Spinal Headaches After Myelograms: Comparison of Needle Types

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OBJECTIVE. We compared traditional bevel-tip end-hole spinal needles and pencil-point-tip side-hole needles for the incidence, severity, and duration of spinal headaches in subjects who had myelograms. Age, sex, and myelographic findings were examined.

SUBJECTS AND METHODS. We studied 138 subjects referred for myelograms. For 108 procedures, we randomly used 22-gauge Quinke bevel-tip end-hole needles or 22-gauge Sprotte pencil-point-tip needles. The 30 additional subjects were examined with Gertie Marx pencil-point-tip needles. All myelograms were performed by one of two neuroradiologists using recommended doses of iohexol. The myelograms were examined by an independent neuroradiologist for quality of image and presence of extraarachnoid contrast material. Five to 14 days after myelography, subjects were telephoned by an independent observer and asked about the presence, severity, duration, and positional quality of headache. Spinal headache is defined by positional quality and increases in severity when the subject moves from horizontal to sitting or standing.

RESULTS. We found that four (8%) of 52 subjects who had myelograms with Sprotte needles had spinal headaches. Likewise, 14 (25%) of 56 subjects who had myelograms with Quinke needles had spinal headaches. We calculated a statistically significant difference in the incidence of spinal headaches using chi-square analysis ($p = .02$). The average grade and duration of the spinal headaches did not differ significantly, although they were less marked in the Sprotte group. Spinal headaches occurred more frequently in young and middle-aged subjects than in older subjects. We found one definite extraarachnoid injection in each group. For the Gertie Marx needles, two (7%) of 30 subjects had spinal headaches. The average grade of postmyelogram headache was 2.5, and the mean duration was 1 day. There were no mixed injections.

CONCLUSION. We found a significant reduction in spinal headaches after myelograms when we used the pencil-point-tip side-hole needle. These results support the routine use of these needles for myelography in young and middle-aged patients.

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Myelography combined with CT is frequently used for preoperative planning after a noninvasive examination reveals appropriate lesions, such as a herniated disc, stenosis, or tumor. CT myelography is also used in selected cases for diagnosis when noninvasive tests fail to show lesions or result in unclear findings. The most common complication of myelography is spinal headache, which is reported to occur in 4–60% of procedures [1, 2]. The hallmark of spinal headache is its postural dependence; it is decreased or absent when the subject is recumbent, and it is aggravated by sitting or standing [3]. Spinal headaches usually begin within 48 hr but may be delayed by as many as 12 days. They occur with equal frequency in a frontal, occipital, or diffuse distribution [3, 4]. Spinal headaches are promptly relieved by an epidural blood or saline patch [3, 4]. Myelography remains an important diagnostic tool in neuroradiology; thus, minimizing the incidence of postmyelogram spinal headaches is in the best interest of the patient.

Many studies have investigated whether the incidence of spinal headaches following diagnostic lumbar puncture, spinal anesthesia, and, most recently, myelography is affected by needle size and configuration. Tourtelotte et al. [5] first suggested in 1972 that smaller needle sizes may reduce the fre-

tion may cause a transient and immediate increase in CSF pressure that reverses adenosine receptor activation and consequently reduces vasodilatation and spinal headaches. Further support that adenosine-related vascular changes may play a role in the cause of spinal headaches includes the successful treatment of spinal headaches with caffeine and theophylline [3, 4].

The type of needle used for lumbar puncture may influence the occurrence of spinal headaches. It has been suggested that pencil-point-tip needles such as the Sprotte and Gertie Marx needles, unlike beveled needles, push apart dural fibers instead of cutting them [2, 4, 7]. Thus, the dural fibers may heal faster, resulting in less CSF leakage, smaller CSF volume changes, and fewer spinal headaches. The prevalence of spinal headaches with the Sprotte needle compared with the Quinke needle has previously been studied for spinal anesthesia and diagnostic lumbar puncture. The Sprotte needle has been used for obstetric anesthesia with mixed results. Some studies have shown a statistically significant reduction in spinal headaches [9, 10] with pencil-point-tip needles such as the Sprotte, whereas other studies have found no difference in the frequency of spinal headaches [11, 12]. However, these latter investigators used needles smaller than 22-gauge and sometimes compared Sprotte and Quinke needles of varying sizes. Braune and Huffmann [4] found a significant reduction ($p < .001$) in the frequency of spinal headaches following diagnostic lumbar puncture when 22-gauge Sprotte needles were used (4% of subjects developing spinal headaches) instead of 22-gauge Quinke needles (36% of subjects developing spinal headaches). Jones et al. [2] described a significant reduction ($p = .03$) in postmyelography spinal headaches when 22-gauge Sprotte needles (15 [38%] of 40 subjects) were compared with 22-gauge Quinke needles (39 [58%] of 67 subjects). However, this study did not distinguish between positional and total postprocedural headaches.

In the current study, subjects' spinal headaches were significantly reduced when Sprotte needles (8% of subjects developing spinal headaches) were used instead of Quinke needles (25% of subjects developing spinal headaches), a finding that supports the results of Jones et al. [2]. Also, subjects less than 60 years old tended to have a higher prevalence of spinal headaches than did older subjects. One possible explanation for this age difference is that younger patients are probably more likely to return to vigorous activity than are older patients.

At first, we found the Sprotte needles more difficult to use. A skin nick from the needle must be made before introducing its pencil-point tip. In addition, the Sprotte needle follows a relatively straight course and is harder to manipulate when bone is encountered. However, our radiologists soon became comfortable with the Sprotte needle and found it no more difficult or time-consuming to use than traditional needles such as the Quinke. We found no difference in the frequency of extraarachnoid injections between the two needle types. In fact, no extraarachnoid injections compromised the diagnostic quality of any of the 108 myelograms.

The Gertie Marx needle, a modification of the original Sprotte needle, has a smaller side hole closer to the tip than does the older pencil-point-tip needle [16]. The smaller side hole may reduce the frequency of extraarachnoid injection and may strengthen the needle tip [16]. Because our study of the Gertie Marx needles was not randomized like the study of the Sprotte and Quinke needles, the three groups of subjects cannot be compared directly. However, the trend is for less frequent spinal headaches with Gertie Marx needles.

The cost of the needles used in this study differs considerably (Quinke, $2; Sprotte, $10; Gertie Marx, $10). The cost of using the more expensive needles must be weighed against the cost of epidural blood injections and medication to treat spinal headaches.

In conclusion, our results indicate that pencil-point-tip needles are associated with lower morbidity for myelograms, especially in subjects less than 60 years old. We now use pencil-point-tip needles in all such subjects.

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quency of spinal headaches; other investigators have supported this suggestion [1, 6]. In addition to needle size, needle tip configuration may also influence the likelihood of spinal headaches [2, 4, 7]. The Sprotte needle (Pajunk, Geisingen, Germany) and the Gertie Marx needle (International Medical Development, Park City, UT) have a rounded, tapering pencil-point tip rather than the beveled cutting edge of the traditional Quinke needle (Becton-Dickinson, Franklin Lakes, NJ) (Fig. 1). In addition, the pencil-point-tip needles have a side-hole exit rather than the traditional end hole. The Sprotte needle has been compared favorably with the beveled cutting needle for spinal anesthesia [8–12], diagnostic lumbar puncture [4, 7], and myelography [2, 13]. The mechanism for spinal headaches is incompletely understood, but CSF leakage is thought to be a significant factor [3, 4]. One frequent hypothesis is that the pencil-point tip tears the meninges less than does the bevel tip, producing less leakage of CSF [7, 8]. However, the side-hole needle is not commonly used for myelography, partly because of apprehension about extraarachnoid injections, anticipation of greater technical difficulty in traversing paraspinal tissue with the relatively blunted conical tip, and the higher cost of the pencil-point-tip needles.

This study compared the incidence, severity, and duration of postmyelogram spinal headaches after using the 22-gauge Sprotte pencil-point-tip needle and after using the traditional 22-gauge Quinke bevel-tip needle. The Gertie Marx needle, which is a newer pencil-point-tip needle that has a smaller side hole closer to the tip than in the Sprotte needle, was studied independently.

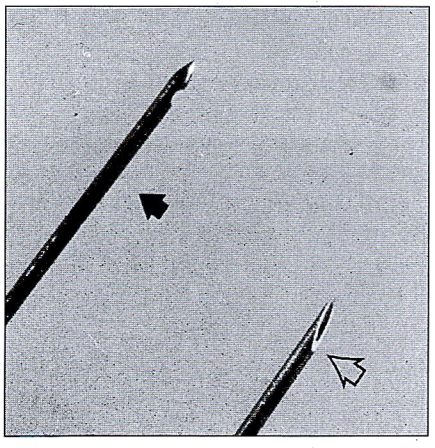

Fig. 1.—Sprotte pencil-point-tip needle (*solid arrow*) and Quinke bevel-tip needle (*open arrow*) with stylets removed.

Subjects and Methods

We studied 138 subjects referred for myelography, of whom 108 were randomized to a 22-gauge bevel-tip Quinke needle or a 22-gauge pencil-point-tip Sprotte needle. The Gertie Marx needle was introduced for general use after our initial clinical trial had begun; this newer needle was used in an additional 30 consecutive subjects. Exclusion criteria for the study included inability to sit or stand or inability to reliably communicate, a situation that would tend to decrease the presence and reporting of spinal headache. All myelograms were performed by one of two senior neuroradiologists.

The myelograms were performed with the subjects placed prone and slightly oblique on a fluoroscopy table with a pillow under the abdomen. The spinal puncture was slightly off midline except for occasional subjects with large interspinous spaces, in whom the puncture was midline. The dural puncture was at the L2–L3 level regardless of the section of the spine to be studied. Spinal fluid was not collected, and routinely recommended doses of iohexol (Omnipaque; Nycomed, New York, NY) (10–15 ml of 180 concentration for the lumbar spine and 10 ml of 300 concentration for the cervical spine) were injected into the subarachnoid space. CT always followed myelography. Routine orders for subjects after myelograms included bed rest with the head of bed elevated 45° for 6 hr after the procedure.

An observer contacted each subject by telephone 5–14 days after the myelogram. The observer did not know which type of needle had been used on the subjects. The subjects were asked about any problems related to the myelogram and then were specifically questioned about headaches. A spinal headache was defined as a positional headache, that is, aggravated by sitting or standing and relieved by lying down. The severity, duration, and positional quality of headaches were documented. The subjects graded severity on a 1–10 scale: 1, mild; 3, effectively treated with over-the-counter medication; 5, somewhat controlled but too severe to resume normal activities; 8, severe enough to require a blood patch; and 10, requiring hospitalization for treatment. The subjects' age and sex and the area of the spine studied were noted. Results obtained early in the study were compared with those obtained late. Myelograms were inspected for extraarachnoid contrast material by a neuroradiologist who was unaware of the needle type used. Mixed injections were graded 1, questionable; 2, mild; 3, limited yet diagnostic myelogram; or 4, nondiagnostic myelogram.

Demographic variables were compared in the two groups of subjects using either the independent t test or the chi-square test. The chi-square test was used to evaluate frequency data (e.g., presence of headache and postural quality) by needle type. Among those subjects who had headaches, needle types were compared with the rank sum test for ordinal measures such as the subjective severity and duration.

Results

We studied 138 subjects. The initial group had 108 subjects: bevel-tip Quinke needles were used on 56, and pencil-point-tip Sprotte needles were used on 52. The numbers of men and women in both subject groups were equal, and differences in the mean age of subjects in the two groups were not statistically significant (mean age, 57 years old [Quinke] and 56 years old [Sprotte]). Differences in the numbers of outpatients and inpatients were not significant between the two groups. Subjects underwent 87 lumbar studies, 19 cervical studies, one thoracic study, and one lumbar and cervical study. Headaches occurred after use of Sprotte needles in four (8%) of 52 patients and after use of Quinke needles in 14 (25%) of 56 patients. We found a statistically significant difference in the incidence of spinal headaches using chi-square analysis ($p = .02$). Differences in the average grade (Sprotte, 5.25; Quinke, 6.00) and duration (Sprotte, 4.4 days; Quinke, 4.7 days) that subjects gave their spinal headaches were not significant, although both grade and duration were less marked in the Sprotte group (Table 1). In the Quinke-needle group, four patients required blood patches for severe spinal headaches; in the Sprotte-needle group, two patients required blood patches. The total number of postmyelogram headaches (spinal and nonspinal) was 11 (21%) for the Sprotte group and 22 (39%) for the Quinke group. This difference was also statistically significant ($p < .05$). Differences in the frequency of nonspinal (nonpositional) headaches between the two groups were not

significant. We found an increased frequency of spinal headaches in subjects less than 60 years old (13 of 31 patients with spinal headaches after use of Quinke needles and four of 30 patients with spinal headaches after use of Sprotte needles) compared with subjects more than 60 years old (one of 25 patients with spinal headaches after use of Quinke needles and none of 22 patients with spinal headaches after use of Sprotte needles) (Fig. 2). We found no significant difference in the frequency of spinal headaches based on sex, the area of the spine studied, or the time of the myelograms (first half of the study versus second half).

From the initial group of subjects, 65 myelograms were available for technical review. We found four of 33 patients with mixed injections for the Quinke needle (three grade 1 and one grade 2) and two of 32 patients with mixed injections for the Sprotte needle (one grade 1 and one grade 3). Each group had only one definite mixed injection (grade 3 or 4). Diagnostic information was not compromised in any of the 108 myelograms.

We performed myelograms on another 30 consecutive subjects using Gertie Marx needles. This group included 13 women and 17 men with a mean age of 57 years old. For this group, we found that two (7%) of 30 patients had spinal headaches and an additional two (7%) of 30 had nonspinal headaches. The average grade of the headaches was 2.5, and the mean duration of headaches was 1 day (Table 1). Of 19 myelograms available for technical review, none showed mixed injections.

Discussion

Spinal headache as a complication of dural puncture was first described in 1898 by August Bier, the pioneer of spinal anesthesia [3]. Spinal headache is characterized by its postural dependency: it is worsened when the subject sits or stands and is relieved when the subject lies down [3, 4]. In fact, the longer the subject is upright, the longer the spinal headache persists.

The frequency of postmyelogram spinal headaches is influenced by technical factors and subject population. Sand [1] analyzed 19 different investigations on the frequency of spinal headaches and found statistically significant relationships. Larger needle diameter, longer follow-up time after procedures, earlier ambulation, and more detailed inquiry about headaches were associated with a higher reported frequency of spinal headaches. In addition, women and younger subjects had an increased frequency of spinal headaches. To account for factors that cause underreporting of spinal headaches, our study was performed with a longer follow-up time (at least 5 days) and patients were specifically questioned about the incidence and positional nature of postmyelogram headaches. When the patient was not sure if the headache changed with position, the headache was assumed to be spinal. All needles used for this study were the same size (22-gauge). The two subject groups were similar in sex and age distribution.

Jones et al. [2] recently compared 22-gauge Quinke and 22-gauge Sprotte needles for myelography; however, the study evaluated all headaches without distinguishing between positional and nonpositional headaches. This difference may partly explain why their prevalence of headache with the Sprotte needles (37%) and Quinke needles (58%) was much higher than ours.

Although the cause of spinal headaches is not fully understood, the most commonly accepted hypothesis was first proposed by August Bier: A tear in the dura mater rendered by the spinal needle results in leakage of CSF that then leads to spinal headache [1, 3, 4, 6]. This loss of the CSF hydraulic cushion may lead to sagging of intracranial contents so that when a patient is upright there is tension on the brain's anchoring structures, the pain-sensitive dural sinuses [3]. The possibility that pain may also come from the meninges and venous dilatation may explain the postural dependence of spinal headaches [4, 14, 15]. Supporting evidence for the CSF leakage theory includes demonstration of post–lumbar puncture leakage of CSF during radioisotope studies [2, 16] and surgery [2, 12] and reduction of spinal headaches with smaller diameter needles [1, 5, 6].

Epidural blood patches reduce spinal headaches almost immediately [3], and some subjects have persistent CSF leakage without headache. These factors raise the possibility that CSF leakage may not be a direct mechanical cause of spinal headaches but instead may initiate events that lead to spinal headaches [3]. Raskin [3] has suggested that sudden decreases in CSF volume after dural puncture may activate adenosine receptors that produce venous and arterial vasodilatation, resulting in spinal headaches. Epidural injections of blood or saline solu-

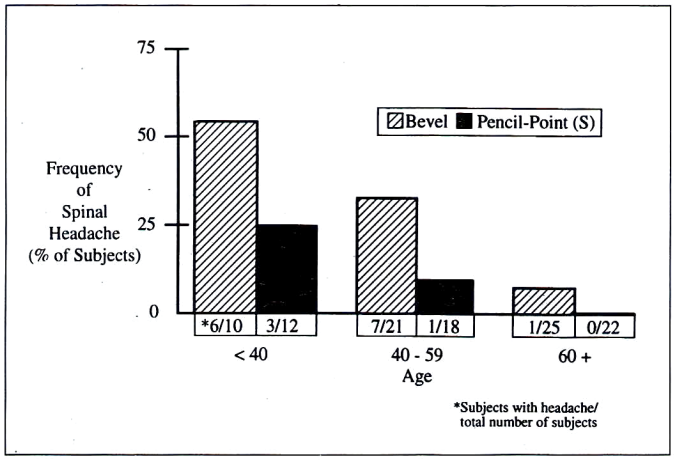

Fig. 2.—Graph shows relationship of headache to age regardless of needle type used. Nine of 22 subjects less than 40 years old had spinal headaches, whereas one of 47 subjects more than 60 years old had spinal headaches.

TABLE 1 Spinal Headache After Myelography

Needle Type	No. of Patients	No. of Spinal Headaches	Average Grade	Average Duration
Pencil-point (Sprotte)	52	4 (7.7%)	5.2	4.4
Bevel	56	14 (25%)	6.0	4.7
Pencil-point (Gertie Marx)	30	2 (6.6%)	2.5	1.0