TITLE: Intraosseous Infusions for Patients Needing Emergency Fluid Resuscitation or Medication Administration: Clinical Benefits, Clinical Harms, and Guidelines

DATE: 01 September 2010

RESEARCH QUESTIONS:

1. What are the clinical benefits and harms of intraosseous infusions in patients needing emergency fluid resuscitation and/or medication administration?

2. What are the guidelines for the initiation of intraosseous infusions in patients needing emergency fluid resuscitation and/or medication administration?

METHODS:

A limited literature search was conducted on key health technology assessment resources, including PubMed, the Cochrane Library (Issue 7, 2010), University of York Centre for Reviews and Dissemination (CRD) databases, ECRI (Health Devices Gold), EuroScan, international health technology agencies, and a focused Internet search. The search was limited to English language articles published between Jan 1, 2005 and Aug 19, 2010. No filters were applied to limit the retrieval by study type. Internet links were provided, where available.

The summary of findings was prepared from the abstracts of the relevant information. Please note that data contained in abstracts may not always be an accurate reflection of the data contained within the full article.

RESULTS:

HTIS reports are organized so that the higher quality evidence is presented first. Therefore, health technology assessment reports, systematic reviews, and meta-analyses are presented first. These are followed by randomized controlled trials, non-randomized studies, and evidence-based guidelines.
The literature search identified six non-randomized studies regarding benefits and harms and three evidence-based guidelines regarding initiation of intraosseous infusions in patients needing emergency fluid resuscitation and/or medication administration. No health technology assessments, systematic reviews, meta-analyses, or randomized controlled trials were identified. Additional articles of potential interest are included in the appendix.

OVERALL SUMMARY OF FINDINGS:

The six included non-randomized studies\textsuperscript{1-6} examined various population groups, from neonate to adult, and all concluded that intraosseous (IO) infusions were effective, fast, and safe, with only minor complications reported. Two studies specified the type of health care workers inserting the IO infusions. Gerritse et al.\textsuperscript{1} studied an emergency medical transport team, while Fiorito et al.\textsuperscript{6} examined insertions performed by emergency medical technician-paramedics, emergency medicine physicians, and transport team members. Both studies demonstrated a high success rate for IO placements by all groups. Additional studies involving a variety of health care providers performing IO infusions are included in the appendix. Table 1 provides more detail on the included non-randomized studies.

<table>
<thead>
<tr>
<th>First author; year</th>
<th>Patient group or setting; IO device</th>
<th>Results</th>
<th>Authors’ conclusions</th>
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<tbody>
<tr>
<td>Gerritse; 2009\textsuperscript{1}</td>
<td>40 children and adults in a pre-hospital setting with an emergency medical transport team; Bone injection gun</td>
<td>Success rate was 71% in children, 73% in adults; no complications for health care providers or patients</td>
<td>The bone injection gun is safe and effective in a pre-hospital setting.</td>
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<td>Leidel; 2009\textsuperscript{2}</td>
<td>10 in-hospital adult emergency patients under resuscitation; EZ-IO</td>
<td>Success rate on first attempt was 90%; mean procedure time 2.3 minutes; failure to obtain access in one patient was the only complication</td>
<td>IO access is reliable for in-hospital adult patients under trauma or medical resuscitation with impossible peripheral IV access, and may improve the safety of these patients compared with central venous catheterization (CVC).</td>
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<td>Ngo; 2009\textsuperscript{3}</td>
<td>24 patients in the emergency department (35 IO insertions); EZ-IO</td>
<td>All IO insertions except one were successful on the first attempt, and all were placed within 20 seconds; complications were minor and included a glove caught in the drill device and extravasation of fluid</td>
<td>The EZ-IO device is fast, easy, and reliable for patients with no venous vascular access, especially in the emergency department.</td>
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<td>Paxton; 2009\textsuperscript{4}</td>
<td>29 emergency room patients undergoing resuscitation (30 IO)</td>
<td>IO catheter placement was significantly faster than peripheral IV (PIV) or CVC; IO insertions are significantly faster than PIV and CVC</td>
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Intraosseous Infusions for Patients Needing Emergency Fluid Resuscitation or Medication Administration
**Table 1: Non-randomized studies**

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<td>inserting); IO device not specified</td>
<td>no major complications; minor complications included placement failure, poor flow, catheter dislodgement, and higher pain scores</td>
<td>placement, although there is increased risk of minor complications; IO access is life saving when conventional methods of vascular access are difficult or impossible.</td>
<td></td>
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<tr>
<td>Horton; 2008&lt;sup&gt;5&lt;/sup&gt;</td>
<td>95 pediatric emergency patients; EZ-IO</td>
<td>Success rate of 94%, with insertion time of ≤10 seconds in 77% of the one-attempt successes; 4 minor, non-significant complications</td>
<td>The EZ-IO device is safe and effective during the resuscitation and stabilization of pediatric patients.</td>
</tr>
<tr>
<td>Fiorito; 2005&lt;sup&gt;6&lt;/sup&gt;</td>
<td>47 pediatric patients in pediatric critical care transport to PICU (58 IO insertions); insertions performed by emergency medical technician-paramedics, emergency medicine physicians, and transport team members</td>
<td>Success rate of first attempt was 78%; mean of 1.2 attempts per placement; 7 (12%) of placements had complications (all were local edema or infiltration)</td>
<td>IO infusions are safe and there is a similar rate of successful placement for different provider groups; all of these provider groups should be familiar with IO placement.</td>
</tr>
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</table>

**CVC=central venous catheterization; IO=intraosseous; IV=intravenous; PICU=pediatric intensive care unit; PIV=peripheral intravenous**

The three evidence-based guidelines<sup>7-9</sup> included in this report all recommend the use of IO infusion if vascular access cannot be obtained quickly. All three guidelines agree that use of the IO route is preferred over the endotracheal route for drug administration. The individual guidelines are specific to pediatric and neonatal resuscitation,<sup>7</sup> patients with cardiac or cardiopulmonary arrest,<sup>8</sup> and infants, children, and adolescents.<sup>9</sup>
REFERENCES SUMMARIZED:

Health technology assessments
No literature identified

Systematic reviews and meta-analyses
No literature identified

Randomized controlled trials
No literature identified

Non-randomized studies


Guidelines and recommendations

See: Alternative Routes for Drug Delivery

See: Vascular Access and Drugs for Cardiac Arrest

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APPENDIX – FURTHER INFORMATION:

Non-randomized studies


Clinical practice guidelines (unclear methodologies)


See: Assisting the circulation, p. 54

See: Route and dose of adrenaline, p. 103

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Review articles


Additional references

