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# A Comparison of the 24-Gauge Sprotte® and Gertie Marx® Spinal Needles for Combined Spinal–Epidural Analgesia during Labor

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***Background:*** **Prior experience with the combined spinal–epidural technique (CSE) for labor analgesia demonstrated a high (up to 14%) failure rate because of failure to obtain cerebrospinal fluid (CSF) or lack of response to appropriate doses of intrathecal sufentanil. The current study was designed to test whether a longer needle with a shorter side port (Gertie Marx® needle; 127 mm long) would eliminate failures to obtain CSF compared with the needle we had used previously (Sprotte® needle; 120 mm long).**

***Methods:*** **Seventy-three parturients were randomly assigned to have a CSE performed with one of these two needles. After identifying the epidural space with an 18-gauge Touhy needle at the L2–L3 or L3–L4 interspace, the spinal needle was introduced through the Touhy needle until penetration of the dura was felt or until the needle was maximally inserted. If no CSF was obtained, the alternate needle was tried. After obtaining CSF, 10 μg sufentanil diluted in 1.8 ml saline was injected. Verbal pain scores (0–10) were obtained every 5 min for 30 min.**

***Results:*** **Failure to obtain CSF occurred six times in the Sprotte group compared with none in the Gertie Marx group ($P < 0.05$). In all six failures in the Sprotte group, the Gertie Marx needle subsequently proved successful in obtaining CSF. There were no differences in pain scores between the groups.**

***Conclusions:*** **The extra length of the 127-mm Gertie Marx needle resulted in a higher success rate for obtaining CSF when used in the CSE technique. Side port design was not a factor influencing success in this clinical setting.**

THE combined spinal–epidural (CSE) technique is used frequently, especially for labor analgesia.[1] The most common technique consists of placing the tip of an epidural needle in the epidural space and inserting a spinal needle through the epidural needle until it punctures the dura. Opioids with or without local anesthetics are then given intrathecally, the spinal needle is removed, and an epidural catheter is threaded into the epidural space. Advantages of this technique include a fast onset using small intrathecal drug doses, along with the ability to give additional drug *via* the epidural catheter if needed. In a previous study, we found that the CSE technique provided excellent labor analgesia[2]; however, there was a high incidence of failure of the spinal component of the procedure. In 4 out of 49 cases, there was no flow of cerebrospinal fluid (CSF) in the spinal needle, despite later confirmation (by the presence of adequate continuing analgesia) that the epidural needle was indeed in the epidural space. In addition, there were three cases in which CSF was visible in the spinal needle, drug was injected, but there was no evidence of any clinical effect of the intrathecal sufentanil.

In this study, we sought to determine the causes of these failures. Two hypotheses might explain why we failed to obtain CSF from a spinal needle placed through a properly placed epidural needle:

1. The spinal needle did not protrude sufficiently beyond the epidural needle and was therefore not long enough to consistently penetrate the dura (figs. 1A and B). In this case, a longer needle should penetrate the dura.
2. The epidural needle tip was in the epidural space but deviated to one side. The spinal needle thus was directed to the side of the intrathecal space (fig. 1C). In this case, a longer needle would not be more successful in entering the CSF.

We also hypothesized that failure to obtain analgesia after an intrathecal injection of sufentanil may relate to needle design. Although both the Sprotte® and Gertie Marx® are pencil-point needles, the Sprotte has an elongated side port (fig. 2), which some investigators[3,4] believe can straddle the dura, allowing CSF to flow through the needle while at least part of the injectate is deposited in the epidural space. The smaller side port of the Gertie Marx needle potentially might result in fewer failures.

## Methods

With institutional review board approval and written informed consent, 73 American Society of Anesthesiologists I and II women in active labor who requested labor analgesia and accepted a CSE for this purpose were enrolled in the study. Patients were randomized to have the spinal component of the CSE performed with one of two needles: a 120-mm Sprotte spinal needle (Pencan; B. Braun, Melsungen, Germany; n = 36) or a 127-mm Gertie Marx spinal needle (International Medical Development, Park City, UT; n = 37). Both needles were 24 gauge. When fully inserted, the Sprotte needle protruded 9 mm past the tip of the 18-gauge Tuohy needle that is standard in our epidural kit (B. Braun, Inc., Bethlehem, PA). The Gertie Marx needle protruded 17 mm

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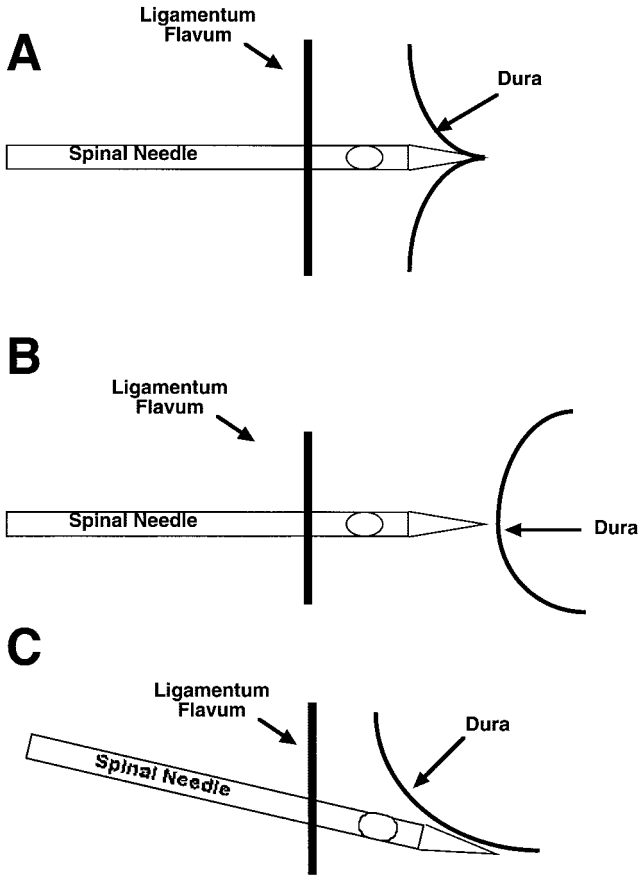


**Fig. 1. Three possible reasons why the spinal needle may not penetrate the dura and not result in CSF return are illustrated in this cross-sectional diagrammatic view. (*A*) The spinal needle tents the dura but does not penetrate it. (*B*) The spinal needle does not reach the dura. (*C*) The spinal needle passes to the side of the dural sac.**

beyond the tip of the Touhy needle. All blocks were performed at the L2–L3 or L3–L4 interspace with the patient in the sitting position. A loss of resistance technique with air or a small amount of saline was used to locate the Touhy needle in the epidural space. A spinal needle was then passed through the Touhy needle until a "pop" indicating puncture of the dura was felt. The person performing the procedure then observed whether there was flow of CSF in the needle. If no CSF was seen at this point, the spinal needle was inserted maximally. If there was still no flow of CSF, that needle was withdrawn from the Touhy needle, and the alternate needle was inserted. After CSF flow was obtained, 10 $\mu$g sufentanil was injected, and an epidural catheter was inserted for later use. Verbal pain scores on a scale of 0–10 (0 = no pain and 10 = the worst imaginable pain) were obtained every 5 min for 30 min. If the patient requested additional analgesia within 30 min of the intrathecal injection, it was considered a failure of the spinal portion of the technique. Patients were questioned (in person if still in the hospital, or by telephone if discharged) at least 24 h after the procedure regarding the existence of a postdural headache. Statistical analyses included *t* tests for the demographic data, one-way and two-way analysis of variance for the pain scores, and the chi-square test for analysis of anesthetic failures and headache rates. Power analysis showed that if there was a 10% difference in the failure to obtain CSF between the needles, we would need to enroll 69 subjects in both groups to have a power of 0.8 at a significance level of 0.05.

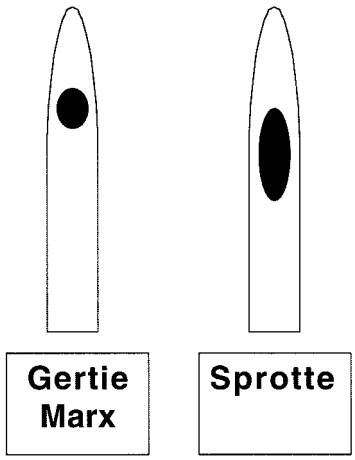


**Fig. 2. Diagrams of the tips of the Gertie Marx and Sprotte spinal needles. Note that the Sprotte side port is longer and further back from the tip of the needle compared to the Gertie Marx needle.**

**Table 1. Success and Failure Rates for Analgesia and Return of Cerebro-Spinal Fluid in the Spinal Needle Using the Combined Spinal–Epidural Technique for Labor Analgesia**

| | Sprotte | Gertie Marx | Significance |
|---|---|---|---|
| n | 36 | 37 | — |
| CSF | 30 (83%) | 37 (100%) | — |
| No CSF | 6 (17%) | 0 | $P < 0.05$ |
| Analgesic failures after administration of drug | 3 (10%)* | 4 (10%)* | NS |

* Because the Gertie Marx needle was used when the Sprotte needle failed, N = 30 for the Sprotte group, and N = 42 for the Gertie Marx group.
CSF = cerebrospinal fluid; NS = not significantly different.

## Results

The two groups were similar with regard to cervical dilation, parity, height, weight, and initial pain score. CSF was obtained in all cases in which the Gertie Marx needle was the initial needle used. In contrast, no CSF was obtained in six (17%) patients in whom the Sprotte needle was used first (table 1). When the Gertie Marx needle was subsequently used in these six cases, CSF was obtained in every case. Seven patients requested additional analgesia within 30 min of the intrathecal injection (table 1), but this 10% failure rate was similar in

**Table 2. Number of Patients with a Postdural Puncture Headache and Number of Patients Requiring an Epidural Blood Patch**

| | Sprotte Needle Only | Gertie Marx Needle Only | Both Needles Used |
|---|---|---|---|
| n | 30 | 37 | 6 |
| Postdural puncture headache | 1 | 6 | 5* |
| Epidural blood patch | 0 | 4 | 2 |

There were a total of 12 headaches. Both needles used: the patient was initially randomized to the Sprotte group. No cerebrospinal fluid (CSF) was obtained from that needle and then a Gertie Marx needle was subsequently used. At no time was the Gertie Marx needle used first without obtaining CSF.

* $P < 0.05$ *versus* both the Sprotte and Gertie Marx needles used alone.

both groups. There was also no difference in the pain scores between the groups.

Although the number of patients developing postdural puncture headaches (PDPHs) and requiring blood patches was greater with the Gertie Marx than the Sprotte needle, this difference did not reach statistical significance ($P = 0.20$; table 2). However, PDPH and the need for an epidural blood patch were significantly greater when CSF was not obtained with the Sprotte needle and a Gertie Marx needle was subsequently used (*i.e.*, both needles used on the same patient). Five out of these six patients in whom both needles were used developed a PDPH ($P < 0.05$; table 2). We halted enrollment short of our original goals because of the unexpectedly large number of headaches.

## Discussion

Our results suggest that failure to obtain CSF from a spinal needle using a CSE technique is probably due to inadequate length of the spinal needle. In this study, the failure rate for obtaining CSF with the Sprotte needle was similar to that experienced in a previous study in which we used the same needle.[2] In the current study, we found the longer Gertie Marx needle always was successful in obtaining CSF, even when the shorter Sprotte needle had been tried and had failed, and all epidural catheters functioned appropriately. This indicates that the epidural needles were indeed correctly placed and that it was unlikely that the spinal needle was striking the dura obliquely during the failed attempts (fig. 1C). More likely, the shorter Sprotte needle either did not reach the dura (fig. 1B) or was pushing against the dura (*i.e.*, "tenting" it; fig. 1A) but needed greater length to penetrate it. The 127-mm Gertie Marx needle had the necessary length and was able to more consistently puncture the dura. An alternative hypothesis is that the Gertie Marx needle has a sharper point and therefore more easily penetrates the dura. We did not test the alternative hypothesis in this study.

The results of this study lead us to conclude that it is necessary to have a spinal needle that protrudes more than 9 mm beyond the epidural needle tip. This agrees with findings by Hoffmann *et al.*[5] who found that, after using a loss-of-resistance technique to identify the epidural space with a Touhy needle, the average distance needed to insert a coaxially placed spinal needle beyond the tip of the Touhy needle in order to puncture the dura was 7.1 mm. The longest distance required was 13.3 mm.

In a previous study, we found that intrathecal sufentanil occasionally failed to provide adequate analgesia, even when there was good return of CSF in the spinal needle. We suspected this might be due to spinal needle side port design, with some drug being deposited outside the spinal space because of the elongated Sprotte aperture. Our finding in the current study suggests that side port design is relatively unimportant because similar numbers of analgesic failures occurred in both groups. It should be noted that since completion of this study, the company manufacturing the Sprotte needle has made the side port shorter in response to other studies that suggested the longer side port was problematic.[3,4]

If needle side port design is unimportant, why did we have a 10% analgesic failure rate despite obtaining CSF in the spinal needle? The most logical explanation is that spinal opioids alone may not be completely effective for relieving labor pain, particularly in advanced labor and during the second stage. First, there is an analgesic ceiling for intrathecal sufentanil.[6] Second, intrathecal opioids appear to block C-fiber pain better than A-δ–fiber pain.[7] During the end of the first stage and the second stage of labor, pain is more of a somatic origin with a greater A-δ component. Women with inadequate relief from intrathecal sufentanil alone may need greater blockade of A-δ–mediated pain. The addition of bupivacaine to intrathecal sufentanil is very successful at treating the pain in advanced labor and has become a common practice.[8,9]

The PDPH rate in the Sprotte group was similar to that reported in other studies,[3,10] whereas the rate with the Gertie Marx (16%) appeared high. There was no statistical difference in PDPH rates between the groups, although PDPH was not the primary outcome studied, and the study had inadequate power to permit conclusions about this complication. If in fact there were more PDPHs in the Gertie Marx group, this would be of clinical importance. It is difficult to envision why the Gertie Marx needle would cause more headaches than the Sprotte needle. We doubt that needle design differences would account for differences in headache rates, and both are pencil-point needles. It is conceivable that the longer needle might occasionally also puncture the anterior aspect of the dura and cause a greater CSF leak, thereby increasing the risk of PDPH. Since completing this study, we have changed our practice and now use a 124-mm 26-gauge Gertie Marx needle for CSE, and our PDPH rate is clinically insignificant. Because our anec-

dotal experience suggested a greater frequency of paresthesias using the 127-mm-long spinal needle, the needle of intermediate length (124 mm) may be an excellent compromise.

One unexpected finding in this study was the PDPH rate in the women in whom both needles were used in their procedure. Five out of six of these women developed a PDPH. Why using the second needle in this circumstance would increase the risk for PDPH is unclear. Our initial presumption was that the first needle did not puncture the dura, and that the second needle would follow the same path but would be long enough to penetrate the dura. However, it is possible that just the tip distal to the side port of the Sprotte needle penetrated the dura, creating a hole but not reaching a depth that permitted CSF flow. The second needle might not in fact follow the same track and might penetrate the dura at a different point. Alternatively, the second needle might have enlarged a hole made by the first, or might be so long that it also punctured the anterior wall of the intrathecal space, resulting in two dural holes. Any of these situations might increase the risk for PDPH as a result of greater CSF leakage. Regardless of the cause, in view of our findings, we recommend that one should proceed with caution if there is a need to insert the spinal needle a second time. Unless there is an overwhelming clinical need to make the first injection intrathecal, we recommend abandoning the spinal component of the technique and proceeding with epidural catheter placement.

In conclusion, the spinal needle used in the CSE technique must protrude far enough from the end of the epidural needle to consistently puncture the dura. We did not study a range of needle lengths and are thus unable to recommend a minimally effective length. However, we can assert that the 9-mm distance the Sprotte needle protruded from the end of the epidural needle was inadequate and that the 17-mm distance the Gertie Marx needle protruded was adequate. It must also be noted that different brands and models of spinal and epidural needles will not fit together in the same fashion. Therefore, it is necessary to check to see how far a particular spinal needle protrudes past the tip of a particular epidural needle before determining whether that combination is likely to work consistently.

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