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Histological Effects of Trigeminal Nerve Radiosurgery in a Primate Model: Implications for Trigeminal Neuralgia Radiosurgery

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Abstract

OBJECTIVE:

Stereotactic radiosurgical treatment of the proximal trigeminal nerve is used to relieve the pain of trigeminal neuralgia. The mechanism of the radiosurgical effect is not understood.

METHODS:

Two adult baboons underwent stereotactic magnetic resonance imaging-guided radiosurgery, using a gamma knife. A single 4-mm isocenter was targeted to each proximal trigeminal nerve, just anterior to the pons, to deliver a maximal dose of 80 or 100 Gy (total of four nerves). A nonirradiated baboon brain and nerves served as control specimens. Six months after treatment, magnetic resonance imaging was again performed and the brains and nerves were studied using light and electron microscopy.

RESULTS:

Magnetic resonance imaging indicated a 4-mm-diameter area of contrast enhancement at the target site in each nerve. All irradiated nerves exhibited axonal degeneration and mild edema at the target, with remnants of some myelinated axons. Large and small myelinated and unmyelinated fibers were affected. No inflammation was observed. Nerve necrosis was identified after 100-Gy treatment. The trigeminal ganglion appeared normal.

CONCLUSION:

Radiosurgery at 80 Gy causes focal axonal degeneration of the trigeminal nerve. At higher doses, partial nerve necrosis is observed. We think that these effects influence the physiological features of trigeminal neuralgia.

Keywords: [Radiosurgery](#), [Trigeminal nerve](#), [Trigeminal neuralgia](#)

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