CORRESPONDENCE

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Use of Shoulder Restraints during Arm Abduction and Steep Trendelenburg's Position

To the Editor:—As noted in the recent American Society of Anesthesiologists Closed Claims Study, 15% of all claims were for anesthesia-related nerve injuries, with 23% of these cases involving the brachial plexus.[1] Recently at our institution, a patient was anesthetized for a prolonged pelvic procedure during which she was positioned in steep Trendelenburg's position with shoulder restraints placed over the acromioclavicular joints bilaterally. Three hours into the procedure, after an unexpected amount of blood loss, the patient was repositioned to undergo insertion of a radial arterial catheter. The right arm was abducted approximately 80° from the patient's right side and secured on an arm board without removal of the shoulder restraint from the right side. The surgical procedure ended uneventfully 2 h later. On awakening in the recovery area, the patient complained of right arm numbness and weakness. Subsequent evaluation by an anesthesiologist and a neurologist demonstrated that this patient's findings were consistent with a brachial plexus injury. Although the original positioning of the patient was consistent with Schiller's recommendations for patients in Trendelenburg's position,[2] the subsequent abduction of the arm may not have been. Schiller notes that the arm should not be abducted without removal of the shoulder restraints, though does not explain why. Romanowski *et al.*[3] reported a retrospective study of peripheral neuropathies in patients who underwent surgeries while in steep Trendelenburg's position and while secured with shoulder braces. They noted a 0.16% incidence (5 of 3,200) of neuropathy after abduction of the arm with the shoulder braces in place. A likely mechanism of injury in this scenario involves the caudad movement of the humeral head in relation to the cervical spine, stretching the brachial plexus inferiorly around the humeral head. These authors since have refrained from abducting the arm, and no subsequent neuropathies have occurred. Such empirical evidence led the faculty of our institution to reconsider the approach for positioning such patients: (1) steep Trendelenburg's position should be avoided when possible; (2) shoulder restraints, when necessary, should be placed over the acromioclavicular joints bilaterally; (3) abduction of the upper extremities should be to less than 90° from the body; (4) the patient's head position should remain neutral; and (5) when the arms are abducted, the shoulder restraints should be removed on the ipsilateral side. Such guidelines may prove helpful for clinicians but are no substitute for vigilance for potentially injurious positioning in which the plexus may be compromised.

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Volumetric Capnography and Lung Growth in Children: A Simple Model Validated

To the Editor:—I read with interest the paper by Ream *et al.*[1] in which the slopes of the alveolar plateaus of volumetric capnograms (phase III slopes) were studied in a series of children of various ages whose lungs were mechanically ventilated. Their finding that, as children grow, the normalized slope diminishes in a way that is predicted by the "single path" lung model with stratified inhomogeneity is presented as evidence in support of this hypothesis. Inspection of the plots of normalized slope *versus* age or weight reveals a seemingly