United States Patent

Sierra

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[54] **BIOPSY NEEDLE WITH ECCENTRICALLY-MOUNTED CUTTING TIP**

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[52] **U.S. Cl.** ..... **128/2 B**, 128/305

[51] **Int. Cl.** **A61b 10/00**, A61b 17/32

[58] **Field of Search** ..... 128/2 B, 305, 304, 314, 347, 128/309, 321, 324

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Assistant Examiner—J. C. McGowan
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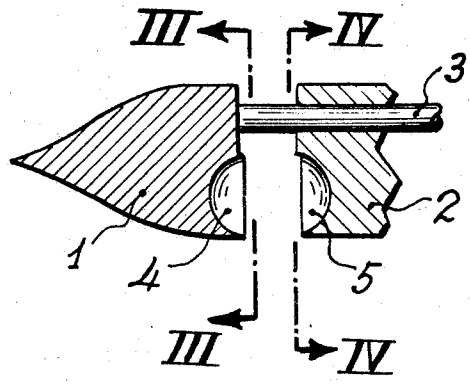
[57] **ABSTRACT**

An improved surgical biopsy needle is adapted to facilitate precise and accurate control of the depth of penetration thereof, particularly when taking a biopsy of a patient's pleura. The needle includes a specially designed tip, movable in relation to the main body of the pleura and then twisted to a position such that slight withdrawal of the tip will cause it to bear against the inner surface of the pleural to locate the tip against the pleura. Cutting elements are formed on the adjacent surfaces of the tip and the main body of the needle to thereafter cut a small sample of the pleura and enable its withdrawal together with the needle.

8 Claims, 8 Drawing Figures



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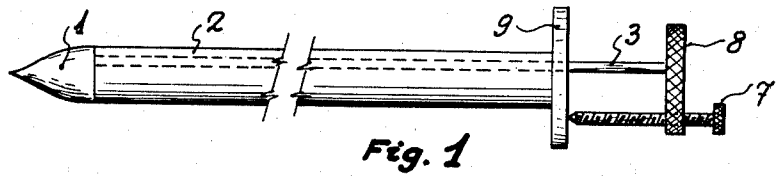

Fig. 1

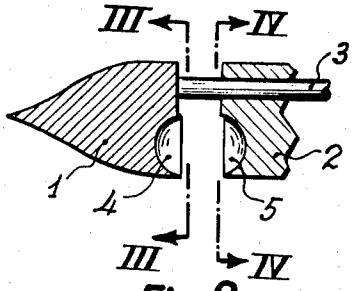

Fig. 2

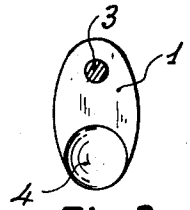

Fig. 3

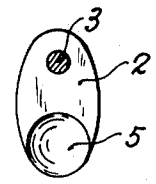

Fig. 4

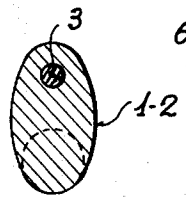

Fig. 5

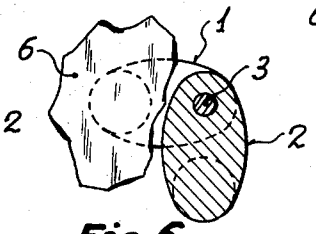

Fig. 6

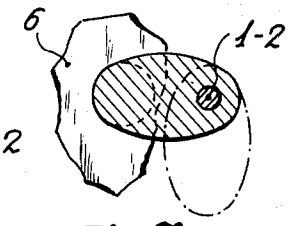

Fig. 7

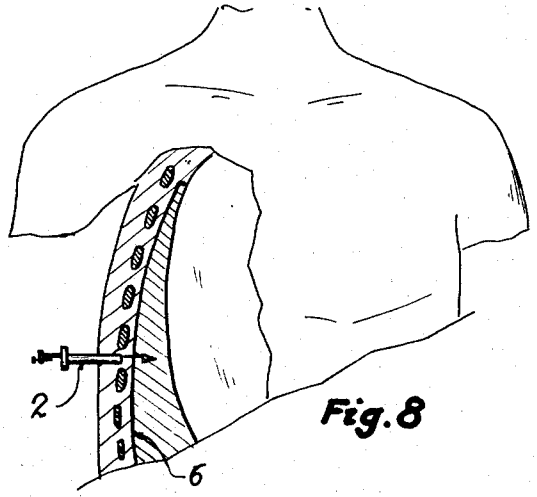

Fig. 8

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BIOPSY NEEDLE WITH ECCENTRICALLY-MOUNTED CUTTING TIP

BACKGROUND OF THE INVENTION

This invention relates to an improved biopsy needle which is suited for use particularly in taking a sample of human tissue from a patient's pleura. In the diagnosis of certain pleuritic and pleura-pulmonary diseases, the pleura biopsy often is indispensable. The existing biopsy needles which currently are employed to take such biopsy present certain difficulties when taking a biopsy of the patient's pleura. Among the more troublesome of these difficulties is that, because of the wide variation in patients, it is difficult to determine precisely when the needle has penetrated to a depth at which the biopsy may be taken. Frequently, the depth of the pleura beneath the patient's skin is miscalculated and the sample obtained may be an adipose tissue, muscle sample of other tissue than the desired pleura sample. In this event, the surgeon must make repeated efforts to insert the biopsy needle to the proper depth. It is among the primary objects of the invention to provide an improved biopsy needle which enables the surgeon to take the biopsy sample at the desired, correct penetration depth.

SUMMARY OF THE INVENTION

The biopsy needle of the invention includes an elongated main body and a tip which are arranged to enable the tip to be extended longitudinally of the main body. The tip also is mounted for pivoted movement about an axis which parallels the longitudinal dimension of the main body but which is disposed eccentrically of the main body to enable the tip to be pivoted transversely of the main body. The forward end of the tip has a sharp piercing point. The facing surfaces of the tip and the forward end of the main body are formed to define a pair of hemispherical cups which mate along cooperative cutting edges so that when the needle is manipulated to dispose a portion of the pleura between the aligned cutting edges, the tip and main body may be drawn together to sever a small sample of the pleura and retain the severed sample to enable its withdrawal with the needle.

The needle construction enables the surgeon to determine precisely when the pleura is disposed between the facing surfaces of the tip and main body of the needle in position to be cut. This results from the ability of the tip to be pivoted about the eccentric axis after the needle tip has penetrated beyond the pleura. After such penetration, the needle tip is pivoted to the transverse position and then is withdrawn carefully until the rear surface of the tip engages the inner surface of the pleura. The main body of the needle then is pivoted into alignment with the tip and these parts are brought together to cut a small portion of the pleura and retain the cut sample within the mated hemispherical cavities. The needle assembly then is rotated to its original position and withdrawn from the patient together with the sample.

It is among the primary objects of the invention to provide an improved biopsy needle which facilitates accurate positioning with respect to the region from which the biopsy is to be taken.

Another object of the invention is to provide an improved biopsy needle which eliminates guess work on the part of the surgeon as to proper needle penetration depth.

Still another object of the invention is to provide an improved technique for taking a pleura biopsy.

DESCRIPTION OF THE DRAWINGS

These and other objects and advantages of the invention will be understood more fully from the following detailed description thereof, with reference to the accompanying drawings wherein:

FIG. 1 shows a side view of the biopsy needle;

FIG. 2 is a lengthwise section of the forward end of the needle showing the main body and the needle tip in a separated configuration;

FIG. 3 is an elevation of the rearward face of the needle tip as seen along the lines 3—3 of FIG. 2;

FIG. 4 is an elevation of the forward face of the needle main body adapted to mate with the rearward face of the tip, and as seen along the lines 4—4 of FIG. 2;

FIG. 5 is a somewhat diagrammatical illustration of the aligned needle tip and main member when the needle is injected into the patient;

FIG. 6 is a somewhat diagrammatical illustration of the needle tip when it has been pivoted to engage the inner surface of the patient's pleura;

FIG. 7 is a somewhat diagrammatical illustration of the needle tip and main body of the needle after the main body has been pivoted into transverse alignment with the pivoted needle tip; and

FIG. 8 is a diagrammatic illustration of a patient's thorax illustrating the location of the pleura and the position of the biopsy needle when properly positioned but before the biopsy is actually taken.

DESCRIPTION OF THE PREFERRED EMBODIMENT

As shown in FIG. 1 the biopsy needle includes a tip portion 1 and an elongated body portion 2. For ease of explanation, directions toward the tip will be referred to as "forward" and the opposite direction will be referred to as "rearward." In the illustrative embodiment, the cross-sectional configuration of the needle is generally oval. The tip 1 is movable in relation to the needle body 2 both in a direction longitudinal of the needle body and pivotally about an eccentric axis which is offset from the center line of the needle. The tip 1 is mounted for such movement by means of a rod 3 which extends through a bore in the main body 2. The rod preferably is offset from the central longitudinal axis of the needle and is of greater length than the body 2. The forward end of the rod is secured to the rearward surface of the tip, as shown in FIG. 2. The rearward end of the rod 3 extends rearwardly beyond the end of the needle body 2 and is secured to a bracket 8. By manipulation of the bracket 8, the needle tip 1 may be positioned in relation to the needle body 2 to mate the tip 1 and body 2 as shown in FIG. 1, to separate the tip 1 and body 2 as shown in FIG. 2 and to vary the relative angular orientation of the tip 1 and body 2 with respect to each other about the rod 3 as shown in FIGS. 6 and 7. When the tip 1 and body 2 are in engagement with each other, as shown in FIG. 1, their mating surfaces engage each other to align the outer, oval surfaces of the tip 1 and body 2, thus presenting a substantially continuous and smooth outer surface. The

smooth outer surfaces facilitates insertion and withdrawal of the needle from the patient.

As shown in FIG. 2, the mating surfaces of the tip 1 and body 2 are of special configuration and are adapted to perform a number of functions. The mating surfaces enable the tip 1 and body 2 to be aligned properly to define the smooth outer surface. They also provide means for cutting a portion of the pleura tissue and for capturing the cut portion so that it may be withdrawn together with the needle. For these purposes, the facing surfaces of the tip 1 and body member 2 each are provided with concave cavities 4, 5 respectively. The cavities 4, 5 are arranged so that when the tip 1 and body 2 are brought together in registry, they will cooperate to define an enclosed chamber. Each of the cavities 4, 5 is surrounded, at its periphery, by a sharp cutting edge which faces and cooperates with the sharp cutting edge on the other of the mating surfaces. Additionally, as shown in FIG. 2, the cutting edge surrounding the cavity 4 and the tip 1 extends rearwardly beyond the general plane of the rearward facing surface of the tip 1. The mating forward surface of the body 2 is recessed about its cavity 5 to receive in complementary fashion the rearwardly projecting cutting edge of the tip 1. This interlocking arrangement can be felt by the surgeon as he manipulates the device and assures him that the tip 1 and body 2 have been brought together properly, with the cavities 4, 5 being mated and closed, when this is desired.

The biopsy needle also includes an enlarged collar 9 which is secured to the rear end of the body 2. The collar 9 facilitates manipulation of the needle by the surgeon in the same general manner as does the collar in a hypodermic syringe. The needle also includes a screw 7 which is threaded through the member 8 and which bears against the rear surface of the collar 9 for the purposes described below.

In use, the tip 1 and body 2 are brought together as shown in FIG. 1 to define the smooth continuous outer surface of the device. After the surgeon has anesthetized the local region where the needle is to be inserted, he then may make a small incision in the thorax skin to facilitate insertion of the needle. The needle then is inserted through the incision and is advanced to a depth at which the surgeon is sure that the tip 1 has penetrated through the patient's parietal pleura. The sharp point of the tip 1 facilitates smooth injection through the parietal pleura. Surgeon then maintains the tip 1 within the parietal pleura, as by holding the member 8 in position and then withdraws the body 2 outwardly as shown in FIG. 8 so that the parietal pleura 6 is disposed between the separated tip 1 and body 2 as shown in FIG. 8. In the preferred technique, the tip 1 and body member are separated between 5 and 10 millimeters. The surgeon then rotates the member 8 while maintaining the body 2 in a fixed position. This causes the tip 1 to be pivoted about the offset axis 3 as shown in FIG. 6. Preferably the tip 1 is pivoted approximately 90°. The surgeon then withdraws carefully the tip by drawing the member 8 outwardly until the rearward surface of the tip engages the inner surface of the parietal pleura. As the tip engages the parietal pleura, this can be felt in the form of a resistance to further withdrawal by the surgeon. The surgeon thus is assured of the location of the device with respect to the parietal pleura. While maintaining the tip 1 in this position, the body 2 then is pivoted about the rod 30 into alignment with the already pivoted tip 1. When aligned, the body then is advanced forwardly, as by turning the screw 7, to bring the mating surfaces of the tip 1 and body together. This is effective to cut a small specimen of the parietal pleura, retain the specimen within the closed cavities 4, 5 and to realign the tip 1 and body 2 to present the smooth outer surface. The entire needle then is rotated back to its original position of entry and is then extracted to withdraw the needle and biopsy sample. The screw 7 then is loosened to expose the biopsy sample.

It should be understood that the foregoing description of the invention is intended merely to be illustrative thereof and that other embodiments and modifications may be apparent to those skilled in the art without departing from its spirit.

Having thus described the invention what I desire to claim and secure by Letters Patent is:

1. A biopsy needle comprising:
   - an elongate body;
   - a tip disposed at the forward end of said body, said tip having a forwardly extending end adapted to pass easily through tissue, the rear end of said tip and the forward end of said body being abuttingly matable;
   - means mounting said tip to said body for movement longitudinally toward and away from the forward end of said body and for further movement in relation to said body to enable a portion of the rear surface of said tip to be disposed transversely of and out of alignment with said body; and
   - means formed on said portion of said rear surface of said tip and the forward surface of said body for cooperatively cutting and retaining a tissue sample therebetween.

2. A biopsy needle as defined in claim 1 wherein said means mounting said tip and body for said relative movement comprises:
   - a rod extending longitudinally through said body in offset relation to the longitudinal axis of said body;
   - means for securing the forward end of said rod to said needle tip at a location offset from the longitudinal axis of said needle tip, said rod being disposed slideably and rotatably within said body; and
   - said rod being of greater length than that of said body whereby the rearward end of said rod may extend rearwardly of said body to control the relative position of said body and said tip.

3. A biopsy needle as defined in claim 1 further comprising:
   - the outer surfaces of said tip and said body, at least in the mating regions thereof being of identical contour to enable them to be mated to define a smooth continuous outer surface.

4. A biopsy needle as defined in claim 3 further comprising:
   - said mating surfaces of said tip and said body being substantially complementary and lying in more than one plane, said complementary surfaces being arranged so that when mated, said transverse movement of said tip and body is precluded.

5. A biopsy needle as defined in claim 1 wherein said means for cutting and retaining said tissue sample comprises:

said rearward surface of said tip and said forward surface of said body each having a concave cavity formed therein, each of said cavities being surrounded by and defined by a cutting edge, said cutting edges being adapted to be aligned and to be drawn together to cut said tissue therebetween and to retain said cut tissue between said cavities.

6. A biopsy needle as defined in claim 4 further comprising:

the cutting edge on one of said facing surfaces projecting beyond the plane of its associated facing surface;

the outer cutting edge on the other of said surfaces being recessed so that when said cutting edges are mated, the outer surfaces of said tip and body adjacent said facing surfaces thereof may be brought together to define a smooth continuous surface with said cutting edges being in alignment with each other.

7. A biopsy needle as defined in claim 1 further comprising:

a screw threadably mounted to the rear end of said

rod for adjustment longitudinally of and in spaced relation to said rod, the forward end of said screw being adapted to bear against the rear end of said body whereby advancement of said screw toward the rear end of said body will cause said tip and body to be brought together.

8. A method of performing a biopsy employing an apparatus as defined in claim 1 comprising:

inserting said biopsy needle to a depth such that the tip thereof is disposed beyond the tissue from which said biopsy sample is to be taken;

separating longitudinally said tip and said body so that said tissue is disposed therebetween;

moving said tip so that said portion thereof is disposed transversely of said body;

withdrawing said tip outwardly until the rear surface of said tip engages said tissue;

aligning said body of said needle with said tip while maintaining said tip in said last mentioned position;

urging said body toward said tip while maintaining said aligned relation to cut said tissue and retain said cut portion of said tissue therebetween; and

withdrawing said mated tip and body.

* * * * *