

The Safety of High Concentration Nitrous Oxide for Procedural Sedation in Children

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The Safety of High Concentration Nitrous Oxide for Procedural Sedation in Children

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Nitrous Oxide Procedural Sedation



Introduction

- N₂O accepted for paediatric procedural sedation, however most research used N₂O 50%
- Concerns using higher concentration (N₂O 70%) regarding deeper sedation and increased complications
- Previous largest ED study of N₂O 70% involved 224 patients (64 pt N₂O 70%)
 - (Frampton A et al. EMJ 2003;20(5):410-3)

Objective

- Characterise the depth of sedation and incidence of adverse events associated with different concentrations of N₂O used in paediatric ED
- To identify associations between
 - Sedation depth
 - Adverse events
 - Age

Methods

- Prospective observational study in ED
- Tertiary Paediatric ED (60,000 pt/year)
- All sedations embedded in comprehensive sedation program
- Inclusion: All children (May 04-June 06) who received N₂O
- Exclusion: Patients receiving other sedative agents

Methods

- Prospective review of checklists and retrospective review of medical record
- Wisconsin sedation scale (0-6)
 - 0, unresponsive to painful stimulus
 - 6, anxious, agitated or in pain
- Deep sedation 0-2
- Moderate sedation 3

Results

- 762 patients enrolled
- 72% N₂O 70%
- 13% N₂O 50%
- 9% adjunctive analgesic agent within 2hr
 - Morphine 4%
 - Codeine 6%
- Procedures undertaken
 - Orthopaedic 38%
 - Laceration repair 29%
 - FB removal 9%

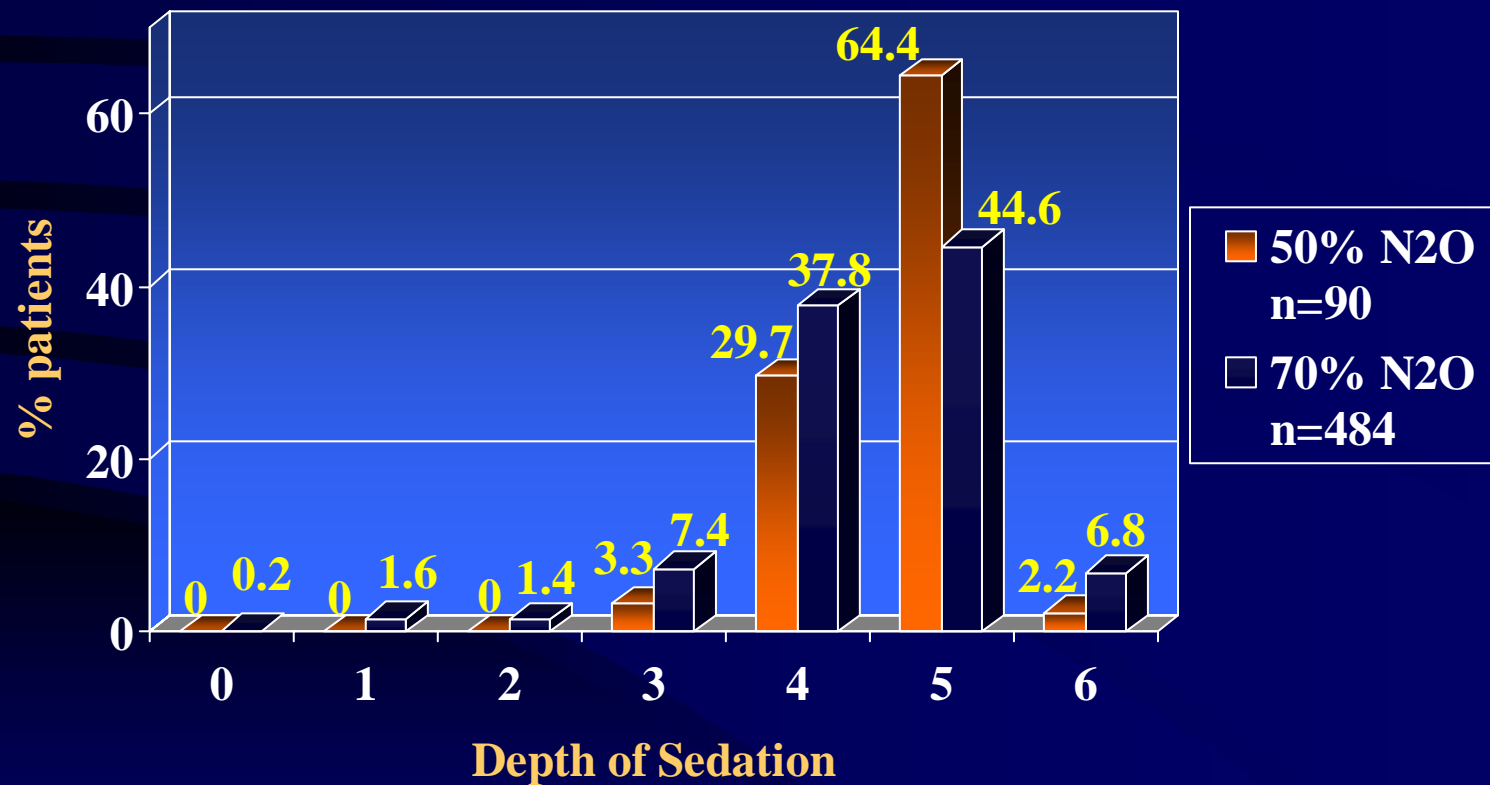
Results – Adverse Events

- 63 patients (8.3%) mild & self resolving adverse events
 - Vomiting 5.7%
 - Agitation 1.3%
 - Nausea 0.9%
- 2 patients (0.3%) serious adverse events
 - Chest pain
 - Desaturation with admission overnight
 - No aspiration, laryngospasm, advanced airway support

Results – Adverse Events

	Adverse Events:
50% N ₂ O	9.9% (95% CI 4.8-17.4%)
70% N ₂ O	8.4% (95% CI 6.2-11.0%)
p value	p=0.6

Depth of Sedation vs. N₂O Concentration



Depth of Sedation vs. N₂O Concentration

- 90.5% mild sedation (scores 4-6)
- 2.9% deeply sedated (scores 0-2)

	Mean sedation score:	Deep Sedation: (scores 0-2)	Moderate-Deep Sedation: (scores 0-3)
50% N ₂ O	4.6 (95% CI 4.5-4.8)	0% (95% CI 0-4.0%)	3.3% (95% CI 0.7-9.4%)
70% N ₂ O	4.4 (95% CI 4.3-4.5)	3.3% (95% CI 1.9-5.3%)	10.7% (95% CI 8.1-13.8%)
p value	p=0.002		p=0.03

Depth of Sedation vs. Age

- 24.9% (190 pt) \leq 3yo
- Children \leq 3yo generally required N₂O by assisted mask application

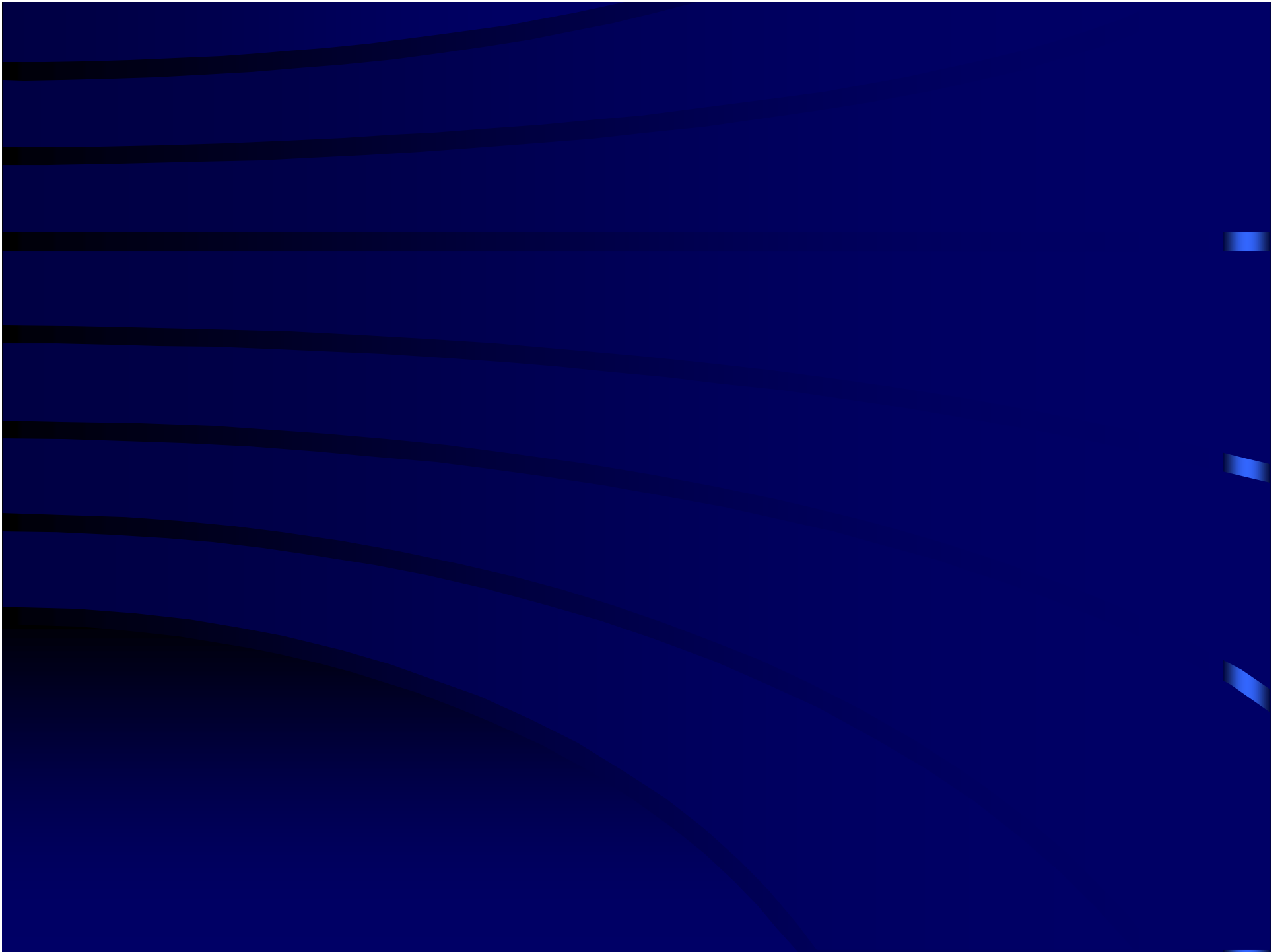
	Mean sedation score:	Deep Sedation: (scores 0-2)
\leq 3yo	4.5 (95% CI 4.3-4.6)	2.9% (95% CI 0.9-6.8%)
$>$ 3yo	4.5 (95% CI 4.3-4.5)	2.8% (95% CI 1.5-4.7%)
p value	p=0.7	p=0.9

Limitations

- Accuracy of recording adverse events in sedation checklist or medical record
 - Potentially mild adverse events not recorded, or occurred after discharge
 - However also reviewed adverse events reporting system
- Missed procedures under N₂O during study period
- Analysis of sedation depth based on deepest sedation depth being recorded
- Subjectivity in assessment of sedation scores

Conclusion

- Children with N₂O 70% had overall deeper sedations and more moderate-deep sedation
 - However not clinically significant difference – 0.5 sedation score
- Adverse events (8.3%)
 - Mild adverse events not infrequent
 - Serious adverse events very infrequent
 - No difference between N₂O 70% and N₂O 50%
- N₂O appears to be safe for use in children 1-3 years of age
- It remains to be shown whether there is any *advantage* in using N₂O 70% i.e. improved ability to complete a procedure without pain and distress



Depth of Sedation Slide

- 6, anxious, agitated or in pain
- 5, spontaneously awake without stimulus (talking)
- 4, drowsy, eyes open or closed, but easily arouses to consciousness with verbal stimulus
- 3, arouses to consciousness with moderate tactile or loud verbal stimulus
- 2, arouses slowly to consciousness with sustained painful stimulus
- 1, arouses, but not to consciousness, with painful stimulus
- 0, unresponsive to painful stimulus

Details of Adverse Events – Chest pain

- 11yo boy PSA N₂O 70% to suture toe lac
 - Lidocaine ring block
 - After procedure: developed sustained stabbing central chest pain
 - Vital signs, ECG & CXR normal
 - Administered antacid
 - Pain settled
 - Observation
 - D/C home

Details of Adverse Events – Desaturation

- 12yo boy PSA N₂O 70% displaced distal radius fracture
 - morphine 1/24 prior, Lidocaine regional nerve block
 - Sedation score 4 during procedure
 - O₂ saturation 100% throughout procedure
 - Immediately afterwards O₂ sat dropped to 73%, visibly cyanotic
 - Returned to 100% with high flow O₂ via mask
 - 10minutes later mask removed – became cyanotic again, O₂ saturation returned to 70%
 - Two further failed attempts – visible cyanosis
 - Thereafter vomited once
 - Oxygen then 95-99% RA
 - Admitted for observation
 - Discharged with no further complication