United States Patent

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[54] SPINAL NEEDLE

1 Claim, 4 Drawing Figs.

[52] U.S. Cl. **128/221,** 128/347
[51] Int. Cl. **A61m 5/32,** A61b 17/34
[50] Field of Search 128/214.4, 221, 2, 215, 347, 348

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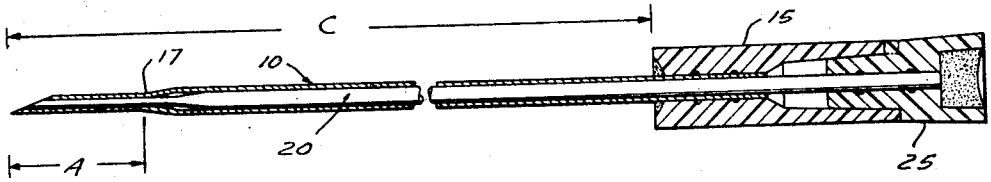
ABSTRACT: A spinal needle having two portions of different diameter, and which is accurately dimensioned to facilitate entry and positioning in the spinal cord. The needle is hollow and has a sharpened point section of reduced diameter connected by a tapering intermediate portion to an enlarged portion which extends to a hub member. A stylet is also provided which has an external configuration identical to internal configuration of the hollow needle.



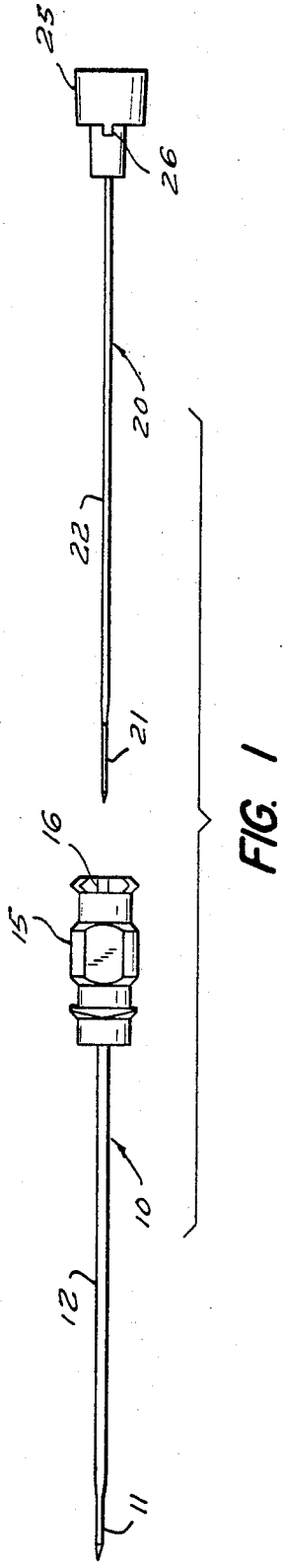


FIG. 1

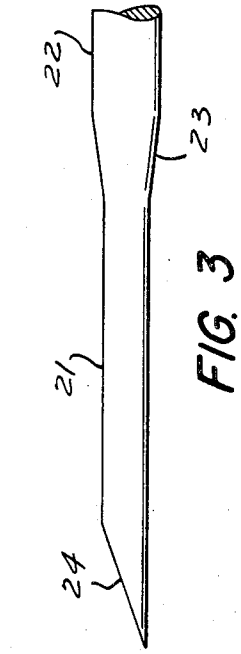


FIG. 3

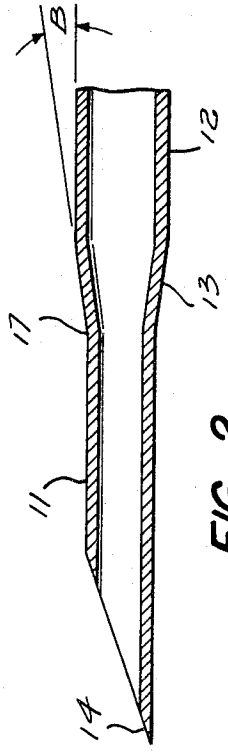


FIG. 2

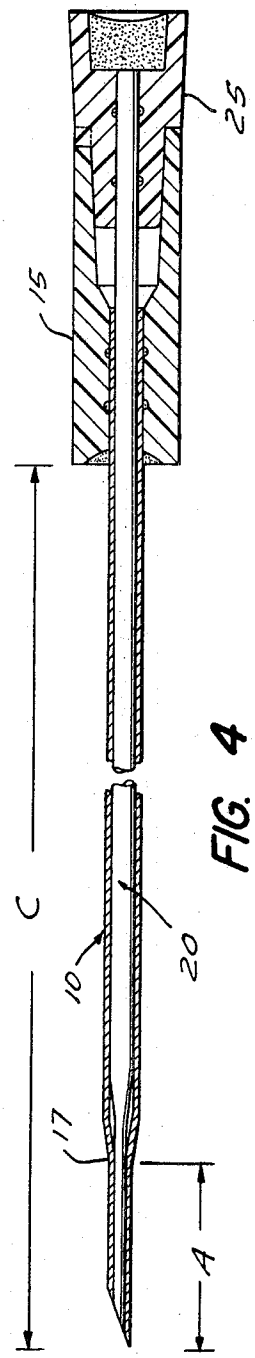


FIG. 4

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SPINAL NEEDLE

BACKGROUND AND SUMMARY OF THE INVENTION

This invention relates to an improved spinal needle which may be used either to inject an anesthetic solution or for diagnostic purposes.

The spinal cord and the spinal nerve roots lie in a sac formed by the thin but water tight arachnoid and the immediately adjacent dura mater, the latter of which is the thickest and most substantial of the various layers surrounding the spine. The dura and the arachnoid are usually closely adjacent to each other, and both are penetrated by the spinal needle as if they were a single membrane.

In giving spinal injections, the needle and stylet must penetrate the dura and arachnoid, and enter the subarachnoid space which contains the spinal fluid. Usually, the distinct sensation is imparted to the fingers of the doctor as the needle penetrates the dura. However, this sensation is not always apparent, especially when a smaller diameter needle is used. Therefore, it has been current practice to interrupt the advancement of the needle and frequent intervals, to withdraw the stylet, and observe whether or not fluid appears in the hub of the needle; the presence of fluid indicating that the needle has entered the subarachnoid space.

When the fluid indicates that the needle is properly positioned, a syringe containing the selected dose of anesthetic or other solution is carefully attached to the hub. An attempt is then made to aspirate the fluid into the syringe by drawing on the plunger to once again make certain that the tip of the needle is still in the subarachnoid space. If fluid again appears, the injection is made.

The presently used injection procedures have many disadvantages. First, the interruption of the insertion of the needle to check for penetration of the dura is most uncomfortable to the patient. Also, the resulting time delay increases the opportunity for a sudden movement by the patient which may tear the puncture opening or break the needle.

Second, the needle may be advanced too far through the dura such that it may strike or even pierce the posterior surface. If this occurs, the needle must be retracted and there exists the possibility that part of the injection may exit through the perforation.

Third, a small diameter needle may lack the degree of stiffness necessary to properly control its direction during insertion and is easily broken.

Fourth, the use of a larger diameter needle to improve the stiffness will result in increased trauma and may cause excess coring of the body tissue into the bore of the needle. Also, a larger needle will increase the size of the puncture opening through the dura which will permit the loss of spinal fluid from the subarachnoid space upon withdrawal of the needle. This loss of fluid is a major cause of spinal headache.

In general, the invention relates to a spinal needle comprising an initial portion having a precise outside diameter, a rear portion having a precise outside diameter somewhat larger than that of the initial portion, and a tapered portion joining the initial and rear portions.

It is an object of the present invention to provide a spinal needle which may be advanced to its final position by a continuous uninterrupted insertion operation. It is a further object to provide a needle which gives a distinct sensation to the doctor when it enters a proper distance into the subarachnoid space of the spinal column.

It is another object of this invention to provide a spinal needle which has a high degree of stiffness and strength, but at the same time may be inserted with a minimum of trauma and coring.

Additional objects and advantages of the present invention will become apparent to one skilled in the art from the following detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side view of the needle and mating stylet of the present invention;

FIG. 2 is an enlarged horizontal sectional view of the tip of the needle;

FIG. 3 is an enlarged horizontal view of the tip of the stylet;

FIG. 4 is a horizontal cross-sectional view of the needle and stylet in assembled relationship.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings, the needle of the subject invention is generally designated at **10**, and its mating stylet at **20**. The needle **10** includes a forward portion **11**, a rear portion **12** of greater diameter, and a conical or tapered connecting portion **13**. The tip of the needle is beveled, as at **14**, in any conventional manner. The needle is joined to a standard hub **15**, such as the Luer-Lok hub, which may be either metallic or plastic. The hub is provided with a slot **16** in its outer periphery for the purpose hereinafter set forth.

The forward portion **11** of the needle is of relatively large gage (*i.e.*, small diameter) to minimize the incision or puncture. For purposes of example, a needle having an outside diameter of approximately .02 inches and a bore diameter of .01 inches (commonly called 25 gage in the industry) has been found to be very satisfactory.

The rear portion **12** is of relatively small gage to add the required stiffness to the structure and eliminate the need for a needle guide or other external means of support against bending during insertion. For example, if the rear portion has an outside diameter of approximately .035 inches and a bore diameter of approximately .023 inches (20 gage) very satisfactory results are obtained.

It is thus apparent that the needle of the present invention retains the advantageous features of both the large gage and small gage needle, yet retains none of their disadvantages. The enlarged diameter rear portion has the effect of adding stiffness to the needle, while the smaller forward portion has the effect of minimizing the incision or puncture.

The transition from the forward to the rear portions is accomplished by a tapered or conical portion **13** which is smoothly blended into the adjacent surfaces to minimize the resistance to insertion.

An important feature of the present invention is the particular length of the forward portion **11**, designated A in FIG. **4**. In use, the forward portion **11** pierces the dura and enters the subarachnoid space of the spine. When the tapered portion **13** reaches the dura, the increased resistance gives a distinct sensation to the hands of the doctor such that he will be aware of the needle's exact position. By design, the length A of the portion **11** is such that the tip of the needle will be at the most favorable depth in the subarachnoid space when the dura is adjacent the taper **13**. It has been found that if the length A is seven thirty-seconds of an inch (or approximately .22 inches) very satisfactory results are obtained. The particular length A is also critical by reason of the fact that a needle having a forward portion of a length greater than seven thirty-seconds of an inch will tend to bend or break at point **17** during the insertion operation. This dimension may otherwise vary to a slight extent depending on the age and size of the patient, as well as the exact portion of the spine to be entered.

The angle of taper B as seen in FIG. **2** should be in the order of 3.5° for optimum penetration characteristics. Also, an angle of this order has been found to be sufficient to give the required distinct sensation to the hands of the doctor upon reaching the dura.

The overall length C of the needle varies considerably according to the specific use of the spinal tap, but typically is in the order of 3½ inches.

In the preferred embodiment, the stylet or obdurator **20** includes a forward portion **21** of a diameter closely conforming to the bore diameter of portion **11**, a rear portion **22** of a diameter closely conforming to the bore diameter of portion **12**, and a conical connecting portion **23**. The tip of the stylet is beveled at an angle corresponding to the angle at **14**. The stylet is joined to a handle **25** in a conventional manner, the handle including a key **26** adapted to engage the slot **16** of the

hub **15** to effect alignment of the beveled surfaces **14** and **24** when assembled as shown in FIG. **4**.

The stylet **20** could of course be of constant diameter throughout its length. However, it is preferred to have its external shape closely conform to the shape of the bore of the needle to provide extra strength for the needle. Similarly, the bore of the needle could be of constant diameter throughout. It is preferred however to utilize a larger bore diameter in the rear portion **12** since this improves the flow characteristics during injection by reducing the pressure drop along the length of the needle.

The needle of the present invention may conveniently be manufactured from a standard needle by employing a reduction process, such as swaging, at its tip. Also, a conventional stylet may easily be modified to the configuration of the present invention by reducing the tip diameter by centerless grinding or other suitable methods.

While a preferred embodiment has been described and illustrated herein, it should be understood that this invention is in no sense limited thereby and its scope is to be determined by that of the appended claims.

I claim:

1. In combination, an accurately dimensioned tubular integral spinal needle having a distal end portion, an intermediate portion, a proximal end portion and a bore therethrough, a hub mounted on the rear end of the proximal end portion, the forward end of the proximal end portion terminating at the rear end of the intermediate portion and the forward end of the intermediate portion terminating at the rear end of the distal portion, the forward tip of the distal portion being beveled, the distal portion having a precisely determined outside diameter in the order of .02 inches and precisely determined length in the order of .22 inches to minimize the size of the puncture made by the needle upon insertion and to assure that insertion is at the proper depth, the proximal end portion having a precisely determined outside diameter in the order of .035 inches to provide a needle of desired stiffness, the intermediate portion being tapered and joining the distal and proximal end portions with the angle of taper in the order of 3.5° so as to join said distal and proximal end portions in a smoothly blended manner to minimize resistance to insertion of the needle, the bore of said needle having a surface configuration approximating the outer configuration of said needle, a stylet removably inserted in the bore of the needle and having an outer configuration and diameter substantially conforming to the surface configuration and diameter of the bore of the needle so as to substantially fill the bore of the needle when inserted therein, and said stylet having a beveled distal tip which may be aligned with the beveled distal tip of said needle when said stylet is positioned within the bore of said needle to facilitate proper insertion of said combination.