



Clinical Trial of Eye Irrigation with Buffer Solution.

Purpose

To examine side effects and any damage caused by eye irrigation with a buffer solution in normal healthy eyes.

Background

It is widely accepted that the re-establishment of physiological pH value in the eyes is important in order to reduce damage to the eye after accidental eye burn caused by acid or base.

Animal tests have shown that the pH value in the cornea of the eye is normalised more quickly when irrigated with a phosphate buffer solution than with isotonic saline.

For ethical reasons, the effect of the buffer solution on human eyes with manifest eye burn cannot be examined under standardised conditions. However, it seems rational to assume that an injured eye will not be more susceptible than a normal eye.

Subjects

Voluntary subjects, employed at the Department of Ophthalmology at Vejle Hospital, were included in the clinical trial.

A personal letter was distributed to all secretaries, nurses and physicians with a description of the project and the buffer solution.

The employees could subsequently register for participation in the project.

Method

The trial was a randomised, double-blind, prospective study. The study included 26 subjects (a total of 52 eyes).

Prior to the eye irrigation, all eyes were examined under a slit lamp by one of two physicians.

Objective conjunctival and corneal changes were registered.

The eyes were randomised so that one eye of the subject was irrigated with isotonic saline and the other with the buffer solution. Only the nurse who irrigated the eyes knew which eye was irrigated with saline and which with the buffer solution, and neither the subject nor the examining physician had knowledge of this.

First, one eye was irrigated and then the other eye was irrigated immediately afterwards. The irrigation lasted 2 minutes for each eye, and a special irrigation bottle designed for use in first aid was used.

The subject filled in a questionnaire 1 minute after irrigation. The eyes were re-examined by the physician 5 minutes after irrigation, and, finally, the subject filled in the last part of the questionnaire.

Results

An objective examination did not demonstrate any corneal changes in the subjects eyes either before or after irrigation.

Conjunctival changes were graded into "no redness", "slight redness", "noticeable redness" and "pronounced redness" (fig. 1). Two subjects had slight redness in both eyes both before and after irrigation. In addition, two eyes became slightly red after irrigation with saline, and 6 eyes became slightly red after irrigation with buffer solution. This difference is not significant ($p>0.05$). No eyes became "noticeably red" or "pronouncedly red" after irrigation.

The questionnaire consisted of 7 questions. In the first 4 questions, the subjects were asked to state the discomfort experienced during irrigation, the discomfort after 1 minute and the discomfort after 5 minutes for each eye separately.

The answer choices were "no discomfort", "slightly uncomfortable", "uncomfortable" and "very uncomfortable".

The result table (fig. 2) shows that significantly more subjects had slight discomfort in the eye irrigated with the buffer solution than in the eye irrigated with saline ($p = 0.0005$).

3 persons found irrigation with buffer solution "uncomfortable", whereas no one found irrigation with saline "uncomfortable". 1 subject found irrigation with both saline and buffer solution "very uncomfortable", and this person was the only one who had an "uncomfortable" feeling in the eyes after 1 and 5 minutes. The other subjects all had only slight discomfort or no discomfort after 1 and 5 minutes. There was no significant difference between the groups who found the irrigation "uncomfortable" and "very uncomfortable" ($p>0.05$).

In the final questions, the subjects preferred irrigation with saline to irrigation with the buffer solution, but the level of discomfort caused by the buffer solution was acceptable to all subjects except one.

Conclusion

Eye burns after accidents with splash of acid and, in particular, bases are often very serious. Rapid assistance is highly important in order to limit the eye burn. The recommended acute treatment has been to irrigate with water or, if possible, isotonic saline. The irrigation is continued en route to the emergency room, and here irrigation continues until the pH value has normalised. This often requires a long irrigation process of more than 1 hour.

The purpose of eye irrigation is twofold: to wash out the corrosive material and to achieve a dilution effect so that the pH value is slowly normalised.

Eye irrigation with a buffer solution will also wash out and dilute the corrosive material, but it also has a neutralising buffer effect, which means that the pH value is normalised more quickly.

However, it is important that the buffer solution itself must not be uncomfortable or downright harmful to the eye.

The results of this clinical trial have shown that the subjects experienced more discomfort in irrigation with the buffer solution than with isotonic saline. The subjects primarily stated the discomfort from the irrigation as slight discomfort, and the difference between the irrigation solutions was acceptable.

Only very few subjects felt that irrigation with the buffer solution was uncomfortable, and the discomfort disappeared quickly. Only a few eyes were slightly red after the irrigation process, and no corneas were affected.

Based on these findings, the conclusion is that the buffer solution is not harmful to healthy eyes.

Clinical Evaluations

The buffer solution is safe to use as acute first aid in connection with accidents in which there is a risk of eye burn. The treatment may be commenced immediately with an easy-to-handle 200-ml bottle with a sterile buffer solution and is followed up with standard irrigation with water or isotonic saline en route to the emergency room.

Use of the buffer solution in the ambulance and in the emergency room will be a theoretical option for more rapid normalisation of the pH value in the eye, but it has not been studied whether there will be any harmful effect of irrigation with a buffer solution for more than a few minutes.

In order to achieve rapid normalisation of the pH value of the eye, the buffer solution will, in many cases, presumably be preferable to eye irrigation fluid, which is the method used so far.

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Yours sincerely,

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