# WORKSHEET for Evidence-Based Review of Science for Emergency Cardiac Care

**Worksheet author(s)**  
Anthony J Handley MD FRCP  

**Date Submitted for review:**  
14 December 2009

---

**Clinical question.**

In adult and paediatric patients with foreign body airway obstruction (out-of-hospital and in-hospital) (P), does the provision of abdominal thrusts, and/or back slaps, and/or chest thrusts, compared with no action (C), improve outcome (O) (e.g. clearance of obstruction, ROSC, survival)?

---

**Is this question addressing an intervention/therapy, prognosis or diagnosis? Intervention/therapy**

**State if this is a proposed new topic or revision of existing worksheet:** Revision of 2005 worksheet

---

**Conflict of interest specific to this question**

Do any of the authors listed above have conflict of interest disclosures relevant to this worksheet? No

---

**Search strategy (including electronic databases searched).**

Worksheets W151A and W151B from CoSTR 2005 were reviewed and search strategies re-run.

**Medline (2004-2009)**

- Foreign body airway obstruction (human): 7 hits; 2 papers reviewed; 1 relevant  
- (Foreign body airway obstruction OR choking) AND (treatment OR management) (human): 125 hits; 4 papers reviewed; 1 relevant (duplicate)  
- (Foreign body airway obstruction OR choking) AND therapy (human): 78 hits; 1 relevant (duplicate)  
- Abdominal thrusts (human): 2 hits; no papers reviewed  
- Heimlich: 45 hits; 10 papers reviewed; 5 papers relevant (1 duplicate)  
- Back blows: 1 hit; 1 paper reviewed; none relevant  
- Chest thrusts: 0 hits

**Embase (2004-2009)**

Repeat of searches as for Medline. No additional relevant papers found.

**Cochrane Library**

Search: airway obstruction; choking; Heimlich; back blows; abdominal thrusts; chest thrusts: 0 hits

**Other**

Cited references; papers cited (Scopus); journal searches: 1 relevant

**Search strategy as above re-run 14 September 2009**

- Heimlich OR abdominal thrusts (Scopus and Medline) produced 2 further case reports of complications

No other additional relevant papers were found for the other search terms or databases.

---

**State inclusion and exclusion criteria**

Include: 2004-2009 (since worksheet CoSTR 2005); human (except Heimlich – include all); include cases reports for Heimlich only (complications)

Exclude: Reviews; opinions

---

**Number of articles/sources meeting criteria for further review:**

6 including 7 case reports
## Summary of evidence

### Evidence Supporting Clinical Question

<table>
<thead>
<tr>
<th>Good</th>
<th>Fair</th>
<th>Poor</th>
</tr>
</thead>
</table>
|      | Soroudi 2007, 25 E  
Redding 1979, 475 E  
Boussuges 1985, 733 E  
Heimlich 1975, 188 E  
Vilke 2004, 196 B | Langhelle 2000, 44E  
Ruben 1978, 725 E | Guildner 1976, 675 E |

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Level of evidence

- **A** = Return of spontaneous circulation
- **B** = Survival of event
- **C** = Survival to hospital discharge
- **D** = Intact neurological survival
- **E** = Other endpoint

*Italics = Animal studies*
### Evidence Neutral to Clinical Question

<table>
<thead>
<tr>
<th>Good</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Fair</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poor</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
</table>

**Level of evidence**

A = Return of spontaneous circulation  
B = Survival of event  
C = Survival to hospital discharge  
D = Intact neurological survival  
E = Other endpoint  

*Italicics = Animal studies*

### Evidence Opposing Clinical Question

<table>
<thead>
<tr>
<th>Good</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Fair</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poor</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
</table>

**Level of evidence**

A = Return of spontaneous circulation  
B = Survival of event  
C = Survival to hospital discharge  
D = Intact neurological survival  
E = Other endpoint  

*Italicics = Animal studies*
**REVIEWER’S FINAL COMMENTS AND ASSESSMENT OF BENEFIT / RISK:**

**CONSENSUS ON SCIENCE (2005):**

NOTE: Those references not LOE 1-5 (2010 criteria) and those considered ‘unsatisfactory’ by authors have not been included.

It is unclear which method of removal of FBAO should be used first. For conscious victims, case reports showed success in relieving FBAO with back blows (LOE 4: Redding 1979, 475; Vilke 2004, 196), abdominal thrusts (LOE 4: Heimlich 1975, 188; Redding 1979, 475; Boussuges 1985, 733; Vilke 2004, 196), and chest thrusts (LOE 4: Redding 1979, 475; LOE 5: Guildner 1976, 675). Frequently, more than one technique was needed to achieve relief of the obstruction. Life-threatening complications have been associated with the use of abdominal thrusts [See Citation List]. For unconscious victims, case reports showed success in relieving FBAO with chest thrusts and abdominal thrusts [Unsatisfactory - single case reports]. One randomized trial of manoeuvres to clear the airway in cadavers (LOE 5: Langhelle 2000, 44) and two prospective studies in anaesthetised volunteers (LOE 5: Ruben 1978, 725; Guildner 1976, 675) showed that higher airway pressures can be generated by using the chest thrust rather than the abdominal thrust. Case series reported the finger sweep as effective for relieving FBAO in unconscious adults and children aged >1 year [Unsatisfactory single case report]. Four case reports documented harm to the victim’s mouth or biting of the rescuer’s finger [Unsatisfactory - review of literature].

**TREATMENT RECOMMENDATION (2005):**

Chest thrusts, back blows, or abdominal thrusts are effective for relieving FBAO in conscious adults and children >1 year of age, although injuries have been reported with the abdominal thrust. There is insufficient evidence to determine which should be used first. These techniques should be applied in rapid sequence until the obstruction is relieved; more than one technique may be needed. Unconscious victims should receive CPR. The finger sweep can be used in the unconscious patient with an obstructed airway if solid material is visible in the airway. There is insufficient evidence for a treatment recommendation for an obese or pregnant patient with FBAO.

**CURRENT COMMENTS (2010):**

No relevant studies on the effectiveness of back blows or chest thrusts in adults or children were found subsequent to those reported in CoSTR 2005.

A single, fair, pre-hospital, LOE 4 study (Soroudi 2007, 25) reported an 86.5% success rate in adults for the Heimlich manoeuvre, and a 70% success rate for supine abdominal thrusts in ‘relieving symptoms’.

A number of case reports, published since 2004 (CoSTR 2005), of complications due to the use of the Heimlich manoeuvre were found and are listed below.

**Acknowledgements:**

Gavin D Perkins MD and Thomas A Barnes MD for their 2005 worksheets

---

**Citation List**

**Paper published since 2005 worksheets**


*Level 4: fair; supporting*

Retrospective review of San Diego County EMS pre-hospital records of cases of airway obstruction over a 17-month period revealed 513 cases of FBAO. 43.5% relieved with no treatment prior to paramedic arrival. Of the techniques used to relieve
obstruction, Heimlich manoeuvre was successful in 86.5% of cases, and supine abdominal thrusts in (from the graph shown) approximately 70% of cases.

Papers cited in 2005 worksheets (LOE 1-5 as per 2010 criteria)


Level 5; fair; supporting

Retrospective case series of successful use of Heimlich maneuver in very young children and infants.


Level 5. Poor. Supporting.

Heimlich, low chest thrust (2 fingers above xiphoid) and mid chest thrust performed on 6 healthy anaesthetized, intubated adults in sitting and horizontal position by 4-5 volunteers. Peak flow rate, volume and peak pressure were measured with each technique. No statistical comparisons presented. Low chest thrust produced higher values for all parameters than other techniques. Heimlich and mid chest thrust produced similar values. All parameters appeared higher in sitting compared to horizontal position.


Level 4; fair: Supporting

This paper had two parts:

(1) 96 anecdotal reports of successful use reported (no details provided).

(2)Experiment in conscious adult volunteers (n=10) looking at peak pressure, volume and flow rate following the Heimlich maneuver during different phases of respiration. Procedure during early expiration: Average flow 205 L/min, vol 940 ml, pressure 31mmHg; late respiration: 75L/min, 350ml


Level 5. Fair. Supporting

Randomised cross over comparison of chest compressions and abdominal thrusts in recently deceased adults (n=12) with simulated complete airway obstruction. Endpoint was peak airway pressure. Findings – average peak airway pressure greater with chest compressions than abdominal thrusts (40.8cmH2O versus 24.6, P=0.005).

Study also reports that abdominal thrusts did not work in thin subjects (n=2) and chest thrust did not work as well as abdominal thrust in obese subject.


No abstract supplied

Level 5. Fair.

Review of studies and politics surrounding use of Heimlich manoeuvre. In addition review of 386 anecdotal reports of successes / failures of various choking techniques voluntarily reported to the AHA registry. Interpretation of results difficult as reports were anecdotal, data not systematically collected, probably favoured successes rather than failures, often reported by lay observers.
Review reports successes and failures for back blows, abdominal thrusts, chest thrusts, finger probes, instrumentation and CPR used alone or in combination with each other.


No abstract supplied.

Level 5. Fair. Supporting

12 anaesthetised, paralysed volunteers had Heimlich, sternal thrusts and back blows performed on them. Intra-tracheal pressure and ability to dislodge various food substances from model larynx also performed. Peak airway pressures were greatest for back blows (median 25 cm H2O), then sternal thrust (20 cm H2O) then Heimlich (10 cm H2O). The duration of the pressure wave for each technique was 0.02 sec, 0.2 sec and 0.33 secs respectively. The area under the curve indicated that the Heimlich moved the greatest volume of air. The model experiments were inconclusive. Conclude that back slaps likely to be most effective.


Level 5. Fair. Supporting.

Database review of choking patients (age <5) that had received 911 emergency response. 182 cases, 99(55%) less than one year. 107(59%) resolved before paramedic arrived. Methods used by parents – bulb suction (3%), finger sweeps (6%), Heimlich (3%), back blows (12%). No breakdown on which techniques were successful.

Case reports


No abstract supplied

Single case report

Conscious patient eating peanut butter sandwich - failure of Heimlich manoeuvre, success with finger sweep which removed large clot of peanut butter


Case report.

Small numbers, biased as not truly evaluating finger sweep.

Thumb-in-mouth technique infrequently used and led to thumb being bitten in several cases.


No abstract supplied

Case report

Review of evidence to date with inclusion of unpublished data and conjecture on best practice from evidence available at the time. Problems with procedures being too complex leading to failure in up to 1/3 of resuscitation attempts. Particular problems with asphyxia leading to trismus and patients biting rescuers thumb when placed on lower teeth.

Case reports of complications from abdominal thrusts
Agia GA, Hurst DJ. Pneumomediastinum following the Heimlich maneuver. JACEP. 1979;8:473-475.


