needle-stick injury.\textsuperscript{2,3} An epidural catheter with a single end-hole can be introduced centrally into the distal lateral T-port of the pre-prepared intravenous set, in an aseptic fashion, utilizing a sterile Tuohy needle and Burrton Accu-Bloc Perifix set (Burrton Medical Inc, Bethlehem, PA) (fig. 1). The 20-gauge catheter is 3 feet long with a deadspace volume of 0.2 ml and is held snugly in the latex membrane without leaking or compromising flow. The catheter is taped securely in place and can be removed without destroying T-port integrity. Air bubbles are readily aspirated when seen in the clear epidural catheter. Injection occurs without needles under direct and unencumbered visual control. A syringe or the included occlusive cap seals the epidural catheter, when not in use.

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Spinal Anesthesia with Extremely Fine Needles

To the Editor—Post-spinal headache is the most common side effect of spinal anesthesia. Post-spinal headaches are felt to be due to CSF loss through a dural hole that does not seal after dural puncture.\textsuperscript{1,3} The incidence of spinal headache has been correlated with an increasing needle size. In the interest of reduced patient morbidity, we have introduced the routine utilization of 29-G spinal needles\textsuperscript{*} for spinal anesthesia in our institution. Since May of 1983, we have prospectively evaluated the incidence of post-spinal headaches in 1,775 patients. During this period, 461 (26%) and 1,314 (74%) patients had spinal anesthesia induced using 26-G and 29-G needles, respectively. All patients were specifically questioned regarding headaches prior to and between the third and eighth postoperative day by an attending staff anesthesiologist. Headaches were classified as follows:

1. **Minimal** postural headache, elicited only by direct questioning by the physician.
2. **Mild** postural headache reported by the patient spontaneously upon questioning, but with a normal ability to ambulate and requiring only occasionally analgesics.
3. **Moderate** postural headache limiting daily activities and requiring analgesic therapy.
4. **Severe** postural headache as above, but persisting for longer than one week.

Although 29-G needles were utilized as the needle of first choice, a substantial number of 26-G needles were used at the discretion of the attending anesthesiologist. Intravenous preanesthetic medication with meperidine, atropine, and promethazine was routinely administered, as well as supplementation with 1–2 mg of midazolam intravenously as indicated. Spinal anesthetics were routinely administered with the patient in the lateral supine position. Spinal anesthesia with 29-G needles required the use of a 20-G introducer needle, as well as a 2-ml luer lock syringe containing normal saline solution for aspiration because the small needle lumen precludes rapid flow of CSF upon subarachnoid puncture. Individual proficiency with 29-G needles is rapidly attained and the failure rate of spinal anesthesia in this series was 1.4% and 1.2% in 26- and 29-G groups, respectively.

The overall incidence of post-spinal headache was 1.37% in patients in the 29-G group and 3.69% in patients in the 26-G group ($P < 0.01$, Chi-square test). No severe headaches were noted and in no instance was an epidural blood patch required. A decreased severity of headache in the 29-G group was noted (fig. 1) and the classified “moderate”

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\textsuperscript{*} Becton & Dickinson, Tutallstr. 8-12, 6900 Heidelberg, W. Germany.

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**FIG. 1.** Number of individual patients with postspinal headache (PSH). Every bar represents one patient. Age and sex distribution, 29-G (total = 1,374 patients); 26-G (total = 461 patients).
form of headache was noted in only one versus six patients in the 29-
and 26-G groups, respectively.

The difference between minimal to mild headache (P < 0.05) and
moderate headache (P < 0.01) was statistically significant, but there
was not significant difference between mild and moderate headache
(P < 0.14, exact Fisher test). The technique of spinal anesthesia with
29-G needles is readily learned, requires only little increased time and
no more effort to complete, and is as successful as spinal anesthesia
with larger 26-G needles in the routine practice. We recommend the
use of 29-G needles for use in younger patients at risk for headache.
With the increasing number of patients presenting for ambulatory sur-
gal procedures, these thin needles may prove to be especially beneficial
in precluding headache.

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Dose-Response Relationship to Mivacurium in Humans

To the Editor:—We would like to make a correction and comment
regarding the recent paper describing the dose-response relationship
of mivacurium chloride in humans.1 Weber et al.2 did not use a single
twitch mode of nerve stimulation in their study of the dose-response
relationship of mivacurium. We used a stimulation pattern of 2 Hz for
2 s at 10-s intervals.

Because of recent discussion about the methods of calculation of
the dose-response relationship for mivacurium,3 we would like to offer
reanalysis of our dose-response data for mivacurium. Similar questions
could be asked of Caldwell et al.4 The ED50 reported by Weber et al.2
was calculated from observations of 26 patients with normal pseudo-
cholinesterase activity who each received a single dose of either 30,
40, or 50 µg/kg of mivacurium. If we add an additional nine adult
patients who received 60 µg/kg of mivacurium to the calculation of
the dose-response relationship, then the ED50 is 45 µg/kg and the ED90
is 70 µg/kg.4 This is in contrast to the ED50 of 41 µg/kg and ED90 of
58 µg/kg calculated from the observation of 26 patients.4 Not all of
the nine adults receiving 60 µg/kg developed 100% neuromuscular
blockade. The patients who developed 100% neuromuscular blockade
in this group were assigned a probit of eight. We would expect, as do
others,5 that adding patients with 100% neuromuscular blockade to
the calculation of a dose-response relationship might increase the slope
of the regression line. It is of our preference to present dose-response
data based on the responses of patients who have received doses between
the ED50 and ED90, because this is expected to be the linear portion
of the dose-response relationship and linear regression is employed to
estimate the relationship.

These arguments are somewhat specious in that adding nine patients
who received 60 µg/kg of mivacurium to our calculations of the dose-
response relationship produced no statistically significant change in
the slope or intercept of the regression line. Individual patient variability
in response appears to be more important than these small differences in
methods in the determination of the dose-response relationship for
mivacurium.

Variation in pseudocholinesterase activity may contribute to inter-
patient variability in response to mivacurium. We find it interesting
that Caldwell et al.4 noted aberrant response to mivacurium in patients
with slightly abnormal pseudocholinesterase activity. Perhaps the pa-
ient who was sensitive to mivacurium and had pseudocholinesterase
activity at the low end of the normal range and 85% inhibition by
dibucaine is a homozygous normal patient as determined by response
to dibucaine and the substrate used by Smith Kline BioScience Labo-
atories, Van Nux, California. (Could there be a significant difference
between 84 and 86% inhibition?) Undoubtedly, there is a difference
between the effects of pseudocholinesterase on mivacurium and on
the substrate employed to assay pseudocholinesterase in this study. All
patients with "normal pseudocholinesterase activity" may not metab-
olize mivacurium at the same rate. The characterizations of pseudo-
cholinesterase activity that were useful guides for the administration
of succinylcholine may not be as useful in the description of the effects
of mivacurium. To improve our understanding of this area, the sub-
strate used to assess pseudocholinesterase activity should be reported.

In the study of Weber et al.,2 the substrate used was acetylthiocholine
iodide.

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REFERENCES

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