RATIONAL REDUCTION IN ABUSE OF NEUROIMAGING

The Role of Emergency Neuroimaging in Children with New-Onset Afebrile Seizures

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PURPOSE: The objectives of this study were (a) to determine the frequency of clinically significant abnormal neuroimaging in children coming to the emergency department (ED) with new-onset afebrile seizures (ASZs), and (b) to identify children at high or low risk for clinically significant abnormal neuroimaging.

METHODS: Five hundred consecutive cases of new-onset ASZs seen in the ED of a tertiary care children's hospital were reviewed. Neuroimaging reports were categorized as normal, clinically insignificant abnormal, or clinically significant abnormal. Recursive partition analysis was used to identify clinical variables that separated children into high- and low-risk groups for clinically significant abnormal neuroimaging.

RESULTS: Ninety-five percent of patients (475 of 500) with new-onset ASZs had neuroimaging. Clinically significant abnormal neuroimaging was noted in 8% [95% confidence interval (CI): 6–11; 38 of 475] of patients. Recursive partition analysis identified two criteria associated with high risk for clinically significant abnormal neuroimaging: (a) the presence of a predisposing condition, and (b) focal seizure if younger than 33 months. Of the high-risk patients, 26% (95% CI, 17–35; 32 of 121) had clinically significant abnormal neuroimaging compared with 2% (95% CI, 0.6–3.7; six of 354) in the low-risk group.

CONCLUSIONS: In this large, retrospective review of children with new-onset ASZs, clinically significant abnormal neuroimaging occurred with relatively low frequency. Emergency neuroimaging should be considered, however, for children who meet high-risk criteria. Well-appearing children who meet low-risk criteria can be safely discharged from the ED (if follow-up can be assured) without emergency neuroimaging, because their risk for clinically significant abnormal neuroimaging is appreciably lower.

COMMENTARY

Since the advent of neuroimaging, its role in the initial evaluation of a child with a first seizure has been under discussion. In a litigious society, a strong tendency is found to order all tests that could come into question should something adverse happen. This may have influenced the emergency department (ED) in which the study by Sharma et al. was performed. Ninety-five percent (475 of 500) of the children who were seen in the ED at Children's Hospital, Boston, had neuroimaging. It is often assumed that the reason so many studies are done is that EDs are staffed by physicians trained in adult medicine, in which the yield of an imaging study is considerably higher. That was not the case here.

Before this study, a heterogeneity of definition and results existed. Many studies had mixed febrile and afebrile seizures, as well as chronic seizure disorders. It is not surprising that prevalence of abnormal neuroimaging ranged from none to 21%. Other studies had a bias of ascertainment in which only small numbers of those with seizures were imaged. The current study was scrupulous in the definition of new-onset afebrile seizures, the determination to identify studies that actually demonstrated neuroimaging abnormalities of clinical significance, and delineation of risk factors that could routinely be discerned. Clinically significant abnormalities were noted in 8%, but only 1% had tumors or acute infarctions, and fewer than 1% required immediate operative intervention. With a partition analysis, the authors were able to identify a low-risk and a high-risk group: (a) presence of a predisposing condition such as bleeding disorders, malignancy, hydrocephalus, or closed head injury; or (b) the occurrence of a focal seizure if younger than 33 months. Of the high-risk group, 26% had clinically significant neuroimaging compared with 2% of the low-risk group. In four of these six "low-risk" children, intuitively worrisome factors that would have suggested the need for imaging existed (abnormal mental status, focal findings, or hypertension). The vast majority (91%) of the studies were computed tomography (CT) scans, and this would be expected, given the difficulties of arranging anesthesia from an ED. Because only 21 magnetic resonance imaging (MRI) studies were done initially, and this is considered the more sensitive technique, it is interesting to note that in 163 of 374 cases in which the CT was originally normal, an MRI was subsequently obtained. In only six (3.7%) patients was a clinically significant abnormality noted, providing even further evidence of the low yield of neuroimaging in first afebrile seizures.

The authors note that a recent practice parameter published by the American Academy of Neurology stated that insufficient evidence is available to make a recommendation at the level of standard or guideline for the use of routine neuroimaging in children with new-onset afebrile seizures (1), unlike the guidelines for adult patients. Sharma et al. provided strong evidence that emergency neuroimaging should be considered only for the high-risk group that they delineated. Dr. Freeman's commentary that accompanied the article went well beyond the neuroimaging issues, and placed the data in perspective and forced us to face the costs that are involved (2). If we apply his figures to Sharma's study, we find the following costs.

Group	Cost of studies ($)
475 with CT @ $264	125,400
163 with MRI @ $1,066	173,758
TOTAL COST FOR NEUROIMAGING IN STUDY	299,158
If CT on only 121 high risk	31,944
If MRI on all the 121 high risk	128,986

Even the most aggressive imaging of the high-risk population would result in a saving of almost two thirds. None of these analyses take into account another cost: the radiation exposure involved in all these CTs (3). The authors' recommendations that imaging be reserved for children at high risk and who are otherwise well appearing is sensible in light of their data and begins to move us toward more rational use of our resources.

by Eileen P. G. Vining, M.D.

References

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