SHORT COMMUNICATION

CT Pelvis in Children; Should We Routinely Scan Pelvis for Wilms Tumor and Hepatoblastoma? Implications for Imaging Protocol Development

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Abstract

Wilms tumor and hepatoblastoma are the most common intra-abdominal solid organ childhood tumors. CT examination is one of the routinely performed procedures in hospitals for children with these tumors inspite of high radiation exposure associated with CT scans. Sixty patients (Wilms tumor = 45, hepatoblastoma = 16) were evaluated retrospectively. Higher proportion (44.4%) of metastatic disease was identified at presentation in the Wilms tumor subset as compared to hepatoblastoma (6.3%) [p=0.006]. Metastatic disease was noted in 6 patients having Wilms tumor on follow-up while it was also low in hepatoblastoma which was noted in only 2 patients (p > 0.05). No significant difference was identified in pelvic extension of disease at presentation in both studied population (p > 0.05). Pelvic metastasis was noted in 1 patient only with Wilms tumor on follow-up while no pelvic metastasis was seen in the hepatoblastoma patients (p-value > 0.05).

Key Words: *Wilms tumor. Hepatoblastoma. CT scan. Children. Radiation.*

Unnecessary radiation exposure has become an increasing public health concern.[1] Medical justification of CT studies particularly in children is now paramount.[1] There have been several efforts to reduce unnecessary exposure to radiation in general.[2] The number of CT scans has increased significantly during the past two decades.[3] Moreover, radiation exposure in children bears greater risks than in adults and it has been reported that the use of CT scans in children to deliver cumulative doses of about 50 mGy might increase the risk of leukaemia by three times and doses of 60 mGy increase the risk of brain cancer.[4] Radiation exposure comes through diagnostic procedures, cancer screening programmes which are rarely if ever utilized in childhood and treatment involving irradiation.[5] There are three important ways through which radiation exposure can be minimized such as by substituting procedure involving radiation with other appropriate procedure such as ultrasonography, by managing CT dose for individual patient where possible, and by decreasing the number of CT studies that are prescribed.[1]

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Received: July 23, 2014; Accepted: August 15, 2015.

Wilms tumor and hepatoblastoma are intra-abdominal tumors that are mostly diagnosed in early childhood.[6] Abdominopelvic CT examination is one of the routinely performed procedures in hospitals for children with Wilms tumor or hepatoblastoma at presentation and follow-up. The usefulness of obtaining pelvic CT combined with abdominal CT for the surveillance of hepatoblastoma and Wilms tumor has been controversial.[7] Overall, there are no fixed recommendations for imaging in these conditions.[8] Although pelvic involvement is possible with both tumors, it occurs only in a small number of patients. Therefore, the benefits of including pelvic CT as a routine investigation for these conditions needs to be explored.

The purpose of this study was to evaluate the impact of abdominopelvic CT on a cohort of European and Asian children with Wilms tumor or hepatoblastoma. This retrospective study was done at the Radiology Departments of The Aga Khan University Hospital, Karachi, Pakistan and Great Ormond Street Hospital, London, UK. Patient information and data was retrieved from two radiological databases from 21/10/1999 to 13/6/2013. Inclusion criteria were patients' age up to 15 years, histopathologic diagnosis of hepatoblastoma or Wilms tumor with abdominopelvic CT scan done for staging, follow-up and surveillance. Patients having other imaging modalities like MRI or Ultrasound as primary follow-up or surveillance techniques or incomplete information were excluded. Final diagnosis, age at presentation, date of birth, gender and follow-up were identified from medical records. The radiology databases were reviewed for time and number of abdominopelvic CT scans, pelvic extension or

metastasis on initial or later scans, last follow-up scan and site or frequency of disease. All CT examinations of included patients were done in arterio-venous phase and reviewed on PACS by a consultant radiologist having more than 5 years of experience in pediatric radiology. Pelvic extension of tumor was considered when the hepatic or renal tumor reached or was below the iliac crest. Initial CT scan performed for tumor staging was considered as the diagnostic study, later pre-operative scans were called follow-up studies, and those that were performed after definitive surgical resection of tumor were labelled as surveillance scans. Data was entered and analyzed in SPSS version 19, descriptive statistics were calculated and where applicable Fisher's Exact test was applied to test statistical significance at the 95% confidence level. P-value less than 0.05 was considered as significant.

A total of 61 patients (Wilms tumor = 45, hepatoblastoma = 16) were identified fulfilling the inclusion criteria. Mean age at the time of diagnosis was 2.8 years (4.7 years for Wilms tumor and 0.9 years for hepatoblastoma). Mean follow-up of all patients was 10.6 months (13.8 months for Wilms tumor and 7.4 months for hepatoblastoma patients). Wilms tumor was more common in females and on right side while hepatoblastoma was unifocal and most commonly noted in males. The demographic characteristic of studied patients is described in Table I.

The studied cohort of the patients received a total of 228 diagnostic and surveillance CT scans, with a mean of 3.73 CT scans per patient. A significantly high proportion (44.4%) of metastatic disease was identified at presentation in Wilms tumor patients as compared to hepatoblastoma (6.3%) with a p-value of 0.006. Metastatic disease was noted in 6 patients having Wilms tumor on follow-up while it was also low in hepatoblastoma which was noted in only 2 patients ($p > 0.05$). The most common site of metastasis was the lung in both groups followed by liver in patients with Wilms tumor. No significant difference was identified in pelvic extension of disease at presentation in both studied population ($p > 0.05$). Pelvic extension was observed only in 3 patients with Wilms tumor (Table II).

Table I: Studied patients' demographic features.

Variables	Total population (n = 61)		Wilms tumor (n = 45)		Hepatoblastoma (n = 16)	
	n	%	n	%	n	%
Mean age at diagnosis (years)	2.8 (0.2 - 15)	-	4.7 (0.4 - 15)	-	0.9 (0.2 - 7.2)	-
Mean follow-up (months)	10.6 (0.2 - 118.7)	-	13.8 (0.2 - 118.7)	-	7.4 (1.1 - 36.1)	-
Gender						
Male	33	54	19	42	14	87.5
Female	28	46	26	58	2	12.5
Site or frequency						
Right	-	-	23	51	-	-
Left	-	-	17	38	-	-
Bilateral	-	-	5	11	-	-
Unifocal	-	-	-	-	13	81
Multifocal	-	-	-	-	3	19

Range in parenthesis

Table II: Studied patients' demographic features.

Variables	Wilms tumour (n = 45)		Hepatoblastoma (n = 16)		p-value
	n	%	n	%	
Metastatic disease at presentation					0.006*
Present	20	44.4	1	6.3	
Absent	25	55.5	15	93.7	
Metastatic disease at follow-up					NS
Identified	6	13.3	2	12.5	
Not identified	39	86.7	14	87.5	
Pelvic extension at presentation					NS
Present	3	6.7	0	0	
Absent	42	93.3	16	100	
Pelvic metastasis at follow-up identified					NS
Yes	1	2.2	0	0	
No	44	97.8	16	100	
Abdominopelvic CT					NA
Total scans	169	NA	59	NA	
Average No. of scans per patient	3.75	NA	3.68	NA	

** Fisher's Exact test is statistically significant; NA = Not applicable; NS = Not significant.*

A pelvic metastasis was found in 1 patient only with Wilms tumor on follow-up whilst no pelvic metastasis occurred in hepatoblastoma patients ($p > 0.05$). In 3 patients with Wilms tumor recurrence was seen on follow-up at the site of the primary tumor resection while it was only seen in 1 patient with hepatoblastoma.

An average of around four CT scans were performed in each patient during the diagnosis and follow-up process which points toward high radiation exposure. The surveillance CT scans were able to detect only a very small number of pelvic extensions which is rare in these cancers. However, this study and another from the USA suggest the prevalence is too small to justify routine CT imaging of pelvic region in children with these conditions. Thus, routine pelvic CT imaging in these patients may lead not only to unnecessary radiation exposure but also increased cost. Ultrasonography can also be used for monitoring and surveillance as recommended by the International Society of Pediatric Oncology for Wilms tumor.[8] Therefore, we recommend for now that pelvic CT is added to abdominal CT in the following scenarios: tumor is suspected in the pelvic with initial diagnostic ultrasound examination, haemorrhagic ascites is suspicious for tumor rupture; the anaplastic sub-type of Wilms tumor is proven on initial biopsy. The high prevalence of metastatic disease was noted in Wilm's patient cohort in this study might be due to selection bias as these patients are usually followed with CT scans.

This study has a number of limitations. First, this is a retrospective study which has its own inherent limitation of availability of information. Second, it was a small scale study and the findings are to be interpreted with caution in the presence of small sample size. However, the study was conducted on rare tumors in two centers so it was difficult to obtain a very large sample. Third, the study involved more than one site so different equipment and imaging algorithm was used to perform CT scans at these settings. Fourth, histological type of tumor was not assessed with studied outcome variables.

There were some important strengths of the study. It was a two-center study and all scans were reviewed by the same consultant radiologist. This preliminary study will provide a basis for the future large scale evaluation studies to determine the usefulness of routinely performed pelvic imaging in this population.

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