

***The following statement, drafted in 2010, reflects the opinion of the Pennsylvania Trauma Systems Foundation, Pediatric Trauma Committee.***

There is considerable agreement that diagnostic imaging, particularly with computed tomography (CT), results in significant radiation exposure in children. In addition, while the precise implications of this radiation exposure have not been defined, there is consensus that it is associated with a low, but real, increase in the long term development of fatal malignancy. Children are particularly sensitive to the effects of radiation given their small size (increase dose per unit area) and the long latent times between exposure and the resultant cancer. Exposure to diagnostic radiation in children has increased dramatically in recent years with increasing use of CT. The primary indication for these scans is for the evaluation of trauma and appendicitis. Both the American Academy of Pediatrics and the American Pediatric Surgical Association have recently published statements encouraging their members to adhere to the ALARA principle, "As Low as Reasonably Achievable," when obtaining imaging in pediatric patients (1, 2)

While the use of CT to diagnosis injuries in children has been increasing, there is a growing body of literature to suggest that CT is not required for routine evaluation. Kupperman recently published a prediction rule for the identification of children at very low risk for traumatic brain injury and demonstrated that application of the rule would decrease the number of head CTs in children by 20-25% (3). A large, multi-center study evaluating the role of imaging in the evaluation of possible cervical spine injury in children less than three years of age noted that the incidence of cervical spine injury was extremely low in this population (0.66%) and developed a decision rule that identified those children at increased risk who might benefit from further imaging (the type of imaging was not specifically addressed) (4). An interesting finding in this particular study was that utilization of CT for the evaluation of cervical spine injury varied according to type of institution, with Pediatric Trauma Centers in children's hospitals obtaining CT scans in only 17.5% of children, whereas Pediatric Trauma Centers in adult hospitals obtained cervical spine CTs in 38% of children. A small, single institution study evaluating the use of chest CT in children found that there were no occult life-threatening injuries missed by chest x-ray, suggesting that the routine chest x-ray is an adequate screening tool (5).

Not only is there evidence of a dramatic increase in the number of CT scans performed in injured children, but it also appears that scans are being done using a variety of techniques and prior to the transfer to a definitive care institution. From a technological

standpoint, CT can be performed using a variety of techniques. Most scanners today have "pediatric" software packages that can be purchased that will alter the radiation dosage administered according to the weight of the child, but the utilization of these modifications is unclear. One pediatric radiology department demonstrated dramatic differences in radiation exposure, with essentially the same quality of scan, with aggressive adherence to protocols (6). Finally, a recent, single-institution study highlighted the potential adverse effect of obtaining CT scans prior to transfer to a definitive care institution, noting that over 90% of children who received an initial CT at an outside hospital required repeat imaging (7).

In light of this evidence, we recommend adherence to the ALARA principle when imaging pediatric trauma patients. Specifically, we recommend:

- 1) Avoidance of the use of protocols which automatically result in the performance of multiple CT scans (i.e. head, cervical spine, chest, and abdomen and pelvis) in pediatric patients.
- 2) Avoid further CT imaging once the decision to transfer to definitive care is made, unless the accepting institution specifically requests a scan prior to transfer.
- 3) All CT scans on children should be performed using "pediatric" dose-reduction protocols.
- 4) Accepting institution should avoid repeating scans unnecessarily and when possible utilize alternative imaging strategies.

### **References**

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- 4) Pieretti-Vanmarcke, Velmahos, Nance, et al Clinical clearance of the cervical spine in blunt trauma patients younger than 3 years: A multi-center study of the American Association for the Surgery of Trauma. *J Trauma* 67:543-550, 2009.
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- 7) Chwals, Robinson, Sivit, et al. Computed tomography before transfer to a level I pediatric trauma center risks duplication with associated increased radiation exposure. *J Pediatr Surg* 43 2268-2272, 2008.