

Airway Management Resources in Operating Theatres

Provisional recommendations for South African hospitals and clinics

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SAJAA 2007; 13(6): 17-23

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This article is intended as a draft guideline for difficult airway equipment that should be available to anaesthesia providers throughout South Africa. To ensure that the final guidelines are as representative and as accurate as possible, the authors would like to invite feedback from anaesthesiologists, anaesthetists and also manufacturers of airway management devices. It is important that differences of opinion regarding the guidelines, and any items of equipment omitted from the guideline, are identified.

Feedback should be directed to Dr RE Hodgson by email to iti20178@mweb.co.za or faxed to 086 672 3630.

Three months after the publication date of this article (end of February 2008), all feedback will be collated and evaluated by all the authors. Formal guidelines will be published under the auspices of the South African Society of Anaesthesiologists.

INTRODUCTION

General anaesthesia (GA) requires airway instrumentation to facilitate spontaneous or mechanical ventilation. The endotracheal tube (ETT) is still considered the airway management device of choice in intensive care, emergency medicine and anaesthesia, particularly where muscle relaxants are used. Endotracheal intubation is an essential skill for anaesthesia practitioners.

A wide variety of airway devices is now available for management of situations where intubation is required, but may prove to be difficult or impossible. The intention of this paper is to provide a suggested guideline for the equipment that should be available in healthcare facilities (HCFs) where intubation is performed for GA.

REQUIREMENT FOR ENDOTRACHEAL INTUBATION

The decision to perform endotracheal intubation is dependent on both patient and procedural factors that will not be discussed in this article, but which have been extensively reviewed.^{1,2}

AIRWAY ASSESSMENT

Airway assessment is beyond the scope of this article, but has been extensively reviewed elsewhere.^{3,4}

Airway assessment should answer three questions regarding potential airway difficulties:

1. Is laryngeal visualisation going to be difficult? – Can't Intubate

Defined by the four D's:

Disproportion
Distortion
Dysmobility
Dentition

2. Is mask ventilation going to be difficult? – Can't Ventilate

Defined by the acronym "BONES":

Beard
Obesity
No teeth
Elderly
Snores

3. Is cricothyroidotomy going to be difficult? – Can't Rescue

Should a potentially difficult airway be recognized, the cricothyroid membrane should be identified and marked, BEFORE any airway intervention is undertaken.

Following airway assessment, the person performing the intubation should be in a position to decide between three possible options:

1. Intubate awake

The patient's need to be intubated awake – there is significant risk of death if sedatives and/or muscle relaxants are administered prior to airway control.

OR

2. "Quick Look"

The patient may be sedated for an attempt at direct laryngoscopy WITHOUT muscle relaxation ("Quick Look") – there is some risk of failed laryngoscopy but a low risk of failed mask ventilation.

OR

3. Induce and paralyse

The patient may be induced and paralysed, by a rapid sequence induction if required – the airway is assessed as normal, with low risk of failed laryngoscopy and/or mask ventilation.

Anticipated versus unanticipated airway difficulty

Classifying patients in this way, allows time to prepare and assemble the required equipment. Airway assessment is neither completely sensitive nor specific, thus resulting in situations of unanticipated difficult or failed intubation, that fall into two categories:

1. Cannot intubate - Can ventilate

Unable to intubate BUT able to mask ventilate:

This is a non-emergency situation in which there is time available to assemble equipment and call for help.

Note: Devices used in this situation may be subclassified as:

- Rescue devices – devices that provide a means of ventilation but do NOT protect the airway.
- Definitive airway devices – devices that provide a means of establishing a definitive airway.

2. Cannot intubate - Cannot ventilate

Unable to intubate AND unable to mask ventilate:

This is an emergency situation requiring rapid response with a limited number of devices.

CLASSIFICATION OF AIRWAY EQUIPMENT

From the various scenarios discussed above, airway devices can be classified into three classes:

1. Routine equipment for endotracheal intubation,

INCLUDING additional equipment for facilitation of intubation, where there is no difficulty with mask ventilation.

The following devices should be available in ALL THEATRES.

Table I: Routine equipment for performance of endotracheal intubation

1. Facemasks	Size 3-5 for adults
	Size 0-3 for paediatrics
2. Guedel airways	Size 3-5 for adults
	Size 0-2 for paediatrics
3. Two laryngoscope handles	
4. Laryngoscope blades:	
<i>Macintosh (curved)</i>	Size 3-5 for adults
	Size 1/2 for paediatrics
<i>Miller (straight)</i>	Size 3/4 for adults
	Size 1/2 for adults
<i>Doerges blade</i>	Suitable for adults and paediatrics
5. Endotracheal (ET) tubes	Size 5.5-8 cuffed (two per 0.5 increment) for adults
	Size 2.5-5 cuffed AND uncuffed (two per 0.5 increment) for paediatrics
6. Suction nozzles and tubing	
7. Suction catheters to fit available endotracheal tubes	
8. Magill's forceps, including a smaller size for paediatrics	
9. Bag valve mask with oxygen	
Additional devices available in any theatre where GA is performed	
1. Malleable stylet, including a smaller size for paediatrics	
2. Malleable bougies including:	
a. Re-useable/single use bougie (<i>Smiths Medical</i>)	
b. Hollow Frona ± stylet (<i>Cook/Marcus Medical</i>)	
c. Solid Eschman (<i>Tyco</i>)	

2. Alternative devices for establishing a definitive airway, INCLUDING devices for a surgical airway.

These devices should be found in the **AIRWAY RESOURCE CART** (see also Appendix 2).

Table II: Airway Resource Cart

A. Alternative equipment for airway rescue	
1. Supraglottic airways	<ul style="list-style-type: none"> • LM Softseal • Ambu LM • I-Gel LM
2. Needle cricothyroidotomy + jet ventilator/Sanders injector	
B. Alternative equipment for establishment of a definitive airway	
1. Specialised ET tubes for blind nasal intubation	<ul style="list-style-type: none"> a. LMA Fastrach ET tube b. Parker FlexTip ET tube
2. McCoy laryngoscope OR	
3. Lightwand	Lightwand (<i>SSEM</i>) Trachlight <i>Laerdal (Survival Tech)</i>
4. Retrograde intubation kit	(<i>Cook</i>)
5. Surgical tracheostomy equipment OR	
6. Percutaneous dilatational tracheostomy	(<i>Portex/Cook/Intersurgical</i>)
7. Alternative laryngoscopes	Video (<i>Karl Storz</i>) Glidescope (<i>Parker</i>) Airtraq McGrath (<i>Aircraft Medical</i>) Bullard/Wu/Uppsher
8. Flexible video stylet	<i>Parker (SSEM)</i>
9. Malleable video stylet	Leviton/Shikani (<i>Parker (SSEM)</i>)
10. Rigid video stylet	Bonfils (<i>Karl Storz</i>)
11. Flexible fibroscopic scope	(<i>Karl Storz</i>) (<i>Pentax</i>) (<i>Olympus</i>)

These devices should ideally be used electively, when a difficult airway has been identified during pre-anesthetic assessment. They can also be used if laryngoscopy with additional equipment remains difficult, while mask ventilation remains possible.

The devices chosen will depend on the patients being treated, and the skills of the treating clinicians.

3. Emergency airway equipment, where laryngeal visualisation AND mask ventilation are BOTH difficult.

These devices should form an easily accessible **EMERGENCY AIRWAY KIT**. (See table III and Appendix 1)

The requirement for airway equipment is based on the level of facility in which intubation is being performed, and also on whether the intubation is an elective or emergency procedure. (See table IV)

2. Equipment for emergency CANNOT INTUBATE/CANNOT VENTILATE airway management

This equipment may be available for routine airway management. However, for an emergency situation, intervention will be more rapid and effective if the necessary equipment is available in a clearly marked container in an identified location.

The contents of the container should include laryngeal masks, a scalpel and a selection of the other items listed below. A list

Table III: Emergency Airway Kit

1. Laryngeal Mask Airway	
a. Classic/Unique (general)	
b. Proseal/Supreme	Morbid obesity / pregnancy
c. Fastrach/C-Trach	Can be used for definitive airway placement
2. Combitube OR a. EasyTube Rusch (Intersurgical)	
b. Laryngeal Tube VBM (SSEM)	
3. Cricothyroidotomy	
a. Needle (14-20G)	Smaller for paediatrics
Insufflation/jet ventilation for adults	Requires adapter: Size 7 ETT connector 2 ml syringe barrel
b. ET Tube + scalpel	Size 6 ET Tube Scalpel blade and handle
c. Single stab kit	Portex PCK
d. Non-Seldinger	Portex Minitrach
	Cook Melker
e. Seldinger	Portex Minitrach
	Cook Melker
4. Rigid bronchoscope	Cardiothoracic/ENT theatres

should be provided in the container, so that items may be replaced when they are used.

The alternative devices chosen should be housed in a single location, either in a mobile trolley or a fixed cupboard.⁵ The smaller emergency airway kit may form part of this airway resource location. This resource location should be checked daily, and after every use, with the regular replacement of used/expired components.

Staff should be trained in the use of any equipment purchased. Every effort should be made to use equipment in an elective setting prior to emergency use. Invasive procedures should be practised at least quarterly on a mannequin.

References

- Practice guidelines for management of the difficult airway. (ASA Task Force) Anesthesiology 2003;98:1269-77.
- Henderson JJ, Popat MT, Latto IP, Pearce AC; Difficult Airway Society. Difficult Airway Society guidelines for management of the unanticipated difficult intubation. Anaesthesia 2004;59:675-94.
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Table IV: Requirements for airway equipment according to the HCF

Equipment requirement	All HCF including clinics, where GA and intubation are not routinely performed (OPD/ER)	District hospitals where GA and intubation are performed infrequently	Regional and tertiary hospitals and busy district hospitals, where GA is performed frequently
Performance of endotracheal intubation	Yes (See equipment for endotracheal intubation in table I)	Yes (See equipment for endotracheal intubation in table I)	Yes (See equipment for endotracheal intubation in table I)
Additional routine equipment for difficult airway	No	Yes With a limited choice of items (see below)	Yes With a wider choice of additional items (see below)
Equipment for emergency "can't intubate can't ventilate"	Yes EMERGENCY AIRWAY KIT: including LMA and scalpel	Yes EMERGENCY AIRWAY KIT: including LMA and scalpel	Yes EMERGENCY AIRWAY KIT: including LMA, scalpel AND one or more of: 1. Combitube (or equivalent) 2. Seldinger cricothyroidotomy 3. Rigid bronchoscope
Alternative devices for airway rescue	No	Yes AIRWAY RESOURCE CART: with a limited choice of items. Must include LMA and variants, depending on patients treated (see table II)	Yes AIRWAY RESOURCE CART: with a wider choice of equipment depending on procedures being done and available expertise (see table II)
Alternative devices for establishing a definitive airway	No	Yes AIRWAY RESOURCE CART: with contents depending on the levels of training of available staff (see table II)	Yes AIRWAY RESOURCE CART: with a wider choice of equipment, depending on procedures being done and the available expertise (see table II)

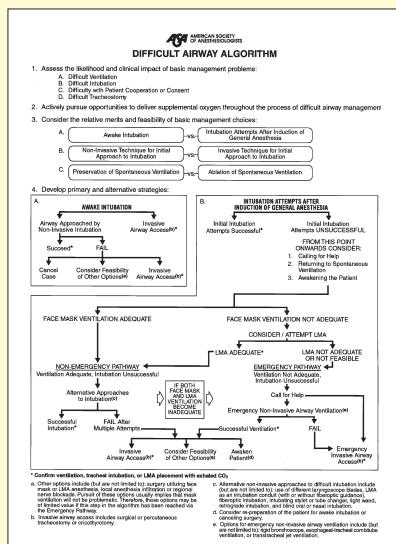
Appendix 1

EMERGENCY AIRWAY KIT Contents to be checked daily
1. Laringeal Mask Airways Re-useable Classic OR Disposable Unique <i>Alternatives:</i> Proseal OR Supreme – Obstetrics/Obesity Fastrach
2. Scalpel handle and blades <i>Alternatives:</i> Combitube OR EasyTube Laryngeal Tube
3. Single stab cricothyroidotomy kit
4. Seldinger cricothyroidotomy kit
5. Rigid bronchoscope and light source

Appendix 2

AIRWAY RESOURCE CART Contents to be checked daily
1. ASA algorithm and difficult airway prediction chart (See Appendices 3 and 4)
2. Tracheal tube guides: Gum elastic bougies <i>Alternatives:</i> Frova Intubating introducer with adaptor for ventilation Lightwand/Trachlight
3. Nasopharyngeal airways: Portex size 6, 7 and 8
4. Alternate laryngoscope blades to Macintosh 3 and 4 <ul style="list-style-type: none"> McCoy size 3 and 4 Straight blades: Miller or McGill size 3 and 4
5. Laryngeal Mask Airways of assorted sizes. <ul style="list-style-type: none"> Re-useable Classic OR Disposable Unique LMA's size 3, 4 and 5 <i>Alternatives:</i> <ul style="list-style-type: none"> Intubating LMA's (Fastrach) size 3, 4 and 5 (Complete set of LMA, correct tube and exchanger) Proseal OR Supreme LMAs
6. Airway exchange catheter
7. Retrograde intubation set
8. Needle cricothyroidotomy Size 12 and 14 IV cannulae with 15 mm connector (size 5 ETT)
9. Cricothyroidotomy set
10. Dilatational tracheostomy set
11. Fibreoptic bronchoscope with a light source
12. Jet ventilation set (Sanders injector – preferably with a pressure gauge)
13. Access to a rigid bronchoscope with a light source
14. Access to a surgical tracheostomy set and tubes
15. Drugs <ul style="list-style-type: none"> Vasoconstrictor drops e.g. Drixine® 0.05% or Otrivin® Nasal gel with local anaesthetic e.g. Cathgell® with lignocaine Lignocaine spray 10% e.g. Xylotox® 10% Access to ribbon gauze and cocaine Nebulisation kit for local anaesthetic Mucosal atomiser devices

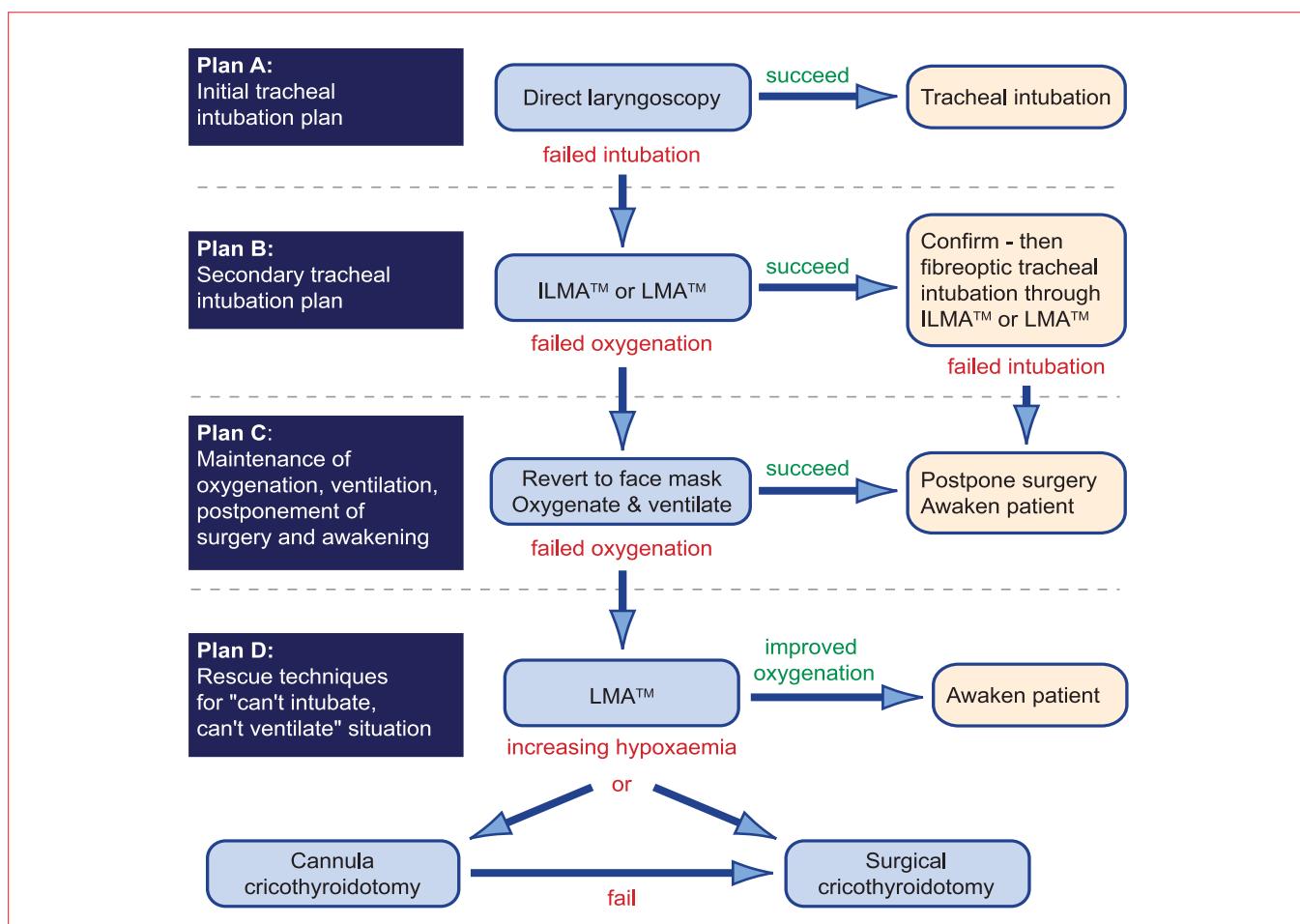
Appendix 3: ASA Airway Assessment and Management Algorithm
 (Practice Guideline for Management of the Difficult Airway. Anaesthesiology 2003;98(5):1273)



The algorithm is available at:
www.asahq.org/publicationsAndServices/Difficult%20Airway.pdf

Permission to reprint the algorithm could not be obtained in time.

Appendix 4: DAS Airway Management Algorithm.
 (Henderson JJ et al. Management of unanticipated difficult intubation guidelines. Anaesthesia 2004;59:675-694)



Appendix 5
DIFFICULT INTUBATION EQUIPMENT SUPPLIERS

1. DIFFICULT AIRWAY CART (Recommended cart)

Description	Supplier	Manufacturing code	Motivation
Q11 – small cart	Medicare hospital equipment	furnecq11e <i>Dimensions: 610 X 860 X 610</i>	This cart is small and mobile, with sturdy wheels. It is fitted with 5 drawers, compartmentalised and marked. It should be stocked with disposables for advanced airway management. The trolley is lockable.

1. UPPER AIRWAY DEVICES

Description	Supplier	Manufacturing code	Motivation
Combitubes and alternatives:			
Combi-tube	Tyco	41 fr 5-18541 37 fr 5-18537	Used in difficult intubations. Placed blindly, without a laryngoscope. The 2 cuffs create a seal and protect the airway against aspiration. Wherever the tube is placed in the trachea or oesophagus, a patent airway can be established.
Alternatives: 1. Easytube 2. Laryngeal tube			
Disposable laryngeal masks:			
a) Solus	Intersurgical	Mask no 1: AWLM 8001 Mask no 1½: AWLM 8015 Mask no 2: AWLM 8002 Mask no 2½: AWLM 8025 Mask no 3: AWLM 8003 Mask no 4: AWLM 8004 Mask no 5: AWLM 8005	Used in place of endotracheal tubes. In difficult airway situations, may be able to ventilate and oxygenate the patient, where the usual face mask may fail. No need for sterilisation.
b) Ambu	SSEM	Mask no 1: 321 100 000 Mask no 2: 321 200 000 Mask no 3: 321 300 000 Mask no 4: 321 400 000 Mask no 5: 321 500 000	
c) Portex	Smiths	Size 1: 100/220/100 Size 2: 100/220/200 Size 3: 100/220/300	

3. AIRWAYS

Description	Supplier	Manufacturing code	Motivation
Ovassapian airways	Hiline	HU009785 BD6075	Facilitates the placing of endotracheal tube orally whilst using the fiberoptic bronchoscope.
Berman airways	Smiths		Facilitates oral fiberoptic intubation.
Nasopharyngeal airways	Smiths	Size 6: 100/210/060 Size 7: 100/210/070	In a patient who cannot open his mouth, this soft airway can be placed through the nose.
	Tyco	Size 7:	This airway has built-in tubes to connect to the oxygen source and capnogram.

4. ENDOTRACHEAL TUBES

Description	Company	Manufacturing code	Motivation
Parker flex tip tubes (MLT)	SSEM	Size 6: PAIPFHV 60 Size 6.5 ditto 65 Size 7 70 Size 7.5 75	These tubes are useful when tubing a patient with the fiberoptic scope, as they are designed to hug the scope and therefore pass through the vocal cords more easily.
Microlaryngoscopy tubes (MLT)	Tyco Smiths	Size 4: 121-40 Size 4.5: 121-45 Size 5: 121-50 Size 5.5: 121-55 Size 6: 121-60	These are adult length tubes with cuffs, but are very narrow in diameter, allowing intubation and airway protection in patients with pathologically narrowed airways.
Standard endotracheal tubes		Uncuffed 2 to 6.5 Cuffed 6.0 to 9.0	
Reinforced tubes (armoured)		Cuffed 6.0 to 9.0	

5. INTUBATION VIA THE TRACHEA

Description	Company	Manufacturing code	Motivation
Retrograde intubation kits	Cook Marcus Medical	C-RETRO-14.0-70-38J-110 CAE C-RETRO-11.0-70-38J-110 C-RETRO-6.0-50-38J-110	Percutaneous entry via cricothyroid membrane permits retrograde placement of a wire guide orally or nasally. Anterograde introduction of a hollow guiding catheter, allows oxygenation and then intubation.
Seldinger cricothyroid-otomy sets	Cook Marcus Medical	C-TCCS-400 C-TCCS-350	Used to establish an airway through the trachea in an emergency situation, if no airway access is possible through the mouth. Percutaneous entry via cricothyroid membrane.
	Smiths	Minitrach	
Single stab Cricothyroid-otomy	Smiths	PCK	Single incision required. Tracheal entry indicated by loss of resistance, followed by immediate advancement of a cuffed endotracheal tube.
Dilatational tracheostomy kits	Cook Marcus Medical Smiths Medical Intersurgical	Blue Rhino	Used for establishment of a definitive airway after rescue, where long-term upper airway obstruction is expected.

6. LOCAL ANAESTHESIA ADMINISTRATION DEVICES

Description	Supplier	Manufacturing Code	Motivation
Laryngotracheal anaesthesia kit (LTA) 360 degree	Smiths Medical	7031/61	Enables topicalisation via vocal cords of the trachea.
Mucosal atomisation devices	Perryhill International	MAD 300 Mad 400	Atomisation of local anaesthesia of nasal mucosa and pharyngeal mucosa through the mouth is made really easy.
Hudson's humidifier		RD7800	A plastic facemask with a nebulisation facility. Mask attaches to wall oxygen.

7. EXCHANGE CATHETERS

Description	Supplier	Manufacturing Code	Motivation
Cook airway exchange catheters	Marcus Medical	G07833 C-CAE-8.0-45 G06732 C-CAE-11.0-83 G07873 C-CAE-14.0-83 G05880 C-CAE-19.0-83	Used for uncomplicatedatraumatic endotracheal tube exchange. Use of removable Rapi-Fit® Adapter permits use of ventilatory device necessary during exchange procedure.

8. INTUBATING STYLET/BOUGIE

Description	Supplier	Manufacturing Code	Motivation
Frova intubating introducers	Marcus Medical Cook	<i>With stiffening cannula</i> C-CAE-8.0-35-FII C-CAE-14.0-65-FII <i>Without stiffening</i> C-CAE-14.0-65-FI	Used to facilitate endotracheal intubation. Angled tip assists in blindly placing bougie through vocal cords if anterior larynx. Can ventilate through hollow tube.
Eschmann bougie	Tyco		flexible bougie, place blindly between unseen F vocal cords.
Parker Flex-It	SSEM	<i>Use in 6,5-7,0 mm tube</i> REF FLEX 6570 <i>Use in 7,5-8 mm tube</i> REF FLEX 7580	Place inside endotracheal tube and enables acute angulation of tip of tube.

9. MISCELLANEOUS

Description	Supplier	Manufacturing Code	Motivation
Light wand	GRS medical	VS 3960	Used in difficult intubations. Flexible lighted stylet can be used to intubate without a laryngoscope.
Trachlight	Survival Technology		Non-disposable handle. Re-useable but replaceable wands. Removable stylet to allow complete flexibility for nasal/ILMA intubation.
Fibreoptic bronchoscope swivel connector	Smiths	100/257/000	Place fibreoptic scope through this connector. Can view vocal cords and bronchi while still ventilating.