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ORIGINAL ARTICLE

Renal Outcome in Children with Pelviureteric Junction Obstruction (PUJO): A Tertiary Centre Experience

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ABSTRACT

Objective: To investigate the clinical outcome of children with suspected pelvi-ureteric junction obstruction (PUJO) following radioisotope scan.

Study Design: Retrospective study on clinical data of children who underwent DTPA/MAG3 imaging in a tertiary hospital.

Place and Duration of the Study: Department of Nuclear Medicine, Hospital Universiti Sains Malaysia from the year 2008 to 2018.

Material and Methods: The clinical records of these patients were reviewed who were refereed from 2 major tertiary centres. Data was collected using standardized proforma that included age, gender, baseline ultrasound findings, and clinical presentations prior to the imaging. Diagnosis at referral point and actual findings of radionuclide scan were also recorded. Children under 18 who underwent radioisotope imaging (MAG3 and DTPA) were included.

Results: A total 151 patients were recruited into the study. Majority were male [101 (66.9%)]. The median age was four year when the diagnosis was made. The commonest clinical presentations that warranted radionuclide scan were antenatal hydronephrosis and abdominal pain. PUJO was found in 57 (37.7%) patients with 31 (53.1%) of them having left sided obstruction. Pyeloplasty was performed in seventy percent of them, however, 7 (21%) patients showed persistent obstruction during follow up imaging despite the surgical intervention.

Conclusion: There were significant residual hydronephrosis and obstruction despite corrective pyeloplasty, and the need for an imperative measure to prevent future risk of chronic kidney disease in this group of children.

Key Words: *Obstructive uropathy, Pelviureteric junction obstruction, Antenatal hydronephrosis*

INTRODUCTION

Urinary tract obstruction is defined as restriction of urinary outflow that can lead to renal damage.[1] Anatomical obstruction can occur at pelviureteric junction (PUJO) and vesico-ureteric junction (VUJO) obstruction. PUJO has the incidence of 1 in 1000-1500 newborns and is the commonest cause of antenatal hydronephrosis.[2] The cause of

urinary tract obstruction is either primary (congenital) or secondary, with the former being the most common[2,3] which results from the deposition of excess collagen secondary to the activation of inflammatory mediator leading to hydronephrosis.[4,5] The resultant back pressure within the renal pelvis leads to progressive renal damage and deterioration. Delay in diagnosis and presentation leads to an increase in chances of developing renal damage.

Expected management is based on the cause, of which mostly are managed conservatively.[6] Surgical intervention includes pyeloplasty, pigtail drainage or nephrectomy, are required for the severe form of obstruction in about 20% of the patients to relieve the obstruction and improve urinary drainage.[6] The radionuclide imaging and dynamic study have been used to assess the obstruction and measure the glomerular filtration rate[7-9] to distinguish a true obstruction and other causes of pelvicalyceal dilatation.[7,10]

PUJO has been identified as the most common ureteric obstruction and presentes at the mean age of 6 year with abdominal pain as the commonest symptoms at presentation.[4] Almost 50% of the patients undergo pyeloplasty which results in the improvement of drainage and renal function on diethylenetriamine pentaacetic acid (DMSA) scan. Another study described the mercaptoacetyltryglycine scan (MAG3) sensitivity to detect obstruction compared to DTPA.[11] However, DTPA is more sensitive to diagnose kidney dysfunction than MAG3. Both DTPA and MAG3 have improved diagnostic accuracy compared to other type of imaging.

This study aimed to study the clinical presentations and outcomes of obstructive uropathy among children at our local tertiary centre.

MATERIAL AND METHODS

The number of children underwent radionuclear imaging were extracted from Nuclear Medicine Department of Hospital Universiti Sains Malaysia. The patients came from 2 major hospitals in Kota Bharu, Kelantan who were followed up for urological work up. The clinical records of these patients were retrospectively reviewed in both hospitals. Data was collected using standardized proforma including age, gender, baseline ultrasound findings, and clinical presentations prior to the imaging. Diagnosis at referral point and actual findings of radionuclide scan were also recorded. Infant and children (1 month to 18 years age) with suspected obstructive uropathy underwent 99mTc labelled mercaptoacetyl-tryglycine (MAG3) or DTPA scan from 1 January 2008 until 31 December 2018 were included. Patients' records with inadequate crucial data including missing vital information and lack of follow up were excluded from the study.

Urinary tract obstruction was defined as the presence of delay in excretion detected from MAG3 or DTPA dynamic study. Time to half maximum activity (T1/2 was calculated from the time of maximum counts to the time when the imaging decreased to half of the maximum counts) was more than 20 minutes of excretion.

Descriptive statistics were used to summarize the socio-demographic characteristics of subjects. Numerical data were presented as mean (±SD) or median (range) based on their normality distribution. Categorical data were presented as frequency (percentage). All statistical tests were carried out using the Statistical Package for the Social Sciences (SPSS), version 24, with a $p < 0.05$ considered to indicate statistical significance.

The study received ethical approval from the Human Research Ethical Committee Universiti Sains Malaysia (USM/JEPeM/20020127) and Medical Research & Ethics Committee Ministry of Health Malaysia (NMRR-19-4114-45969).

RESULTS

A total of 151 children (101 males and 50 females) were included in the study as presented in table 1. Out of 144 (95.4%) of these were Malay ethnic. Median age of the patient in the study was 4 years with age range between 2 months to 18 years. Eighteen patients (36%) were asymptomatic and referred for antenatal hydronephrosis. The commonest clinical presentation of obstructive uropathy was abdominal mass, abdominal pain and fever (69%, 47.6%, and 37.9% respectively). Other symptoms are described as per fig 1.

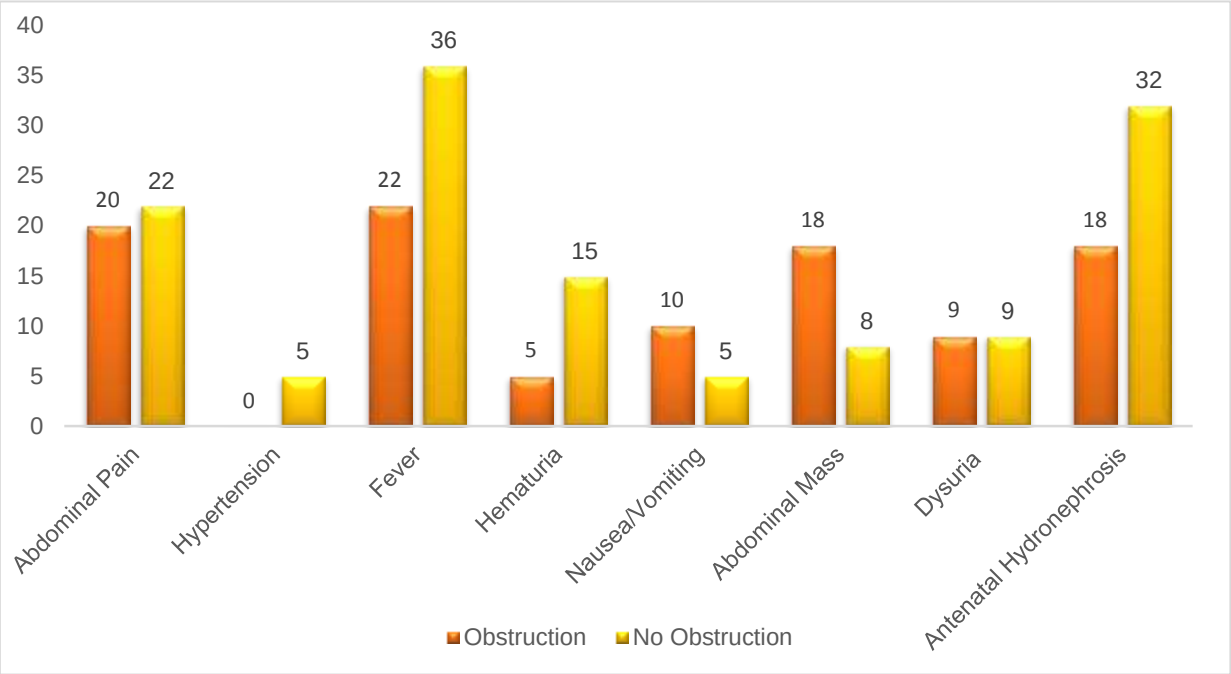

Fig 1: Clinical presentation of obstructive uropathy

TABLE 1: Socio-demographic data

Characteristics	Number (%)
Gender	
Male	101 (66.9)
Female	50 (33.1)
Race	
Malay	144 (95.4)
Chinese	7 (4.6)
Age	
Median(years±IQR)	4 (8.9)
Type of imaging	
DTPA	115 (76.2)
MAG3	36 (23.8)

DTPA = Diethylenediamine Pentaacetate Scan
MAG3 = Mercaptoacetyltriglycine Scan
IQR = Interquartile range

In table 2, 58 (38.4%) patients had obstructive uropathy. Unilateral obstruction involving left kidney was seen in 31 (53.5%) patients while right kidney involvement was in 17 (29.3%) patients. There was bilateral obstruction found in 10 patients (17.2%) and majority of them were PUJO. None of the obstruction was related to renal calculi. Majority of the patients with obstructive uropathy were managed surgically (70.7%) while the remaining patients were subjected to a conservative management.

TABLE 2: Characteristic of obstructive uropathy

	Number (%)
Obstructive uropathy (n=151)	
Detected	58 (38.4)
Not detected	93 (61.6)
Site of Obstruction (n=58)	
Left	31 (53.5)
Right	17 (29.3)
Bilateral	10 (17.2)
Causes of obstruction	
PUJO	57 (98.3)
VUJO	1 (1.7)
Renal calculi	0 (0)
Outcome of Obstructive uropathy	
Surgery	41 (70.7)
Conservative	17 (29.3)

In table 3, follow up DTPA/MAG3 imaging was performed post-surgery in 32 patients, which showed persistent obstruction in 7 patients (21.9%). Most of these patients underwent pyeloplasty (82.9%) for corrective surgery.

TABLE 3: Type and outcome of surgery

	Number (%)
Type of surgery (n=41)	
Pyeloplasty	34 (82.9)
Non-pyeloplasty (heminephrectomy, nephrostomy)	07 (17.1)
Radionuclide Scan Post Surgery (n=32)	
No obstruction	21 (65.6)
Partial obstruction	04 (12.5)
Obstruction	07 (21.9)

DISCUSSION

Abnormalities detected during antenatal scan should warrant for postnatal period scan to determine any significant genitourinary obstruction and abnormalities. Our study demonstrated that a significant number of obstructive PUJO were detected in those with antenatal hydronephrosis. The mean age of presentation was 4 years old when the first diagnostic scan was performed indicating the delay in diagnosis in our setting. Studies in other countries documented that the children present to hospital and are operated at a much earlier time.[12,13] Possible reasons for a late presentation in our cohort are mainly due to late referral, logistic reasons and unawareness on the early referral by the treating doctors. There is an urgent need for educational awareness among the medical practitioners to ensure all patients with antenatal hydronephrosis receive an early ultrasound investigation postnatally. Radionuclear imaging is warranted in those with worsening hydronephrosis to avoid progression of obstructive uropathy. This helps to prevent potential long-term complications such as irreversible renal sequalae due to delayed surgical intervention.

Appropriate intervention is needed in each obstructed cases; this is based on symptomatic presentation, presence of infection, deterioration of renal function and worsening obstruction.[14] Majority of our patients were found to have anatomical narrowing as the cause of PUJO. Pyeloplasty surgery was the commonest corrective surgery offered at our centre. Data from African study showed pyelolithotomy has been the most common intervention due to renal stone as the leading cause for PUJO, hence late detection of obstructive uropathy in the older pediatric patients.[14]

Our data showed that fever was the commonest clinical presentation of PUJO. Fever occurred following upper urinary tract infection due to the retention and retrograde reflux of the urine. The presence of urinary tract infection and abnormal ultrasound finding should prompt PUJO diagnosis. Chronic infection and long-standing inflammation could lead to renal parenchymal damage and nephropathy. The infection must be aggressively handled to prevent future morbidity. For patients with recurrent fever without any source of infection, urinary tract infection must be suspected immediately.

Our data also highlighted the importance of performing repeat ultrasound and radionuclide scan post-surgery. In our cohort, the ultrasound and radionuclide scan were performed within 3 months post-surgery (following the removal of ureteral stent). The finding showed more than 20% of patient were still showing evidence of obstruction following surgical intervention. Ultrasound is recommended as a standard examination in the post-operative follow up.[15] In the case of worsening hydronephrosis, dynamic imaging remains the gold standard. Our data was comparable to other study which showed up to 20% of our patients continued to have obstruction following surgery.[16] However, Koc et al found that surgical intervention yielded a higher therapeutic success but if pyeloplasty were performed in patients with progressive renal function loss, only half of them recovered from the obstruction.[17] The presence of persistent hydronephrosis after corrective pyeloplasty does not warrant for re-operation as the condition may improve with time without further intervention, as long as there is no deterioration in the renal function or recurrent urinary tract infection.[18] Further study is needed to look at the outcome of patients with PUJO treated conservatively, as up to 25% of them will require some form of interventions and investigations.[14]

Our findings demonstrated that surgical intervention in the urinary tract obstruction with poor renal function may lead to persistent obstruction and further deterioration of the renal function. Laparoscopic approach has yielded a much higher success rate compared to open pyeloplasty, with lesser complication and more

patient's comfort.[17,19] Most surgeons prefer conventional pyeloplasty as the laparoscopic procedure can be difficult and not readily available for children in centres especially in developing countries.

Renal tract obstruction is not a single disease process and its pathophysiology remains unclear. The use of dynamic nuclear imaging must be emphasized to attempt for an exact diagnosis rather than channelling for surgical intervention. The accurate information should be used to help categorizing suspected obstruction and predict the potential for obstructive injuries.

There were a few limitations of the study. This study was not designed to explore for the renal function of patients with obstructive uropathy. We could not generalise the overall pediatric obstructive uropathy in Malaysia as the sample size was small and homogenous as majority of the children were Malays in ethnicity. More studies involving multi study centres, longer period of follow up and investigation into renal function of patients with obstructive uropathy are needed to understand the best intervention in our set up.

CONCLUSION

The study highlighted the importance of follow-up investigation in all antenatal hydronephrosis cases. Radionuclide scan is the main diagnostic tool for obstructive uropathy especially in PUJO. This should be arranged at earlier follow up to avoid diagnosis delay and to improve the renal outcome. Potential residual hydronephrosis and obstruction may occur despite corrective surgical intervention, hence the need for complement imaging to detect ongoing abnormality and for future plan chronic kidney disease progression.

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