Amphoteric Compound
Chemical Eye/Skin Splash
Decontamination: Clinical Experience

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Objective and method

- To evaluate clinical experience with using an amphoteric compound in a hypertonic solution as a decontamination solution for eye/skin chemical splashes, extending previously published data.(1-4)

- A review of cases of clinical use of an amphoteric solution for eye/skin chemical splash decontamination voluntarily reported to the manufacturer as part of a post-marketing surveillance program was done.

Mechanism of the chemical injury

- result of a contact of the skin/the eye with an irritant or a corrosive

- The severity of the burn depends mainly on:
  - nature and concentration of the chemical involved,
  - energy level involved,
  - time of contact.
  - And also:
    - physical factors like the pressure or the temperature
    - the Total Body Surface Area (TBSA)
    - and whether the skin/eye is healthy or not.

- Chemicals can also be toxic! (Ex: hydrofluoric acid, HF)
What is Diphoterine®?

- An active washing solution for ocular and cutaneous chemical splashes
- An aqueous solution containing the fundamental properties of water:
  - mechanical effect of pulling the chemical agent away from the surface of the body tissue.
- An amphoteric solution
  - Acts in the same way on the acids and the bases, with a rapid return towards a zone of physiological pH. Also amphoteric for oxidisers/reducing agent and solvents.
- A hypertonic solution
  - Stops the penetration of corrosive chemicals into the tissues creating a flux from the inside to the outside of the body.

A medical device EC 0459, IIa class

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Collected results

- From 1987 to 2010
- 58 reports from 52 different industrial facilities/organizations
- 44 total cases reported
- Some cases exposed several people on several body areas
### Chemicals involved

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Range of conc.</th>
<th>N</th>
<th>Conc. not specified</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium hydroxide (NaOH)</td>
<td>flakes – 50% - 25%</td>
<td>14</td>
<td>4</td>
</tr>
<tr>
<td>sulfuric acid (H$_2$SO$_4$)</td>
<td>98% - 96% - 87%</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>Caustic solution or basic substance</td>
<td>pH&gt;8.2</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Phenol &amp; derivates</td>
<td></td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Nitric acid (HNO$_3$)</td>
<td>100% - 70%</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Lubricants</td>
<td></td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Trichloroethane</td>
<td></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Acrylic acid</td>
<td>100%</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Acrylamide</td>
<td>50%</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Acrylic varnish</td>
<td></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>DMEA</td>
<td></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Others</td>
<td></td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>44</strong></td>
<td></td>
<td><strong>22</strong></td>
</tr>
</tbody>
</table>
Body surfaces splashed

- Eyes and face were the most involved body areas
- Skin splashes (5):
  Mean of TBSA: 9.1%

FIRST AID MANAGEMENT

- 40 cases washed with Diphotherine® first
- 3 cases washed with tap water first
- 1 phenol splash washed with tap water + PEG + Diphotherine®

PEG: Polyethylene Glycol

5 Management of the major burn, Ames WA, practical procedures, Issue 10(1999) art. 10

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First aid management

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
<th>Not mentioned</th>
</tr>
</thead>
<tbody>
<tr>
<td>Secondary treatment</td>
<td>4</td>
<td>9</td>
<td>31</td>
</tr>
<tr>
<td>Lost work time</td>
<td>1</td>
<td>26</td>
<td>17</td>
</tr>
<tr>
<td>Sequelae</td>
<td>9</td>
<td>19</td>
<td>16</td>
</tr>
</tbody>
</table>

- In 2 cases, Diphoterine® was only used on *some but not all* exposed body parts. Outcome was worse in those parts not washed with Diphoterine®.
- In one case, Diphoterine® was used rapidly on some body parts and only erythema developed. However, sodium hydroxide soaked through a shoe and Diphoterine® washing was delayed by 15 minutes, resulting in a second degree skin injury (see picture).
- In the 3 cases with water washing first, the outcome in 2 of 3 cases was generally less good than in the cases where Diphoterine® was used first.

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Other data(4)

- Clinical case series of 180 alkali splashes on skin from Oct. 2006 to March 2008
- Dr M. Donoghue, Chief Medical Officer, Alcoa Australia

<table>
<thead>
<tr>
<th></th>
<th>Diphoterine® first</th>
<th>Water first</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>138</td>
<td>42</td>
</tr>
<tr>
<td>Time elapsed</td>
<td>1 min.</td>
<td>5 min.</td>
</tr>
<tr>
<td>No chemical burn</td>
<td>52.9%</td>
<td>21.4%</td>
</tr>
<tr>
<td>Blisters or more severe signs</td>
<td>7.9%</td>
<td>23.8%</td>
</tr>
</tbody>
</table>


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Conclusion

- Diphotherine® is currently used in industry, as a first aid solution.
- Used as primary action, it limits chemical burn development.
- In this non-random retrospective series, Diphotherine® was associated with good clinical outcomes.
Thank you