Stereotactic Radiosurgery (SRS) and Radiotherapy in Breast Cancer Brain Metastases: Subtype-Specific Analysis of the BMBC Registry

Raphael Bodensohn[1,2,3], Marcus Schmidt[4], Julia Rey[5], Marc Thill[6], Tanja Neunhöffer[7], Montserrat Pazos Escudero[2], Carsten Denkert[8], Rudolf Weide[9], Carlo Fremd[10], Maximilian Niyazi[1,2,3,11], Athina Kostara[12], Tobias Hesse[13], Kristina Lübbe[14], Rachel Wuerstlein[15], Thomas Decker[16], Isabell Witzel[17], Christoph Mundhenke[18], Volkmar Müller[19], Sibylle Loibl[5,20], Elena Laakmann[19]

[1] Department of Radiation Oncology, University Hospital Tübingen, Tübingen, Germany; [2]Department of Radiation Oncology, University Hospital LMU Munich, Munich, Germany; [3]Center for Neuro-Oncology, Comprehensive Cancer Center Tübingen-Stuttgart, University Hospital Tübingen, Tübingen, Germany; [4]University Medical Center of the Johannes Gutenberg University Mainz, Department of Gynecology, Mainz, Germany; [5]GBG Forschungs GmbH, Neu-Isenburg, Germany; [6]Agaplesion Markus Krankenhaus, Frankfurt, Germany; [7]HELIOS Dr. Horst Schmidt Kliniken Wiesbaden, Germany; [8]Marburg University and University Hospital Marburg (UKGM), Institute of Pathology, Marburg, Germany; [9]Institut für Versorgungsforschung in der Onkologie – Koblenz, Koblenz, Germany; [10]National Center for Tumor Diseases, University Hospital and German Cancer Research Center, Heidelberg, Germany; [11] German Cancer Consortium (DKTK), partner site Tübingen and German Cancer Research Center (DKFZ), Tübingen, Germany; [12]GynOnco Duesseldorf, MVZ Medical Center Duesseldorf, Duesseldorf, Germany; [13] Agaplesion Diakonieklinikum Rotenburg, Rotenburg, Germany; [14]Breast Center, DIAKOVERE Henriettenstift, Hannover, Germany; [15] Breast Center, Department of Gynecology and Obstetrics, CCC Munich LMU, LMU University Hospital, LMU Medizin, Ludwig-Maximilians-Universitaet Muenchen; [16]MVZ für Hämatologie und Onkologie Ravensburg GmbH, Ravensburg, Germany; [17] Department of Gynecology, University Hospital Zürich, Zürich, Switzerland; [18]Breast Unit, Center for Gynecological Cancer, Center for High Risk Obstetrics, Klinikum Bayreuth and Friedrich-Alexander-University Erlangen-Nuremberg/Medical Campus Upper Franconia, Germany Germany; [19]Department of Gynecology, University Medical Center Hamburg-Eppendorf, Hamburg, Germany; [20]Goethe University Frankfurt, Frankfurt, Germany

39 P

Background

- In patients with breast cancer brain metastases (BM), increasingly effective systemic therapies may alter the role of local treatments such as stereotactic radiosurgery (SRS) and fractionated stereotactic radiotherapy (fSRT).
- The study evaluated the association between SRS/fSRT and local control/survival across breast cancer subtypes.

Patients and Methods

- The Brain Metastases in Breast Cancer (BMBC) registry (GBG 79) was screened for patients without leptomeningeal disease at initial BM diagnosis. For this analysis, 3,629 patients (pts) were available (data cut 13.12.25). Pts were categorized into SRS (n=632) vs reference cohort (n=2,997):
  - SRS cohort: pts who received SRS after diagnosis of BM, and before first progression of BM, without a whole brain irradiation therapy (WBRT)
  - Reference cohort: patients who did not receive any SRS or together with WBRT until first progression of BM.
- Primary objective: to evaluate the influence of SRS/fSRT on treatment outcomes overall and in relation to biological breast cancer subtypes
- Time-to-event endpoints:
  - Overall survival (OS) was defined as the time interval from the first diagnosis of (BM) to death (from any cause)
  - Intracranial progression-free survival (iPFS) was defined as the time interval from the first diagnosis of BM to intracranial progression (new lesions or progression of existing lesions) or death.

Survival outcomes were analyzed using time-to-event methods.

Table 1: Baseline Characteristics

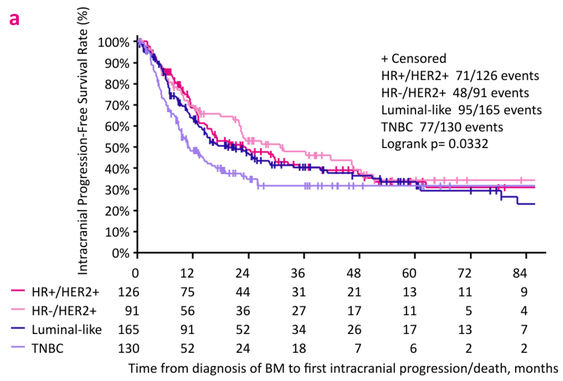
Parameter	Category	SRS cohort N=632	Reference cohort N=2,997
Age, years	Median (range)	51 (25-88)	53 (20-92)
ECOG	ECOG 0	109 (31.5)	207 (14.9)
	ECOG 1	164 (47.4)	790 (45.5)
	ECOG 2-4	73 (21.2)	558 (40.1)
Number of BM at first diagnosis	1	347 (55.8)	732 (25.8)
	2-3	184 (29.6)	710 (25.0)
	≥4	91 (14.6)	1499 (49.3)
Maximal diameter of BM, cm	Median (range)	2.0 (0.1-9.0)	2.0 (0.03-12)
Clinical symptoms of BM	no	163 (25.8)	687 (22.9)
	yes	469 (74.2)	2310 (77.1)
ECM at BM diagnosis*	no	184 (29.1)	529 (17.7)
	yes	448 (70.9)	2468 (82.3)

*extracranial metastases (ECM) at diagnosis of BM present or within 60 days after

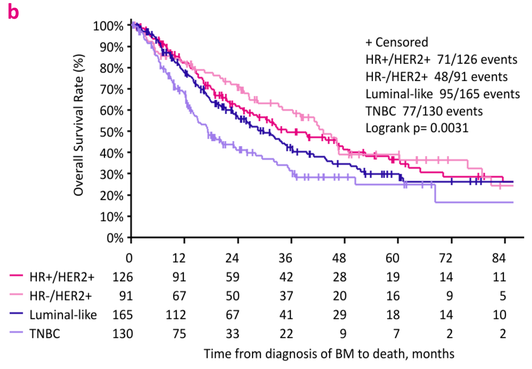
Results

Figure 1: Kaplan-Meier-Curves of iPFS and OS in the SRS cohort

a



b



- The analytic subcohort included 632 of overall 3629 pts treated with SRS (with surgery: n=297; without: n=335) and a reference cohort of 2,997 pts (WBRT alone: n=2082; WBRT+SRS: n=135; no radiotherapy: n=780) before first intracranial progression or death.
- The SRS cohort had (compared to reference cohort) more favorable baseline characteristics, including better performance status (ECOG 0 in 31.5% vs. 14.9%) and lower intra- and extracranial disease tumor burden (extracranial metastases [70.9% vs 82.3%] single metastases [55.8% vs 25.8%]), see **table 1**.

Figure 2: Kaplan-Meier curves of OS between different cohorts

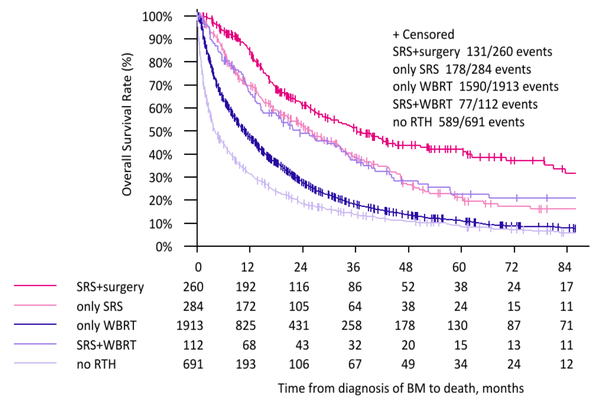
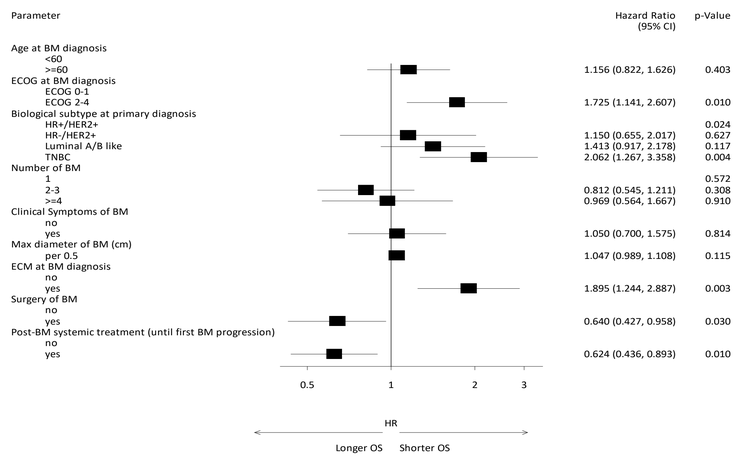


Table 2: Median (95% CI) survival in the subcohorts in months

	Median iPFS (95% CI)	Median OS (95% CI)
SRS cohort	**20.7 (15.6, 24.6)**	**31.1 (25.9, 35.2)**
previous surgery	29.3 (20.7, 50.7)	36.4 (28.5, 52.7)
without surgery	15.0 (12.3, 20.2)	25.9 (20.4, 32.3)
HR+/HER2+	22.9 (15.0, 34.9)	34.9 (25.1, 48.8)
HR-/HER2+	30.9 (21.9, 48.4)	43.2 (33.1, 60.3)
Luminal A/B like	19.5 (14.0, 28.7)	29.8 (22.9, 36.2)
TNBC	11.2 (8.9, 16.0)	17.2 (13.7, 25.9)
Reference cohort	**6.8 (6.2, 7.4)**	**9.4 (8.6, 10.2)**
HR+/HER2+	11.5 (10.1, 13.1)	17.4 (15.2, 20.5)
HR-/HER2+	8.4 (7.6, 10.2)	12.3 (10.5, 14.5)
Luminal A/B like	5.6 (4.8, 6.3)	7.6 (6.5, 8.8)
TNBC	4.1 (3.6, 4.7)	5.1 (4.4, 5.7)

- iPFS and OS were longest in the SRS cohort, particularly after surgery (SRS + surgery vs SRS – surgery vs reference, median iPFS: 29.3 vs 15.0 vs 6.8 months; median OS: 36.4 vs 25.9 vs 9.4 months). Detailed information across the subtypes in the SRS cohort are shown in **figure 1 a/b**, **figure 2** and **table 2.**
- Multivariable analysis identified ECOG 2–4, TNBC subtype, and ECM as independent predictors of shorter OS in the SRS cohort, whereas surgery and post-BM systemic treatment were associated with improved survival (**figure 3**).
- Across biological subtypes, SRS was associated with improved OS in comparison to the reference cohort, with hazard ratios of 0.57 [95%CI 0.44–0.73] (HR+HER2+), 0.43 [95%CI 0.32–0.58] (HR-HER2+), 0.37 [95%CI 0.30-0.47] (HR+HER2-), and 0.37 [95%CI 0.29–0.48] (TNBC). Similar results were observed for iPFS.
- Given the retrospective design and potential selection also as immortal time bias, these exploratory findings should be interpreted with caution; however, a numerically stronger association was observed in HER2- subtypes.

Figure 3: Forest Plot of the SRS cohort regarding OS



Conclusions

- Our data provide valuable insights into OS and iPFS according to local treatment modality and tumor subtype, supporting more informed and individualized patient counseling.
- These findings support a role for SRS in managing brain metastases from breast cancer, particularly in HER2-negative subtypes.
- The retrospective study design and potential selection bias should be taken into consideration when interpreting these results.

Presented at: ESMO Congress 2026

Financial support for the management of BMBC Registry was provided by an unrestricted research grant from Daiichi-Sankyo to GBG.

The presenting author reports honoraria and travel expenses by Brainlab, NovoCure, Aurikamed and Pierre Fabre (all outside of this project).

This presentation is the intellectual property of the author/presenter.
Contact them at publications@gbg.de for permission to reprint and/or distribute.