NONINVASIVE VENTILATION PROTOCOL FOR TRANSPORT

INDICATIONS AND CONTRAINDICATIONS:

a) INDICATIONS:

Respiratory failure type I (hypoxemic) with S/F< 240 or with moderate dyspnea

Respiratory failure type II (hypoventilation):

- Moderate dyspnea after initial treatment (including HFNC)
- Severe dyspnea
- Symptomatic apneas (hypoxemic and bradycardic patients with a low respiratory rate)

Respiratory failure Type I:	Respiratory failure Type II:
▪ Pneumonia with hypoxemia ▪ Cardiac acute pulmonary edema (APE) ▪ Non-cardiac APE	▪ Apnea ▪ Bronchiolitis ▪ Asthma ▪ Neuromuscular patient with ARF ▪ Cystic fibrosis ▪ Home ventilation patient with a deterioration in respiratory function

Use Wood-Downes score for asthma, and BROSJOD score for bronchiolitis

b) CONTRAINDICATIONS:

General contraindications

- Patient with undrained pneumothorax, bullous pneumopathy, vocal cord paralysis.
- Patient with hemodynamic instability
- Patient with Glasgow Coma Scale <= 12, or progressive decrease
- Patient with active digestive bleeding, recent gastric or esophagic surgery, vomiting or bowel obstruction
- Patient with sinus infection, pneumoencephalus in CT scan, facial trauma

Specific contraindications for NIV in transport

- Patient with NIV in the emergency room, without appropriate improvement on arrival of transport team
- Patient with inappropriate management of secretions
- Patient with S/F <150 at 30 minutes if ARDS is suspected
- Patient requiring settings above IPAP 18/ EPAP 8 and FiO_2 >0.60, or CPAP 10, before leaving the referring hospital (15- 30 minutes on NIV)
- No improvement in work of breathing after 15-30 minutes on NIV
- Upper airway obstruction (laryngitis, foreign body)
- Patient who is not collaborative/poorly synchronized in spite of sedation

MATERIAL:

a) INTERFACES:

Interfaces age < 6 months:

Nasal prongs
Nasopharyngeal tube (NT)

Interfaces age > 6 months:

Oronasal NON VENTED without anti-asphyxia valve

Other complementary material

- wide variety of sizes of headgear
- nebulizing device and connector
- T-piece to add oxygen to home ventilators without blender
- exhalation port if using non-vented mask with home ventilator
- Plateau valve: for hypercapnic patients

b) VENTILATORS AND MODES:

Oxylog 3000:

- patients weighing >10kg
- Mode CPAP +/- ASB
- Activate NIV option on the screen
- Minimum inspiratory trigger of 3 liters per minute
- No rescue breaths for apneic patients

Crossvent 2+

- Patients weighing < 10 kg
- No NIV option → no leak compensation
- Set continuous flow
- CPAP preferably used
- When using PC: set Ti and RR close to patients' needs

Home ventilator (Patient's ventilator)

- Set Clinical mode to modify parameters
- Add oxygen in ventilators without blender (T-piece)
- Use patient's interface except if severe hypoxemia is present

APPLYING THE PROTOCOL:

HOW TO PREPARE YOUR PATIENT:

- Explain the procedure to the parents and older children
- Explore the child, check IV access, and perform preliminary treatments/procedures
- Transfer and monitor the patient
- Set the initial NIV parameters
- Put the headgear on, protect the skin and fit the interface (with oxygen attached to prevent desaturation)
- Connect the tubing
- Adjust the interface according to leaks and optimize comfort.
- Modify the settings to decrease the patient's work of breathing
- Consider pacifier when using NT or nasal prongs.
- Consider nasogastric tube to prevent gastric distension and aspirate stomach contents if: previous feeding within 2 hours, high respiratory support (IPAP>16), neurological or muscular disease or transport time > 2 hours.

SEDATION:

When we should use it:

- Before beginning NIV if the patient is agitated or difficult to calm
- After beginning NIV if the patient is not comfortable or if we observe asynchrony (especially with Crossvent ventilator)

Sedatives and dosage:

- Propofol: 1 mg/kg/h after bolus of 1 mg/kg intravenous
- Levomepromazine: 0.5-1 mg/kg oral
- Ketamine: 5-10 mcg/kg/min + Midazolam 0.05-0.1 mg/kg/h intravenous

RESPIRATORY SUPPORT

NIV for apneas: Use NIV if CPAP is not enough

NIV for hypoxemic patients (pneumonia): Use CPAP if the patient does not have significant work of breathing. For significant work of breathing, use NIV. Do not transport patients with a S/F <150 if ARDS is a possible diagnosis.

NIV for bronchiolitis

Consider CPAP: If BROSJOD score > 8 after optimized treatment, or oxygen flow > 2 liters/min.
Consider NIV: If BROSJOD score > 10 after optimized treatment, or FiO_2 > 0.4 with CPAP.

NIV for status asthmaticus: Consider NIV if WD Score >8 after initial treatment (nebulizations and corticoids).

BROSJOD score:

Wheezes/rales	0: no 1: expiratory wheezes or inspiratory rales 2: expiratory and inspiratory wheezes or rales				
Indrawing	0: no 1: subcostal + lower intercostal 2: previous + supraclavicular + nasal flaring 3: previous + upper intercostal + tracheal tug				
Air entry	0: normal 1: regular and symmetric 2: asymmetric 3: very reduced				
SpO_2	Without O_2 0: ≥ 95% 1: 91-94% 2: ≤ 90%	With O_2 1: > 94% with $FiO_2 \leq 0.4$ 2: ≤ 94% with $FiO_2 \geq 0.4$			
RR		0	1	2	3
	< 3m 3-12m 12-24m	< 40 < 30 < 30	40-59 30-49 30-39	60-70 50-60 40-50	> 70 > 60 > 50
HR	< 1 year 1-2 years	< 130 < 110	130-149 110-119	150-170 120-140	> 170 > 140
Mild: 0-6 moderate: 7-9 severe: > = 10					

SpO_2**:** hemoglobin saturation; RR: respiratory rate; HR: heart rate; O_2: oxygen; FiO_2: fraction of inspired oxygen; m: months

Wood-Downes score (modified by Ferrés)

	Wheezes	**Indrawing**	**RR**	**HR**	**Air entry**	**Oxygen**
0	No	No	< 30	<120	Normal, symmetric	No
1	Final expiratory	subcostal + lower intercostal	31-45	>129	regular and symmetric	Yes
2	expiratory	previous + supraclavicular + nasal flaring	46-60		very reduced	
3	expiratory and inspiratory	previous + upper intercostal + tracheal tug	> 60		Silence thorax	

mild =1-3 moderate = 4-7 severe = 8-14

RR: respiratory rate; HR: heart rate