AJNR

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AJNR Am J Neuroradiol 1994, 15 (5) 845-846
http://www.ajnr.org/content/15/5/845.citation

Commentary

Xenon-Enhanced CT: Past and Present

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The brain is a complex and fascinating organ. During thousands of years of evolution, this most highly evolved organ made a monumental blunder, forgetting how to repair itself. Skin and bone never forgot how to heal themselves. How and why the brain, which is supposed to be the smartest organ, made such a simple error defies all reasoning.

As neuroscientists struggle to understand and ultimately repair the brain, we realize how far we have to go. There are many holy grails for which we are searching hoping to gain a better understanding of the function of the central nervous system. One of the most eagerly sought is a measure of cerebral blood flow.

Xenon-enhanced computed tomography (CT) was developed in an effort to give us reliable data regarding cerebral blood flow. The intense desire by clinicians and neuroscientists, coupled with enthusiastic medical equipment manufacturers, stimulated the genesis of xenon CT some years ago.

Despite tremendous efforts by many people during the past decade, xenon CT and other measures of cerebral blood flow have not gotten off the launching pad in their attempts to predict stroke in carotid test occlusion. Xenon CT is difficult to perform in addition to being expensive and time consuming. These factors explain why the technique has not become widely accepted over the past 10 years. The paper by Linskey et al in this issue (1) shows once again that xenon CT cannot predict the occurrence of strokes. Despite the outstanding effort put into this paper, there is still no statistical proof that the addition of xenon CT is an improvement over the carotid test occlusion alone.

Trying to develop a more accurate predictor of carotid test occlusion outcome is one of the holy grails of interventional neuroradiology. Anyone who has performed carotid occlusions knows how frustrating this can be. It is sad to see patients deteriorate after everything seemingly goes so well with the angiogram and test occlusion.

There are many causes of stroke after carotid artery occlusion. The conventional wisdom is that low flow, caused by poor collaterals, is the major cause of problems. Many think that an accurate measure of cerebral blood flow may be of value in predicting who will have a stroke. This is obviously what they hope xenon CT, as well as positron emission tomography and single-photon emission CT, will show. However, embolization of a clot from the occluded segment of the artery is probably a greater problem. When you combine poor collaterals and the risk of distal clot embolization with the unstable hemodynamics frequently encountered with the elderly patient, you have a setup for disaster.

Xenon CT may have clinical use in the evaluation of cerebral blood flow, but the question still remains whether cerebral blood flow measurement by any means is a cost-effective predictor. I fear that it will be many years before we significantly reduce the complication rate associated with carotid artery occlusion. I have an even greater fear that it will not be many years before nameless bureaucrats will tell physicians how to care for their patients. The Health Care Financing Administration will become a powerful tool of Washington in controlling future health-care cost increases simply by just saying "no" to high-technology medical advances. There is little doubt that babies will be thrown out with bath water. If xenon CT survives the purge, it is doubtful that it will be recommended for use as a predictor of stroke after carotid test occlusion.

In the past we have simply introduced new technologies, and little effort was made beforehand to prove their clinical usefulness. In the

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Index terms: Arteries, carotid (internal); Cerebral blood flow; Brain, infarction; Xenon; Interventional neuroradiology, provocative testing; Commentaries

AJNR 15:845–846, May 1994 0195-6108/94/1505–0845

future, with more cost controls, this will not be acceptable. It will be demanded of radiology, in particular, that studies be done to show that the various imaging techniques actually improve the final outcome of the patient. Xenon CT and other blood flow measurement techniques have thus far been poor predictors of carotid test occlusion outcome. We in radiology would be wise to abandon these additional expensive techniques in this situation before health-care bureaucrats force us to do so.

Reference

1. Linskey ME, Jungreis CA, Yonas H, et al. Stroke risk after abrupt internal artery sacrifice: accuracy of preoperative assessment with balloon test occlusion and stable xenon-enhanced CT. *AJNR Am J Neuroradiol* 1994;15:829–843