Research Article

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Diagnosis and Treatment of Palpable Urological Mass in the Neonatal Period: A 5 Year Review

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Abstract

Introduction: *Abdominal masses in the neonatal period often present a diagnostic challenge. The aim of this study was to evaluate which urological pathologies cause the formation of a neonatal mass, the diagnostic pathway and surgical outcome.*

Patients and methods: *The medical and radiological records of 30 neonates who were admitted to the Neonatal Surgical Unit of Yorkhill Sick Children Hospital, Glasgow with an abdominal mass over a five-year period (2008-2013) were reviewed. Data collected included demographics, gestational age, radiological investigations, operative findings and complications.*

Result: *Seventeen neonates (9 males, 8 females) were identified with an abdominal mass arising from the urological tract. Four boys were found to have posterior urethral valves while in 4 girls a duplex kidney with a ureterocele was identified. In the remaining 9 patients the palpable mass was caused by: vesicoureteric reflux (n=2), multicystic dysplastic kidney (n=2), polycistic kidney disease (n=1), ectopic kidney (n=1), pelvi-ureteric junction obstruction (PUJO) (n=1), unilocular renal cyst (n=1), PUJO and vesicoureteric junction obstruction (n=1). Nine patients required a form of urinary diversion and in two of these patients a nephrostomy was followed by a pyeloplasty, 2 required incision of ureteroceles, 1 nephrectomy, 1 partial nephrectomy, 1 STING and 1 primary valve ablation.*

Conclusion: *Only 70% of newborns with abdominal masses were diagnosed antenatally, while 30% were detected postnatally. Posterior urethral valves remain the most common cause of a neonatal mass in a male, while duplex kidneys with ureterocele were seen in girls. Half of the patients will require a form of urinary diversion in the neonatal period. The large majority (88%) of abdominal masses of urological origin required surgical intervention.*

Introduction

According to Schwartz et al. neonatal abdominal mass was present in approximately 1 in 1000 live births. In the past decade, abdominal mass has been identified via palpable mass on physical examination. However, evolution of foetal ultrasound has assisted identification of abdominal mass prior to birth that enables early diagnosis and intervention [1].

Aim of this study

This research was performed to review the commonest causes of neonatal abdominal masses and its surgical outcome. This includes urological, gastrointestinal, hepatobiliary, pelvic and retroperitoneal masses. In addition, further study was performed to review the imaging techniques which have been carried out. Lastly, we focused on urological mass as it is the commonest cause of palpable newborn abdominal mass. Thus, the treatment and outcome of neonates for this particular group of neonates were reviewed. This paper also discusses the advantages and disadvantages of imaging techniques available.

Methods

The data were collected from neonatal surgical admission records at Yorkhill Sick Children Hospital, Scotland from 2008 to 2013. This included demographics, perinatal history, and radiological investigations of 30 newborns. The age of newborns are defined as ranging from Day 1 up to Day 28. The study was further focused on operative findings and surgical complications of urological mass in newborns.

Results

Schwartz et al reported that many abdominal masses are of non-surgical causes [1]. This research found that majority of abdominal masses are due to surgical causes, and they were classified according to the origin of their masses.

Initial Evaluation

The ability to diagnose and categorize the mass according to its origin based on symptoms, location, and physical features of the mass has remained as a diagnostic challenge until today.

The research found that the system of origin of neonatal abdominal mass is as follows: 57% (n=17) are renal, and 43% (n=13) are extra-renal. For the extra-renal group (13/30); 17% (n=5) are gastrointestinal, 10% (n=3) are hepatobiliary, 10% (n=3) are pelvic, and 6% (n=2) are retroperitoneal.

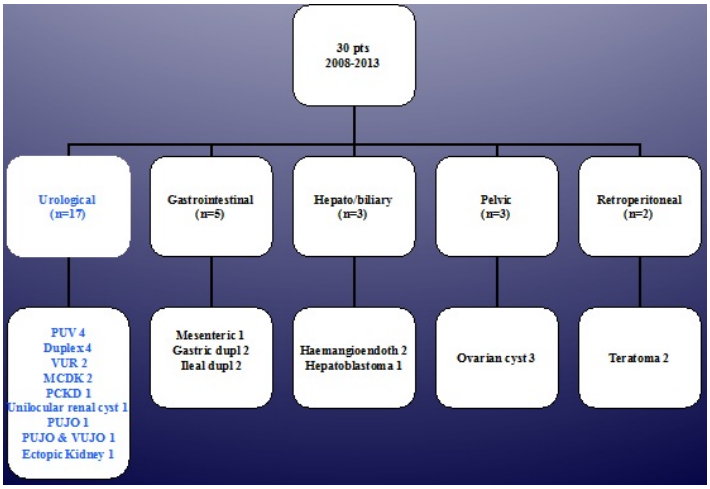


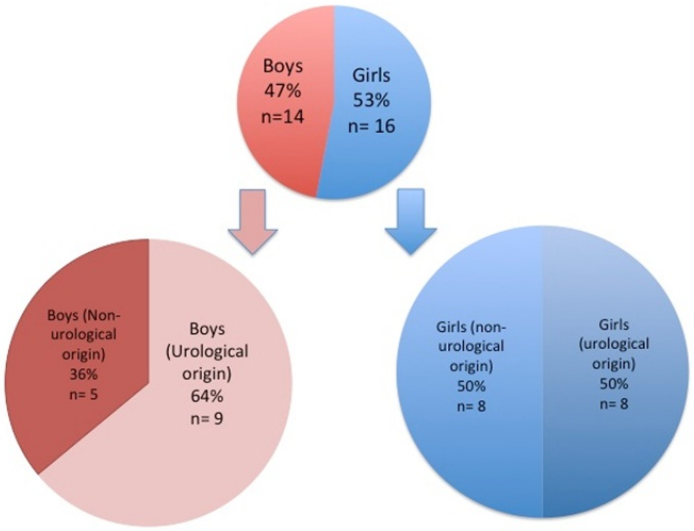
Table: 1 Summary of pathologies of palpable neonatal abdominal masses.

As part of the initial evaluation, the presence or absence of symptoms may give us important clues to the mass, such as bowel obstruction. Important questions to ask are: Is the baby stable or unstable? Is there any poor feeding? Is there any billous or non-billous vomiting? Is the abdomen distended? Has the baby passed meconium in the first 24 hours? Are there any abnormalities on antenatal scan? When is the onset of symptoms?

It may also be helpful to be able to describe the findings during physical examination, although tentative diagnosis must always be accompanied by radiological imaging. Is the mass located in the flank, epigastric, or suprapubic area? Is the mass firm (solid) or fluctuant (solid)? Is the mass movable or fixed to underlying skin? Does the surface feel regular or irregular? Is there any irritability during palpation suggesting inflammation or peritonitis? Is the mass indicative of organ enlargement such as hepatomegaly, splenomegaly, faecal matter or distended bladder [1].

For example, if a newborn infant is found to have palpable flank mass, unilateral, multicystic in nature, with normal gastrointestinal system, or antenatally diagnosed hydronephrosis, it may only require renal ultrasound to confirm the diagnosis. Thus, a good history taking, and examination, will narrow down the differential diagnosis, and avoid unnecessary investigations. From the research, we found that 73% (n=22) of patients were otherwise asymptomatic, 14% (n=4) had bilious vomiting, 3% (n=1) had haematemesis, and 10% (n=3) had respiratory distress.

In addition, we also find that boys (n=14) and girls (n=16) have different commonest origin of abdominal masses. Out of the 14 boys, the majority (n=9) of the boys have urological causes and 5 of them are due to non-urological causes. On the other hand, 50% of the girls (n=8) are due to urological causes and another 50% of the girls (n=8) are due to non-urological origins. In short, the majority of the origins of palpable neonatal abdominal mass are from the urinary tract system (Figure 1).



Antenatal diagnosis still remains as a challenging diagnostic tool in modern day society. 70% (n=21) of neonatal abdominal masses were detected and 30% (n=9) were detected postnatally.

Further study was focused on urological masses. The findings are as follows: 88% of infants (n=15) were diagnosed antenatally and 12% (n=2) were diagnosed postnatally (Figure 2).

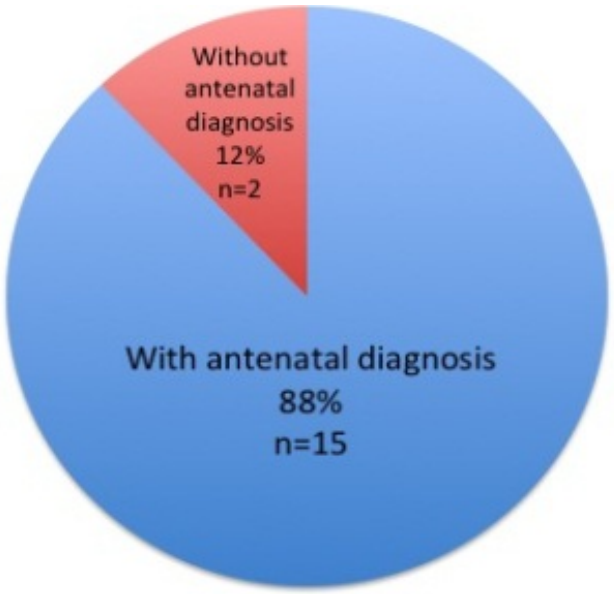


Figure 2: Atenatal diagnosis of palpable urological mass.

Figure 3 and Figure 4 explain that the majority of the male infants are due to posterior urethral valve. This is followed by vesicoureteric reflux, multicystic dysplasic kidney, pelviuretero junction obstruction, and pelviuretero junction obstruction, and vesicoureteric junction obstruction.

In addition, the majority of the female infants are due to ureterocele

and duplex kidney. This is followed by polycystic kidney disease, ectopic kidney, multicystic dysplastic kidney and unilocular renal cyst.

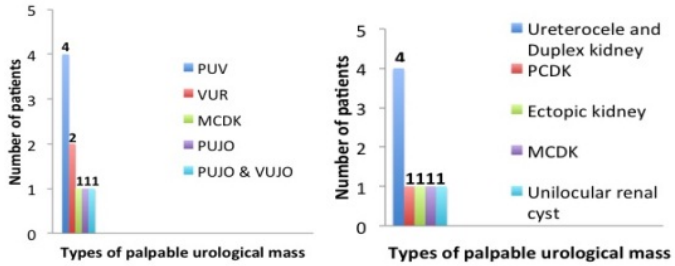


Figure 3: Types of palpable urological mass in male nenotes.
Figure 4: Types of palpable urological mass in female male nenotes.

Radiological imaging

In this modern era, abdominal ultrasound including renal and bladder remains as a strongly valuable diagnostic tool with good sensitivity and specificity. It has added benefits such as being harmless, painless, and cheap. It is also portable, which means it can be performed at anytime and no sedation is required. Ultrasound will give us adequate information as to whether the mass is cystic or solid, and the position and origin of the mass. The disadvantages of abdominal ultrasound are that highly skilled ultrasonographer in neonates is required, the inability to scan through bone or gas, and lack of information regarding the function of an organ, such as kidney function.

All of our patients had an ultrasound scan postnatally as the first-line investigation of choice. Magnetic resonance imaging (MRI) and computed tomography (CT) are very useful modality tools that can be used to assist in the evaluation of neonatal abdominal mass. The advantages of the Magnetic Resonance Imaging (MRI) scan are a lack of ionizing radiation as well as contrast. On the contrary, a Computed Tomography (CT) scan requires moderate doses of ionizing radiation and contrast. However, CT scan is able to provide precise anatomic detail, especially to evaluate solid tumors. Both investigations are relatively expensive.1 18% (n=3) of patients with urological mass underwent CT or MRI scan.

Voiding cystourethrography is another excellent method of investigation for vesicoureteric reflux as well as urethral anatomy, particularly in boys. In addition, it also identifies hydronephrosis and hydroureter secondary to vesicoureteric reflux. Furthermore, it is also the best method to evaluate posterior urethral valves, which is the commonest cause of palpable urological mass in boys. 12 out of 17 newborns with urological mass underwent micturating cystourethrogram (MCUG). 5 of them did not require MCUG which are duplex kidney and ureterocele (n=2), multicystic dysplastic kidneys (n=2) and polycystic kidney disease (n=1).

Management

88% of infants with urological masses required surgical intervention. Approximately half (n=8) of these patients required urinary diversion in the neonatal period within 28 days of life. Only 12% (n=2) of these infants did not require any surgical intervention. Both of these infants were diagnosed with ectopic kidney (n=1) and polycystic kidney disease (n=1).

The table below demonstrates the types of urinary diversion which they had undergone. We had also looked into the immediate complications from the procedure undertaken, and whether the patients had undertaken any subsequent procedures (Table 2).

From the table illustrated below, 3 out of 17 newborns with urological mass underwent vesicostomy, with no immediate complications but requiring subsequent procedures after 28 days of life. A further 3 out of 17 newborns required ureterostomy, with no immediate complications, and only 1 underwent a further procedure after 28 days of life. 2 of them underwent nephrostomy, with one of them experiencing dislodgement of nephrostomy tube, both of them had to undertake subsequent procedures after 28 days of life.

Urinary diversion	No.	Immediate complication	No. of patients underwent Further procedure
Vesicostomy	3	None	3
Ureterostomy	3	None	1
Nephrostomy	2	Nephrostomy displacement (n=1)	2

Table 2 : urinary diversion

Table 3 illustrates the management of commonest cause of palpable urological mass in female and male neonates. 4 out of 8 female infants were diagnosed with ureterocele and duplex kidneys. 1 underwent ureterostomy and ureteric resection, 2 underwent incision of ureterocele and 1 underwent heminephrectomy. None of them had immediate complications and only 1 underwent subsequent vesicostomy.

4 out of 9 male infants were diagnosed with posterior urethral valve. 2 underwent vesicostomy, 1 underwent ureterostomy, and 1 underwent primary valve ablation and circumcision. None of them had immediate complications. 2 of them underwent subsequent valve resection and closure of vesicostomy, while 1 of them required peritoneal dialysis catheter.

Commonest cause of palpable urological mass	No.	Name of procedures	Immediate complication	No. of patients underwent further procedure
Female neonates: Ureterocele and Duplex Kidneys	4	Ureterostomy and ureteric resection (n=1)	None	None
		Incision of ureterocele (n=2),	None	Vesicostomy (n=1)
		Heminephrectomy (n=1)	None	None
Male neonates: Posterior Urethral Valves	4	Vesicostomy (n=2)	None	Valve resection and closure of vesicostomy (n=2)
		Ureterostomy (n=1)	None	Peritoneal dialysis catheter (n=1)
		Primary valve ablation and circumcision (n=1)	None	None

Table 3: Managmetn of commonest cause of urological.

Table 4 shows the management of other causes of urological masses in female and male neonates. The remaining 4 of 8 female

newborns were diagnosed with polycystic kidney disease, ectopic kidney, multicystic dysplasic kidney, and unilocular renal cyst. 2 underwent nephrectomies and only 1 required subsequent resection of cyst. None of them had immediate complications.

The remaining 4 out of 9 male newborns were diagnosed with vesicoureteric reflux (n=2), multicystic dysplastic kidney (n=1), pelviureteric junction obstruction (n=1) and pelviureteric junction and vesicoureteric junction obstruction (n=1). 1 underwent cystoscopy, STING procedure and circumcision. 2 underwent unilateral nephrostomy and 1 developed anastomotic stricture, which requires pyeloplasty and ureteric reimplantation subsequently. 1 underwent bilateral nephrostomy, however, a nephrostomy tube was later displaced. He subsequently underwent bilateral pyeloplasty [2,3].

Causes	No.	Name of procedures	Immediate complication	No. of patients underwent further procedure
Female neonates				
PCKD	1	None	-	-
Ectopic Kidney	1	None	-	-
MCDK	1	Nephrectomy	None	None
Unilocular renal cyst	1	Nephrectomy	None	Resection of cyst
Male neonates				
VUR	2	Cystoscopy (n=1), STING, circumcision (n=1) Vasectomy	None None	None Cystology
MCDK	1	Unilateral nephrectomy	None	None
PUJO	1	Bilateral nephrostomy	Displaced nephrostomy	Bilateral pyeloplasty
PUJO & VUJO	1	Unilateral nephrostomy	Nonanastomotic stricture	Pyeloplasty, ureteric reimplantation,

Table 4: Managmetn of other cause of urological mass.

Conclusions

In conclusion, the prevalence of neonatal abdominal mass occurs in 1 in 1000 live births. It is important for physicians to be able to adopt a methodical thinking and approach in this situation, in order to be effective in time management, resource and cost-saving. History taking and examination, remains the vital essence of neonatology medicine.

The majority of abdominal masses in newborns are originated from the urinary tract system. This is followed by gastrointestinal, hepatobiliary, pelvic and retroperitoneal.

Only 70% of newborns with abdominal masses were diagnosed antenatally, while 30% were detected postnatally. This proves that the antenatal scan remains as a challenging diagnostic tool to detect all of the newborns with abdominal masses.

Further research was then focused on masses of urological origin. The majority of the boys with urological mass are due to a posterior urethral valve. On the other hand, the majority of the girls with urological mass are due to ureterocele and duplex kidney.

Abdominal, renal and bladder ultrasound remains as our first line investigation tool. It gives us adequate information regarding the nature of the mass, the position, and its origin. This will help us to decide whether further cross-sectional imaging is required. 100% of infants with abdominal mass had postnatal ultrasound. Only 3 newborns with urological mass underwent CT or MRI scan.

Voiding cystourethrography is the best investigation to identify vesicoureteric reflux, urethral anatomy such as posterior urethral valve, hydronephrosis and hydroureter. However, it is important to identify which type of urological masses may require further imaging to be cost-efficient and avoid wasting resources. The majority of newborns with urological mass underwent micturating cystourethrogram (MCUG). 5 of them did not require MCUG which are duplex kidney and ureterocele (n=2), multicystic dysplastic kidneys (n=2) and polycystic kidney disease (n=1).

Half of the patients with a urological abdominal mass will require urinary diversion in the neonatal period within the first 28 days with minimal immediate complications. The majority of them required subsequent procedures. Overall, 88% of infants with urological mass will eventually require surgical intervention. Only 2 infants diagnosed with ectopic kidney (n=1) and polycystic kidney disease (n=1) did not undergo any surgical intervention.

References

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