INTRAOSSEOUS VASCULAR ACCESS WEARING PERSONAL PROTECTIVE EQUIPMENT

The ability to obtain rapid vascular access for fluid or medication administration is standard of care when working in emergency conditions. Hazardous materials incidents may require sophisticated levels of personal protective equipment (PPE) that can interfere with fine motor skills needed for intravenous line placement. Early antidotal or supportive therapy may be life saving for hazardous materials victims. Using a goat model, this study was designed to assess the ability of experienced first responders (fire department paramedics and a physician with incident response experience) and limited experienced first receivers (emergency department nurses, physicians and physical assistants) to place intravenous lines (IO) for quick antidote administration wearing various levels of PPE.

PURPOSE

This study was reviewed and approved by the University of Texas Health Science Center at San Antonio Institutional Animal Care and Use Committee (IACUC) prior to implementation. Twelve anesthetized Spanish goats monitored by a veterinarian were used for the study. (Live animals were chosen to permit assessment of the hemodynamic effects of antidotes administered by the IO route.). The EZ-10® (Vidacare Corporation, Shavano Park, Texas) was used for all IO placements. Operators were briefed on the EZ-IO. They were randomized to a particular animal and order of PPE level worn for each preassigned non-randomized anatomical insertion site. Operators were timed from the moment they touched the driver or needle set until they completed an injection of a 5cc saline bolus into the goat. The final IO placement was verified by fluoroscopy.

DESCRIPTION OF STUDY

First responders placed IO lines successfully in 100% of cases. The median times to completion (secs) for PPE levels were: A = 43.5; B = 45.0; C = 40.0; D = 30.0.

Major findings

- First responders placed IO lines successfully in 91% of cases. The median times to completion for PPE levels were: C = 42.0; D = 37.0.
- There were no significant differences in time to completion among PPE levels or operator groups.
- Two of 48 placements (4%) resulted in extravasation.
- All infusions were successfully completed.

IMPLICATIONS FOR PRACTICE

- Emergency department “first receivers” wearing PPE may have to decontaminate and treat victims who have undergone inadequate or no decontamination prior to arrival.
- First responders in the emergency department and first responder rescuers may be trained to initiate antitodal therapy or other treatment in the “hot zone.”
- Definitive vascular access is often required for effective therapy.
- High levels of PPE can interfere with fine motor skills required for intravenous (IV) line placement.
- IO line placement can be readily accomplished even while wearing the highest levels of PPE.
- IO access is an effective alternative to IV access when time is critical and PPE limits motor skills both in the “hot zone” and receiving facilities. The ability for clinicians to rapidly administer an antidote, medications or fluids by the IO route, before or during decontamination could theoretically improve patient outcomes.

LIMITATIONS

The model used for this study was a goat with anatomical and bone density differences from humans. The study was done in a controlled lab setting without the environmental and human variables encountered during an actual hazard incident. Randomization protocol violations occurred twice but due to the limited differences in success rates and completion times we do not believe these violations substantially altered study results. Some operators felt the butyl over gloves were poorly fitting and in practice they would have chosen a better fit.

CONCLUSIONS

Placement of intravenous lines for vascular access and early administration of antidotes can be accomplished rapidly and effectively with the EZ-10® while wearing various levels of PPE. IO access may facilitate earlier administration of antidotes, as well as other IV medications and fluids, in victims of hazardous materials incidents. Despite the anatomical differences in goats, similar success seems likely when using the IO route in humans.

REFERENCES


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First responder wearing level A PPE First responder wearing level B PPE

PPE Worn For Study

<table>
<thead>
<tr>
<th>Level</th>
<th>Operator</th>
<th>Chemical Protective Suits</th>
<th>Airway Protection</th>
<th>Gloves</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>FRSP¹</td>
<td>Vapor –protective, fully encapsulating</td>
<td>SCBA²</td>
<td>2 layers nitrile or latex, butyl³</td>
</tr>
<tr>
<td>B</td>
<td>FRSP¹</td>
<td>Full, hooded chemical splash suit</td>
<td>SCBA²</td>
<td>2 layers nitrile or latex, butyl³</td>
</tr>
<tr>
<td>C</td>
<td>FRSP¹</td>
<td>Full, hooded chemical splash suit</td>
<td>APR**</td>
<td>2 layers nitrile or latex, butyl³</td>
</tr>
<tr>
<td>C</td>
<td>FRK³</td>
<td>Chemical splash suit</td>
<td>PAPR***</td>
<td>2 layers nitrile or latex, butyl³</td>
</tr>
<tr>
<td>D</td>
<td>FRK³</td>
<td>Non-stere gown and eye protection</td>
<td>N95****</td>
<td>Nitrile or latex</td>
</tr>
<tr>
<td>D</td>
<td>FRK³</td>
<td>Non-stere gown and eye protection</td>
<td>N95****</td>
<td>Nitrile or latex</td>
</tr>
</tbody>
</table>

¹ Full protective, butyl face mask, butyl nitrile or latex splash suit, butyl nitrile or latex gloves
² SCBA™ supplied air, butyl nitrile or latex, butyl nitrile or latex gloves
³ Powered air purifier respirator
** PAPR™ supplied air
***Powered air purifier respirator
**** N-95 Healthcare particulate respirator

Funding Sources

Vidacare Corporation, Shavano Park, Texas. Meck Santi, Lyon, France

For Study

Level A front view

Level B after removal of IO stylet

Level D IO insertion

EZ-IO System

Level D, IO insertion

10 needles in human prsented humens

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