

EFFECT OF ETHANOLAMINE ON REPARATIVE REGENERATION OF THE RABBIT CORNEA

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A half-thickness wound was inflicted on a rabbit in the central part of the cornea by means of a trephine 4 mm in diameter. Subconjunctival and subcutaneous injections of ethanolamine were given to stimulate regeneration. In control animals destructive processes predominated in the early stages and epithelization was complete on the 15th-16th days. A coarse leucoma formed at the site of the defect. During ethanolamine injections proliferative processes in the epithelium and in the ground substance of the cornea began sooner and epithelization was complete on the 10th-14th day, with the formation of a hardly visible leucoma. Ethanolamine is a good stimulator of posttraumatic regeneration of the cornea.

KEY WORDS: ethanolamine; post-traumatic regeneration; leucoma.

In most cases lesions of the cornea end with the formation of a persistent scar, or leucoma. Among methods aimed at the prevention of leucoma the use of stimulators of regeneration must be mentioned. Cystamine [10], methyluracil [5], riboflavin [11], kalanchoe juice [6], cryotherapy [4], ultrasound [1], laser irradiation [3], etc., have been used as stimulators. However, not in all cases has permanent transparency of the cornea been recovered.

The object of this investigation was to study posttraumatic regeneration of the cornea with the use of ethanolamine as stimulator. Investigations have shown [7-9] that ethanolamine has a stimulating action on reparative regeneration of various organs. It stimulates protein metabolism and the synthesis of nucleic acids, ATP, and phospholipids, and it activates oxidation-reduction process [2].

EXPERIMENTAL METHOD

Experiments were carried out on 36 Chinchilla rabbits weighing 1.5-2 kg. Half-thickness wounds were inflicted in the central part of the cornea with a trephine 4 mm in diameter. Ethanolamine was given as the hydrochloride in a dose of 1 mg/100 g body weight. The compound was injected subconjunctivally in a dose of 0.3 ml and subcutaneously in a dose of 0.4 ml daily. While the animals remained alive epithelization was monitored by the methylene blue test. A negative methylene blue test (absence of staining of the defect) indicated completion of epithelization of the corneal wound. For histological study of the material, rabbits were killed 3, 7, 10, 15, 20, and 30 days after the operation. Paraffin sections were stained with hematoxylin-eosin and by Van Gieson's method.

EXPERIMENTAL RESULTS

Visual observations on the experimental animals showed that epithelization of the corneal wound in the control group took place on the 15th-16th day after trauma. In the animals receiving ethanolamine epithelization was complete on the 10th-14th day or, in a few cases, on the 16th day of the experiment. Histological examination of the sections showed that on the third day after trauma degenerative changes and destruction of collagen fibers of the ground substance of the cornea were present in the control animals (Fig. 1). In the corneal tissues and in the anterior chamber of the eye many leukocytes gathered. At the junction between the ground substance of the cornea and the connective tissue of the sclera new blood vessels were formed and subsequently invaded the wound.

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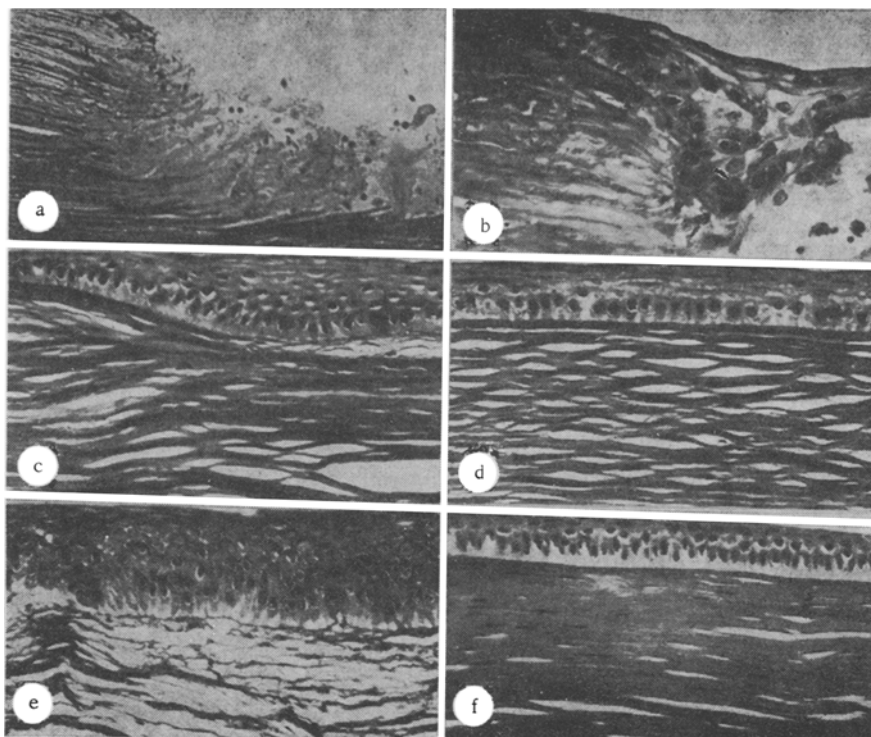


Fig. 1. Rabbit cornea. a) Third day after trauma, control; b) the same time, with administration of ethanolamine; c) 15th day after trauma, control; d) the same time, administration of ethanolamine; e) 30th day after trauma, control; f) the same time, administration of ethanolamine. Objective 25, ocular 12.5.

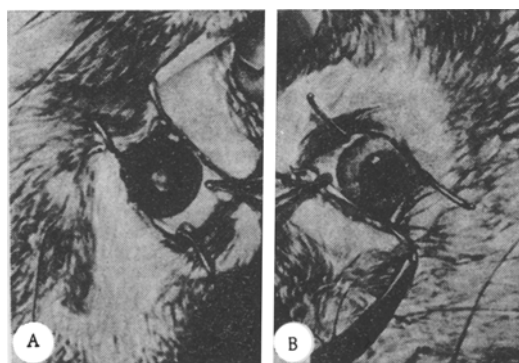


Fig. 2. Eye of a rabbit. A) 30th day after trauma, control; B) 30th day after trauma during ethanolamine administration.

In animals receiving ethanolamine, on the third day after the operation proliferative processes were stimulated in the epithelial cells at the margin of the wound. Marked edema between the fibers was observed in the region of injury and in adjacent parts. A layer of epithelium crept over the surface of the comparatively small wound, the contents of which were abundantly infiltrated by leukocytes (Fig. 1b).

On the 15th day after trauma epithelization was largely complete in the control animals. In places, however, the epithelial layer was thickened and sank into the depth of the underlying connective tissue. The basement membrane was not yet fully formed. Fibers of the ground substance of the cornea in these areas were relatively well differentiated and arranged haphazardly. In areas with a thin epithelial layer the underlying connective tissue was still undifferentiated. Slight edema between the fibers still persisted (Fig. 1c).

In animals receiving ethanolamine, the epithelial surface at this time was smooth and consisted of five layers of cells. The collagen fibers of the ground substance were more regularly arranged although edema between the fibers still persisted (Fig. 1d). In areas with a thin layer of epithelium, mitosis continued fairly intensively in the basal cells. The surface of the newly formed epithelium was uneven and indented, as a result of keratinization, degeneration, and irregular desquamation of the squamous cells.

On the 20th day after trauma the number of cell layers of the epithelium in the region of the leucoma reached 13 in the control animals. The surface of the epithelium was uneven, Bowman's membrane was not yet fully formed, and the collagen fibers were undifferentiated and haphazardly arranged or formed a network.

In the animals receiving ethanolamine, the cornea on the 20th day after trauma had the normal histological structure. Only in the center of the defect, where the epithelial layer was relatively thin, was fibrillogenesis still proceeding in the ground substance of the cornea. However, most collagen fibers were regularly arranged and Bowman's membrane was visibly formed.

On the 30th day after trauma the cornea of some control animals was covered with a thick layer of epithelium, with a regular surface; Bowman's membrane was not yet restored in these areas and fibrillogenesis was continuing (Fig. 1e). A coarse opacity of the cornea, or leukoma, was observed macroscopically (Fig. 2A).

In the overwhelming majority of animals receiving ethanolamine the cornea at this period of the experiment had regained its normal histological structure (Fig. 1f). The corneal opacity was insignificant (Fig. 2B).

Administration of ethanolamine during post-traumatic regeneration of the cornea thus accelerates epithelization of the wound, promotes a more regular arrangement of the fibers in the ground substance of the cornea in the region of the wound defect, and so leads to a more perfect recovery with the formation of a hardly visible leukoma.

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