New device for obtaining subcutaneous tissue specimens: the aspirating syringe

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SUMMARY A new aspirating syringe for the simple and efficient recovery of samples of subcutaneous adipose tissue in man is described. It has been successfully used as an epidemiological tool under field conditions.

KEY WORDS adipose tissue · aspiration · syringe · depot fat · human · field technique

A METHOD HAS BEEN DESCRIBED by Hirsch, Farquhar, Ahrens, Peterson, and Stoffel (1) for the aspiration of depot adipose tissue in man. In this method, the operator injects 1.5–2 ml of saline subcutaneously by means of a 50 ml glass syringe, then pulls back the plunger, thus producing suction which draws depot fat into the syringe.

In order to simplify this technique and make depot fat aspiration more amenable for clinical use and as a field procedure in nutrition or cardiovascular epidemiological surveys, the presently described aspirating syringe was developed. Frequent or multiple depot fat aspirations may become necessary in many investigations since subcutaneous adipose tissue fatty acid composition has been shown to be influenced by specific diseases (2) as well as particular diet patterns of normal subjects (3, 4). The potential usefulness of this instrument in obtaining biopsy specimens from tissues other than depot fat remains to be explored.

Description. Part of the aspirating syringe,[1] as shown in Fig. 1, consists of an evacuated glass tube *T*, which together with its soft, self-sealing rubber stopper *S* comprises the tube-plunger part of the syringe, the barrel *B* of which is made of plastic.

[1] Developed with the cooperation of Becton-Dickinson and Company, Rutherford, N.J. The aspirating syringe is now available from this company.

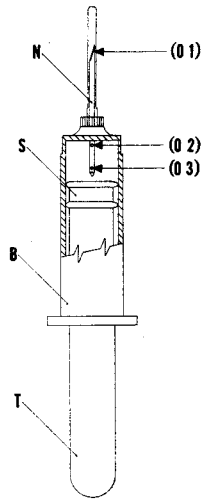

FIG. 1. Depot fat aspirating syringe. *N*, 18-gauge needle; *S*, soft self-sealing rubber stopper; *B*, plastic barrel; *T*, evacuated glass tube. *01*, *02*, *03:* openings.

A unique feature of this syringe is an 18-gauge needle (*N*) with three openings. This needle extends back into the barrel a distance of 0.5 inch. The distal opening of the needle, *01*, is of the conventional type, and is used to enter a body surface. The middle opening, *02*, permits the filling of the syringe with fluid, as well as allowing its evacuation when the tube-plunger is pushed forward. The proximal opening, *03*, is adjacent to the proximal pointed end of the needle.

An important property of this syringe is its ability to aspirate samples of tissue in a procedure no more traumatic than the puncture of the skin by a standard 18-gauge needle. The basic mechanical principle of the aspirating syringe is that as the tube-plunger is pushed forward, the proximal point of the needle punctures the stopper while the plunger is forcing fluid from the syringe. The distance between openings *02* and *03* is such that when all the fluid has been pushed out of the syringe through opening *02*, the stopper is completely penetrated. The vacuum in tube *T* effects the partial recovery of the injected fluid, plus an aspirated sample of depot fat, via opening *03*.

Technique. The skin of the left supragluteal prominence is prepared with alcohol. Sterile saline (2–3 ml) is drawn into the aspirating syringe. Ethyl chloride spray, or a 1% procaine intradermal wheal may be used to anesthetize the skin. At a point just below the iliac crest, the needle of the aspirating syringe is inserted deeply into subcutaneous adipose tissue through the anesthetized area. The skin overlying the point of the needle is grasped by the fingers of one hand while the plunger is pushed by the thumb of the other hand. As the saline is injected into the deep subcutaneous tissues, the skin and subcutane-

ous tissue under the needle site is massaged. This maneuver makes it more likely that small particles of subcutaneous tissue will be detached and aspirated. As the vacuum in the tube-plunger is released, several drops of saline and fat globules are recovered, as can be observed by the cloudy appearance of the saline at the bottom of the tube-plunger. The yield may be increased by inserting the needle deeper into the subcutaneous tissues and rotating the aspirating syringe while continuing to massage the skin around the needle tip. The aspiration of blood from skin capillaries is prevented if the needle is removed quickly from its subcutaneous site by pulling back on the aspirating syringe. This often yields an additional sample of fat resulting from the sudden release of suction.

The tube-plunger is then pulled out of the syringe barrel, which is discarded. The tube-plunger into which the fat has been aspirated now becomes a container for the fat sample. The stopper is removed, 10 ml of chloroform–methanol 1:1 (or other appropriate solvent mixture) and antioxidant are added to the sample, the tube is flushed with nitrogen and closed with the same rubber stopper.

Results. The aspirating syringe was utilized under rigorous field conditions on the island of Crete, Greece, where depot fat samples were obtained from 300 individuals (4, 5). Of this number, aspiration had to be repeated in one subject because of loss of tube suction, and in 3 subjects because of the contamination of the fat sample with blood. The aspirating syringe has also been used in obtaining depot fat samples from 110 children aged 11–12.

The amount of fat obtained from each subject was not determined, but of the depot fat aspirates subjected to gas–liquid chromatographic analysis, none was rejected because of insufficient sample quantity. Contact of the solvent with the rubber stopper did not result in the extracting of substances from the stopper which interfered with or obscured the chromatographic analysis of depot fat samples. This was established by controlled experiments with 20 depot fat samples.

Advantages of the Method. The advantages are:

(*a*) The entire procedure may be performed with previously sterilized equipment. This may be of particular value when used in epidemiological surveys under field conditions.

(*b*) Contamination of the sample with blood is infrequent and appears to be less likely than with use of the standard syringe method.

(*c*) The aspirating syringe both injects the saline and aspirates the sample in one step.

(*d*) The tube-plunger becomes a convenient sample container for freezer storage. In the method of fat aspiration described by Hirsch et al. (1), the barrel and syringe must be carefully washed with the solvent mixture during transfer of the fat sample to the specimen bottle. This step is obviated by the aspiration syringe.

(*e*) The fat sample is obtained while the patient is in a sitting position. This provides an area between the gluteal prominence and the iliac crest which is a convenient site for the rapid aspiration of fat. Moreover, the clothing of the subject need only be lowered or otherwise adjusted to permit exposure of the depot fat aspiration site.

(*f*) In the standard syringe method of fat aspiration, considerable experience must be acquired to grasp and pull back on the 50 ml syringe with one hand while holding the barrel steady with the other in order to produce the suction required to secure the sample. Inadvertent release of the plunger while it is pulled back can result in breakage of the glass syringe and possible injury to the patient. The aspirating syringe method obviates this step and simplifies the procedure.

(*g*) The subject is spared the sight of a 50 ml syringe. This factor may be of importance in surveys where the presence of a large syringe may serve to increase the anxiety of the subjects and reduce cooperation.

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