

Non-invasive Ventilation in Medical Retrieval



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Questions

- > How are we using non-invasive ventilation?
- > Does the transport platform have any impact?
- > What effect has improved technology had?



Disclaimer

- > I have no financial interest in any of the products mentioned in this presentation!



Background – Retrievals in SA

> Pre-2009

- RAH Mediflight - adult
- FMC – adult / paed / neonates
- WCH – paed / neonates

> Jan 2009

- MedSTAR Emergency Medical Retrieval
 - SA Health state-wide retrieval service
 - Adults / paed / neonates
 - Primary / inter-hospital





Data

- > RAH Mediflight
 - 2001-2009
- > MedSTAR
 - 2009-2010
- > Operational data
 - 2001-2010
- > Clinical data (limited)
 - 2006-2010
- > Adult IHT / all primaries

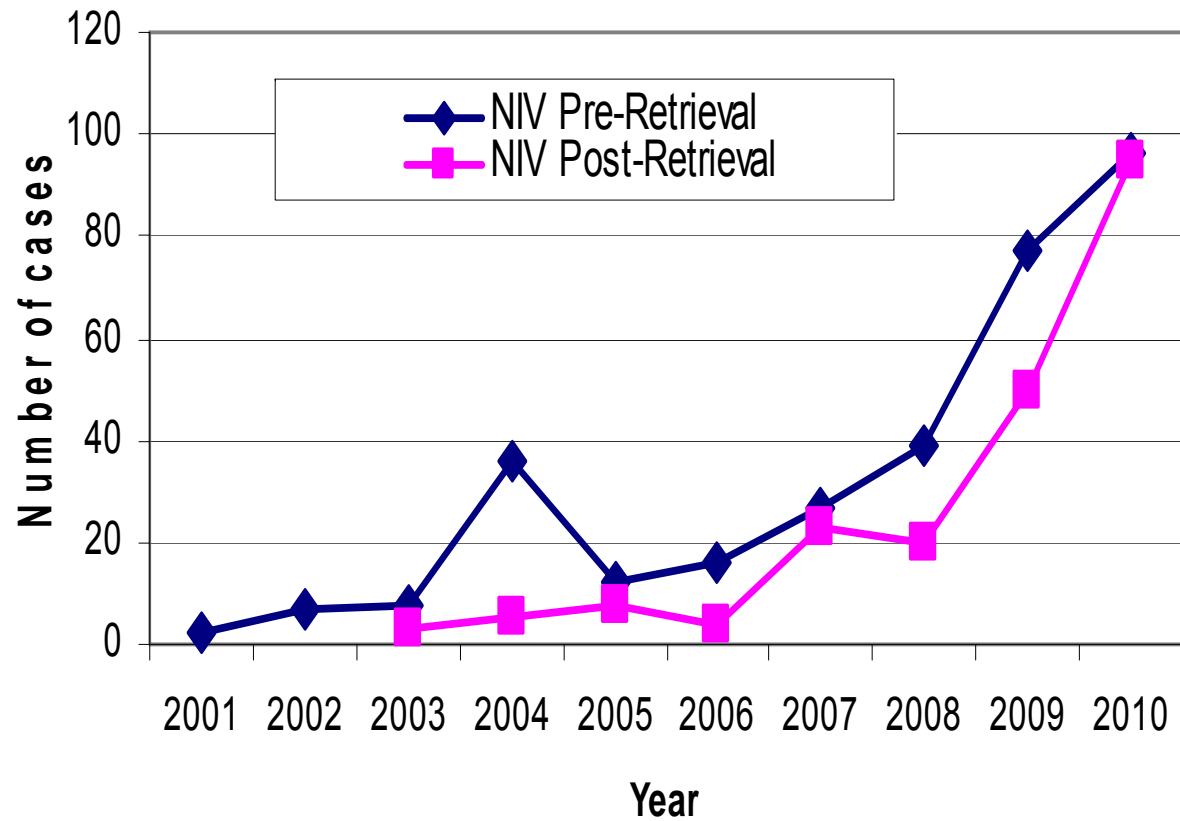


Data

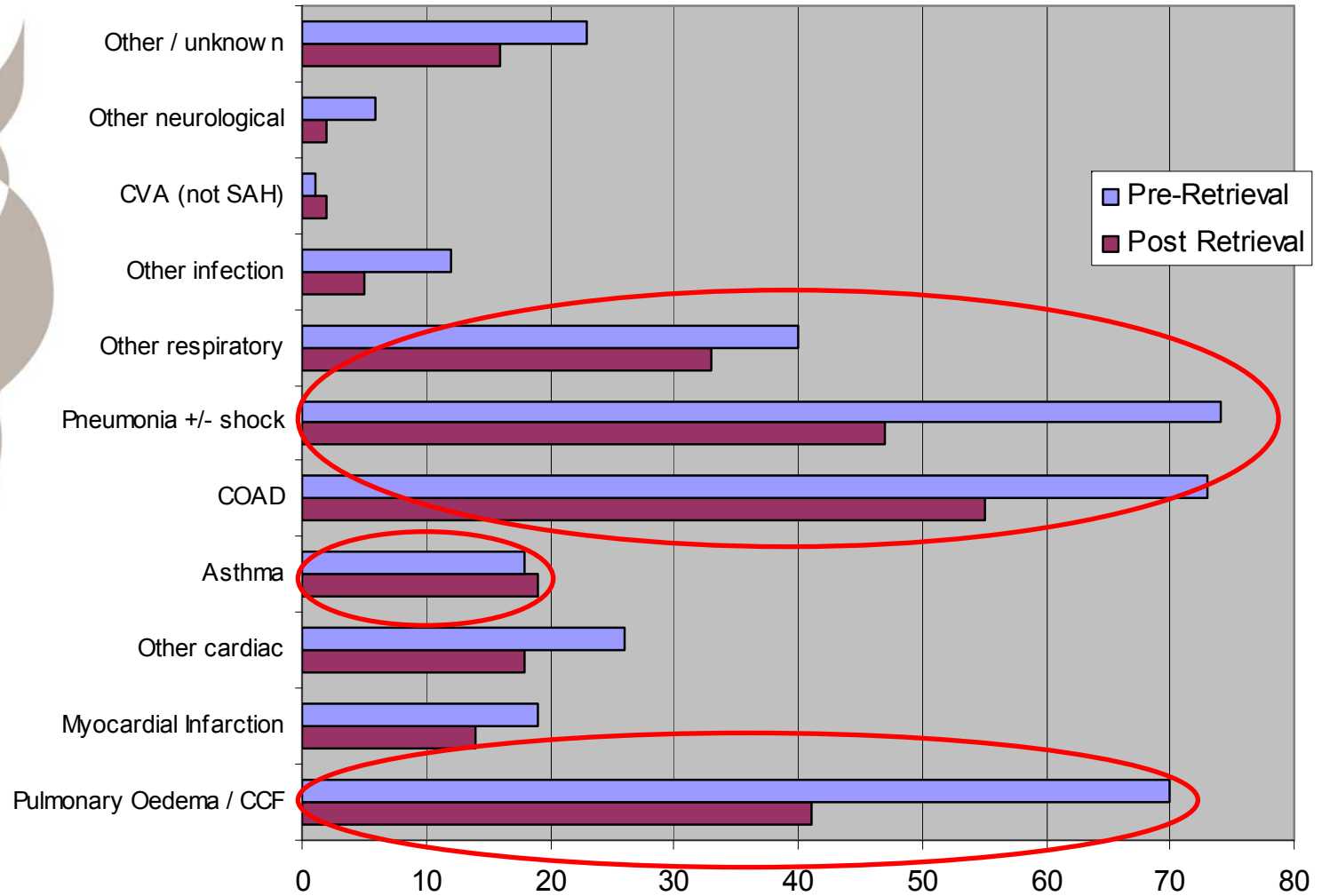
- > 10835 patients
- > 362 on NIV prior to arrival
- > 252 transported on NIV



NIV Pre/Post Retrieval

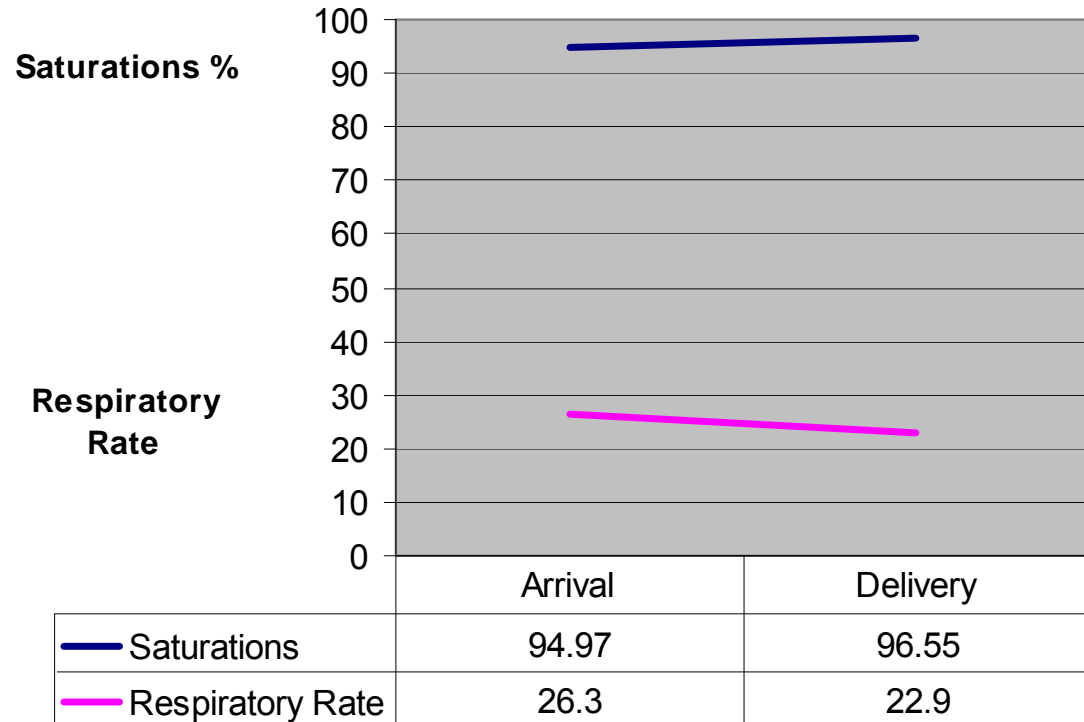


NIV by Working Diagnosis





Respiratory Outcomes





Reasons for NIV

- > Best practice / definitive care
- > Avoidance of invasive ventilation
- > Trial – with a view to intubation if fails
- > Ceiling – with a plan not to intubate
- > Bridging to further care

- > Pre-oxygenation (e.g. prior to RSI)



Patient Selection

- > Underlying pathology
- > Likely clinical course

- > Co-morbid issues

- > Access in transport
 - Monitoring
 - Intubation



NIV for COPD Exacerbation

> Cochrane review of 14 RCTs

- Decreased mortality
- Decreased need for intubation
- Reduction in treatment failure
- Rapid improvement in pH, PaCO₂ and respiratory rate
- Reduction in treatment complications
- Reduced length of hospital stay

> Cochrane Database (2009)

<http://www.mrw.interscience.wiley.com/cochrane/clsysrev/articles/CD004104/frame.htm>



NIV for Asthma

- > Cochrane database – One RCT, 30 pts
- > Significant improvements in
 - Hospitalisation rate
 - Number of ED discharges
 - FEV1, FVC, PEF and RR
- > “The application of NPPV in patients suffering from status asthmaticus... still remains controversial. Further studies are needed to determine the role of NPPV in the management of severe acute asthma.”
- > Cochrane database (2005)
<http://www.mrw.interscience.wiley.com/cochrane/clsysrev/articles/CD004360/frame.html>

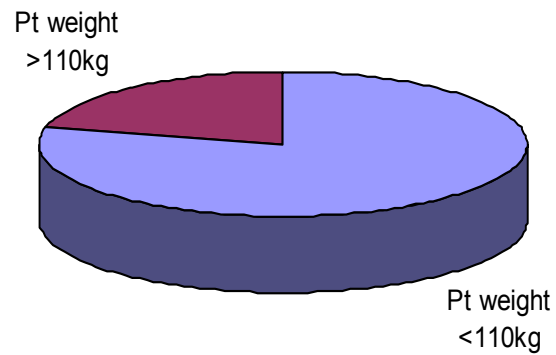
NIV - Bariatric Patients

- > Reduction in WOB
- > Improved oxygenation
- > Improved ventilation
- > Avoidance of intubation

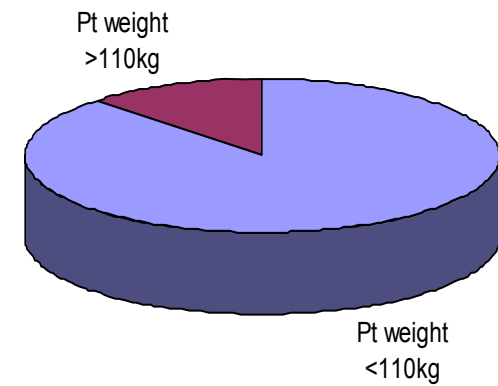


NIV By Weight

NIV



All Pts



Weight Category	NIV	%	All transports	%
Pt weight <110kg	210	79%	4000	87.90%
Pt weight >110kg	57	21%	549	12.10%
Total	267		4549	

Platforms

PC-12



Ambulance



BK117

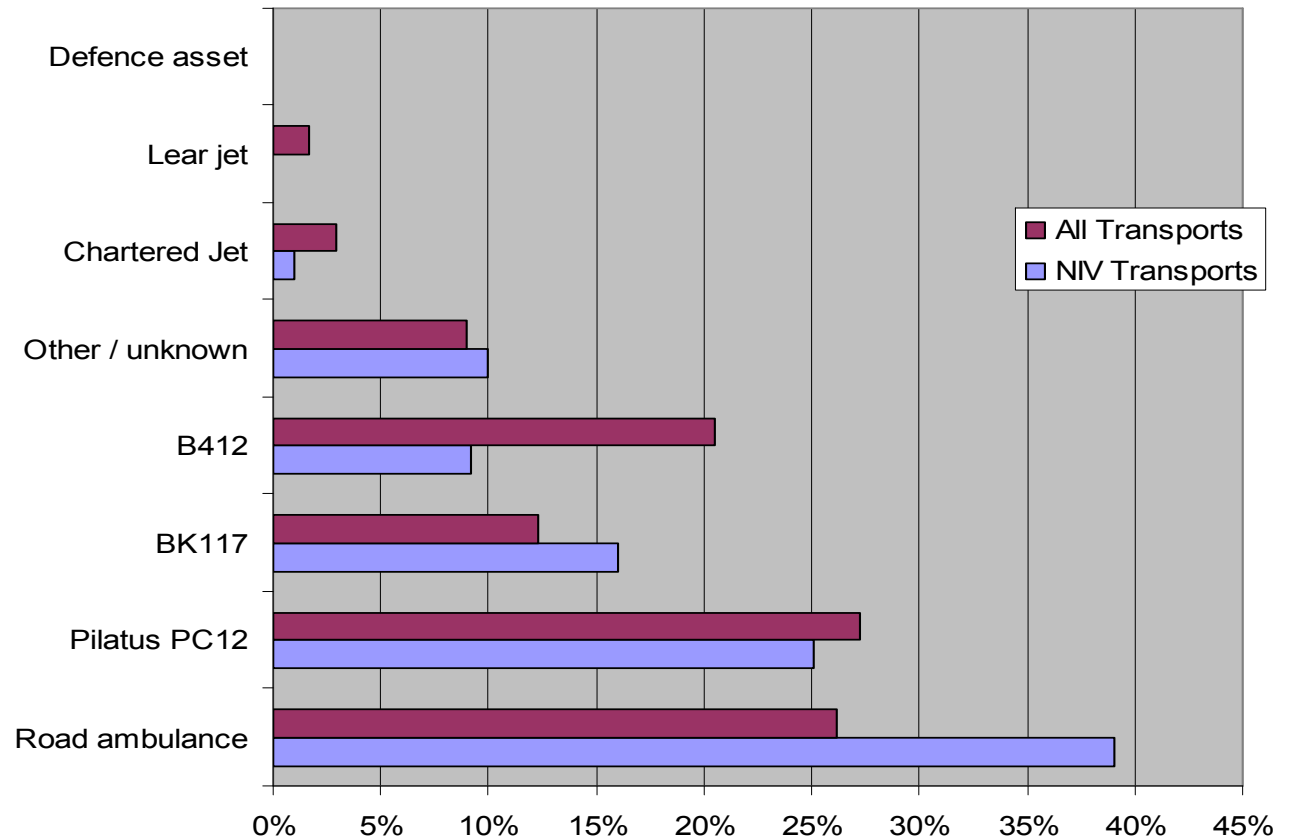


B412





% NIV By Transport Platform



Pilatus PC-12



Bell 412



BK117





Ventilator Selection

- > “Work of breathing was halved with a high-performance ventilator”
- > “...the effort required to trigger the ventilator represents 10-20% of the breathing effort.”
- > “...turbine-based ventilators perform as well as the best conventional ICU ventilators.”

Thille, A. et al (2009) A bench study of intensive-care-unit ventilators: new versus old and turbine-based versus compressed gas-based ventilators”, *Int. Care Med.*, 35: 1368-1376.



Oxygen Requirements

> $2 \times \text{transport time (mins)} \times [\text{MV} \times \text{FiO}_2]$

> + ventilator driving gas

> + leak compensation

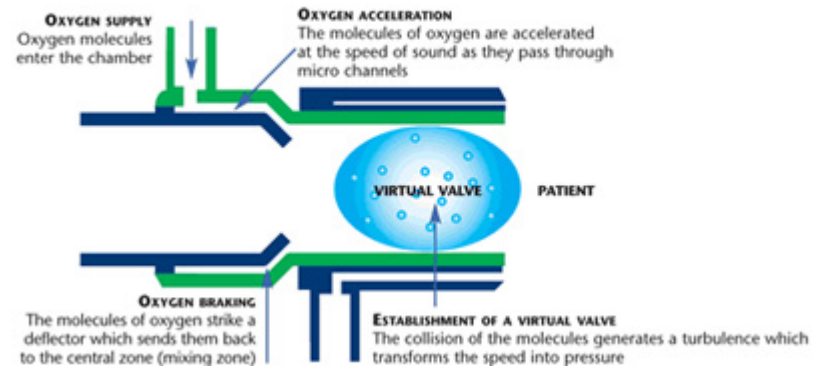
> Ellis, D; Hooper, M; 2010, *Cases in Pre-hospital and Retrieval Medicine*, Elsevier.

Prehospital CPAP

> Boussignac



Boussignac CPAP works the same way as the turbines of a jet engine.



Oxylog 2000

- > Gas powered
- > NIV:
 - CPAP
- > No leak compensation
- > [O2] 60/100%



Oxylog 3000

- > Gas driven + battery <4 hours
- > NIV:
 - PS
 - PCV +/- PS
 - CPAP +/- PS
- > Leak compensation
- > [O₂] 40-100%
- > Trigger sens. 3-15 lpm

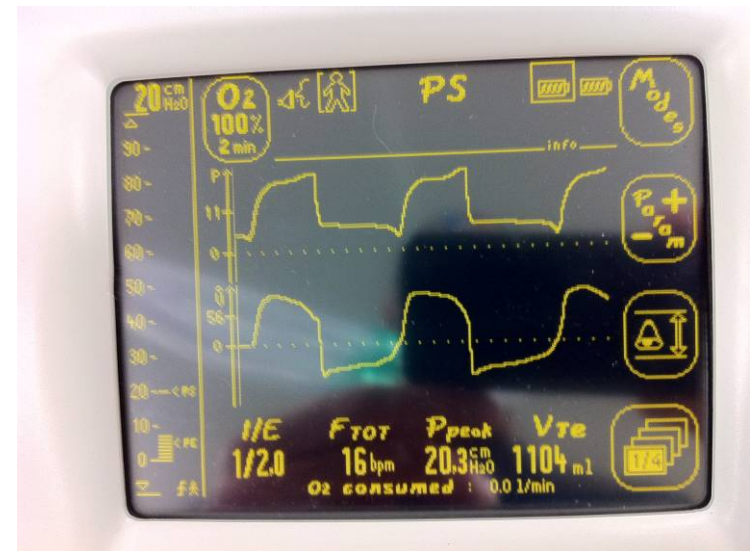
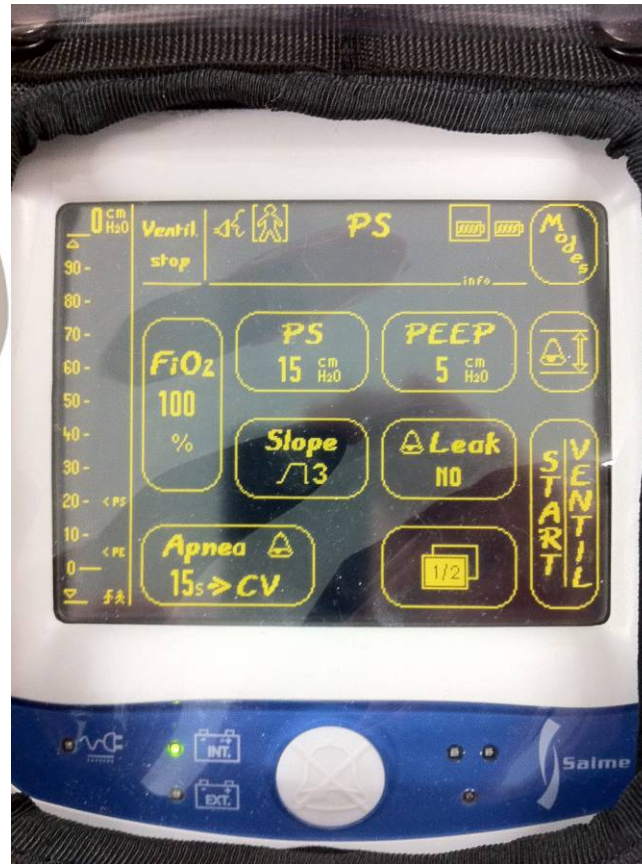


ResMed Elisee 350

- > Electric turbine ≤ 6 hrs
- > NIV:
 - PS +/- TV
 - CPAP +/- PS
- > Leak compensation
- > [O2] 21-100%
- > Trigger sens. 1-5 lpm
- > Triggering delay <50ms
- > Synchronised nebulisation



ResMed Elisee 350





Conclusions

- > The use of NIV has increased significantly over the last few years.
- > NIV can be used safely in medical retrieval
- > Patient screening is important
- > Technology has allowed improved provision of NIV
- > Data recording could be better
- > Further multi-centre research is required

Thank you...

