Some aspects of waterloadings in rabbits

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Abstract. The effect of various amounts of waterload and the differences caused by oral and parenteral administration of fluids on the intraocular pressure (IOP), pupilldiameter and bloodosmolality were investigated. Trained rabbits were given loadings of fluids by different routes. An oral waterload of 100 ml/kg bodyweight gave an elevation of the IOP of about 12 mm Hg. Smaller amounts give a less pronounced IOP elevation. Intra-peritoneal administration does not seem to increase IOP markedly. Rapid infusion of glucose 5% 15 ml/kg produces a transient and modest increase of the IOP. The mechanisms by which oral waterloading increases the IOP are discussed.

Introduction

Animal models to study glaucoma are numerous and varied. The techniques of a number of these models are rather unphysiological. Waterdrinking has been used for many years as a provocative test for the diagnosis of primary open angle glaucoma (Leydhecker, 1950; Becker and Christiansen 1956; Galin et al., 1961). The waterloading test has also been used as a model to increase the intraocular pressure (IOP) (Thorpe and Kolker, 1967; McDonald et al., 1969; Seidehamel and Dungan, 1974; Vareilles et al., 1977; Van Bijsterveld et al., 1979, 1981; Rowland and Potter, 1980). In this model, however, controversy exists on the activity of some drugs (McDonald et al., 1969; Vareilles et al., 1977; Rowland and Potter, 1980; Van Bijsterveld et al., 1981). Part of this controversy may be due to variations in techniques used, especially the amount of water, time of measurement and the route of administration. Bietti (1972) has demonstrated that in humans oral water-loading can be substituted by i.v. infusion of glucose 5% solution and Bonomi et al. (1976) have used this principle as an experimental procedure to increase the IOP. Therefore, we investigated the effect of various amounts of waterloads and the differences caused by oral and parenteral administration on the IOP, pupildiameter and bloodosmolality.

Material and methods

Twelve unaesthetized, trained albino rabbits (F Flemish giant X Danish white, Dept. of Animal Care, National Institute of Public Health) of either
sex (weight 2.8–3.8 kg) were used for all experiments. The animals were
deprived of food and water for 24 h before each experiment. Rabbits were
given loadings of water as described earlier (Van Bijsterveld et al., 1979,
1981). First a baseline was taken, IOP's were then measured at 0, just before
the waterloading, and after 10, 20, 30, 45, 60, 75, 90, 120, 150, 180 and 240
min. IOP's were measured with an Alcon applanation pneumotonograph
standardized with the Alcon calibrator. Exceptionally 20 µl 0.1% oxybupro-
caine was applied in those situations when IOP measurement was difficult.
Glucose 5% and sodium chloride 0.9% solutions were used for intravenous
and intraperitoneal administration. For the intraperitoneal way the loads
were given within 2–3 min and in the intravenous route in maximally 45
seconds. Horizontal pupil diameter was measured to the nearest 0.5 mm with
a transparant rule held close the cornea. Osmolality was determined with
Osmett A (Precision Systems Inc. USA). Mean and standard error of the mean
(SEM) are presented.

Results

Waterload and IOP

Within 10 min after the administration of water via an orogastric tube the IOP
rises, reaching its maximum between 30–60 min and returning within 4 h
slowly to the pretreatment value.