First aid regarding chemical burns

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Accepted for poster presentation at the Nordic Burn Meeting, June 2016
Awarded as best poster for Nordic Burn Meeting 2016

Introduction

Clinic is the main reference in case of chemical accidents in industries around us. **We have 28 years of experience in chemical burns, about 200 cases per year.** Burns treated are due to various corrosives from industries. pH remains most of the time corrosive when patients get to the clinic despite 15 minutes safety shower rinsing with water. Treatment with water has limitations. **How to improve?**

Materials and methods

A polyvalent hypertonic amphoteric first-aid solution stopping corrosive reactions, Diphoterine® solution, registered as a medical device in India was introduced at the hospital after one accident due to bromine splash in a known factory. The present study compares the results obtained from different first aid managements. **During a 10 months period**, chemical burns were registered. Water was used by the patient himself within the first 10 minutes after exposure on site. The polyvalent solution was used 20 minutes after exposure upon arrival at the clinic. When both rinsing solutions were used, water was used within 10 minutes after exposure and the polyvalent solution after 30 minutes. The clinic situated only 10 minutes away from the industrial area, some patients came to the clinic without first rinsing with water at the accident site. Statistical analysis was performed following large or small samples according to the population (Ref. Schwartz D).

Results

During the 10 months study, we registered 110 cases of chemical burns in industries. 100% of the patients are men. 71 cases rinsed with water only on site (plant), 31 cases rinsed with Diphoterine® solution only (at the clinic), 8 cases with water first and Diphoterine® solution upon arrival at the clinic. The clinic being situated 10mn away from the industrial area, in 32 cases, patients came to the clinic without first rinsing with water at the accident site. After study duration of 6 months (70 cases), we noticed that some elements could help improve outcome, so they were introduced from December onwards (40 cases):

- Pain factor upon arrival versus pain factor when leaving the clinic (after use of water or Diphoterine® solution),
- Visual acuity upon arrival versus visual acuity when leaving the clinic (after use of water or Diphoterine® solution).

So the comparative study of these 2 criteria added at the end is based on the cases from Dec 2015 till March 2016 (26 for water and 12 for Diphoterine® solution). There were 62 ocular, 48 dermal splashes. No patient has shown any side-effects / allergic reaction after using polyvalent solution. Work loss and time of recovery were significantly decreased when the polyvalent solution was used compared to water. When measured, pain score was less important for the polyvalent solution and visual acuity was improved.

A - Demographic characteristics and nature of the burn

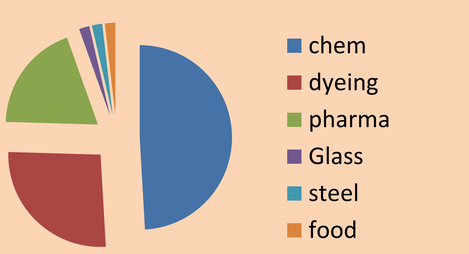
	water	Diphoterine® solution	*p*	Difference
Delay from exposure till rinsing (min)	9,93	19,52	< 0,01	Diphoterine® solution delay significantly higher than that of water
standard deviation ±	0,593	1,50		
mean age (years) of patient	34,58	32,32	-	No difference between age in Diphoterine® solution and water group
standard deviation ±	9,65	10,20		
cases	**71**	**31**		

**note: the cases where both rinsing solutions have been used (8) are not taken into account in this table*

B – Distribution of splashes

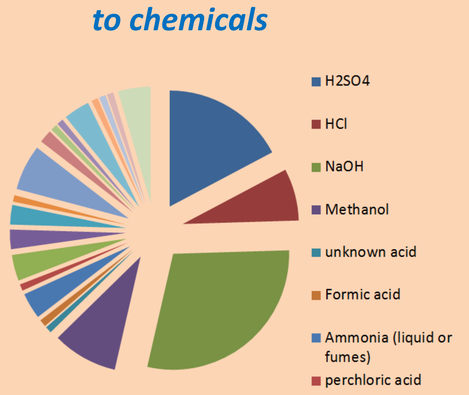
62 ocular = 56%
48 dermal = 44%
110 cases TOTAL

C – Distribution of splashes according to industries



	Chemistry	Dyeing	Pharma	Glass	Steel	Food	Total
cases	**54**	**29**	**21**	2	2	2	110
%	**49**	**26**	**19**	2	2	2	100

D – Distribution of splashes according to chemicals



D - Results: WORK LOSS

Work-loss after splashes
all cases (ocular, dermal), all chemicals

all	water	Diphoterine® solution	*p*	Difference
Work-loss days	**10,41**	**2,42**	< 0.01	Work-loss days with Diphoterine® solution significantly less important than with water
standard deviation ±	18,12	2,31		
number of cases	**71**	**31**		

Exclusive rinsing: Either Diphoterine® solution **OR water Not both**

E - Results: COST of HOSPITALIZATION

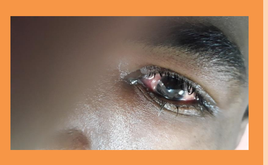
Cost of Hospitalization after splashes
all cases (ocular, dermal), all chemicals

all	water	Diphoterine® solution	*p*	Difference
Average cost of hospitalization post accident	**8085**	**2065**	< 0.01	Average cost of hospitalization with Diphoterine® solution significantly less important than with water
standard deviation ±	12449	2108		
number of cases	**71**	**31**		

A REAL CASE PICTURE

15 MINUTES AFTER ACETIC ACID splash

INJURY TO LEFT EYE
***500ml Diphoterine® solution* applied**



45 MINUTES AFTER using *Diphoterine® solution*

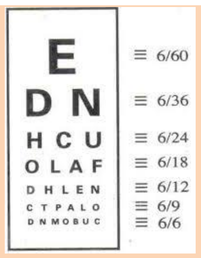
Conjunctival edema has decreased, Lid edema has also decreased, Less epiphora after this

12 HOURS AFTER *Diphoterine® solution* WASH

Cornea and conjunctiva clear
No surrounding edema

G – Results of visual acuity

Ocular splashes, all chemicals
28 cases



Visual acuity before VS after rinsing with	Water	Diphoterine® solution
No improvement	13	2
Improvement of 1 acuity threshold **e.g. 6/9 to 6/6**	3	8
Improvement of 2 acuity thresholds **e.g. 6/12 to 6/6**	0	2
Total cases	**16**	**12**

The visual acuity is measured before and after the rinsing at the clinic (Snellen's 6/6, 6/9, 6/12, 6/18 etc.)

Average improvement outcome:

With water: 19%
With Diphoterine® solution: 84%

Decontamination with Diphoterine® solution significantly improves visual acuity versus washing with water (p < 0,0005)

Second part of the study From December

H – Results of pain factor (Over 38 cases)

all cases (ocular, dermal), all chemicals

	water	Diphoterine® solution	*p*	Difference
gap from exposure till rinsing (mn)	9,81	18,75	< 0,001	Victims decontaminated with Diphoterine® solution present pain change before/after significantly different from those washed with water.
standard deviation	0,981	2,261		
mean age (years) of patient	34,31	33,17		
standard deviation	9,09	9,11		
cases	**26**	**12**		
assessment of pain before/after rinsing				
average pain improvement (scale 1 to 10)	**2,12**	**3,67**		
standard deviation	0,86	0,65		

Solution	Average pain decrease	*Average pain from*
Water	2,12	**6,1 to 3,8**
Diphoterine® solution	3,67	**6 to 2,4**

Conclusion

These clinical preliminary results show that chemical burns classical management can be improved. The number of work-loss days and hospitalization cost when decontaminated with Diphoterine® solution are about a ¼ of the ones with water (*p < 0,01*). Victims decontaminated with Diphoterine® solution present pain change before/after significantly different from those washed with water (*p < 0,001*). Visual acuity was also improved (p < 0,0005). Further results will be presented in due time including more patients.

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