



EDITORIAL

Making good use of ultrasound for abdominal tumors in children *



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Second only to trauma, cancer is the leading cause of death in adolescents and children. There are approximately 9,000 new cancer cases diagnosed each year in the United States and 1,500 related deaths.¹ Neuroblastoma and Wilms tumor are the most common abdominal tumors in children. Ultrasound is the most common imaging modality used in the initial imaging investigation of children with suspected intra-abdominal masses. Once ultrasound makes the diagnosis of an intra-abdominal mass, magnetic resonance imaging (MRI) and computed tomography (CT) scans are needed to confirm the organ of origin and assess locoregional and distant staging.² These tests are not without their limitations in this young population. CT scans expose children to radiation, and both CT and MRI often require sedation for optimal images. MRI is also not promptly available in most institutions. Yet, the use of ultrasound for preoperative evaluation of solid tumors in pediatric patients has not been widely studied.

Recently, Dr. Lucena and colleagues³ published a retrospective study in a single center to “estimate the performance of single phase enhanced computed tomography and ultrasonography examinations in the preoperative evaluation of solid abdominal tumors and their relationship with relevant structures (solid organs, vessels, GI organs, neuromuscular structures) in children”. During this 8-year study period, they identified 50 cases of abdominal tumors, 20 of them were renal tumors, 19 neuroblastoma, and complete surgical resection with negative margins was achieved in 44 (88%) of them. In their analysis they found that the comparison between single-phase CT and USG showed a sensitivity of

95.3% vs 86.6%, specificity = 86.8% vs 94.6% and accuracy = 87.9% vs. 92.2%. They conclude that ultrasound can be complementary to single-phase CT scans in the preoperative evaluation of children with an abdominal tumor.

The methodology of this work included a single sonographer, an experienced pediatric radiologist. The sonographer assessed the circumferential involvement of the main abdominal vessels, the relationship of the tumor with adjacent organs and structures using the sliding sign and cleavage planes to determine local invasion as a tool for preoperative assessment and locoregional staging. The results were compared to contrast-enhanced single-phase CTs acquired in the portal venous phase with a single bolus of contrast injection. The information about the CT imaging post-processing protocol, such as slice thickness and potential additional imaging such as MIP reconstructions, was not described in the methodology for the CT interpretation. The scanners used for imaging acquisition were PHILIPS Brilliance 16 and TOSHIBA Aquillion 64.

The treatment planning and outcome of neuroblastoma, in particular, are largely dependent on the stage of disease and ultimately risk group. In 2009, the International Neuroblastoma Risk Group (INRG) task force adopted a new staging system for neuroblastoma based on radiologic findings. The main radiological points, called image-defined risk factors (IDRFs) essentially involved encasement of vessels, intraspinal extension, airway compression, contiguous organ infiltration, and involvement of multibody compartments. The task force further stipulated that these criteria should be evaluated by CT or MRI for surgical planning and that ultrasounds were inadequate for the determination of local extension.⁴ Ultrasound may complement details for the local invasion assessment, however, can not replace CT and MRI

*See paper by Lucena et al. in pages 17–22.

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for staging given that important findings such as intraspinal involvement, presence or not of bone metastasis, and involvement of multibody compartments, as metastasis in other body regions than the abdomen or pelvis, are out of scope for an ultrasound study. The assessment of the retroperitoneal structures can also be limited by ultrasound, especially if bowel gas distention is present. In cases of Wilm's tumor, the assessment of the contralateral kidney, liver, lung metastasis, and intravascular thrombus is as important as the local invasion for disease staging. The knowledge of a supradiaphragmatic tumor thrombus extension is vital for surgical planning.²

The ultrasound sensitivity, specificity and accuracy numbers calculated in this abstract is based on a single operator, an experienced pediatric radiologist. Ultrasound is an imaging modality highly dependent on the skill level of the operator and, therefore, the results of this abstract are not reproducible in other practice settings, especially if scans are not performed by someone experienced in pediatric ultrasound.

The CT scanners used were a PHILIPS Brilliance 16 and TOSHIBA Aquilion 64. The newer CT scanners are available with updated technology, offering more detectors, faster imaging acquisition, and sometimes the dual source of energy and other tools that facilitate post-processing and imaging interpretation.

An important limitation of this study is selection bias. This study had a small sample size that did not represent the true heterogeneity of the clinical population. The majority of patients in this study had localized disease: 88% of these tumors were completely resected at the time of surgery with negative margins, ergo they were not invading adjacent structures. A major exclusion factor of this study was that patients could not have metastatic disease on presentation. In the literature, only 30% of neuroblastoma patients present with localized disease.⁵ Yet neuroblastoma was nearly half of the patient population represented in this study. The study sample represented in this scientific paper may not be a true reflection of the present study's patient population. This may affect the authors' ability to interpret the results of clinical practice.

The CT methodology presented in this paper was minimalistic. There are adjustments in the CT imaging acquisition protocol that may enhance the assessment of intra-abdominal masses. The use of dual bolus contrast injection with single imaging acquisition can improve the assessment of vasculature involvement, highlighting arterial and venous structures in a single acquisition, without increasing the radiation dosage.⁶ In addition, dual-energy CT is a newer technology that has been shown in adults to enhance the assessment and characterization of neoplastic processes and metastatic disease.⁷ This is another promising technique for further use and research in pediatric imaging. The authors defended that multiphase CT scans should be avoided, and this is also promoted by pediatric imaging societies across the globe.⁸

The authors of this paper stated that "a complete surgical resection results in improved survival in patients", and while this may be true in some patients, this is often an oversimplification of the nuanced approach in the therapy in Wilm's tumor and neuroblastoma. The success of treatment is quite variable and dependent on the stage of disease and risk

stratification.^{9,10} Multimodal imaging plays an essential role in the assessment of the local extent of disease as well as metastatic spread, surgical planning, response to therapy, and surveillance.

Lucena and colleagues asked an important question: can the initial ultrasound assessment have a role in the surgical planning of pediatric abdominal malignancies instead of just being a screening test? Unfortunately, given the selection bias, their study sample did not represent a true clinical population, and therefore it is difficult to discern if their findings are meaningful. Further, operator dependency of the ultrasound is a significant limitation of this study and its reproducibility at any center. To truly answer the question, the authors are encouraged to repeat the study without excluding patients with a higher staging of disease and including more than one sonographer. The authors are further encouraged to adjust their methodology to compare ultrasound with a more detailed CT imaging acquisition protocol.

This study does provide valuable information regarding the use of the sliding sign and analysis of the cleavage planes at the initial ultrasound investigation. Regardless of the ongoing need for additional CT and MRI imaging for these patients, the experience of this pediatric radiologist has shown that the inclusion of the sliding sign and the assessment of the cleavage planes in the imaging acquisition protocol of the initial ultrasound at presentation complements preoperative information in some cases.

Conflicts of interest

The authors declare no conflicts of interest.

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