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Another Look at Tension Pneumocephalus

To the Editor:—Considerable attention has been devoted recently to the subject of tension pneumocephalus¹⁻³ and the role of nitrous oxide in its genesis. In reviewing the reports of tension pneumocephalus of the last few years,⁴⁻⁷ one notes that clinical difficulties often were encountered several hours postoperatively and worsened with time. If nitrous oxide were the main culprit this clinical course is difficult to explain since the air bubbles should have decreased in pressure and/or size with time and resorption of nitrous oxide.

I think the problem of tension pneumocephalus can best be viewed using a two-compartment model, one compartment being composed of brain substance, blood, and cerebrospinal fluid (CSF), the other being the air mass of pneumocephalus itself. Anything that causes an increase in mass of one compartment will, because the cranium is a rigid container, cause a decrease in volume (very limited capacity) or an increase in pressure in the other compartment and in the intracranial space as a whole. Intraoperatively, nitrous oxide may directly increase the mass of the air collection. Postoperatively, this air bubble is compressed by expanding intracranial contents—the brain reexpands with rehydration, some cerebral edema may develop, spontaneous ventilation restores eucardia, and CSF drained earlier by ventriculostomy or lumbar puncture is gradually repleted. These events may all serve to raise intracranial pressures and lead to neurologic compromise.

Clinical management of this problem follows from an understanding of this model. Some degree of pneumocephalus will always be present with a craniotomy performed in the sitting position. The greater the degree of intracranial dehydration from forced diuresis, steroids, and CSF drainage, the larger this initial air collection will be. Terminating use of nitrous oxide prior to dural closure should mitigate against an early

increase in mass of the entrapped air bubble. Postoperatively, a brow-up skull x-ray should be obtained and, especially in those patients showing a significant air collection, strict attention must be directed to ventilation, fluid management, and steroid therapy so that reexpansion of the brain occurs gradually. However, since air is only slowly reabsorbed it may not be possible to prevent significant intracranial hypertension and definitive treatment via twist-drill burr holes may be needed.

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Another Use for Intravenous Fluid Containers

To the Editor:—The use of inflatable devices as patient positioning aids for left uterine displacement during cesarean section has been described by both Redick¹ and Elliott *et al.*² We have also found this method to be helpful in our practice of obstetric anesthesia.

In addition, we have successfully utilized a variation of this method by using empty intravenous fluid containers (Viaflex®, Travenol Laboratories Inc., Deerfield, Illinois) as inflatable axillary and shoulder rolls for some years. The 250-ml containers have been used with-