

Whats and Whys With Neonatal CT

What and why? As health care professionals, we must address both of these questions in scientific inquiry as well as in clinical practice. Most times, facts (the “what”) are relatively easy to come by. The reasons (the “why”) behind these events are usually more difficult to discover and understand. Let us look at the example of head computed tomography (CT) in a group of neonates. There are 2 facts here. First, in an investigation of 4107 term infants diagnosed with encephalopathy by Barnette et al¹ in this issue of *Pediatrics*, CT examinations were performed in 22.7%, with 2.4% of this population having >1 CT examination. Second, the investigators remind us that MRI is better than CT at prognostic evaluation in this scenario. From these facts, the investigators concluded that a preferred imaging strategy would be ultrasonography followed by MRI, without a CT examination.

There are a few other relevant facts we know. First, a CT scan is easier to obtain than an MRI (MRIs are often not available 24 hours a day, every day of the week, everywhere), and CT scans afford faster examination (literally seconds for a brain examination) with better monitoring (particularly in unstable neonates) and have fewer equipment-related contraindications than MRIs. Often, modality decisions are justifiably made based on available resources and patient status in addition to diagnostic yield. In addition, CT use in children has been declining.² The authors also found a decline (of 59%) in the number of CT examinations in the study population from 2006 to 2010.¹

Another fact has been implied or outright stated when discussing CT, especially in children, which warrants some additional discussion. The fact is radiation is necessary for a CT examination, and radiation in high doses can cause cancer. We also know the dose estimates or metrics for head CT examinations in children. When appropriately performed, the examinations should be between ~2.0 and 4.0 mSv. We also know that data for the risk of developing a fatal cancer indicate that the consensus in the medical and scientific community is a threshold at or above ~100 mSv,³ although some would argue that this cutoff could be as low as 50 mSv. Even this lower threshold is dozens of times greater than a single CT examination of the brain. This amount is still an unproven risk.⁴ There are real costs, such as that the CT examinations are relatively expensive (although not, in general, as much as an MRI) and use resources including personnel and equipment that are often busy. We should not dismiss the existence of risk but rather should be mindful of the import of this risk on ultimate decisions to perform a CT examination. More directly stated, the risk of cancer (or any other significant biological effect) from a single, appropriately performed CT examination of the head in a term infant is either zero or at most a small fraction of a single percentage point. I could support defending dismissal of CT in these neonates based on either more appropriate (ie, better diagnostic yield) imaging strategies such as MRI, or improved utilization of limited resources, rather than potential

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ABBREVIATION

CT—computed tomography

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carcinogenesis. I think that acknowledgment of the potential and at most small cancer risk is reasonable but should not be, in this setting, a driving factor.

We are getting to the “why” here. What the investigators rightly point out is that we must be aware of what we are doing with our medical care (in this case, the number of CT examinations performed in neonates) and, furthermore, that this care must be justified, based on issues discussed earlier such as diagnostic yield as well as recognized and accepted costs (and available resources). If there is a better imaging strategy, recognizing the

influence of resource availability and all considerations for that modality (eg, monitoring), then MRI and ultrasonography alone may be the appropriate path to follow. This investigation reminds us to measure what we do (the requisite initial step of quality improvement), and argues for a mandate, a justification. We should not accept a number alone as being high or low outside of the reasons behind these facts; that is, is the CT testing warranted? It is not simply that it is done frequently, but we must understand the background behind this action. Once we are presented with the “whats,” the “whys” should

be explored and then the “hows” developed. These include better imaging pathways through evidence-based decision support, decision rules, appropriateness criteria, imaging guidelines, CT dose registries such as through the American College of Radiology, or institutionally based individual patient CT radiation dose-tracking programs (which would provide databases for us to access the “whats” more easily and with greater resultant clarity).

This investigation by Barnette et al¹ points out what we do with imaging in neonates with encephalopathy and provokes exploration of why.

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