Clinical Standard Operating Procedure (SOP)

RAPID SEQUENCE INDUCTION INTUBATION

University Hospitals Bristol NHS
NHS Foundation Trust
NEST Newborn Emergency Stabilisation & Transport Team
Southwest Neonatal Network

Setting	UHBristol: Neonatal Emergency Stabilisation and Transport Team
Staff	NEST Team
Patients	Neonates being intubated

Aims

Ensure a standard approach to rapid sequence induction of anaesthesia and intubation (RSI) by the Newborn Emergency Stabilisation and Transfer team (NEST) clinicians in order to minimise risk and optimise effectiveness of transfers.

Background

RSI performed in the retrieval environment is recognised as being part of a high quality retrieval and transfer critical care team. It is a high risk but potentially lifesaving procedure that aims to enhance patient outcome and facilitate a safe transfer. It is not without risk and may prolong retrieval times.

Indications for RSI

The decision to perform RSI should be undertaken for each individual patient according to dynamic risk/benefit assessment. This will include factors such as urgency, clinical instability, predicted clinical trajectory and predicted difficulty of intubation.

These indications include the following using an ABCD principle.

A: Airway

Requiring airway protection best performed by endotracheal intubation

B: Breathing

Ineffective or inadequate ventilation whereby RSI and endotracheal intubation would optimise ventilation and gas exchange and allow drugs to be given such as Surfactant and Nitric Oxide

C: Circulation

Haemodynamic instability can be potentiated by induction of RSI and should not be considered an indication for RSI per se. However, in the severe circulatory instability RSI to facilitate stability of airway and breathing allowing the focus to remain on stabilising circulation may be beneficial.

D: Disability

Neurological conditions with a reduced level of consciousness requiring support of airway or breathing. Severe agitation depending on aetiology may on occasion require RSI to facilitate safe transfer.

Other Indications

Predicted Clinical Course

If the predicted clinical course of the patient would require RSI on arrival at the receiving hospital to facilitate on-going investigation and treatment then retrieval RSI may expedite the transit through to definitive care albeit at the expense of potentially increasing on scene times.

Humane Reasons

If analgesia doses are required that would lead to apnoea, RSI can be undertaken to allow adequate analgesia

Guidance on the decision making process

Each decision to RSI should be performed on an individual patient risk v benefit assessment taking into account the following:

- Patient factors; Technical difficulty and risk of further harm
- Indications
- Time & distance to appropriate destination including mode of transport
- Environmental factors
- Team factors

Preparation for RSI

Pre-RSI Checklist (see page 7)

A standardised pre-RSI check list has been developed, based on a challenge and response format. This can be used as an aide memoire to assist in the preparation phase then as the final challenge and response check prior to induction. (see Page 8)

Controlling the Environment

Retrieval RSI is ideally achieved on a supine patient with 360 degrees of access at an appropriate height with space for a kit dump, oxygen supply, suction and monitoring.

The patient should be positioned (with understanding of airway anatomy) in order to optimise the ability to both intubate and bag mask ventilate. The kit dump should be laid out for ready access by operator one and assistant, including easy access to suction and oxygen.

Monitoring should have an unobstructed eye line to operator one and assistant.

Ideally an RSI should be performed on an open cot / resuscitaire with 360 degree access. This may not be practical on all occasions and dynamic assessment of each individual case to maximise patient safety should be used.

Temperature management is imperative in the RSI patient. Passive cooling to target temperature for HIE patients may be indicated and active warming of preterm infants to aim for temperature of >36 C.

Active crew resource management (CRM) is vital to ensure control and clinical safety at the scene of the RSI.

Briefing the retrieval team together and stating the reason for RSI, the plan for achieving the RSI and delegating roles is key to maintaining patient and clinician safety. Ensure this briefing occurs on every occasion – it is time well spent.

Retrieval RSI should be performed by a competent ANNP / Doctor and trained team member ideally with the assistance of 1 additional person. The team leader will designate these roles as appropriate.

Immediately prior to RSI a calm, quiet environment is essential to complete check list, and allow team members to communicate timings of drugs and actions during intubation. This may require extra people to leave the room.

The choice of intubator (operator 1) at RSI is dependent on multiple factors including crew resource management and human factors. The delegation of intubator (operator 1) should be made once the decision to perform RSI has been made. The decision will involve all RSI team members but the final decision rests with the senior RSI competent doctor / ANNP at scene.

Role Allocation
The decision regarding first intubator has been described above but the intubator must be an RSI team member.

Operator 1	Intubating clinician
Operator 2	Assisting clinician and has overview of the whole procedure
External Laryngeal manipulation (ELM)	Operator to assist with external laryngeal manipulation (or cricoid if indicated)

Cricoid pressure is not mandatory due to limited evidence of effect and potential for worsening laryngoscopic view.
Bimanual external laryngeal manipulation should be advocated to optimise grade of view at laryngoscopy.
Manual in line stabilisation of the cervical spine is advocated if the risk of cervical spine instability is considered high. However, achieving an adequate airway is paramount.

Kit Dump
A standardised kit dump layout would be beneficial to allow teams to work together at units – a template has been designed to standardise this layout

Pre-oxygenation
Ideally 3 minutes of pre-oxygenation should be obtained prior to induction. This can be achieved by three techniques.

1. Tight fitting reservoir mask with high flow oxygen
2. Bag mask or Neopuff Mask
3. Ayers T-piece

The choice will depend on operator familiarity and availability of equipment.
Apnoeic oxygenation through induction with nasal specs has increasing scientific evidence to support its use and should be adopted for all RSI if dependant on oxygen

Patient Assessment
Once a patient has been anaesthetised vital clinical information is lost. Therefore before undertaking RSI ensure that you have accurately assessed all of the following.

- Respiratory rate
- Movements and where applicable Glasgow coma scale
- Pupillary response
- Abdominal tenderness and guarding
- Airway assessment, looking for evidence of difficult airway (micrognathia, dysmorphic features etc.)

Equipment
The kit dump should be laid out to allow immediate access to all required airway equipment including rescue airway.
Sufficient oxygen should be present to allow pre-oxygenation, apnoeic oxygenation and on-going ventilation and transfer.
Two forms of suction must be present and readily accessible.

Monitoring

Full monitoring, ECG, oxygen saturations, non-invasive blood pressure on 2 minute cycle should be applied if no invasive arterial line is in situ. Waveform $EtCO_2$ must be present and ready to be attached. The monitor should be removed from the transport incubator to facilitate this

Vascular Access.

Ideally two IV/IO accesses should be inserted, secured and functioning prior to RSI. However, in extremis a single functioning access may be considered. One access should have fluids connected and running to act as flush for drugs.

Drugs

A balanced RSI requires induction drug in appropriate dose and neuromuscular paralysing drug to facilitate intubation.

All drugs for RSI induction and maintenance of anaesthesia should be drawn up and labelled prior to induction.

The choice of induction drug will be dictated by clinical considerations. The clinician must be aware of the pharmacokinetic properties of the drug and familiar with its use.

Fentanyl

Fentanyl is the first line induction agent in Neonatal patients. It will also reduce the sympathetic response to laryngoscopy as is recommended in all patients with risk of increased ICP or bleeding from rapid rise in blood pressure. The efficacy is dose dependant and full blunting of sympathetic response may require 5mcg/kg but is usually effective at 3mcg/kg. The haemodynamically unstable patient will require an attenuated dose. The peak time of effect is 3 minutes however respiratory depression will often occur prior to this and a decision as to whether to bag mask ventilate the patient or proceed to induction prior to 3 minutes should be taken if respiratory compromise occurs during this period.

Ketamine

(Second line agent) Most congenital cardiac patients and those that are haemodynamically unstable should be induced with ketamine as it has good haemodynamic stability. The usual induction dose is 2mg/kg though this may need to be reduced in the profoundly hypotensive patients.

The sympathomimetic effects of ketamine can cause tachycardia and hypertension which may be harmful in some patients. However these effects can be mitigated with pre-induction fentanyl if necessary

Propofol

Propofol has profound vasodilatation which can result in haemodynamic instability but should be considered for RSI induction in those patients with pure neurological indication for RSI, particularly if hypertension or seizures are co-existent. The dose range is 2.5-4mg/kg.

Long acting neuromuscular Blockade

This is preferred to suxamethonium as there are less contra-indications, duration of action is longer and “wake up” is very rarely a viable option in retrieval RSI.

Vecuronium

The use of Vecuronium for neuromuscular blockade at a dose of 100mcg /kg achieved ideal intubating conditions within 3 minutes

Rocuronium

The use of Rocuronium for neuromuscular blockade at a dose of 1mg/kg achieves ideal intubating conditions within 60 seconds.

Reversal agents

Reversal of Neuromuscular blockade is not usually an option in the unwell child on retrieval however it can be considered. Sugammadex at a dose of 2mg/kg can be used

Drug	Dose Range	Indication	Preparation
Fentanyl	1-5mcg/kg 3mcg/kg usual dose)	Pre-treatment to obtund sympathetic response (1-3mcg/kg) or induction agent (3-5mcg/kg)	50 mcg/ml 2ml vial
Ketamine	1-2mg/kg (2mg/kg usual dose)	Induction for cardiac or shocked patients	10mg/ml 20ml vial
Propofol	2.5-4mg/kg	Induction for hypertensive neurological cases with potential raised ICP	1% solution (10mg/ml) 20ml ampoule
Vecuronium	100mcg/kg	Neuromuscular paralysis (onset 3 mins)	10mg dry powder
Rocuronium	1mg/kg	Neuromuscular paralysis (onset 1 min)	10mg/ml 5 ml ampoule containing 50mg
Sugammadex	2mg/kg	Reversal of NM blockade with Roc / Vec	100mg/ml (2ml vial)

In patients who are unconscious due to severe hypovolaemic shock, or who are clearly agonal but with some residual upper airway tone, it may be appropriate to undertake intubation using only neuromuscular blockade. However this technique is rarely required and not appropriate for patients with a significant cerebral injury.

Delivery of RSI

Induction

1. Having completed the preparation steps, induction should commence. The use of induction drugs and or pre-treatment with opioid is discussed above. The induction drugs are given through an IV or IO line with a suitable flush following them. Drugs should be given by a trained team member.
2. The drugs are given time to act (at least 60 seconds), though onset of paralysis may be delayed if significant shock is present.
3. During this time, the patient is not bagged if their oxygen saturations remain above 93%. If oxygen saturations are below 93% then the patient is bagged with a BVM / Neopuff circuit

The requirement for post-induction ventilation to maintain saturation above 93% is reduced by the use of apnoeic oxygenation via nasal specs.

A standardised approach to difficult airway management is advocated according to the principles outlined by the Difficult Airway Society. . A “wake up” option is very rarely appropriate in the patient group undergoing Retrieval RSI.

Each team performing RSI should be well drilled and competent in managing these occurrences. This can be rehearsed in regular drills and simulation based training. The team must be competent and able to deal with these potentially harmful situations.

A standardised planned approach is advocated and must be clearly understood by all team present at each RSI.

This can be reinforced by the use of the pre-RSI checklist.

Plan A

For laryngoscopy start with a suitable sized blade. Carry out manual manipulation of the larynx to perfect the view, guiding the ELM assistant’s hand to maintain the position.

The use of cricoid pressure is at the discretion of the senior clinician on a risk-benefit assessment for each individual patient.

Only advance the ET tube to place the thick black line at the level of the cords. Note the length of the tube in cm at the patient’s mouth.

The cuff of the ET tube is inflated (if present) and the patient is bagged via the ET tube. The presence of end tidal carbon dioxide demonstrates the ET tube is within the patient’s airway. This can be initially confirmed using colourimetric method (PaediCap). Waveform capnography must subsequently be used. Checking for equal chest movement visually and by auscultation suggests the ET tube is in the trachea (rather than further down a main stem bronchus). Secure the tube with a neobar

If the first intubator is unable to successfully intubate up to 2 further attempts can be made using a change of head position, operator or blade. Cricoid pressure should be removed and external laryngeal manipulation optimised if there is difficultly in viewing the laryngeal inlet. A bougie can be used if only a partial view of the cords is visible

Adequate oxygenation is paramount during this process.

Optimisation of oxygenation to the patient is the key concern. In some patients, normal saturations may not be possible (i.e. because of underlying respiratory pathology).

Once intubation has been confirmed proceed immediately to the post-intubation checklist.

One attempt Airtraq or Glidescope (indirect video laryngoscopy) could also be considered if available

Plan B

If unable to intubate (no more than 3 attempts) and saturations cannot be maintained with a bag valve mask, use a supraglottic airway device. Currently iGel is the preferred supraglottic rescue airway.

Plan C

If the patient cannot be oxygenated with the measures in plan B. Then progress to front of neck for needle cricothyroidotomy.

NEST pre RSI Challenge-Response checklist

Checklist for emergency intubations red points only

Decision making
- Why are we anaesthetising this patient ?
- Do we have optimal 360° access to the patient / positioning ?
- Is difficult airway anticipated (do I need anaesthetist / ENT surgeon ?)
- Has NEST top cover been informed ?
Equipment
- Oxygen
- Working Suction
- 2 functioning iv lines
- Patient monitoring all attached, baseline obs done
- Waveform capnography warmed up and attached to BVM or Neopuff
- Check kit
• Nasal Cannulae for Apnoeic oxygenation ?
• Bag Valve Mask or Neopuff or Ayres T-Piece
• OPA size……./ NPA size……
• 2 Laryngoscopes “bright and white”
• Blades required… Miller (straight)……Mac (curved) ……..
• ETT tube size (expected…… next size down…….)
• Syringe for cuffed tube (balloon checked) ?
• ETT introducer needed ?
• Bougie available ?
• Paedi-cap / Easy-cap available ?
• Method of securing ETT
• Difficult airway - LMA size….. / ….. Glidescope…..... Airtraq…..
• Surgical airway (needle cric kit available)
• Ventilator ready
Team
- Do we have 2 team members with clearly defined roles
- Airway plan (including failed airway) discussed with team
- Cricoid, (how, when, move?)
Drugs
-Induction agent and dose ?.....
-Muscle relaxant and dose ?.....
-Maintenance infusion being prepared ?
-Fluid Bolus / Inotrope (Adrenaline 1:100,000) pre draw necessary ?
Final checks
-Pre oxygenation optimal
-Drugs drawn and ready
-Final patient assessment (limb movement, RR, Pain and set of Obs)
-“Quiet please”

NEST Intubation and Failed Intubation Pathway

PREPARE
(Self / Environment / Team / Patient)

Use RSI Checklist

Do we have 360° access around patient, and 2 functioning iv lines ?

Is the patient's airway position optimal ?

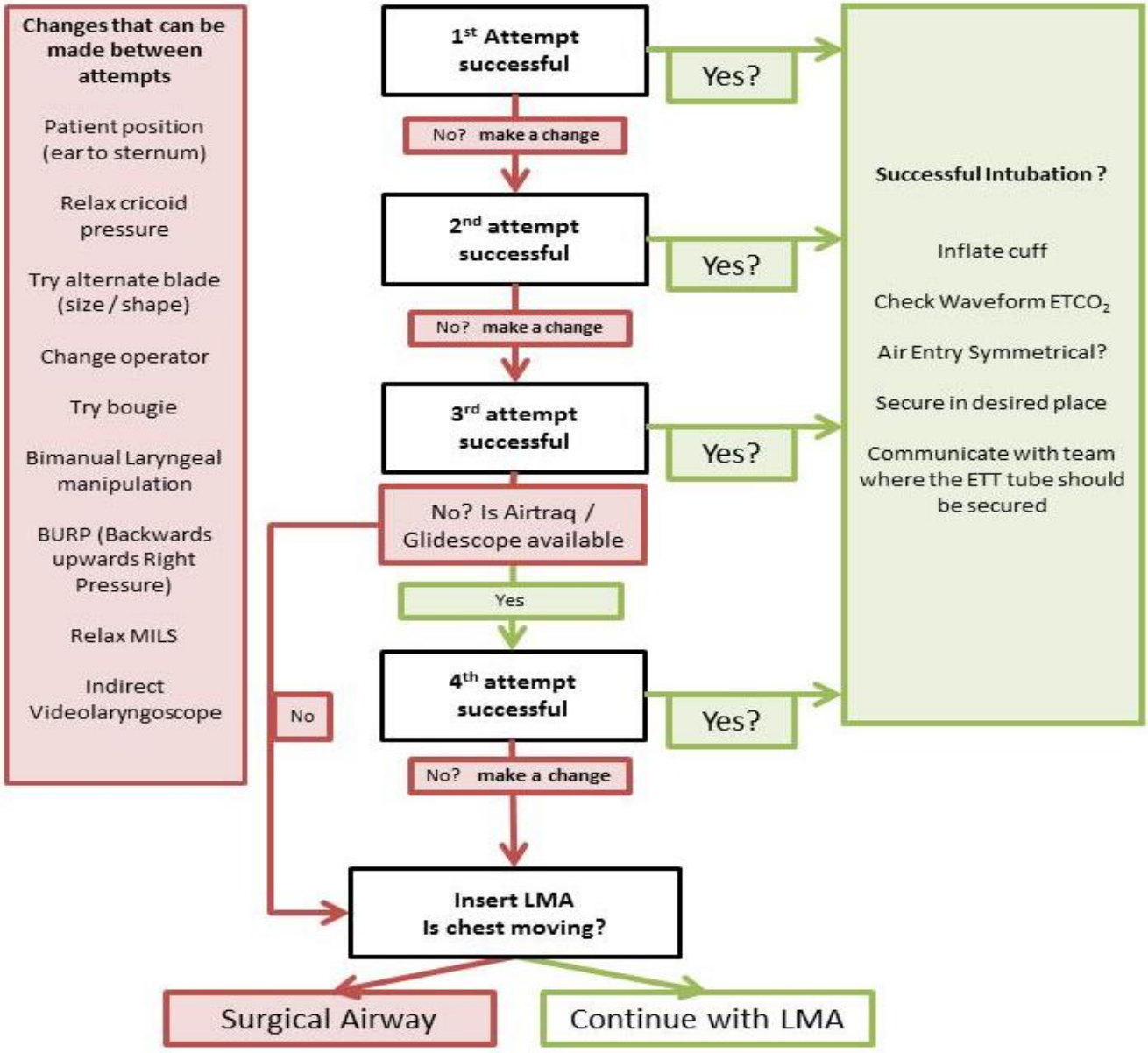
Do we have optimal induction / muscle relaxation meds / doses ?

Do we have difficult airway equipment ready (to hand) ?

Are team aware of roles ? (who is intubating, giving drugs, passing equipment)

Do those undertaking Cricoid / MILS (Manual Inline Stabilisation) understand what is expected of them ?

Give induction agent, allow 60-90 seconds before giving muscle relaxant.



Post-RSI Checklist

1. The immediate post-RSI period should be used to reassess the patient optimise stability and prepare to transport. There can be a tendency to post intubation inertia and the Post-RSI check list is designed to ensure patient safety and direct progress.
2. Waveform capnography must be attached and functioning to confirm tracheal tube placement and guide ventilation. Adequate oxygenation delivered and the tracheal tube secured and the length at lips appropriate and documented.
3. Chest examination performed to ensure correct tube length and assess for potential pneumothorax.
4. Hypotension can occur after RSI particularly in the presence of hypovolaemia and the cause may be multifactorial. Potential causes include
5. Induction drug; vasodilation and myocardial depression. This may require treatment with fluids and inotropic and vasopressor support.

Tension pneumothorax

In the intubated patient this will require rapid diagnosis and treatment with drainage and needle decompression within 60 seconds. Hypoxia and increased airway pressure will be the earliest signs with reduction in ETCO2 and hypotension occurring. Tracheal deviation is a late & unreliable sign. Ultrasound to diagnose pneumothorax can also assist.

POST - RSI CHECKLIST	
A & B	$ETCO_2$ trace
	Oxygenated
	Adequate ventilation –
	Auscultate Chest
	ETT length & Secured
	Chest Drain required ?
C	Post-induction BP
	Vasopressor or fluids required
	Vascular access adequate
D	Maintain anaesthesia
E	Temperature Probe & Management plan

An RSI Audit form should be completed after each RSI

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RSI audit form

Date of procedure		Patient Age		Audit ID no	
Gestation at birth		Current Weight			
Location of baby					
Location of RSI					
ANNP(s) present					
Doctor(s) present					
Nurse(s) present					
NEST top cover informed?		Time of discussion			
Time Arrived at Referring Hospital		Time of Decision to RSI			
Time of RSI		Time left referring hospital			
PRE RSI					
Diagnosis					
Why was the baby being anaesthetised?					
Was optimal access and positioning ensured?					
Was a difficult airway anticipated?					

Equipment laid out (tick all that apply)

- Bag Valve Mask / Neopuff / Ayres T-Piece
- OPA size……./ NPA size……
- 2 Laryngoscopes "bright and white"
- Blades required… Miller (straight)……Mac (curved) ……..
- ETT tube size (expected…… next size down…….)
- Syringe for cuffed tube (balloon checked)?
- ETT introducer needed?
- Bougie?
- Paedi-cap / Easy-cap?
- Method of securing ETT
- Difficult airway - LMA size….. / ….. Glidescope….. Airtraq…..
- Surgical airway (needle cric kit available)
- Ventilator ready

Did you use the visual template?

If yes was it helpful?

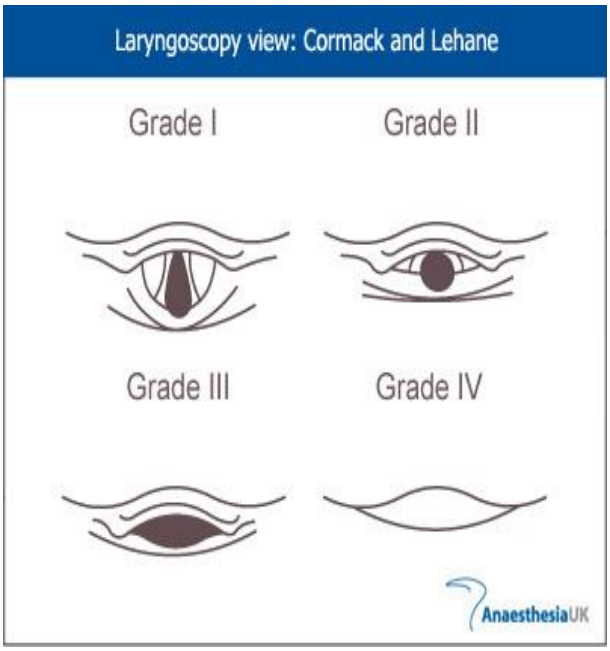
Equipment check pre-procedure (tick all that apply)

- Oxygen
- Suction
- 2 functioning iv lines
- Monitoring attached

DURING RSI							
Fluid bolus given pre RSI?							
1st Analgesic Drug given and dose							
1st Muscle relaxant given and dose							
Extra doses of muscle relaxants or analgesic required? (specify drug and dose)							
Other drugs used? (specify drug and dose and why used)							
Number of intubation attempts		Grade of view					
Insert initials of those who attempted intubation, put number of attempts in brackets and circle who was ultimately successful (eg Beth (2) James (1))							
Size of tracheal tube passed		Tube length at lips					
Introducer used?		Bougie used?					
LMA used?		Surgical airway required?					
Tube too long and pulled back –please state if clinically detected or x ray finding		Oesophageal intubation					
SaO2 < 80% at any time?		Oropharyngeal trauma?					
HR< 100 at any time?		Cardiac arrest					
Was pleural drainage required?	Left		Before/ After RSI				
	Right		Before/ After RSI				

Vital signs	Pulse	BP	RR	SaO_2	FiO_2	$EtCO_2$	Comments
On arrival							
1-2 minutes pre-RSI							
1-2 minutes post-RSI							
En route to hospital							
On arrival at hospital							

Destination hospital		Problems or complications Arising	



Related documents	NEST: Respiratory Support SOP
Safety	
Queries	Dr J Tooley. NEST Team 21745