A review about Diphotérine®
the solution for emergency decontamination of chemical splashes

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Introduction

The diverse range of chemicals currently being used throughout industry present a significant potential hazard to health[1] when personnel become contaminated as a result of accidental splashes[2]. The need to use a polyvalent and active rinsing solution becomes more and more necessary.

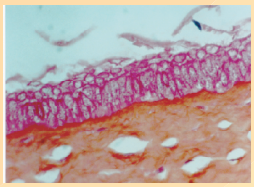
Materials and methods

Diphotérine® is an emergency first aid rinsing solution for eye/skin chemical splashes. Using its hypertonicity[3] and its chemical properties[4], Diphotérine® is able to stop and absorb the aggressiveness of a wide spectrum of chemicals and remove them from the tissues. Diphotérine® is a non toxic[5] solution (Oral Toxicity LD_{50}>2000 mg/Kg, Test 6564 TAR 1990 CIT, France; Acute Dermal Toxicity LD_{50}>2000 mg/Kg, test 133/9, 1988, Safepharm Laboratories, UK). It is slightly irritant on the skin and non irritant in the eye (test 133/3-133/4, 1987, Safepharm Laboratories, UK). Its residues with acids and bases are non irritant (test 6463TAL/6462TAL, 1990, CIT, France). Diphoterine has no sensitising effect (Test 20030418ST, 2003, CERB, France). The environmental effects of Diphotérine® have been studied and it was found non toxic by Microtoxicity (CE_{50}-15 minutes>5000 mg/l, CE_{50}-30 minutes>5000 mg/l) and Aquatic Toxicity (on Daphnia Magna, CE_{50}-24h>5000 mg/l) (tests n°D9811\0611, 1998, SGS Crépin Laboratory, France). Diphotérine® is a medical device CE 0459, first classifying and sterile. Most of the companies mentioned in this report, were previously using water for emergency first aid decontamination of eye/skin chemical splashes without complete success : irremediable sequelae, numerous secondary care and loss of work. Subsequently, the Medical and Health and Safety Services decided to introduce Diphotérine® (or Previn®) for rinsing chemical splashes and to train workers to use it correctly. Previn® is the German version of Diphotérine®. Each ocular or cutaneous chemical splash was rinsed in emergency (some seconds to a few minutes) with Diphotérine®, on location, while undressing if necessary. Then each person went to the medical centre for an examination. In the MANNESMANN company, a secondary rinsing with Diphotérine® was performed in the medical centre.

Results

In vivo experiments

Comparative study of a 15.3% ammonia burn between saline solution rinsing and Diphoterine rinsing [7]



Results : An inflexion of the pH was observed for Diphotérine® rinsing of a 15.3% ammonia burn in a rabbit eye. No stromal edema was observed for Diphotérine® rinsing but it was observed for saline solution rinsing as shown in the Figure 1.

Fig. 1: Pathological anatomy of the cornea with a saline solution rinsing, 3 minutes after the burn with ammonia 15.3%, coagulated epithelium and edematous stroma

Comparative study of a concentrated HCl burn between saline solution, calcium gluconate and Diphoterine rinsing [8, 9]

Decontamination with Diphoterine® significantly modulated plasma cytokines and opioid peptides in an experimental HCl dermal burn model, as well as promoting better wound healing as compared to no decontamination or decontamination with either normal saline or 10% calcium gluconate.

A SERIE[6] OF 24 CHEMICAL SPLASHES rinsed with Diphotérine® in the MANNESMANN factory, in Germany, 1994-1998

Exposure	Cutaneous splashes	Ocular splashes
Acids*	8	11
Bases**	1	4

*acids : sulfuric acid, nitric acid, phosphoric acid or sulfamic acid, alone or in mixture with the other acids, with a concentration of 5 to 100%.
**bases : calcium oxide, 30-45% sodium hydroxide, 30% basic solution

Results : no DAMAGE, no secondary care, no loss of work excepted two accidents with one day lost from time

A STATISTICAL STUDY[6] ABOUT 42 SODIUM HYDROXIDE (40-600 g/L) SPLASHES rinsed with different rinsing solutions in the MARTINSWERK factory, Germany, 1991-1993

	Diphotérine®	Acetic acid	Water
Loss of work	0,18d ± 0,4	2,91d ± 4,3	8d ± 8,12
No care	100% ± 15%	0 ± 15%	0 ± 15%
Simple care	0 ±15%	80% ±15%	25% ±15%
Medical care	0 ±15%	20% ±15%	75% ±15%

Results : Using Diphotérine® resulted in a noticable decrease in sick leave average and a standard deviation. No secondary care was necessary. There is a significant difference ($p<0.05$) between Diphotérine® and water concerning secondary care.

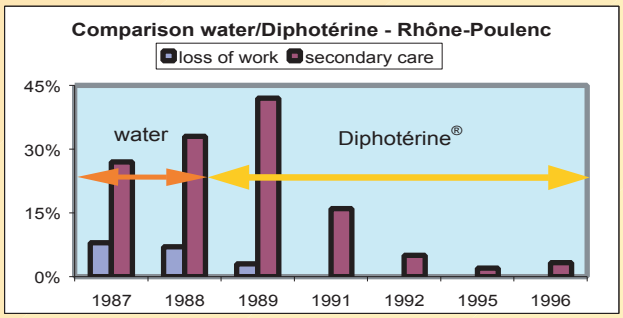
A STATISTICAL STUDY[6] ABOUT 195 CHEMICAL ACCIDENTS in the RHÔNE-POULENC factory, France, 1987-1996 with two periods

*** Until 1989 : Immediate rinsing with water during 15 minutes => Two splashes with big sequelae**

Concentrated, hot nitric acid inducing
- burns on head, torso, all of the body, eye
- Hypertension for the rigrt eye
- reject for the left corneal grafting
- ocular vision stable at 2/10

Condensa of soda inducing
- burns on back and right buttock
- Important necrosis of the buttock 48 hours after the accident
- Necessary of a grafting

*** from 1989 to 1996 : Immediate rinsing with Diphotérine® => No accidents with sequelae**



Results : Using Diphotérine® instead of water completely suppressed loss of work and significantly reduced the need for secondary care.

Conclusion

The emergency use of Diphotérine® is a good way for the decontamination of ocular or cutaneous chemical splashes. Its emergent use often gives an immediate pain relief. It achieves a reduction of loss of work and secondary care in all cases and avoids sequelae for the workers.

References

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