

**Review and Conclusions – Final Draft**

**4/22/08**

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## Committee III: Techniques for Thyroid FNA

### A. Aspiration devices, needles and methods

#### Review:

#### *Needles*

A wide variety of needles of varying lengths and diameters are available for FNA use (Figure 1). A large majority of those posting comments at the website exclusively use 25-27 gauge needles for their initial biopsies.

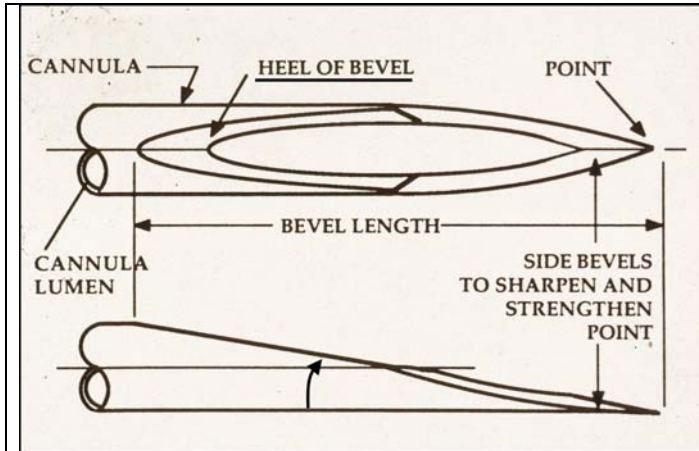
**Figure 1** (Adapted from Sigma-Aldrich Co @ [http://www.sigmaaldrich.com/Area\\_of\\_Interest/Research\\_Essentials/Chemicals/Key\\_Resources/Technical\\_Library/Needle\\_Gauge\\_Chart.html](http://www.sigmaaldrich.com/Area_of_Interest/Research_Essentials/Chemicals/Key_Resources/Technical_Library/Needle_Gauge_Chart.html))

Needle Gauge	Nominal O.D.		Nominal I.D.	
	mm	inches	mm	inches
10	3.4040	0.1340	2.6920	0.1060
11	3.0480	0.1200	2.3880	0.0940
12	2.7690	0.1090	2.1590	0.0850
13	2.4130	0.0950	1.8030	0.0710
14	2.1080	0.0830	1.6000	0.0630
15	1.8290	0.0720	1.3720	0.0540
16	1.6510	0.0650	1.1940	0.0470
17	1.4730	0.0580	1.0670	0.0420
18	1.2700	0.0500	0.8380	0.0330
19	1.0670	0.0420	0.6860	0.0270
20	0.9020	0.0355	0.5840	0.0230
21	0.8130	0.0320	0.4950	0.0195
22	0.7110	0.0280	0.3940	0.0155
23	0.6350	0.0250	0.3180	0.0125
24	0.5590	0.0220	0.2920	0.0115
25	0.5080	0.0200	0.2410	0.0095
26	0.4570	0.0180	0.2410	0.0095
27	0.4060	0.0160	0.1910	0.0075
28	0.3560	0.0140	0.1650	0.0065
29	0.3300	0.0130	0.1650	0.0065
30	0.3050	0.0120	0.1400	0.0055
31	0.2540	0.0100	0.1140	0.0045
32	0.2290	0.0090	0.0890	0.0035
33	0.2030	0.0080	0.0890	0.0035

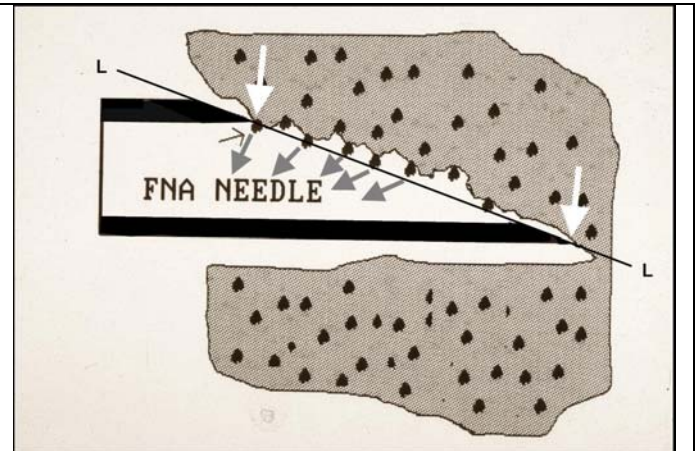
Most solid phase biopsies utilize 27 to 22 gauge needles that equates to outside diameters of 406 - 711 microns and inside diameters of 191 - 394 microns.[1] Follicular cell nuclei on smear preparations are similar to the diameter of red blood cells or lymphocytes, around 8-10 microns.[2, 3] Thus, the commonly used needles would have internal diameters better than 20 – 50 times that of a follicular cell nucleus. Since three dimensional follicles average around 200 microns, but vary considerably, these commonly used needle sizes often allow passage of intact individual follicles or even small stromal-epithelial fragments (‘mini-cores’) on many FNA smears.[4] Given that the

risk of a hemorrhagic complication reasonably bears some relationship to increasing needle diameter, one approach is to begin the biopsy sequence with the smallest diameter needle that in one's experience is usually effective (25-27 gauge). The resulting unstained slide can be visually assessed for colloid and tissue fragment content, with progression to larger needle sizes if needed. This approach is supported by one study of 123 patients biopsied with 23 and 27 gauge needles that found no significant difference between the two sizes of needles in the adequacy of material obtained.[5] That report also recommended using both sizes noting that 'the number of dry passes is lower with the larger needle, but the diagnostic quality of the aspirate may be better with the smaller one'. In a study of needle sizes in the diagnosis of lung cancer, Unver found, however, that 18, 22, and 25 gauge needles had no significant differences in diagnostic yield or cell type concordance.[6]

Needles come in two basic bevel styles.[7] For FNA purposes, the long or regular bevel needles are the best, are the most commonly available, and are the typical needles used for intramuscular injections. The angle of the long bevel needle is 14 degrees or less. The arrow in **Figure 2** is 9 degrees, a common value.



**Figure 2.** Long bevel needle



**Figure 3.** Needle heal cutting action

Because of this relatively narrow angle, these long bevel needles are relatively "side looking" and thus are perfect for thyroid sampling as the trailing edge of the needle bevel can act in a guillotine-like fashion as the needle is advanced forward, harvesting the soft epithelial component and relatively avoiding the accompanying stromal component (Figure 3). Just as the 9° bevel of the leading edge of the needle is a very effective cutting device (right white arrow), the trailing edge (left white arrow) is also equally effective for effective cutting (line L cuts the parallel lines of the needle cylinder at equal angles). The cellular yield is maintained within the needle core by a combination of forward movement of the needle and the suction-like effect of surface tension induced capillary action, which is relatively high in these smaller diameter needles.

In contrast, the two other needle bevel styles, grouped together as short bevel, have a much greater angle and are usually used for intradermal use. Since they open nearly perpendicular to the direction of needle travel, they are not generally used in FNA sampling. In addition, the short bevel needles tend to become occluded by normal tissue such as muscle prior to reaching the thyroid target. This is due to the larger bevel angle

that is closer to a core needle with a 90 degree bevel compared to a long bevel at 14 degrees or less.

Larger gauge needles are often needed to drain viscous colloid cysts. Specifically, for straight pipes, such as a FNA needle, the resistance is inversely proportional to the diameter of the pipe. Twenty, 14 and 10 gauge needles have internal diameters of 0.584, 1.600, and 2.690 millimeters, respectively. These diameters are generally sufficient to allow full evacuation of all but the most viscous of colloid cyst contents, and are atraumatic when preceded by adequate anesthesia. As will be discussed below, a standard 34 inch flexible IV extension tube can be used to join the vacuum producing pistol syringe holder and these larger needles.

### *Aspiration Devices*

There are a variety of syringe holders. Among the oldest and most widely used pistol grip like holders is the Cameco [Precision Dynamics Corp., San Fernando, CA] as shown in the opening chapter of the late Dr. Josef Zajicek's classic FNA textbook.[8] Wide experience in both the Swedish and the American models have show this to be an excellent instrument allowing the aspirator to both direct the biopsy and supply negative pressure with one hand, with the other hand immobilizing the target and assessing needle depth of penetration.

In 1986 Zajdela suggested a novel approach to needle biopsy, using a bare needle without syringe or negative suction.[9] The Zajdela technique relies on the forward motion of the needle as well as the surface tension induced capillary action within the core of the needle which can be quite strong, particularly in small diameter needles. The formula showing how smaller diameter needles have a greater capillary effect is included in his original paper. Later on Cajulis validated the effectiveness of this approach showing that FNA both with and without aspiration provided adequate cells for diagnosis and special studies.[10] Moreover, their results show that, when both aspiration and non-aspiration techniques are used in the evaluation of a given nodule, they had an additive effect.

There are more recent studies of aspiration versus non-aspiration in needle biopsy. In a series of 200 patients with thyroid nodules scored for blood, number of cells obtained and preserved architecture, no statistically significant differences were found with or without aspiration.[11] In another study of 150 patients with thyroid gland enlargement, diagnostically superior specimens were obtained significantly more frequently by the non-aspiration techniques.[12] In a meta-analysis of 4 cross over trials, an odds ratio favored non-aspiration but the difference was not significant.[13]

Based as much on favorable clinical experience as in these studies, many FNA practitioners adopted the Zajdela technique for the first biopsy sample. Also, the visual impact to the patient is less with this technique since the physician can approach the patient with the needle concealed in the palm of the hand versus the larger visual cross section of the pistol grip syringe holder. With or without anesthesia, the first biopsy using the Zajdela methods can often be obtained with so little impact that patients occasionally ask, "Was that the biopsy?" In addition, "spinning" or variably oscillating the needle around its long axis in a clockwise-counterclockwise manner during the forward motion has been suggested. With spinning the rotational velocity vector slightly increases the effective forward velocity of the needle. Also, the circular rotation adds a

shearing component to the cutting action of the trailing edge of the needle, an action that may improve cellular yield.

With the advent of ultrasound directed biopsies of smaller and often non-palpable nodules, the pistol grip syringe holder may seem more cumbersome and awkward in contrast to its great utility in conventional palpable thyroid nodules. The Tao instrument [Tao and Tao Technology, Carmel, IN] seeks to bridge this gap by being small and gripped much like a pencil, but still able to provide the element of suction during the course of the biopsy.[14] The main drawback to the Tao device (<http://www.taoaspirator.com/>) is its lack of a simple means of quickly relieving any residual vacuum at the end of the biopsy prior to withdrawing the needle. That residual vacuum, although small, is often more than sufficient to draw the specimen into the syringe, a major impediment for a more rapid specimen recovery and slide smearing. In a like manner, the Inrad aspiration biopsy syringe gun [Inrad, Inc., Kentwood, MI] has been presented as offering some advantages over the Tao device (<http://www.inrad-inc.com/main.htm>).

There is a potential solution to the awkward size and mass of the pistol-grip-syringe-needle instrument in the ultrasound directed sampling of small targets. One can interpose a plastic disposable IV tube extension between the pistol-grip-syringe and the needle. This is a simple modification of an earlier suggested method which utilized a butterfly IV needle and its attached plastic tubing.[15] Thus the biopsy physician can have the delicate tactile feel of the Zajdela technique holding just the needle with one hand while having a second hand free to isolate the lesion or manipulate the ultrasound probe while suction is applied by an assistant holding the pistol grip as needed. A single IV tube extension can mate any already available needle in the inventory of the FNA clinic to the syringe holder without the expense of having to have butterfly IV needles in an array of sizes. Also the relatively short length of the butterfly needle can be insufficient for deep posterior nodules or for patients with thick necks.

#### *Methods*

There are a variety of methods for proceeding with manual and ultrasound directed FNA sampling. The Stanley and Lowhagen textbook nicely combines the Swedish and the American approaches to FNA biopsy in Chapter 1 “Equipment, Basic Techniques, and Staining Procedures”[1] Descriptions of smearing techniques along with detailed illustrations have been published.[16] Additional reviews can be found in current cytopathology text books.[17] The Pap Society’s web site (<http://papsociety.org/>) also offers study aids applicable to thyroid FNA, including a detailed instructional video outline all aspects of FNA including sample preparation (<http://www.papsociety.org/fna.html>). Available as down-loadable PDF files from its Guidelines tab are “Optimal Smear Preparation Techniques” ([http://papsociety.org/guidelines/Smears\\_handout\\_distribution.pdf](http://papsociety.org/guidelines/Smears_handout_distribution.pdf)) and “Pathologist Performed Ultrasound Guided FNA” ([http://papsociety.org/guidelines/us\\_SanDiego\\_cut\\_handout\\_distribution.pdf](http://papsociety.org/guidelines/us_SanDiego_cut_handout_distribution.pdf)). Videos of FNA technique can also be downloaded for free via Google™.

These concepts are presented briefly in the following figures. The specimen character or location determines the technique needed as outlined in **Figure 4**. **Figures 5 and 6** present the one step technique for semisolid or viscous samples, whereas **Figures 7 and 8** demonstrate concentration techniques for a fluid sample.

**Figure 4**

<u>Character</u>	<u>Technique</u>
Semisolid	One step
Thin watery	Two step
Fluid in hub	Snap
Fluid in syringe	Pop

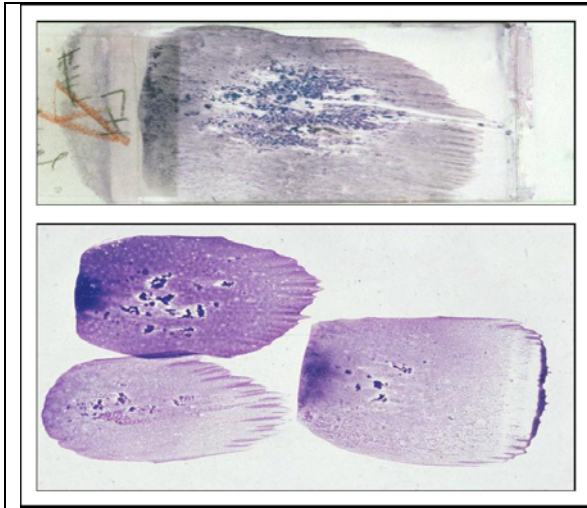


Figure 5. 1 step technique smear

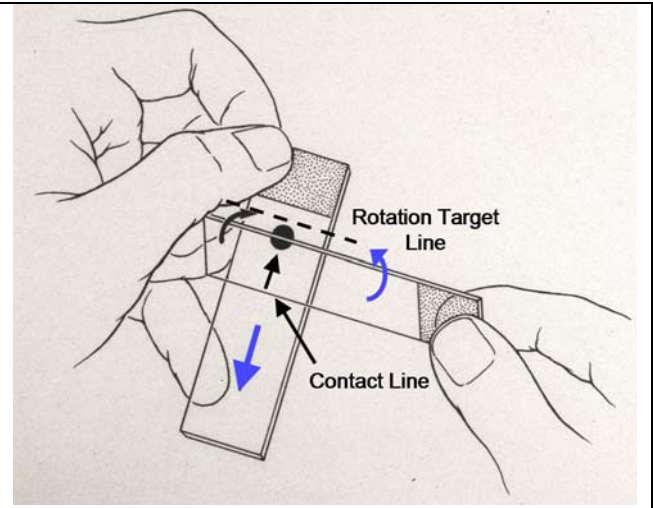


Figure 6. 1 step technique method

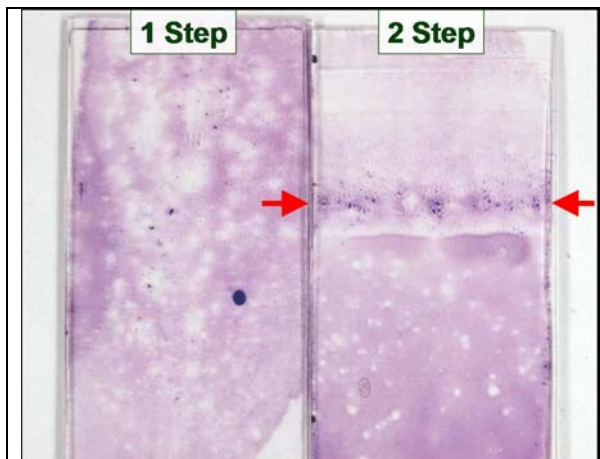


Figure 7. 1 step and 2 step smears

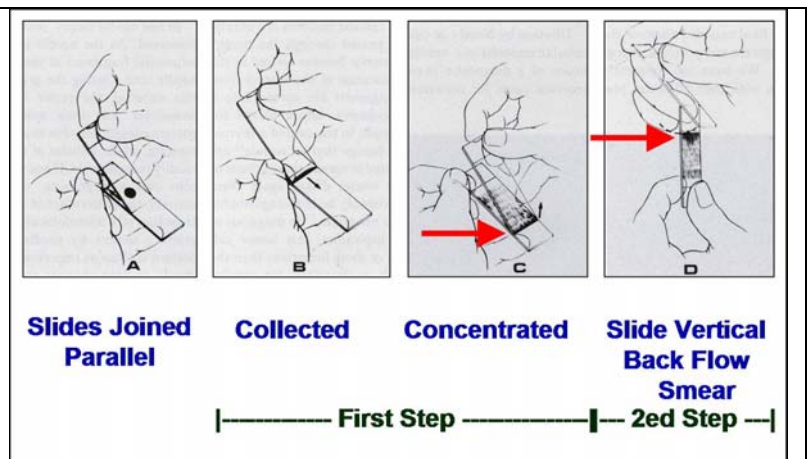


Figure 8. 2 step smearing technique

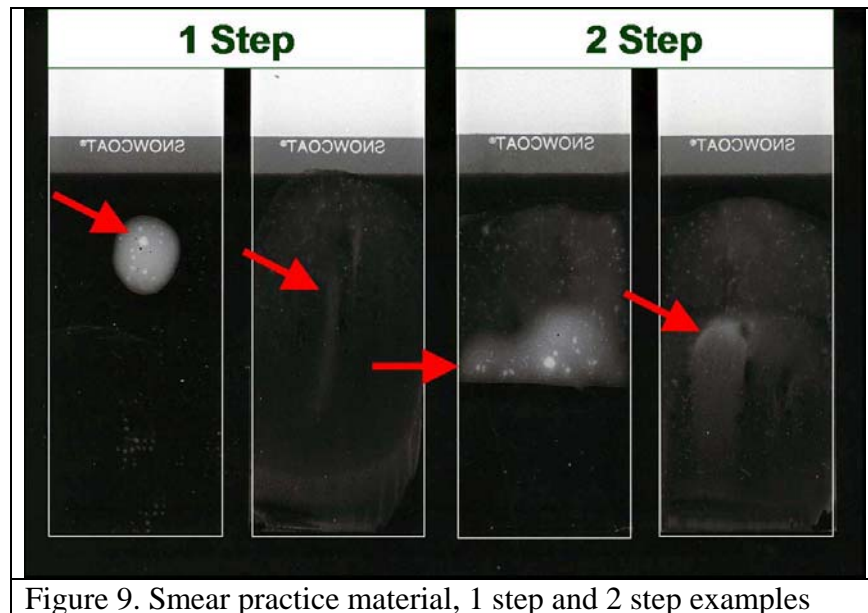


Figure 9. Smear practice material, 1 step and 2 step examples

Reasonably realistic smearing practice materials can be prepared utilizing a suspension of any of the readily available hand lotions. Lubriderm for normal skin (Pfizer, Morris Plains, New Jersey), when gently swirled with water, disperses into small droplets of opaque white tissue-like fragments within a watery background. Swirling rather than shaking is recommended since the latter tends to produce bubbles. By incorporating less or more water into this mixture, one can mimic the semi-solid material appropriate for a one-step technique, as opposed to more watery material appropriate for a 2-step technique as illustrated in **Figure 9**. This material remains relatively stable for an hour or so and can be transferred to small bottles with eyedropper dispensers so that one can produce a precise and appropriate sized droplet on a slide for demonstration purposes. Although the classic calf liver model is excellent for practicing the biopsy method (discussed below), the relatively fibrous content of aspirated calf liver fragments does not correspond well to the tissue from thyroid FNA, and thus this lotion suspension method is recommend for smearing practice.

These conventional smearing techniques, which were perfected by the early 1970s, now have a world wide experience of over 35 years and provide the basis for which the vast majority of thyroid FNA criteria now in use have been developed. These techniques, as presented in illustrations given above, may seem complex to the inexperienced. Yet they are in fact quite easily learned as one practices them with someone experienced in proper smear preparation.

Due to poor or absent teaching of these techniques and the subsequent poor quality smear production has led some to non-smear techniques such as cell blocks and liquid based preparations. These alternatives to smears add technical costs not associated with direct smears and may limit the higher definitive diagnostic ability of good quality direct smears for inexperienced cytopathologists in LBC presentation.

There are a variety of readily available materials for training and practice in FNA collection. One easy practice source for the FNA biopsy technique is a portion of liver wrapped in several layers of latex examining gloves. In particular, calf's liver has a relatively soft parenchyma that nicely approximates aspiration biopsy collection.

To perform an FNA, in brief, the skin is cleansed only with a simple alcohol preparation since the needle sizes are generally those of an intramuscular injection or blood drawing. Accordingly, there is no need for elaborate sterile draping. When larger needles (18 gauge or larger) are used to evaluate a viscous cyst, an iodine preparation in a non-iodine allergic patient may be a reasonable additional safeguard. If anesthesia is used, a half cubic centimeter of local anesthetic slowly delivered into the subcutaneous fat through a 30 gauge needle (readily available through dental supply outlets) provides rapid, comfortable anesthesia as long as the agent is delivered into the subcutaneous fat without the formation of a dermal wheal. The use of anesthesia is discussed further under Agenda Item B.

By visual or US means the needle is quickly introduced into the nodule with a series of advance-withdraw motions, the excursions of which are carefully maintained within the target over a brief time; 2-5 seconds on the first sample is usually a good starting point for most thyroid nodules. Some benign thyroid nodules are sufficiently rich in colloid and limited in vascularity to allow a somewhat longer sampling time. The presence of blood in the needle hub is indicative of too long a needle dwell time in the nodule so that sampling process has been changed from the desired collection of the more viscous colloid and cellular material to a sampling of the considerably less viscous capillary blood, which preferentially enters the needle. Rapid (3 excursions per second) sampling motions with brief dwell time within the nodule may diminish bloody dilution and obscuration. Production of 1-2 slides per biopsy reflects an appropriate dwell time. The consistent production of over 3 or more slides per biopsy suggests an overly long dwell time and risks bloody dilution and/or obscuration.

Some tumors are exquisitely vascular, such as hyperactive nodules, microfollicular neoplasia, and some metastatic carcinomas, notably renal cell carcinoma. Such tumors present a contest between successful tissue sampling versus capillary blood sampling. Fortunately a simple modification of the basic biopsy is usually effective. First, since these lesions are usually hypercellular, vacuum is usually not needed and may even be counter-productive. For such hypervascular nodules, the Zajdela technique is ideal. Secondly, the dwell time within the nodule must be greatly reduced. To do this the patient is advised that the biopsy will be very rapid so as not to be surprised, expecting the smooth gentle motion of the initial FNA sample. The needle is gently placed through the skin and comes to rest just outside of the thyroid and nodule. When ready, the physician proceeds with one or two extremely rapid but fully controlled thrusts before it is withdrawn and the smears rapidly made. Again the needle tip excursions are only allowed within the volume of the targeted area. The speed of the needle advancement greatly augments the ability of the sharpened metal at the trailing edge of the needle's bevel to act in an efficient cutting fashion, rendering multiple epithelial fragments into the core of the needle before the injured capillaries can release much in the way of blood. Because of localized release of capillary blood at a prior biopsy site, subsequent biopsies are obtained from geographically different areas to the greatest degree possible.

If US guidance is used, the needle must never be passed through a layer of US gel on the skin since this gel produces a serious obscuring precipitation on Wright's staining. Rather the point of skin entry is identified by placing an ultrasound dense object under the probe, such as a ball point pen. When centered over the target, the site of the pen's tip is inked with a surgical skin marker. Once the needle is within the skin, the probe

with its gel is applied, the target acquired, and the biopsy performed. When the needle is withdrawn, often US gel will coat its outside surface. This US gel can be completely removed by simply wiping gauze from needle hub to needle tip.

Following the biopsy, the biopsy site is gently compressed with manual pressure for about a minute and then a small bandage applied to protect the patient's clothing. For most patients normal activities can immediately be resumed at the discretion of the physician.

Conclusions:

1. Commonly available 27-25 gauge needles are best used for thyroid FNA starting with the smallest diameter needle and increasing needle size as needed; larger diameter needles reserved for drainage of viscous colloid cyst contents.
2. The native suction provided by surface tension within smaller diameter needles often make devices for additional suction unnecessary.
3. When suction is needed, such as in the drainage of cystic contents, a section of IV tubing interposed between the needle held by the physician and the aspiration device as held by an assistant allows for near normal tactile sense and needle mobility that approaches that of the Zajdela technique. A syringe in an aspiration device is also useful.
4. The basic principles of thyroid FNA are the same whether the needle is inserted into the lesion by manual or ultrasound guidance. Cellular material is obtained by the cutting action of the trailing edge of the needle (heel of the bevel) and is retained in the needle core by forward motion and capillary tension.
5. As a starting point, a dwell time of 2-5 seconds within the nodule with 3 forward and back oscillations per second often maximizes cellular yield, minimizes bloody artifacts, and efficiently produces 1-2 slides per biopsy pass.
6. Readily available and easily learned smearing techniques allow the aspirated material to be best presented on the slides for optimal fixation, staining, and microscopic assessment. Failure or any significant flaw in smearing technique can limit or totally hinder microscopic evaluation, irrespective of how much material was obtained during the biopsy phase of the FNA.

## **B. The role of anesthesia for palpable and nonpalpable FNA and guidelines for its use**

Review:

There are no good published data on the use of topical anesthesia in thyroid FNA. Most authors, however, recommend no local anesthetic for palpable nodules.[18] However, the trend with other FNA physicians, particularly as they acquire experience in the effective anesthetic techniques described below, has been to offer local anesthesia to all patients.

Discussing superficial FNA in general, the National Committee for Clinical Laboratory Standards (NCCLS), in their publication (GP20-A2, Volume 23, Number 27), clearly states that most of these FNAs can be performed without local anesthetic for three main reasons: 1) injection of a local anesthetic can cause more pain than the FNA itself; 2) infusion of the anesthetic agent can obscure anatomic detail and make the target lesion/mass difficult to palpate; 3) local anesthetic may cause degeneration and loss of cellular morphology.

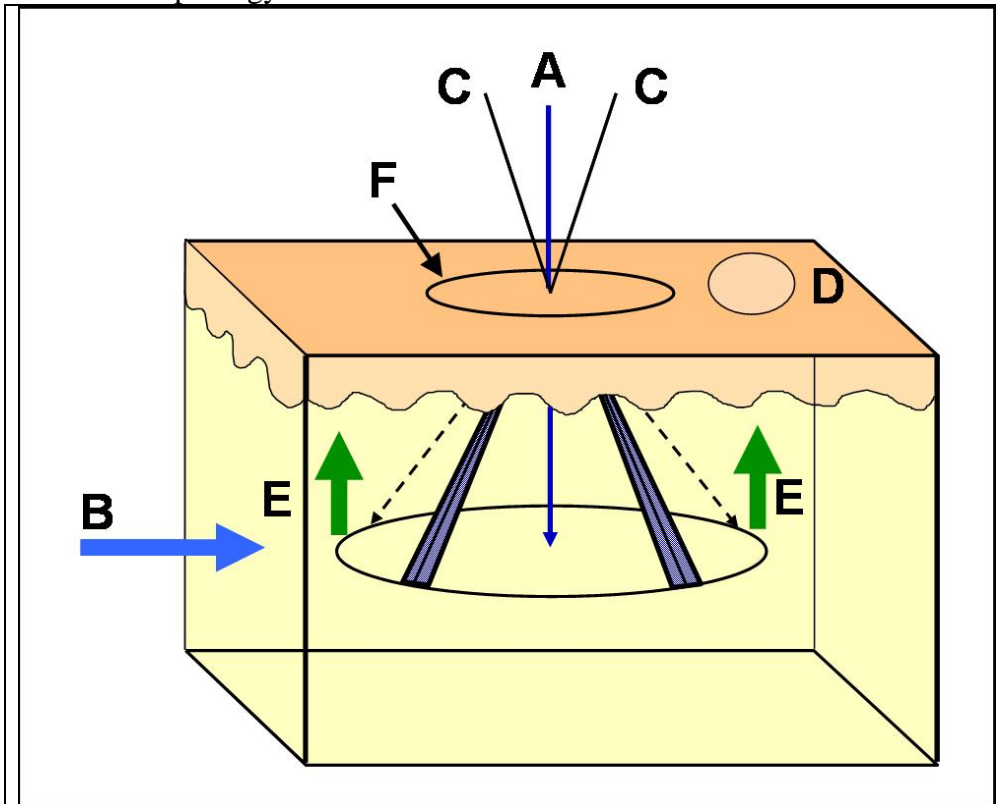


Figure 10. Local anesthesia technique.

Excellent anesthesia for thyroid FNA is obtained by injecting between 0.5-1.5 cc of 2% lidocaine with or without epinephrine 1:100,000. The ultra thin 30-32 gauge needles minimize discomfort during the initial skin puncture. These are available as disposable items for use with a reusable tubex injector, and are readily obtainable through dental supply outlets.

As demonstrated in Figure 10, the needle goes directly down through the skin (A) into the upper subcutaneous fat plane (B). Approximately half the total desired amount to be delivered is slowly infiltrated into the outermost portion of the subcutaneous fat to avoid a wheal. The remaining half of the desired anesthetic volume is administered as the needle is progressively withdrawn and repositioned into sequential quadrants (C) in the same fat plane (B).

The standard 2% Lidocaine tubex unit contains 1.8 ml of anesthetic agent. As a general guideline, one can place about a third of the total tubex volume during the first phase of injection and a second third of the tubex volume is equally distributed into the perimeter quadrants. This will deliver about 1.2 cc of anesthetic agent, which almost always is sufficient, but 0.6 cc remains should further administration be needed.

During both the first and the second phases of the anesthetic injection, introducing counter irritation, such as tapping or rubbing the skin adjacent to the injection site with one's finger (D), is quite helpful. During the next minute or so the anesthetic back infiltrates into the dermis (E) leading to a slowly evolving zone of excellent anesthesia (F). After approximately one minute or so, one has about a 1 cm area of completely numb skin.

Normally cutaneous anesthesia as described here is all that is necessary to provide for a painless thyroid FNA. Rarely a patient may encounter pain upon capsular penetration. In such a case, one should consider anesthetizing the anterior part of the thyroid capsule through which the biopsy needle will pass. Such capsular tenderness can certainly be the case for subacute thyroiditis. Additionally it may be seen in other conditions, such as chronic thyroiditis as well as patients who have an acute process such as intrathyroidal hemorrhage, infarction, or cyst leakage. With good quality ultrasound equipment one can easily visualize the small 30 gauge needle either directly, or as a distinctive zone of soft tissue distortion. Under this visualization an additional third of a tubex is applied just above the surface of the thyroid capsule. Adequate capsular anesthesia generally develops in 2-5 minutes.

The duration of local anesthesia after the initial injection lasts long enough and a repeat injection is rarely, if ever, needed. With epinephrine the anesthetic effect lasts 0.5-1.5 hours. At these low doses lidocaine is safe and only rare instances of allergic reactions have been reported.

Alternative numbing methods used by some include an ice pack placed on the proposed FNA site before the procedure, 4% lidocaine spray and Lidocaine gel.

Conclusions:

1. In some practitioners' experience thyroid FNAs are well-tolerated and are not associated with significant discomfort or pain for the well prepared patient. These physicians feel that local anesthesia prior to FNA is not need.
2. Other physicians, particularly as they gain experience with proper anesthetic administration techniques, feel that properly administered local anesthesia renders the biopsy painless, and offers patients comfort and piece of mind, resulting in an overall more pleasant experience. These FNA physicians use local anesthesia for all thyroid FNAs.
3. Thus, the use or non-use of local anesthesia is within the judgment and discretion of the FNA physician with the concurrence of the informed patient.
4. For deep, non-palpable thyroid nodules that may require more time and probing to reach the nodule, and for all biopsies using needles other than a fine needle, local anesthesia is recommended.
5. Local anesthetic of choice is 1-2% lidocaine with or without 1:100,000 epinephrine.
6. Inject about 0.5 – 1.5 cc of the anesthetic utilizing 30 gauge needle and inject slowly into the subcutaneous fat (not the reticular dermis) and allow allowing the anesthetic to back infiltrate the dermal nerves, avoiding rather than make a painful intradermal wheal.

### **C. Influence of thyroid lesion location, size and imaging characteristics on FNA sampling technique**

## Bibliography

1. Stanley MW and Lowhagen T. Fine needle aspiration of palpable masses. 1993, Boston: Butterworth-Heinemann.
2. Jeffrey PB and Miller TR, Fine-needle aspiration cytology of the thyroid, in *Pathology: State of the art reviews*. 1996, Hanley and Belfus: Philadelphia.320.
3. Koss LG, Woyke S, and Olszewski W. Aspiration biopsy. Cytologic interpretation and histologic bases. 2nd ed. 1992, New York: Igaku-Shoin.
4. Rosai J, Carcangiu M, and DeLellis R. Atlas of Tumor Pathology: Tumors of the Thyroid Gland. Vol. Fascicle 5. 1992, Washington, D.C.: Armed Forces Institute of Pathology. 4-7.
5. Hanbidge AE, Arenson AM, Shaw PA, Szalai JP, Hamilton PA, and Leonhardt C. Needle size and sample adequacy in ultrasound-guided biopsy of thyroid nodules. *Can Assoc Radiol J* 1995; 46(3):199-201.
6. Unver E, Yilmaz A, Aksoy F, Baysungur V, Celik O, Altinsoy B, and Baran R. Does needle size affect diagnostic yield of transthoracic needle biopsy in malignant pulmonary lesions? Comparison of 18-, 22- and 25-gauge needles in surgical specimens. *Respirology* 2006; 11(5):648-51.
7. BE Medical Product Catalogue.  
[http://www.bd.com/injection/pdfs/bd\\_Medical\\_Catalog\\_2006.pdf](http://www.bd.com/injection/pdfs/bd_Medical_Catalog_2006.pdf).
8. Zajicek J. Aspiration Biopsy Cytology. Part 1: Cytology of Supradiaphragmatic Organs. 1974, New York: S. Jarger.
9. Zajdela A, de Maublanc MA, Schlienger P, and Haye C. Cytologic diagnosis of orbital and periorbital palpable tumors using fine-needle sampling without aspiration. *Diagn Cytopathol* 1986; 2(1):17-20.
10. Cajulis RS and Sneige N. Objective comparison of cellular yield in fine-needle biopsy of lymph nodes with and without aspiration. *Diagn Cytopathol* 1993; 9(1):43-5.
11. Haddadi-Nezhad S, Larijani B, Tavangar SM, and Nouraei SM. Comparison of fine-needle-nonaspiration with fine-needle-aspiration technique in the cytologic studies of thyroid nodules. *Endocr Pathol* 2003; 14(4):369-73.
12. Rizvi SA, Husain M, Khan S, and Mohsin M. A comparative study of fine needle aspiration cytology versus non-aspiration technique in thyroid lesions. *Surgeon* 2005; 3(4):273-6.
13. Pothier DD and Narula AA. Should we apply suction during fine needle cytology of thyroid lesions? A systematic review and meta-analysis. *Ann R Coll Surg Engl* 2006; 88(7):643-5.
14. Tao LC and Smith JW. Fine-needle aspiration biopsy using a newly-developed pencil-grip syringe holder. *Diagn Cytopathol* 1999; 20(2):99-104.
15. Boccato P. Fine needle aspiration biopsy of small targets. *Acta Cytol* 1987; 31(2):200-1.
16. Abele JS, Miller TR, King EB, and Lowhagen T. Smearing techniques for the concentration of particles from fine needle aspiration biopsy. *Diagn Cytopathol* 1985; 1(1):59-65.

17. DeMay R, Chapter 14 "Fine needle aspiration biopsy", in *The art and science of cytopathology: Aspiration cytology*. 1995, ASCP press: Chicago.463-492.
18. Gharib H and Goellner JR. Fine-needle aspiration biopsy of the thyroid: an appraisal [see comments]. *Ann Intern Med* 1993; 118(4):282-9.
19. Alexander EK, Heering JP, Benson CB, Frates MC, Doubilet PM, Cibas ES, and Marqusee E. Assessment of nondiagnostic ultrasound-guided fine needle aspirations of thyroid nodules. *J Clin Endocrinol Metab* 2002; 87(11):4924-7.
20. Hsu C and Boey J. Diagnostic pitfalls in the fine needle aspiration of thyroid nodules. A study of 555 cases in Chinese patients. *Acta Cytol* 1987; 31(6):699-704.
21. Gobien RP. Aspiration biopsy of the solitary thyroid nodule. *Radiol Clin North Am* 1979; 17(3):543-54.
22. Bakhos R, Selvaggi SM, DeJong S, Gordon DL, Pitale SU, Herrmann M, and Wojcik EM. Fine-needle aspiration of the thyroid: rate and causes of cytohistopathologic discordance. *Diagn Cytopathol* 2000; 23(4):233-7.
23. Frates MC, Benson CB, Charboneau JW, Cibas ES, Clark OH, Coleman BG, Cronan JJ, Doubilet PM, Evans DB, Goellner JR, Hay ID, Hertzberg BS, Intenzo CM, Jeffrey RB, Langer JE, Larsen PR, Mandel SJ, Middleton WD, Reading CC, Sherman SI, and Tessler FN. Management of thyroid nodules detected at US: Society of Radiologists in Ultrasound consensus conference statement. *Ultrasound Q* 2006; 22(4):231-8; discussion 239-40.
24. Frates MC, Benson CB, Charboneau JW, Cibas ES, Clark OH, Coleman BG, Cronan JJ, Doubilet PM, Evans DB, Goellner JR, Hay ID, Hertzberg BS, Intenzo CM, Jeffrey RB, Langer JE, Larsen PR, Mandel SJ, Middleton WD, Reading CC, Sherman SI, and Tessler FN. Management of thyroid nodules detected at US: Society of Radiologists in Ultrasound consensus conference statement. *Radiology* 2005; 237(3):794-800.
25. Bellantone R, Lombardi CP, Raffaelli M, Traini E, De Crea C, Rossi ED, and Fadda G. Management of cystic or predominantly cystic thyroid nodules: the role of ultrasound-guided fine-needle aspiration biopsy. *Thyroid* 2004; 14(1):43-7.
26. Braga M, Cavalcanti TC, Collaco LM, and Graf H. Efficacy of ultrasound-guided fine-needle aspiration biopsy in the diagnosis of complex thyroid nodules. *J Clin Endocrinol Metab* 2001; 86(9):4089-91.
27. Castro MR and Gharib H. Continuing controversies in the management of thyroid nodules. *Ann Intern Med* 2005; 142(11):926-31.
28. Cesur M, Corapcioglu D, Bulut S, Gursoy A, Yilmaz AE, Erdogan N, and Kamel N. Comparison of palpation-guided fine-needle aspiration biopsy to ultrasound-guided fine-needle aspiration biopsy in the evaluation of thyroid nodules. *Thyroid* 2006; 16(6):555-61.
29. Izquierdo R, Arekat MR, Knudson PE, Kartun KF, Khurana K, Kort K, and Numann PJ. Comparison of palpation-guided versus ultrasound-guided fine-needle aspiration biopsies of thyroid nodules in an outpatient endocrinology practice. *Endocr Pract* 2006; 12(6):609-14.
30. Carmeci C, Jeffrey RB, McDougall IR, Nowels KW, and Weigel RJ. Ultrasound-guided fine-needle aspiration biopsy of thyroid masses. *Thyroid* 1998; 8(4):283-9.