

Endoscopic ultrasound-guided fine needle aspiration: The wet suction technique

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ABSTRACT

Endoscopic ultrasound-guided fine needle aspiration (EUS-FNA) has become a fundamental tool in obtaining cytopathological diagnosis of pancreatic tumors. When sampling solid lesions of the pancreas, the endosonographer can use two suction techniques to enhance tissue acquisition; the dry and the wet suction techniques. The standard dry suction technique relies on applying negative pressure suction on the proximal end of the needle after the stylet is removed with a pre-vacuum syringe. The wet suction technique relies on pre-flushing the needle with saline to replace the column of air with fluid followed by aspiration the proximal end by using a prefilled syringe with saline. A new modified wet suction technique (hybrid suction technique) relies on preloading the needle with saline, but having continuous negative pressure with a pre-vacuum syringe to avoid manual intermittent suction. Tissue acquisition can be enhanced by applying fluid dynamic principles to the current aspiration techniques, such as the column of water used in the needle of the wet technique. In this review, we will focus on EUS-FNA using the wet suction technique for sampling of pancreatic solid lesions.

Key words: Endoscopic ultrasound (EUS), hybrid suction technique, wet suction technique

INTRODUCTION

Endoscopic ultrasound (EUS) has revolutionized the field of advanced endoscopy since it was first introduced in the early 1980s. Many indications, including staging and diagnosis of gastrointestinal and lung malignancies; evaluation of subepithelial lesions and pancreatic cysts; and diagnoses of chronic pancreatitis and choledocholithiasis, among others, have been established, and current studies for other potential indications are ongoing.^[1] EUS-guided fine-needle aspiration (FNA), that is, EUS-FNA has become a fundamental tool in

obtaining a cytopathological diagnosis. Several variables have been studied to optimize outcomes of EUS-FNA, and these include the skill and experience of the endosonographer and the cytopathologist, the diameter of the FNA needle, the use of suction and stylet, the number of FNA passes, and the presence of onsite cytopathology assessment.^[2,3] When approaching solid malignant lesions of the pancreas, two suction techniques have been developed: The dry suction technique and the

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wet suction technique. Currently there is no standardized EUS-FNA suction technique for performing aspiration of solid lesions. In this review, we will concentrate on EUS-FNA using the wet suction technique in encountering pancreatic solid lesions.

WET SUCTION TECHNIQUE

The approach for EUS-FNA of pancreatic lesions depends on the location, size, and characteristics of the lesion. Once the lesion is localized, the next step is to determine the type of needle to use. Whether a 19G, 22G, or 25G needle is used will depend mostly on the location of the lesion, the type of lesion, and the endosonographer's preference.^[4] Guidance as to what needle should be used is beyond the scope of this review. After the type of needle has been determined and the lesion has been punctured, the suction technique is chosen. The role of suction was proposed to improve the diagnostic yield during FNA by holding tissue against the cutting edge of the needle as it is moved back and forth from the lesion and "aspirating" up the cells.

Current standard suction techniques for EUS-FNA sampling in clinical practice rely on applying negative pressure suction on an empty needle after the stylet is removed with a 10 cc prevacuum syringe while the needle is moved to and fro in the lesion (dry technique). However, this technique has associated flaws such as increased bloodiness, which may impact the quality of the specimen.^[5,6] A more recent technique was developed with the aim to improve the quality of the aspirate, the so-called wet technique.

In the wet suction technique, prior to puncturing the lesion, the stylet is removed and the needle is preflushed with 5 mL of saline to replace the column of air with fluid. A 10 cc syringe prefilled with 3 mL of normal saline is left attached to the proximal port and later used for aspiration after puncturing the lesion. Once the needle is passed into the lesion, the needle is moved to and fro 3 times followed by maximal-strength suction to obtain the aspirate. We recommend that this maneuver be repeated 4 times for a total of 12 to and fro. Once the needle is removed from the lesion, the aspirate is delivered onto a slide by air flushing.

Although there are limited data regarding the ideal technique for expression of FNA aspirates, we recommend air flushing as it is more efficient and safer, because it decreases procedure time and

averts the risk of accidental needle stick injury while reinserting the stylet. A recent randomized controlled trial comparing the use of a stylet and that of air flushing during expression of aspirates showed that there was no difference between the two groups with regard to the number of diagnostic samples, overall accuracy, cellularity, and air-drying artifact, although the bloodiness was in fact greater in the group where the stylet was reinserted to express the aspirate.^[6]

A recent, blinded randomized trial by Attam *et al.* compared the wet technique with the dry technique.^[7] One hundred seventeen patients were randomized to "wet" versus "dry" technique for the first pass, subsequent passes being made in alternating fashion between the two techniques. Aspirates were then assessed for adequacy by an onsite cytopathologist, and cell blocks were interpreted by expert cytopathologists blinded to the FNA technique. Cellularity and hemorrhage of the cell-block specimen were graded according to a validated scale (0-3). The results revealed that the wet technique yielded a significantly higher cellularity compared to the dry technique (1.82 *vs.* 1.45; $P < 0.0003$) and a significantly better diagnostic yield compared to the dry technique (85.5% *vs.* 75.2%; $P < 0.035$). No difference in the amount of hemorrhage was reported.

The reasoning behind a column of fluid yielding a better sample than a column of air while applying negative pressure was explained nicely by a proof-of-concept study performed by Berzosa *et al.*, where they described how a column of water enhances tissue aspiration (wet technique) as compared to the dry technique.^[8] EUS-FNA tissue acquisition can be enhanced by applying fluid dynamic principles to current aspiration techniques. This is based on the principle that water is a less compressible fluid compared to air. Therefore, the volume of vacuum enforced to the distal tip of the needle could be enhanced when the EUS needle is filled with a continuous column of water (wet technique). They compared the effect on tissue aspiration between wet (water-filled) and dry (air-filled) techniques when using a 22G EUS needle. A three-dimensional (3D) computational fluid dynamic (CFD) model was used. A model with tetrahedral elements with five boundary layers was meshed. The tissue material property was assumed to be glycerol (a highly viscous material). The needle was defined as either water or air. Following the simulation after 0.1 s, the results were compared between air-tissue and water-tissue conditions. Volume

of tissue aspirate was calculated by the difference of volume aspirate at 0.1 s minus volume of tissue aspirate at 0 s. The needle filled with water aspirated the tissue for a much longer distance than the needle filled with air for the same simulation time of 0.1 s [Figure 1]. The volume of tissue aspirated was 5.6 times greater in the wet technique compared to the dry technique. It was concluded by CFD that a water-filled needle was superior to an air-filled needle as it allows faster aspiration of material into the distal end of the needle.

MODIFIED WET SUCTION TECHNIQUE (THE HYBRID SUCTION TECHNIQUE)

Based on the principle that preloading a needle with a noncompressible fluid might enhance tissue aspiration by increasing the volume of vacuum enforced to the distal tip of the needle, a hybrid technique was developed, which is more of a modified wet technique. The hybrid technique consists of preparing the needle as with the wet technique but applying suction as with the dry technique. In other words, the hybrid technique has the advantage of having a column of fluid in the needle but having continuous negative pressure application with a 10 cc prevacuum syringe. This avoids manual suction of the syringe, as performed in the wet technique, while sampling a lesion.

A recent abstract presented at digestive disease week (DDW) 2014 was of a single-center pilot study by

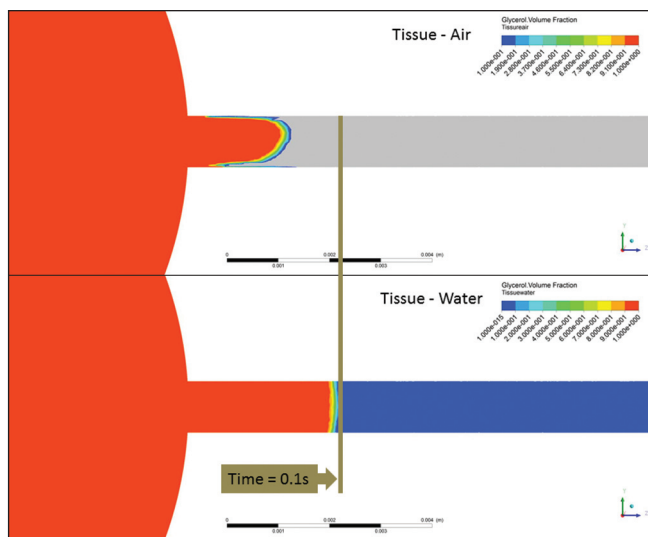


Figure 1. CFD model comparing volume of tissue aspirate between air-filled and water-filled needles in 0.1 s

Berzosa *et al.*, which was performed in 15 patients with solid lesions comparing the wet, hybrid, and dry suction techniques of EUS-FNA. The aim was to determine the sample adequacy to provide a final pathological diagnosis, the volume of aspirated material, and the diagnostic yield (malignant or nonmalignant) for each technique.^{19]} Using a 22G needle, each lesion was sampled 3 times (alternating between techniques) during the same EUS. For sample adequacy, there was no significant difference between hybrid, wet, and dry techniques (87%, 87%, and 67%, respectively). For total volume aspirate, both hybrid and wet techniques provided more tissue aspirate ($1.5 \text{ mL} \pm 0.75$ and $1.4 \text{ mL} \pm 0.75$, respectively) over the dry technique, but only the hybrid was significant [Figure 2]; there was no difference between hybrid or wet techniques. For the diagnostic yield, there was no statistical significant difference between techniques (hybrid 100%, wet 92%, dry 90%). It was concluded that the hybrid

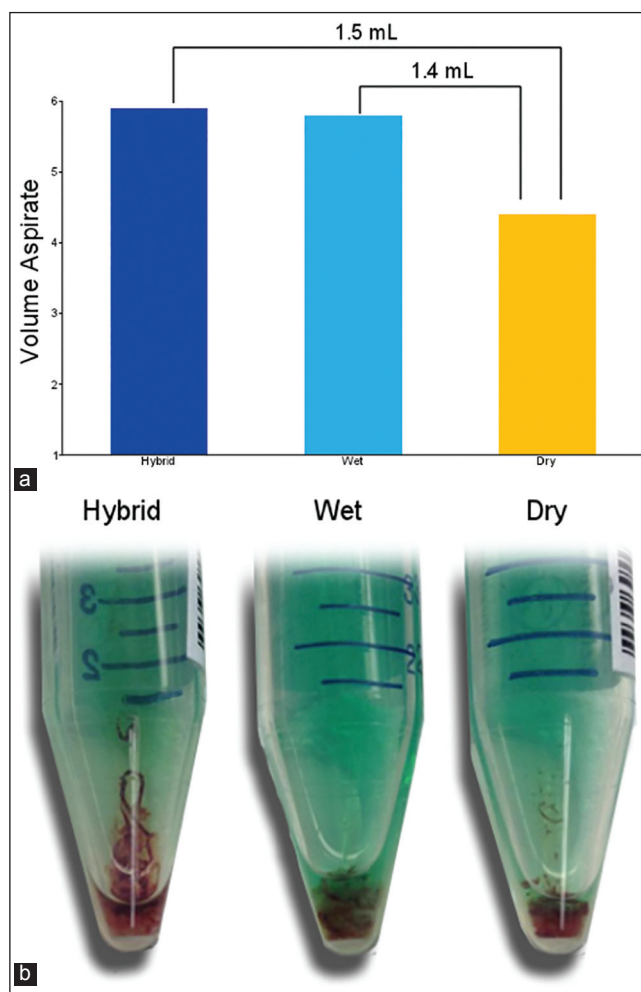


Figure 2. (a) Comparison of the total volume of aspirate between the hybrid, wet, and dry techniques (b) FNA specimens from the hybrid, wet, and dry techniques

technique provides a larger amount of volume aspirate compared to the dry technique, and for both sample adequacy and final diagnosis, there was a non-significant tendency in favor of pre-filling the needle with normal saline (hybrid and wet) compared to a standard (dry) technique, perhaps not detected in this underpowered pilot study.

Recommendation

In our clinical practice, we favor the modified wet suction technique (hybrid suction technique) over the standard wet suction and dry suction techniques, due to its simplicity and efficiency. Further studies are necessary to evaluate if this simple and inexpensive modification of the wet technique can improve the diagnostic yield of EUS-FNA. In the meantime, we recommend the use of the wet suction technique over the dry suction technique.

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Conflicts of interest

There are no conflicts of interest.

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