THYROID BIOPSY WITH THE RECIPROCATING PROCEDURE DEVICE (RPD) © 2006, 2007

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Educational Objectives

- To review the indications for thyroid biopsy and thyroid cyst aspiration.
- To understand the different forms of thyroid biopsy and their indications.
- To understand the advances in technology in fine needle aspiration and cyst aspiration of the thyroid.
- To understand and apply ultrasound-guided FNA and cyst aspiration using the RPD to the thyroid patient.
Evaluation and Biopsy of the Thyroid Lesion
Types of Clinical Thyroid Lesions

- Palpable nodule or cyst.
- Nodule or cyst on Ultrasound.
- Euthyroid lesion.
- Hyperthyroid lesion.
- Hypothyroid lesion.
- Cold euthyroid nodule on $I^{131}$
- Hot hyperthyroid nodule on $I^{131}$
- Hyperthyroid and Hypothyroid lesions may be managed medically first before biopsy.
Palpable Thyroid Lesion
Hot vs. Cold Thyroid Lesions $^{131}$

- Contralateral Lobe Suppressed
- Contralateral Lobe Not Suppressed

Hot vs. Cold Thyroid Lesions

Hot Nodule

Cold Nodule

Adapted from Lange et al Geneeskunde 2001;43 (2) and G Henneman, Chapter 13, Thyroid Disease Manager.
Hyperthyroid Lesions

- Hyperthyroid lesions often require complex medical management.
- Cold hyperthyroid lesions usually not biopsied until patient is euthyroid.
- Hot hyperthyroid lesions are usually not biopsied but rather treated first with I\textsuperscript{131} ablation.
- Hot hyperthyroid lesions or nodules are not usually appropriate for biopsy as an initial management step.
Cold Euthyroid Nodules on $I^{131}$ may be Cancer or Benign

Cold Nodule

Cold Nodule

Adapted from Lange et al Geneeskunde 2001;43 (2).
Euthyroid Lesions

- Euthyroid lesions can be cancer, benign neoplasms, cysts, or inflammatory.
- Palpable euthyroid lesions can be biopsied with the palpation method or can be studied further with ultrasound.
- Ultrasound visible simple cysts are only aspirated with they are symptomatic.
- Ultrasound complex cysts and solid euthyroid lesions are often appropriately biopsied.
Risks for Thyroid Cancer

- Enlarging painless lesion.
- Multiple endocrine neoplasia II syndrome.
- Cervical lymph node biopsy results consistent with thyroid cancer.
- Prior head and neck radiation.
- Past thyroid lobectomy for carcinoma now appearing as a nodule in the contralateral lobe.
Solid Lesion on Ultrasound in a Patient with Previous Thyroid Carcinoma

Adapted from Titton et al: AJR 2003;181:26-271.
Color Doppler - Lesion with Reduced Perfusion

Adapted from Rausch et al; J Ultrasound Med 20:79-84, 2001
Thyroid Nodules and Thyroid Cancer

- 40% of the population has thyroid nodules by ultrasound.
- Cystic lesions and solid lesions less than 1 cm in diameter are unlikely to be carcinoma and can be observed or biopsied.
- Isolated hypoechogenic lesions, lesions with indistinct margins, or lesions with punctate calcifications have increased carcinoma risk and should be biopsied.
Mixed Solid Cystic Lesion on Ultrasound

Adapted from Titton et al: AJR 2003;181:26-271.
Characteristics of Benign Thyroid Lesions

- Typically isoechoic or echogenic.
- Hypoechoic peripheral “halo” is characteristic but not an invariable or a specific finding.
- Most benign nodules are either adenomas or colloid cysts.
- Adenomas are often mixed solid and cystic lesions that may undergo internal hemorrhage to varying degrees.
- Calcifications within benign nodules tend to be either of 2 types: (1) peripheral “eggshell” calcifications or (2) large, coarse calcifications.
Characteristics of Malignant Thyroid Lesions

- A single hypoechoic lesion with indistinct margins,
- With or without small punctate calcifications.
- Gray scale US imaging differentiates benign from malignant nodules with sensitivities ranging from 75% to 87% and specificities ranging from 61% to 95%.
- Vascularity is variable, and it is not possible to reliably differentiate benign from malignant nodules with color Doppler or US alone.
- Thus, thyroid biopsy is frequently necessary.
Evaluation of a Thyroid Nodule

Thyroid Nodule → Measure TSH

- **TSH Suppressed**
  - Pertechnetate Thyroid Scan
    - "Hot" nodule → Radioiodine Ablation or Surgery
    - Nodule Cold → Fine Needle Aspiration (FNA)
  - TSH Suppressed
National Institutes of Health: Evaluation of the Euthyroid Lesion

- Recommend biopsing suspicious palpable or US-visible euthyroid lesions 1 cm diameter or larger.
- Recommend US as the imaging modality of choice for euthyroid lesions.
- Recommend fine needle aspiration (FNA) biopsy as the thyroid biopsy procedure of choice.
- Recommend repeat FNA for non-diagnostic specimens or inadequate specimens.
- Recommend open biopsy only for malignant or suspiciously malignant cytology on FNA.
National Institutes of Health
Evaluation of Euthyroid Thyroid Lesions

Thyroid Nodule

Fine Needle Aspiration (FNA)

Malignant OR Probably Malignant

Open Surgical Excisional Biopsy

Non-Diagnostic OR Inadequate Specimen

Repeat FNA

Complex Cyst

Simple Cyst

Benign Cytology

Follow

Adapted from the National Institutes of Health
Thyroid Biopsy Techniques

- **Open biopsy** with complete or partial lobectomy - moderately dangerous.
- **Core needle biopsy** - minimally dangerous.
- **Cutting needle aspiration biopsy** - minimally dangerous.
- **Fine-needle nonaspiration biopsy (FNNA)** - benign.
- **Fine-needle aspiration biopsy (FNA)** - benign.
Open Thyroid Biopsy

Adapted from Majlis et al Rev. méd. Chile v.127 n.8 Santiago ago. 1999
Open Biopsy

- Gold Standard
- Can be curative.
- Hazards include: general anesthesia, injury to recurrent laryngeal nerves, carotids, trachea, or parathyroid glands; hemorrhage, infection, cosmetic injury, death.
- For most patients, a needle-based diagnostic technique is advantageous before open biopsy is planned.
Core Needle Biopsy of the Thyroid

Spring-Loaded

US-Guided
Core Needle Biopsy of the Thyroid

- **Core biopsy is performed with a spring-loaded gun.** Often a small incision is required.
- The biopsy needle “springs” forward, cutting a “core” of tissue.
- Core biopsy provides a larger piece of tissue, but also leaves a larger hole.
- However, core biopsy has no greater sensitivity or specificity than FNA techniques.
- Core biopsy results in a greater risk to surrounding structures and of hemorrhage. Thus, core biopsy is not the technique of choice for the thyroid.

Cutting Needle Aspiration Biopsy

Cutting Needle Has a Stylet
Cutting Needle Aspiration
Biopsy of the Thyroid

- **Cutting needle biopsy is performed with a needle with a stylet.** A typical example is a Chiba cutting needle. When the stylet is removed, suction is applied with a syringe to biopsy.

- Cutting needle biopsy requires extra steps compared to FNA, and leaves a larger hole, resulting in greater hemorrhage.

- Cutting needle aspiration biopsy is not superior to FNA in the thyroid, and thus is not the technique of choice.
Fine Needle Non-Aspiration (FNNA) Biopsy of the Thyroid

Needle Used Without a Syringe or Suction

Needle directed Toward Target Lesion

Adapted from Gharib H, Chapter 6, Thyroid Disease Manager.
Fine Needle Non-Aspiration (FNNA) Biopsy of the Thyroid

- **FNNA is performed with a 25 gauge conventional needle.**
- The needle is held in the fingers or placed on a syringe without a plunger.
- The needle is directed at the lesion.
- Multiple passes through the lesion are performed, and the needle is removed from the lesion.
- The sample is attached to a syringe, expelled on a cytology slide, or into carrier/fixative solution, or sent to the pathology laboratory in the needle.
Fine Needle Aspiration of Thyroid

Vacuum Applied with Device

Needle directed Toward Target Lesion
Fine Needle Aspiration (FNA)

- **FNA is performed with a 25 to 20 gauge conventional needle and a syringe.**
- The needle is placed on a syringe.
- The needle is directed at the lesion.
- Once the needle is in the lesion, suction is gently applied.
- Multiple passes through the lesion are performed, vacuum removed, and the needle removed from the lesion.
- The sample is expelled on a cytology slide, or into carrier/fixative solution, or sent to the pathology laboratory in the needle.
FNA vs. FNNA: Which is Better?

Adapted from Gharib H, Chapter 6, Thyroid Disease Manager.
FNA vs. FNNA: Which is Better?

- FNA and FNNA of the thyroid provide essentially the same sensitivity for malignant lesions. However, FNA is clearly superior to FNNA in all other tissues.
- FNNA samples of the thyroid are smaller with fewer cells and of lesser volume.
- FNNA is also insensitive to benign lesions of the thyroid and often does not provide adequate sample, thus more patients with FNNA have repeat FNA procedures and open procedures due to inadequate sample.
- Thus, FNA is to be recommended over FNNA.
Findings on FNA: Neoplasm

- Neoplasm 5% of the time.
- Papillary Thyroid Carcinoma (70-80%).
- Follicular Thyroid Carcinoma (5%).
- Hurthle Cell Carcinoma (5%).
- Medullary Carcinoma (5-10%).
- Anaplastic Thyroid Carcinoma (3%).
- Malignant Lymphoma (1-2%).
- Metastatic Carcinoma (2-4%).
Findings on FNA: Benign

- Lesions Benign 95% of the time.
- Multinodular Goiter.
- Hashimotos Thyroiditis.
- Simple or Hemorrhagic Cysts.
- Follicular Adenomas.
- Subacute Thyroiditis.
FNA: Thyroid Medullary Carcinoma

Dispersed atypical cells ovoid and triangular shapes with fine granular cytoplasm

Adapted from Dr. JC Prolla and Dr. Ada R. S. Diehl: Atlas of Histopathology
FNA: Benign Colloid Nodule

Abundant Colloid (diffuse purple) and Clusters of Epithelial Cells

Adapted from Rausch et al; J Ultrasound Med 20:79-84, 2001
FNA: Thyroid Papillary Carcinoma

Papillary Fronds with Atypia
FNA: Squamous Cell Carcinoma

Malignant squamous cells metastatic to thyroid from primary laryngeal carcinoma

Adapted from Dr. JC Prolla and Dr. Ada R. S. Diehl: Atlas of Histopathology
FNA: Thyroid Follicular Carcinoma

Atypical follicular Cells
FNA: Hashimoto’s Thyroiditis

Numerous Well-Differentiated Lymphoid Cells
FNA: Thyroid Primary Plasmacytoma

Adapted from Dr. JC Prolla and Dr. Ada R. S. Diehl: Atlas of Histopathology
FNA: Benign Colloid Nodule

Sheets of Normal Thyroid Epithelium with Colloid

Adapted from Gharib H, Chapter 6, Thyroid Disease Manager.
FNA: Huerthle Cell Carcinoma

Huerthle Cells with large nuclei and prominent cytoplasm surrounded by lymphocytes

Adapted from Gharib H, Chapter 6, Thyroid Disease Manager.
FNA: Subacute Thyroiditis

Large multinucleated giant cells on a background of lymphocytes and little colloid

Adapted from Gharib H, Chapter 6, Thyroid Disease Manager.
How Effective Diagnostically is FNA?

- FNA is extremely effective diagnostically as follows:
  - 5% of biopsied thyroid nodules are malignant.
  - Approximately The diagnostic sensitivity for identifying a lesion is 80-93% and the diagnostic specificity is 54-92%.
  - Positive predictive value of 50-90% and a negative predictive value of 92-95%.
  - 18% malignancy rate for indeterminate or suspicious findings on FNA.
  - More dangerous methods, including core biopsy, open biopsy, and cutting needle biopsy should only be used when FNA fails.

Who Performs Thyroid FNA?

- Generally, physicians as follows:
  - Interventional and Ultrasound Radiologists (usually US-guided, occasionally CT-guided).
  - Endocrinologists (palpation and US-guided).
  - Otolaryngologists (usually palpation guided).
  - Family practice (usually palpation guided).
Complications of Thyroid FNA

- Complications of Thyroid FNA are generally minimal, but include:
  - Hematoma, Pain, Bruising, Inflammation (common 5-10%, benign).
  - Puncture of carotids (rare, life-threatening).
  - Progressive hematoma with respiratory compromise (rare, life-threatening; requires surgical intervention).
  - Vascular proliferation of the thyroid (rare, dangerous).
  - Pneumothorax and pneumomediastinum (rare, occasionally dangerous).
  - Abscess (rare, life-threatening).
  - Needle track seeding of tumor (rare, life-threatening).
  - Tumor and thyroid necrosis (rare, interferes diagnostically).
  - Vocal cord paralysis (rare, usually reversible).

THE RECIPROCATING PROCEDURE DEVICE (RPD™)
The Reciprocating Procedure Device (RPD) vs. Traditional Vacuum Sources for FNA

- Reciprocating Procedure Device (RPD).
- The Conventional Syringe.
- The Conventional Syringe with Plunger Lock.
- The 3-ringed control syringe.
- The Bio-Suk-7
- Syringe Pistols
What is the RPD?

The RPD is a one-handed device that is functionally superior to and replaces the conventional syringe, control syringes, and syringe pistols for FNA. The RPD is better controlled and safer than previous devices.
Why Use the RPD for Thyroid FNA?

- Most serious complications of thyroid biopsy are related to poor direction of the needle, resulting unintended puncture of a vital structure.
- The RPD with one hand is better controlled than the traditional syringe, control syringes, syringe pistols and guns used with 1 or 2 hands.
- Unlike syringe pistols and gun, the RPD is disposable, reducing infection risk.
- Since the RPD is a one-handed device, the free hand can be used for other necessary tasks.
Hazardous Anatomy for FNA

SCM Muscle
Strap Muscle
Isthmus
Thyroid Lobe
Jugular Vein
Carotid Artery

Adapted from Gharib H, Chapter 6, Thyroid Disease Manager.
The RPD: Improved Outcomes for Syringe Procedures

In physician-performed syringe procedures, including FNA, the RPD results in:

- Greater accuracy and needle control.
- Reduced patient pain and tissue trauma.
- Reduced procedure time.
- Improved tissue and fluid samples.
- Facilitates physician-administered local anesthetic.
- Improved safety.
- Superb vacuum control
- Improved patient outcomes.
Expert Response:
The RPD is Safer for the Patient

Linda Williams, RN, MSI of the Veteran’s Administration National Center for Patient Safety noted,

“The design is marvelous in its own right, but it is also a great example of the best kind of safety solution.”
RPD vs. Conventional Syringe

A  1-Hand Aspiration

B  1-Hand Injection

C  2-Hand Aspiration

D  2-Hand Injection
Clinical trials have demonstrated that the RPD is superior to the conventional syringe in terms of:

- physician control of syringe and needle
- aspiration of body fluids and tissues
- suction needle biopsy and thyroid biopsy
- arthrocentesis and intraarticular therapy
- administration of local anesthesia

The RPD consistently caused less patient pain and reduced procedure time.

Physician Control of Syringe and Needle Loss of Control in the Forward Direction

RPD with 1-hand is better controlled than the Traditional Syringe with 1 or 2 hands

Physical Control of RPD: Conclusions

- The RPD markedly reduces unintended forward penetration (loss of control in the forward direction).
- The RPD markedly reduces unintended retraction (loss of control in the reverse direction).
- The RPD is superior to the conventional syringe at every size (1, 3, 5, 10, and 20 ml).
- The improved control of the RPD results in significantly reduced patient pain, reduced procedure time, reduced perforation rates, and improved outcomes.

Aspiration of Body Fluids and Tissue: The RPD vs. the Conventional Syringe

Patient Pain
67 % Reduction
P < 0.001

Physician Satisfaction
83 % Increase
P < 0.001

Procedure Time
32 % Reduction
P < 0.10

From: J Rheumatol. 2006;33:771-8;
Ann Rheum Dis. 2006;65:1084-7
J Vas Inter Rad 2007, Abstract 199
Needle Procedures: Conclusions

- In needle procedures, the RPD with one hand is superior to the conventional syringe with two hands or one hand.
- Reduced patient pain and procedure time.
- The RPD improves operator satisfaction.
- The RPD provides greater sample yield with less trauma (hemorrhage).
- The RPD is superior to the conventional syringe for aspiration of body fluid and tissue.

J Vas Inter Rad 2007, Abstract 199
The RPD as a FNA Device

- RPD demonstrated markedly improved needle control compared to plunger locks, syringe pistols, three-ringed control syringes, and dedicated biopsy syringes.
- The RPD was able to control vacuum better than all these devices.
- The RPD was able to eject the sample more easily than the above devices.
- For FNA and cutting needle procedures the RPD was superior to other existing devices.

The RPD: Superior for FNA to Syringe

RPD Superior To Syringe with 1-Hand

RPD Superior To Syringe with 2-Hands

Disadvantages to Traditional Syringes

- The traditional syringe becomes longer with aspiration forcing needle forward. Limited control with 2-hands.
- Poor control with 1-hand or two hands.
- RPD demonstrates better control, less pain, and improved procedure outcome.
- RPD shown to be superior in syringe procedures.

The RPD: Superior for FNA to Control Syringes

RPD Superior
To Plunger Locks

RDP Superior
To 3-Ring Control Syringe

Disadvantages to Control Syringes

- Syringes becomes longer with aspiration forcing needle forward.
- Plunger lock difficult to release vacuum.
- Difficult to generate vacuum in 3-ring syringe.
- RPD demonstrates better control than plunger locks and 3-ring control syringes during typical FNA procedures.
- RPD is superior to plunger locks and control syringes.

The RPD: Superior to Biopsy Syringes

Disadvantages to Biopsy Syringes

- Biopsy syringes becomes longer with aspiration forcing needle forward.
- Requires major change in hand positioning when transitioning from aspiration to injection.
- RPD demonstrates better control than the Bio-Suk-7 and reverse aspiration biopsy syringes.
- RPD is superior to plunger locks and control syringes.

The RPD: Superior to Syringe Pistols

INRAD Biopsy Gun  Cameco Syringe Pistol

Disadvantages to Biopsy Guns and Pistols

- Major hand movement is required to generate vacuum.
- Control is not with the fingers, but rather the base of the hand and arm.
- Difficult to insert and remove syringe.
- RPD is better controlled than and superior to syringe pistols.

Biopsy: Conclusions

- In suction biopsy, the RPD was superior in control, generating vacuum, one-handed use, and clearing the sample from the biopsy needle.
- The RPD was superior to the syringe pistol, dedicated biopsy syringes, three-ring syringe, and conventional syringe.
- The RPD was also superior for image guided thyroid biopsy and non-thyroid biopsy.

RPD: FNA of the Thyroid

- Generation of Vacuum for FNA.
- Control of the Needle in FNA.
- Expelling sample for FNA.
- Administration of Local Anesthesia - The RPD is less painful than a traditional syringe.

The RPD was Compared to the Conventional Syringe for Local Lidocaine Anesthesia in 150 Deep Needle Procedures

Conventional Syringe More Painful and Less Effective for Local Anesthesia

RPD Less Painful and More Effective for Local Anesthesia

From: J Vasc Interv Rad 2007, Abstract 377
Local Anesthesia: Conclusions

- Administration of local lidocaine anesthesia is 30-40% less painful with the RPD as compared to the conventional syringe.
- Anesthesia administration time is significantly reduced.
- Local lidocaine anesthesia administered by the RPD is more effective than with a conventional syringe, presumably due to better anatomic placement and less trauma.
- The RPD is superior to the conventional syringe for the administration of local anesthesia.

From: J Vasc Interv Rad 2007, Abstract 377
How is the RPD Different than a Traditional Syringe?

- The RPD is designed to provide better control of the needle than any existing syringe device.
- The RPD is designed to provide superb vacuum control.
- The RPD can be used to both aspirate and inject with effortless transition.
- The RPD is designed to be operated with one hand so that the other hand can be used for other tasks during the procedure.
The RPD - Designed for Control

- The RPD is designed so aspiration and injection use the same finger motions and the strongest muscles of the hand - the flexors.

- The RPD is designed so that the stabilizing digits, the index and middle fingers, do not change position when transitioning from aspiration to injection.
Design Differences Between the RPD and Traditional Syringe

- The traditional syringe consists of one barrel and one plunger; in the aspiration phase the plunger-syringe complex becomes longer forcing the needle forward into patient tissues.

- The RPD because of its unique design does not become longer and does not force the needle forward, protecting patient tissues.
Components of the RPD vs. the Traditional Syringe

○ The traditional syringe has no reciprocating mechanism.

○ The RPD has a **reciprocating mechanism** connecting the two plungers. When the injection plunger is depressed the RPD injects; when the aspiration plunger is depressed, the RPD aspirates.

○ **The mechanical linkage of the RPD causes the aspiration and injection plungers to reversibly “reciprocate” with each other.**
Equipment for Thyroid FNA

- 1.5 inch 25 or 27 gauge needles.
- Glass slides, frosted one end, 1mm thickness
- Alcohol prep sponges.
- Alcohol bottles for immediate fixing of slides.
- Gloves
- Containers for cystic fluid collection
- Cytology lab slips with patient name, origin of sample, type of sample, date, tests to be performed.
- Lidocaine 1% or 2%, very important.
- Reciprocating procedure device (RPD) 5 ml or 10 ml for vacuum source.
Equipment for Thyroid FNA

- RPD
- 25 G Needles
- Lidocaine
Equipment for Thyroid FNA

- Histology Slides
- Alcohol Fixative
Prepare and Cycle RPD
Preparation for a Procedure with the RPD

- Remove the RPD from the sterile packaging.
- Press the plungers, one at a time, and cycle the RPD through several reciprocation cycles to assure smooth functioning.
- **DO NOT PRESS BOTH PLUNGERS AT THE SAME TIME - EXCESSIVE FORCE MAY DAMAGE THE PULLEY MECHANISM.**
- **DO NOT PULL PLUNGERS, ONLY PRESS.**
Remove RPD from Sterile Packaging
Cycling The RPD Through Several Cycles

Thumb moves alternatively from aspiration to injection plunger
2. Attach Needle to RPD and Use Appropriate Grip

- Attach needle or other device to needle fitting of RPD.
- Hold the RPD in 1-handed, 2-handed or trumpet grip.
- Press the larger plunger to inject.
- Press the smaller plunger to aspirate.
- Use the RPD in any procedure where a traditional syringe would be used.
1. Attach Needle to Needle Fitting
2. Hold RPD like a traditional syringe
3. Press Reciprocating Plungers to Aspirate or Inject
2. Holding the RPD

- **One-Handed Standard Grip** with RPD held between the index and middle fingers, and thumb operates the aspiration-injection plungers. The free hand is used for other tasks.

- **Two-Handed Standard Grip.** Like the One-Handed Standard Grip, but the free hand is used to further stabilize the RPD or direct needle.

- **Trumpet Grip-One-handed.** RPD held upside down, and index and middle fingers operate the aspiration-injection plungers like the keys of a trumpet. The free hand is used for other tasks.

- **Trumpet Grip-Two-handed.** Like the One-Handed Trumpet Grip, but the free hand is used to further stabilize the RPD or direct needle.
**Aspirate with RPD**
- The smaller plunger is depressed with the thumb
- Index and middle fingers on the finger flanges

**Inject with RPD**
- The larger plunger is depressed with the thumb
- Index and middle fingers on the finger flanges
To inject the large plunger is depressed with the index finger.

To aspirate the smaller plunger is depressed with the middle finger.

Used in certain anatomic situations.
Thyroid FNA with the RPD

- Position patient with operator on side of patient.
- Cover ultrasound transducer with sterile dressing.
- Wear Gloves.
- Ultrasound transducer transverse to lesion.
- Local anesthetic with RPD on thyroid capsule.
Localize Lesion with Ultrasound
Localize Lesion with Ultrasound
Anesthetize Thyroid Capsule
Local Anesthesia with the RPD

- We recommend a 1 or 1.5 inch 22 gauge needle for aspirating drugs such as lidocaine.
- Hold lidocaine vial with one hand, and RPD with other.
- Pressing aspirating plunger, aspirate lidocaine into RPD.
- Needle is dulled going through stopper and becomes more painful for patient. We recommend discarding aspiration needle, and switching to a fresh 25 gauge or 27 gauge needle of length appropriate for procedure.
3. Local Anesthesia with the RPD (cont).

- Insert anesthesia needle mounted on RPD into target tissue.
- Depress aspiration plunger of RPD and be certain there is no blood return into the needle hub, assuring extravascular positioning of needle tip.
- If there is no blood return, slowly and cautiously inject lidocaine by pressing the RPD injection plunger. Repeat.
1. Aspirate Lidocaine
2. Insert Needle
3. Aspirate for Blood Return before Injecting
4. If No Blood Returns, Inject Lidocaine
Insert Needle Tip into Lesion

US Transducer

Thyroid Lesion

25 or 27 gauge needle

5 ml or 10 ml RPD
Insert Needle Tip into Lesion

Adapted from Titton et al: AJR 2003;181:26-271.
Apply Vacuum with Needle in Lesion

Depression of RPD Aspiration Plunger

Needle directed Toward Target Lesion
The RPD for FNA

- Generation of vacuum is important for FNA.
- After the biopsy needle on the RPD is inserted into the target tissue, vacuum is generated by depressing the aspiration (smaller) plunger.
- The vacuum is maintained by keeping the aspiration plunger depressed as multiple needle passes through tissue are obtained.
4. General Instructions:

The RPD for FNA

- Prior to extracting the needle from the patient, the aspiration plunger is released, eliminating the vacuum and preventing the sample from being sucked into the barrel and trapped there.
1. Insertion of Biopsy Needle Into Target Tissue

2. Generation of Vacuum for FNA

3. Thumb Depressing Aspiration Plunger

4. Thumb Releases Plunger

Release of Vacuum

Multiple Needle Passes with Vacuum for FNA

After Vacuum Released Needle Can be removed from patient
Release Vacuum and Lesion

Release RPD Aspiration Plunger

Pull RPD and Needle From Lesion
5. Expelling FNA Sample Using the RPD

- After the FNA, the tissue sample may need to be expelled to a cytological slide or container.
- To accomplish this, the biopsy needle is removed.
- The aspiration plunger is depressed, putting air into the RPD barrel.
- The biopsy needle is reattached.
- The injection plunger is depressed, expelling the tissue sample for cytological analysis.
1. Remove Needle With FNA Sample

2. Fill RPD with Air
   - Air Enters Functional Barrel
   - Needle With Sample

3. Reattach FNA Needle to RPD
   - Functional Barrel Filled with Air

4. With Needle Attached, Expel FNA Sample
   - FNA Sample Expelled From Needle
   - Depression of Injection Plunger
Preparation of Cytologic Slides

1. Expel sample on Slide
2. Smear between slides
3. Immediately fix slides in alcohol
After Biopsy Completed

- Apply pressure to biopsy site.
- Apply plastic adhesive strip.
How Effective is FNA with the RPD?

- 83 patients with a thyroid nodule underwent either FNA with the RPD or a core biopsy.
- 51 patients under FNA with the RPD.
- 32 patients underwent core biopsy with a spring loaded core device.
- All samples were analyzed blindly by the cytopathologist.

How Effective is FNA with the RPD?

- The samples were classified as either diagnostic or inadequate-non-diagnostic, requiring an additional procedure.
- All suspicious or definitely malignant aspirates resulted in open surgery.
- Operating physicians rated ease of use, satisfaction, and effectiveness of the RPD for FNA.

RESULTS:
RPD FNA vs. Core Biopsy of Thyroid

- Diagnostic Biopsies: Core 81.5% vs. RCP 83.2%, P > 0.1
- Inadequate or Non-Diagnostic Sample: Core 18.5% vs. RCP 16.8%, P > 0.1
- Physician Satisfaction: Core 6.9±1.3 vs. RCP 8.2±1.2, P < 0.02

CONCLUSIONS:

RPD FNA vs. Core Biopsy of Thyroid

- FNA with the RPD is as effective as core biopsy for diagnosis of thyroid lesions.
- FNA with the RPD is easier to perform and safer than core biopsy of the thyroid.
- Operating physicians rated the RPD was superior for FNA of the thyroid.
- Based on this data, the practice group stopped using core biopsies of the thyroid and completely converted to FNA using the RPD.

Patents

- The patents for the RPD are owned by the University of New Mexico. The RPD is protected by patents in both the USA and other countries.

- The RPD is manufactured by AVANCA Medical Devices, Inc., 600 Central Ave SE, Suite 232, Albuquerque, NM, 87102 USA
  - www.AVANCAMedical.com
  - Tele: 505 243-4600
  - Fax: 505 243-4601
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