Critical Care Standard Operating Procedure

Refractory Hypoxaemia in Critical Care

Aim: To provide a stepwise strategy for managing refractory hypoxaemia in critical care patients.

Scope: Ventilated adults with hypoxaemic respiratory failure due to parenchymal lung disease. Patients with predominantly obstructive respiratory failure (eg bronchospasm) or pulmonary embolism are outside the scope of this document.

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Step 1

ARDS Net lung protective ventilation

ARDS Net Goals (GRADE 1A)

- PaO_2 ~8kPa or P/F ratio >13.3 (may tolerate lower PaO_2 if not acidaemic)
- Pplat<30 cmH_2O
- Vt 6-8ml/kg IBW
- Accept high pCO_2 if pH>7.2

Ideal Body Weight (kg)

Male = 50 + 2.3 x (($height_{cm}$/2.54)-60)

Female = 45.5 + 2.3 x (($height_{cm}$/2.54)-60)

Step 2

Additional Measures

In order to achieve the above goals consider:

- Paralysis (GRADE 2A)
- Conservative fluid management (GRADE 2B)
- Bronchoscopy (GRADE 2C)
- Recruitment manoeuvres (GRADE 2C)
- Prone positioning for 16hrs (GRADE 2A); see Prone Position Ventilation SOP

Consider tracking the Murray Score at all stages

Points	**0**	**1**	**2**	**3**	**4**
P/F ratio (kPa)	≥40	30-39.9	23.3- 29.9	13.3- 23.2	<13.3
PEEP (cmH_2O)	≤5	6-8	9-11	11-14	≥15
Compliance (ml/cmH_2O)	≥80	60-79	40-59	20-39	≤19
CXR quadrants infiltrated	0	1	2	3	4

Murray Score = Total Points / 4

Compliance = Vt(ml) ÷ (Pplat – PEEP)

Step 3

Consider ECMO Referral

If still unable to achieve ARDS Net goals, consider ECMO referral (GRADE 1B)

Criteria include:

- Murray Score > 3
- Potentially reversible acute lung disease
- Uncompensated hypercapnoea with pH <7.2

Senior consensus discussion is recommended at this stage

Step 4

Other Measures

If ECMO not appropriate or not available consider:

- Novalung iLA (GRADE 2C)
- Inhaled prostacylin (GRADE 2C)
- High Frequency Oscillation Ventilation (May be detrimental)

Notes

This document describes a standard strategy only and is not prescriptive. It is the clinical judgement of the treating physician to decide which strategy to employ and when.

Conservative fluid management[1]
This can be achieved using diuretics/ fluid restriction/ haemofiltration/ SCUF aiming for at least neutral balance and ideally negative fluid balance if tolerated.

Paralysis[2]
An atracurium bolus followed by an infusion should be considered with the goal of reducing the 'Train of Four' on peripheral nerve stimulation to 2/4 as per the DCCQ Neuromuscular Blockers Guideline.

Recruitment manoeuvres[3]
In patients with 'recruitable' alveoli, this can be a lifesaving procedure if tolerated. Beware causing cardiovascular collapse, particularly in hypovolaemia.

Prone Positioning[4]
This has been shown to improve oxygenation and can possibly improve mortality in severe ARDS. It can be difficult to identify those in which benefit will be gained. It is labour intensive requiring at least five staff members to perform. Beware tube/line displacement and pressure areas.

Bronchoscopy
Caution should be exercised, particularly in severe hypoxaemia. Bronchoscopy can treat bronchial plugging but can also worsen infiltrates and cause de-recruitment from suctioning.

ECMO[5]
The strength of evidence for ECMO is disputed and senior consensus discussion is recommended. See Guys and St Thomas' referral criteria and contact details published online:
http://www.guysandstthomas.nhs.uk/our-services/critical-care/referrals.aspx

Novalung iLA
This venous-venous CO_2 removal device may be beneficial in selected patients. The evidence base is weak and senior consensus discussion is recommended.

Prostacyclin[6]
May improve oxygenation but lacks quality evidence in severe ARDS and has mostly been used in patients with increased pulmonary artery pressures and hypoxia.

High Frequency Oscillator Ventilation (HFOV)[7,8]
In light of the OSCAR and OSCILLATE trials, HFOV's role in ARDS has been downgraded. As a department, the feeling is that HFOV *may* still be of benefit on rare occasions and its use should not be excluded by this strategy.

References

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