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Paul Twose\textsuperscript{1,2}, Gemma Jones\textsuperscript{1}, Jennifer Lowes\textsuperscript{1}, Dr Paul Morgan\textsuperscript{1}
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6. Introduction to Nasal High Flow on Surgical Acute Dependency Unit (SADU)
Miss Zoe Freeman\textsuperscript{1}
\textsuperscript{1}Frimley Health NHS Foundation Trust
Did we get More Bang for our Bic

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Introduction:
A high prevalence of undiagnosed obstructive sleep apnoea (OSA) exists in the general population. Up to 69% of cases are first diagnosed in the preassessment of patients prior to surgery. Its diagnosis, management and treatment in the surgical patient is important as OSA is associated with high morbidity, mortality and perioperative complications, longer hospital stays and the need HDU beds. Last year we developed a pathway for the screening and diagnosis of OSA in patients attending The Royal Glamorgan Hospital at preoperative assessment. The STOP-Bang questionnaire was introduced for all patients, and serum bicarbonate used to improve the sensitivity of diagnosis of OSA in those patients who are at moderate risk scoring 3-5. This project evaluated the effectiveness of its introduction.

Methods:
Data was retrospectively collected for a 6 month period on a total of 1400 patients. We assessed our compliance with the new pathway and its impact on our referral process. We analysed if

- STOP-Bang score was recorded,
- serum bicarbonate was tested for STOP-Bang scores 3-5,
- overnight oximetry was requested for bicarbonate ≥ 28 or STOP-Bang 6-8,
- the relationship between STOP-Bang scores and the results of overnight oximetry.
- the relationship between serum bicarbonate and overnight oximetry results
- the number of patients being referred for overnight oximetry

Results:
- STOP-Bang screening has increased from 23% to 90%.
- Serum bicarbonate was requested in 82% of those scoring 3-5
- In patients with suspected OSA 61% were referred for sleep studies
- Reasons for not referring for sleep studies were
  o 8/72 (11%) unknown or missed
  o 21/72 (29%) urgent surgery but list anaesthetist informed so perioperative risk could be managed
  o 2 cases previously been investigated for OSA.
- Of those scoring 3-5, 69% had a normal bicarbonate (<28) and did not need further investigation for
  o 77% (STOP-bang 3),
  o 67% (STOP-Bang 4)
  o 70% (STOP-Bang 5).
- The range of STOP-Bang scores was 3-7 in those testing positive for OSA
- Bicarbonate ranged from 28 to 31 in the positive OSA group and 28 to 33 in the negative OSA group.
- Before introduction of the screening pathway 25/294 (8.5%) of patients underwent overnight oximetry. In this study 44/1400 (3.14%) were referred for overnight oximetry. If we factor in those that were not referred who should have been if the pathway was followed strictly excluding other factors then 72/1400 (5.14%) should have been referred.
- Of those who underwent overnight oximetry, before the screening pathway 15/25 (60%) tested positive for OSA. Since its introduction 13/24 (54%) tested positive for OSA.

**Conclusion:**
Introduction of a screening pathway for OSA in pre-assessment clinic has improved our percentage of patients being screened by STOP-Bang scoring to 90%. By following the pathway only 11% of those needing overnight oximetry are missed with other cases not receiving overnight oximetry mainly due urgency of surgery outweighing the risk of being on a waiting list for a sleep study. The pathway has successfully reduced the proportion of overnight oximetry requests by 3.36-5.56% as 69% in the STOP-Bang 3-5 group avoid unnecessary overnight oximetry testing due to their serum bicarbonate of <28. However despite serum bicarbonate testing being introduced, the specificity of overnight oximetry has not increased. The variation in bicarbonate in those testing positive and negative for OSA suggests that we cannot increase the bicarbonate screening parameter.

**Discussion:**
We were limited to sleep study results for only 24 patients due to a backlog of sleep studies lagging 7 months behind the referral being made. Another limitation is the pathway does not account for those with certain chronic respiratory or cardiac conditions who are likely to score highly on the pathway. To improve screening further new equipment could be bought for the department to carry out more overnight oximetry testing to try and obtain results for those patients who have time critical surgeries. By presenting this data at hospital audit I hope to raise awareness of those few cases that are simply missed and encourage investigators to order and chase results.
Evaluation of the impact of humidifier choice on aerosol delivery: MR850 vs MR950

Gavin Bennett, Mary Joyce, Ronan MacLoughlin, Paul McKiernan

Introduction
Humidification during invasive mechanical ventilation is a necessary requirement for respiratory system functionality. Active humidifiers supply heated and humidified air to the patient by means of a heated water reservoir placed within the circuit. This study assessed the delivery of aerosol in combination with a vibrating mesh nebuliser during mechanical ventilation of both adult and paediatric patient populations, using two different humidification system models.

Methods
Aerosol delivery was assessed by characterising the % tracheal dose delivered in simulated mechanical ventilation for both adult and paediatric patients using two different humidification system models (MR850 & MR950 humidifier, Fisher & Paykel, New Zealand). A vibrating mesh nebuliser (VMN) (Aerogen Solo, Aerogen, Ireland) was positioned at different placement locations (at the dry side of the humidifier, at the inspiratory limb, and between the wye and ETT) within a dual limb breathing circuit (RT200, F&P, NZ) and connected via a filter (Respirgard 303, Baxter, Ireland) to a SERVO-U ventilator (Maquet, Germany) set to adult parameters of BPM 15, Vt 500mL and I:E ratio 1:1 and paediatric parameters of BPM 20, Vt 300 ml and I:E ratio 1:2. 1ml of 2mg/ml albuterol sulphate (GSK, Ireland) was nebulised and delivered dose captured on a filter, placed distal to the trachea, was determined using UV spectroscopy at 276nm.

Results
See Table 1

<table>
<thead>
<tr>
<th>Nebuliser Position</th>
<th>Adults</th>
<th>P-Value</th>
<th>Paediatrics</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MR950</td>
<td>MR850</td>
<td></td>
<td>MR950</td>
</tr>
<tr>
<td>Dry side of humidifier</td>
<td>40.96 ± 0.42</td>
<td>30.40 ± 0.86</td>
<td>&lt; 0.0001</td>
<td>18.69 ± 1.80</td>
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<tr>
<td>Inspiratory Limb</td>
<td>35.51 ± 1.69</td>
<td>34.09 ± 1.84</td>
<td>0.38</td>
<td>13.79 ± 0.35</td>
</tr>
<tr>
<td>Between wye &amp; ETT</td>
<td>39.27 ± 0.39</td>
<td>33.89 ± 0.68</td>
<td>0.00</td>
<td>13.89 ± 0.80</td>
</tr>
</tbody>
</table>

Table 1: Mean ± Standard Deviation for % tracheal dose using two different humidification systems

Conclusion
Results of this study indicate that efficient aerosol delivery can be achieved during simulated mechanical ventilation across both humidification system models. For adult settings, there was a statistically significant increase in % tracheal dose using the MR950 model when the nebuliser was placed at the dry side of
humidifier and between the wye and ETT. For paediatric settings, there were no statistically significant
differences in % tracheal dose across both humidifier models. The highest % tracheal dose for both systems
was with the nebuliser placed at the dry side of the humidifier.
ENHANCING CARE OF PATIENTS REQUIRING A TRACHEOSTOMY: STANDING ON THE SHOULDERS OF GIANTS. A QUALITY IMPROVEMENT PROJECT

Paul Twose¹², Gemma Jones¹, Jennifer Lowes¹, Dr Paul Morgan¹
¹Cardiff and Vale UHB, ²Cardiff University

Introduction:
Within the UK approximately 5,000 surgical and 12,000 percutaneous tracheostomies are performed annually. Whilst an essential component of patient care, the presence of a tracheostomy is not without concern. Landmark papers have demonstrated recurrent themes related to the provision of training, staff and equipment, leading to avoidable patient harm, life-altering morbidity and mortality. The development of the Global Tracheostomy Collaborative (GTC) and the Improving Tracheostomy Care (ITC) project have provided the necessary infrastructure to make improvements, with individual organisations responsible for its implementation.

Method:
This quality improvement project, funded by the NHS Wales Critical Care and Trauma Network, developed a dedicated tracheostomy team to improve the quality of care provided to those patients requiring a tracheostomy through staff education, equipment standardisation and multidisciplinary tracheostomy ward rounds. Global Tracheostomy membership was funded through involvement in the ITC project.

Results:
Formal tracheostomy teaching was delivered by the tracheostomy team to 165 clinicians involved in tracheostomy care. Improvements in self-assessed confidence with knowledge and were observed for all aspects of tracheostomy care. Standardisation and centralisation resulted in reduction in waste and unnecessary variation. Compliance with ‘emergency tracheostomy blue box’ availability with an increase from 5% to 100%. Comparison of data from the QI period against baseline data, demonstrated improvement in rates of decannulation, and non-significant improvements in time to decannulation, critical care and hospital length of stay. Additionally, there were associated reductions in adverse events.

Conclusion:
This QI project, supported by involvement with the GTC and ITC, resulted in reductions in adverse events, improved patient safety, non-significant reduction in time to achieve weaning milestones and a reduction in hospital length of stay.
The New Complex Sleep Service at UHCW NHS Trust

Michelle Goodlad1, Trishandeep Matharu1

1UHCW NHS Trust

Since 1997 there has been a sleep disordered breathing service (SDB) at UHCW NHS Trust. The SDB service performs 50 sleep domiciliary studies/week and now treats over 3,000 patients on CPAP. In May 2016 it was suggested that the sleep service should expand to include in patient polysomnography testing. It was important to the Trust to expand the SDB service to deliver a comprehensive sleep service in aspects of sleep medicine to:

- Shorten waiting times for complex sleep tests and provide a service for local patients closer to home and offer tests to patients outside the area. Nearest PSG service waiting times were over 6 months
- Providing treatment for patients with complex sleep conditions
- Be involved in research both within the Trust and to collaborate with other disciplines and sleep services.

- Increase the profile of the sleep service and the Trust

After a pilot service it was decided to look for accommodation for the Complex Sleep Unit at UHCW hospital site. There was no appropriate accommodation found at the Coventry site and it was decided to build the unit at St Cross Hospital Rugby.

There were many challenges faced in setting up

- Finding appropriate accommodation setting
- Business case writing/Finance support/Trust permission
- Time – didn’t realise in how long it would take
- Co-ordinating different department etc ICT, equipment suppliers, estates

The new in-patient sleep unit opened at St Cross on 12th November. The unit is a bespoke 2 bedded sleep unit at St Cross Hospital with the potential to expand. Currently employs 4 specialist Sleep Physiologists and 1 associate Sleep Physiologist. Using brand new sleep equipment using up-to-date technology

Future Developments include:

- Development of insomnia service
- Increase number of studies
- Increase staff
- Expand facilities
Aerosol dose prediction during high flow nasal therapy using the Airvo aerosol adapter

Gavin Bennett, Mary Joyce, Ronan MacLoughlin, Paul McKiernan

Introduction
Current clinical practice for concurrent aerosol delivery during high flow nasal therapy (HFNT) can involve the use of a facemask placed over the nasal cannula. Recently, accommodation of concurrent aerosol delivery has been facilitated through the release of the Airvo 2 nebuliser adapter (F&P, NZ). The objective of this study was to compare aerosol delivery across combinations of various drug delivery modalities, using two nebuliser types.

Methods
A vibrating mesh nebuliser (VMN) (Aerogen Solo, Aerogen, Ireland) was used with the Airvo 2 system (F&P, NZ) at a gas flow rate of 50LPM (with the Airvo 2 nebuliser adapter). A jet nebuliser (JN) was used with a facemask (Cirrus2 at 8LPM driving gas flow rate, Intersurgical, UK). A facemask and/or nasal cannula were positioned on an adult nose-throat model that was connected to a breathing simulator (Ingmar Medical, US) via a filter (Baxter, Ireland) using a healthy adult breathing pattern (Vt 500 ml, BPM 15, I:E 1:1) or a distressed adult breathing pattern (750 ml, BPM 30, I:E 1:1). A 2 mL dose of 2mg/mL albuterol sulphate (GSK, Ireland) was nebulised. The mass of drug captured on a filter placed distal to the trachea was quantified using UV spectroscopy at 276 nm.

Results
See Table 1

<table>
<thead>
<tr>
<th>Drug delivery modality</th>
<th>Healthy adult breathing (%)</th>
<th>Distressed adult breathing (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VMN + HFNT at 50LPM</td>
<td>2.88 ± 0.15</td>
<td>6.81 ± 0.45</td>
</tr>
<tr>
<td>Facemask + JN + HFNT at 50LPM</td>
<td>0.82 ± 0.16</td>
<td>5.72 ± 0.71</td>
</tr>
<tr>
<td>Mouthpiece + JN + HFNT at 50LPM</td>
<td>0.86 ± 0.11</td>
<td>0.69 ± 0.53</td>
</tr>
<tr>
<td>P-value</td>
<td>&lt;0.0001</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>

Table 1. Tracheal dose (%) across drug delivery modalities.

Conclusion
These findings confirm the feasibility of efficient aerosol delivery during simulated adult HFNT using the Airvo 2 nebuliser adapter. During healthy adult breathing, greater aerosol delivery was observed when the VMN was integrated with HFNT (2.88 ± 0.15), as opposed to using a JN and facemask placed over the nasal cannula (0.82 ± 0.16) and a JN and a mouthpiece with a nasal cannula (0.86 ± 0.11). During distressed adult breathing, greater aerosol delivery was observed when HFNT was integrated with HFNT (6.81 ± 0.45), as opposed to using a JN and facemask placed over the nasal cannula (5.72 ± 0.71) and a JN and a mouthpiece with a nasal cannula (0.69 ± 0.53). Furthermore, concurrent aerosol delivery during HFNT with a VMN, as described here, has been shown in clinical studies to achieve clinically relevant bronchodilation.
Introduction to Nasal High Flow on Surgical Acute Dependency Unit (SADU)

Miss Zoe Freeman¹
²Frimley Health NHS Foundation Trust

Following demonstrations of nasal high flow and the positive research evidence to reflect this, the anaesthetist, physiotherapists and senior sister of SADU felt that the new level 1 area in the hospital would be a prime area for this trail. Following buy in from the surgeon’s a trial was commenced. It was used on patients with fractured ribs once pneumothorax has been excluded, patients requiring high levels of oxygen, and patients with an increased work of breathing.

All staff were trained on the nasal high flow machine, with regards to setting it up and application. A nursing competency was developed for SADU as part of their induction to the unit. During the trail it was found that patient comfort was greatly increased when transferred onto nasal high flow from face mask. The buy in from the multidisciplinary team has meant that high flow on the unit is nurse and physiotherapy lead.

Barriers were experienced during the trail one being obtaining bloods gases promptly enough from the medical team. The risk of pneumothorax, lead to some apprehension in starting without senior input. Future learning needs from this trial are teaching the nursing staff to learn to wean patients from nasal high flow with confidence. From this a weaning flow chart that is now attached to the machine for easy access. The success of the trial has directly lead, to the implementation of nasal high flow with in the ICU.