

Staircase Recruitment Manoeuvre (SRM)

D Tuxen, C Hodgson

The following describes the SRM developed and researched at the Alfred

1. **Contraindications**

Circulatory instability – ensure fluid and inotrope resus complete with stable BP above target
Pneumothorax or other air leaks (pneumomediastinum, etc) – present or recent
High risk of pneumothorax – necrotising lung infection, lung cysts, etc
Relative contra-indication – ventilated ARDS present >1 week (poor responders, ? risk)

2. **Pressure Control Mode** - 15 ± 3 cm H₂O (depending on pt size and Vt)

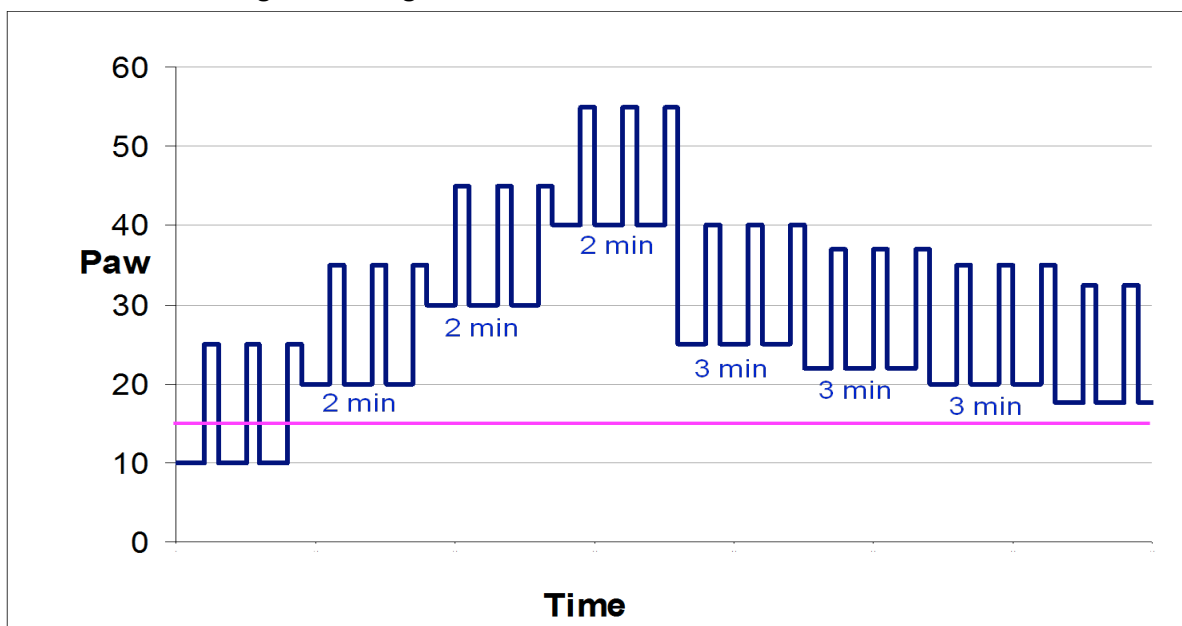
The patient **must** be in pressure control mode (fixed pressure increment as PEEP increases)
NOT Volume control (uncontrolled/excessive Palv increases as PEEP increases)
NOT Bi-Level (necessitating 2 pressure changes as PEEP increases)
Usually rate 10-20 b/min, I:E 1:2-3, No additional sedation given. Not paralysed

3. **FiO₂ decreased to achieve SaO₂ 91-94%**

This is to enable increases (and subsequent reductions) in SaO₂ to be discriminated
NOT High FiO₂ / high SaO₂ (>98%) – this will not effectively detect changes

4. **Wait 15-20 min** for the above changes to result in a stable SaO₂

5. **Perform the following PEEP changes with a timer**



This can commence at any PEEP level

The increases to 20 (2 min), 30 (2 min) before 40 cmH₂O (2 min) are to check hemodynamic tolerance
PEEP reductions are initially to 25 cmH₂O, then down in 2.5 cmH₂O increments every 3 min

- Cease PEEP reductions when the SaO₂ first decreases by 1-2%

- then **1 min re-recruit and return to PEEP level above level of 1st desaturation (above)**

- PEEP is not reduced below 15 cmH₂O.

6. **NB1: Hypotension**

Mild hypotension (SBP 85-100 mmHg) may occur at maximum PEEP. This usually recovers promptly when PEEP is reduced and should not curtail the SRM.

If hypotension occurs at lower PEEP levels or more severe hypotension occurs at maximum PEEP then the SRM should be ceased and resumed after more circulation support (more inotrope or, only if otherwise indicated, more fluid)

7. **NB2: Desaturation at high PEEP levels**

Don't cease the SRM! This does not mean recruitment has failed

Desaturation (below baseline) is common (40%), transient and recovers when PEEP is reduced

This may be due to high PEEP induced SvO₂ reduction (transient CO depression) or blood flow redistribution

Most patients who desaturate at maximum PEEP recover to above baseline when PEEP is reduced

If desaturation is excessive (<85%, the SRM may be ceased and repeated with a higher FiO₂)

8. **NB3: Coughing during recruitment**

This occurs in about 30-40% of patients and may be a good sign resulting from expansion of collapsed lung.

If significant sputum production occurs, suctioning may be required and the SRM will need to be repeated.

9. **Re-recruitment**

This should be done a minimum of 1/day but is probably better 2-3 times /day

This may be at regular intervals (eg 1/shift) or following suctioning, disconnections or desaturation

It need not be the full SRM – in P control mode (eg P control 15) with the pressure limit set to 60, it can be simply PEEP up to 40 (if that was reached with stability during the initial SRM) for 1-2 min then return in 1 step to optimal PEEP

10. **Evidence? By 25/11/2011**

This SRM has been studied by us (Tuxen, Hodgson and co-workers) in >100 patients, >30 in studies
We have found it to be safe (mild transient hypotension in some, no barotrauma) and effective

Pilot Study (Journal of Int Care Med) – 20 patients early ARDS, 90% response

If we had used a 40/40 RM (Max Pplat 35-40 for 30-40 sec) and had ceased the RM for desaturation at high PEEP (as was done in several major studies) we estimated we would have had only a 45% response.

We have used it (or supervised its use) in >12 patients with ARDS referred for ECMO with successful improvement in SaO₂ and avoidance of ECMO

David Tuxen
Senior Intensivist
The Alfred