

of craniopharyngeoma cysts. The derived polynomial helps to (i) design the best treatment, (ii) follow up the patients' condition and (iii) plan reirradiation if necessary.

# Analysing the effectiveness of Yttrium-90 colloid brachytherapy in the treatment of cystic craniopharyngeomas

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**Purpose:** The aim of our study is to reveal the long-term effects of Yttrium-90 colloid radioisotope brachytherapy applied for the treatment of cystic craniopharyngiomas. To provide a mathematical expression that can describe the cyst reduction as a function of time in an accurate matter.

**Material and methods:** 14 cystic craniopharyngiomas were selected for intracavitary irradiation with stereotactically implanted beta-emitting radioisotope Yttrium-90 silicate colloid. The cumulative dose aimed at the inner surface of the cyst wall was ranging between 180-300 Gy. Volumes of the cysts were measured on image-fused control CT/MRI images for a 28-month period. Dose planning was done after the Loevinger formula, while stereotactic calculations, volume calculations and image fusion were done with the BrainLab Target 1.19 software. Mathematical and statistical computations were carried out with the Matlab numeric computation and visualization software. To determine the volumes, the control images were fused with the planning images.

**Results:** Relative volumes normalized with respect to the volume of cysts before irradiation were determined from the patients' measured data, the mean values of volumes were determined, then a polynomial was fitted to the mean values using the polynomial curve fitting method. We have found that the dynamics describing the reduction of cysts can be expressed mathematically by the polynomial  $V = 93.627 - 18.091t + 1.473t^2 - 0.054t^3 + 0.0007t^4$ , where "t" denotes the time in months passed after irradiation. The accuracy of our results was verified by correlating the predicted data with the measured ones.

**Conclusions:** Our long-term results support the view, that intracavitary Yttrium-90 irradiation is a non-invasive and very effective method for treatment