

# Histologic effects of high-intensity focused ultrasound for cyclocoagulation

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## ABSTRACT

**Purpose:** To evaluate the histologic effects and clinical outcomes of high-intensity focused ultrasound (HIFU) delivered by miniaturized annular transducers for ciliary body destruction in an animal study.

**Methods:** Eighteen eyes of 18 rabbits were insonified using a ring comprising a six sectors transducer and allowing a 12.8 mm diameter circular lesion. Six sectors were activated in 6 rabbits (group 1), five in six rabbits (group 2) and four in six rabbits (group 3) at 2 watts acoustic power. The rabbits were examined on day 0 before treatment, and day 1, 7, 15, 21 and 28 post treatments. Detailed qualitative and semi-quantitative histopathological analyses of eyes enucleated at day 28 were performed.

**Results:** In the treated eyes, intraocular pressure changes ranged from +2.0mmHg (+7.1%) at day 7 to -7.9mmHg (-28.1%) at day 28 in Group 3 (4 sectors activated), from -1.4mmHg (-7.6%) at day 7 to -4.7mmHg (-25.5%) at day 28 in Group2 (5 sectors activated) and from -8.9mmHg (-29.7%) at day 7 to -16.6mmHg (-55.3%) at day 28 in Group1 (6 sectors activated). No macroscopic abnormalities were observed in the anterior segment or fundus examination. Histologic examination showed segmental to annular lesions of the ciliary processes, mainly coagulation necrosis of the ciliary processes, whereas the sclera and the lens appeared undamaged. The inflammatory reaction assessed by the presence of macrophages, lymphocytes, plasma cells, polymorphonuclear cells or giant cells was very limited.

**Conclusions:** Ultrasonic destruction of the ciliary body using HIFU delivered by a circular miniaturized transducer seems to be an effective and well-tolerated method to reduce intraocular pressure in an animal study. Histopathology confirmed the ability to selectively coagulate the ciliary epithelium without significant inflammatory response.

**Key words:** high intensity focused ultrasound, ciliary body, glaucoma, histopathology.