

High proportion of urograms in this indications were normal(64.3%). Abnormal urograms accounted for 35.7%; out of which 16.6% showed incidental findings. The reason for high number of normal urograms is because abdominal pain which was diagnosed as renal colic, might have been a referred pain from other areas in the abdomen. This could as well explain for high proportion of incidental findings as observed in this indication. The 19.1% which showed abnormality included those already diagnosed to be having renal calculus.

About 71.4% cases with this indication required further clinical evaluation by their clinicians to identify source of their symptoms and signs.

About 90% of renal calculi can be detected with simple abdominal radiographs (21). Excretion urography is the simplest method for confirming the location of a calcific density within urinary tract and identifying non-opaque calculi which appear as filling defects. In Kreel's et al study (14) only 5% of his patients, the indication was renal colic.

#### 6. Obstructive uropathy:-

In 39 patients, 8.1% of the study group, indication for requesting excretion urography examination was symptoms and signs of obstructive uropathy. Some were already known cases of hydronephrosis from previous examinations (ultrasound + urogram).

There was a high proportion of abnormal urograms (74.4%). The normal urograms were only 25.6%.

After excretion urography examination, most patients continued to be managed in the same way, as most urograms showed expected findings. About one third required further clinical evaluation to delineate the cause of their symptoms and signs. About 20.5% of the cases with this indication required further Radiological investigations, mainly in form of ultrasound, especially those cases which showed no-function or poor function due to obstruction.

## 7. Renal Masses:-

Renal masses in this indication, included benign, malignant, cystic, and lesion presenting as a mass. There were 39 patients accounting for 8.1% of all patients studied. A total of 31 patients (79.5%) showed abnormal urograms. Normal urograms were only in 8 patients (20.5%).

Following excretion urography examination, there was no change in clinical management in 13 patients (33.3%) as urograms done revealed expected findings. In twelve patients (30.8%) further clinical evaluation was required and 14 patients (35.9%) were sent for further radiological investigations mainly in form of ultrasound.

Excretion urography examination remains the 'standard' imaging procedure for identifying renal masses (16). Excretion urography though sensitive, is relatively non-specific, hence if a mass appears more cystic, sonography is usually the next step. If the mass appears more solid, computerized tomography is more appropriate (22).

8. Prostatism: Included in this indication are patients who presented with symptoms and signs of prostatism (benign prostatic hypertrophy), and a small number of patients (3) whom clinicians thought that they might be having carcinoma of prostate. They were 32 patients (6.6% of all patients).

The number of abnormal urograms was 25 (78.1%) and normal urograms were only 7(21.9%). The number of abnormal urograms is high. This can be compared to Kreel's et al study (14) in which the incidence of picking an abnormality in patients with signs and symptoms of prostatism was about 92% to 94%. Most of urograms showed expected features, mainly prostatic impression at bladder base. Few showed signs of obstructive uropathy. Since the findings were mainly those expected, there was no change in patient management, few required further radiological evaluation mainly by ultrasonography and cystography.

9. Nephrotic syndrome:

There were 28 patients (5.8% of total patients), whom the indication for requesting excretion urography was nephrotic syndrome. Clinically its characterised by massive pitting oedema, proteinuria, hypoalbuminemia, and hypercholesterolemia. Most cases are idiopathic, but it may occur in the course of glomerulonephritis, collagen diseases etc. (20).

The number of normal urograms was 12 (42.9%) and abnormal urograms was 16 (57.1%). There was slight high proportion of abnormal urograms. The common findings were enlarged kidneys, and rarely poor functioning kidneys. Compared to other indications, this showed a significant large number of normal urograms. Most patients required further clinical evaluation as most urograms showed normal findings. Very few needed further radiological evaluation.

10. Developmental anomalies of upper urinary tract:-

Most common anomaly seen in this indication was ectopic kidney/s. In most cases the diagnosis was already known. They were 15 patients, making 3.1% of the total. The proportional of abnormal urograms was 76.9%. Three patients were suspected to be having ectopic kidneys, but they were found to be normal. These accounted for only 20.0%. There was no much influence on patient management after excretion urography. Very few patients required further radiological evaluation, mainly in form of ultrasonography.

11. Haematuria:

There were 13 patients (2.7% of the total patients) in which the indication for excretion urography was haematuria. The aim here was to try to find if the cause could be established by excretion urography.

There was a very high number of abnormal urograms, which had a proportion of 92.3%. One patient showed a normal urogram 7.7%.

Further evaluation by clinicians was required for 6 patients accounting for 46.1%, as the findings in these patients was not conclusive. Further radiological investigation was done for 5 patients (38.5%). Investigations included cystography and ultrasonography.



The outcome in this indication, tends to agree with what Kreel et al (14) had already found that, whenever there is haematuria and there is strong evidence for it, then an abnormality in urinary tract is usually found.

12. Developmental anomalies of external genitalia:

They were 14 patients with this indication making 2.9% of total patients. Reason for requesting excretion urography was to see if there are any associated abnormalities of urinary tract. 78.6% of urograms were normal. 21.4% of urograms were abnormal, showing mainly features of urinary tract infection, usually associated with these abnormalities. The fact that lower urinary tract, distal to the bladder is not visualized in excretion urography added to increased number of normal urograms.

Effect of excretion urography examination, in these patients, showed that 8 patients (57.1%) needed further evaluation by clinicians and only one patient needed further radiological investigation.

13. Renal failure: There were 5 patients, who the indication for excretion urography was either chronic or acute renal failure, accounting for 1.0% of total patients. There was no normal urograms i.e abnormal urograms were 100%.

The findings of excretion urography were those expected, and hence no alteration in patients management was done. Only one case required further evaluation by clinicians.

Suspected bladder carcinoma:-

There were a total of 6 patients (making 1.2%) who the indication for excretion urography examination was suspected carcinoma of bladder.

4 patients showed abnormal urograms (66.7%), where as 2 patients (33.3%) showed normal urograms. In these two patients no abnormality was seen in the bladder or else where in urinary tract.

One showed an incidental finding, instead of carcinoma of bladder, he showed renal mass with ipsilateral non-functioning kidney.

After the excretion urography, 2 cases required further evaluation clinically; 2 patients needed no change in their management as the findings conforms to what was expected. Two patients out of six needed further radiological investigations mainly by cystography and ultrasonography.

15. Extra abdominal malignancy: There were 6 patients (1.2%) who had extra abdominal malignancy, excretion urography examination was requested to rule out any renal involvement by metastasis.

Five urograms (83.3%) were normal. Only one urogram showed an abnormality.

After excretion urography examination. There was no change in patient management in five of the patients (83.4%). One patient required further radiological investigation.

16. Abdominal pains (non-renal):

The main indication for requesting excretion urography in these patients was colicky abdominal pains, which did not have features of renal colic, excretion urography was done to rule out chances of patients having renal stone. There were six patients, 1.2% of the total patients, 5 patients (83.3%) showed normal urograms. One patient (16.7%) showed an abnormal urogram (incidental).

Following excretion urography examination further evaluation was required for 83.3% of the patients (5) to establish the source of their symptoms and signs.

17. Surgical complications of upper urinary tract:

This indication for requesting excretion urography involved all patients who were referred for follow up after ureteric implantation, diversion and suspected 'ureteric tie' post surgery. There were 11 patients (2.3% of total patients).

Abnormal urograms were six (54.6%); these mainly showed features of urinary tract infection and its complications. Normal urograms were 5(45.4%).

On management, there was no effect on 7 patients (72.7%), Two patient required further evaluation clinically as they showed features of poor functioning single or both kidneys. One needed further radiological investigation.

18. Enuresis:

There were 4 patients (0.8% of total patients), who had indication for excretion urography examination as enuresis. All urograms were normal (100%). All of them required further evaluation clinically to find the cause of their symptoms as urograms did not show any abnormality. No one needed further radiological investigation.

Others:

All those patients who did not fall in any of the preceeding groups were grouped in this group. It includes the following:- Kidney donor (1); Malabsorption (1); Congenital syndrome (Turner's Syndrome, mucopoly saccharidosis) - 2; Trauma (1); Precocious puberty (1); Cushing's syndrome (1); renal tubular acidosis (1). They were a total of 8 patients (1.7%).

CONCLUSION:

1. The commonest indications for requesting excretion urography at Kenyatta National Hospital shown by this study are inflammatory conditions of urinary tract-13.6%; abdominal masses non-renal-12.8%; incontinence-8.9%; hypertension-8.9%; symptoms and signs of renal stone-8.7%; obstructive uropathy-8.1%; renal masses-8.1%; prostatism-6.6%. These accounted for 67.4% of all patients.
  
2. The rare indications for requesting excretion urography at Kenyatta National Hospital shown by this study are:- haematuria (2.7%); surgical procedures involving urinary tract (2.3%); suspected bladder malignancy (1.2%); abdominal colicky pain of non-renal origin (1.2%); extra-abdominal malignancy to rule out renal involvement (1.2%); renal failure (1.0%); enuresis (0.8%). These accounted for 10.4% of all patients.
  
3. The indications which showed a high number of normal urograms (with percentage proportion in brackets) are as follows: enuresis (100.0%); abdominal colicky pain non-renal (83.3%); extra abdominal malignancies to rule out renal involvement (83.3%); developmental anomalies of external genitalia (78.6%); symptoms and signs of renal stone (64.3%); hypertension (60.5%).

4. Indications which showed a high number of abnormal urograms (with percentage proportion in brackets) are as follows: renal failure (100.0%); haematuria (92.3%); developmental anomalies of urinary tract (upper) (80.0%); renal masses (79.5%); prostatism (78.1%); incontinence (74.5%); obstructive uropathy (74.4%).
5. Indications which showed a high proportion of urogram in which the Radiologist required further radiological evaluation or investigations are as follows: haematuria (38.5%); renal masses (35.9%); suspected bladder malignancy (33.3%); abdominal masses (20.5%); obstructive uropathy (20.5%).
6. Indications which required further clinical evaluation or assessment by referring clinicians, as the findings of excretion urography were either normal or did not add new information are:-  
enuresis (100.0%), abdominal colicky pain non-renal (83.3%); renal calculi (71.4%); hypertension (72.1%); inflammatory conditions of renal tract (63.4%).  
These also showed high proportional of normal urograms.

7. Indications which showed high proportion of urograms which did not require change in the already established line of management of the patient after the excretion urography examination were as follows:- renal failure (80.0%); prostatism (68.8%); developmental anomalies of urinary tract (66.7%); incontinence (62.8%); abdominal masses (49.2%); obstructive uropathy (48.7%). In this case the urogram findings were those expected.
  
8. It can be deduced that, there are common frequent indications for requesting excretion urography which give a high number of normal urograms e.g. symptoms and signs of renal stone, hypertension etc. At the same time there are common frequent indications which yield a high number of abnormal urograms, these includes: renal masses, prostatism, incontinence and obstructive uropathy.
  
9. Rare indications for requesting excretion urography which in most cases will yield an abnormal urogram, these includes; renal failure, haematuria and developmental anomalies of urinary tract, where as there are rare indications but almost always will yield a normal urogram these includes: enuresis, abdominal colicky pain non-renal in origin, and extra abdominal malignancy to rule out renal tract involvement.



RECOMMENDATIONS:

1. Some indications, which are commonly used as the basis for request of excretion urography examination, but yield a high number of normal urograms e.g. signs and symptoms of renal calculi, hypertension; these patients should be repeatedly re-examined and screened using different types of investigations before excretion urography is done.
2. For indications which are rare, non-specific and almost always results in a normal urogram e.g. enuresis, abdominal colicky pain non-renal, extra-abdominal malignancy rule out renal involvement etc; such patients should be screened by other methods like ultrasonography, cystography, urinalysis rather than excretion urography.
3. Excretion urography is strongly recommended for those indications which commonly lead to abnormal findings, thus contributing positively in patient's management. These are either frequent indications like renal masses, prostatism, incontinence, obstructive uropathy or rare indications like renal failure, haematuria, developmental anomalies of urinary tract. It will be noted these are more specific to renal tract.

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APPENDIX B

REQUEST FORM

**DUPLICATE**

REPUBLIC OF KENYA  
**MINISTRY OF HEALTH**

X-ray Request Form		NAME		NUMBER
Walking Chair Trolley Portable		ADDRESS	AGE	SEX
Appointment Time:                      Date:				
TYPE OF INVESTIGATION REQUESTED:		REPORT TO BE SENT TO:		
X ray Number:				

IS PATIENT ENTITLED TO A FREE X RAY:

HAS PATIENT BEEN PREVIOUSLY X RAYED: YES/NO

PROVISIONAL DIAGNOSIS                      NUMBER

CLINICAL SUMMARY: (Does patient suffer from any allergy or sensitivity to iodine)

DOCTOR'S NAME: .....

SIGNATURE: ..... TIME:                      DATE:

X RAY REPORT:

X-ray Investigation	Radiologist's Signature	Date	Time
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APPENDIX C

INSTRUCTION FORM

X-ray Department,  
P.O. Box 20723,  
NAIROBI.

DATE .....

Name .....

IP/OP NO. ....

PREPARATION OF PATIENT FOR INTRAVENOUS UROGRAPHY (IVU)

INSTRUCTIONS

1. For 2 days before the x-ray, eat only boiled rice or potatoes (without oil) and drinks allowed are Uji, tea or coffee without milk (Sugar can be added).
2. Take ..... tablets/casteroil at 8 p.m. of 3 evening before the x-ray (Total of 9 tablets).
3. Take uji at 6 p.m. on ..... (No Supper)
4. Do not eat or drink anything for at least 6 hours before the x-ray.
5. Report for the x-ray on ..... at .....

NR: Diabetic patient could have a slice of dry brown bread with tea without milk.

Females of reproductive age are advised to come for the x-ray within the first ten days of their monthly period.

for: SPECIALIST RADIOLOGIST