

## Fine Needle Biopsy Without Syringe Aspiration

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**Abstract.** Aspiration biopsies of fresh disease-free bovine hepatic liver were performed with three commercially available, small-gauge biopsy needles. A syringe was used to create a negative pressure when using Chiba® and Sure-cut® needles. A syringe was not used when using PercuCut™ needles which create an internal negative pressure equivalent to a 1.5 ml syringe when the stylet is partially withdrawn. The PercuCut and Chiba needle yielded a significantly larger specimen size than the Sure-Cut needle. There was no significant difference in sample size between the PercuCut and Chiba needles. All samples were of diagnostic quality.

**Key words:** Liver, fine-needle biopsy—Aspiration biopsy—Cytology

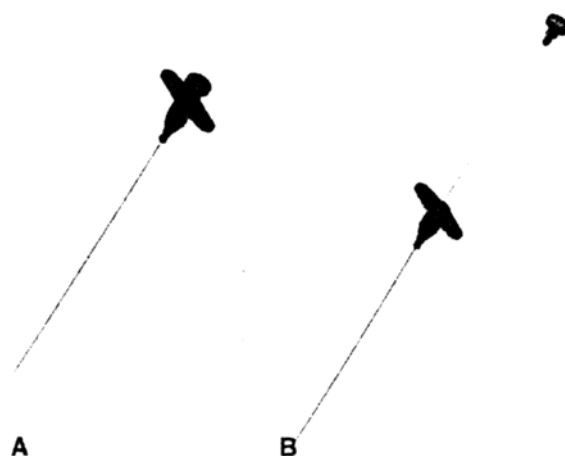
An innovative line of percutaneous biopsy needles has been introduced (PercuCut; E-Z-EM, Inc.; Fig. 1). The needle is introduced in a conventional manner. Instead of removing the stylet completely, as with traditional needles, it is only partially withdrawn. A membrane located in the needle hub forms a seal between the stylet and needle body allowing creation of internal negative pressure without connection to a vacuum system such as a syringe.

Others have shown that minimal [1] or no [2] negative pressure is required to obtain an adequate specimen when using fine-biopsy needles. We therefore wondered whether this new needle could be used to obtain specimens similar to those obtained with conventional biopsy needles with syringe aspiration.

We quantified in mm Hg the negative pressure generated by the PercuCut needle in order to determine the equivalent size syringe that would be required to generate a similar negative pressure with a conventional needle. We compared the weight and quality of the specimens obtained with two other commonly used biopsy needles.

### Materials and Methods

The suction pressure generated by a 15-cm PercuCut needle was determined by measuring the amount of mercury drawn into the needle upon withdrawal of the stylet needle. With the needle vertical and its tip immersed in a pool of mercury, the internal stylet was rapidly withdrawn to a fixed distance. The stylet, needle, and contained mercury were then weighed using a Mettler Model PL300 balance sensitive to 0.010 g. From the mass density of mercury and the internal volume of the needle, we calculated



**Fig. 1.** **A** The PercuCut needle with its stylet inserted. **B** The PercuCut needle with its stylet partially withdrawn as it would be when applying suction during a biopsy procedure.

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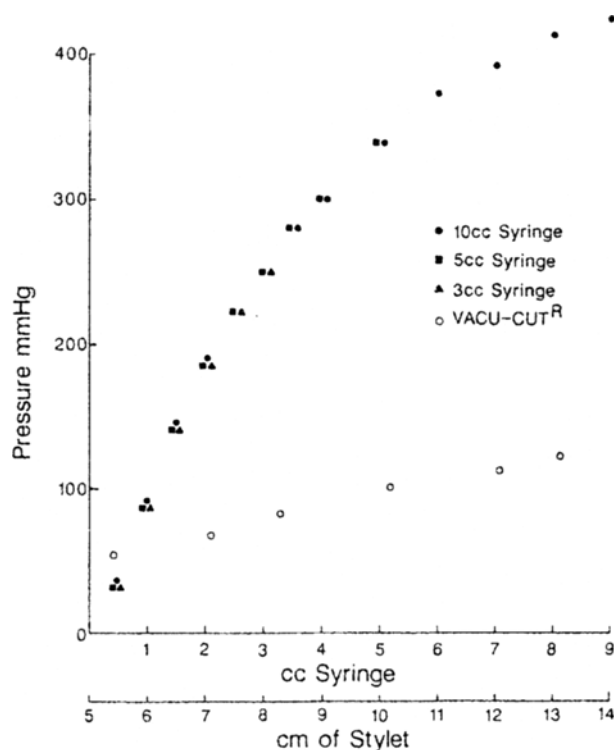


Fig. 2. Graph showing linear plot of negative pressure at stylet end of the PercuCut needle as a function of length of stylet removed (open circles), compared with the pressure generated with conventional syringe/needle combinations (closed symbols).

the volume and heights of mercury that yielded a pressure in mm Hg. The small volume of the PercuCut needle prevented us from using a mercury manometer to measure the negative pressure it created as we had done previously for a variety of syringes and conventional fine-needle biopsy needles (Lee H. Monsein, unpublished data).

Fine-needle biopsy samples were taken from fresh, disease-free bovine liver. Ten biopsy specimens were initially obtained with each of three different types of 22-gauge biopsy needles: PercuCut (Fig. 1), Chiba (Medi-Tech, Inc.), and Sure-Cut (modified Mengini, Surgimed, Inc.). The stylet of the PercuCut was withdrawn approximately 14 cm to achieve an estimated negative pressure of about 150 mm Hg (Fig. 2). A 10 ml syringe was used with the latter two needles with the plunger withdrawn to the 9 ml mark to achieve an estimated negative pressure of about 450 mm Hg.

Specimens were obtained in a uniform manner by a single individual using a depth of needle placement of 3 cm [3]. The needles were alternated and the specimens were then handled in a blinded fashion. The specimens were weighed on a Sartorius Research Analytical balance to the nearest 0.0001 g.

Two additional specimens were obtained in a uniform manner with each type of needle and processed for histological and cytological examination [4]. These were evaluated in a blinded fashion for the quantity of the specimens (1+ to 4+), the cytological preservation (excellent, good, or fair), and the quality of the cell block (excellent, good, or fair).

## Results

The further the stylet was withdrawn in the PercuCut needle, the greater the pressure generated at the

needle tip; however, this only varied over a small range (Fig. 2). The maximum pressure generated by this needle (with the stylet withdrawn 14 cm) was approximately 150 mm Hg, which is equivalent to the pressure generated by a syringe (any size) whose plunger is pulled back to the 1.5 ml mark (Fig. 2).

The average weights and SDs of tissue samples were calculated after discarding the high and low values. The PercuCut specimens averaged 0.010 g (SD 0.002), Chiba specimens averaged 0.015 g (SD 0.005), and the Sure-Cut specimens averaged 0.006 g (SD 0.001). The weights of the specimens obtained with the PercuCut and Chiba Needles were significantly greater than those obtained with the Sure-Cut needles ( $p < 0.05$ , student's two-tailed  $t$  test). The weights of the specimens obtained with the PercuCut needles were not significantly different from those obtained with the Chiba needles. There were no observable differences in the preservation and cell block quality of the specimens. All specimens were adequate and of diagnostic quality.

## Discussion

Fine-needle aspiration and biopsy techniques are in common use and have been applied to most areas of the body. The first popular configuration of a "skinny needle" was the Chiba needle which obtained aspiration samples suited best for cytological examination.

A number of additional biopsy needle designs, with and without power assistance, have been introduced to safely obtain a small core of tissue for histological in addition to cytological evaluation. These are usually used in conjunction with syringes in order to create a negative pressure which is felt to optimize the aspiration biopsy. Zajdela et al. [2] have, however, shown that adequate specimens can be obtained without suction. Our data support this conclusion.

Hueftle and Haaga [1] have shown that the suction of a 5-ml syringe with a 20-gauge needle yields a sample size of 84% of the maximum obtainable, and that there is no significant difference in sample size when syringes from 5 to 30 ml were used. This can be explained on a theoretical basis by Poiseuille's law and was demonstrated again by Hueftle and Haaga [1], who showed that the negative pressure obtained in a 20-gauge needle using a 1.5 ml syringe for suction is already greater than 80% of the maximal negative pressure. (The pressure would even be greater with a 22-gauge needle.) It could therefore be predicted, that the smaller amount of suction

generated by the PercuCut needle would not result in significantly smaller sample sizes. In our study, the PercuCut needle obtained significantly larger sample sizes than the Sure-Cut needle, which used a 10-ml syringe for suction.

It is clear from Figure 2 that the negative pressure created by a syringe is dependent upon the volume that is displaced when withdrawing the plunger and not on the size of the syringe. For example, if the plunger of a 3, 5, or 10-ml syringe is pulled back to the 3 ml mark, it will create about 200 mm Hg of negative pressure in all three syringes.

We have shown in fresh, disease-free, bovine liver that the small vacuum generated by partially withdrawing the stylet of the PercuCut needle provides specimens of a size and quality similar to conventional needle syringe combinations. These results warrant the trial of this needle to determine its

usefulness in a variety of clinical situations where the texture of the material on which the biopsy was done may vary considerably from disease-free bovine liver.

## References

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