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SHARMAS' TECHNIQUE OF THORACENTESIS: A THEORETICAL MODEL OF A NOVEL TECHNIQUE

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ABSTRACT
Introduction: Pleural effusion is characterized by the collection of excess fluid within the pleural space caused by different etiologies. Thoracentesis is done as diagnostic or therapeutic intervention. **Challenges**: Iatrogenic pneumothorax is one of the complications of thoracentesis, which can occur due to the air entry in the intra-pleural space through the puncture site during or after thoracentesis, or through the puncture of lung parenchyma. This complication is further increased in low BMI and underweight patients. **Methods**: A theoretical model of a novel technique of thoracentesis, hereafter will be referred as *Sharmas' Technique of Thoracentesis* is explained. This model of thoracentesis also includes a novel pulling and sliding thumb technique, and is further explained. **Benefits**: Using *Sharmas' technique of Thoracentesis*, the incidence of iatrogenic pneumothorax should be hypothetically reduced compared to the conventional methods of thoracentesis.

KEYWORDS: Iatrogenic Pneumothorax, Pleural effusion, Pulling and Sliding Thumb Technique.

INTRODUCTION
Pleural effusion is defined as an excessive collection of pleural fluid in the pleural cavity.[1] It is caused by many different underlying diseases. Diagnostic and therapeutic interventions of pleural effusion include closed needle pleural fluid aspiration, also known as Thoracentesis as the treatment is tailored according to the underlying cause.[2]

CHALLENGES
One of the complications of thoracentesis is iatrogenic pneumothorax.[3] A meta-analysis of 24 separate studies with 6605 thoracenteses reported that iatrogenic pneumothorax was developed in 6.0% of thoracenteses, and 1/3rd of the pneumothoraces required intercostal tube insertion.[4]

This complication is further accentuated in old age, low BMI and cachexic patients as was reported in a study in which underweight patients (BMI <18.5 kg/m^2) were three times more prone to have an iatrogenic pneumothorax (p=0.02) than normal-weight patients.[5]

Ultrasound-guided thoracentesis reduces the rate of complications.[6] However, ultrasound imaging alone is not sufficient to reduce iatrogenic complications.[7]

Gordon CE et al. compared the effect of ultrasonography-guided thoracenteses in 16 cohorts with un-guided thoracentesis in 14 cohorts, and the percentage of iatrogenic pneumothorax was 4.0% and 9.3% (P=0.001), respectively.[4]

PATHOPHYSIOLOGY
Air can enter the intra-pleural space through communication from the chest wall (i.e. from the puncture site during or after thoracentesis) or through the lung parenchyma across the visceral pleura.[8] In patients with loss of subcutaneous fat, muscle mass and thin chest wall, the rate of development of the iatrogenic pneumothorax is increased as was reported in univariate analysis, in which weight and BMI were found to be significantly lower in patients who developed a pneumothorax (P<0.001).[9]

RESEARCH GAP
The literature is limited to comparative studies of the development of iatrogenic pneumothorax in the conventional method of thoracentesis with or without ultrasonography guidance. A different technique of thoracentesis has not been developed, performed and evaluated.

AIMS AND OBJECTIVES

We aim to develop a novel technique of thoracentesis (hereafter referred to as *Sharmas' Technique of Thoracentesis*) with an objective to decrease the incidence of iatrogenic pneumothorax.

MATERIALS

1. Local anaesthetic agent (5-10 mL of 1% lidocaine)
2. 10 ml and 20 or 50 ml syringes or thoracentesis needle with a plastic catheter
3. 25-gauge needle and 16, 18 or 20 gauge needles.
4. Tri-way stopcock
5. Drainage tube and Container
6. Antiseptic solution, drapes, and gloves.
7. Gauge and other dressing materials

METHOD

1. Make the patient sit upright and lean 20 - 30° forward with arms supported or recumbent or supine thoracentesis position.
2. Localize the pleural fluid with the help of clinical examinations or radiological method(s) (e.g. ultrasonography), and mark the site as a needle insertion point using a marker (Fig 1).

Fig 1: Site marked for needle insertion. The vertical straight line is drawn for illustration purpose only.

3. Localize the upper edge of the lower rib in the intercostal space to avoid the injury of the neurovascular bundle.
4. Prepare and drape the needle insertion point and the area around it.
5. Take an anaesthetic agent in a syringe with a small-bore needle, preferably 25 gauge. Pierce the needle perpendicular to the skin and inject superficially and then deeper in different layers of the chest wall, including skin, subcutaneous tissue, muscle layers and parietal pleura; until you reach the pleural space. Infiltration of the parietal pleura is crucial as it is sensitive to pain. Once injected, pull the needle out and wait for the effect of anaesthesia.
6. Put the tips of both the thumbs over the insertion point in such a manner that the nails of both the thumbs face each other and make a V-shaped angle between them. Fan out the rest four fingers of both hands and keep them over the patient's body to balance the thumbs (Fig 2).

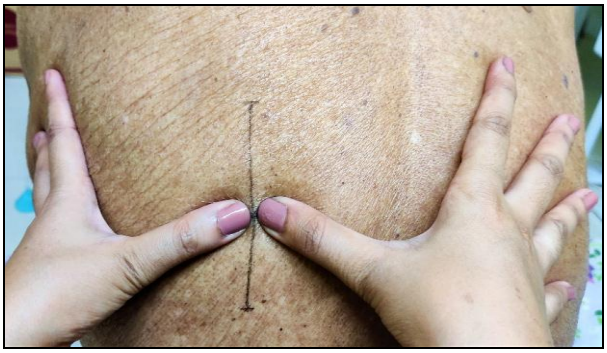

Fig 2: Putting the tips of both the thumbs over the needle insertion point with fanning out of rest of the fingers of both the hands.

Press one thumb firmly on the skin over the insertion point and pull the skin laterally towards its side in the same intercostal space for two (2) cms. At the same time, keep the contralateral thumb in position and let it slide over the skin while pulling the skin towards the opposite side (Fig 3).

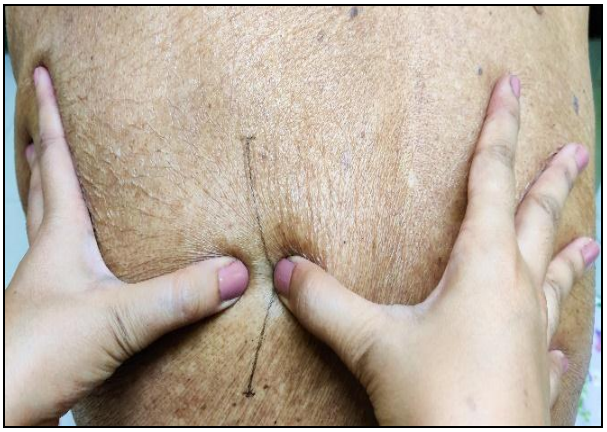

Fig 3: Pulling the skin towards its side (pulling thumb). The other thumb is resting at its place and sliding over the skin (sliding thumb).

At this point, pulling and the sliding thumbs are two (2) cms apart from each other. Now, press the sliding thumb against the skin, hard enough to not let the skin retract back. Next, lift the pulling thumb off the skin (Fig 4).

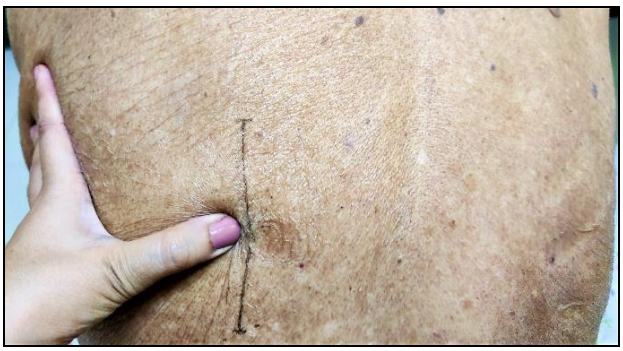

Fig 4: Lifting off the pulling thumb while keeping the sliding thumb firmly at its place.

For easier reference to this step in *Sharmas' Technique of Thoracentesis* and anywhere else in future, this particular maneuver shall be called *Sharmas' Pulling & Sliding Thumb Technique* (SPSTT).

7. Take the wide bore needle (assembled beforehand with a triway stopcock, 20 or 50 ml syringe and a drainage tube) in your free hand, pierce it at the point of the sliding thumb perpendicular to the skin and subcutaneous tissue, and advance the needle deeper until you reach the pleural space.

The needle insertion should be done along the upper border of the lower rib to avoid injury to the neurovascular bundle.

8. Aspirate the fluid, as per the indications.

9. Once aspiration is done, ask the patient to hold the breath until you withdraw the needle or the catheter. Ask the patient to re-breath after putting a sterile gauge over the puncture site. Do the dressing.

HYPOTHESIZED BENEFITS

Sharmas' Technique of Thoracentesis creates a self-sealing tract that reduces the air entry into the pleural cavity.

With this novel technique of thoracentesis, the incidence of iatrogenic pneumothorax should further be reduced compared to the conventional methods of thoracentesis.

However, a randomized control trial is required to test this hypothesis.

DECLARATIONS

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