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Background: Whole Brain Radiotherapy (WBRT) has been the standard of care for multiple brain metastases, but due to its toxicity and lack of survival benefit, its use in the palliative setting has started to be questioned. New clinical algorithms regarding the correct use of WBRT are needed.

Methods: This was a retrospective, single institution cohort study, consisting of 280 patients with brain metastasized lung cancer who received WBRT at Karolinska University Hospital between 2010 and 2015. Information about RPA and GPA scores, demographics, histopathological results and received oncological therapy was collected. Predictors of Overall survival (OS) from the time of received WBRT were identified by Cox regression analyses. OS between GPA and RPA classes was compared by pairwise log rank test. A subgroup analysis was performed stratified by RPA class. Separate multivariate analyses were performed for RPA and GPA scoring systems, due to significant collinearity between them.

Results: Median OS was 324, 130 and 41 days for RPA class 1(n=13), 2(n=165) and 3(n=101), respectively. Median OS for GPA groups 0 (0-1 points, n=168), 1 (1.5-2.5 points, n=98) and 2 (3-4 points, n=13) was 55, 166 and 110 days, respectively. Age>70 years was associated with worse OS. OS differed significantly between RPA class 1 versus 3 and 2 versus 3, GPA groups 0 versus 1 and age ($p<0.0001$ for all comparisons). Multivariate analyses are shown in table 1.

A: Multivariate analysis including GPA	P value	HR (95% CI)
GPA class group		
- 0 (0-1)	Ref	
- 1 (1,5-2,5)	<0.0001	0.49 (0.37-0.63)
- 2 (3-4)	0.58	0.84 (0.45-1.56)
Surgery CNS before WBRT (Yes vs No)	0.008	0.51 (0.31-0.84)
Age (>70 vs ≤70)	0.006	1.44 (1.11-1.86)
Symptomatic CNS disease (Yes vs No)	0.009	1.88 (1.17-3.01)
B: Multivariate analysis including RPA	**P value**	**HR (95% CI)**
RPA class		
- 1	<0.0001	0.27 (0.15-0.49)
- 2	<0.0001	0.34 (0.26-0.45)
- 3	ref	
Surgery CNS before WBRT (Yes vs No)	0.026	0.58 (0.36-0.94)
Age (>70 vs ≤70)	0.01	1.41 (1.09-1.82)
C: RPA class 2 subgroup multivariate analysis	**P value**	**HR (95% CI)**
GPA class group		
- 0 (0-1)	Ref	
- 1 (1,5-2,5)	0.015	0.67 (0.48-0.92)
- 2 (3-4)	0.351	1.47 (0.65-3.31)
Surgery CNS before WBRT	0.005	0.40 (0.21-0.76)
Age>70	0.038	1.44 (1.02-2.02)

Table1. Multivariate Cox-regression analyses for OS. A: Including GPA as an independent variable, B: Including RPA as independent variable. C: Multivariate analysis within RPA class 2 subgroup.

Conclusion: WBRT should be omitted for RPA class 3 patients. RPA class 1 patients should receive WBRT if clinically indicated. For RPA class 2 subgroup, patients with age≤70 years and GPA≥1.5 points should be treated as RPA 1, whereas patients with age>70 and GPA<1.5 points as RPA 3. WBRT is not recommended in patients older than 70 years and GPA≥1.5 points, and should be considered in younger patients with GPA<1.5 points.

Keywords: RPA class, Brain metastasized Lung Cancer, Whole Brain Radiotherapy, GPA class

P2.05-034
New 3D «All in 1» Device for Fiducial Tumor Marking: A Pilot Animal Study

Topic: RT Techniques

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Background: Malignant lung lesions are commonly treated with stereotactic body radiotherapy e.g. Cyberknife®. However, a common problem of existing markers is migration which requires placement of several devices (usually 3). This study presents the results of a first animal evaluation of a new device that comprises several markers in a single implant device, which can be placed in a one-step bronchoscopic procedure.The purpose of the study was to demonstrate feasibility of a new « All in 1 » shape memory (Novatech®) Nitinol (Ni—Ti) device with Tantalum (Ta) markers, with safety and efficacy as key points, in a porcine model.

Methods: Devices: 55 devices with 3 different shapes were used to determine the best design to reduce the migration risk. Animals: 2 series with a total of 8 Piétrain pigs, 5 animals for safety and 3 animals for efficacy evaluation using flexible bronchoscopy under general anesthesia. Follow-up period: 4 weeks. Image based analysis: CT scans pre- and post-procedure, after 2 and 4 weeks. Procedure: The markers where launched in different peripheral sub-segments using a radial EBUS guide sheath (Olympus® K-201) under fluoroscopy control. Evaluation: Procedure time, ease of placement, blinded CT scan analyses for evaluation of migration, complications and histological analysis.

Results: All 55 devices were easily inserted into the peripheral bronchi. All devices could be visualized under fluoroscopy. The average procedure time was 5 min (+/- 2,6). 5 devices per animal were inserted in the first series and 10 devices per animal in the second series. During the 4 weeks clinical follow up and CT evaluation, no immediate or late complication occurred (pneumothorax, pneumonia, severe granulations or bleedings) in the first series. One partial (<20%) pneumothorax with spontaneous remission occurred in the second series due to forceful reintubation of the pig after accidental extubation. Migration has been seen in some pigs of the first series but not in the second series. No device related complications have been noted.

Conclusion: In this pilot animal study the new « all in 1 » device for fiducial tumor marking was easy, quick and safe to use. It could be demonstrated that migration risk can be reduced with the right design.

Keywords: radiation oncology, Fiducial, bronchoscopy, Image guidance

P2.05-035
Interim Analysis of the Phase II Trial Dose Risk Adapted FFF Using SBRT in Stage I NSCLC and Lung Metastases (NCT01823003)

Topic: RT Techniques

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Background: This study is a phase II, prospective, pilot feasibility study designed to evaluate the safety of SBRT in selected patients with stage I NSCLC or metastatic lung cancer lesions using an ablative dose-adapted scheme with Free Flattening Filters (FFF) beams. An interim analysis was planned after enrollment of the first 27 patients. We present our results of this interim analysis.

Methods: Medically inoperable patients or medically operable patients who refuse surgery with a life expectancy >12 months with lung lesions were candidates. All patients will be treated using FFF beams and the following schedule:

Topographical Criteria				
Dose	Distance to Chest Wall	Size	Distance to main Bronchus	Patients
A. 34Gy single fr.	>1cm	< 2cm	>2cm	5p (18.5%)
C. 50Gy (12 x 5 fr.s) Peripheral	<1cm	<5cm	>2cm	13p (48%)
D. 60Gy (7.5Gy x 8fr.)Central	>1cm	<5cm	<2cm	9p (33.3%)

Physical examination, toxicity and clinical response will been performed every three months for the first year and 6 months thereafter. Follow up will include Thoracic CT, pulmonary function, quality of life survey and blood test.

Results: After median of follow up of 33 months (r 10-45) we analyzed 27p, with median age of 74y (r 83-58), 21 males (78%). Main reasons for inoperability were: 7 (26%) poor respiratory function, 10 (37%) with multiple comorbidities and 6 (22%) who refused surgery. Location was RUL 9 (33%), RLL 6 (22%), LUL 7 (26%), LLL 4 (15%). Lung primaries in 19p (70%) and the main histologies were Squamous Carcinoma (7, 26%) and Adenocarcinoma (7, 26%). T1a (9, 33%), T1b (7, 26%), T2a (5, 18%) and T3 (2, 7%). Maximum grade of acute toxicity was GIII 1p(asthenia), and for chronic toxicity was GII (asthenia) 4p (15%). Local Control at 30 months was 84% (three local failures, two from metastasis) and overall survival was 100% at this time.

Conclusion: FFF beams using dose risk adapted schedule seem to be a safe approach with a good response profile. Further analysis with the entire cohort of the trial is needed in order to confirm these early results.

Keywords: SBRT, Lung, Trial

P2.05-036
Single Fraction of SBRT for Pulmonary Lesions

Topic: RT Techniques

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