

ANESTHESIOLOGY

■ Using Life-sized Mannequins to Assess Acute Care Skills of Medical Students and Residents. Boulet *et al.* (page 1270)

Boulet *et al.* recruited 40 participants, including 13 first-year residents and 24 fourth-year medical students, to take part in 10 simulated acute care situations. (The results from three of these participants were later deleted from the final evaluation.)

The authors had developed the simulation cases using a multistage process, selecting critical care scenarios from a wide range of clinical contexts. Four faculty members from different divisions at the authors' institution reviewed the list of scenarios and prioritized them according to their potential utility in measuring the acute care skills to be tested. From the initial list, 10 scenarios were selected and modeled using the simulator program. The goal was to achieve acute care situations that required both diagnosis and initiation of treatment within a 5-minute period. Included in the scenario development was scripting regarding verbal questions and responses to "patient" input that candidates would be expected to perform. The faculty also formulated a detailed checklist of expected actions, giving each checklist item a scoring weight ranging from 1 to 4.

Each study participant was required to work through at least 6 of the 10 scenarios. Two faculty members and two nurse clinicians, none of whom participated in the scenario development, scored the videotaped simulation encounters independently. A score for each scenario was derived by multiplying the credited actions (scored 0 for no and 1 for yes) by their respective weights and summing. The average of checklist ratings for the four raters was used to generate student/resident scores, which were then converted to percentages based on mean performance and the maximum score that could be obtained for a given scenario. The mean performance of the fourth-year students was 57.1, whereas the mean performance of the resident group was 64.9 (out of a maximum of 100). As hypothesized, the more time an individual student or resident had spent in an elective rotation, the better his or her simulation performance in that area. The total number of weeks spent in critical care electives was positively associated with simulator performance. The two participants who had current Advanced Life Support certification outperformed those who did not.

Although the results of this study indicate that reasonably valid measures of clinical performance can be ob-

tained from carefully developed scenarios, the authors caution that there is no guarantee that a participant's performance in a simulated environment would translate to real-life situations.

■ Are Sleep and Respiratory Changes Linked after Abdominal Surgery? Wu and Drummond (page 1295)

Seeking to clarify the relationship between relief of respiratory obstruction and arousals or awakenings following abdominal surgery, Wu and Drummond monitored 16 women who underwent gynecologic surgery for non-malignant conditions. Anesthetic management was not standardized, because the study was observational. However, after surgery, all patients were given patient-controlled analgesia (morphine, 2 mg, intravenously, with a 5-min lockout period) and prophylactic antiemetic treatment. Electroencephalographic, electrooculographic, and electromyographic measurements were obtained perioperatively and postoperatively. The patients' oxygen saturation measured by pulse oximetry was measured postoperatively, and nasal pressure cannulas were used to measure outflow. Although the normal practice on postoperative wards is to dim the lights and limit activity, no special precautions were taken to enhance patients' sleep during the study period. All patients were questioned on the quality of their sleep the next morning, when monitoring leads were removed.

Respiratory signals and signals for sleep staging were transferred to a laboratory display unit, and the traces were coded so that investigators were blinded as to patient source. The signal tracings were analyzed using 30-s epochs to classify sleep into one of four states: alert, relaxed wakefulness, non-rapid eye movement stages 1–4, and rapid eye movement sleep. Arousal was defined by at least 1.5 s of alpha or theta electrocardiographic rhythm and a concurrent increase in submental electromyographic activity, after a period of at least 10 s of sleep. Nasal flow signals were scored for events classified as relief of obstruction, fulfilling one of three predefined criteria. Relief of respiratory obstruction and sleep events were considered "related" if they occurred within 12 s of each other.

In interviews on the morning after surgery, most study participants reported that they had slept poorly. Monitoring revealed similar conclusions: None of the patients had registered stage 3 or 4 sleep, and only four had had

any rapid eye movement sleep. There were many arousals (short periods of electrocardiographic changes) and awakenings (longer changes) from sleep, but only 30% of these events were associated with respiratory events. Patients also experienced obstructive breathing during wakefulness. Relief of obstruction was more frequently associated with arousal from sleep after benzodiazepine premedication.

■ Effect of Epidural Needle Design, Angle, and Bevel Orientation on Cerebrospinal Fluid Leak. Angle *et al.* (page 1376)

Angle *et al.* conducted a series of epidural punctures on human cadaveric dura using different needles, angles, and bevel orientations to determine effects on cerebrospinal fluid (CSF) leak after puncture. The team mounted 2-cm-square pieces of lumbar dural sac on a cylinder with a 1-cm aperture in order of harvest, preserving anatomic orientation of the tissue. The team used customized gaskets and hose clamps around the segments to achieve a “wet seal.” The model was pressurized to physiologic levels with artificial CSF, and pressures were measured using a standard in-line manometer.

Six types of epidural needles (two 17-g, three 18-g, and one 20-g) were coded, randomly selected for use, and advanced using a hand screw. Each dural specimen was punctured only once; after puncture, the needle was withdrawn and the syringe model was rotated to allow for fluid collection at four 15-min intervals. The dural specimens were then mounted and fixed in paraffin to be examined using scanning electron microscopy to determine trauma patterns. In a second set of experiments, the effect of needle angulation and tip design was studied using two different 18-g needles, with punctures done at 90- and 30-degree angles to the dural sac in the horizontal plane. In the third experiment, an 18-g needle was used, with the bevel positioned either perpendicular or parallel to the dural long axis.

The greatest CSF leak was found with the 17-g Hustead needle and the least with the 20-g Tuohy. Fluid leaks decreased over time for all needle types used, but leaks did not completely cease after any of the dural punctures. Punctures performed at 30 degrees produced no significant differences in CSF leaks compared to punctures performed at 90 degrees with the same gauge

needle. Similarly, bevel orientation (perpendicular *vs.* parallel to the long axis) demonstrated no significant differences. In some experiments, CSF leak was absent, and later scanning electron microscopy studies revealed this phenomenon to be due to complete or partial plugging of the puncture sites with dural tissue fragments. This latter finding may provide an explanation for the 20–30% of patients who do not develop postdural puncture headache following their epidural procedures. Although the study used *in vitro* methods, it suggested that use of a 20-g Tuohy needle significantly reduces CSF leak rates. Using such small needles for continuous epidural analgesia in adults, and the effect on postdural puncture headache, warrant further study.

■ Neuropathic Pain Mechanisms in the Spared Nerve Injury Model in Rats. Suter *et al.* (page 1402)

Suter *et al.* sought to identify whether injury discharge and peripheral ectopic activity emanating from an injury site in the first few days postinjury contributes to the development of hyperalgesia. The team placed silicone tubes containing bupivacaine-loaded biodegradable microspheres around the sciatic nerves of Sprague-Dawley rats to produce a conduction block. Following a battery of sensory-motor tests to establish the completeness of the block, the authors performed a spared nerve injury procedure on both bupivacaine-block ($n = 12$) and control ($n = 11$) animals.

All animals were observed for 4 weeks to see whether neuropathic pain-related behaviors developed. The authors assessed withdrawal responses to various stimuli: von Frey filaments, acetone, pinprick, and radiant heat. The animals that had received the bupivacaine-microspheres pretreatment demonstrated a long-lasting anesthetic block, evidenced by complete lack of sensory responsiveness for 6–10 days. Once the block wore off, however, the degree of hypersensitivity to pain was similar to levels found in the control animals. It may be that peripheral input from the site of nerve injury is not critical in the development of neuropathic pain behavior. In addition, the ectopic activity from the periphery after resolution of local anesthetic block may be adequate for the development of allodynia/hyperalgesia in this model.

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