London Health Sciences Centre

Flexible Bronchoscopy in the CCTC/MSICU/CSRU

Types of Bronchoscopes

There are two types of bronchoscopes: rigid and flexible. A flexible bronchoscope may be fibre-optic, video, or hybrid. A flexible bronchoscope consists of a proximal housing (handle held in one hand by the operator), a flexible insertion tube ranging from 1.8 (neonatal) to 7.0 mm in diameter, and a cord connecting the light source to the proximal housing. The proximal housing contains controls for angulation, suction, and the working/instrumentation channel port. The flexible tip is controlled by a lever using a Bowden cable system.

- Fibre-optic/Hybrid scopes: fibre-optic cables are enclosed in the flexible insertion tube and transmit views from the distal tip to an eyepiece; the eyepiece may be attached to a camera and/or video system that displays images on a screen.

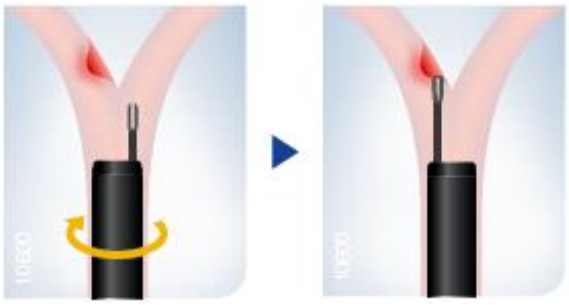
- Video bronchoscopes: use a charge-coupled device (CCD) located at the distal tip of the scope to sense and transmit images, replacing the image guide and eyepiece found on fibre-optic models.

LHSC Critical Care Bronchoscopes

In our LHSC critical care units, we use the Olympus™ video-bronchoscopy system, powered by Evis Exera III™, which includes a cart containing the processor and light source, Sony™ monitor screen, HD image capture device (via USB flash drive), and the bronchoscopes. The bronchoscopes use a "videoscope optical system" (chip-on-tip).

We have purchased new bronchoscopes from the Evis Exera III BF-190 bronchoscope series and updated the processor and light source. The new tower remains compatible with the older bronchoscopes. The new scopes only require one connection to the light source as opposed to both the light source and processor. They also offer **a pivot point between the handle and the insertion tube** that allows the operator to unlock the pivot and twist the handle orientation without changing the orientation of the insertion tube in the airway, or adjust the position of the distal end without changing the handle orientation. This allows the operator to obtain a more comfortable position of the handle, allow for easier access to the working channel port, or position the working channel opening in the most optimal position for biopsies.

Repositioning of the instrument channel port



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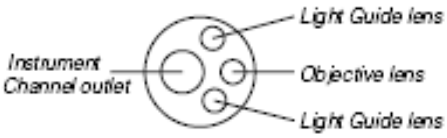
Bronchoscope Dimensions: Choose the Right Size

For safe passage of the bronchoscope through the endotracheal tube, use the "+2 rule" add 2 mm to the outer diameter of the distal end to determine the minimum required inner diameter of the endotracheal tube. Most cytology brushes and biopsy forceps will fit a 2.0 mm channel. A "therapeutic" bronchoscope is required for some larger foreign body retrieval devices which will only fit through the 2.8 mm channel. The following bronchoscopes are available within our critical care units, with additional bronchoscopes available from the Operating Rooms.

Bronchoscope Model	Working Channel (mm)	Outer diameter – distal end (mm)	ETT Size Required* (mm)	Use	MSICU/ CSRU (#)	CCTC (#)
BF-Q180 (old)	2.0	5.5	7.5	Diagnostic (blue)	1	0
BF-1TQ180 (old)	2.8	6.3	8.5	Therapeutic (yellow)	1	0
BF-P190 (new)	2.0	4.2	6.0-6.5	Diagnostic (blue)	1	0
BF-Q190 (new)	2.0	4.8	7.0	Diagnostic (blue)	1	2
BF-1TH190 (new)	2.8	6.2	8.0-8.5	Therapeutic (yellow)	0	2
BF-XP190 (new)	1.2	3.1	5.0	Diagnostic (pediatric)	0	1

**Using the + 2 mm rule, this is the MINIMUM ETT size required, leaving a ≈ 2 mm space between ETT and bronchoscope.*



4.8 mm bronchoscope with a 2.0 mm instrument channel

3.0 mm bronchoscope with a 1.7 mm instrument channel

This is an expensive system that needs attention to care by the operator to mitigate bronchoscope damage. Bronchoscope damage may be caused by the patient biting; friction from inadequate lubrication, especially if a tight fit down a tube; or needle injury during a tracheostomy if the bronchoscope is not sufficiently pulled back and protected within the ETT while the procedure is being performed.

<u>To prevent damage to the bronchoscopes</u>:

- All new senior residents will undergo a training session on safe use of the bronchoscope BEFORE using this equipment.
- Always use a bite block, even if patient is paralyzed with neuromuscular blockade
- Follow the +2 rule and use adequate lubrication (e.g., lidocaine ointment, lubricant spray)
- Tracheostomy presents a higher risk of bronchoscope damage; bronchoscopy for the purpose of tracheostomies should be performed by an experienced operator (e.g., senior ICU resident) and may only be delegated to a learner under close supervision (see below)

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Basic Procedure

<u>Pre-Bronchoscopy Set-Up of Equipment by RRT:</u>

We will receive the new scopes from MDR with the venting cap attached. Please remove the venting cap before the procedure and leave it in the container for next reprocessing.

1. Remove Sterilization wrap of the Bronchoscope chosen.
2. Remove Venting Cap and place in tray for next reprocessing
3. The Biopsy Cap & Suction Valves are the same as previous scopes
4. Plug scope into light source
    - Older scopes require a connection to the processor as well as light source
5. Turn Universal Power Switch
    - On at tope of tower (Power to both the processor and light source)
6. Ensure video image is present.
    - The scope information is displayed for a 5 seconds (outer diameter size, serial number, working channel size)
    - To review this again, hit "Exam ON" on front panel of the processor
7. Turn on Light Source
8. After case is over, please press the "Exam ON" button to end case
9. Pre-cleaning of the scope is the same
    - (Wipe Insertion Tube and Suction enzymatic cleaner for 30 Seconds, Suction Air for 10 seconds)
10. Send scope with addressograph and venting cap in the tray provided to MDR for reprocessing

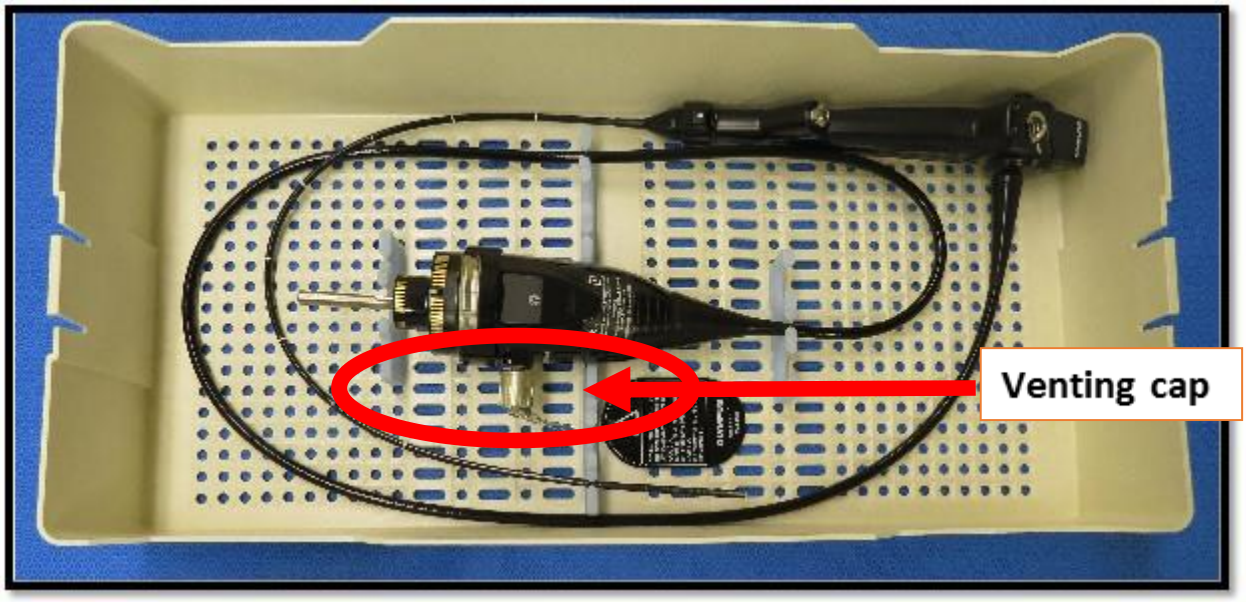

Photo courtesy of Belinda Gougoulias RRT

Pre-Bronchoscopy Set-up of Patient and Operators:

1. Perform procedural safety pause.
2. Let the RRT set up and turn the equipment on; they will also clean afterwards
3. Don appropriate PPE* (see link and below)
4. Note the ETT size and bronchoscope size (use the +2 rule, e.g., you need a 7.5 mm ETT for the 5.5 mm bronchoscope)
5. Ensure proper patient positioning (move the patient towards the operator)
6. Ensure proper operator height above patient for scope straightening/tip turning
7. Monitoring of patients vital signs: set BP cuff to cycle q3 min if no arterial line; continuous O2 saturation, 3 lead ECG
8. Pre-oxygenate patient on FiO_2 1.0
9. RRT will always place a bite block or mouthpiece (even if patient receiving neuromuscular blockade)
10. Lubricate the bronchoscope and, if needed, widen the bronchoscope tip insertion site; use dry gauze to advance the scope
11. RRT will straighten the ETT for easier bronchoscope advancement.

During Bronchoscopy:

1. Ventilate using Ambu™ bag ventilation or the ventilator on volume control mode, FiO_2 1.0
2. NEVER force bronchoscope advancement; the bronchoscope should slide easily through the ETT;
3. Consider the possibility of extrinsic PEEP (auto PEEP may be significant)
4. Suction is quick and intermittent (≤ 3 seconds)
5. Obtain necessary samples (bronchial washings, BAL and/or brushings); make sure the specimen container tops are adequately tightened.
6. If oxygen desaturation occurs, withdraw bronchoscope to recruit the lungs using Ambu™ bag plus PEEP valve

Special Considerations for Percutaneous Tracheostomy Insertion:

1. Follow the RRT pre-procedure checklist; Be prepared that you may need to reintubate patient so have intubation equipment nearby and mask for bag-mask ventilation if needed
2. Discuss and confirm plan for ventilation during the procedure; is there a need to pause ventilation during the procedure to mitigate risk of viral transmission? At what time points will ventilation pause? Have we confirmed that the patient will tolerate apnea?
3. Perform procedural safety pause before starting procedure AND prior to needle insertion
4. Clean secretions from trachea prior to needle insertion for ideal visualization; do this before start of procedure. Be clear on the anatomy you are visualizing.
5. Perform prescribed “PAUSE” just before needle insertion to ensure point of entry is BELOW tip of bronchoscope
6. ALWAYS keep bronchoscope tip within lumen of the ETT during needle insertion

Post Bronchoscopy:

1. Continue monitoring patient –patient may be hypotensive post cessation of stimulation
2. Ensure adequate ventilation – patient was likely hypoventilating during procedure
3. RRT will send scope with addressograph and venting cap in the tray provided to MDR for reprocessing
4. Choose which tests are appropriate to order from the following list; in PowerChart, go to ICU Bronchial Brush/Lavage careset:

   a. Acid Fast Bacilli Culture (note: you need to complete a Public Health paper requisition). **Note that sending AFB does NOT necessitate moving patient to a negative pressure room if you are looking for non-tuberculous mycobacterium (MAI or MAC). If TB is a concern, patient must be in a negative pressure room.*
   b. Respiratory Culture (bacterial stain and culture)
   c. Fungal Culture
   d. Legionella Culture (also order and obtain legionella antigen urine sample)
   e. Mycoplasma/Ureaplasma Culture
   f. Pneumocystis carinii
   g. Respiratory Virus Panel **Note that COVID-19 needs to be ordered separately*
   h. Coronavirus SARS-CoV-2 2019 Diagnostic (COVID) – choose BAL as specimen type
   i. Cytology (needs to be in fixative) – separate order
5. Ensure proper labelling of specimen containers with appropriate paper requisitions as needed; Note that all microbiology tests will be pooled in one container, whereas cytology will be processed separately from distinct lobes (labelled).
6. Ensure lids to specimen containers are properly tightened so the specimen does not leak in transit.
7. Ensure prompt delivery of specimens to lab
8. Complete documentation – dictate or type a Procedure Note in powerchart, including: date/time procedure performed; name of operator performing procedure and name of physician providing anesthesia/sedation (ICU consultant); indications; topical/systemic anaesthetic agents and dose; findings (describe anatomy, mucosa, presence of blood or pus); specimens and location obtained (for BAL include amount instilled and amount returned); tolerance/ complications (there are templates available on PowerChart that may be used)

Potential Complications

- Trauma to the airways, bleeding
- Coughing and bronchospasm (if inadequate anaesthesia)
- Loss of PEEP with derecruitment and oxygen desaturation
- Barotrauma
- Infection (scope to patient and patient to operator especially if inadequate respiratory precautions adopted)
- Accidental extubation

Precautions to Protect Health Care Providers (HCPs)

Note that bronchoscopy is considered a high risk aerosol generating medical procedure (AGMP). At **minimum**, Droplet + Contact + Enhanced PPE (N95 mask + Full Face Shield, Level 2 gown and gloves) must be worn by all staff within 2 meters of the patient during the procedure, for ALL patients undergoing bronchoscopy.

During the COVID-19 pandemic, **PROTECTED Droplet-Contact-Enhanced PPE** (N95 mask + goggles + face shield + blue hair bouffant +Level 3 or 4 gown + extended cuff nitrile or sterile gloves which cover wrists) must be worn by all staff within 2 meters of the patient during the procedure. A negative pressure room should be used (if available).

See Guiding Principles in Guidelines ADULT CRITICAL CARE for Aerosol Generating Medical Procedures (AGMP) for more information. (https://www.lhsc.on.ca/media/8476/download)

Additional Resources:

1. Olympus BF-190 Bronchoscopes Specifications https://medical.olympusamerica.com/products/bf-190-bronchoscopes
2. Bronchoscopy Simulator: http://www.thoracic-anesthesia.com/?page_id=2
3. Flexible Bronchoscope by Dr. Chris Nickson https://litfl.com/flexible-bronchoscope/
4. Bronchoscope by World Health Organization https://www.who.int/medical_devices/innovation/bronchoscope.pdf?ua=1
5. Bronchoscopy International YouTube Channel https://www.youtube.com/user/BronchOrg?feature=watch