Ultrasound in the diagnosis of palpable abdominal masses in children

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Summary

Ultrasound examinations were done to evaluate clinically palpable abdominal masses in 125 children. The examinations were normal in 21 patients. In 15 patients, the clinically palpable masses were actually anterior abdominal wall abscesses or hematomas. Final diagnosis was available in 87 of 89 patients with intraabdominal masses detected on ultrasound. The majority (71%) were retroperitoneal masses where two-thirds were of renal origin. Ultrasound diagnosis was correct in 68 patients (78%). All cases of hydronephrosis were correctly diagnosed based on characteristic ultrasound appearances. Correct diagnoses of all cases of adrenal hematoma, psoas abscess, liver hematoma, liver abscess and one case of liver metastases were achieved with correlation of relevant clinical information.

Key words: Ultrasound, paediatrics, abdominal masses.

Introduction

In the past, intravenous urography (IVU) has been the primary radiological investigation to evaluate children with abdominal masses, because the majority of these are of renal or pararenal origin.[1,2,3] However, ultrasound has changed this investigative approach. This modality is now the first choice screening tool. It is particularly advantageous in children, because of its noninvasiveness and lack of ionising radiation. Furthermore, demonstration of anatomy of several organs can be accomplished in multiple planes and without the use of intravenous administration of contrast medium.

This paper reports our experience with the use of ultrasound to investigate clinically suspected intraabdominal masses in children.

Patients and Methods

The ultrasound records from January 1986 until March 1988 were retrospectively reviewed.

One hundred and twenty five children aged 12 years and below were referred for evaluation of clinically palpable abdominal masses. Ultrasound examinations were done using Philips SDR 1500 realtime scanner with 3 MHz sector and 4 MHz linear tranducers. For confirmation of the ultrasound diagnosis, the clinical and pathological records were reviewed.

Results

In 21 patients the ultrasound findings were normal. No further imaging was carried out on these patients. In another 15 patients, the masses were actually located in the anterior abdominal wall (Fig. 1). Diagnostic aspiration and/or drainage of these masses revealed either an abscess or hematoma.

Intraabdominal masses were detected in the remaining 89 patients, where in 72 (81%) they were reported as retroperitoneal and in 17 (19%), as intraperitoneal in origin. Specific ultrasound diagnosis of the mass was made in 80 of the 89 patients. Nine patients had unspecified retroperitoneal masses.

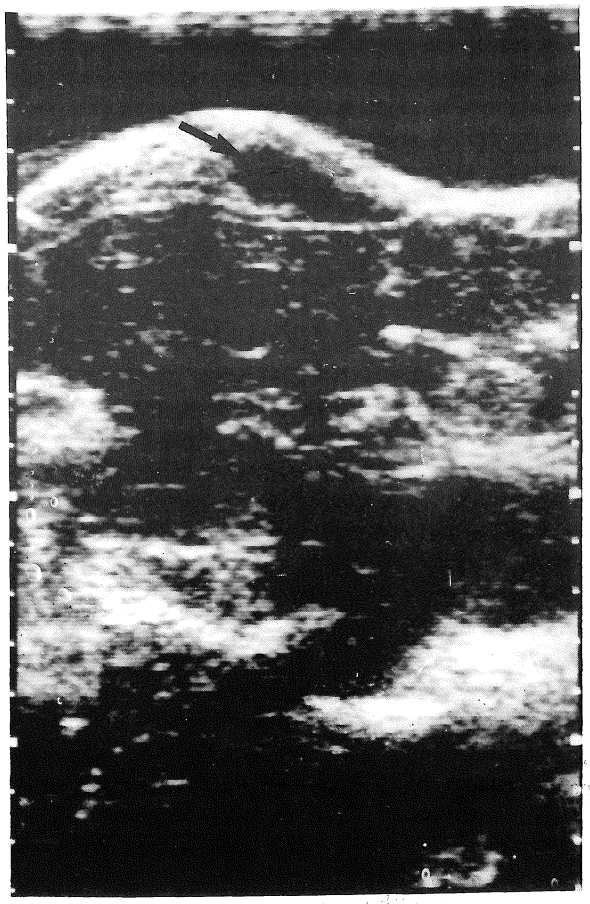

Figure 1: Sagittal scan of the right hypochondrium showing an anterior abdominal wall abscess (arrow).

Final diagnosis of the masses were available in only 87 of 89 patients. Confirmation was obtained by surgery and histopathological examination for 51 patients; by further radiological examinations such as intravenous urography (IVU), micturating cystourethrography (MCU) and antegrade pyelography (APG) for 26 patients; by followup ultrasound examinations for nine patients, and by ultrasound guided percutaneous biopsy for the remaining patient. The ultrasound diagnoses were correct in 68 of the 87 patients (78%) (Table 1).

Table 1
Comparison of ultrasound diagnosis of 87 intraabdominal masses with final diagnosis

Ultrasound Diagnosis	Total	Ultrasound Diagnosis Correct
Retroperitoneal Mass:		
Hydronephrosis	26	26
Wilms' tumour	15	13
Neuroblastoma	15	12
Adrenal hematoma	3	3
Psoas abscess	3	3
Nonspecific	9	0
Intraperitoneal Mass:		
Liver hematoma	4	4
Liver abscess	2	2
Hepatoblastoma	4	2
Liver metastases	1	1
Choledochal cyst	2	1
Mesenteric cyst	1	0
Ovarian cyst	2	1
Total	87	68

All cases of hydronephrosis, adrenal hematoma, psoas abscess, liver hematoma, liver abscess and liver metastases were correctly diagnosed. The presence of anechoic dilated calyces communicating with the pelvis of the kidney was consistent with hydronephrosis (Fig. 2). The ultrasound appearances of adrenal hematoma, psoas abscess, liver hematoma, liver abscess and liver metastases were nonspecific. Correct diagnosis of these lesions on ultrasound was achieved by correlation with the relevant clinical data available.

Eighty-six percent of Wilms' tumours, 80% of neuroblastomas, 50% of hepatoblastomas, 50% of choledochal cysts and 50% of ovarian cysts were correctly diagnosed. Wilms' tumours are echogenic renal masses (Fig. 3) whereas neuroblastomas appear as echogenic extrarenal masses (Fig. 4). The presence of calcific foci were observed in one-third of neuroblastomas.

The final diagnosis in 10 patients with incorrect ultrasound diagnosis is shown in Table 2 and in the nine patients with unspecified retroperitoneal masses in Table 3.

Discussion

Diagnostic procedures in children should ideally be those which are noninvasive, not utilising

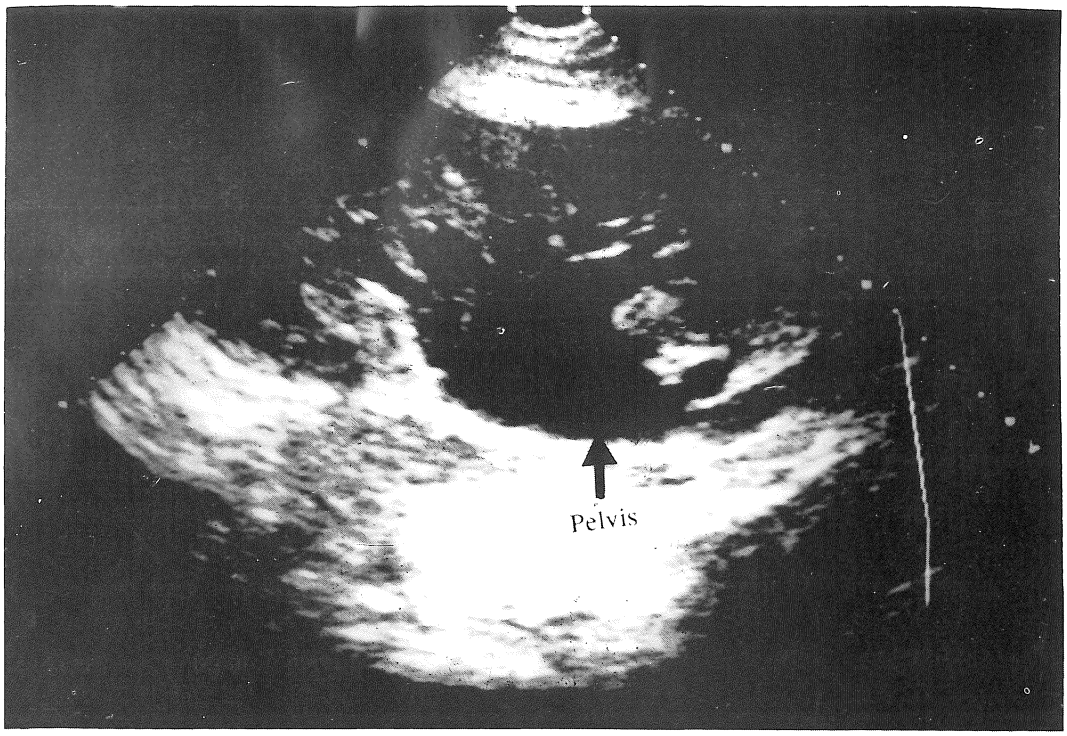

Figure 2: Longitudinal posterolateral view of the kidney showing hydronephrosis.

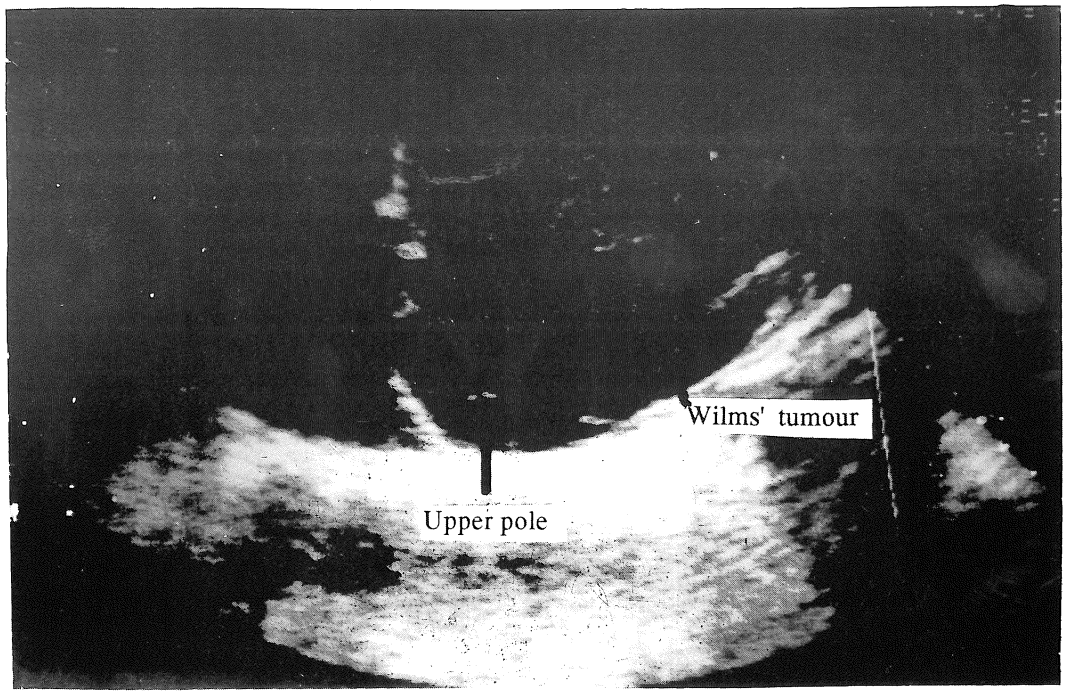

Figure 3: Sagittal scan of the kidney showing a Wilms' tumour of the lower pole fairly well demarcated from the upper pole renal tissue.

ionising radiation and intravenous contrast medium. Ultrasound has these characteristics which makes it very suitable to evaluate abdominal masses in paediatric patients. For soft tissue masses, ultrasound can establish its presence, primary origin, size, extent and effect on the surrounding structures. Besides, ultrasound has the capacity of characterising the mass into whether it is cystic

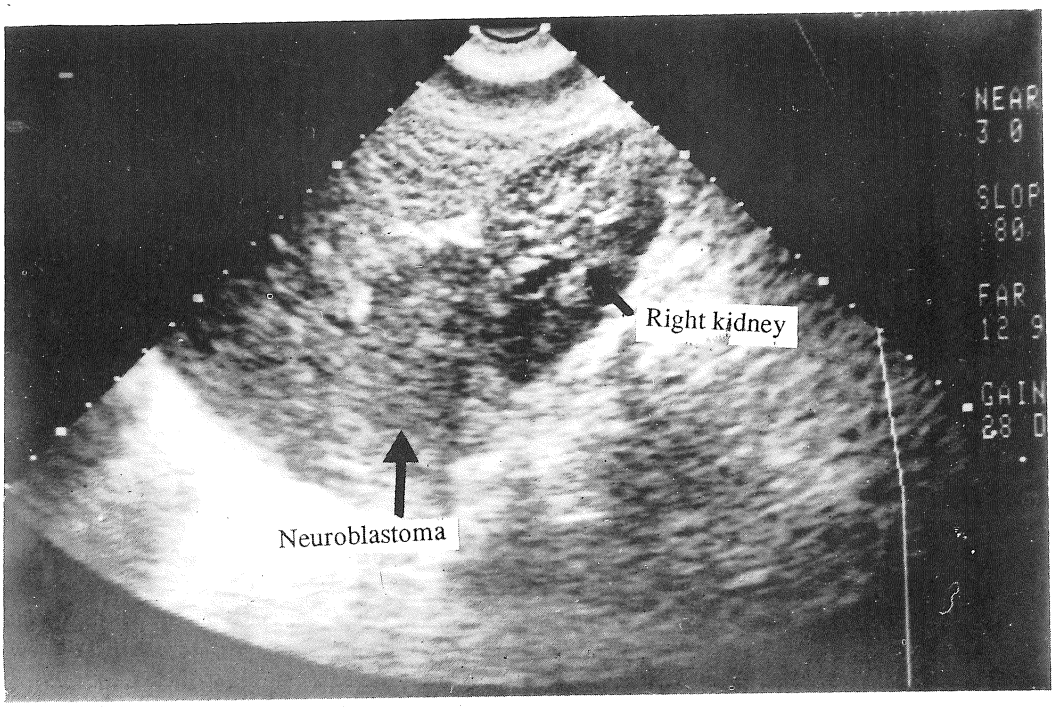

Figure 4: Sagittal section of the right hypochondrium showing an echogenic right suprarenal neuroblastoma.

Table 2
Masses incorrectly diagnosed on ultrasound (n = 10)

Ultrasound diagnosis	Final diagnosis	Number
Wilms' tumour	Mesoblastic nephroma	1
	Neuroblastoma	1
Neuroblastoma	Teratoma	1
	Non-Hodgkin's lymphoma	1
	Wilms' tumour	1
Hepatoblastoma	Yolk sac tumour	1
	Hemangioma	1
Choledochal cyst	Enlarged gallbladder	1
Mesenteric cyst	Teratoma	1
Ovarian cyst	Appendicular abscess	1

Table 3
Final diagnosis of retroperitoneal masses with nonspecific ultrasound diagnosis (n = 9)

Final diagnosis	Number
Teratoma	2
Lymphoma	2
Mesenteric cyst	1
Rhabdomyosarcoma	1
Adrenal carcinoma	1
Leukemia	1
Lymph node metastases from seminoma	1

or solid. In certain disease conditions a specific diagnosis of the mass can also be made. The diagnostic role of ultrasound can be extended from being primarily a tool for imaging to its utilisation as a means to guide percutaneous biopsies and diagnostic aspirations, obviating the need for surgery to obtain a definitive diagnosis.

This review illustrates the value of ultrasound in the management of children with clinically palpable abdominal masses. Where the presence of a mass is clinically less definite, confirmation of its presence can be achieved with certainty by ultrasound especially when the mass is related to the kidney. The majority of patients without any identifiable mass on ultrasound in this series, were infants with ballotable kidneys, where the presence of renal or pararenal retroperitoneal masses were suspected. The absence of pathology in such patients can be explained by the easy palpability of the lower pole of the kidneys in young children and also the high index of suspicion by the paediatrician when anything unusual is palpated in this area, as most paediatric abdominal masses are retroperitoneal in origin.[4] The outcome of the ultrasound examination has a significant bearing on the subsequent management of the patient. The initial information obtained on ultrasound enables us to make an appropriate choice of subsequent radiological investigations, should there be a need.

Localisation of an intraabdominal wall mass does not usually pose much problem. A mass in this location will manifests as a focal area of thickening of that structure and will not move with respiration. Mobile intraabdominal structures such as loops of bowel can be seen sliding freely with respiration underneath the inner margin of the wall. However, since the abdominal wall is a superficial structure, a mass within it can be easily overlooked if a water-path is not used to increase the distance between the transducer surface and the skin. Fifteen patients in this series actually had abdominal wall lesions, which were either abscesses or hematomas. Abscesses and hematomas exhibit similar ultrasound appearances. Specific diagnosis requires correlation with clinical data or percutaneous diagnostic aspiration.

Correct diagnosis of all cases of hydronephrosis was based on the presence of dilated anechoic calyces, within or replacing the kidney, depending on the degree of hydronephrosis communicating with the renal pelvis. However, dilated calyces can be misinterpreted as multiple cysts, when scanning planes are inadequate or inappropriate, resulting in failure to establish continuity of these fluid-filled spaces with the renal pelvis. Where ultrasound appearances are nonspecific, relevant clinical data should be considered to establish an appropriate ultrasound

diagnosis, as illustrated in cases of adrenal hematoma, psoas abscess, liver hematoma, liver abscess and liver metastases.

The majority of those masses with ultrasound diagnosis of Wilms' tumours and neuroblastomas were correct. Differentiation between these two conditions requires careful assessment of their echotexture and relationship of the masses to the kidney. Wilms' tumour is typically echogenic and well demarcated from the normal renal parenchyma.[5] The presence of an echogenic extrarenal mass with foci of calcification favours the diagnosis of neuroblastoma. It is not always possible to establish the renal or extrarenal origin of a loin mass. A Wilms' tumour can be mistaken for an extrarenal mass if it grows exophytically or when it is very large and completely replacing the kidney, leaving no identifiable normal renal tissue.[5] In the latter situation the renal mass may be erroneously interpreted as an extrarenal mass and the kidney would be thought to be displaced from its normal location making it unidentifiable. Likewise, a nonrenal retroperitoneal mass like neuroblastoma can invade and distort the adjacent kidney, thus mimicking a renal neoplasm. Computed tomography (CT) would be the next modality of choice for subsequent evaluation.

The appearance of other non-renal retroperitoneal masses apart from neuroblastoma, solid or otherwise, are nonspecific. If, the available clinical information is noncontributory, it would be difficult to provide a specific diagnosis. This difficulty is illustrated in nine of our patients. However, since ultrasonography is operator dependent, the expertise of the sonologist would also be contributory to the outcome of the examination.

In conclusion, ultrasound is a valuable noninvasive means to confirm, locate and in the majority of instances suggest the precise nature of abdominal masses in children. The outcome of this preliminary investigation enables appropriate choice of subsequent radiological examinations and treatment.

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