

Stepwise Approach to NIV

"An education isn't how much you have committed to memory, or even how much you know, it's being able to differentiate between what you know and what you don't know."

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Clinical Vignette

- 58 year old female, hx severe COPD
- Multiple admissions for AECOPD past 2 years
- CC: dyspnea, productive cough, increasing SOB, wheezing
- Alert although sleepy
- Meds: bronchodilators, steroids
- HR 110/min, BP 130/80

Initial ABG (100% NR3)

- pH 7.25
- SpO₂ 85%
- PCO₂ 70
- HCO₃ 29

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What should we do now?

Where should they go?

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NIV Care Bundle

- 3 Main Settings
 - FIO2
 - EPAP / CPAP
 - IPAP
- Driving Pressure = IPAP – EPAP
- Set driving pressure at a minimum of 5 cm H2O
- Initial pressure settings
 - IPAP 10 cm H2O (range 10-20)
 - EPAP 4-5 cm H2O
 - FIO2 50-100%

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Troubleshooting

- If PCO₂ high, ↑ TV by ↑ IPAP
- If PO₂ low, ↑ EPAP or ↑ FIO₂
- If pH < 7.25, RR > 25 or new onset confusion
 - Clinical Review
 - ✓ Mask
 - ✓ Chest PT
 - ✓ Steroids
 - ✓ Bronchodilators
 - ✓ ICU consult
 - Need for monitored unit → trend the data target O₂ sat 88-92%
 - Patient repositioned → maximize ventilation, minimize aspiration
 - ABG at 1 hour and at 4 hours post NIV

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Started BPAP

- Initial ABG (100% NRB)**
 - pH 7.25
 - SpO₂ 85%
 - PCO₂ 70
 - HCO₃ 29
- NIV Settings**
 - FIO₂ 50%
 - RR 35/min
 - IPAP 10cm H₂O
 - EPAP 5CM H₂O

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Clinical Vignette: Case 1

ABG at 1 hour (FIO2 50%)

- pH 7.28
- SpO₂ 85%
- PCO₂ 68
- HCO₃ 29

Clinical findings

- RR 28/min, HR 100/min
- Awake, still in respiratory distress
- Complains of the mask not being comfortable

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Agitation

- The nurse noticed that the patient is agitated and tries to pull the mask off
- She pages the physician who asks to put soft restraints and tell the patient that if they don't comply they will intubate the patient
- What should the nurse/RT/physician do next?

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Agitation Management

- Hypercapnia or hypoxemia can manifest as agitation / confusion which can prevent starting NIV if unable to tolerate mask
- Verbal sedation → can be lifesaving → ensure constant supervision
- Pharmacologic management
 - Sedation Target
 - Improve pt – vent synchrony
 - Minimize resp drive suppression
 - Ideal sedative/drug (rapid onset, no impact on breathing/BP, minimal drug interactions)
 - Agents
 - Analgo-sedatives (Fentanyl, remifentanyl)
 - Sedatives – Dexmedetomidine, Haldol, benzos

*Level of evidence in favor of extensive application of sedatives is limited

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Teamwork Importance

- Core team (directly involved in patient care): nurse, RT, physician
- Patient should rarely be looked after by just one health professional
- Effective teamwork essential for patient safety as it minimizes adverse events
- Incorporation of shared responsibilities with accountability between team members offers great benefit

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Clinical Vignette: Case 1

ABG at 1 hour (FIO₂ 50%)

- pH 7.28
- SpO₂ 85%
- PCO₂ 68
- HCO₃ 29
- HR 80
- RR 30/min
- IPAP 14
- EPAP 6

ABG at 2 hours (FIO₂ 50%)

- pH 7.31
- SpO₂ 91%
- PCO₂ 60
- HCO₃ 29

**RX: HALDOL

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Monitoring BPAP

Initial 1-2 hours

- HR, RR, O₂ sats (continuous), GCS
- Dyspnea
- Hypercarbia
- Patient-ventilator synchrony
- Mask discomfort
- Gastric distension
- Mask leakage (minimize leak)
- Breathing movements, breath sounds

Remember

- Need to eat / drink
- Meds
- 10-15 minute break every 3-4 hours if tolerated
- Pressure sores

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Predictive Factors

<p><u>NIV Success</u></p> <ul style="list-style-type: none"> ○ Lower acuity of illness (APACHE score) ○ Ventilator-patient synchrony ○ Improvement in gas exchange, RR, HR within 1-2 hours ○ Moderate acidosis (ph > 7.2 but < 7.35) ○ pH improvement within 1-2 hours 	<p><u>NIV Failure</u></p> <ul style="list-style-type: none"> ○ Patient intolerance / uncooperative ○ Acidosis ph < 7.25 ○ Severe hypoxemia after 1 hour ○ Early NIV failure due to technical factors (mask intolerance, mask leak)
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Clinical Vignette: Case 2

- 71 year old female, COPD, worsening cough, wheezing
- Temp 37.8°C, RR 28, HR 107, BP 130/90
- R flank pain (kidney stone)

Initial ABG (50% FIO₂)

- pH 7.37
- PO₂ 58
- PCO₂ 55
- HCO₃ 33

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Clinical Vignette: Case 2

- 71 year old female, COPD, worsening cough, wheezing
- Temp 37.8°C, RR 28, HR 107, BP 130/90
- R flank pain (kidney stone)

Initial ABG (50% FIO₂)

- pH 7.37
- PO₂ 58
- PCO₂ 55
- HCO₃ 33

**What Should We Do Now?
NIV? HFNC? O₂?**

- NIV not as useful when pH >7.35
- Correct Underlying Disease

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When to Use NIV?

- AECOPD complicated by hypercapnic acidosis
- $7.25 < \text{pH} < 7.35$
- CPE
- Selected populations in ARF
- Other indications
 - Facilitation of weaning
 - DNR patients
 - Community acquired pneumonia

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NIV Contraindications

Absolute

- Need for immediate intubation
- Patient intolerance
- Inability to protect airway, risk of aspiration
- Facial trauma / surgery (mask fit)
- Upper GI surgery
- Copious secretions
- Bowel obstruction
- Patient says no
- Undrained pneumothorax

Relative

- Hemodynamic instability
- Severe hypoxia ($\text{P/F} < 100$)
- Lack of trained / experienced staff
- Encephalopathy

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Clinical Vignette: Case 3

- 65 year old male, A. Fib, Hx COPD, Hx CHF
- Temp 36.3°C, RR 40, HR 130, BP 110/70
- 50 pack year

Initial ABG (50% FIO_2)

- pH 7.27
- PO_2 : 53
- PCO_2 : 60
- HCO_3 : 28

What Should We Do Now?

Transfer to ICU
 ↑ IPAP to 10, EPAP to 8
 ↑ IPAP to 12, EPAP to 5
 Intubation

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NIV applied to the right patient, in the right setting, in the right way and at the right time improves outcomes

Assign Patient to 1 of 5 Groups

- Immediate intubation / ventilation
- Suitable for NIV and escalation to ICU
- Suitable for NIV but no escalation
- Not suitable for NIV but desires full active treatment
- Palliative care preference
 - Scenario: NIV failure without escalation (need proactive approach to palliation)

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Clinical Vignette: Case 3
What Should We Do Now?

ABG at 1 hour (70% FIO₂)

- pH 7.25
- PO₂ 54
- PCO₂ 67
- HCO₃ 23
- RR 35
- BP 90/60
- CXR - hyperinflation
- IPAP 12, EPAP 5

ABG at 2 hours (100% FIO₂)

- pH 7.24
- PO₂ 75
- PCO₂ 64
- HCO₃ 19
- RR 35
- BP 80/50

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What should we do now?

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NIV Escalation

- Management strategy in event of NIV failure should be made at onset of initiation
- Uncertainty / meet for escalation → discussion of goals of care
- Ph < 7.25 or severe hypoxia (P/F/100) → ICU

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NIV

Best used as a short term strategy to buy time for medical therapy to treat rapidly reversible causes of acute respiratory failure.

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NIV improves important clinical outcomes in AECOPD complicated by hypercapnic acidosis

- Reduction in mortality
- Reduction in intubation rates, rates of nosocomial pneumonia
- Reduction in ICU admission rates / hospital costs

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Enhancing Healthcare Team Outcome

- Review interprofessional team strategies → ensure safety indications
→ familiarity with NIV complications
- Collaboration / communication among team
 - At least 1 member directly observes patient initial 15 minutes / documents in EMR
 - Both nurse / RT should inform treating physician of significant changes/concerns
 - Nurse/RT monitors vital signs, → HR, RR, pulse oximetry, patient comfort

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