

Stereotactic Radiosurgery for Adenoid Cystic Carcinoma Brain Metastases: A Single Institution Retrospective Study

Ahed H. Kattaa, MD, Yusuke S. Hori, MD, Amirhossein Akhavan-Sigari, MD, Aroosa Zamarud, MD, Amit R. Persad, MD, Armine Tayag, NP, Louisa Ustrzynski, NP, MBA, Sara C. Emrish, NP, David J. Park, MD, PhD, Steven D. Chang, MD, MBA
 Department of Neurosurgery, Stanford University School of Medicine, Stanford, California, USA

Introduction:

- Adenoid cystic carcinoma (ACC) is a malignant neoplasm arising from the minor and major salivary glands that tends to spread by perivascular and perineural routes.

Objectives:

- Brain metastases (BM) secondary to ACC are very rare, and the standard management strategy has not been well reported due to the rarity. Especially, only a few case reports described the use of stereotactic radiosurgery (SRS) for BM from ACC.

Methods:

- We retrospectively reviewed cases of BM from ACC treated with (CK) SRS at our institution between 1998 and 2024. A total of 40 lesions from 5 patients were included, and the patient and lesion background variables were collected.
- Tumor control was defined based on radiological response to CK SRS as a complete response (CR), partial response (PR), stable disease (SD), and progressive disease (PD) per RECIST guidelines.

Table 1. Post-treatment Response Summary

Factor	Number (%) or Median (IQR)
Median lesion maximum diameter (mm)	
3-month follow-up	4.3 (2.0–7.3)
6-month follow-up	3.3 (0–5.0)
Last follow-up	2.9 (0–5.2)
Radiological response at 3 months	
Complete response	9 (22.5)
Partial response	19 (47.5)
Stable disease	12 (30.0)
Progressive disease	0 (0)
Radiological response at 6 months	
Complete response	15 (39.5)
Partial response	17 (44.7)
Stable disease	6 (15.8)
Progressive disease	0 (0)

Results:

- The median overall survival was 15.0 months (IQR: 11–30 months).
- The mean age at treatment was 51.2 years (SD): 7.8 years) and 60% were male patients.
- The mean maximum diameter of the lesions was 11.1 mm (SD: 10.9 mm). The median dose delivered was 24 Gy (IQR: 22–24Gy).
- The MRIs at 3 and 6 months demonstrated reductions in mean maximum diameters at 5.5 mm and 3.3 mm, respectively.
- The treatment responses at the first follow-up were; CR/PR/SD/PD: 9/19/12/0.
- At the last follow-up, 5 lesions had local progression, with one lesion at 39 months, and 4 lesions at 9 months after CK SRS, while 16 lesions remained CR.
- The cumulative 3-months, 6-months, and 12-months local control rates were 100%, 100%, and 87.5%, respectively.

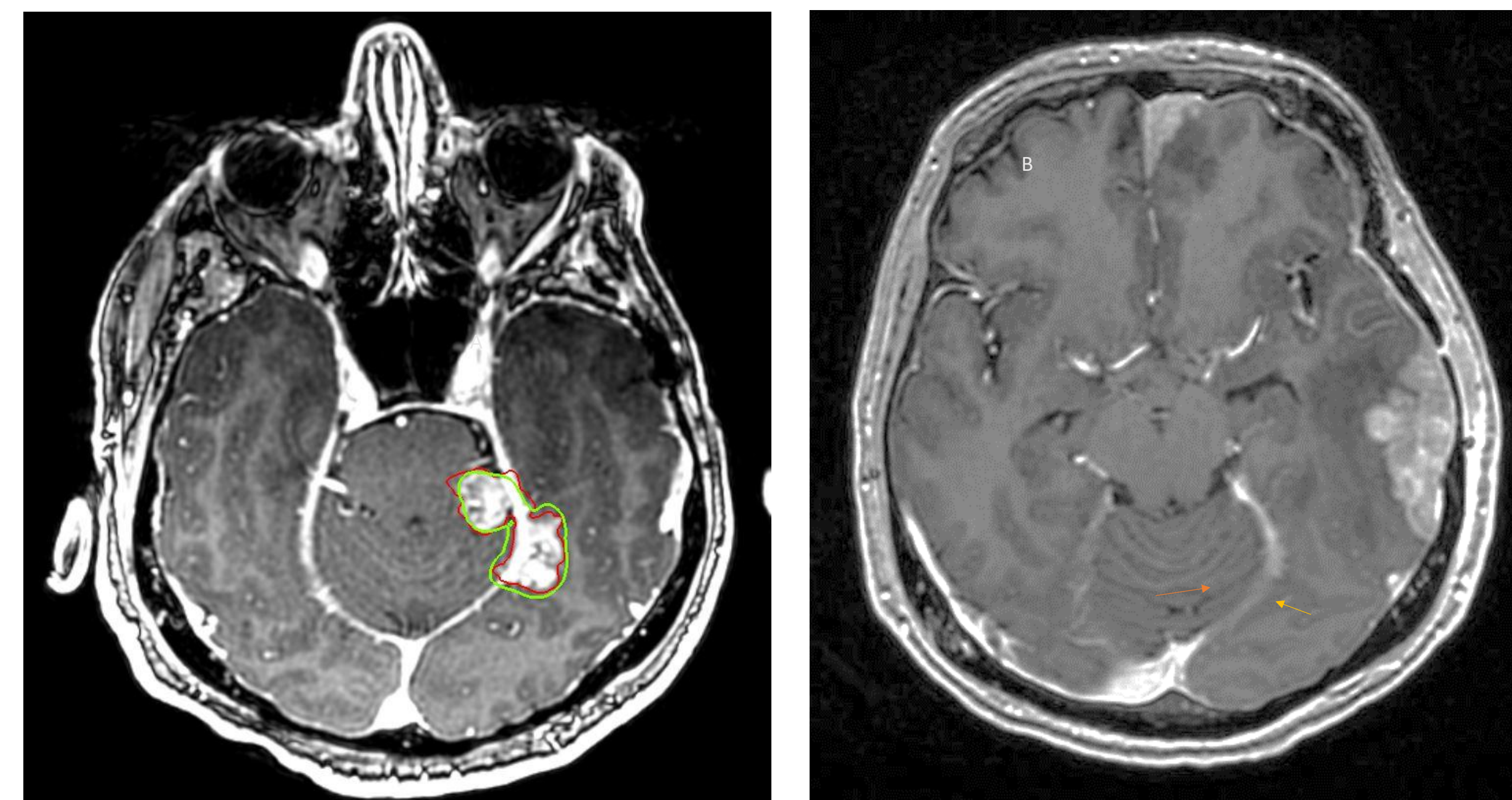


Figure 1. MRI studies of patient # 2.

A: CyberKnife radiosurgery plan for the left Infratentorial lesion. The maximum tumor diameter was 16.3 mm. The GTV (contoured in red) was 2.16 cc. The Isodose line (contoured in green) was 75%. A marginal dose of 24 Gy, with the maximum dose of 36 Gy, was delivered in 3 fractions to 75% isodose line (T1-Weighted with Contrast Enhancement).

B: MRI study of 15-month follow-up demonstrates no residual of the left Infratentorial metastasis where SRS was delivered (AX 3D T1 (BRAVO) Post).

Conclusion:

- To date, this is the largest study examining the efficacy of SRS for ACC BM.
- Our results showed the sufficient local control following the treatment.

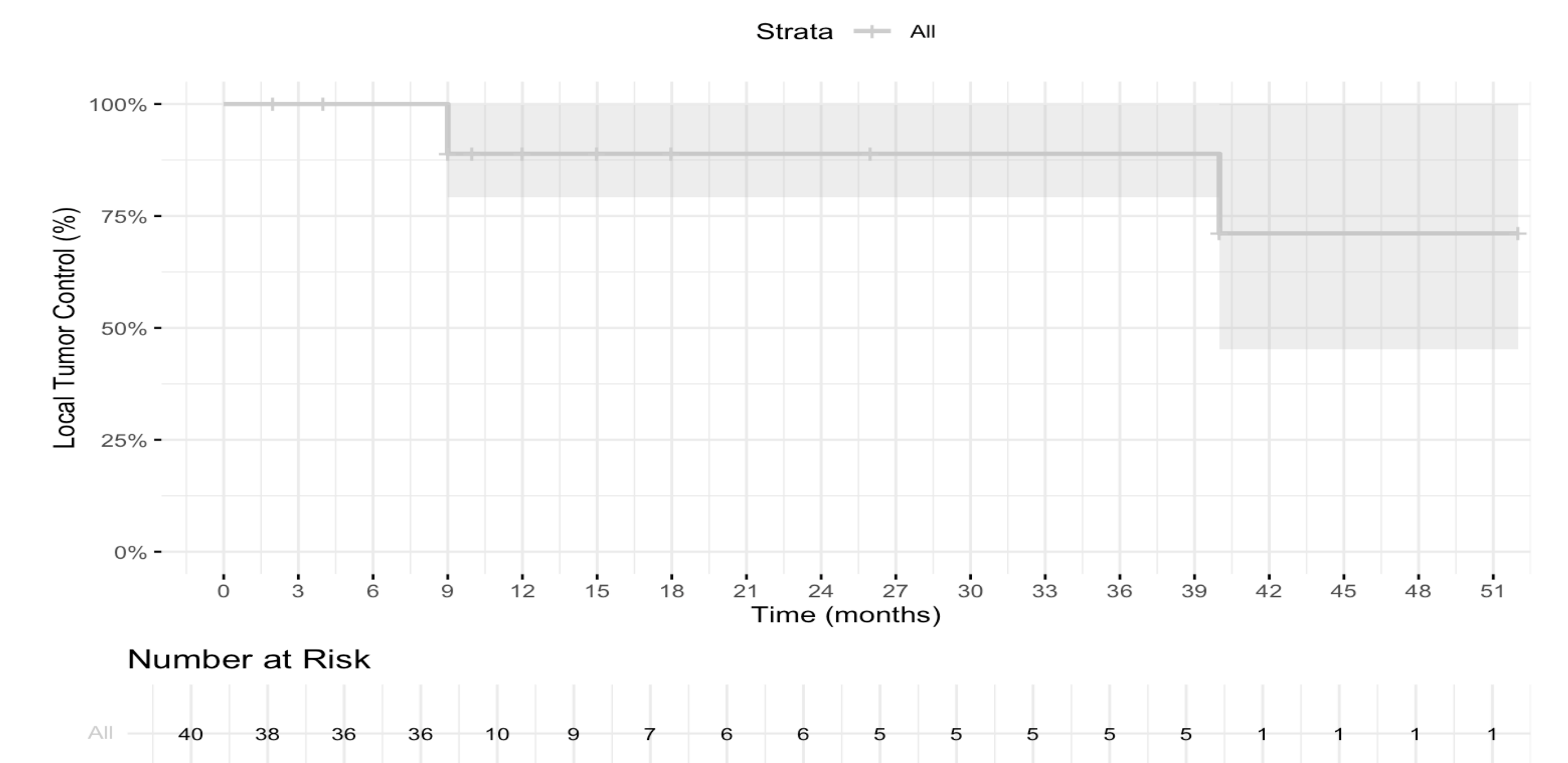


Table 2. Survival and Local Control Estimation

Outcome	
Mean overall survival (months) (95% confidence interval)	22.78 (1.45 to 47.01)
Local tumor control (%)	
At 3 months	100%
At 6 months	100%
At 12 months	88.89%

- Hong S, Garces YI, Price KA, Shinya Y, Parney IF, Link MJ. Treatment outcomes of single-fraction stereotactic radiosurgery for a denoid cystic carcinoma: a case series of 55 patients. *J Neurooncol.* 2024 Jan;166(2):369-376. doi: 10.1007/s11060-024-04561-1. Epub 2024 Jan 5. PMID: 38180687.
- Fowler JF. 21 years of biologically effective dose. *Br J Radiol.* 2010 Jul;83(991):554-68. doi: 10.1259/bjr/31372149. PMID: 20603408; PMCID: PMC3473681.
- Higuchi Y, Serizawa T, Nagano O, Matsuda S, Ono J, Sato M, et al. Three-Stage Stereotactic Radiotherapy Without Whole Brain Irradiation for Large Metastatic Brain Tumors. *Int J Radiat Oncol Biol Phys* (2009) 74(5):1543–8. doi: 10.1016/j.ijrobp.2008.10.035
- Chaturvedi J, Konar SK, Jethwani D, Metastatic Intracranial Adenoid Cystic Carcinoma with Unknown Primary: Case Report and Review of Literature. *J Neurosci Rural Pract.* 2017 Apr-Jun;8(2):274-276. doi: 10.4103/0976-3147.203810. PMID: 28479807; PMCID: PMC5402499.
- Inoue HK, Sato H, Seto K, Torikai K, Suzuki Y, Saitoh J, Noda SE, Nakano T. Five-fraction CyberKnife radiotherapy for large brain metastases in critical areas: impact on the surrounding brain volumes circumscribed with a single dose equivalent of 14 Gy (V14) to avoid radiation necrosis. *J Radiat Res.* 2014 Mar 1;55(2):334-42. doi: 10.1093/jrr/rrt127. Epub 2013 Nov 1. PMID: 24187332; PMCID: PMC3951086.
- Schwartz LH, Litière S, De Vries E, et al. RECIST 1.1—Update and clarification: From the RECIST committee. *Eur J Cancer.* 2016;62:132-137.