

Pattern of Findings for Patients Undergoing Conventional Intravenous Urography in Aminu Kano Teaching Hospital, Nigeria

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Abstract

Conventional intra venous urography (IVU) remains the imaging modality of choice to evaluate the urinary system especially in developing countries despite all the recent advanced imaging modalities. This study is aimed at evaluating the pattern of findings of conventional IVU in Aminu Kano Teaching Hospital, Nigeria. This study design was retrospective, conducted in the Department of Radiology Aminu Kano Teaching Hospital from March 2020 to September 2020. A total of 396 radiology reports on conventional IVU were retrieved from the archive of the department. The demographic information, and clinical indications were obtained from patients request card while the findings were obtained from radiologist's report and recorded in the data capture sheet. Data was analyzed using Statistical Package for Social Sciences (IBM SPSS) Version 22.0. Three hundred and ninety-six radiology reports on conventional IVU were reviewed, 326(82.3%) were adults and 70(17.7%) were pediatric. 236(59.6%) were male and 160(40.4%) were female. Right flank pain was the most frequent indication 109(66.3%) in adults and 13(42.2%) in pediatrics. The abnormal IVU finding was 230(58.1%) and right renal calculi was the most frequent finding 22(12.8%) in adults. Left pelvic-ureteric junction calculus was the most frequent finding in male pediatric while left non-functional kidney 3(12.5%) in female pediatric. Urinary tract calculi was the most common frequent abnormal IVU findings, bladder tumor, renal agenesis and bilateral nephron-blastoma were the least findings.

Keywords: Calculi, Conventional, Nephroblastoma, Pattern, Urography

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Introduction

Conventional intravenous urography (IVU) is an essential radiological examination used to assess the morphological and functional state of the urinary system following the introduction of contrast media (Kunwar *et al.*, 2010). The IVU Imaging Sequence is designed to optimize depiction of specific part of the urinary tract during the maximal contrast media opacification. A tailored urographic study may provide diagnostic detail beyond some current capabilities of other imaging modalities (Raymond *et al.*, 2001). The IVU examination is occasionally limited by some variable factors like level of bowel preparation, patient body habitus, split renal function, and radiographic factors (Market *et al.*, 2012). The main disadvantage of IVU examination is that it is associated with nephrotoxicity and allergy to the contrast media used. For many decades IVU has been the primary imaging modality of choice for evaluation of the urinary tract diseases (Raymond *et al.*, 2001). In recent years IVU has been gradually replaced as the gold standard for investigation of urinary tract diseases. Ultrasonography (US), Computed tomography (CT), and Magnetic resonance (MR) have been used with increasing frequency to overcome the limitations of conventional IVU (Raymond *et al.*, 2001; Abou El-Ghar *et al.*, 2014). Like conventional IVU, these imaging modalities have their own advantages, disadvantages and limitations. Despite all the recent advanced imaging modalities, however conventional IVU remain the modality of choice to evaluate the urinary system especially in developing countries (Kunwar *et al.*, 2010; Aklan & Mikhlafy, 2018).

A retrospective study conducted by Aklan & Mikhlafy, (2018) on analysis of intravenous urography findings in a tertiary reference center Yemen showed that (68.8%) of IVU findings were abnormal. Urinary tract calculi were the most frequent type of calculi observed among patients (36.8%). Kidney was the most frequently affected organ by calculi (66.5%). A prospective study conducted by Kunwar *et al.* (2010) on conventional intravenous urography to study urinary system in a tertiary center revealed that, about 55.0% of the findings were urolithiasis, congenital abnormalities (15.0%), upper urinary tract mass (6.0%), and urinary bladder mass (5.0%).

Another retrospective study was conducted by Michael *et al.* (1997) on radiological findings in acute urinary obstruction in medical center Boulevard showed that, all the obstructions except one were located in the lower one-third of the ureter. Abnormal IVU findings were Hydroureter 46(87%), nephropyelographic delay 36(68%), Hydronephrosis 35(66%), intra-ureteric ridge edema 11(23%), persistence dense nephrogram 6(11%), urine extravasation 5(9%), vicarious excretion 1(2%), striation 1(2%), and stricture 1(2%). Empirical study has shown that no data has been documented for conventional IVU findings in Aminu Kano Teaching Hospital. Using all the available search engine showed that no published article on conventional IVU in the study area. The findings of the study will serve as a guide to the radiographers, radiologist, nephrologist and urologist in the diagnosis and management of patients with urinary track pathologies. This study aimed at evaluating pattern of findings of conventional IVU in Aminu Kano Teaching Hospital, (AKTH) Nigeria.

Materials and Methods

This study design was retrospective, conducted in the Department of Radiology, Aminu Kano Teaching Hospital from March to September 2020. A total of 396 radiology reports on conventional IVU were retrieved from the archive of the department. Ethical approval to conduct the study was obtained from the Research and Ethics Committee of the Aminu Kano Teaching Hospital. All the patients request cards and reported conventional IVU findings were retrieved and sorted from the archive of the department. The sex, age, and clinical indication(s) were obtained from the patients request card and recorded into the data

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capture sheet. The findings were obtained from radiologist's report and recorded in the data capture sheet. Only descriptive statistics was employed in the data analysis; mean, standard deviation, frequency, and range were obtained. The data was analyzed using Statistical Package for Social Sciences (IBM SPSS) Version 22.0.

Results

Demographic data

Table 1 shows demographic information of the patients. A total of four hundred and eighty-five radiology reports and patents request cards on conventional IVU were reviewed. Three hundred and ninety-six request cards were adequately filled, and 85(17.7%) were inadequately filled. Out of 396 reports, 326(82.3%) were adults and 70(17.7%) were pediatrics. Two hundred and thirty-six were male 236(59.6%) and 160(40.4%) were female. The mean ages were 35.5±13.3 (years), and 7.8±5.04 (years) for adults and pediatrics respectively.

Table 1 shows the mean age and standard deviation of the male adult patients to be 33.77±12.3 years, while that of the female was 38.03±14.31 years. For pediatric male patients it was found to be 7.25±4.80 years, while that of female was 8.89±5.43 years

Table 1: Agerage of the patients.

Variables	Adult (n=326)			Pediatic (n=70)		
	Male (n=190)	Female (n=136)	Total (n=326)	Male (n=46)	Female (n=24)	Total (n=70)
Age (years)	33.77±12.3 (18-85)	38.03±14.31 (18-84)	35.5±13.3 (18-85)	7.25±4.80 (0.3-17)	8.89±5.43 (0.3-17)	7.81±5.04 (0.3-17)

Data presented as mean ±SD (range).

Table 2 shows that, the most frequent indication in adults male and female was found to be right flank pain 66(34.7%) & 43(31.6%) respectively. For pediatrics male patients was bilateral flank pain 8(17.4%) while that of female was right flank pain 7(29.2%).

Table 2: Indications for Conventional IVU of the patients

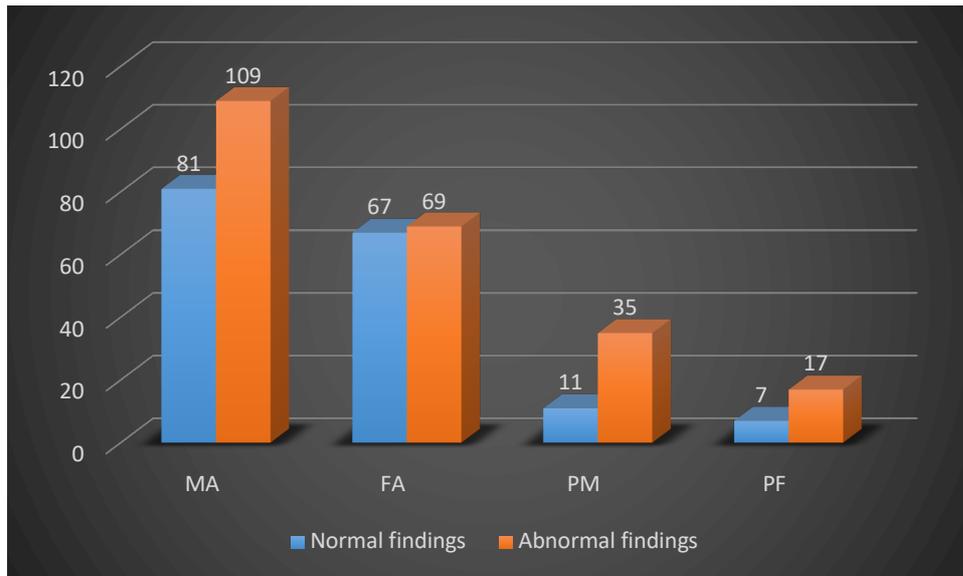
INDICA-TIONS	Adult		Pediatic	
	Male F(%)	Female F(%)	Male F(%)	Female F(%)
BFP	52(27.4)	28(20.6)	8(17.4)	5(20.8)
BFP, D	3(1.6)	1(0.7)		
BFP, H	2(1.1)			
BUDT			1(2.2)	
CACX		22(16.2)		
D	2(1.1)			
D, H	2(1.1)		1(2.2)	
H			1(2.2)	
HAM			2(4.3)	
HOM		4(3.0)		
HUF		1(0.7)		
LAP	7(3.7)	4(3.0)	6(13.0)	6(25.0)
LAP, D	1(0.5)		4(8.7)	
LFP	47(24.7)	19(14.0)	10(21.7)	5(20.8)
LFP, D	2(1.1)	1(0.7)		
LFP, H		3(2.2)		
LURI				1(4.2)
MUF		8(5.9)		
PUV, VT			5(11.0)	
RFP	66(34.7)	43(31.6)	6(13)	7(29.2)

RFP, D	5(2.6)	1(0.7)	2(4.3)	
RFP,H	1(0.5)	1(0.7)		
TOTAL	190(100)	136(100)	46(100)	24(100)

Data presented as frequency and (%).

Keys:

BFP: Bilateral flank pain BUDT: Bilateral undescended testis CACX: Ca Cervix
 D: Dysuria H: Hematuria HAM: Huge Abdominal Mass HOM: Huge Ovarian Mass
 HUF: Huge Uterine Fibroid LAP: Lower Abdominal Pain LFP: Left Flank Pain
 LURI: Left Ureteric Re-implantation MUF: Multiple Uterine Fibroid VT: Vesicostomy
 PUV: Posterior Urethral Valve RFP: Right Flank Pain



Keys:

MA: Male adult
 FA: Female adult
 PM: Pediatric male
 PF: Pediatric female

Figure 1: Overall Normal and Abnormal IVU findings among Adults and Pediatrics

Figure 1 above shows that, the overall normal and abnormal findings in adult male was 81(48.8%) and 109(47.4) respectively, while that of female was 67(40.4%) and 69(30.0%) respectively. For pediatrics male was found to be 11(6.6%) and 35(15.2%) respectively while that of female was 7(4.2%) and 17(7.4%) respectively

Table 3 shows that, the most frequent abnormal findings in adult male was right renal calculus 16(8.4%) while that of female was right hydronephrosis 14(10.3%). For pediatrics male it was found to be left pelvic ureteric junction calculus 5(10.9%), while that of female was found to be left non-functional kidney3(12.5%). The least findings in adult male includes, bilateral pelvic ureteric junction calculi 1(0.5), while that of female includes bilateral renal calculi 1(0.7%). For pediatrics male includes, bladder diverticulum1(2.2), while that of female includes bilateral nephron-blastoma1(4.2%).

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Table 3: Findings for conventional IVU of the patents

FIND-INGS	Adult		Pediatric	
	Male F(%)	Female F(%)	Male F(%)	Female F(%)
BC	2(1.1)	1(0.7)		2(4.3)
BD			1(2.2)	
BDRF	2(1.1)		3(6.5)	
BEK			1(2.2)	1(4.2)
BNB				1(4.2)
BHN	6(3.2)	5(3.7)	3(6.5)	
BPUJO	1(0.5)			
BPCKD			1(2.2)	
BRC	7(3.7)	1(0.7)		
BT	1(0.5)			
BUC	2(1.1)	1(0.7)	1(2.2)	
DLRF		5(3.7)		
DRRF	3(1.6)	1(0.7)		
LEK	2(1.1)	1(0.7)	2(4.3)	
LHN	7(3.7)	1(0.7)	1(4.2)	
LNFK	6(3.2)	6(4.4)	2(4.3)	3(12.5)
LPUJC	2(1.1)		5(10.9)	
LRA	1(0.5)		1(2.2)	1(4.2)
LRC	8(4.2)	7(5.1)	1(2.2)	2(8.3)
LRT	1(0.5)			
LNB			2(4.3)	
LUC	4(2.1)	2(1.5)		
LVUJC	1(0.5)		1(2.2)	
NS	81(42.6)	67(49.3)	11(23.9)	7(29.2)
REK	5(2.6)	1(0.7)	2(4.3)	2(8.3)
RHN	5(2.6)	14(10.3)		
RNFK	2(1.1)	7(5.1)	2(4.3)	
RPUJC	12(6.3)	6(4.4)		1(4.2)
RRC	16(8.4)	6(4.4)	1(2.2)	2(8.3)
RRA				1(4.2)
RUC	11(5.8)	4(2.9)	2(4.3)	
RVUJC	2(1.1)		2(4.3)	2(8.3)
Total	190(100)	136(100)	46(100)	24(100)

Data presented as frequency and (%).

Keys:

BC: Bladder Calculus BD: Bladder Diverticulum. BDRF: Bilateral depressed Renal function
 BEK: Bilateral Ectopic kidney BNB: Bilateral Nephroblastoma. BT: Bladder Tumor
 BHN: Bilateral Hydronephrosis. BPUJC: Bilateral pelvic-ureteric junction obstruction
 BPCKD: Bilateral Polycystic Kidney Disease. BRC: Bilateral renal calculi NS: Normal Study
 BUC: Bilateral ureteric calculi. DLRF: Depressed Left Renal function
 DRRF: Depressed Right Renal function LEK: Left Ectopic Kidney LRC: Left Renal Calculus
 LHN: Left Hydronephrosis. LNFK: Left Non-functional Kidney LRA: Left Renal Agensis
 LPUJC: Left Pelvic-ureteric junction calculus LRT: Left Renal Tumor
 LNB: Left Nephroblastom LUC: Left Ureteric Calculus REK: Right Ectopic Kidney
 LVUJC: Left Vesico-Ureteric Calculus RRC: Right Renal Calculus RRA: Right Renal Agensis
 RHN: Right Hydronephrosis RNFK: Right Non-functional Kidney RRC: Right Renal Calculus
 RPUJC: Right-Pelvic Ureteric Calculus RUC: Right Ureteric Calculus
 RVUJC: Right Vesio-Ureteric Calculus

Discussion

The findings of this study as shown in Table 1 are similar to the findings of the study conducted by Aklan and Mikhlafy (2018) that reported more than 90% of patient were adult and only 5.2% were less than 18years of age. The possible reasons of the agreement between the two studies might be because both studies were conducted in developing countries and both used a larger sample size. Furthermore, the findings of the two studies showed that, adults presented with urinary system disorders are more than the pediatrics age group. The

findings of the current study reported that 85(17.7%) request cards were inadequately filled. This is against the guidelines for standard that clearly suggested that, all radiology request cards should be adequately and legibly completed. The findings of the present study as shown in Table 1 are similar to findings of the study conducted by Aklan and Mikhlafy (2018) that reported more than 60% were males and 33.2% were female. The possible reason of the agreement between the two studies might be because male population in both study locations are greater than the female population. The findings of the two studies showed that male presented with urinary tract pathologies more than female population. However, the findings of this study as shown in Table 1 are contrary to the findings of a study conducted by Kunwar *et al.*, (2010) reported that,52% were female. The implication of their study is that females presented with urinary tract disorders are more than the male population.

The findings of the current study as shown in Figure 1 were similar to the findings of the studies conducted by Aklan and Mikhlafy (2018) and Raza *et al.* (2011) that reported 1012(68.8%) and 94(74%) as the overall abnormal IVU findings respectively. The possible reason of the agreement between the three studies might be because both studies were conducted in developing countries. Furthermore, the findings of this study showed that, abnormal IVU findings has the higher proportion in both adults and pediatrics age group. The possible reasons could be in both adults and pediatrics patients referred for IVU had clinical history associated with the urinary system, therefore abnormal IVU findings are suspected. The findings of the current study as shown in Table 2 are in line with findings of the study conducted by Kunwar *et al.* (2010) that reported renal colic was the most frequent indication 115(57.5%) for IVU. Furthermore, the findings of this study as shown in Table 2 indicated that right flank pain is more frequent than the left, however, the previous study did not categorize flank pain into right and left. The findings of the current study showed that lower abdominal pain with dysuria and huge uterine fibroid were the least indications for IVU in both male and female adults with 1 (0.5%) and 1(0.7%) respectively. Meanwhile, hematuria and left ureteric injury were the least indication for IVU in both male and female pediatrics with 1(2.2%) and 1(4.2%) respectively. This is almost similar to the findings of the study conducted by Kunwar *et al.* (2010), that reported hematuria and others as the least indications for IVU examination. The possible reason for the agreement between the two studies might be because both studies were conducted in developing countries.

The findings of current study as shown in Table 3 are similar to the findings of the study conducted by Aklan and Mikhlafy (2018) that reported renal calculi were the most frequent abnormal IVU findings 541(36.8%). The possible reasons of the agreement between the two studies might be both studies were conducted in developing countries. Moreover, the findings of the study showed that right kidney is more affected by calculus than the left kidney, the possible reason might be because the right kidney has more blood supply than the left kidney. The findings of this study as shown in Table 3 indicated that, left non-functional kidney was the most frequent abnormal IVU findings in pediatrics female. Pediatrics with unilateral non-functional kidney are more prone to develop renal damage in early adult life characterized by proteinuria, hypertension, glomerulosclerosis somatic growth and renal failure (Krishna *et al.* 2018). The previous study did not classify the IVU findings base on adults and pediatrics age groups. The present study showed that, bilateral pelvic ureteric junction obstruction, bladder tumor, left renal tumor, left renal agenesis, and left vesico-ureteric junction calculus were the least IVU findings in male adults with 1(0.5%) each as shown in Table 3. Bilateral pelvic ureteric junction obstruction is rare and is associated with high morbidity and mortality (Ibrahim *et al.* 2014). Meanwhile, bladder calculus, bilateral renal calculi, bilateral ureteric calculi, depressed right renal function, left ectopic kidney, left Hydronephrosis, and right ectopic kidney were the least abnormal IVU

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findings in female adult each with 1(0.7%) as also shown in Table 3. Bilateral ureteric calculi are uncommon finding and it associated with urinary outflow obstruction which can cause acute kidney injury of great severity (Sumner *et al.* 2016). Furthermore, as also shown in Table 3, bladder diverticulum, bilateral ectopic kidney, bilateral ureteric calculi, left renal agenesis, left renal calculus, left Hydronephrosis, bilateral polycystic kidney disease were the least abnormal IVU findings in male pediatric with 1(2.2%) each. Bilateral ectopic kidneys are rare and only a few cases are reported in medical literature (Kumar *et al.* 2016). Patient with ectopic kidney are more prone to have vesio-ureteric reflux (VUR) which may lead to urinary tract infection. An ectopic kidney in the lower abdomen or pelvis may be at higher risk of certain injury or trauma (NIDDK). Patients with bilateral polycystic kidney disease may be at greater risk of developing thoracic aortic aneurysms (Rose, 2020). As indicated in Table 3. bilateral ectopic kidney, bilateral nephroblastoma, left renal agenesis, and right pelvic ureteric junction calculus were the least abnormal IVU findings in pediatrics female, with 1(4.2%) each. Nephroblastoma is the most common primary malignant renal tumor of children accounting for approximately 6% of all pediatric tumors (Peter & Robert, 2012). Between 10% and 13% of patients with nephroblastoma have other anomalies and syndromes associated with the tumor and screening may be recommended for these patients (Andrea, 2007). Congenital anomalies of the kidney and urinary tract are predominant cause of end stage renal disease in pediatrics. Patients with renal agenesis are associated with chronic kidney disease (CKD) and ESRD (Westland *et al.* 2014).

Conclusion

This study showed that, right flank pain was the most frequent indication for IVU in adults and pediatrics female while left flank pain was the most frequent indication in male pediatrics. Right renal calculus was the most frequent finding in adult male and right hydronephrosis was the frequent finding in adult female. left pelvic ureteric junction calculus was the most frequent finding in male pediatrics and left non-functional kidney was the most frequent finding in female pediatrics. The least findings in adults included left renal tumor, and left hydronephrosis, while the least findings in pediatrics included bladder diverticulum and bilateral nephron-blastoma.

Recommendation

Complementary ultrasound scan should be performed in all the patients that have undergone conventional intravenous urography.

References

- Abou El-Ghar, M., Huda, R., Doaa, S., & Tarek, E. (2014). 'Diagnosing Urinary Abnormalities IVU or CT Urography', *Dove Press Journal. Report in medical imaging*; (7): 55-63.
- Andrea, S, H. (2007). *Pediatric Clinic Advisor: Diagnosis and treatment*, 2ndEdn, Elsevier Inc
- Akhan, M, H.,& Mikhlafty, A. (2018). 'Analysis of Intravenous Urography in a reference center', *Eurasian Journal of Medicine*; **50**: 71-74.
- Auwal, K., Dambele, M, M., Mohammed, H., & Sidi, M. (2019). 'Audit of completion of Radiology Request Cards in Aminu Kano teaching Hospital Nigeria', *Journal of Radiography and Radiation Sciences*,**35**(1): 21-24
- Ibrahin, A, G., Aliyu, S.,& Ali, N. (2014). 'Bilateral pelvic-ureteric junction obstruction: Our experience in developing country', *Nigerian journal of clinical practice*; **17**(3): 267-269.
- Krishna, K, K., Veerbhadra, R., Kumaravel, S., Bibekanand, J.,& Bikash, K, N. (2018). 'Solitary functional kidney in children: clinical implications', *Brazilian Journal of Nephrology*; **40**(3): 261-265.

- Kunwar, L., Adhikari, B., & Phantee, M. (2010). 'Conventional Intravenous Urography To Study Urinary System', *Postgraduate Journal of NAMS*; **10**(2): 65-67.
- Kumar, D, P., Pritesh, J., & Manju, B. (2016). 'Bilateral pelvic kidneys: A rare anomaly', *Journal of case report*, **6**(3): 411-414
- Mark, A, L., David B, S, J., John, P, O., & Joseph, J, W. (2000). 'The Diagnostic yield of Intravenous Urography', *Nephrology Dialysis Transplant*; **15**: 200-204
- Michael, Y, M, C., Ronal, J, Z., & Raymond, B, D. (1997). 'Radiological Findings in Acute Urinary Tract Obstruction', *Journal of Emergency Medicine*; **15**(3): 339-343
- National Institute of Diabetes and Digestive and Kidney Diseases. Available from <https://www.niddk.nih.gov/health-information/kidney-disease/children/ectopic-kidney>
- Peter, F, E., & Robert, C, S. (2012). *Pediatric surgery*, 7thEdn, Elsevier Inc.
- Raza, M., Khan, S, F., Ahmed, S., & Zameer, S. (2011). 'Diagnostic Yield of Intravenous Urography in a Tertiary Care Hospital', *Pakistan Journal of Medical Research*; (**50**): 93-96.
- Roser, T. (2020). 'Polycystic kidney disease: Clinical presentation', *Medscape*25. Available from <http://emedicine.medscape.com/article/244907-clinic>
- Sumner, D., Rehnberg, L., & Kler, A. (2016). 'Bilateral ureteric stones: an unusual cause of acute kidney injury', *BMJ, Case Rep* 2016.
- Westland, R., Michiel, F, S., Johannes, B, G., Simone, S, C., & Joanna, A, E. (2014). 'Clinical implication of solitary functional kidney', *Clin J Am Soc Nephrol*; **9**: 978-986

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