Irish Paediatric Acute Transport Service

Clinical Guideline

Document Details	
Document Type:	Guideline
Document Name:	Pneupac BabyPAC Paediatric Invasive Ventilation Guideline
Document Location:	IPATS
Version:	1.0
Effective From:	18/09/2019
Review Date:	18/09/2022
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Related Documents:	

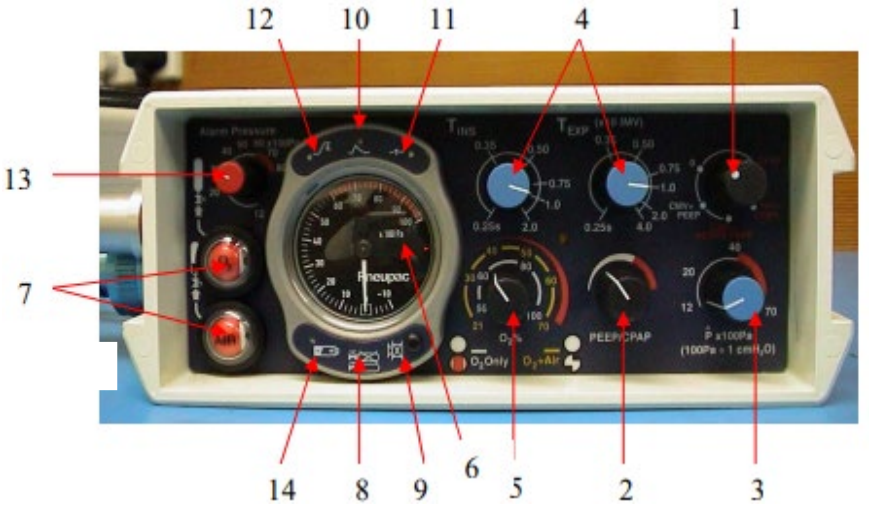
The Irish Paediatric Acute Transport Service (IPATS) has produced this clinical guideline. It has been designed for nurses, doctors and ambulance staff to refer to in the emergency care of critically ill children.

This guideline represents the views of IPATS and was produced after careful consideration of available evidence in conjunction with clinical expertise and experience. The guidance does not override the individual responsibility of healthcare professionals to make decisions appropriate to the circumstances of the individual patient.

Pneupac BabyPAC Paediatric Invasive Ventilation Guideline

(This is not intended to replace the manufacturers guideline and is an aide-memoir only)

- The BabyPAC 100 is a **gas driven** paediatric transport ventilator
- Time/Pressure cycled
- Can ventilate neonates and infants up to (ideally <12Kg)
- 0-330ml Tidal Volumes (12cmH_20 to 70cmH_20)



"Knobology"

1. **Mode Selector** – turns on ventilator & selects mode of ventilation
2. **PEEP/CPAP control**
3. **Inspiratory Pressure**
4. **Inspiratory & Expiratory times** – used to set Ti and ventilator rate – see table below
5. **Oxygen Concentration** (When air is available the yellow ring is operative, when O2 alone is available, the white ring is operative). 21-70% on o2/air mix. Minimum 02 conc of 40% on O2 only – beware in HLHS
13. **High Pressure Relief Valve** – Will emit high pressure alarm when set pressure reached. Set just above PIP set on knob 3

Alarms & Monitoring

6. **Patient Pressure Manometer** – displays patients pressure during respiratory cycle
7. **Supply Gas Failure alarm** – Low gas pressure displays red. Adequate oxygen pressure is white, air is black&white
8. **Single Gas Operations** – A green visual indicator flashes 3times q30sec when operating a single gas supply. If a gas supply fails during use, an audible alarm will sound. This can be silenced using the silence button. Pressing this twice is interpreted as an acknowledgement that moving to a single gas was deliberate and no audible alarm will sound again but the visual alarm will continue
9. **Silencing & Muting of audible alarms**
10. **Cycle indicator –** A green flash indicates each time the patient inflation pressure rises through 10cmH20
11. **Low pressure/Disconnect alarm –** will alarm to warn of possible disconnect or vent not cycling correctly ie vent does not cycle through 10cmH20 q8sec – an asthmatic with RR of <7bpm will trigger this alarm)
12. **High pressure alarm –** Will alarm if PEEP set to >10cmh20 - can be muted if desired
14. **Low battery alarm –** Battery only powers alarms not the ventilator itself which is gas driven

Recommended Modes of Ventilation with BabyPAC Ventilator

- **CMV + Active PEEP –** Delivers set PIP/PEEP. Rate Determined via Ti/Te settings as below.
- **CMV + PEEP –** As above however PEEP is not active and is only maintained via the expiratory valve and is lost if spontaneous breathing occurs. This mode is recommended only when compressed gas economization is required.

How to set the Rate

- The ventilator rate is a product of the inspired and expired time. It is important to remember to preserve an appropriate I:E ratio at all times –aiming for close to 1:2 as standard care.

Texp	Frequency/RR						
0.25	120	80	71	60	48	34	27
0.35	100	71	63	55	44	32	26
0.5	80	60	55	48	40	30	24
0.75	60	48	44	40	34	27	22
1	48	40	38	34	30	24	20
1.5	34	30	29	27	24	20	17
2	27	24	23	22	20	17	15
3	18	17	17	16	15	13	12
4	14	13	13	13	12	11	10
T ins -->	**0.25**	**0.5**	**0.6**	**0.75**	**1**	**1.5**	**2**

	I:E Ratio
	1:1
	1:1.5 - 1:2
	1:2.5
	1:3
	1:4

Paediatric Invasive Ventilation Guideline

(This is a guideline only and is not intended to replace patient-specific decision making by the senior Anaesthesiologist/Intensivist in attendance)

Common indications for intubation in the acute setting

It is often prudent to pre-emptively intubate a deteriorating child in advance of collapse – contact the PICU referral line for advice – 1800 222378

- **Airway protection/patency**
- **Respiratory Failure** – Progressive hypoxaemia/hypercarbia or respiratory muscle failure
- **Cardiovascular Support** - congenital heart disease/myocarditis (*discuss with PICU prior to intubation – can be ++Risk)* or impending cardiovascular collapse i.e. Severe Sepsis
- **Neuroprotection** – to facilitate scanning/optimise pC02 and reduce cerebral metabolic O2 demands
- **Facilitate a procedure** i.e. Central Venous Access / Chest drain insertion

Pre-Intubation Considerations

1. **Location –** Aim to move child as little as possible as this can cause significant delays - bring equipment/staff to the child where possible i.e. Resus/HDU bay
2. **Equipment Selection –** Use intubation/airway guide @ http://www.nasccrs.ie/IPATS/Guidelines/Respiratory/Intubation-and-Airway-guide-1- .pdf as an aide memoire if required
3. **Induction agents –** Ketamine 2mg/kg + Rocuronium 1mg/kg IV is a cardio-stable and reliable induction combination for most children. For older haemodynamically stable children, propofol + muscle relaxation is generally well tolerated. Atropine can be a useful adjunct in the ill neonate at risk of vagal stimulation and bradycardia.
4. **Pre intubation checklist / team huddle** – We recommend printing & using the 'pre intubation checklist' to ensure all monitoring/ equipment and team dynamics have been discussed prior to intubation. http://www.nasccrs.ie/IPATS/Guidelines/Respiratory/intube.pdf

Post Intubation Checklist

ETT Confirmation: Auscultation □ + ETC02 waveform Capnography □ + **CXR** □ **(Chest X Ray is mandatory before transfer). Naso/Oro gastric tube placement is required in all ventilated children – on free drainage for transfer**

Ongoing sedation: Young/unstable children – Morphine 20mcg/kg/hr (10-40mcg/kg/hr) + Midazolam 2mcg/kg/min (1-5mcg/kg/min). Older stable children can be sedated with Propofol infusion. We recommend intermittent muscle relaxation in all ventilated patients for transfer. Urinary catheterisation of all paralysed patients is recommended.

Blood Gas: Any blood source (cap/ven/art) is acceptable in paediatrics. Perform **at least one gas** on transport ventilator prior to departure - ideally after approx. 10min of stable ventilator settings. Correlate with ETC02 for ambulance journey.

Suggested *Starting* Ventilator Settings

Patient	Peak Pressures Start at lowest pressure to achieve chest rise	Tidal Vol	PEEP	Rate	I Time	I:E ratio	Target Sats
Infant	15-25	5-7ml/kg/min is a safe tidal volume target for most infants and children. Peak pressures should be weaned to target this volume to limit barotrauma whenever possible	5	35	0.5	1:2	>94%
Young child	15-30		5	25-30	0.7	1:2	>94%
Adolescent			5	15-20	1	1:2	>94%
+Asthma	To move chest		0-5	12-20	1	1:2-1:4	>90%
+ARDS	To move chest		5-15	15-20	1	1:1.5 -1:2	>88%

Troubleshooting Ventilation

D isplaced ETT	Ensure ETC02 reading, auscultate chest, check ETT depth at lips
O bstructed ETT	Suction ETT with largest possible catheter, **saline lavage can be very helpful** (1ml/kg up to 10ml per lavage)
P neumothorax	Check trachea is midline/look + auscultate, CXR if unsure / trans illuminate if neonate
E quipment	Check ventilator settings and circuit. Higher pressure may be required to ventilate children on T/port vents
S tomach	Ensure NG/OG is open and aspirate to ensure diaphragm splinting is not occurring

Deadspace – This can be difficult to manage in small infants on transport ventilators. If Pc02 is difficult to clear - ensure rate is optimised & breath stacking is not occurring; consider cutting ETT (leave 4cm); Ensure appropriate sized circuit is in use. Contact PICU 180022237 for further advice if these measures are ineffective. **Do NOT remove the HME filter or ETC02**