

C-MAC® VIDEO LARYNGOSCOPE – NETS PRACTICE GUIDELINE ®

DOCUMENT SUMMARY/KEY POINTS

- Unexpected difficult airways in children are uncommon
- In many infants and children, their background predicts the likelihood of a difficult airway
- Direct laryngoscopy can be difficult in some cases
- The video laryngoscope (VL) is an important tool in anticipated and unanticipated difficult intubation¹. The C-MAC® VL allows the airway proceduralist to both directly and indirectly (via the screen) visualize the larynx
- Appropriate training and education of the NETS C-MAC® VL is required before use by team members on retrieval
- The C-MAC® VL requires priority cleaning

Related Guidelines

- COVID-19 Intubation Guideline
- Advanced (Difficult) Airway Guideline
- Neonatal Intubation Guideline
- Endotracheal Tubes – Cuffed Guideline

Disclaimer

This document is available on-line as a stimulus for interchange of knowledge and ideas in the field of Neonatal and Paediatric Retrieval. It is provided "as-is" and without support or warranty of any kind. Many of our guidelines may not be appropriate for use in retrieval settings other than NETS NSW, especially in non-Australian environments.

This document reflects what is currently regarded as safe practice. However, as in any clinical situation, there may be factors which cannot be covered by a single set of guidelines. This document does not replace the need for the application of clinical judgement to each individual presentation.

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| Approved by: | SCHN Policy, Procedure and Guideline Committee | |
| Date Effective: | 1 st March 2022 | Review Period: 3 years |
| Team Leader: | Staff Specialist | Area/Dept: NETS |

CHANGE SUMMARY

- N/A - new guideline
- **9/05/2022:** minor amendments on page 3 around who is able to use the device and the tasking of the device.

READ ACKNOWLEDGEMENT

NETS clinical retrieval staff are to read and acknowledge they understand the contents of this guideline.

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Rationale/Background

- Unexpected difficult airways in children are uncommon.
- In many infants and children, their background predicts the likelihood of a difficult airway.
- The VL is an important tool for anticipated and unanticipated difficult intubation
- It is the first line method of laryngoscopy for highly infectious respiratory diseases to minimize the aerosolization of pathogens and to minimize the exposure of pathogens
- The deployment for use of the NETS C-MAC® VL by teams is the decision of the medical lead of the retrieval tasked with securing the airway.
 - Teams tasked R1 should take the C-MAC® VL and advise the NETS consultant at their earliest convenience
 - Teams tasked R2 should notify the NETS consultant of their request to take the C-MAC® VL

Training Requirements

- The C-MAC® VL must only be used by NETS medical staff who are competent in using the equipment.
- Prior to using the C-MAC® VL NETS medical staff must:
 - **Be competent in the procedure for intubating neonatal and paediatric patients using direct laryngoscopy**
 - Have a working knowledge of the following NETS guidelines:
 - Neonatal intubation
 - Advanced (difficult) airway management
 - COVID-19 intubation
 - Attend a training session at NETS on the use of the C-MAC® VL and participate in a skills workshop **OR** have prior experience and competence in using the C-MAC® VL
 - Maintain airway management skills by participating in simulation, skills workshops and attending rostered airway skills days
 - Have a knowledge of preparing and dispatching the contaminated VL(s) to CSSD at the Children's Hospital at Westmead (CHW) for cleaning and high level disinfection

Equipment

Components of the NETS Neonatal C-MAC® VL Intubation Bag



Fig. 1: 1. Battery 2. Monitor 3. Laryngoscope blades (Miller 0, Miller 1)
4. Multifunctional button 5. Video connection cable

Components of the NETS Paediatric C-MAC® VL Intubation Bag



Fig 2: 1. Battery 2. C-MAC® pocket monitor 3. Laryngoscope blades (Miller 1, MAC 2, MAC 3)
4. Multifunctional button 5. Video connection cable



Fig 3: Battery charging station



Fig 4: C-MAC® VL protective cap

When taking out the C-MAC® VL bag on retrieval ensure that a charged battery is inside the bag.

Procedure

1. Setting Up the C-MAC® VL for use⁴:

- Prior to use, visually inspect the C-MAC for signs of damage or rust/ corrosion
- Check that all components are present
- Check that the C-MAC is clean



Fig. 5

- Gently insert the battery into the back of the C-MAC® pocket monitor (Fig. 5)
- Remove the black protective cap off the socket on C-MAC® VL handle



Fig. 6

- Connect the monitor into the socket on the C-MAC® VL handle. The orientation pin on the plug should be in line with the orientation pin on the socket (Fig. 6). Check it is fully inserted with no visible gap
- This will turn on the C-MAC® VL and it will be ready to operate immediately (Fig. 6)
- If the monitor is folded downwards when connected to the C-MAC® VL, fold it upwards and turn it 90° clockwise to turn it on
- Before each use, check that the view on the screen is a live image, rather than a stored one, and that it has the correct image orientation
- 5 seconds after it is turned on, a blue information bar will be displayed at the top of the monitor screen for a few seconds. It shows:
 - The remaining memory capacity (in minutes) in the top left corner and
 - the name of the directory where the saved data is stored in the top right corner (this is a number)

Turning off the display monitor⁴

- Turn the monitor 90° counter-clockwise
- Fold the display downwards.

The monitor will automatically turn off after 10 minutes. To turn it back on, follow the above steps to close it and then open it by folding the monitor upwards and turning it 90° clockwise.

2. Intubation using the C-MAC® VL

- The major advantage of the C-MAC® VL is the ease with which a view of the laryngeal opening can be obtained when compared to direct laryngoscopy (Fig. 8)
- The C-MAC® VL also requires less lifting force to obtain a view and it is therefore less stimulating for the patient as compared to direct laryngoscopy and may also lower the risk of airway trauma⁵
- Users should be aware that even excellent visualisation of the vocal cords does not guarantee that tube delivery to the trachea will be easy
- Technical failure of the VL is not easily fixed/ replaced⁵
- The C-MAC® VL has the familiarity of a traditional Macintosh or Miller blade shape which should mean it is intuitive to use for those skilled in direct laryngoscopy
- Additionally, this similarity means that users have the option to switch to direct laryngoscopy if required e.g. if blood/ secretions are blocking the camera view⁵



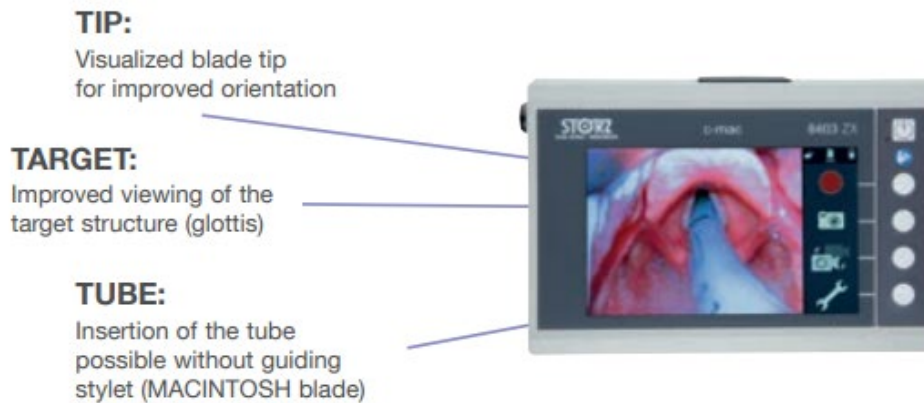
Fig. 8⁶

The four-step procedure (mouth – screen – mouth – screen)⁷

1. Mouth: look in the mouth as you insert the VL (to avoid oropharyngeal trauma)
2. Screen: look at the screen to visualize the epiglottis, glottis and vocal cords
3. Mouth: look in the mouth as you insert the endotracheal tube (ETT) into the mouth (to avoid oropharyngeal trauma)
4. Screen: look at the screen as you pass the tube through the larynx

In the above four-step procedure you should have identified the 3T's (Tip, Target and Tube) as seen below in Fig 9.

3Ts* – Essential for Secure Video Laryngoscopy



* Preconditions for secure video laryngoscopy are that the Tip, Target, and Tube can be identified on the monitor.

Fig. 9 The 3Ts of video laryngoscopy⁸

In addition to the four-step procedure, the following key technical skills will maximize the chance of a successful procedure:

- **Secretions and suction**
 - Secretions, blood or vomit can obscure the camera, making it impossible to use the video laryngoscope for intubation⁵
 - If the patient has oropharyngeal secretions/ blood/ vomit, have a suction catheter available to suction as you advance the video laryngoscope to avoid them obscuring the camera
 - Introduce the C-MAC® VL blade into the oral cavity using your left hand. Use it to gently protract the floor of the mouth and mandible and sweep the tongue to the left (the same manoeuvre as direct laryngoscopy)^{7,9}
 - Introduce the suction catheter using your right hand and suction any secretions as you advance the C-MAC® VL blade down the tongue until you identify the epiglottis. This will avoid you putting the laryngoscope tip in a pool of secretions^{7,9}
- **Optimize your view of the larynx**
 - Once the C-MAC® VL blade has been introduced and secretions suctioned, proceed with visualization of the larynx on the screen
 - Lifting the jaw and controlling the epiglottis will maximize laryngeal exposure and create more space for the ETT delivery^{7,9}
 - Avoid over extending the neck – this will decrease the hypopharyngeal space and limit mouth opening^{7,9}
- **Tilt the C-MAC® camera lens towards the ETT**
 - ETT delivery using the C-MAC® VL is similar to direct laryngoscopy⁵
 - However, maximizing the view of the larynx might impede tube delivery⁹

- When introducing the ETT, ensure you can see the ETT tip as it enters the hypopharynx. You might need to slightly tilt the camera lens towards the ETT. This will help you to make adjustments to direct the ETT towards the vocal cords⁹

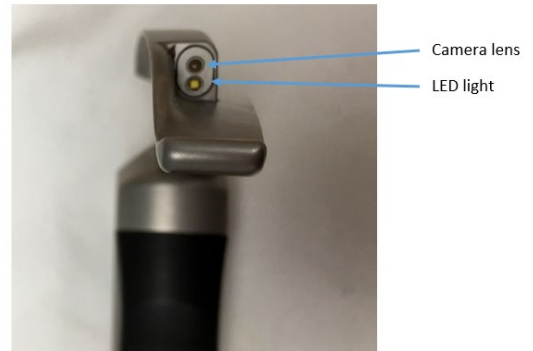


Fig 10: C-MAC® VL camera lens and LED light

- **Two-stage ETT delivery**

- Advance the ETT slowly until the tip comes into view on the monitor^{7,9}
- Adjust the insertion angle and direction of the ETT as needed to direct it towards the larynx. Avoid plunging it up and down in an attempt to insert it through the larynx – use the monitor for visual feedback of where the ETT tip is and where it is pointing⁹
- ETT delivery and insertion through the larynx is otherwise similar to direct laryngoscopy^{5,9}

3. Capturing images/videos using the C-MAC® VL

The multifunctional button of the VL⁴

This button is located on the handle of the VL blade (Fig. 7). The colours of the multifunctional button have the following meaning:

- Blue:** Permanently lit. The recording function is ready for use.
Green: Temporarily lit when capturing an image, or flashes during video recording



Fig.7

How to capture a single image⁴

1. Using your thumb press the multifunction button once, briefly, to capture the image.
2. The image currently on the screen will be saved on the memory card in the monitor.

3. The multifunction button will briefly light up green and then turn blue.
4. See Appendix 1 to download image.

How to record a video⁴

1. Press and hold the multifunction button for about 2 seconds to start recording.
2. The multifunction button will flash green whilst recording.
3. Press the multifunction button briefly to stop the video recording. It will turn blue.
4. The video will be saved to the memory card in the monitor.
5. See Appendix 1 to download video.

If there is less than 10 minutes of memory capacity available, the information bar is displayed in orange-red.

Demonstration videos

- Set up and use of the C-MAC® video laryngoscope: <https://vimeo.com/320831190>
- Video laryngoscopes (scroll down the page to the C-MAC section): <https://www.paediatricemergencies.com/video-laryngoscopes/>

4. Cleaning & storage of the C-MAC® VL

- After use, separate C-MAC® VL handle/blade from the display monitor.
- Wipe down the C-MAC® VL with hospital grade non-alcohol disinfectant wipes such as TUFFIE wipes. Ensure all blood or mucus is removed. Insert the small black protective cap into the socket of the VL and click into place (Fig. 11a-c). Then place the VL in a zip-lock bag to return to base for cleaning.
- Wipe down the display monitor with non-alcohol disinfectant wipes such as TUFFIE wipes. Let it dry and place back in the blue NETS C-MAC® Intubation Bag
- If the NETS C-MAC® Bag has been soiled wipe down with non-alcohol disinfectant wipes such as TUFFIE wipes

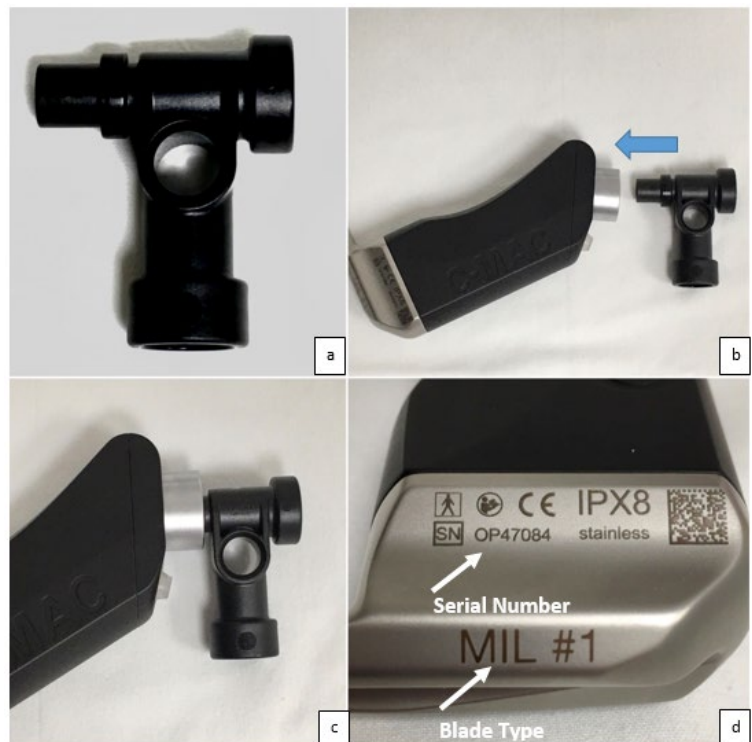


Fig 11: a. C-MAC® video laryngoscope (VL) protective cap b. Inserting protective cap into VL handle c. VL with protective cap ready for high level disinfection d. VL serial number and blade type

Back at NETS Base

- Return the blue NETS C-MAC® Intubation Bag to the pharmacy room and insert the used battery into the charger in the pharmacy room. Place an 'equipment offline' sign on the bag
- The C-MAC® VL blades should be prepared to be sent to CSSD at CHW for high level disinfection. This is the responsibility of the medical team member
- The VL must always have the protective cap on before sending to CSSD. Spare caps are kept in the cupboard with the CSSD boxes in the equipment restore room
- Put on gloves and place VL with cap in the zip lock bag in a plastic CSSD box with the completed white CSSD form. Place box in another large clear plastic bag for transport
- On a CSSD duplicate request form, complete the following details (Fig 12):
 - the blade type (Fig. 11d)
 - serial number (Fig. 11d and Table 1) – this identifier number is unique and will inform CSSD to which department VL belongs
 - write 'neonatal' or 'paediatric' depending on which C-MAC® Intubation Bag VL is from
 - write "PRIORITY CLEANING"
- Arrange for 'priority cleaning' at CHW CSSD level 3 if possible.
 - Arrange for either an available EVO or other driver to deliver item directly to the CSSD decontamination area not the mailroom
 - CSSD have advised that a priority clean generally takes about 4 hours
- If no transport is available. send instrument with the usual 'CSSD' Toll deliver

| NETS C-MAC® Video Laryngoscopes with Identifier Serial Numbers | | |
|--|--------------------|---|
| Blade Type | Serial Number (SN) | Picture |
| NEONATAL | | |
| MIL #0 | NP44828 |  |
| MIL #1 | PP47652 |  |
| PAEDIATRIC | | |
| MIL #1 | OP47084 |  |
| MAC #2 | PP49195 |  |
| MAC #3 | OP47384 |  |

CSSD - Central Sterilising
 place item in plastic bag / clear biohazard bag and then in the CSSD clear bucket.

The following NETS equipment requires cleaning:
 Cut-Down Set (8 items)

- Needle Holder x 1
- Dressing scissors x 1
- Curved Mosquito Forceps x 3
- Curved Iris Forceps x 1
- Micro Forceps with teeth x 1
- Micro Forceps x 1

Laryngoscope Blades

- Size 1 – straight
- Size 2 – straight
- Size 3 – straight
- Size 4 – straight

1 x Neonatal CMAC
MIL # 0 Serial No. NP44828

- Size 1 – curved
- Size 2 – curved
- Size 3 – curved
- Size 4 – curved

PRIORITY CLEANING

Magill's forceps

- Neonatal
- Paediatric

Neurosurgical Emergency Kit (Barcode 259106)

- Legend Stylus Motor – electric x 1
- Legend 8cm Straight attachment x 1
- Legend Craniotomy/footeed attachment x 1
- Other separates :

Sent by: (print name) ... **AB INTUBATOR** ..Date: **3/8/2020**
 Assemblies complete on return: Yes / No

Table 1: NETS C-MAC® VL Serial Numbers

Fig. 12 Example of a CSSD Request Form

- When the C-MAC® VL has returned from CSSD restore it to its designated bag
- Place a charged battery (if available) in the battery pocket in the C-MAC® Intubation Bag
- Ensure that the contents of the C-MAC® Intubation Bag are complete (see Appendices 2-4) and if so remove the 'equipment offline' sign
- The neonatal and paediatric C-MAC® VL bags will be checked on the daily base checks

Documentation

- Document on NETS Medical Record and Intubation Data Record
 - Name of airway proceduralist
 - Type of C-MAC® VL blade used
 - Visualization used to achieve intubation – direct or video
 - Cormack & Lehane Classification (see appendix 5)
 - POGO (Percentage of Glottic Opening) Score (see appendix 5)
 - ETT used and record depth at cords and lips/nare, ml of air for cuff and cuff pressure
 - Time of induction and intubation
 - Difficulties if any encountered
- Document other relevant data as requested on Intubation Data Record
- Document CSSD details in CSSD book as outlined in previous section
- Images or videos that are downloaded should be saved under the folder in the G drive named 'MEDIA pending POWERCHART' with the following details: CCL, hospital and date (e.g. CCL123456 StElsewhere 20Jan20 image 1). After the media have been transferred to POWERCHART they shall be deleted from the G drive.

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Appendices

Appendix 1: Saving data with the USB video connection cable

With the USB video connection cable, the saved media in the C-MAC® pocket monitor can be downloaded to a computer.

1. The rechargeable battery must be removed from the pocket monitor's battery compartment
2. Connect the socket of the cable to the pocket monitor
3. Connect the USB plug to the computer
4. The computer should recognise the pocket monitor after approximately 7 seconds.
5. At the same time the message 'Do not unplug cable' appears on the display of pocket monitor.
6. If the message 'Check and repair (recommended) appears on connection, this process should be initiated. Always follow instructions shown on the computer
7. Refer to documentation section about how to save media data on the NETS G drive
8. To remove from the computer, use the command 'Eject' for USB removal. Wait for message saying that the device can be removed safely, then disconnect the cable USB plug from the computer and then the cable socket from pocket monitor.

Appendix 2: The NETS Neonatal and Paediatric C-MAC® Intubation Bags



Appendix 3: Contents of the NETS Neonatal C-MAC® Intubation Bag



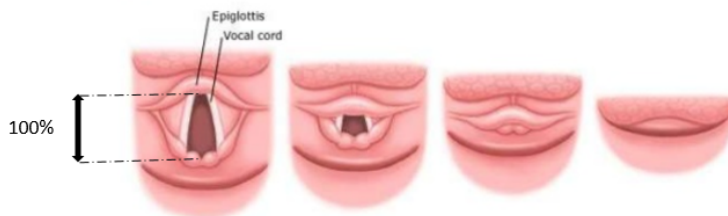
A: Cover holds C-MAC® pocket monitor. 1st base holds battery and Miller 0 and Miller 1 VLs with protective caps attached B: 2nd base holds video connection cable

Appendix 4: Contents of the NETS Paediatric C-MAC® Intubation Bag



A: Cover holds C-MAC® pocket monitor. 1st base holds battery and Miller 1, MAC 2, MAC 3 VLs with protective caps attached B: 2nd base holds video connection cable

Appendix 5: Assessment of airway visualization during laryngoscopy¹⁰



| Cormack-Lehane | Grade I | Grade II | Grade III | Grade IV |
|----------------|---------|----------|-----------|----------|
| POGO Score | 100% | 1 - 99% | 0% | |

Cormack-Lehane Classification

- Grade I Visualization of the entire glottic opening
- Grade II Visualization of just arytenoid cartilages or posterior portion of glottic opening
- Grade III Visualization of epiglottis only
- Grade IV Visualization of tongue or of tongue and soft palate

POGO (Percentage of Glottic Opening) Score

- 100% denotes visualization of the entire glottis from anterior commissure of the vocal cords to the arytenoid notch
- 0% denotes none of the glottic opening visualized
- 1-99% denotes partial view of glottic opening