First Aid Science Essential Information for MSDS Authors

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Evidence-Based Approach

- Identify specific questions
- Search for relevant literature
- Critically evaluate quality of evidence
- Determine best answer

Specific Questions

Routes of exposure

Breadth of toxic effects

Standard first aid practices

Literature Search

Bibliographic databases

Secondary sources

Data mining

Literature Evaluation

Human vs animal

Controlled study vs case reports

Quality of study design

Extrapolation

Common sense

Best Answer

Clearly stated conclusions

Supported by best evidence

Today's Focus

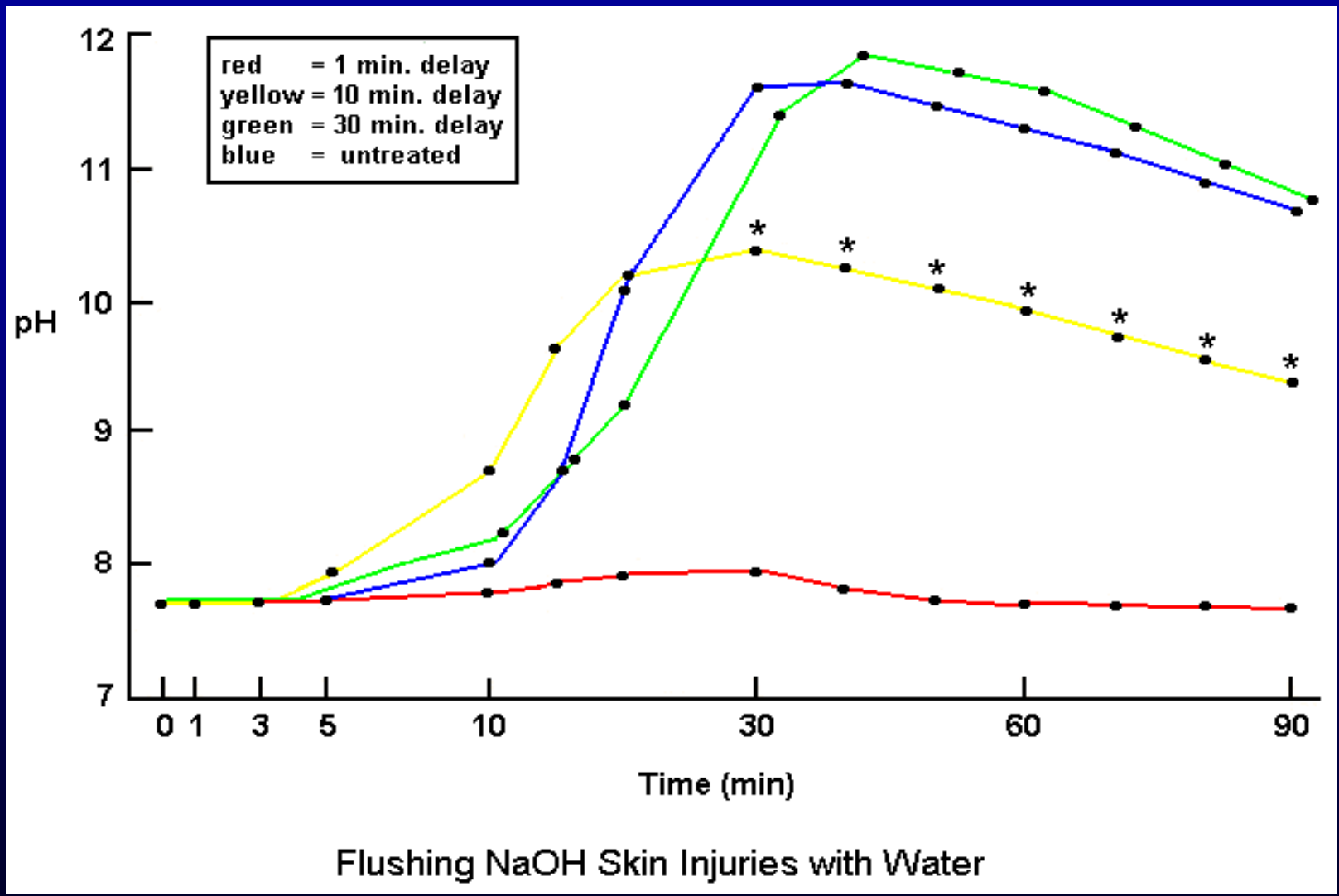
How long should the skin be flushed with water following a chemical exposure?

Yano, K., et al. Experimental study on alkaline skin injuries – periodic changes in subcutaneous tissue pH and the effects exerted by washing. Burns. Vol. 19, no. 4 (1993). p. 320-323

Methods

- 8% sodium hydroxide (1-minute; rat)
- Water flushing at 1, 10 or 30 minutes
- Subcutaneous pH measured
- Baseline pH 7.70-7.72
- Degree of injury assessed

NaOH	Peak pH	pH @ 90 Minutes	Tissue Damage
Untreated	12.11 @ 32 minutes	10.71	Severe
1-minute delay	7.97 @ 23 minutes	7.71 @ 60 minutes	Mild
10-minute delay	10.57 @ 27 minutes	9.39	Moderate
30-minute delay	12.17 @ 41 minutes	10.78	Severe


red = 1 min. delay
yellow = 10 min. delay
green = 30 min. delay
blue = untreated
pH
12
11
10
9
8
7
0 1 3 5 10 30 60 90
Time (min)
Flushing NaOH Skin Injuries with Water

Results

- ✓ Flushing MUST start immediately
- ✓ With a 1-minute delay - pH normal at 60 minutes – mild injury
- ✓ With a 10-minute delay - pH not normal at 90 minutes – moderate injury

Andrews, K., et al. The treatment of alkaline burns of the skin by neutralization. Plastic and Reconstructive Surgery. Vol. 11, no. 6 (May 2003). p. 1918-1921

Methods

- 8% sodium hydroxide (1-minute; rat)
- Flushing with water started at 1 minute
- Subcutaneous pH measured

Results

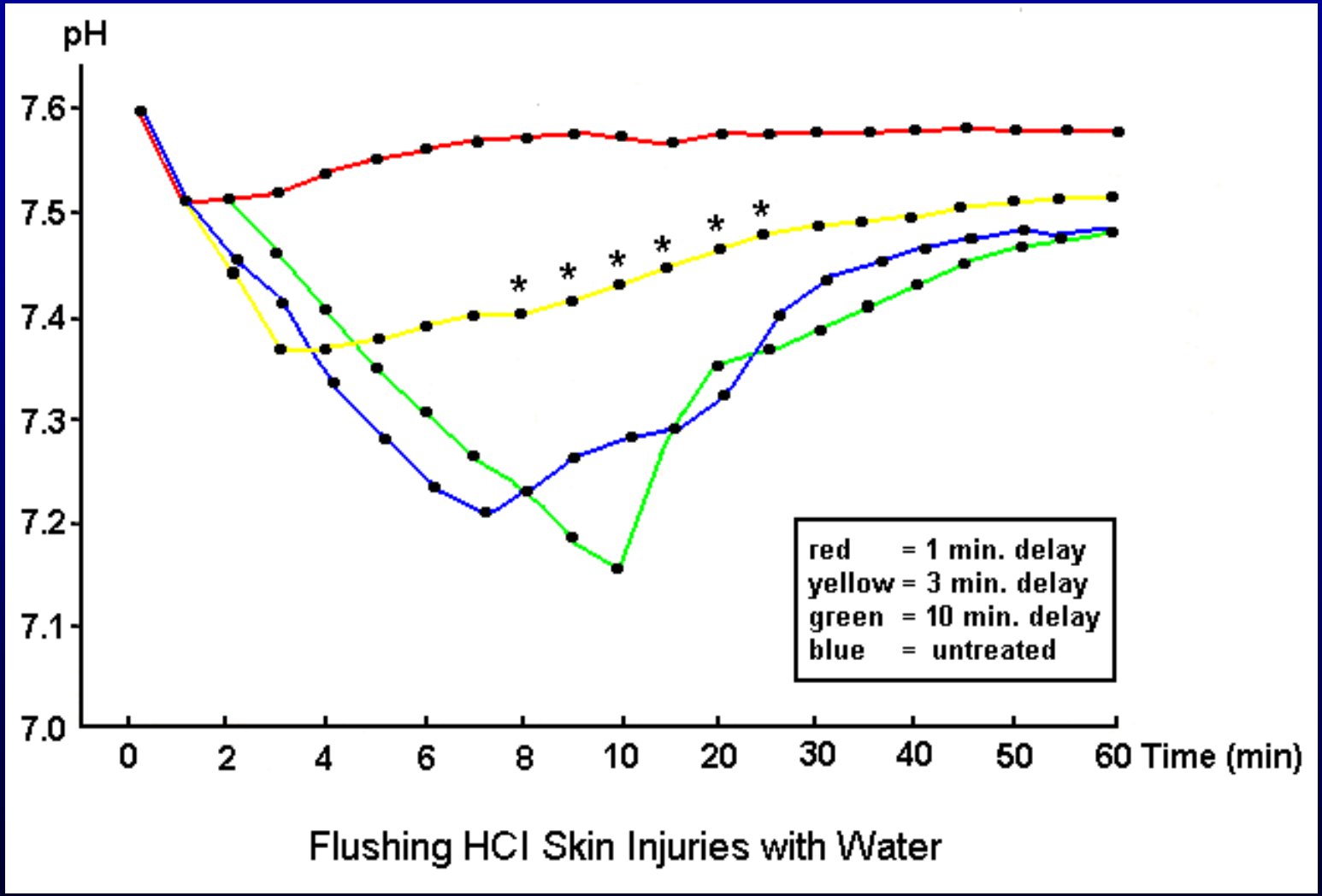
- pH returned to normal at 31.62 minutes
- Complete healing at 14 days

Yano K., et al. Effects of washing acid injuries to the skin with water: an experimental study using rats. Vol. 21, no. 7 (1995). p. 500-502

Methods

- 3.65% hydrochloric acid (1-minute; rat)
- Water flushing at 1, 3 or 10 minutes
- Subcutaneous pH measured
- Baseline pH 7.71
- Degree of injury assessed

HCl	Minimum pH	pH @ 60 Minutes	Tissue Damage
Untreated	7.22 @ 7 minutes	7.48	Severe
1-minute delay	≥7.5 @ All times	7.58 @ 10 minutes	Mild
3-minute delay	7.35 @ 3 minutes	7.52	Moderate
10-minute delay	7.15 @ 10 minutes	7.48	Severe


pH
7.6
7.5
7.4
7.3
7.2
7.1
7.0
0
2
4
6
8
10
20
30
40
50
60 Time (min)
red = 1 min. delay
yellow = 3 min. delay
green = 10 min. delay
blue = untreated
Flushing HCl Skin Injuries with Water

Results

- Flushing MUST start immediately
- 1-minute delay - pH “normal” in 10 minutes – mild injury
- With a 3-minute delay - pH “normal” within 60 minutes; improvement at 8-25 minutes - moderate injury

Historical Research

- 50% sodium hydroxide and 36% hydrochloric acid
- immediate flushing
- pH did not normalize for at least 60 minutes

(Bromberg 1965)

Human Evidence

- Follow-up on 35 skin burn cases
- Flushing started within 10 minutes
- Continued for at least 15 minutes
- Significantly better outcomes

(Leonard 1982)

- Experience with 83 chemical burns
- Copious water lavage within 3 minutes
- Significantly better outcomes

(Moran 1987)

American Heart Association

- ✓ Flush with large amounts of cool running water.
- ✓ Continue flushing until EMS personnel arrive.

www.c2005.org

CCOHS Conclusions

- ✓ 5 minutes for no to mild irritants
- ✓ 15-20 minutes for moderate to severe irritants
- ✓ 30 minutes for most corrosives
- ✓ 60 minutes for strong alkalis

Other Topics Covered

- Emergency oxygen
- Neutralization
- Alternate flushing solutions
- Inducing vomiting
- Oral dilution
- Syrup of Ipecac
- Universal antidote
- Activated charcoal

Major Changes

- ✓ Remove clothing earlier (skin contact)
- ✓ Not recommending milk (ingestion)
- ✓ Smaller amount of water (2-8 oz instead of 8-10 oz) (ingestion)
- ✓ Automated External Defibrillation (very toxics)

Re-Emerging Issues

- Activated charcoal
- Neutralization (skin or ingestion)

Do NOT follow first aid instructions on product label – they may be wrong.

American Association of Poison Control Centers

American College of Emergency Physicians

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