

Improving Lung Protective Ventilation Compliance Across Lancashire and South Cumbria Critical Care Network

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Background:

Current literature supports the use of low tidal volume ventilation strategies (6 ml/kg Ideal Body Weight) in order to reduce the risk of developing acute lung injury (ALI) and furthermore reduce mortality (ARDSnet, 2000 and Faculty of Intensive Care Medicine (FICM) and Intensive Care Society (ICS), 2015).

During March 2015, a case note review was performed of patients admitted to critical care with severe sepsis across 4 units in Lancashire and South Cumbria (n=35), this identified some areas for improvement, notably mechanical ventilation strategies.

Aims and Objectives:

The Critical Care Network established a multi professional group consisting of medical, nursing and pharmacy representatives. The group utilised quality improvement methodologies to implement improvements in relation to lung protective ventilation strategies within adult critical care units across the Network.

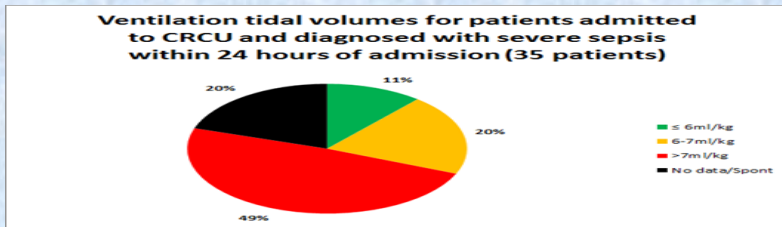
Methods:

The group reviewed national recommendations and local audit data to inform improvements. Through achievement of consensus, identification of local unit quality improvement leads and a programme of regular audit and feedback, members have developed and shared various resources to support improvements.

Results:

Baseline data indicated that only 31% of tidal volumes recorded were 7ml/kg of ideal body weight or below. 49% of recorded tidal volumes were above 7ml/kg, with 20% having no data recorded or being related to augmented tidal volumes.

Chart 1: Tidal Volumes for Ventilated Patients Admitted to CRCU



Through consensus achievement, the group has developed a variety of resources to support improvements in relation to lung protective ventilation. Activities and resources include;

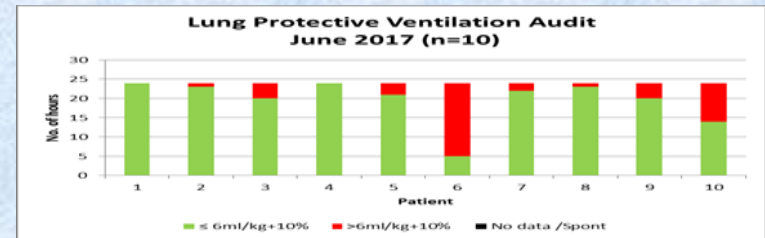
- Poster campaign –‘Blow Low’
- Monthly audit programme –see Chart 2
- Development of a ‘Tidal Tape’ to provide instant tidal volume requirements.
- Feedback at network forums
- Education
- Quality Improvement methodology training
- Presentation at local conference

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Chart 2: Feedback Graph Example



Discussion:

Quality improvement can often be challenging and this project has encountered a number of hurdles which have hampered progress. Units utilised different modes of ventilation which required adaptation of the audit tool, and with poor clinical engagement, some quality improvement lead nurses have struggled to drive improvements. The context within which quality improvement projects are carried out can also be an influential factor of success. With changes in equipment and patient information systems, there is an acknowledgement that the timing of such projects can affect engagement. One unit adopted a phased approach to reducing the target tidal volumes, and have demonstrated the greatest success; this in part is due to the enthusiasm and determination of those leading the improvement project. Supporting clinicians to automatically ‘do the right thing’ is essential to promote compliance with target tidal volumes. Technology to support automated ventilator settings according to patient height can enhance compliance, however, current practice relies on individuals performing a number of steps in order to determine the required target tidal volume. This complicated process reduces the likelihood of success. Appropriate patient selection is also a crucial factor in assessing compliance with lung protective ventilation particularly in smaller units where numbers of fully ventilated patients are small, this can occasionally result in data being collected that may not be appropriate, as tidal volumes can appear to be erratic. Despite these challenges, the Network has supported a group of enthusiastic individuals to develop local strategies for improvement and sharing those elements that have proved influential in changing behaviour.

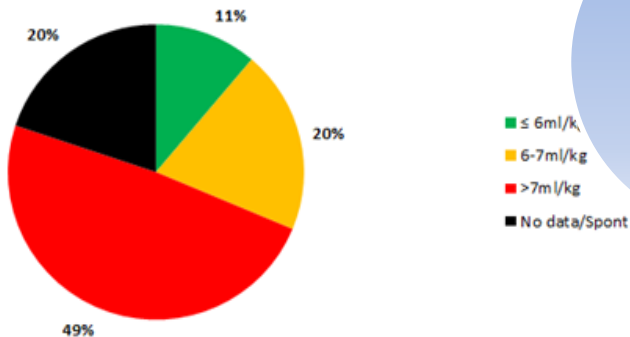
Conclusion:

Through the establishment of a multi professional group of critical care practitioners, and utilising quality improvement methodologies, the group has applied a multi-faceted approach in order to drive improvements in relation to lung protective ventilation. Despite a number of challenges, the Network has taken crucial steps towards highlighting and addressing the need to promote lung protective ventilation strategies in every day practice.

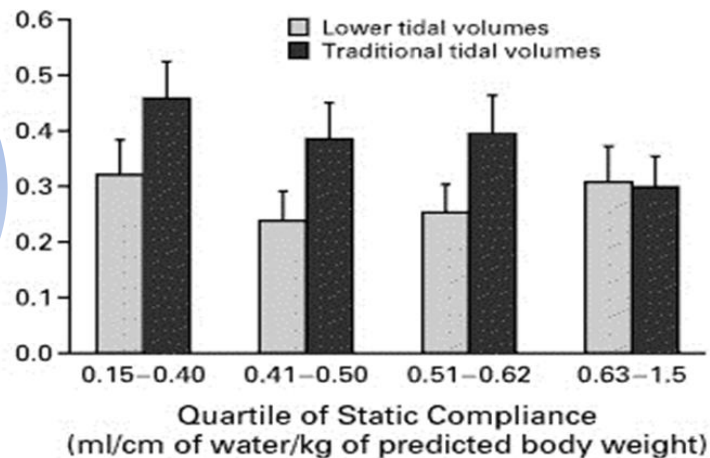
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- FICM and ICS (2015) *Guidelines for the Provision of Intensive Care Services. First Edition.* ICS, London

Ventilation tidal volumes for patients admitted to CRCU and diagnosed with severe sepsis within 24 hours of admission (35 patients)



ARDNET



Network Data

Evidence (Enablers)

Non-ALI /ARDS Research

GPICS



Table 1. Characteristics of the Included Studies

Source ^a	No. of Patients	Protective		Conservative		Setting	Follow-up, h	Duration of MV, Mean (SD), h		Primary Outcome	Jadad Score
		V _T , ml/kg	No.	V _T , ml/kg	No.			Protective	Conservative		
Lee et al. ¹¹ 1999	100	6	47	12	56	ICU	168	2.30 (0.5)	3.90 (0.8)	Duration of MV	3
Chaney et al. ¹⁵ 2000	26	6	12	12	13	CABG	Dis	ST + 1	ST + 1	Pulmonary mechanics	2
Osip et al. ¹⁶ 2004	166	9	66	12	100	ICU		NS	NS	U	
Konar et al. ¹⁷ 2004	44	6	15	10	29	CABG	12	9.90 (1.0)	10.0 (1.4)	Cytokines in blood	1
Wrigge et al. ⁷ 2004	62	6	30	12	32	Surgical	3	NS	NS	Cytokines in BAL	3
Wrigge et al. ¹⁸ 2005	44	6	22	12	22	CABG	Dis	16.1 (10.2)	12.9 (4.4)	Cytokines in BAL	1
Zupanich et al. ¹⁹ 2005	40	8	20	10	20	CS	6	NS	NS	Cytokines in BAL	1
Michalet et al. ²⁰ 2006	52	5	26	9	26	CS	18	7.06 (1.81)	7.76 (1.85)	Cytokines in blood	3
Cai et al. ²¹ 2007	16	6	8	10	8	Neurosurgery	7.15	6.90 (2.2)	7.4 (3.1)	CT atelectasis	2
Wolffius et al. ²² 2007	36	8	23	10	13	ICU		NS	NS	Sedative use	
Vitmar et al. ²³ 2007	375	8	163	11	212	ICU		NS	NS	U	
Deleman et al. ²⁴ 2008	40	6	21	12	19	Surgical	5	ST	ST	Cytokines in BAL	3
Lin et al. ²⁵ 2008	40	5	20	9	20	CS	24	4.33 (0.9)	4.23 (0.71)	Cytokines in blood	1
Johar et al. ²⁶ 2009	1091	6	556	9	533	CS		2.93 (1.2)	2.76 (1.0)	U	
Jeltemann et al. ²⁷ 2010	150	6	76	10	74	ICU	672	NS	NS	Cytokines in BAL	3
de Oliveira et al. ²⁸ 2010	20	6	10	12	10	ICU	672	168.0	72.0	Cytokines in BAL	3
Fernandez-Buckemuhl et al. ²⁹ 2011	229	8	154	10	75	Surgical		NS	NS	Duration of MV, ICU mortality	
Sundar et al. ³⁰ 2011	149	6	75	10	74	CS	672	7.50	10.71	Duration of MV	3
Yang et al. ³¹ 2011	100	6	50	10	50	CS	168	2.00 (0.68)	2.11 (0.8)	U	3
Wengarten et al. ³² 2012	40	6	20	10	20	Surgical	Dis	5.13 (1.86)	5.73 (1.71)	Oxygenation	3
Total, Mean (SD)	2622	6.45 (1.09)	1416 (1.14)	10.60 (1.14)	1406 (1.14)			6.90 (5.28-8.54) #	6.96 (2.93-9.90) #	(3.61-10.17) #	2.33 (0.89)

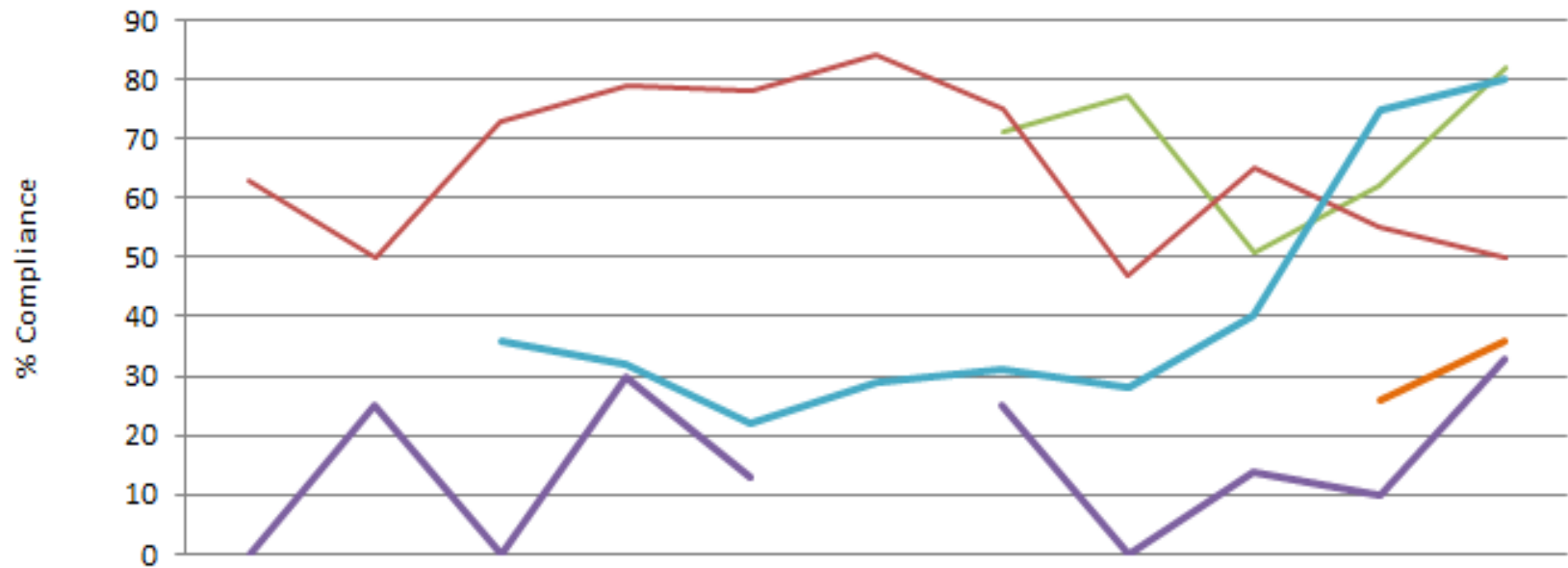
^aAbbreviations: BAL, bronchoalveolar lavage; CABG, coronary artery bypass graft surgery; CS, cardiac surgery; CT, computed tomography; Dis, unit patient's discharge; ICU, intensive care unit; ICI, length of stay; U, long follow-up; MV, mechanical ventilation; NS, not specified; O₂, oxygen; O₂ body, surgical ICU; surgical intensive care unit; ST, surgery time; V_T, tidal volume.

^bMean of the studies were randomized controlled trials. The exceptions are as follows: Osip et al.,¹⁶ Vitmar et al.,²³ and Johar et al.²⁶ were cohort studies; Wolffius et al.²² had a before-and-after design; and Buckemuhl et al.²⁹ had a cross-sectional design.

^c#Median (interquartile range).

Results

**Lung Protection Ventilation Compliance
Summary Chart Aug 2016- Jun 2017**



	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17
Unit A	70						71	77	51	62	82
Unit B	63	50	73	79	78	84	75	47	65	55	50
Unit C										26	36
Unit D	0	25	0	30	13		25	0	14	10	33
Unit E			36	32	22	29	31	28	40	75	80

Recipe for Success

- Enthusiasm for Improvement
- No 'I' in team
- Start small
- Regular feedback
- Make it easy to 'do the right thing'
- One size doesn't fit all
- Links to other outcomes
- Share, share, share!
- Remember to '**Blow Low**'!



References

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