Preventing Wrong Gas Delivery to Patients
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Key issue: Air / Oxygen delivery & adverse events

Background

Incidents involving the inadvertent administration of the wrong gas to patients are a world-wide problem and can lead to severe adverse patient outcomes. Over the last 12 months, Flinders Medical Centre (FMC) observed an increased number of incidents reported via AIMS (Australian Incident Management System) and an increased NBT (Medical Emergency Team) call rate relating to the issue. A Patient Safety Advisory, published by the South Australian Department of Health also indicated this type of incident was being reported at greater levels than before.

Discussion & Recommendations

Before Photos - identifies visual barriers that can create error

1. The most common error was: Reconnection to air rather than oxygen occurs most frequently when a patient returned from a procedure or was transferring from another clinical unit
2. Black air ‘nipples’ were not readily available from the Supply Department and so staff were forced to use white (oxygen) nipples on air supply connections
3. Other contributing factors included: poor lighting, similar medical equipment within the immediate area & bed curtains obscuring the gas panel

Investigation

An ‘expert’ panel was created involving medical, nursing, biomedical engineering and safety & quality staff to investigate the “root causes” of the problem. The panel reviewed each reported incident, undertook a literature review(1-4), interviewed staff and the clinical units were visited and audited for medical gas set up (photos 1, 2 & 3).

Results of Investigation

- The most common error was: Reconnaissance to air rather than oxygen occurs most frequently when a patient returned from a procedure or was transferring from another clinical unit
- 30% of the clinical units had at least one incorrect air (oxygen set up) (Incorrect colour flow nipples; white = oxygen, black = air supply was the most common error)
- Three different brands of flow meters were in use (no standardisation)
- Black air ‘nipples’ were not readily available from the Supply Department and so staff were forced to use white (oxygen) nipples on air supply connections
- Other contributing factors included: poor lighting, similar medical equipment within the immediate area & bed curtains obscuring the gas panel

Discussion & Recommendations

The panel reviewed various improvement strategies based on their ability to:

- Error Proof (eliminate potential for human error absolutely)
- Error Reduce (prevent errors being made by providing attention
- Evaluate effectiveness

Types of Recommendations Risks/Barriers Costs

<table>
<thead>
<tr>
<th>Type of Recommendation</th>
<th>Error Proof</th>
<th>Error Reduce</th>
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<tbody>
<tr>
<td>Introduction of a system, whereby the delivery of oxygen and medical air from the gas outlet panel to the patient is different and not interchangeable (similar to systems used by ventilators and anaesthesia machines)</td>
<td>Not recommended by 3 Respiratory Consultants. Evidence suggests 40% of patients with COPD are Co2 retainers. Delivery of high flow oxygen to these patients will cause hypoxaemia and potentially lead to severe adverse events.</td>
<td>NA</td>
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<td>Biomedical designed device (see photos 4 – 6) that alters the connection process of medical air flow meters to incorporate visual/physical barriers</td>
<td>Potential decreased staff morale as - sharing pumps between patients - need to locate pump - need to clean pump between patients to reduce spread of infection - medications due at same time - need to wait till pump finished cycle - possible shortage of power outlets at the bedside due to only one power outlet per bed</td>
<td>Approx $10,000 (pumps are $1000 each, 4 per ward) Approx cost per bed = $58</td>
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Discussion & Recommendations

1. Error Proof
   - Remove all air /flow meters. Deliver all rebubled medications via air driven-electric pumps
   - Potential decreased staff morale as - sharing pumps between patients - need to locate pump - need to clean pump between patients to reduce spread of infection - medications due at same time - need to wait till pump finished cycle - possible shortage of power outlets at the bedside due to only one power outlet per bed - Patient complaints as a medication maybe delayed

2. Error Reduce
   - Educat staff to remove air flow meters when not in use
   - Potential decreased staff morale as - sharing pumps between patients - need to locate pump - need to clean pump between patients to reduce spread of infection - medications due at same time - need to wait till pump finished cycle - possible shortage of power outlets at the bedside due to only one power outlet per bed - Patient complaints as a medication maybe delayed

Recommendation approved

Develop a device to alter the connection process to medical air flow that creates strong visual / physical barrier was selected as the most viable alternative.

- A black moulded plastic (clearly labelled AIR) device has been developed to fit over the black air nipple
- All air outlets have been fitted with the device and a hospital wide education campaign was undertaken
- A Patient Safety Alert was developed and promoted to medical & nursing staff

The “Air Guard” in use

1. Easy to clean, no infection risk. 2. Aims at the best solution. But system is currently not available in Australia
3. Patients can still be injection moulded device is not available in Australia
4. Aims will be monitored for further incidents to evaluate the effectiveness of the new system

Evaluation Strategies

- Check air/O2 meters - there may be an incident waiting to happen or some you don’t know about
- INCIDENT monitoring and incident review is integral to diagnosing problems (aggregate your data)
- Staff satisfaction questionnaire will be undertaken 6 months after implementation of the new system

Lessons Learnt

- AIMS will be monitored for further incidents to evaluate the effectiveness of the new system
- A staff satisfaction questionnaire will be undertaken 6 months after implementation of the new system

Acknowledgements

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References

1. Advanced Incident Management System
2. Patient Safety Advisory: Veterans Health Administration, USA, 2002
3. Agency for Healthcare Research and Quality, 2004
4. South Australian Department of Health Advisory, 2006