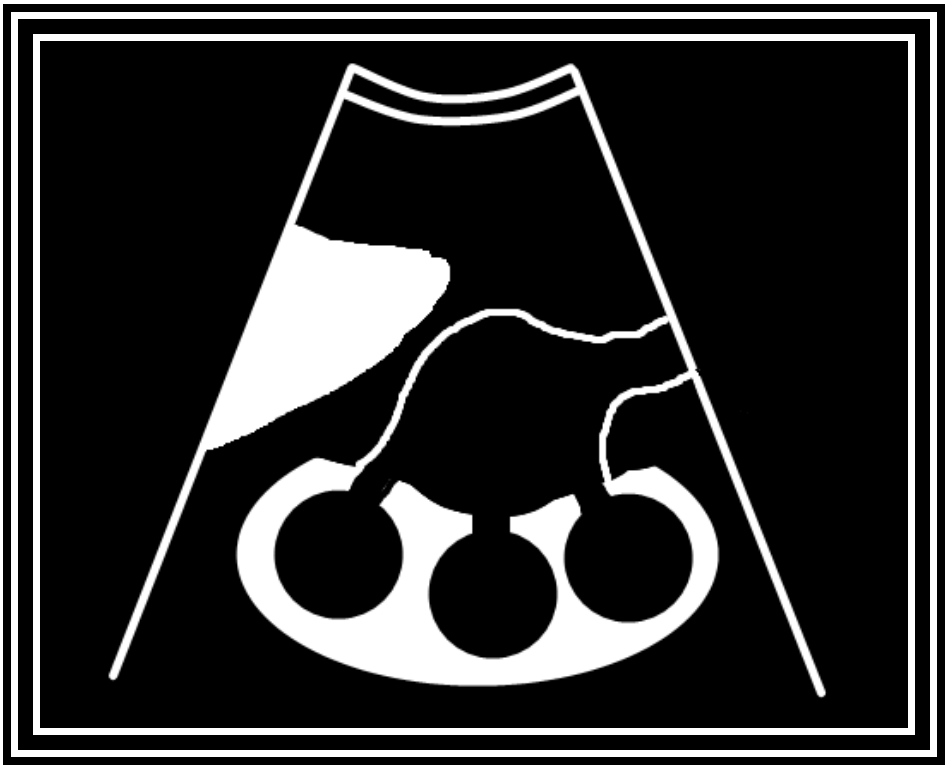
ADEQUACY OF PAEDIATRIC RENAL TRACT ULTRASOUND

REQUESTS AND REPORTS

Nishentha Govender



A research report submitted to the Faculty of Health Sciences,

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in partial fulfilment of the requirements for the degree of

Master of Medicine in the branch of Radiology

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DECLARATION

I, Nishentha Govender declare that this thesis is my own work. It is submitted for the degree of Master of Medicine in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at this or any other University

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_____ Day of _____ 2011

DEDICATION

To my supervisor and teacher, Professor Andronikou, thank you for your charisma, guidance and wisdom. I am honoured to be your student.

Thank you to my parents, brother and family, for their love and encouragement. You are the vivid paint on my life`s canvas.

Dr Matthew Goodier thank you for the assistance and support.

Dr Louise Keating, a friend, an angel and master of the tea leaves.

Thank you Samuel for your belief and cheer.

"Live as if you were to die tomorrow. Learn as if you were to live forever."

Mohandas Gandhi

PUBLICATIONS AND PRESENTATIONS

“Adequacy of paediatric renal ultrasound requests and reports” has been accepted, as an Oral presentation at the SORSA-RSSA Imaging Congress 2011 Durban, South Africa.

ABSTRACT

Management guidelines for urinary tract infections (UTI) invariably include renal ultrasound (RUS). Adequacy of RUS requests and reports is important for clinical practice.

Aim

To assess the adequacy of paediatric RUS requests and reports, the effects of the former on the latter, the effect of reporter`s rank, determine the yield and correlate adequacy with regard to the frequency of pathology.

Materials and Methods

Retrospective review of RUS reports of children was performed. A “Request Adequacy Score” (total 3) and a “Report Adequacy Score” (total 21) based on the RSNA reporting template was developed. A UTI subgroup was created.

Results

Mean “Report Adequacy Score” was 6.67. Residents performed better than consultants. There was no significant factor correlating with report adequacy. Hydronephrosis was the commonest pathology.

Conclusion

RUS requests and reports are inadequate. To improve reporting a renal ultrasound reporting template was developed.

ACKNOWLEDGEMENTS

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INTRODUCTORY CHAPTER

1.1. INTRODUCTION

The most common bacterial infection in childhood is urinary tract infection (UTI). [1] Imaging is a valuable investigative tool in the context of UTI for the detection of abnormalities, such as vesicoureteral reflux (VUR), urolithiasis or congenital abnormalities, which require specific and appropriate treatment. Furthermore imaging detects the development of complications. [2]

The management of urinary tract infections is contentious and guidelines are evolving, with renal ultrasound providing the one consistent initial screening tool. Ultrasound continues to form an essential component of all management protocols, aimed at decreasing morbidity and mortality.

Current views regarding Urinary Tract Infections:

Multimodality imaging of UTI and VUR is complex and controversial. Evolution in imaging practice is motivated by the desire to minimize unnecessary interventions and radiation exposure in children.[3] Renal ultrasound (RUS) is non-invasive, lacks ionising radiation, and is of low cost, which makes it a favourable choice when imaging UTIs in paediatric patients.

Other modalities for imaging UTI in children include fluoroscopic voiding cystourethrogram (VCU), nuclear voiding cystourethrogram (direct Mag 3), and

nuclear renal scintigraphy (NRS) in the form of DMSA and Mag 3 renogram. Excretory urography (otherwise known as IVP – intravenous pyelogram) is no longer recommended in the routine evaluation of childhood UTI except when information regarding anatomy is needed. Computed tomography is reserved for investigating renal calculi and renal tumours [4] but magnetic resonance imaging (MRI) is gaining popularity as a primary tool for imaging the collecting system and providing information regarding function, as it is non-invasive and imparts no radiation dose.

Importance of Reporting Guidelines:

The Radiological Society of North America (RSNA) Radiology Reporting Committee intended to create and distribute a best-practice template for the documentation of important imaging test results. An XML-based template format was designed, which could be adopted into radiology reporting standards and be used for collaborative authoring.[5]

The RSNA Radiology Reporting Template (published 2009) (see Appendix 5.1) for imaging the urinary tract in children, emphasises that provision of a history of UTI and hydronephrosis, as well as documentation whether the study requested is the first or a repeat RUS, are integral components of the request.[6]

The RSNA reporting template requires mention of certain key findings, which include the mean kidney length and a correlation to standard deviations for age, comment on the presence or absence of hydronephrosis or focal

parenchymal thinning, the presence or absence of a renal mass or calculi, a description of the kidney, the distal ureters and the amount of bladder distension.[6] Measurement of bladder parameters is an important component of RUS, with smaller bladder volumes, larger residual volumes and bladder wall thickening common findings in children with UTI. These parameters provide an objective method of evaluating bladder function, during the acute UTI and post-treatment follow-up.[7]

Another important measurement to assess during RUS is the antero-posterior (AP) renal pelvis diameter, especially when evaluating infants with an antenatal diagnosis of hydronephrosis. An association between immature function at the pelviureteric junction and bladder dysfunction has been postulated, due to the abnormal functional bladder parameters, in infants with antenatally diagnosed hydronephrosis. [8]

Role of Ultrasound in the setting of urogenital abnormalities:

RUS has a useful role in detecting urogenital structural and functional abnormalities which may predispose to urinary tract infections, including upper urinary tract obstruction (ureteropelvic junction obstruction), vesicoureteral reflux, lower urinary tract obstruction (primary megaureter), ureterovesical junction obstruction, posterior urethral valve, parenchymal scars, neurogenic problems (dysfunctional voiding), ectopic ureterocele with or without associated duplex collecting system) and calculi.[4] Children represent 2-3% of all patients

with urolithiasis. UTI is a major aetiological factor in the setting of urolithiasis, especially in boys; another contributing factor is a metabolic predisposition to stone formation. In the developed world, the proportion of infection based calculi, would be reduced by the early detection of underlying congenital abnormalities and urinary tract infection. If a predisposition has been identified, then RUS is a most appropriate screening tool. In the setting of a high index of clinical suspicion, when RUS has failed to detect urolithiasis, then only is low dose CT is indicated.[9]

The development of reporting styles:

"The complex cognitive task of radiology reporting is mostly learned during a resident's education and training. Specific didactic instruction, supervised practice, and the rigorous evaluation of reporting skills are vital components of any comprehensive program to improve radiology reporting."[10] A 2004 report of a national survey of accredited radiology residency program directors in the United States of America showed that "86% of training programs devote 1 hour or less per year to formal instruction in radiology reporting. Likewise, 82% of programs evaluate less than 1% of their residents' clinical reports. There clearly is room for improvement in education about reporting at both the residency and postgraduate levels." [10] There is a shortage of paediatric radiologists in South Africa, with a lack of subspecialty radiology training programmes, due to health budget constraints and a health policy which is

aimed at a widespread generalist service rather than sub-specialist service. Registrars in training are therefore often required to practise subspecialist work, with minimal training or even specialist supervision.

The relationship between the clinicians request and the radiologist`s report:

It is well documented that there is a direct relationship between the exam request seen by the radiologist and the report seen by the clinician. Dacher JN et al, reported that requests and reports represent two essential steps of the consultation process in radiology.[11]

Stavem et al, described that requests for imaging studies are frequently written in illegible handwriting and important clinical information might be inaccurate or incomplete. It was noted that radiologists` reports should be well written and composed of adequate content, for the report to meet the clinicians' needs[12]. A computerised radiology information system, which allows both the clinicians` requests and radiologists` reports to be typed and archived, may provide a solution.[12]

The majority of radiologists and clinicians, hold the view that the clinical indication of the request, the date of comparison study, the quality of the scan, relevant descriptive details, pertinent negative findings and measurements, should be included in the report. [13] The radiologist's opinion and recommendations for further investigations must be concluded in the assessment. Often dictated prose reports result in important data being

omitted. Computer–generated itemized detailed reports with accompanying images have been suggested to address the referring clinician's needs.[13]

Role of reporting tools:

Subspecialty societies are encouraged to consider clinically specific reporting templates to guide the development of a standardized, open-source information model for radiology reporting.[5] An integrated information model will enable subspecialty societies and others to collaborate on the creation of reporting templates that can be adopted throughout the profession. These templates will help radiologists to improve their reporting practices and vendors to incorporate structured information into their products.[5]
Simple tools, such as tick sheets or standardised methodology, as used by sonographers, and radiological templates, may ensure more accurate diagnoses with fewer errors, improved record keeping and more effective follow-up.

This provides better interdisciplinary communication, allows for valuable comparable data which can be used for follow-up, patient referral and improves patient care.

1.2. AIMS

This study aims to assess the adequacy of paediatric renal tract ultrasound requests and reports, the effects of the former on the latter, as well as the effect of the rank of the radiologist. The study will develop a guideline reporting template, for use in the local setting.

1.3. OBJECTIVES

1.3.1. To assess the adequacy of paediatric renal tract ultrasound reports against The Radiological Society of North America (RSNA) Radiology Reporting Committee Paediatric Reporting Guidelines for Renal ultrasound.

1.3.2. To determine the adequacy of paediatric renal tract ultrasound request forms, for the indication of UTI, against the RSNA Radiology Reporting Committee Paediatric Reporting Guidelines for Renal ultrasound.

1.3.3. To correlate the radiologist experience level, with the adequacy of reporting for the total and UTI subgroup.

1.3.4. To analyse the subcategory of referrals, relating to urinary tract infection as a special group.

1.3.5. To correlate the adequacy level of requests for UTI, with the adequacy level of reports for UTI.

1.3.6. To assess the pathological yield of paediatric renal tract ultrasound and the spectrum of pathology.

1.3.7. To create a standardised reporting template for paediatric renal ultrasounds, for the local setting.

2. CENTRAL CHAPTER

2.1. METHODOLOGY

A retrospective review of ultrasound requests and reports, of paediatric patients was conducted at the Charlotte Maxeke Johannesburg Academic Hospital (CMJAH). Hardcopy paediatric ultrasound reports were accessed from the record keeping area of the radiology department for 14 months (commencing 1st June 2009 and ending 31st July 2010). An ethics application was approved on the 1st October 2010 by the University of Witwatersrand ethics committee [see Appendix 5.2:Ethics clearance number M10902], and the Chief Executive Officer of CMJAH, had approved use of the necessary hardcopy files from the Department of Radiology [see Appendix 5.3]. Requests and reports were reviewed as per the inclusion and exclusion criteria. Patient`s data was anonymised for recording. Data was collected for two groups, namely the total group and for a subgroup with the indication of UTI. The information from the forms was recorded onto data collection sheets for the request, report and assessment components.

2.1.1. INCLUSION CRITERIA

a. Only ultrasound reports filed in the radiology department were included.

b. Any ultrasound request to image

    a) One or many parts of the genitourinary tract
    b) The abdomen, with either specified kidney size or with an indication for urogenital pathology
    c) The kidneys (renal) or bladder specifically.

c. Any request referring to genitourinary pathology, using the words UTI, VUR (vesicoureteric reflux), renal mass, hydronephrosis, hydroureter, VACTERAL, assessment of anomalies, spina bifida, neurogenic bladder, renal calculi, nephrotic syndrome, nephritic syndrome and ureterocele.

d. Children 14 years and younger.

2.1.2. EXCLUSION CRITERIA

a. Any requests not completed by a clinician.

b. Illegible reports.

c. Replacement requests due to lost forms.

d. Renal or abdominal ultrasound requests with the indication being trauma, for assessment of haematoma or expanding collections.

e. Renal ultrasound for the assessment of a transplant kidney.

f. Renal Doppler ultrasounds or renal requests for assessment of renal arteries.

2.1.3. DATA COLLECTION

Data was collected using data collection sheets [see Appendix 5.4].

A descriptive statement was scored positive if a comment was made, irrespective of whether pathology was present or not. Thus importance was placed as to whether standard descriptions were documented consistently even when there was no pathology detected. Data was collected as follows.

A) Request Adequacy Score:

A “Request Adequacy Score”, was scored out of a maximum of 3. Points were awarded for forms wherein the referring clinician indicated “onset of UTI”, “culture positive” or indicated significant biochemical results. Specific causative agents were recorded in separate subcategories: “ *E.coli*”, “*Klebsiella*” and “*Proteus*”. [see attached Appendix 5.4 (a)]

B) Rank:

The level of experience and qualification of the reporter was categorised into “Registrar”, “Consultant” or “Registrar assisted, by a fellow registrar or consultant”. [see attached Appendix 5.4 (b)]

C) Indication:

The indication for the renal ultrasound, was categorised into: ‘UTI’, ‘Anomalies’, ‘Hydronephrosis’, ‘Hydroureter’, ‘Renal Failure/Renal Dysfunction’, ‘Renal Mass’, ‘Heamaturia’, ‘Neurogenic Bladder’ and ‘Malnutrition’. [see attached Appendix 5.4 (c)]

D) Type of request: “Renal specifically” or “Abdominal request”

Clinicians suspecting renal pathology, either requested abdominal ultrasounds or renal ultrasounds. Abdominal ultrasounds comment on the renal structures in addition to many other structures, thus these are thought to be more time consuming and not as focussed as compared with the specific renal ultrasound. [see attached Appendix 5.4 (c)]

E) Report Adequacy Score:

A “ Report Adequacy Score” based on The Radiological Society of North America Radiology Reporting Committee Paediatric Reporting Guidelines for Renal ultrasound [RSNA 2009] was used [see attached Appendix 5.1]. The “Report Adequacy Score” was a sum of the “Kidney” score, the “Special Comment” score, the “Distal Ureter” score, the “AP Pelvis” score and the “Bladder” description score. This is summarised in Table 1. The score ranged from 0 to 21. The descriptive information from the report was categorised and a

score was given for the use of various words and measurements. Examples of the data collection sheets used are attached in Appendix 5.4 (d) 1 - 4.

Table1: Different components of the "Report Adequacy Score".

Categories of Adequacy of Reporting	**Score**
Adequacy score for "Kidney" [see attached Appendix 5.4 (d) 1]	8
Adequacy score for "Specific Comments" (Hydronephrosis, Hydroureter, Calculi, Anomalies and Focal Lesions) [see attached Appendix 5.4 (d) 2]	5
Adequacy score for "Distal Ureter" [see attached Appendix 5.4 (d) 3]	1
Adequacy score for "AP Pelvis" [see attached Appendix 5.4 (d) 4]	3
Adequacy score for "Bladder" [see attached Appendix 5.4 (d) 3]	4
Total Adequacy Score	**21**

F) Data from the assessments or conclusions:

The ultrasound form was analysed as to whether an assessment was made, and if this assessment was “normal” or “abnormal”. Forms with no comment or assessment were grouped as a separate category, termed “no comment”. [see attached Appendix 5.4 (e)]

The report was categorised as “normal” if the assessment stated any one of the following: “normal”, “no significant pathology”, “normal findings” or “no abnormalities”. Furthermore information was subcategorised into normal renal ultrasound and normal abdominal ultrasound.

Those assessments categorised as “abnormal” where examined as to the type of documented pathology classified into: “hydronephrosis”,” hydroureter”, “abnormal echogenicity” , “abnormal size”, “anomalies”, “calculi”, “pyelonephritis” or “glomerulonephritis” and “bladder pathology”. [see attached Appendix 5.4 (f)1]

The “Bladder Pathology was further categorised into: “uterocele”, “calculi”, “diverticuli”, “wall thickening”, “trabeculation”, “irregular wall”, “residual volume”, “bladder outlet obstruction and ‘other’. [see attached Appendix 5.4 (f)2]

The assessments were collected for the total reports received as well as for the subgroup of UTI.

2.1.4. MANAGEMENT OF MISSING DATA

If specific areas of the ultrasound form, such as the “request”, “rank”, “report” or “assessment”, were illegible or incomplete, then those specific areas were omitted from the data collection and calculations were performed from a modified total. All forms with documented signatures, of the reporting doctor, were correlated with department records to determine rank. If this was inadequate, then interpretation by the head of department with regard to determining rank was employed. The “rank” of the reporter documented on the form, was deemed to be inconclusive if the above methods were unsuccessful. The data regarding the “rank” of that specific reporter would be excluded. However data from the “request” and or the “report” were still be used, if those sections were considered complete and legible.

Missing values were addressed by referring back to the hardcopy patient file. However if the relevant data was not found then that section of that specific form was excluded.

2.2. DATA ANALYSIS

The “Report Adequacy Score” provided continuous quantitative data for analysis and ranged from 0 to a maximum of 21. Data was cleaned and assessed for missing values and extreme values.

Special statistical tests included the following: The Spearman’s correlation coefficient was used to correlate the “Request Adequacy Score” with the “Report Adequacy Score”. The Kruskal-Wallis test was used to investigate whether the “Report Adequacy Score” differed significantly for the different ranks. For the UTI subgroup the correlations of the “Request Adequacy Score”, “Report Adequacy Score” and pathological yield were investigated using Spearman’s Correlation Coefficient. Relationships between the gender of patients and the presence of pathology as well as the rank of the reporter and the presence of pathology were examined. The Chi-square test of Independence was used to test for significant relationships. Where the cell frequencies were too small, Fisher’s Exact test was used. The level of significance used in all tests was 0.05.

2.3. RESULTS

A total of 398 patients met the inclusion criteria. The 32 patients who met the exclusion criteria were removed leaving a total of 366 renal ultrasound request forms for evaluation, with 141 of these making up the UTI subgroup.

The total group showed a minimum age of 0 days and a maximum age of 14 years. The mean was 3 years and 8 months. The largest proportion of children imaged was younger than one year of age. For the UTI subgroup, the minimum age was 2 days and the maximum was 14 years. The mean age was 2 years and 9 months.

The gender was recorded in 362 patients - of these 229 (63%) were male patients and 133 female patients (36%). For the UTI subgroup 93 children were male (66%) and 48 female (34%).

2.3.1. ANALYSIS OF REQUEST

A) Request Adequacy Score

Results of the “Request Adequacy Score”, which was exclusively used for the UTI subgroup, ranged from 0 to 3. “Request Adequacy Scores” were ‘0’ in 92 requests (65%), ‘1’ in 12 requests (9%), ‘2’ in 35 requests (25%), and the maximum of ‘3’ in 2 requests (1%). These results are summarised in Table2 below.

Table2: Demonstrates the mean “Request Adequacy Score” achieved for different “Report Adequacy Scores” in the UTI subgroup.

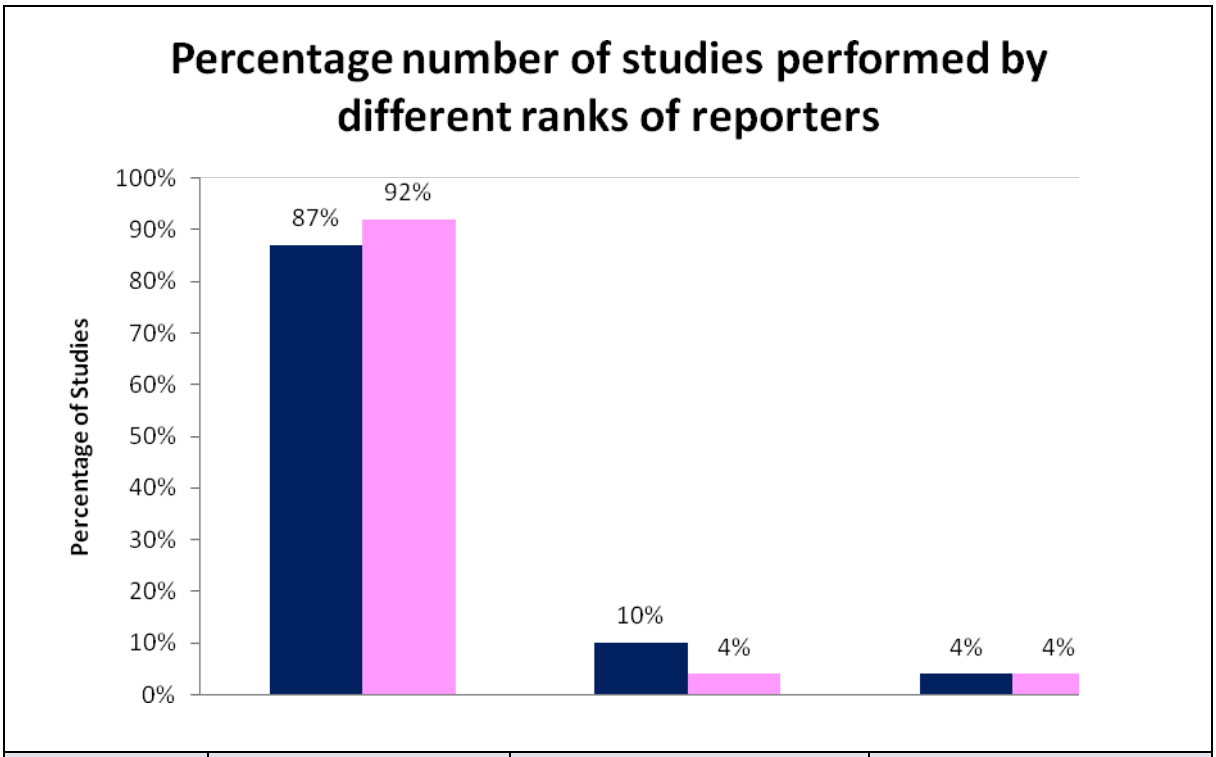
“Request Adequacy Score”	Mean “Report Adequacy Score”	Number of Forms
0	6.85	92 Forms
1	5.92	12 Forms
2	6.66	35 Forms
3	5.50	2 Forms

No statistically significant correlation was found between the three variables: “Request Adequacy Score”, “Report Adequacy Score” or the assessment of the ultrasound.

B) Rank of doctors performing the ultrasound:

The total of 365 forms had indicated legibly the rank of the doctor performing the procedure. For the total group, the majority of studies (87%; 314 forms), were performed by “registrars” and the minority by “consultants” (4%; 13 forms). The “registrars” also performed the majority of UTI subgroup studies (92%; 130 forms) and the “registrar assisted” by a consultant or fellow registrar performed the minority of studies (4%; 5 forms), as illustrated in Figure1.

Figure 1: Diagram demonstrating the number of studies performed by different ranks of doctors.



	Registrar	Registrar Assisted	Consultant
Total Group	87% 314 forms	9% 37 forms	4% 13 forms
UTI Subgroup	92% 130 forms	4% 5 forms	4% 6 forms

Correlation Tests:

The average report “Report Adequacy Scores” was not found to be statistically significantly different between the 3 ranks (p= 0,066) using the Kruskal-Wallis test. The mean “Report Adequacy Score” for the consultants was the lowest for both the total group and the UTI subgroup, as summarised in Table 3.

Table 3: The mean “Report Adequacy Score” achieved by different Ranks of doctors, for the Total and UTI subgroups (maximum achievable score 21)

	Mean “Report Adequacy score” achieved by “Registrar”	Mean “Report Adequacy Score” achieved by “Consultants”	Mean “Report Adequacy Score” achieved by “Registrar assisted”
“Report Adequacy score” for Total group	6.76	6.08	6.08
“Report Adequacy score” for UTI group	6.74	5.50	7.2

C) Types of request: “Renal specifically” or “Abdominal request”:

49% (179) of request forms for the total group and 46% (65) for the UTI subgroup were requested as “abdominal” scans and not “renal” scans. The mean adequacy score achieved by the total group was 6.83 for “renal” requests, as compared to 6.5 for “abdominal” requests (table 4). This was not a statistically significant difference.

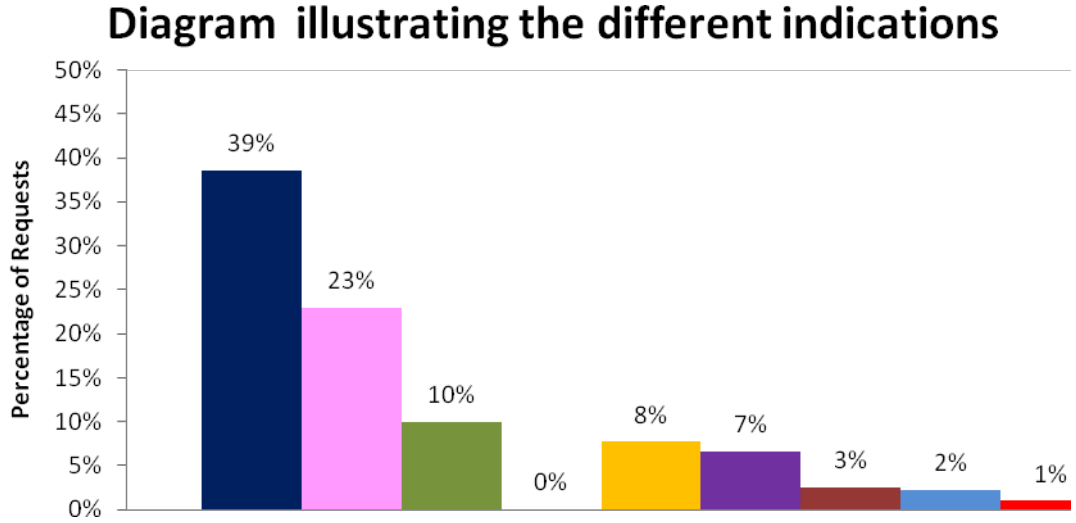
Table 4: Compares the different types of clinician requests, with the mean “Report Adequacy Score” achieved.

	mean “Report Adequacy Score” for Total group	mean “Report Adequacy Score” for UTI subgroup
abdominal request (not renal specifically)	6.5	6.52
renal specifically	6.83	6.82

D) Spectrum of Indications for renal ultrasounds:

Paediatric renal ultrasounds were requested for different indications which are summarised in Figure 2. The most common indication was for the assessment of “UTI” (141 requests; 39%). The least common indication was for “hydroureter” with no requests made.

Figure 2: Different indications comprising the total ultrasound requests.

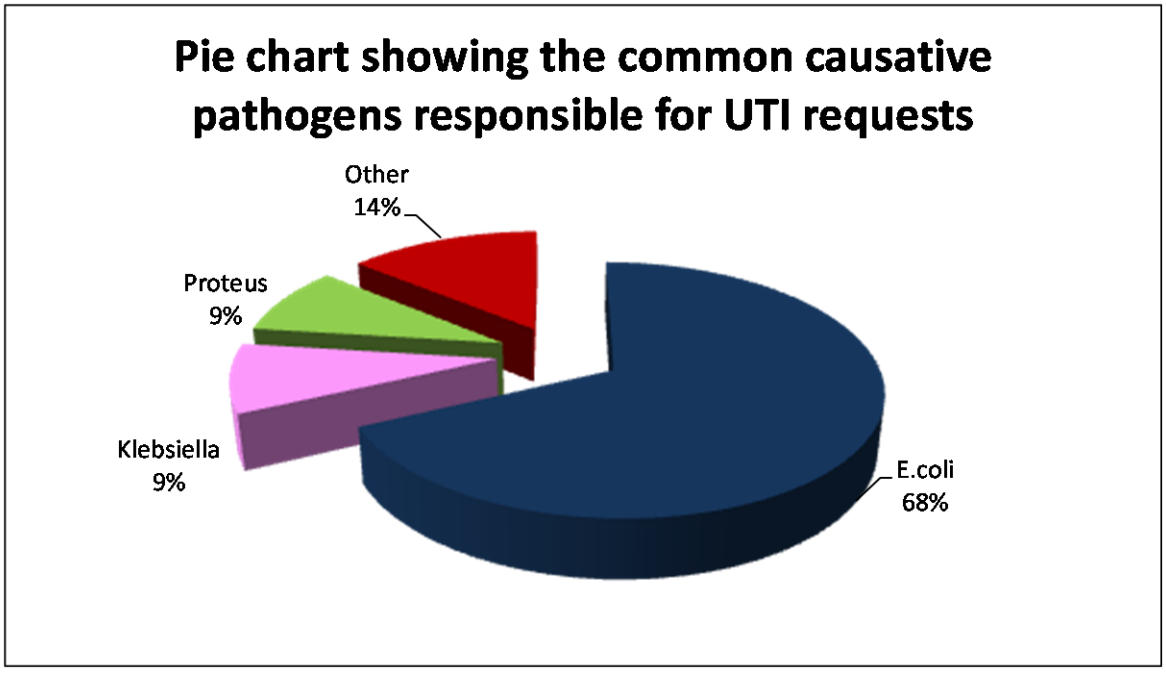


	Indications		
	UTI	39%	141 forms
	Anomaly	23%	84 forms
	Hydronephrosis	10%	37 forms
	Hydroureter	0%	0 forms
	Renal failure / dysfunction	8%	28 forms
	Renal Mass	7%	24 forms
	Haematuria	3%	9 forms
	Neurogenic Bladder	2%	8 forms
	Malnutrition	1%	5 forms

E) Analysis of the UTI Subgroup:

The ‘onset of the UTI’, ‘if culture positive’ and the ‘causative agent’ was analysed for the UTI subgroup only. The ‘onset of the UTI’ was mentioned in 7 forms (5%). 47 forms (33%) documented positive cultures, with 35 forms (25 %) indicating the causative pathogen. Figure 3 illustrates the percentage incidence of different culture positive pathogens.

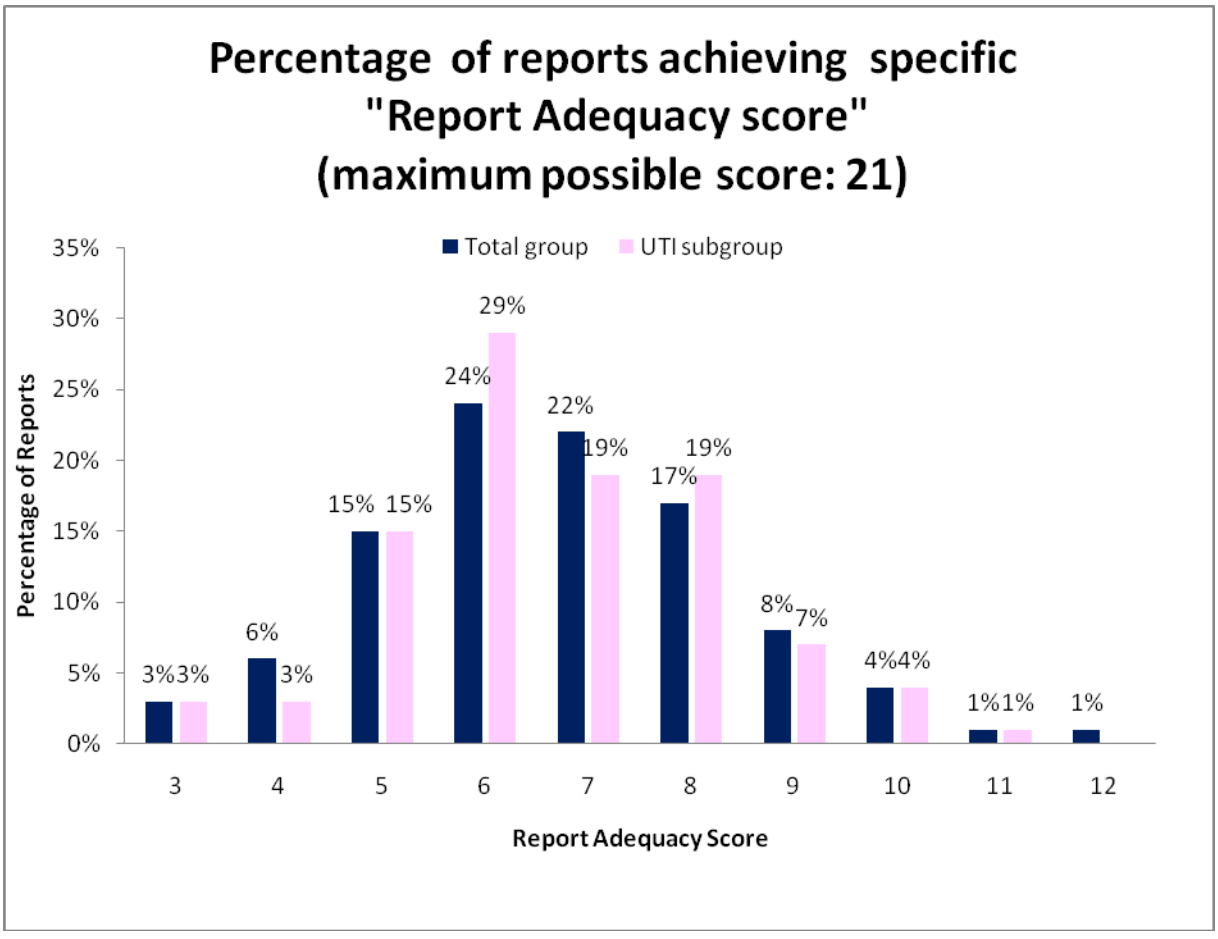
Figure 3: Diagram demonstrating the different causative agents cultured.



2.3.2. ANALYSIS OF "REPORT ADEQUACY SCORE"

The "Report Adequacy Score" ranged from 0 to a possible maximum of 21. The minimum score achieved was 3 and the maximum score achieved was 12. The commonest score was 6, for both the UTI and total group. The "Report Adequacy Scores" for the Total and UTI subgroups are summarised in Figure 4.

Figure 4: Comparison of the "Report Adequacy Scores" of the total subgroup and the UTI subgroups.



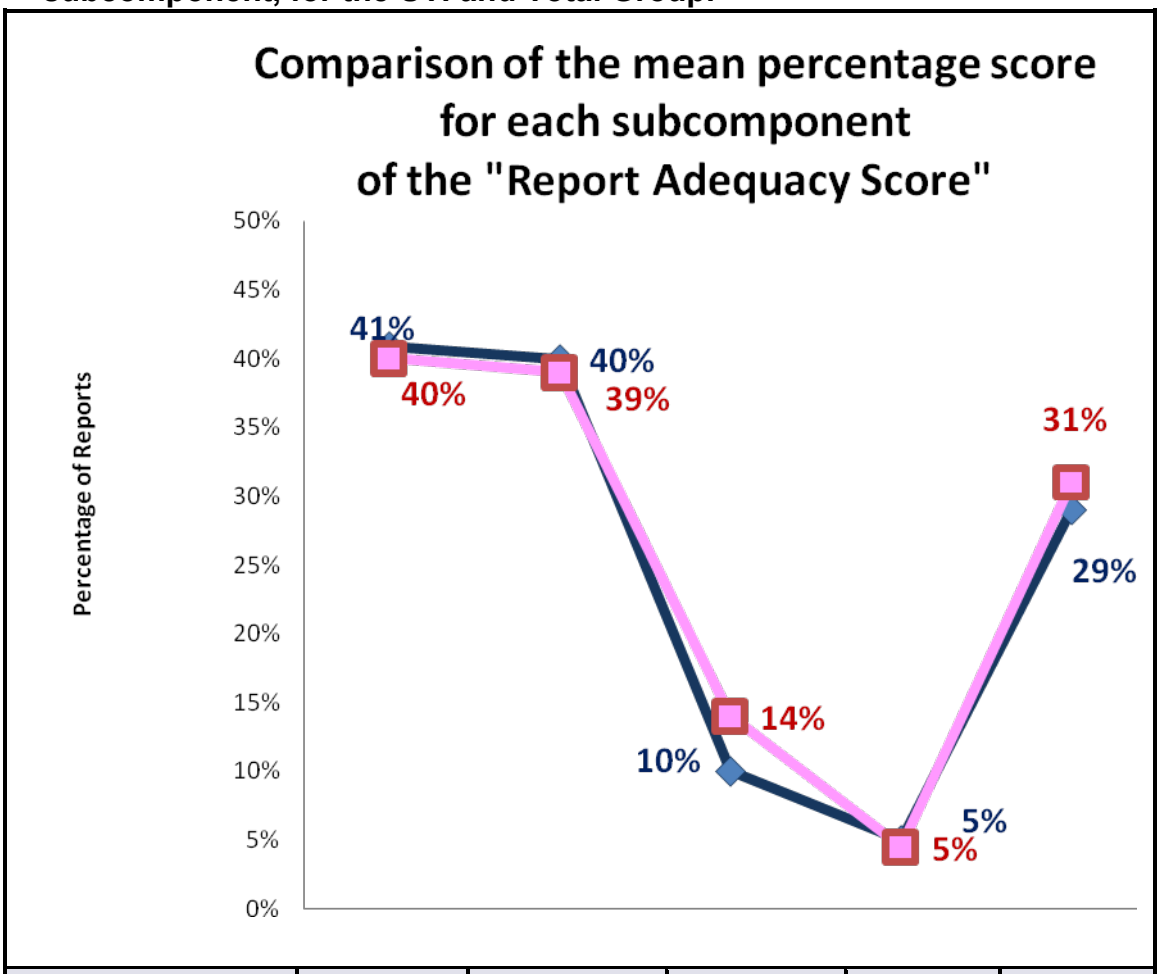
For both the total and UTI subgroups, the best reported section was the “Kidney” comment, followed by “Specific comments”, “Bladder”, “Distal ureter” and then the “AP pelvis. These results are summarised in Table 5.

Table 5: Demonstrates the average “Report Adequacy Score” and as a percentage of the maximum possible score, for each subcomponent of the “Report Adequacy Score”.

“Report Adequacy Score” And maximum possible score for each section	Average Score Total group	Average Score UTI sub-group
“Kidney” Comment (maximum score:8)	3.27 (41%)	3.22 (40%)
“Specific Comments” (maximum score:5)	2.0 (40%)	1.95 (39%)
“Distal ureter” (maximum score:1)	0.1 (10%)	0.14 (14%)
“AP Pelvis” (maximum score:3)	0.16 (5%)	0.13 (5%)
“Bladder” (maximum score:4)	1.14 (29%)	1.26 (31%)
Total “Report Adequacy Score” (maximum score:21)	6.67 (31.8%)	6.7 (31.9%)

The best reported subcomponent was the mean “kidney” score was 41% for the total group and 40% of the UTI subgroup. The “distal ureters” were on average reported better in the UTI group as compared to the total group. The “AP Pelvis” was the worst reported for the total and the UTI subgroups. These results are summarised in Figure 5.

Figure 5: Comparison of the average "Report Adequacy Score" for each subcomponent, for the UTI and Total Group.



	Mean "Kidney" score	Mean "Specific Comments"	Mean "Distal Ureter" score	Mean "AP Pelvis" score	Mean "Bladder" score
Total Group	41%	40%	10%	5%	29%
UTI Subgroup	40%	39%	14%	5%	31%

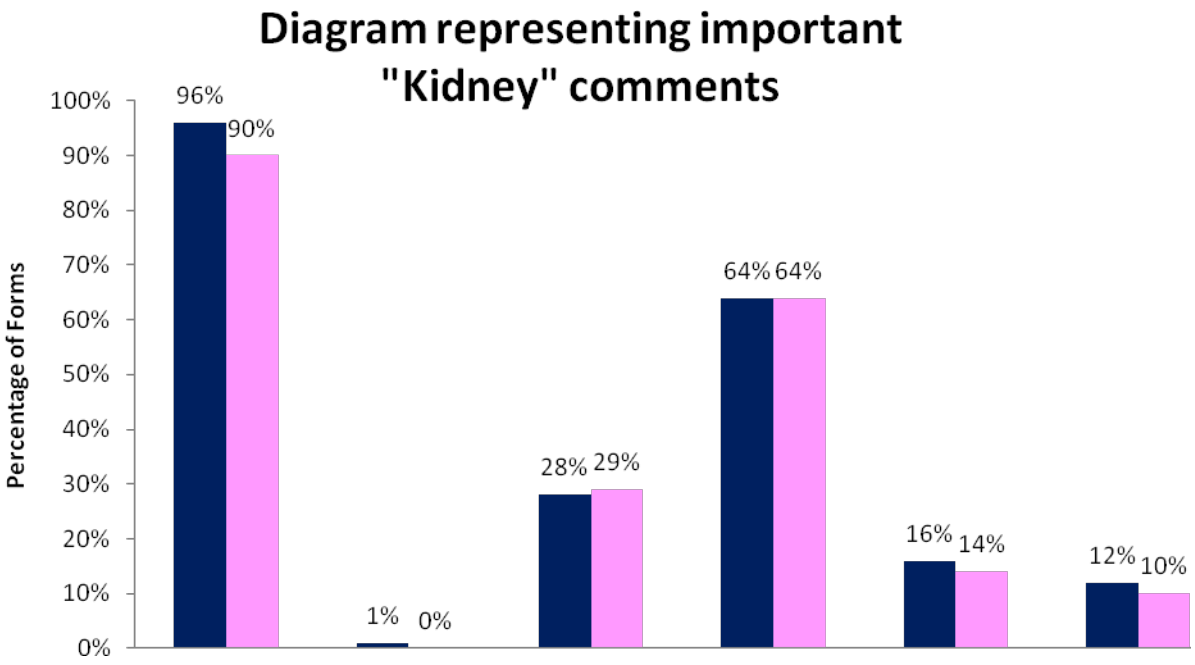
2.3.3. ANALYSIS OF REPORT SUBCOMPONENTS

A) Kidney Comments

i) Kidney Descriptions:

The “presence of one or both kidneys” was recorded in 100% of the total group and UTI subgroup. The “measured size of one or both kidneys” was documented on 347 (96%) forms and 133 forms (90%), for the total and UTI subgroups respectively. The worst documented comment for both the total group and UTI subgroups, was “normal international predicted values for age provided”, as illustrated in Figure 6.

Figure 6: Graph comparing important "Kidney" comments, for the Total and UTI subgroup.



	Measured size	Normal international predicted values for age provided	Commented normal and abnormal in size	Echo-genicity	Cortico-medullary differen-tiation	Location
Total Group	96% 347 forms	1% 2 forms	28% 101 forms	64% 234forms	16% 58 forms	12% 43 forms
UTI Subgroup	90% 133 forms	0% 0 forms	29% 41 forms	64% 90 forms	14% 19 forms	10% 14 forms

ii) “Kidney” Adequacy Score:

The “kidney” adequacy score, ranged from 0 to 8. The minimum score for both groups was 1, whilst the maximum score was 5 and 6, for the total and UTI subgroup respectively. The majority of reports 176 forms (48%) for the total group and 77 forms (55%) for the UTI subgroup, achieved a score of 3, which is suboptimal. Table 6 demonstrates the different scores achieved.

Table 6: Demonstrates the percentage reports achieving different "Kidney" Adequacy Scores, for the Total and UTI subgroups.

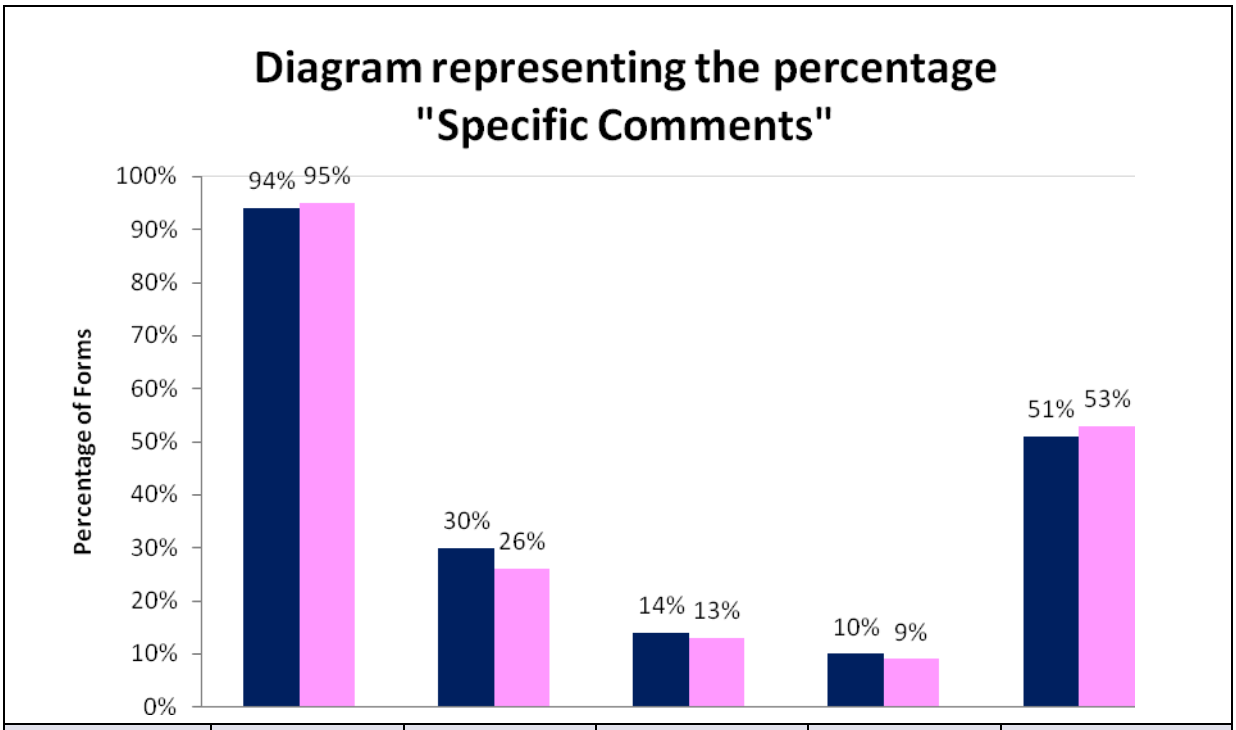
"Kidney" adequacy Score [maximum 8]	Percentage of the total group	Percentage of the UTI subgroup
Score 1	1% (5 Forms)	1% (2 Forms)
Score 2	17% (63 Forms)	15% (21 Forms)
Score 3	48% (176 Forms)	55% (77 Forms)
Score 4	23% (82 Forms)	21% (29 Forms)
Score 5	8% (28 Forms)	6% (9 Forms)
Score 6	3% (10 Forms)	2% (3 Forms)
Score 7	0.3% (1 Form)	0% (0 Forms)
TOTAL NUMBER OF FORMS	365 Forms	141 Forms

B) Specific Comments

i) Specific Descriptions:

“Hydronephrosis/ Prominence of the calyceal system” was the best reported “Specific comment” with 344 forms (94%) and 134 forms (95%) for the total and UTI subgroups respectively. “Anomalies” was the least reported, with only 38 forms (10%) and 12 forms (9%) for the total and UTI subgroups, as illustrated in Figure7.

Figure 7: Graph comparing important "Specific Comments", for the Total and UTI subgroup.



	Hydro-nephrosis	Hydro-ureter	Calculus	Anomalies	Focal Lesions
Total Group	94% 334 forms	30% 110 forms	14% 51 forms	10% 38 forms	51% 186 forms
UTI Subgroup	95% 134 forms	26% 37 forms	13% 18 forms	9% 12 forms	53% 74 forms

ii) “Specific Comments” Adequacy Score:

The maximum number of points allocated for “Specific Comments” was 5. However the most frequent score achieved was 2, for the total and UTI subgroups, 208 forms (57%) and 85 forms (60%), as demonstrated by Table 7.

Table 7: Demonstrates the percentage reports achieving different “Specific Comments” Adequacy Scores, for the Total and UTI subgroups.

“Specific Comments” adequacy Score [maximum 5]	Percentage of the total group	Percentage of the UTI subgroup
Score 0	2% (6 Forms)	1% (2 Forms)
Score 1	20% (73 Forms)	21% (29 Forms)
Score 2	57% (208 Forms)	60% (85 Forms)
Score 3	20% (72 Forms)	17% (24 Forms)
Score 4	2% (6 Forms)	1% (1 Form)
TOTAL NUMBER OF FORMS	365 Forms	141 Forms

C) Distal Ureters

i) Distal Ureter Description:

Distal ureters were commented on in 36 forms (10%) of the total group reports and 20 forms (14%) of the UTI subgroup.

ii) “Distal Ureters” Adequacy Score:

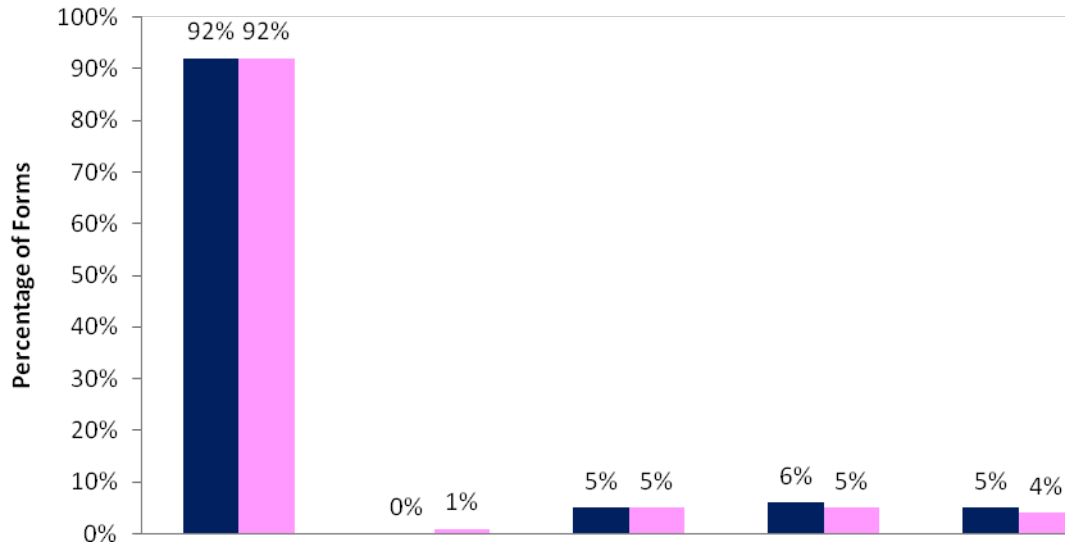
For the total group a maximum score of 1 was achieved, for 36 forms (10%) and the minimum score of 0, in 329 forms (90%). For the UTI subgroup, 20 forms (14%) achieved the maximum score and 121 forms (86%) the minimum.

D) AP Pelvis

i) AP Pelvis Description:

Most frequently there was no comment regarding the “AP Pelvis” 336 forms (92%) for the total group and 130 forms (92%) for the UTI subgroup. Comments regarding the AP Pelvis are summarised in Figure 8.

Figure 8: Graph comparing important "AP Renal Pelvis" comments, for the Total and UTI subgroup.



	No Comment	Not Visible	Commented if normal or abnormal	Commented visible or measured	Actual value given in SI Unit
Total Group	92% 336 forms	0% 1 form	5% 19 forms	6% 22 forms	5% 19 forms
UTI Subgroup	92% 130 forms	1% 1 form	5% 7 forms	5% 7 forms	4% 4 forms

ii) “AP Pelvis” Adequacy Score:

The most common score for both the total and UTI subgroups, was a Score of 0, which was noted in 338 forms (93%) and (93%) 131 forms respectively. The maximum possible Score was 5, however, the highest score achieved was a Score of 3, noted in 9 forms (3%) and 2 forms (1%) of the total and UTI subgroups. See Table 8 below.

Table 8: demonstrates the percentage reports achieving different “AP Pelvis” Adequacy Scores, for the Total and UTI subgroups.

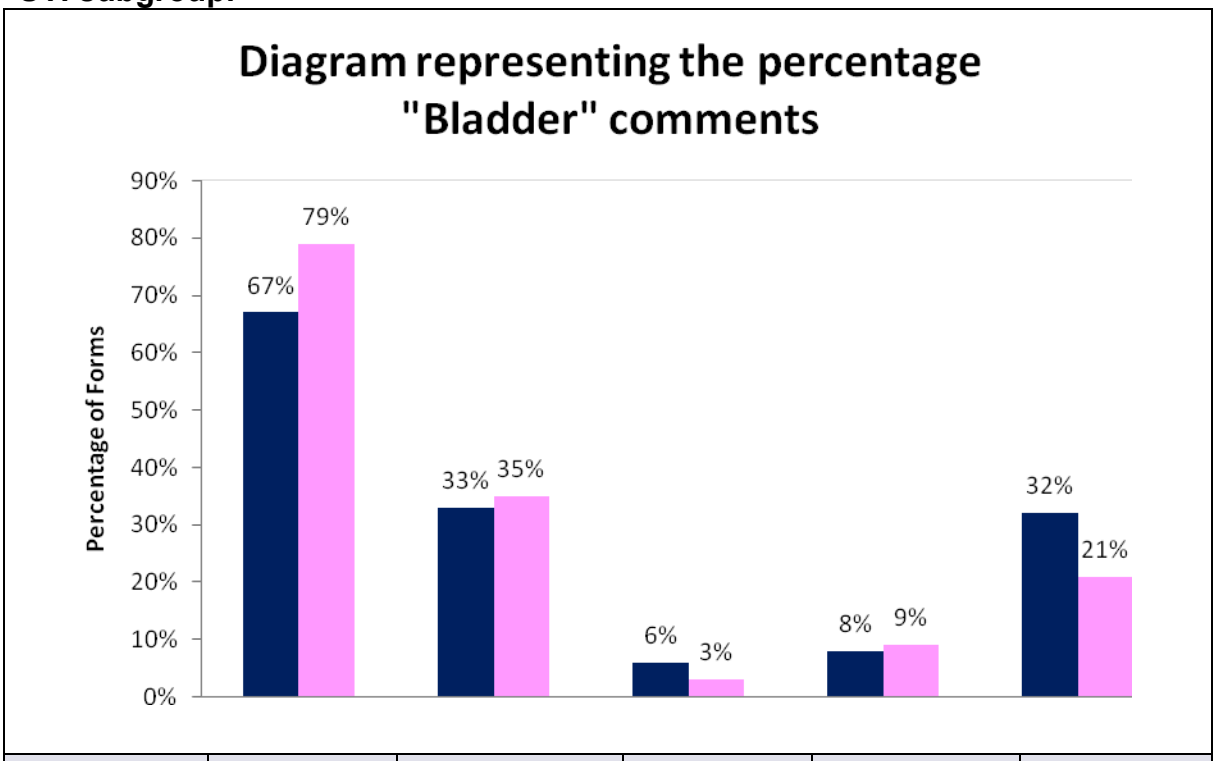
“AP Pelvis” adequacy Score [maximum 5]	Percentage of the total group	Percentage of the UTI subgroup
Score 0	93% (338 Forms)	93% (131 Forms)
Score 1	1% (5 Forms)	2% (3 Forms)
Score 2	4% (13 Forms)	4% (5 Forms)
Score 3	3% (9 Forms)	1% (2 Forms)
TOTAL NUMBER OF FORMS	365 Forms	141 Forms

E) Bladder Comments

i) Bladder Description:

The Bladder was “visualised, measured or recorded as empty/collapsed” in 246 forms (67%) of the total group and 111 forms (79%) of the UTI subgroup. This was the most frequent comment, as summarised in Figure 9 below. The poorest reported comment for the total and UTI subgroup was the “bladder volume calculation” in 21 Forms (6%) and in 4 forms (3%) respectively.

Figure 9: Graph comparing important "Bladder" comments, for the Total and UTI subgroup.



	Bladder visualised or measured or recorded as empty	Bladder wall thickness measured or comment if abnormal/ normal or if empty	Bladder Volume measured	Post micturition bladder volume or comment why not possible	No comment
Total Group	67% 246 forms	33% 122 forms	6 % 21 forms	8% 28 forms	32% 117 forms
UTI Subgroup	79% 111 forms	35% 49 forms	3% 4 forms	9% 13 forms	21% 29 forms

ii) "Bladder" Adequacy Score:

The maximum score of 5, was not achieved by any reports. The highest score was 4, attained by 3 forms (1%) and 1 form (1%) for the total and UTI subgroups respectively. The most frequent score, as illustrated in Table 9 below, for both the total and UTI subgroups was a Score of 0, in 118 forms (32%) and 30 forms (21%) respectively.

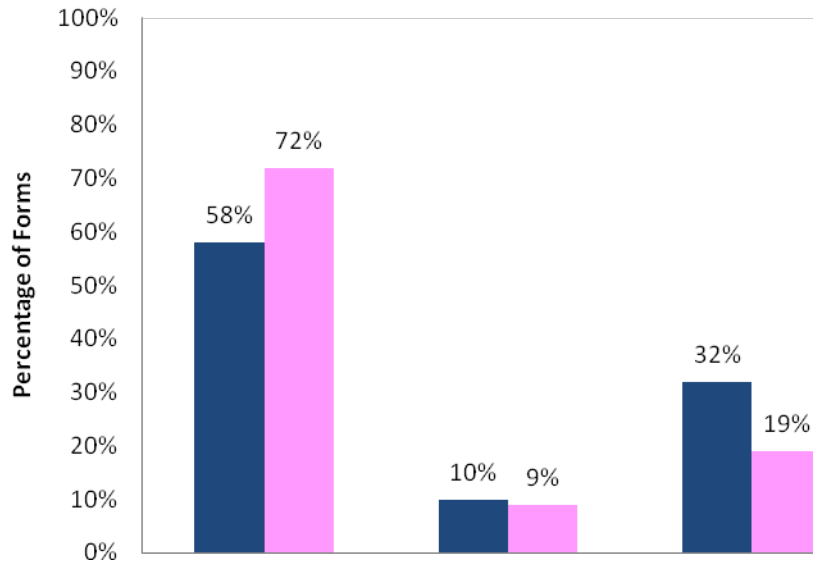
Table 9: Demonstrates the percentage reports achieving different "Bladder" Adequacy Scores, for the Total and UTI subgroups.

"Bladder" adequacy Score [maximum 5]	Percentage of the total group	Percentage of the UTI subgroup
Score 0	32% (118 Forms)	21% (30 Forms)
Score 1	29% (106 Forms)	38% (53 Forms)
Score 2	32% (115 Forms)	36% (51 Forms)
Score 3	6% (23 Forms)	4% (6 Forms)
Score 4	1% (3 Forms)	1% (1 Form)
TOTAL NUMBER OF FORMS	365 Forms	141 Forms

2.3.4. ANALYSIS OF ASSESSMENT

Reviewing the ultrasound assessment section of the total group, showed 211 forms (58%) were assessed as “normal’’, “no significant pathology” or “no abnormal findings” and only one form was assessed as suboptimal. 35 forms (10%) documented “no comment or assessment” and 117 forms (32%) had assessments which were “abnormal”. In the UTI subgroup, 101 forms (72%) were assessed as” normal”, 12 forms (9%) had “no comment or assessment” and 28 forms (19%) assessed as “abnormal” studies. These findings are summarised in Figure 10.

Figure 10: Diagram illustrating the assessments for the paediatric renal ultrasounds, for the total group and the UTI subgroup.



	Normal Assessment	No Comment	Abnormal Assessment
Total Group Assessments	58% 211 forms	10% 35 forms	32% 117 forms
UTI Subgroup Assessments	72% 101 forms	9% 12 forms	19% 28 forms

A) Gender distribution of abnormal assessments

Male patients comprised 78 of the 'abnormal' assessments (66%) for the total group and 21 assessments (75%) of the UTI subgroup. Females were found in 39 abnormal assessments (34%) of the total group and 7 assessments (25%) of the UTI subgroup.

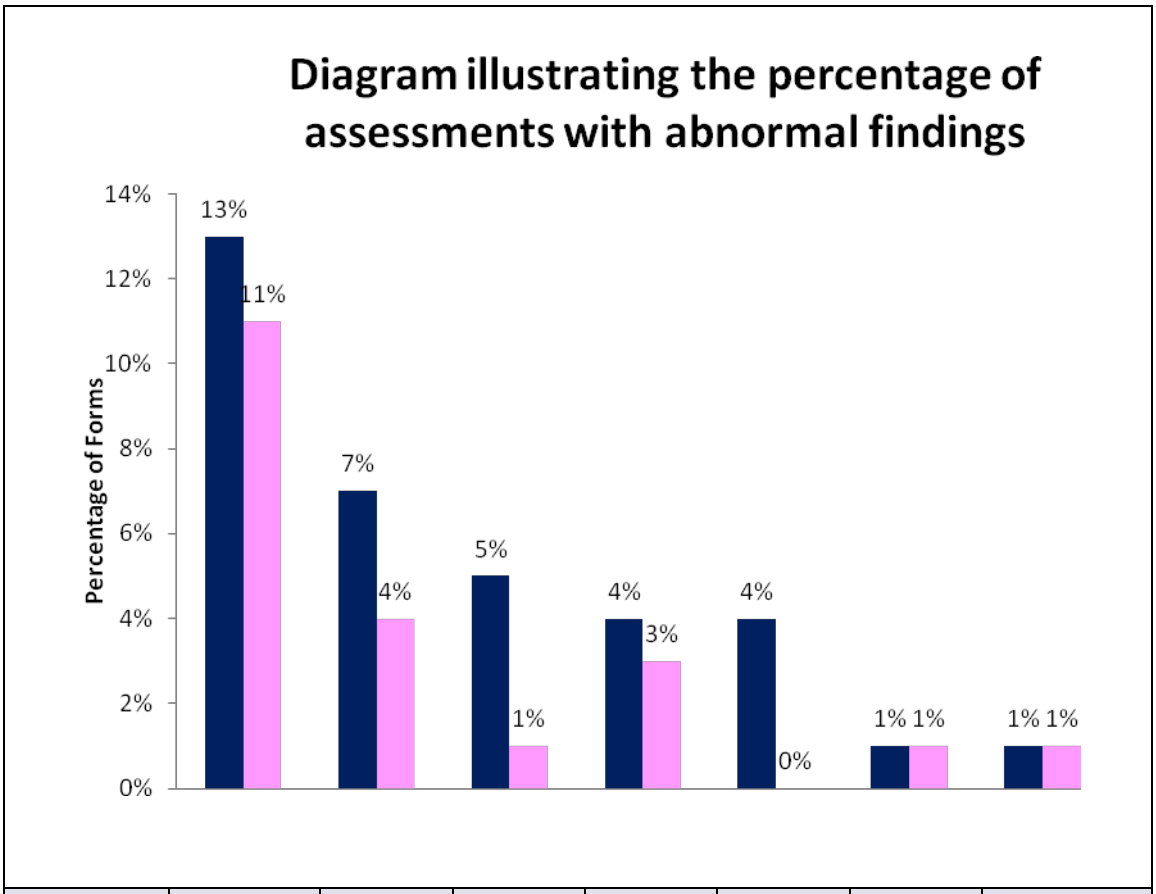
Correlation Tests:

Chi-square Tests on the cross tabulations between the gender of patients and the presence of abnormal pathology, showed no significant relationships, for both the total group (p=0.486) and the UTI subgroup (p=0.259).

B) Specific pathologies yielded in the Assessment section

On analysis of the assessments of the renal ultrasound forms, it was found that 47 forms (13%) documented the presence of "hydronephrosis" and 24 forms (7%) "hydroureter" in the assessment, which were the most frequent pathology noted for the total group. Similarly the commonest documented pathologies in the 'assessment' for the UTI subgroup were "hydronephrosis'' in 15 forms (11%) and "hydroureter" in 6 forms (4%) . These finding are summarised in Figure 11.

Figure11: Different pathologies documented in the assessment section, for the total and UTI subgroups.



	Hydro-nephrosis	Hydro-ureter	Abnormal echo-genicity	Abnormal Size	Anomaly	Calculus	Pyelo-nephritis / Glomerulo-nephritis
Total Group	13% 47 forms	7% 24 forms	5% 19 forms	4% 14 forms	4% 13 forms	1% 1 form	1% 5 forms
UTI Subgroup	11% 15 forms	4% 6 forms	1% 1 form	3% 4 forms	0% 0 form	1% 1 form	1% 1 form

The commonest types of “Bladder Pathology” were “wall thickening’’, ‘’trabeculations’’ and ‘’irregular wall” for both the UTI and Total Group. The least common pathology recorded in the assessments was “uteroceles” for the total group and no studies in the UTI subgroup yielded “uteroceles” or “diverticuli”, as illustrated in Table 10.

Table 10: Demonstrates the various "Bladder Pathologies" for the Total and UTI Subgroups recorded in the 'Assessment'.

	TOTAL GROUP	UTI GROUP
Uterocele	1 Form	0 Forms
Calculi	2 Forms	1 Form
Diverticuli	2 Forms	0 Forms
Wall thickening, Trabeculation, Irregular Wall	8 Forms	3 Forms
Residual Volume	5 Forms	1 Form
Bladder outlet obstruction and other	2 Forms	2 Forms
TOTAL	20 Forms	7 Forms

Correlation Tests:

No significant relationship existed between the “rank” of the doctor and presence of “abnormal” assessments for the total or the UTI sub-groups, according to Chi-square and Fisher`s Exact tests.

The “Request Adequacy Score” showed no relationship with the “Report Adequacy Score ($p=0.143$) and with the assessment ($p=0.892$), using Spearmen`s Correlation. The “Report Adequacy score” showed no significant relationship with assessment ($p=0.964$).

3. CONCLUDING CHAPTER

3.1. DISCUSSION

Paediatric renal tract pathology is common, both throughout the world and in South Africa. The management of urinary tract infections (UTI) is contentious and guidelines are evolving, in particular with regard to the role and type of imaging performed. Imaging for UTI using renal ultrasound is non-invasive, lacks ionising radiation, and is of low cost, which makes it a favourable choice in paediatric patients. Adequate paediatric renal tract ultrasound requests and reports are therefore paramount for urinary tract management and other renal tract disease in children.

Our results include a majority of patients under a year of age, which is the age when renal pathology most often presents. "Age and gender are important factors influencing prevalence. As males are more likely to be born with structural abnormalities of the urinary tract, UTI is common in their first six months of life."[14] Male patients were imaged most frequently in our study and the majority of abnormal studies were also found in male patients for both the total and UTI subgroups. There was no statistical relationship between gender and the likelihood of an abnormal "overall assessment" in reports. UTI infections are most commonly found in female patients [15], due to the shorter urethra, and thus female patients should represent a larger proportion of patients imaged. It is possible in our setting

clinicians are unfamiliar with current referral practises and continue to image only males with UTI, as was practised.[16]

This study represents a single institution, which has a heavy reliance on registrars for performing imaging procedures. The “Rank” of the doctor performing the ultrasound did not demonstrate a significant statistical relationship with the “Report Adequacy Score” of the report. However the average “Report Adequacy Score” achieved by the registrar group was higher than the score achieved by the consultant. As registrars are in a specialist training programme, they are taught to report in a proforma manner for most radiology modalities. Thus, they document or comment on structures, irrespective of whether pathology is present or not. Sistrom et al, described that improved radiology communication maybe achieved by employing “innovative software for creating, archiving, transmitting, and displaying reports’’ as well as “targeted education of radiology trainees and practitioners and the adoption of widespread standards for radiology report contents, language, and styles”. [10] They also concluded that “specific didactic instruction, supervised practice, and the rigorous evaluation of reporting skills are vital components of any comprehensive program to improve radiology reporting”.[10] In our study consultants, who are more experienced, may be reporting in less detail, because they fail to recognise the importance of comprehensive and reproducible reporting styles. Structured reporting has shown to have definite benefits. As described by Langlotz, “they facilitate clear communication, increase the availability of information resources, and foster clinical imaging research, thereby improving the practice of radiology.”[17] Better patient care, financial

benefits and improved service delivery for referring clinicians has been documented.[18]

Consultants performed few paediatric ultrasounds and for these irrespective of the indication, they scored lower average scores as compared to the registrars. This study cannot determine whether the consultants assess patients less thoroughly or only document their findings in a less systematic manner. In this study it was assumed implicit that if pathology was present during the ultrasound, then it would have been reported for clinical purposes. Furthermore the consultant group was a much smaller sample group as compared to the registrar group, and therefore results may represent the reporting styles of a few individuals. The registrars only had assistance from consultants or peers in 10% of the total number of cases and 4% of the UTI cases. For the UTI subgroup, however, the mean “Report Adequacy Score” did increase from 6.74 achieved by a registrar alone, to 7.2 when the registrar was assisted. This suggests that double reading and supervision may act as a motivator for more comprehensive reporting.

Irrespective of rank, patient age category, type of request or indication, the average “Report Adequacy Score” for this single institution lacking paediatric radiology subspecialists was substandard, at 32% of the expected reporting for renal tract ultrasound in children (6.67 out of a possible 21 points). Paediatric radiology is a subspecialty, requiring further training and often a dedicated unit within the radiology department. Jankharia described that “Radiologists who understand how to adjust protocols, and who can speak the same language as the

pediatricians and pediatric surgeons, are sorely required, if we are to be an integral part of the teams that manage infants and children."[19] Dedicated paediatric radiology expertise on the ground, not only assures clinical excellence but also sets a standard for colleagues and acts as a pillar for training registrars.[20] The poor scores achieved by consultants implicates them as responsible for this pattern of substandard reporting learnt by registrars.

The commonest indication for a renal ultrasound was "UTI", followed by the search for renal anomalies and hydronephrosis, with no requests searching for hydroureter. On analysis of the yield of pathology, however, hydronephrosis was the commonest finding, followed by hydroureter. In the setting of UTI, hydronephrosis is the most frequent finding and is probably the most useful ultrasound finding as it is easily and accurately detected as well as being surgically correctable.

A score for the adequacy of requests was determined for the UTI subgroup only. The majority (65%) of clinician`s requests, scored 0 of a possible 3, for adequacy, with basic information regarding onset, confirmation of UTI on culture and causative pathogen, not provided in the majority. There was however, no correlation between the UTI "Request Adequacy Score" and the "Report Adequacy Score". This precludes blaming clinician requests for the quality of reports issued for paediatric ultrasounds, without taking into account accuracy of diagnosis. Interestingly the highest mean "Report Adequacy Score" was achieved when no

history regarding the UTI was provided, and similarly the lowest “Request Adequacy score” resulted in reports with maximum “Report Adequacy Score”.

The **“Report Adequacy Score”** designed for use in this study was based on RSNA guidelines[6], with the inclusion of a further 12 points of local relevance added by a paediatric radiologist, making it more comprehensive than the RSNA guidelines. The RSNA guidelines describe 9 points of the total 21 points in the “Report Adequacy Score” of this study. The average “Report Adequacy Score” was 6.67, which is still inadequate by the RSNA standards. Attempting to correlate our average score against the RSNA standards maximum score above (9), is inappropriate, as the additional points in our modified scoring system may be falsely elevating the overall scores.

The mean “Report Adequacy Score” for the total group was 6.67, which is 32% of a total possible score of 21. The UTI subgroup achieved a mean “Report Adequacy Score” of 6.7. For both the total group and the UTI subgroup, only 6% and 5% of reports respectively achieved more than 50% reporting adequacy. A detailed discussion for each section of the reporting score system follows below:

KIDNEY

The “Report Adequacy Score” for the “kidney” had the highest average score of all the sections, but an average well below 50% (40.9% of the total possible points awarded). No reports achieved the maximum of 8. The most frequent criteria

documented were ‘size measurement’, followed by ‘echogenicity’. Precise standardised techniques are required when measuring the size of the kidney on ultrasound. Hederstrom and Forsberg, described ultrasound to be a “reliable and suitable alternative to urography in periodic controls of kidney size and growth in children’’. [21]

Accurate kidney measurement is important for follow-up and should be measured in a standardized fashion. [22] “Renal disease may augment or decrease organ size with or without simultaneous alterations in renal architecture.” [22] This is relevant with regard to the pathological yield, where “abnormal echogenicity” and “abnormal size” were the third and fourth most common renal pathologies. 99% of reports failed to state the international normal values, which is important information for the clinician who may be following up the patient and may not have access to the same charts for this population. The RSNA guidelines make special mention of measured size and comparison to normal standard and deviations from the mean for age.[6] Renal size charts for age are widely available and should be accessible in every ultrasound room. Dinkel et al, described that “growth charts for kidney length and volume in childhood are constructed and provide the basis for objective intra- and interindividual determination of renal size.”[22]

SPECIFIC COMMENTS

“Specific comments” referred to comments on hydronephrosis, hydroureter, calculi, focal lesions and anomalies. Most reports scored 40% “Reporting Adequacy” for this subcategory. After renal size measurement, the “presence or absence of hydronephrosis” / “prominence of the calyceal” system was the most commonly reported finding. The “presence or absence of hydroureter” was reported more often than “calculi”. “Hydroureter” and “hydronephrosis” were the commonest pathological findings (7% and 13% of all patients imaged respectively) in comparison to “calculi” which were the least common pathology (1% of all patients imaged). Hydronephrosis is an important comment in reports, as it is not only a common abnormal finding but also a surgically correctable one. Furthermore, children with hydronephrosis require follow-up for decisions on further management. This is best performed in a repeatable manner using the AP-renal pelvis diameter (see below).

“The major aim of the evaluation of children with UTI is to attain prognostic information related to permanent renal damage (PRD)”.[23] Muller et al, investigated the role of ultrasound in predicting PRD in the setting of paediatric UTIs. It was described that “vesico-ureteric reflux (reflux), obstruction, and anomalies” may suggest or reveal children at risk of permanent renal damage. It was concluded that “dilating reflux and obstruction are strong indicators of PRD”.[23] The worst score for a “specific comment” was for the presence or absence of “anomalies”. Fewer than 20% of the reports commented on “anomalies. Comments regarding

"calculi" were more frequent; however on analysing the abnormal yield, "calculi" were a less common abnormality, than "anomalies".

AP PELVIS AND DISTAL URETER

The two descriptions scoring the worst on "Reporting Adequacy" were the "AP pelvis" followed by the "distal ureter". The presence or the absence of the distal ureters was only commented on in 10% of all reports. 93% of the reports did not make a comment on the AP pelvis or measure it. The AP Pelvis has been the focus of much research, as it is a reproducible measurement which can be used for comparison and follow-up of hydronephrosis. Blane et al, suggested a need for "further evaluation in children with calyceal dilatation and/or dilatation of the anteroposterior renal pelvis greater than 10mm."[24]

BLADDER

The bladder was not recorded as "not visualised", "measured" or "empty" in a large proportion of studies (67%), for the total and UTI subgroups. We have also falsely inflated the score for the bladder wall measurement, by automatically awarding points when the bladder was empty – because of the inaccuracy of measuring the wall when the bladder is empty. Thus although bladder thickness was scored as

recorded in 33%, this includes the studies that received a point when the bladder was recorded empty. Post-micturition volume calculations were documented more frequently than the pre-micturation bladder volume, for the total and UTI subgroups. “An abnormal post-void residual urine could be defined as post void residual urine greater than 20ml, rather than as greater than 10% bladder capacity, on repeat micturitions without bladder over distension”. [25] Only 8% of the total group, documented a comment regarding the post-micturation bladder volume, which is inadequate as the presence of abnormal residual volume, was the second commonest bladder pathology. Numerous factors have been cited to affect the post void residual volume. An excessively distended bladder, the child`s age and hydration are thought to affect the post void residual volume. [25] Shaikh et al, documented a significant relationship between the number of UTIs occurring after the initial visit and the volume of residual urine.[26] Modern paediatric guidelines advocate that bladder wall thickness and both pre and post micturition measurements be calculated. “Assessment of post-void residual urine volume is mandatory in a variety of pediatric patients, such as those with voiding dysfunction, spinal cord closure abnormalities (myelodysplasia), UTIs, vesicoureteral reflux, and posterior urethral valves.”[27]

3.2. LIMITATIONS

The results of this retrospective study are specific to the practises at one institution without a paediatric radiologist subspecialist, and may not represent general practise. Only the records that were filed at the radiology department were used and these were often carbon copies of the original report. The quality of these varied and if the reports were deemed to be illegible, then those reports were excluded. This may have led to some bias with certain doctors reports being consistently excluded for poor legibility which may be reflection of shoddy reporting and ultrasound technique. If sections of the requests were incomplete, for example age or gender, those specific areas in the data collection were marked as incomplete, and the other complete areas were recorded, and used for analysis by performing calculations out of modified totals.

Registrars and consultants involved belong to a larger multi-institutional rotation program including 4 academic hospitals and some consultants perform sessions at multiple private practices in Johannesburg. Registrars, who have completed one year of training, are allocated a specific one month paediatric rotation at CMJAH. Registrars training in paediatric imaging, work in ultrasound daily for that period. Data has been collected for 14 months, wherein a minimum of 14 registrars have completed their paediatric training. This study represents approximately 35 different reporting styles.

3.3. CONCLUSION

Renal ultrasounds are frequently requested to evaluate and follow-up children, for many different conditions but urinary tract infections are the commonest indication for renal ultrasound in our setting. The referring doctors' UTI requests were poor, with essential information not documented in the majority.

Paediatric renal ultrasounds are reported suboptimally, when measured on our "Report Adequacy Score". The poor reporting quality was independent of the clinician's request quality, rank of reporting doctor, the type of study or the indication. The mean "Report Adequacy Score" for the total group was 32% of the total possible score. However, registrars reported significantly better than consultants suggesting that training doctors follow guidelines and practise standardised methods.

Most often renal ultrasound examinations were normal. An array of pathology was noted in the abnormal studies, with hydronephrosis and hydroureter being the commonest. The presence of pathology showed no relationship to gender. The follow-up and management of hydronephrosis is reliant on accurate comprehensive documentation of measurements, such as the AP pelvis which was the worst performed part of the reports.

Specialised Paediatric radiology units, are recognised to be a vital component of Radiology Departments, however paediatric subspecialists are scarce. It has also

been recognised that there is a fine balance between registrar teaching and service delivery. Often training and supervision are given less priority in busy departments. Further training, for all doctors performing paediatric ultrasounds is needed and a standardised reporting template has been developed to address the reporting weaknesses, while allowing for individual reporting styles.

3.4. RECOMMENDATIONS AND AREAS FOR FURTHER RESEARCH

A recommended reporting guideline, based on our “Reporting Adequacy Score”, has been produced for use in the local setting. This is reproduced in appendix 5.5. The guideline template is inspired by the literature and the results of this study. This is intended to address reporting deficiencies and encourage a standardised reporting technique. Use of this reporting template ensures documentation of each important subcomponent of the study, also allowing for a reproducible and comparable reporting style. There is also provision for further description of pathology, in the “Additional Findings”. A “follow-up and recommendation” section is provided, which is important in the management of pathology, such as hydronephrosis. Figures 1 – 12 are ultrasound equivalent images for the recommended reporting categories in the guideline. Furthermore, pathological example US images are provided for comparison and self learning.

We advocate dedicated paediatric radiology units, staffed with paediatric subspecialists, most especially at training institutions. This will afford training radiologists better teaching and guidance. A follow-up study will be performed to assess if the use of a reporting template improves reporting adequacy. Also new studies assessing reporting skills in other imaging modalities are recommended, as this will ensure better radiology practise overall and improve patient care.

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5. APPENDICES

5.1) RSNA Radiology Template

5.2) Human Research Ethics Clearance Committee(Medical) Clearance Certificate

5.3) Letter granting permission to conduct research at Charlotte Maxeke Johannesburg Academic Hospital

5.4) Data Collection Sheets

- **a) Adequacy of Requests Sheet and General Info**
- **b) Rank of Reporting Radiologist**
- **c) Type of Request & Indication for Renal Ultrasound**
- **d) Adequacy of Report Sheet**
  - **(1) Kidney Comments**
  - **(2) Specific Comments**
  - **(3) Distal Ureter and Bladder**
  - **(4) AP Renal Pelvis**
- **e) Correlate "Report Adequacy" Score and the "Assessment" Section**
- **f) Abnormal Assessments**
  - **(1) Yield of Renal Pathology**
  - **(2) Yield of Bladder Pathology**

5.5) Suggested Reporting Template

APPENDIX 5.1

RSNA Radiology Reporting Template

RSNA Radiology Reporting Template

The renal ultrasound reporting template, publication or knowledgebase listed below is based on the RSNA Radiology Reporting Templates developed at the Radiological Society of North America, Inc. (RSNA) by the RSNA Radiology Reporting Committee and its subspecialty subcommittees and is provided under license from RSNA.

History: [Urinary tract infection | Hydronephrosis]. Comparison: [<date> | None*].

Technique: The kidneys and bladder were evaluated at real-time sonographically with static gray scale images obtained for image documentation.

Findings: Mean renal length for age is [#] +/- [#] cm for two standard deviations.

The right kidney is [normal in location, contour and length*], measuring [#] cm. [There is no stone or renal mass*.] [There is no focal parenchymal thinning or hydronephrosis.*] The left kidney is [normal in location, contour and length*], measuring [#] cm. [There is no stone or renal mass*.] [There is no focal parenchymal thinning or hydronephrosis.*] There is [no | mild | moderate | severe] [right | left | bilateral] distal ureteral dilatation at the level of the [minimally | mildly | moderately | hugely] distended urinary bladder. Images of the IVC and abdominal aorta are [normal*].

Impression: [Normal renal ultrasound with appropriate renal growth|

Normal renal ultrasound with appropriate renal growth and resolution of prior collecting system dilatation].

APPENDIX 5.2

Human Research Ethics Clearance Committee(Medical) Clearance Certificate

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG
Division of the Deputy Registrar (Research)

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
R14/49 Dr Nishentha Govender

CLEARANCE CERTIFICATE	**M10902**
PROJECT	Adequacy of Paediatric Renal Tract Ultrasound Request and Reports
INVESTIGATORS	Dr Nishentha Govender.
DEPARTMENT	Department of Radiology
DATE CONSIDERED	01/10/2010
DECISION OF THE COMMITTEE*	Approved unconditionally

Unless otherwise specified this ethical clearance is valid for 5 years and may be renewed upon application.

DATE 01/10/2010 **CHAIRPERSON** .....
(Professor PE Cleaton-Jones)

*Guidelines for written 'informed consent' attached where applicable
cc: Supervisor : Prof S Andrronikou

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10004, 10th Floor, Senate House, University.
I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. **I agree to a completion of a yearly progress report.**
PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES...

APPENDIX 5.3

Letter granting permission to conduct research at

Charlotte Maxeke Johannesburg Academic Hopsital

Private bag X39, Johannesburg 2000, South Africa
Tel: +27 (0) 11 488 4911, Fax: +27 (0) 11 643 1612
www.johannesburghospital.org

Gauteng Department of Health

Office of the CEO
Enquiries: N. Monama
(011): 488-3785
(011) 488-3753

25 October 2010

Dr. Nishentha Govender
Department of Radiology

Dear Dr. Govender

RE: Permission to conduct research on "Adequacy of Paediatric renal tract ultrasound request and reports."

Permission is granted for you to conduct the above research as described in your request provided:

1. Charlotte Maxeke Johannesburg Academic hospital will not in anyway incur or inherit costs as a result of the said study.
2. Your study shall not disrupt services at the study sites.
3. Strict confidentiality shall be observed at all times.
4. Informed consent shall be solicited from patients/ staff participating in a prospective study.

Please liaise with the Head of Department and Unit Manager or Sister in Charge to agree on the dates and time that would suit all parties.

Kindly forward this office with the results of your study on completion of the research.

Yours sincerely

Dr. Barney Selebano
Chief Executive Officer

APPENDIX 5.4

Data Collection Sheets

a. Adequacy of Requests Sheet and General Info

b. Rank of Reporting Radiologist

c. Type of Request & Indication for Renal Ultrasound

d. Adequacy of Report Sheet

    1. Kidney Comments

    2. Specific Comments

    3. Distal Ureter and Bladder

    4. AP Renal Pelvis

e. Correlate “Report Adequacy” Score and the “Assessment” Section

f. Abnormal Assessments

    1. Yield of Renal Pathology

    2. Yield of Bladder Pathology

Appendix 5.4 Data Collection Sheets

a. Adequacy of Request Sheet

Adequacy of Requests and General Info.						
General Information			**"Request Adequacy" Score**			
Number	Gender	Age	Onset of Urinary Tract Infection	Culture positive or significant biochemical results	Name of causative pathogen (Ecoli,Klebs, Proteus,other)	Score
			[Score1]	**[Score1]**	**[Score1]**	**[/ 3]**
001						
002						
003						
004						

Appendix 5.4 Data Collection Sheets

b. Rank of Reporting Radiologist

Rank of Reporting Radiologist			
Number	Registrar	Consultant	Registrar assisted by Consultant or fellow registrar
001			
002			
003			
004			

Appendix 5.4 Data Collection Sheets

c. Type of Request & Indication for Renal Ultrasound

No.	**Type of Request**		**Indication for Renal Ultrasound**								
	Renal Specific-ally	*Abdominal Request*	UTI	Anom-alies	Hydro-nephro-sis	Hydro - ureter	Renal Failure / Dys-funct-ion	Renal Mass	Haem-aturia	Neuro-genic Bladder	Mal-nutrition
001											
002											
003											
004											

Appendix 5.4 Data Collection Sheets

d. Adequacy of Report Sheet

1) Kidney Comments

Adequacy of report **Kidney Comments**										
No.	No comment or measure-ment of kidneys	Comment on any of: • Presence • normality • size of one / both kidneys	Value of size in SI units	Normal international predicted values for age provided	Comment normal for age	Location	Contour	Comment on cortico-medullary differentiation	Comment on echogenicity: • Normal • Hypoechoic • Hyperechoic	Score
	[Score 0 overall]	**[Score 1]**	**[Score 1]**	**[Score 1]**	**[Score 1]**	**[Score 1]**	**[Score 1]**	**[Score 1]**	**[Score 1]**	**[/8]**
001										
002										
003										
004										

Appendix 5.4 Data Collection Sheets

d. Adequacy of Report Sheet

2) Specific Comments

Adequacy of report **Specific comments**						
No.	• Hydronephrosis • pelvis or pelvicalyceal prominence • description of uppertracts	Hydroureter	Renal calculi Or nephrocalcinosis	Anomaly	Focal lesions	Score
	[Score 1]	**[Score 1]**	**[Score 1]**	**[Score 1]**	**[Score1]**	**[/5]**
001						
002						
003						
004						

Appendix 5.4 Data Collection Sheets

d. Adequacy of Report Sheet

3) Bladder and Distal Ureter Comments

Adequacy of report: **Bladder and Distal ureter Comments**									
No	**Bladder comment**					Score **[/ 4]**	**Distal ureters**		Score **[/1]**
	Bladder visualised or measured or recorded empty/collapsed	Bladder wall thickness measured **or** comment if abnormal / normal **or** If empty/ collapsed	Baldder volume measured	Post micturition bladder volume **or** comment why not possible	No Comment		No comment on ureter	Comment visible or non-visible	
	[Score 1]	**[Score 1]**	**[Score 1]**	**[Score 1]**	**[Score 0]**	**[/ 4]**	**[Score 0]**	**[Score 1]**	**[/1]**
001									
002									
003									
004									

Appendix 5.4 Data Collection Sheets

d. Adequacy of Report Sheet

4) AP Renal Pelvis

Adequacy of report **AP (anteroposterior) renal pelvis Comment**						
No.	No comment	Commented not visible	Commented visible or measured	Measured value given	Comment if normal or abnormal	Score
	[Score 0 overall]	**[Score 3 overall]**	**[Score 1]**	**[Score 1]**	**[Score 1]**	**[/3]**
001						
002						
003						
004						

Appendix 5.4 Data Collection Sheets

e. Correlate “Report Adequacy” Score and the “Assessment” Section

Correlate “Report Adequacy” Score and the “Assessment” Section				
No.	Total “Report Adequacy” Score	Assessment Section		
		Normal U/S	Abnormal U/S	No Comment
	[Maximum 21]	**[Score 1]**	**[Score1]**	**[Score 0]**
001				
002				
003				
004				

Appendix 5.4 Data Collection Sheets

f. Abnormal Assessments

1) Yield of Renal pathology

Abnormal Assessments **Yield of Renal Pathology**							
No.	Hydronephrosis	Hydroureter	Abnormal Echogenicity	Abnormal Size	Calculus	Pyelonephritis or glomerulonephritis	Bladder Pathology Refer to next table
001							
002							
003							
004							

Appendix 5.4 Data Collection Sheets

f. Abnormal Assessments

2) Yield of Bladder pathology

Abnormal Assessments **Yield of Bladder Pathology**						
No.	Uterocele	Calculi	Diverticuli	Wall Thickening, Trabeculation, Irregular Wall	Residual Volume	Bladder outlet obstruction and other
001						
002						
003						
004						

APPENDIX 5.5

Suggested Reporting Template

Department of Radiology *Paediatric Renal Ultrasound*

By: N.Govender, S.Andronikou, M.Goodier

Name:_____ Patient Number:_____

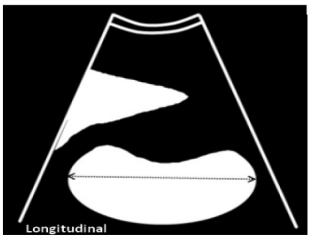
Date of study:_____

Indication: UTI / Hydronephrosis / Other:_____

Previous study: Date _____ Details_____

Radiologist: Name_____ Signature_____

Renal length & location



	R	L
Kidney Size		
Normal for age is _____		
Location (N/ABN)		

Echogenicity, contour & corticomedullary differentiation

	R	L
Echogenicity (N/incr/decr)		
Corticomedullary Differentiation (N/ABN)		
Contour (N/ABN)		

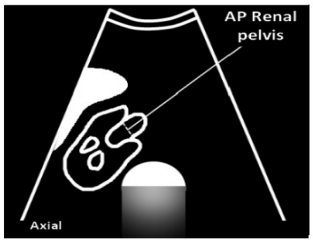
Hydronephrosis & hydroureter

	R	L
Hydronephrosis if present: - mild,moderate or severe - cortical thickness: upper pole lower pole		
Hydroureter if present: - mild,moderate or severe		
Other info		

Renal length & location

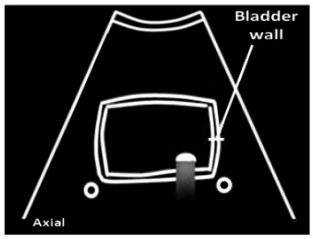
	R	L
Calculi (yes/no)		
Focal lesions (yes/no)		
Anomalies (yes/no)		
Other info		

AP renal pelvis measurement



AP Pelvis visible: YES / NO
If visible: AP Renal pelvis _____mm
Other info:

Bladder & distal ureters



Bladder distended / empty / collapsed		
If distended: Bladder wall thickness	_____mm	
If distended: Bladder volume	_____ml	
Post micturition volume	_____ml	
Focal pathology		
	R	L
Distal ureters visible		

Additional Info:_____

ASSESSMENT:_____

FOLLOW-UP/RECOMMENDATIONS:_____

Figure1: Measure Kidney [Longitudinal]

Figure2: Echogenic Kidney [Longitudinal]

Figure3: Horseshoe Kidney: note the kidney parenchyma is seen to cross over the vertebra. [Axial]

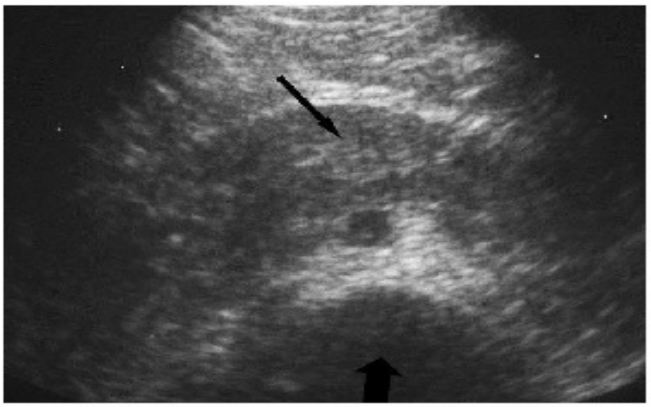


Figure4: Renal Calculus: note the acoustic shadowing seen distal to the lesion [Longitudinal]

Figure5:Multiple renal cysts [Longitudinal]

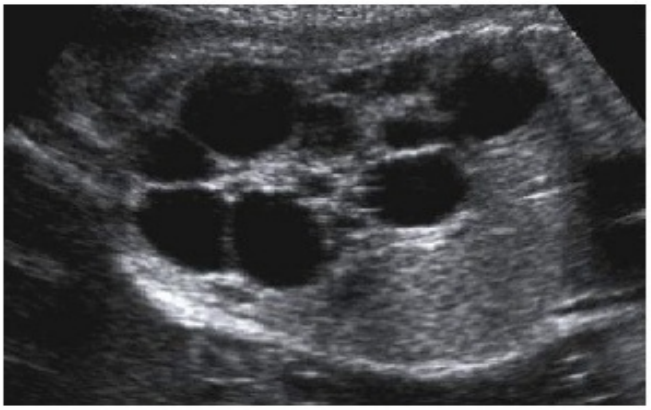


Figure6: Focal Kidney lesion, which represents a nephroblastoma

Figure7: Hydronephrosis [Longitudinal]

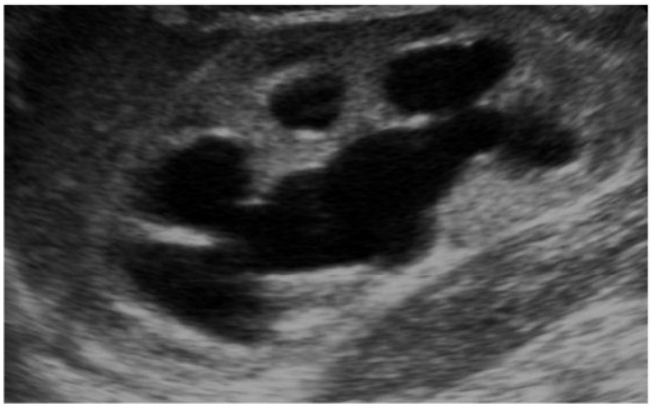


Figure8: Measure the AP Renal Pelvis normal <10mm [Axial]

Figure9: Pelvi-ureteric junction obstruction [Longitudinal]

Figure10: Lateral wall of a full bladder is used to calculate Bladder wall thickness [Axial]

Figure11: Postmicturition bladder wall volume measurement [Axial]

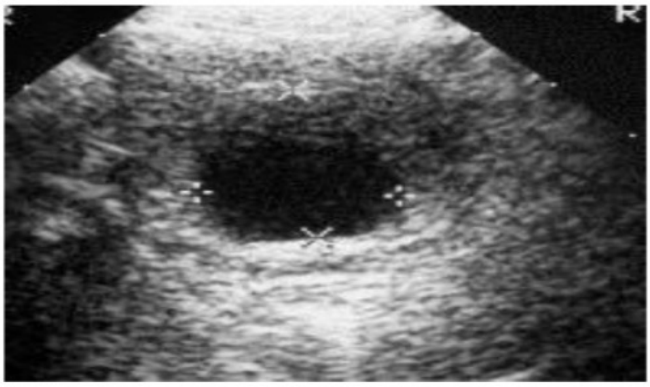


Figure12: Bilateral ureteroceles [Axial]