LRI Emergency Department

Acute hypercapnic respiratory failure (AHRF) management

Version 67

Intended to aid decisions regarding safe use of NIV (Non-Invasive Ventilation) and escalation to critical care

Use only if arterial pH <7.35 AND pCO_2 >6.5

Disclaimer:
This is a clinical template; clinicians should always use judgment when managing individual patients

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Patient details

Full name

DoB

Unit number

(use sticker if available)

ABG on arrival
Time
pH
P_aCO_2
Base excess

Repeat ABG (if needed)
Time
pH
P_aCO_2
Base excess

Gas after 1h on NIV
Time
pH
P_aCO_2
Base excess

- Manage in resuscitation room (ER) using ABCDE approach
- Give oxygen only if required to keep SpO_2 at 88-92%
- Involve ER senior **NOW**
- Contact ITU **NOW** if patient critically unwell (see box 1) **UNLESS** ITU care clearly not appropriate (see box 2)
- Record initial ABG result on the left

Use Venturi mask at lowest concentration that maintains the desired target SpO_2

- If COPD exacerbation, see box 3 for actions
- If pulmonary oedema, try CPAP initially (plus GTN / loop diuretics)
- If drowsy and on benzodiazepines or opiates, try reversal

Potentially reversible cause **AND** signs of critical illness absent (see box 1)? — N / Y

- Treatment trial of reversible causes
- Assess improvement after **60min** (or sooner if clinical signs of deterioration)
- Record repeat BG result on the left

Repeat pH <7.35 **AND** pCO_2 >6.5? — N / Y

NIV not indicated; manage as appropriate

Review patient together with ER senior

Use NIV cautiously if
- Pneumonia *unless in COPD patient*
- Central respiratory depression
- Copious respiratory secretions
- Fixed upper airway obstruction
- Facial
  - burns
  - trauma
  - surgery
- Recent surgery to
  - upper airway
  - upper GI tract
- Bowel obstruction

Would ITU care be appropriate (see box 2)? — Y / N

Refer to ITU team

Accepted? — N / Y

ITU care

- Document ceiling of care
- Complete ReSPECT form if ITU escalation is not being offered

NIV contraindicated (see box 4)? — Y / N

Start NIV Bundle (complete box 5)

NIV futile? — Y / N

i.e. blood gas getting worse or patient remains critical after appropriate period on NIV and despite careful troubleshooting

NB: Needs consultant / EPIC decision

See also ED Covid-19 guidance
Withdrawal of CPAP or NIV

GGH transfer feasible (see box 6)? — N / Y

Request respiratory team admission (see box 8)

NIV no longer / not appropriate

Suitable bed available? — Y / N

Transfer to GGH

NB: Transfer escort to return ED NIV machine to ER

Refer to ACB

Admit to **AMU/AFU** for end-of-life care

① Patient critically ill?

☐ **Yes**, as at least one of the below
- Imminent respiratory arrest ☐
- SpO_2 88% despite high flow O_2
- Arterial pH <7.15 ☐
- GCS <9 ☐
- Haemodynamic instability ☐

☐ **No**, as none of the above

② ITU care appropriate?

☐ **No**, because of the reason(s) below
- Has mental capacity & declines critical care ☐
- Too frail to benefit from ITU care ☐
- Advance Decision to Refuse Treatment (ADRT) or ReSPECT form defining a ceiling of care below ITU ☐

NB: Patients with a CFS of 6 or higher are generally considered not to gain a survival benefit from invasive ventilation. Patients with a CFS of 5 should be assessed by ITU for suitability. Discuss with ED senior if in doubt.

☐ **Yes** – as none of the above

③ COPD initial care bundle

Tick off items below when completed

- Nebulizers on compressed **AIR** (not O_2)
- ☐ Salbutamol 5mg nebulizers back-to-back
- ☐ Ipratropium 500MCG nebulizer x2 only

Oxygen via nasal specs:
- ☐ If SpO_2 <88%; give Oxygen 0.5-6L/min to maintain SpO_2 at 88–92%
- ☐ If SpO_2 on air >92%, do not give Oxygen

Steroids:
- ☐ If able to swallow, Prednisolone 30mg PO
- ☐ If unable to, Hydrocortisone 100mg IV

Antibiotics:
- ☐ If evidence of infection, give them
- ☐ If no evidence, do not give antibiotics

④ NIV contraindications?

☐ **Yes**, at least one of the below
- Acute asthma ☐
- Agitation if not settling after Haloperidol ☐
- Vomiting if not settling after antiemetics ☐
- Pneumothorax if not successfully drained ☐
- Head injury if suitable for ITU or QMC ☐
- Moribund patient ☐

☐ **No**, none of the above

⑤ NIV bundle

Tick off items below when completed

- ☐ Start NIV as per setup guide in box 7 on reverse (trained nurse or doctor only!)
- ☐ Notify DART nurse on **Bleep 5293** or dial **#6826 (**links to mobile **07960 779855**)
- ☐ Up-titrate IPAP over 10-30min to 20-30
  NB: in neuromuscular disease [NMD]), keep IPAP at 10, or 5 above usual setting
- ☐ Start 'NIV acute patient record' & audit form ('NIV pack' available from 'ER – Other' menu)
- ☐ Repeat blood gas after 50-60min (or sooner if clinical signs of deterioration)
- ☐ Act on repeat gas result
  - If gas no better, discuss with ED senior ☐
  - If gas improved, maintain present settings ☐

⑥ Suitable for GGH transfer?

☐ **NO**, as at least one of the below

Patient deteriorating despite NIV		☐
Uncooperative or agitated		☐
pH still	<7.25 or falling	☐
SpO_2 despite maximum FiO_2	<88%	☐
GCS	<13	☐
Respiratory rate	*EITHER* >29/min	☐
	OR <11/min	☐
Heart rate	*EITHER* >130/min	☐
	OR <50/min	☐
Systolic BP	*EITHER* <90mmHg	☐
	OR >180mmHg	☐
Need to stabilise critical comorbidity (e.g. arrhythmia, deranged electrolytes etc.)		☐

☐ **YES**, as none of the above

① Assessment by ② Senior sign-off (consultant when present, EPIC when not) by

①

②

Print name Signature Position

⑦ NIV setup guide (NIPPY 3+)

- All equipment and paperwork can be found in the resuscitation room equipment stacks
- Place NIPPY 3+ on a clean trolley next to patient
- Ensure machine is connected to mains power throughout use in ED (to charge battery)
- Choose correct mask size (there's a sizing guide)
- Assemble breathing circuit as shown in the picture from NIV consumables pack, and attach it to the NIPPY 3+ outlet

Do not yet fit mask onto patient at this point

- Press Start/Stop button to switch on machine
- In the Mode menu, ensure screen shows that machine is set to PRESSURE SUPPORT
- Settings can be changed by pressing the ◀ and ▶ buttons
- If settings are locked, press ◀ and ▶ simultaneously; hold for 2sec to unlock them
- Press Hi Alarm and set it to 160L/m, then press Lo Alarm and set it to 20L/m. (This will keep the alarms from becoming a nuisance temporarily while you are setting up the system.)
- Set IPAP to 15.0cm H_2O
  (or 20 if pH <7.25; in neuromuscular disorders [**NMD**] start at 10, or 5 higher than usual setting)
- Set EPAP to 3.0cm H_2O
  (higher only if NIV given for pulmonary oedema, or if obstructive sleep apnea [**OSA**] suspected)
- Set Back Up breaths to 12BPM

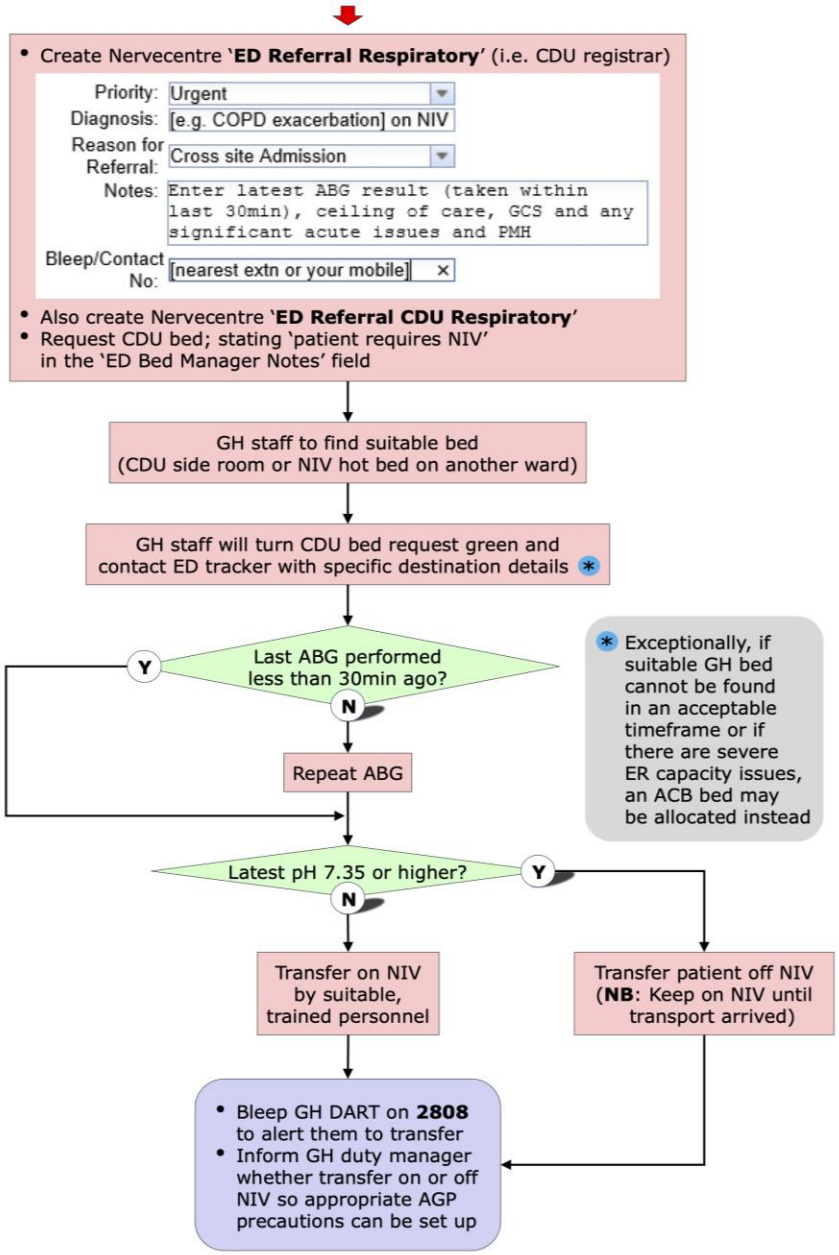
Patient may now hold mask to their face (assist if required)

- Allow patient to get used to breathing through the mask
- If inspiratory or expiratory triggers need to be fine-tuned press Menu/Clear, select 1. Adjust trigger levels and adjust to suit patient. Trigger sensitivity is scaled 1-10, 1 being the most sensitive.
- Count respiratory rate. If the respiratory rate displayed at the top of the screen is greater consider adjusting trigger, as it might be too sensitive and causing 'self triggering'.

Strap mask to patient. Check for air leak at the top of the mask as this can rapidly damage the eyes. Remember the patient does not exhale via the machine but through the exhalation port in the circuit – ensure this is not occluded.

- Check SpO_2. If < 88%, give oxygen and titrate flow by 1L increments until SpO_2 88-92%.
- Press and hold Hi Alarm – this will automatically set the high flow alarm
- Press and hold Lo Alarm – this will automatically set the low flow alarm
- Cancel the Mute (if on) - press and hold 🔕 for 2 seconds (until beep is heard)
- Test high flow alarm and disconnect alarm by disconnecting the breathing circuit at the NIPPY 3+ outlet. The alarm will be activated after a delay of 5 seconds (screen will display high flow alarm message). After a further 5 seconds, the alarm will be replaced by the disconnect alarm (screen will show disconnect alarm message). Reconnect circuit.
- Test low flow alarm by occluding NIPPY 3+ outlet for 10sec (alarm signals possible blockages in breathing circuit or patient's airway). Alarm will sound (screen will show low flow alarm message and the flow display will turn red). Reconnect circuit.
- Check inspiratory/expiratory trigger indicators on screen – should 'flash' at start of each breath
- Up-titrate IPAP in 2.5cm steps to 20.0-30cm within 10-30min (but **DO NOT** up-titrate in **NMD**)
- EPAP > 8.0 may be needed in obesity hypoventilation syndrome (OHS; BMI >35), if hypoxic due to severe kyphoscoliosis (aids lung recruitment) or to overcome intrinsic PEEP in severe airflow obstruction
- **NB: DO NOT** exceed IPAP 30 or EPAP 8 without first discussing patient with respiratory team
- Lock settings to prevent inadvertent changes: Press ◀ and ▶ together then hold for 2sec
- Before any transfer, check remaining battery run time by double-clicking the SET button

Switching off the NIPPY 3+

- Disconnect the patient outlet port
- Press Start/Stop; 'Switch Ventilator Off' message will appear on screen
- Wait 2sec then press Start/Stop again (delay built in to prevent accidental switch-off)

⑧ Respiratory team admission request