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*The following faculty report no relevant financial interests:* Dr John B Hanks.
Fine-Needle Aspiration Biopsy of Neck Masses: Tips for Increasing Diagnostic Yield

Diagnostic interventions for neck masses seem to focus on fine-needle aspiration (FNA). FNA has helped in the evaluation of neck masses, breast masses, or other intraoperative masses. For thyroid masses, the surgeon must know (1) where FNA should be performed in the workup algorithm and (2) the specifics of using the technique. For head and neck masses, use an algorithm that starts with the basics: get a good history and physical exam, and demonstrate your suspicion as to where you need to go in your algorithm. Generally, imaging is obtained next, which is ultrasound (US) in our office. With imaging, you may be able to differentiate cystic versus solid lesions.

**FNA vs FNAB:** When doctors first started performing FNA in the office, they were aspirating cystic lesions. By using either US guidance or palpation, a needle was placed in the lesion, the lesion was aspirated, and the fluid sample was submitted for cytology. FNA biopsy (FNAB) has a different connotation than FNA. If lesions are solid or suspicious, then you want to get a tissue sample to aid in further diagnosis (FNAB) rather than aspirating something to treat it or delineate its nature (FNA). Like FNA, FNAB can be done in the office.

**Technique:** FNAB must be performed properly. Work very closely with your cytopathologists and have a person standing by your side when you do this biopsy in order to fix it appropriately. Fixation is an extremely important part of this process. When a palpable lesion is biopsied, we usually use a 5- or 10-mL aspirating syringe with a 22- or 26-gauge needle. Insert the needles into the lesion, then apply suction to the syringe as you pass it into the lesion a couple of times. Then, let the suction off, remove the needle from the lesion, smear the contents of the aspiration biopsy onto a slide, and get it fixed immediately. FNAB looks at cellular morphology but not architecture. In thyroid pathology, looking at certain cells can be diagnostic, but making the whole spectrum of cancer diagnoses may not be possible with just FNAB.

**Needle & Syringe:** For FNAB, a 5- or 10-mL syringe with a 22-gauge needle is fine. Do not use a needle with a large bore as these may cause a hematoma. Remember, FNAB can set off some local hemorrhage, which would make later surgery a little more interesting, particularly in the thyroid area.

**Suction:** Some cytopathologists use an automated suction device to limit the suction on the syringe. I have no direct experience with these devices. Remember, no suction should be applied before the needle is inserted into the lesion. Suction should be applied only while passing the needle within the lesion. Suction should be removed as the needle is withdrawn so that the sample is not sucked back into the barrel of the syringe where it becomes irretrievable.

**Thyroid Nodules: When to Avoid FNA and Managing Intermediate-Grade Nodules**

Not all thyroid lesions undergo FNA.

**Previous FNA:** First, FNA of a neck lesion is not a comfortable procedure for a patient. Some patients have previously undergone aspiration of a nodule, which caused a little hematoma and pain. Now they return for another biopsy because imaging results are somewhat confusing or suspicious. These patients may directly state, “I am not having that again. I would rather have it out.” This patient input is important for making the final decision.

**Highly Suspicious:** New guidelines have established categories of suspicion for US results on thyroid nodules. Therefore, if the lesion appears highly suspicious (increased risk of cancer) on US, I offer these patients the opportunity to forgo FNA and proceed directly to lobectomy or thyroidectomy. For example, a 45-year-old patient who has had previous radiation exposure now has a highly suspicious lesion on US. You know that if you do FNA and the cytology report comes back anything less than highly suspicious, you are still going to be removing the lesion. So before proceeding with FNA, I will explain this situation to the patient and offer them the chance to go directly to surgery.
Intermediate-Grade Nodules: The Bethesda system for reporting thyroid FNA assigns the results to various categories that are associated with cancer risk. Intermediate-grade lesions previously meant taking the patient to surgery. However, the patient, usually from a referring doctor, generally has some thoughts and deserves input into the decision. Therefore, before proceeding, I consider all these factors. Example 1: If the patient has a thyroid nodule with a Bethesda category of “medium grade” (suspicious or moderately suspicious for cancer), the likelihood that the lesion is benign is 50% or more. Now the patient’s history becomes important. If this is an elderly person with a previous history of radiation exposure or a patient with a familial predisposition to thyroid cancer, then I would discuss the risk factors with the patient. Then we can discuss managing the nodule via observation or removal. At that time, the patient has some input into making the decision. Example 2: The patient is a young lady or a college student who has an intermediate-grade nodule that does not look overly suspicious but has a couple of atypical cells. The cancers associated with these lesions are not usually bad-acting cancers. One option is to wait 6 months and repeat the imaging. If the nodule becomes bothersome because it will not go away, we can schedule an elective lobectomy or, if needed, a total thyroidectomy. The patient can give their input, which figures into the final decision for how to proceed.

High-Grade Lesions: If the FNA cytology report on a thyroid nodule indicates a high-grade lesion (high risk for cancer), then it is time to consider a thyroidectomy.

Thyroid Nodules: Role of Gene Profiles in Decision Making

On the cytology report of FNA of thyroid nodules, the Bethesda diagnostic categories III and IV are considered medium-grade thyroid nodules that most likely will be benign, although this is not a certainty. Deciding whether to proceed with observation or thyroidectomy can be difficult in these cases. Some physicians are now testing the gene profile of these lesions to help them decide how best to proceed. Gene Profiles: Practicing physicians and surgeons need to be aware of gene profiling. Gene profiling provides another piece of information for the decision-making process. It is especially useful if it helps patients make a decision. Certain genes or gene profiles are more suggestive of malignancy and perhaps some more aggressive kinds of well-differentiated cancers. Two good examples are \textit{K-ras} and \textit{BRAF} mutations. I think that gene profiling is an option if the patient really wants it. Although I am unsure of the expense involved in genetic testing, I believe that patients need to know this information as well. I do not believe that gene profile results offer anything absolutely confirmative, but these data could be added to the other risk factors and help us in making the decision about how best to proceed. I believe gene profiling is an important area in clinical research. I also believe there will be future developments that may help more with the decision-making process. However, the technology continues to evolve at this time.

Cervical Lymph Nodes: Open Biopsy Tips, Technique

Cervical node biopsies (usually posterior neck or supraclavicular) occasionally appear on our operative schedule. The volume of open cervical biopsies has decreased significantly since the introduction of FNA. Nonetheless, surgeons occasionally are asked to perform cervical node biopsies, usually from either infectious disease physicians who need a tissue culture or from oncologists who are performing a workup on a lymphoma patient. Technique Highlights: When performing open biopsy of a cervical node, first plan carefully. Inform the cytopathologists and/or your infectious disease people. Importantly, you will want to do 2 things during these biopsies. (1) You want to keep fresh tissue as part of the biopsy, even for touch preps or for aerobic and anaerobic cultures if needed. (2) You want to get proper handling of the tissue...
for permanent section. Again, let pathology and/or your laboratories know that what you are doing. This is not something you do in the middle of the night.

**Technique Tips:** When performing cervical node biopsies, be very careful is a good plan. Usually you are given a palpable lesion to biopsy, so you would cut down to the node and then stay in the plane of the lymph node. If you are doing a malignancy workup, you want to keep your planes fairly well established. If you are getting a biopsy for an infectious disease workup, then you can sometimes take just part of the gland without getting really deep in the neck, thus avoiding the trouble areas near the subclavian vein and major vascular structures. I always do those in the operating room (OR): this is not a clinic procedure. You can use balanced anesthesia to relax everyone. I have used ultrasound just to double-check the local structures around the lymph node to make sure I really have an idea where major vascular structures are located. Stay in a plane that you are comfortable with right around the lymph node or around the area that you are biopsying — do not take more than you need. Most pathologists need about a cubic centimeter of tissue to get all the things that we mentioned.

**Modified Neck Dissections: General Approaches for Safe, Efficient Procedures**

Modified neck dissections are being performed by otolaryngologists with increasing frequency, although general surgeons and otolaryngologists sometimes work together.

**Modified RNDs:** For modified radical neck dissections (RNDs), you want to clear out the lymphatic or fibrofatty tissue in the lateral neck. It involves at least Levels II, III, and IV, and extends into the posterior triangle in Level V. Be aware of vital structures. Classic otolaryngology texts generally show options to transect or remove the sternocleidomastoid (SCM) with or without taking the internal jugular (IJ) vein. Removing these structures depends on the bulkiness of the metastatic lymph nodes in the area.

**General Approaches:** You can extend a cervical incision and stay fairly low but, to get fairly high up into level II, you need a more lateral cervical incision. You want to get access deep to the SCM and stay anterior to the carotid sheath. Start your incision low, just above the clavicle, and get to the deep lateral border in the posterior triangle to where you are down on the prevertebral fascia where the phrenic nerve is on the anterior scalene muscle. On the left side of the neck, be very careful about the thoracic duct as it enters at the subclavian vein–IJ junction. Your goal is to work superficially and remove all lymphatic tissue between the superficial and prevertebral fascia, leaving the carotid artery and visualizing the vagus, phrenic, and spinal accessory nerves. Whether you take the jugular vein depends on the bulkiness of the involved tissue. As you work medially, avoid damage to the cervical sympathetic chain. As you move more superiorly, you will encounter the spinal accessory nerve, which is deep and lateral to the SCM, and it runs into the posterior triangle. As you proceed more cephalad, you enter the area of the hypoglossal nerve where it crosses anteriorly to the internal carotid. You can usually stop at the top of this region, but if you have submental lymph nodes, you can get into Level I. Endocrine modified radical neck dissections probably require that the surgeon get up into Level II, probably at the top near the hypoglossal nerve. For the thyroids, you will be in low Levels II, III, and IV and in the posterior triangle.

**Sternocleidomastoid:** It would be very unusual to need to take the SCM with metastatic thyroid cancer. Some texts show that you can unhook it off the clavicular head and then reattach it, but usually we work around it and retract it out of the way. If you unhook it or transect it from the clavicular heads, you get great exposure and can better visualize the spinal accessory nerve. But if you work around the SCM, be careful as you retract it to avoid putting undue tension on it which could tear the spinal accessory nerve. If you injure the sensory branches of the spinal accessory nerve, this results in a sensory deficit as well as some shoulder movement issues and weakness.
Modified Neck Dissections: Central Dissection During Total Thyroidectomy

Modified neck dissections may include a central dissection (Level VI). For example, I perform a total thyroidectomy for papillary carcinoma with bulky extension in Levels III and IV. I would also probably clean out the central compartment in Level VI, which is in the operative field. As a result, the patient would be getting a total thyroidectomy and also be cleaned out in Level VI. This would likely be performed on the contralateral side as well, but this depends on how aggressive the cancer appears. Unless things were really clean on the contralateral side, I would probably be tempted to clean that out as well. When a central dissection is performed with a total thyroidectomy, you want to make sure you see the nerves, that they are intact, and that you do not damage them. In addition, you want to be careful of the parathyroids.

My Experience: Personally, if the patient has enough bulky disease that I am dissecting the central compartment, then I would probably clean out the better part of the Level VI on the contralateral side as part of the surgery. At a minimum, I would clean out Level VI very well on the ipsilateral side if everything looked absolutely okay on the contralateral side. Another consideration to avoid the normal appearing contralateral side would be the potential of devascularizing the parathyroid during the dissection. I prefer not to leave anything suspicious in Level VI.

Parotid Gland: Superficial Parotidectomy

As a general rule, a parotid lesion needs to be appropriately worked up before deciding to go to surgery. For a standard superficial parotidectomy, the most cosmetic incision is a preauricular one that comes around the anterior border of the ear and extends down to the angle of the jaw. As you lift up your flaps, you will get into the parotid fascia fairly quickly. You want to avoid damaging the facial nerve, which separates the superficial from the deep lobe. You can generally locate the facial nerve medially as it comes out near the mastoid process. As you go through the fascia medially or close to the ear, you want to be very careful and find that facial nerve — the trunk of the nerve is usually right there. Then you can roll the superficial parotid up as you dissect out the branches of the facial nerve. The superficial parotid rolls up fairly easily, allowing you to do a superficial parotidectomy, leaving the facial nerve intact and the deep lobe underneath the branches.

Greater Auricular Nerve: The accessory branch of the greater auricular nerve comes up inferiorly into the operative region just off the border of the sternocleidomastoid. Some laryngology texts talk about removing this branch of the greater auricular nerve, which will leave the patient with some numbness around their ear. I would probably try to avoid this step, but I do not have a great deal of experience with superficial parotidectomies.

Thyroidectomy: Intraoperative Nerve Monitoring

During thyroidectomy, intraoperative nerve monitoring is used to avoid nerve injury, most commonly to the recurrent laryngeal nerve. A lot of literature is being published about the use of nerve monitoring and it use for monitoring the recurrent laryngeal nerve. Additionally, some literature describes monitoring the external branch of the superior laryngeal nerve. Throughout my practice, I did not use a lot of nerve monitoring until about 3 or 4 years ago. Originally, I was fortunate enough to train with Dr. Sam Wells who taught me that, when doing thyroid surgery, you located the nerve, you knew where it was, and you took care of it. This was the classic approach of “find it; know where it is; and know where it is when you do your dissection.” During my career, that stood me on pretty solid ground. I believe that intraoperative nerve monitoring is a help for anyone who has a thyroid practice that includes big bulky tumors or recurrent neck surgeries.
Techniques: A number of different techniques exist for intraoperative nerve monitoring. We use the endotracheal electrodes and the signal monitor that beeps when you use the intraoperative probe. A number of other different things are described in the literature. If you want to use nerve monitoring, my advice is to select one of those techniques and become familiar with it.

Re-Do Cases: I think intraoperative nerve monitoring is a help in difficult re-do cases. I have a new partner that trained with it and brought it with him when he started his practice. He found it very helpful with some of the re-do procedures, especially as he was gaining experience. Surgeons who want to do thyroid surgery should know about intraoperative nerve monitoring, be familiar with it, and then use his/her own comfort level in using it.

There is no good literature that comes out that says that over a large number of cases or a large number of experiences that it is absolutely preferable to visualization of the nerve. So I think it is experience, and you know your capability of being familiar with the technique. So it is a developing technique, and maybe in 5 years, things will change, but right now I would just say to somebody that was coming along, learn to know where the nerve is and visualize it but also be familiar with the techniques and watch it evolve.

Neck Dissection: Right Non-Recurrent Laryngeal Nerve

Case: A patient with a large thyroid tumor is scheduled for surgery. Preoperative CTs are obtained, and a retroesophageal right subclavian artery is seen. As the operating surgeon, what does this US finding indicate to you?

NRLN: A retroesophageal right subclavian artery occurs almost always with a right non-recurrent laryngeal nerve (NRLN). This means that nerve is coming from a different direction: it is coming directly from the vagus and crosses the field at right angles, whereas the normal nerve would be found in the tracheoesophageal groove. Now this does not mean that all thyroidectomy patients need preop CT scans to check for this anatomic variant. Some of these variants may well be seen on either office US or immediate preoperative US. If the right subclavian artery has its normal junction with the innominate artery, then you know that the recurrent laryngeal nerve will probably be normal. But, if US shows that the right subclavian artery dives, like it is going behind the esophagus, then be suspicious of an NRLN. This right-sided anatomic variant is seen in only about 1% of patients, but if you have a large practice and do >100 thyroid surgeries/year, you are going to come across a NRLN. As surgeons, we must realize that, if a nerve can be in an entirely different spot, we must be careful about how we perform surgery on the right side of the neck. An NRLN on the left side of the neck is almost unheard of. Perhaps you might find a left NRLN in cases of situs inversus, but these are extremely unusual variants on the left side.

Modified Radical Neck Surgery: Managing Thoracic Duct Leaks

Case: A patient is taken to surgery to resect a large bulky thyroid tumor on the left side. The surgeon performs a modified radical neck dissection and cleans out the lateral and central compartments before placing a drain on the ipsilateral side. On postoperative day 1, the drainage is serous and the volume is not very high. On postop day 2, the drainage looks like chyle. How should this be managed?

Recommendation: This is a chyle leak, because the surgery was performed on the left side of the neck, this drainage is most likely the result of a thoracic duct leak. First, I would say that it would have been nice to get a hint of a potential problem intraoperatively. But if not, it is reasonable to say that we have a thoracic duct leak. (1) If the chyle appears very soon after the surgery, like the next day, and if we believe the leak to be repairable (which it is probably not), then we might consider going back in,
locating the leaking thoracic duct, and ligating it. This approach is associated with a low success rate. If the chyle drainage first appears beyond postop day 1, then I would not attempt the ligation.

Classic Approach: If the chyle drainage first appears beyond postop day 1, then the classic teaching is to wait it out -- do not pull the drain and wait to see if the leak will resolve either by a low-fat diet or by watchful waiting.

Embolization: For persistent thoracic duct leaks, some interventional radiologists can perform thoracic duct embolization (TDE) to occlude the leak.

Main Teaching Points: A chyle leak that remains open is a challenging clinical situation. First, establish good drainage. Hopefully that can be associated with conservative management using a low-fat diet, which is requires patient compliance (low-fat diets are not much fun for patients). If all goes well, scarring will heal the leak and the drainage will cease.

Prophylactic Central Neck Dissections for Papillary Thyroid Cancer

One challenging topic is whether a prophylactic central neck dissection is necessary for managing papillary thyroid cancer. Ten or 15 years ago, some patients with papillary thyroid cancer would have clinically and, eventually, ultrasonographically negative lymph nodes. On indepth microscopic evaluation of the lymph nodes, metastatic papillary cancer cells were found 20% to 40% of the time. Because of the metastatic potential despite a negative clinical presentation, the thought was that perhaps all lymph nodes should be cleared out in the central compartment. As US came into more frequent use and the technology become increasingly more capable of seeing more detail, these small deposits of metastatic cells were found again. However, after reviewing the data, I am not convinced that I have seen any long-range results showing an associated decrease in mortality. Remember, papillary carcinoma of the thyroid should be associated, in the appropriate stages, with very good mortality results. Therefore, I have never really been convinced that prophylactic lymph node dissection was necessary for papillary thyroid cancer. Nonetheless, anyone going into thyroid surgery needs to be aware of a couple of different circumstances.

Case 1: On physical exam and ultrasound, the findings are negative. However, at surgery, the lymph nodes appear enlarged. You send them off, and pathology shows that the nodal tissue is replaced with papillary cancer. In this situation, I recommend removing the nodes located in the central compartment. Case 2: At one time, referring endocrinologists would request a good dissection to evaluate lymph nodes on the side of the tumor. In this situation, the surgeon and patient must discuss the importance of minimizing damage to the nerve and parathyroids. This practice by referring endocrinologists is not very common today. But if I were asked to consider this option, I would respond that I feel comfortable with it but remind the patient that the procedure is associated with an increased morbidity rate.

Teaching Point: I am not an advocate of performing prophylactic lymph node dissections in the central compartment for papillary thyroid cancer that does not suggest metastatic potential on clinical staging.

Why the Central Compartment? Why is the focus of these prophylactic dissections on the central compartment but not the lateral compartments? The lateral compartments contain some high-rent district, so morbidity is of concern when this area undergoes dissection. The interest in working with Level VI was that the operative field was right there in the central compartment — the dissection would be convenient. However, extending the dissection into Levels II, III, and IV and diving down under the sternocleidomastoid requires an extension of the incision, making it more of an oncology incision rather than a cosmetic incision. Therefore, the lateral compartments are generally not the focus of these prophylactic dissections.
Medullary Thyroid Cancer: Surgical Approaches to Hereditary, Sporadic MTC

Medullary thyroid cancers (MTCs) can be subdivided into hereditary MTC and sporadic MTC. **Hereditary MTC:** Hereditary MTCs account for only 20% to 25% of all hereditary MTCs. The workup of hereditary MTCs requires a workup of the family and a workup for the syndrome, including pheochromocytoma, which needs to be cleared before operating on the patient. Part of the workup involves the patient’s genetic predisposition because some of the associated genes are nastier than others. Therefore, there are high-risk and moderate-risk genes for extensive carcinoma, particularly with the multiple endocrine neoplasia, type 2B (MEN2B) genes. Standard treatment generally involves thyroidectomy and central lymph node dissection. The St. Louis people have a lot of experience with the pediatric cases, and they are diagnosing them earlier using RET oncogene delineations. For some pediatric cases with a high-risk genetic predisposition, MTC is being detected very early — they only have the gene plus elevated calcitonin levels. These cases undergo thyroidectomy without extensive lymph node sectioning in order to maintain the integrity of the parathyroids. In addition, those cases that are seen very, very early are just clear cell hyperplasia without even seeing the malignancy. So they have been shying away from removing what do not look like involved lymph nodes. **Sporadic MTC:** Sporadic MTCs make up the bulk of MTCs. In new recommendations from the National Institutes of Health, cases of suspected sporadic MTC should be assessed via imaging and measuring the calcitonin levels. The calcitonin levels are becoming a guide to surgery. For example, for sporadic MTC cases with no other evidence of lymph node involvement (or any other clinical lymph node disease) and a basal calcitonin level <40 pg/mL, treatment generally involves thyroidectomy and a central lymph node dissection. But if the calcitonin levels are between 40 and 200 pg/mL, a central lymph node dissection plus an ipsilateral neck dissection should be considered. If the calcitonin level is >200 pg/mL, assume that MTC is metastatic and consider a central lymph node dissection plus a bilateral neck dissection. Therefore, for patients with sporadic MTC, serum calcitonin levels must always be measured preoperatively. Generally, these patients have an FNA suggestive of a neuroendocrine tumor and they also have an elevated calcitonin level. Despite the elevated calcitonin levels, I would probably double-check these patients to make sure that it is not multiple endocrine neoplasia (hereditary MTC). Continue looking for the possibility of pheochromocytoma before finally settling on a diagnosis of sporadic MTC.

**Surgical Management of Thyroglossal Duct Cysts**

Patients with thyroglossal duct cysts are generally seen by pediatric otolaryngologists. These are cystic or nodular lesions usually in the midline. The classic presentation is that it will move when the patient swallows because it is attached to the hyoid bone. Occasionally, general surgeons will see thyroglossal duct cysts either for patients with a pediatric bent or for patients who may have previously undergone surgery for the same problem. Thyroglossal duct cysts should not recur if operated on correctly the first time. **Technique:** The correct technique for removing a thyroglossal duct cyst includes taking out all the midline tissue (the anlage that goes down the midline) to the isthmus and then up to and including the middle part of the hyoid bone. This is called a Sistrunk procedure. Therefore, all tissue cystic midline tissue should be removed, and the surgeon should be prepared to excise its attachment onto the hyoid bone. If the cysts extends even further up and attaches to the base of the tongue, the surgeon must be prepared to remove the cyst in its entirety.