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Development of a Streamlined, Non-invasive Robotic Radiosurgery Method for Treatment of Uveal Melanoma (p. 369-374)

Alexander Muacevic, MD[1,*]
Martin Nentwich, MD[2]
Berndt Wowra, MD[1]
Sibylle Staerk, M.Sc.[1]
Anselm Kampik, MD[2]
Ulrich Schaller, MD[2]

[1]European CyberKnife Center Munich
Max-Lebsche-Platz 31
81377 Munich, Germany
[2]Augenklinik der Universität Munchen
Mathildenstrasse 8
80336 Munchen
Germany
*Alexander.Muacevic@cyber-knife.net

Abstract
To analyze the feasibility and safety of frameless, image-guided robotic radiosurgery against uveal melanoma, we developed a streamlined procedure that is completed within 3 hours under retrobulbar anesthesia without immobilization. Twenty patients (10 men and 10 women) with medium (3-5-mm prominence) and large (>5-mm prominence) unilateral uveal melanomas were treated with a frameless robotic radiosurgery system. Median age was 61 years (range 32-78 years). All patients underwent a single-session procedure beginning with retrobulbar anaesthesia, followed by computerized tomography (CT) scanning that was used in the generation of a treatment plan, and then the delivery of a radiosurgical tumor dose between 18 and 22 Gy to the 70% isodose line. Three-dimensional treatment planning was aimed at securing the optical lens and the optic disc as much as possible. Follow-up occurred at 3, 6, 12, and 18 months after the radiosurgery with clinical, ultrasound, and CT studies.

We were able to treat all patients in the frameless setup within 3 hours. In five patients with lateral and dorsal tumors, the dose to the optic lens could be kept below 2 Gy. The clinical response was evaluated for the first seven patients treated with a follow-up of at least 6 months. No local recurrences occurred with any of the clinically evaluated patients for a mean 13-month follow-up (range 6-22 months). Maximum median apical tumor height according to standardized A-scan ultrasound evaluations decreased from 7.7 to 5.6 mm ($p < 0.1$). The median reflectivity increased from 41% to 70% ($p < 0.01$). None of the patients developed a secondary glaucoma during the short-term follow-up period. Frameless, single-session, image-guided robotic radiosurgery is a feasible, safe and comfortable treatment option for patients with uveal melanoma. Longer follow-up and analysis of a larger patient series is required for definitive clinical recommendations.

Key words: Uveal melanoma; Cyberknife; Radiosurgery; Frameless.