UGANDA - CWRU RESEARCH COLLABORATION

Standard Operation Procedure (SOP)
Fiberoptic Bronchoscopy with Bronchoalveolar Lavage (BAL)

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I. Objective

Describe standard procedures for bronchoscopy and bronchoalveolar lavage (BAL) to collect specimens of lower respiratory tract secretions for clinical laboratory examinations and research studies.

II. Scope

Fiberoptic bronchoscopy and bronchoalveolar lavage are used to collect lower respiratory tract specimens for examination in persons who are unable to produce sputum. BAL specimens have been useful clinically for the diagnosis of tuberculosis and other respiratory infections including pneumocystis pneumonia in immunocompromised patients and patients with AIDS as well as in aiding assessment of local immune responses in situ in the lung in infectious and non-infectious pulmonary conditions. The procedure is performed by pulmonologists and thoracic surgeons at most major hospitals worldwide and has been shown to be safe and effective. Side effects are infrequent and include bronchospasm, oxygen desaturation, transient fever and myalgia and, rarely, pneumothorax or arrhythmia.

III. Background

Fiberoptic bronchoscopy and BAL have been performed for over 40 years in patients with a variety of pulmonary diseases and in healthy volunteers participating in clinical research studies. Bronchoscopy and BAL are used to collect specimens of lower respiratory tract secretions for clinical and research examinations.

IV. Procedure

Materials Required

Collect all supplies and equipment before starting the procedure. Wash your hands before setting up the bronchoscope. The fiberoptic shaft of the bronchoscope should be handled aseptically with the bronchoscopist gloved, gowned and masked.
- Sterile 2% lignocaine [(also called lidocaine in USP) viscous (water-based) jelly for topical anesthesia of the nares
- Sterile 1 and 2% lignocaine solution for topical anesthesia of the nares, oropharynx, larynx and tracheobronchial tree
- Sterile cotton wool
- Sterile cotton-tipped applicators for anesthesia of the oropharynx and nasopharyngeal passage
- Olympus BF Type 1T40 fiberoptic bronchoscope
- Olympus CLK-4 halogen light source
- Olympus suction port connectors, disposable
- Olympus biopsy port seal, disposable
- Disposable suction tubing
- Sterile 3-way stop cock, disposable with extension tubing or additional anesthesia extension set
- Sterile, disposable 15 gauge blunt tipped cannula needle to connect to extension tubing/3-way stopcock. The blunt cannula is inserted through the biopsy port seal when performing the BAL.
- Sterile disposable 60 ml syringes with Luer lock tip

- Sterile disposable 10 or 20 ml syringes with Luer slip tips to use to inject small aliquots of lignocaine through the biopsy port/channel for local anesthesia of the pharynx, glottis and lower airways during the bronchoscopy
- 0.9% sterile normal saline solution for IV injection warmed to room temperature for BAL
- Sterile disposable acorn nebulizer with plastic tail tubing and connecting tubing
- 30 ml disposable medication cups to hold lignocaine solution and jelly
- Small basin such as emesis basin or other container for patient to expectorate into during local anesthesia and during and following the procedure
- Pulse oximeter and automated blood pressure cuff

- Oxygen source (cylinder or wall oxygen)
- Nasal oxygen cannula
- Venturi or simple mask for supplemental oxygen administration (if required)

- Yankauer suction tip and disposable plastic suction tubing for suctioning of oropharynx

- Emergency ACLS resuscitation medications (including epinephrine, atropine, albuterol solution and prednisolone) and other resuscitation equipment (ambu bag, laryngoscope, stylet and endotracheal tube)
- Indelible ink marker pen and labels for specimens

**Subject Preparation**
The subject should take nothing by mouth after midnight on the day that the bronchoscopy and BAL will be performed. Any dentures or dental bridges should be removed before bronchoscopy. Bronchoscopy will usually be done by introducing the bronchoscope via the nares but may be performed via the mouth using a plastic bite block.
BRONCHOSCOPY PROCEDURE

1. Identify the subject. Verify the subject's name and the procedure to be performed.
2. Identify yourself to the subject. Explain the procedure to the subject fully and answer any questions the subject may have. Inform the subject that it is best not to talk once the bronchoscope has been advanced into the trachea. Inform the subject that the procedure can be stopped at any point if they are uncomfortable. Subjects should be asked every 3 to 5 minutes if they are comfortable. Subjects will be instructed to indicate that they are comfortable and wish to proceed by a thumb up gesture. If they wish to stop the bronchoscopy, they should indicate this by a thumb down gesture.
3. Obtain vital signs, baseline pulse oximetry and body weight. Only subjects with normal vital signs (temperature 36.6-37.3 C, pulse 50-90 per minute, blood pressure 95-130/60-90 mm Hg and RR 16-22/minute), or whose out of range values are determined to be clinically insignificant by the Study Coordinator and the bronchoscopist, will be allowed to proceed with bronchoscopy and BAL. In addition, a baseline O₂ saturation of 92% or greater on room air is required to proceed with bronchoscopy and BAL.
4. Confirm that the bronchoscope, light source, wall monitor, oxygen system and suction units are functional and that the oxygen supply in the oxygen tank is sufficient for the procedure.
5. Review and confirm the maximal dose of lignocaine that may be administered to the subject (7 mg/kg – not to exceed a total of 400 mg). Maximal dose will be calculated based upon weight at last clinical visit before bronchoscopy by the Study Coordinator. Weight and maximal dose will be received in a written clinical note with the participant chart at the bronchoscopy suite, where it will be confirmed by the bronchoscopist.
6. Examine the nares, mouth and pharynx. Auscultate the heart and lungs. Record the pre-procedure examination.
7. Connect the subject to the pulse oximeter and begin continuous recording of O₂ saturation.
8. Place the subject on nasal cannula supplemental oxygen at 2 l/min flow. May trim back/shorten the tip of the nasal prong, which will be in the naris that will be used for bronchoscopy, with scissors.
9. (Optional) - The Yankauer suction tip should be connected to suction tubing and the second suction source. The subject should be instructed about how to use the Yankauer suction to suction his/her mouth and pharynx if needed.
10. Open a new sterile disposable acorn nebulizer. Add 3 ml of 2% lignocaine to the nebulizer reservoir. Connect the tail tubing, mouthpiece and tubing to the compressor. Connect the tubing to the air compressor and turn it on. Have the patient sit up and instruct them how to hold the
acorn nebulizer and take slow medium deep and deep breaths. Observe and coach the patient every few minutes during the lidocaine nebulization. Continue nebulization until all of the lidocaine in the reservoir of the nebulizer has been aerosolized (no liquid visible in the nebulizer reservoir). This usually takes about 10 to 15 minutes.

11. After the lignocaine nebulizer treatment is done, instruct the subject to tip their head back and gurgle several times (gurgle with lignocaine in back of throat with 2% lidocaine (3 ml of 2% lignocaine solution). Remain with the subject and coach him/her to gurgle for about 3 minutes. Patients should be instructed to gurgle for 15-20 seconds with their head tipped back, rest by tipping their head forward holding the lignocaine solution in their mouth, and then gurgle again.

12. After the lignocaine gurgle has been completed, have the patient recline in a recumbent or semi recumbent position on the procedure table. The most patent nostril should be anesthetized with 2% viscous lignocaine jelly applied with cotton tipped applicators or cotton wool pledgets. Gentle insertion of several applicators along the floor of the nose (under the inferior turbinates) and anterior nose (see figures below) is usually required. Insert applicators with gentle forward motion; it is often helpful to spin them slightly during insertion. Allow the applicators to remain in place for several minutes to assure adequate absorption of the lignocaine. Repeat several times if needed. Move the applicators gently and lightly tap the free end of the applicator with your fingertip to assess the adequacy of local anesthesia. The subject may sense gentle pressure but should not feel pain when the local anesthesia is adequate.
FIG. 1. Diagram of the lateral wall of the nasal cavity illustrating its sensory nerve supply. Anterior ethmoidal nerve, a branch of the ophthalmic division of the trigeminal nerve, supplies the anterior third of both the septum and the lateral wall (A). The maxillary division of the trigeminal nerve via the sphenopalatine ganglion supplies the posterior two-thirds of the septum and the lateral wall (B).

FIG. 3. Positions of cotton-tipped applicators soaked with topical anesthetic solution for producing analgesia of the nasal cavity. A: Blocks the branches of ethmoidal nerve. B: Blocks the sphenopalatine ganglion and branches of maxillary division of trigeminal nerve. C: Demonstrates the passageway for endotracheal tube and provides topical anesthesia for na-

Once adequate local anesthesia of the nose has been achieved, cover the subject’s eyes with a small gauze pad to prevent lignocaine from splashing into the eyes when it is injected through the bronchoscope into the pharynx and lower airways. Introduce the bronchoscope under direct vision through the nasal passage into the hypopharynx. Remember the nasal anatomy. Visualize the nares. The bronchoscope is inserted gently into the naris in a horizontal direction under the
inferior turbinate and advanced through the nose into the pharynx where the epiglottis and glottis will be visualized. Avoid flexing the bronchoscope unnecessarily when introducing it into the naris. Rarely, the nasal passage may be too narrow to pass the bronchoscope without trauma. Options at this point include anesthetizing the other naris and attempting to pass the bronchoscope or, if the participant agrees, the bronchoscope can be introduced transorally with the aid of a bite block.

13. Visualize the larynx and vocal cords and administer 1 to 2 ml aliquots of 1 or 2% lignocaine through the bronchoscope to anesthetize the larynx and lower airways. Pause for 40 to 60 seconds between aliquots to allow adequate absorption of the lignocaine.

14. Advance the bronchoscope through the vocal cords when administration of the lignocaine no longer induces coughing.

15. Advance the bronchoscope into the trachea and advance to the desired location (usually the right middle lobe or lingula) while administering 1 ml aliquots of 1 or 2% lidocaine. 1% lignocaine is preferred below the level of the vocal cords.

16. Wedge the bronchoscope in a subsegmental bronchus by advancing it gently until it can no longer be advanced.

17. Turn off the suction to the bronchoscope.

18. Attach the 3-way stop cock/extension tubing connected to one 60 ml syringe containing normal saline solution and one empty syringe by inserting the blunt 15 gauge cannula needle through the biopsy port cover/seat of the bronchoscope.

19. Instill 30 ml aliquots of saline into the lung via the bronchoscope. Allow the saline to dwell for several seconds and then gently aspirate it into the empty syringe. Use gentle manual suction and visualize the bronchus to avoid collapsing it. BAL fluid usually has a white foamy appearance due to the presence of alveolar surfactant lipoprotein in the aspirate. A total of 240 ml of saline should be instilled in 30 ml aliquots. Not all of the instilled saline will be returned. Usually > 60 to 80% of the instilled saline will be recovered. If fluid recovery from the initial 120 ml of saline aliquots instilled is < 50%, consider repositioning the bronchoscope in a different subsegment or concluding the BAL.

20. Once the BAL is complete, remove the blunt cannula/3-way stopcock/extension tubing BAL set-up from the biopsy cover seal. Turn on the suction to the bronchoscopy and withdraw the bronchoscope applying gentle suction. Allow the subject to sit up.

21. Syringes containing the aspirated BAL fluid should be labeled in the order they were collected. BAL fluid should be placed in a cold box and transported to the laboratory promptly for testing.

22. Once the bronchoscope has been removed, rinse it immediately with 50 ml of sterile saline. Clean the bronchoscope and sterilize it according to the cleaning SOP.

23. After the bronchoscopy, the patient's vital signs should be rechecked and the patient monitored for the period specified in the study protocol. The bronchoscopist should re-examine the subject's nose, throat and chest and record his/her examination. The bronchoscopy nurse should notify the bronchoscopist of abnormal vital signs, cough, epistaxis or other symptoms during recovery.

24. The subjects may be discharged by the bronchoscopy nurse at the end of the recovery period if the subject's vital signs and oxygen saturation on room air are normal. If there are any abnormalities the nurse should contact the bronchoscopist to arrange for admission to hospital or further treatment.

Subjects who are discharged will be instructed to contact the bronchoscopist or bronchoscopy nurse if they develop fever, wheezing, cough, chest pain, dyspnea or sputum production. Subjects will be given a follow-up appointment for their post-bronchoscopy visit at the times of discharge.
References