COMPARISON BETWEEN ULTRASONOGRAPHIC FINDINGS OF WILM'S TUMOR AND NEUROBLASTOMA

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OBJECTIVE

The purpose of this study was to compare the differences of the ultrasonographic findings between Wilm's tumor and neuroblastoma and to determine whether there are ultrasonographic patterns which are characteristic features for both entities.

MATERIALS AND METHODS

Fifteen patients with Wilm's tumor and 17 patients with neuroblastoma who underwent transabdominal ultrasound imaging during January 1992 - December 1997 were retrospectively reviewed. All cases of Wilm's tumor and 8 cases of neuroblastoma were pathologically proved. The diagnosis of remaining 9 cases of neuroblastoma was made by positive urine vanillylmandelic acid plus bone marrow involvement (n=7), bone marrow involvement plus leptomeningeal metastasis (n=1) and bone marrow involvement plus leptomeningeal metastasis plus bilateral retrobulbar mass (n=1). The tumor echogenicity, cystic component, tumor border, pseudocapsule, midline crossing, presenting of calcification and lymphadenopathy were reviewed and analyzed.

RESULTS

Statistically significant ($p< 0.05$) finding that was often seen on ultrasound of Wilm's tumor was cystic component ($p = 0.0006$) while the neuroblastoma often revealed calcification ($p = 0.013$). There was no statistically significant in echogenicity ($p = 0.397$), tumor border ($p = 0.086$), midline crossing ($p = 5.26$), ipsilateral caliectasis ($p = 1.177$) or lymphadenopathy ($p = 0.055$) between Wilm's tumor and neuroblastoma.

CONCLUSION

Initial ultrasonography in children presenting with palpable abdominal mass was non-invasive and useful. The mass with cystic component was more specific for Wilm's tumor than neuroblastoma. The mass contained calcification was statistically significant for neuroblastoma.

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INTRODUCTION

Wilm's tumor and neuroblastoma represent the two most common solid abdominal masses of infant and childhood. One can usually determined whether the mass is intrarenal or extrarenal by means of an intravenous pyelogram. This distinction at time may be difficult, and an incorrect diagnosis may result.

Ultrasonography is a useful method to evaluate abdominal mass in children because of its readily availability, non-invasive and no exposure to radiation. So ultrasonogram is prefered as primary screening.

Many previous reports have described the ultrasonographic appearance and emphasized the use of ultrasonography in the evaluation of echogenicity, size, consistency and extent of the tumor. But the characteristic findings of each disease have not been documented. Distinguishing an intrarenal huge mass from extrarenal location is difficult. Each tumor may have invasive behavior and extents outside its compartment.

The purpose of this paper is to compare the ultrasonographic pattern of 15 cases of Wilm's tumor and 17 cases of neuroblastoma, to evaluate the ability of ultrasound in distinguishing between these two neoplasms, and to determine characteristic features of each disease.

MATERIALS AND METHODS

Technically adequate gray-scale ultrasonograms of 15 cases of Wilm's tumor and 17 cases of suprarenal neuroblastoma from Srinagarind hospital between January 1992-December 1997 were retrospectively reviewed. All cases of Wilm's tumor were pathologically proved. For 17 cases of neuroblastoma: 8 cases were proven pathologically, 7 cases had positive bone marrow aspiration plus urine VMA, 1 case had positive bone marrow plus leptomeningeal metastasis and 1 case had positive bone marrow aspiration plus leptomeningeal metastasis plus bilateral retrobulbar masses with periorbital echymosis.

The tumor echogenicity, cystic component, tumor border, midline crossing, presence of calcification, caliectasis of ipsilateral kidney and lymphadenopathy were reviewed and analyzed.

Fisher's exact test was used to established two-tailed p values. The differences between ultrasound finding in patients with Wilm's tumor and neuroblastoma were considered statistically significant when the p value was less than 0.05.

RESULTS

The peak age incidence of Wilm's tumor is at less than 1 year and another peak is at 4 years (range 1 month-8 years). The peak incidence of neuroblastoma is at 4 years old (range 1 month-9 years). Fourteen Wilm's tumor patients presented with palpable abdominal mass and one patient with hematuria. Neuroblastoma cases had variable presenting symptoms: palpable abdominal mass 10 patients, exophthalmos and periorbital echymosis 4 patients, spinal cord compression 1 patient, hemoperitoneum 1 patient and bone pain 1 patient.

Ultrasonographic findings of Wilm's tumor and neuroblastoma were compared and analyzed as shown on table 1. The Fisher's exact test was used to establish two-tailed p value for each of the ultrasonographic finding. Statistically significance is considered at p value < 0.05.

Wilm's tumor had predominate cystic component that presented in 8 of 15 patients which could be a single large cystic area or multiple small discrete cysts while neuroblastoma was not dem-

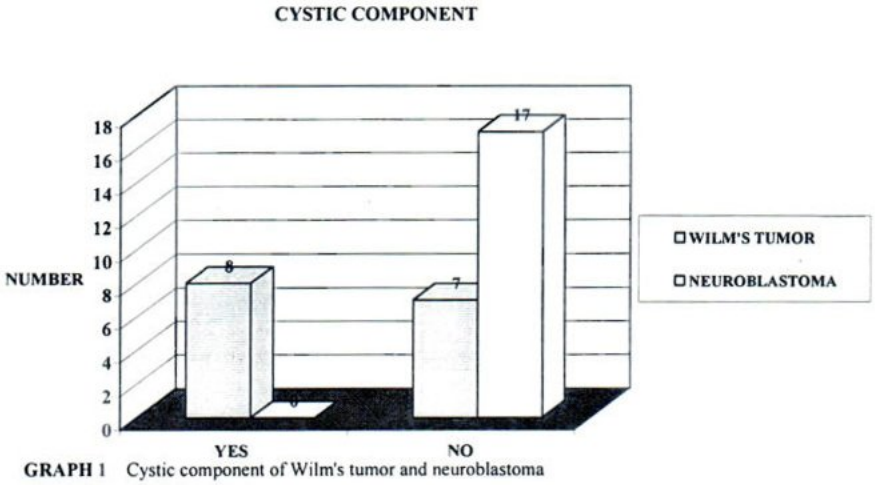
onstrated this finding (p value = 0.0006) (Graph 1, Fig 1,2). Neuroblastoma was shown to have calcified component in 11 of 17 patients but this character was not found in Wilm's tumor (p value = 0.0136) (Graph 2) . The calcified component in neuroblastoma ranged from fine granular to large dense calcification (Fig 3A,B, 4).

Both neoplasms had heterogeneous hyperechogenicity. The size of Wilm's tumor ranged from 5 cm to 19 cm, while neuroblastoma was 2.9 cm to 16 cm. The diameter of both tumors were mostly 5-10 cm and showed no statistically significant difference.

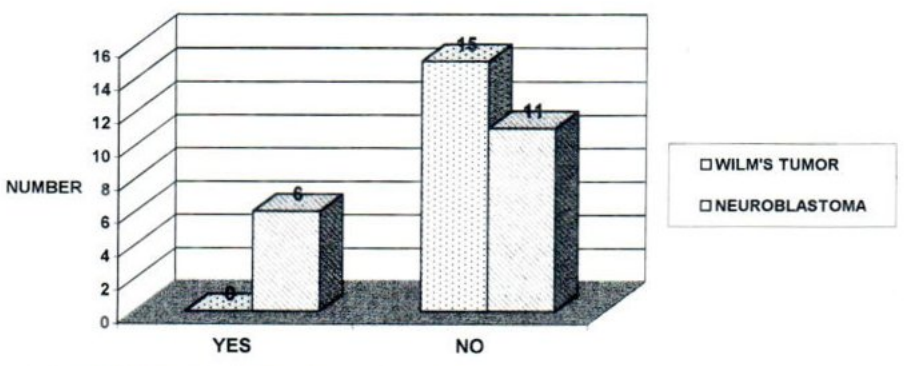
Wilm's tumor had well-defined border in 12 of 15 cases while neuroblastoma had only 3 of 17 cases (Fig 5). Caliectasis of ipsilateral kidney was observed in 1 case of Wilm's tumor and 4 cases of neuroblastoma (Fig 6).

Six of 17 cases of neuroblastoma had metastatic nodes at first presentation while Wilm's tumor had only one. (Fig 7)

Metastases at presentation was found in 12 patients of neuroblastoma (4 pulmonary, 1 liver, 6 brain and 6 skeleton). Only one pulmonary metastasis was found in Wilm's tumor.



GRAPH 1 Cystic component of Wilm's tumor and neuroblastoma



GRAPH 2 Calcification of Wilm's tumor and neuroblastoma

Table 1 Ultrasonographic findings of Wilm's tumor and neuroblastoma, statistical analysis.

FINDINGS	WILM'STUMOR	NEUROBLASTOMA	P VALUE
HETEROGENEOUS ECHO	13	15	0.397
HYPERECHOGENICITY	14	15	0.411
CYSTIC COMPONENT	8	0	0.0006
CALCIFICATION	0	6	0.0136
WELL-DEFINED BORDER	12	9	0.086
SIZE> 10 CM	6	3	0.12
MIDLINE CROSSING	10	7	5.26
CALIECTASIS	1	4	0.177
LYMPHADENOPATHY OR METASTASIS	1	14	0.000003

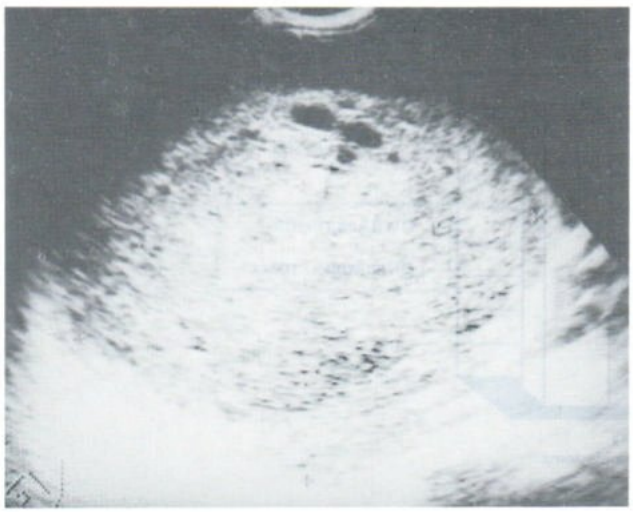


Fig. 1 Wilm' tumor in a 2 year-old-boy. Transverse ultrasonographic image of Rt. flank shows a solid renal mass with small cystic areas at the periphery of the tumor.

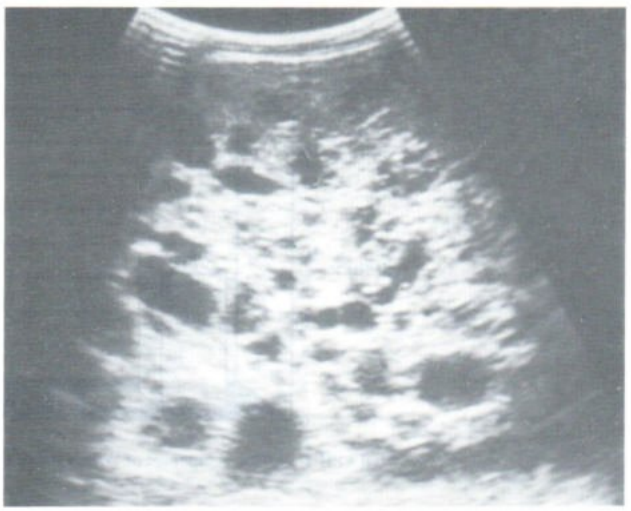


Fig. 2 Wilm's tumor. Longitudinal ultrasonographic image of this 2 year-old boy shows a large Lt. abdominal mass. Multiple small cystic areas, varying in size distributed in the entire mass.

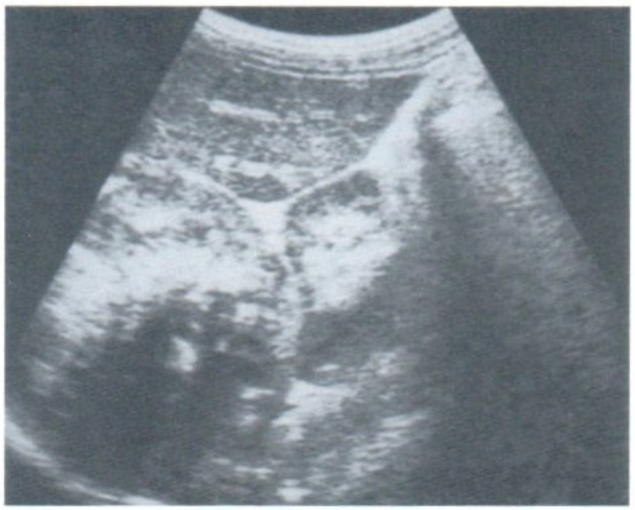


Fig. 3A

Fig. 3A Longitudinal ultrasonogram of Rt. upper quadrant in a 4 year-old boy with Rt. adrenal neuroblastoma. There is a round-shaped mass with isoechogenicity compared to the adjacent liver parenchyma, containing a large area of calcification. Pressure effect to upper pole of Rt. kidney is also demonstrated and confirmed the extrarenal in origin of the tumor.

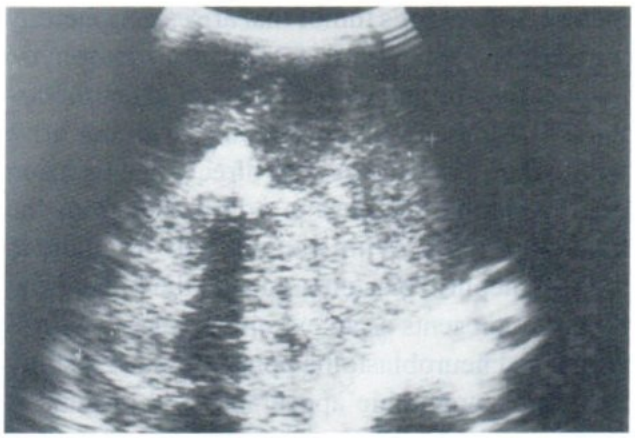


Fig. 4 Transverse ultrasonogram in a 9 year-old girl with huge Rt. adrenal neuroblastoma. The neoplasm shows inhomogeneous high echogenicity containing conglomerated area of calcifications.

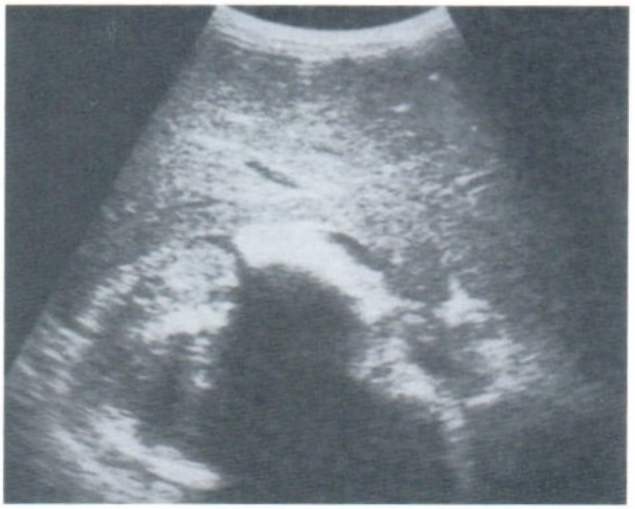


Fig. 3B

Fig. 3B Another area of the same patient shows dense calcification.

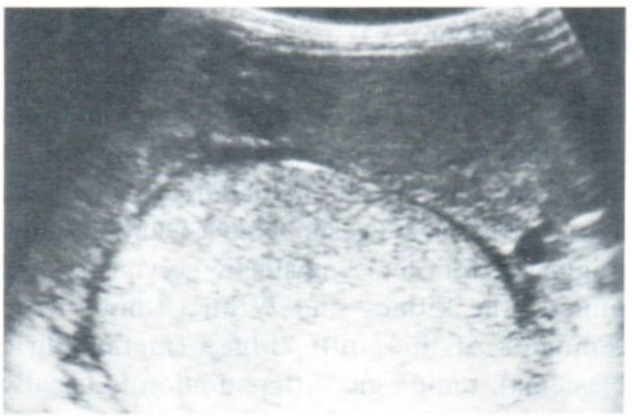


Fig. 5 Wilm's tumor in 5 month-old girl with palpable Rt. flank mass. Longitudinal ultrasonogram of Rt. upper abdomen shows a large well demarcated homogeneous hyperechoic mass. Hypoechoic rim of the compressed renal parenchyma or pseudocapsule surrounding the tumor mass is also observed.

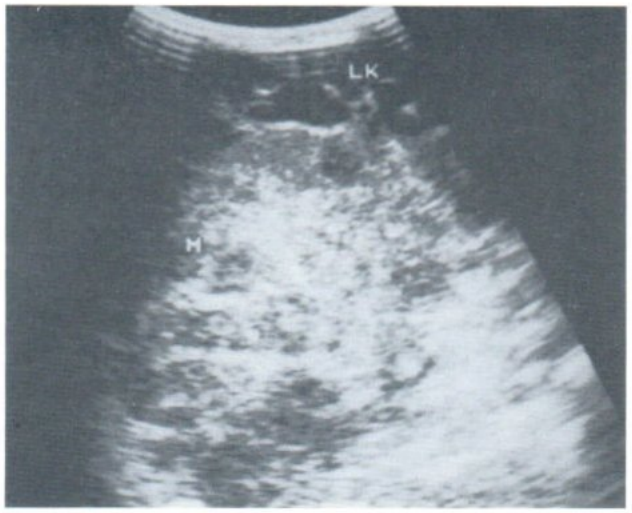


Fig. 6 Neuroblastoma. Longitudinal ultrasonogram of Lt. upper abdomen in a 4 year-old-girl presented with Lt. abdominal mass. There is a large poorly demarcated heterogeneous hyperechoic mass anterior to the kidney. Caliectasis of the ipsilateral kidney is shown.

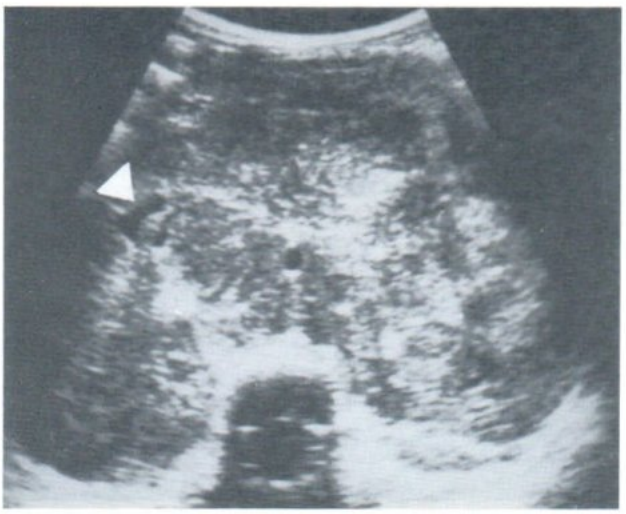


Fig. 7 Neuroblastoma. Transverse ultrasonogram of upper abdomen in a 4 year-old-girl presented with Lt. upper quadrant mass. There is a large poorly defined heterogeneous hyperechoic mass at Lt. renal fossa. Enlarged paraaortic lymphnode causing encasement of abdominal aorta, lateral displacement of IVC (arrowhead) with luminal narrowing is also demonstrated.

DISCUSSION

Wilm's tumor and neuroblastoma represent the two most common abdominal malignancies in infant and children with a peak age incidence at 2-3 years.[2-4] Since neuroblastoma originates from the sympathetic nervous system outside the kidney and Wilm's tumor from remnants of the adult kidney (metanephric blastema), radiologic differentiation is usually possible by determining whether the mass is intrarenal or extrarenal. It is well known that ultrasonography is helpful in establishing this relationship.[5-6]

Occasionally, however, despite technically good urograms and ultrasonograms, it is impossible to determine the origin of the mass. Rarely, a diagnosis made solely on the basis of this intrarenal or extrarenal distinction will be incorrect. A Wilm's tumor that arises peripherally within the kidney and grows in an exophytic manner may mimic with an extrarenal neuroblastoma.[3,4] Although neuroblastoma does not arise within the kidney, those with direct renal invasion often resemble neoplasms originating from the kidney.[1,7] Rarely, Wilm's tumor may originate in the metanephric blastema outside the kidney and therefore presents as an extrarenal mass.[1] Wilm's tumor and neuroblastoma appear to have distinctive ultrasonographic appearances, ultrasound is usually able to differentiate between the two malignancies independent of their relation to the kidney and thus can overcome these difficulties in most cases.[1]

A knowledge of the pathology of these two tumors is helpful in understanding the difference

in their ultrasonic appearance. The typical Wilm's tumor is sharply marginated, compressing the renal tissue and forming a pseudocapsule. Focal hemorrhage and necrosis may be encountered but are seen less frequently than in neuroblastoma. On microscopic examination there is typically admixture of three components: stroma, epithelial and blastematous elements.[6] Neuroblastoma, however, may be sharply marginated in some regions but is often locally invasive and fades into the adjacent tissue. Unlike the Wilm's tumor, the neurob lastoma has a much more variably echogenic pattern on ultrasonographic examination. Hemorrhage, necrosis and dystrophic calcification are common. Microscopically, the tumor is very cellular without much collagenous stroma.[8]

Ultrasonographic findings of Wilm's tumor in our study was a well-marginated, large heterogeneous hyperechoic mass with cystic component predominate. Neuroblastoma was a large heterogeneous hyperechoic mass with predominate calcific component. Few cases of Wilm's tumor (1 case) and neuroblastoma (4 cases) showed caliectasis of ipsilateral kidney. The reason of few cases of the caliectasis may be due to both kinds of the tumors presented with large masses (> 10 cm in diameter) which caused distortion or entirely involved the kidneys.

In 1992, David S. Hartman[1] reported that Wilm's tumor had evenly fair echogenic or evenly echoigenic with discrete holes that represent necrosis, and neuroblastoma showed heterogeneous echogenicity which result from quite cellular and extensive area of hemorrhage with necrosis and microcalcification.[1] In this study, the authors also found predominate cystic component in Wilm's tumor (p value = 0.006) but no statistically significant in heterogenicity.

In 1985, George O. Atkinson reported 3 cases of cystic neuroblastoma as a rare form of Neuroblastoma.[9] In 1992 D.P. Croitoru, A.B. Sinsky also reported a case of cystic neuroblastoma with multiple septation.[10] However, there was no cystic component in neuroblastoma in our study.

Many studies reported that calcification is more common in neuroblastoma.[12,13] And our study also found that calcification is a characteristic finding of neuroblastoma (p value 0.0136). In 1995,Sandra K. Fernbach et al[11,12,13,14] reported 5% of Wilm's tumor had calcification, but in our study, no calcification was found in ultrasonogram of Wilm's tumor.

Lymphadenopathy or other organ metastasis were found in 14 cases of neuroblastoma. One patient with pulmonary metastasis was observed in Wilm's tumor but no lymphadenopathy was detected. Metastasis at first presentation was predominated in neuroblastoma with statistical significant (p value 0.000003).

From previous documents, midline crossing is more frequent in neuroblastoma.[12] In our study, Wilm's tumors cross midline 10 of 15 cases while, neuroblastoma had 7 of 17 cases. This finding may depends on tumor size, as we found tumor larger than 10 cm in 6 of 15 cases of Wilm's tumor and 3 of 17 cases of neuroblastoma.

CONCLUSION

Ultrasonography is a useful, non-invasive method in differentiation between Wilm's tumor and neuroblastoma. Wilm's tumor has predominated cystic component while calcification is specific finding for neuroblastoma. Metastasis at presentation is another clue for diagnosis of neuroblastoma. No statistical significant in the differences of tumor echogenicity, tumor border, midline crossing or caliectasis of ipsilateral kidney is observed.

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