

at an increased risk of osteonecrosis. Thus, we sought to investigate surgical specimens after sSBRT and primary SBRT (pSBRT) regarding histopathological changes.

#### Material and Methods

We retrospectively assessed 704 patients who were treated with sSBRT (69.6%) or pSBRT (30.4%) for spinal bone metastases at 7 international centers between 2006 and 2012. 30 patients underwent salvage surgery after SBRT. In 23 cases, the histopathological reports were available for review. Clinical and histopathological findings were statistically analyzed and compared between the two groups.

#### Results

Mean time to surgery after sSBRT/pSBRT was 8.3/10.3 months ( $p=.64$ ). Reasons for salvage surgery after SBRT included pain (sSBRT/pSBRT: 12.5%/71.4%,  $p=.25$ ), fractures (sSBRT/pSBRT: 37.5%/28.6%,  $p=.68$ ) and neurological symptoms (sSBRT/pSBRT: 68.8%/42.9%,  $p=.24$ ). Radiological tumor progression after sSBRT/pSBRT was seen in 71.4%/42.9% ( $p=.20$ ). Histopathological findings were similar in specimens from patients after sSBRT and pSBRT. Most specimens displayed viable/proliferative tumor (sSBRT/pSBRT: 62.5%/71.4%,  $p=.68$  and 56.3%/57.1%,  $p=.97$ ). Few specimens showed soft tissue necrosis (sSBRT/pSBRT: 20%/28.6%,  $p=.66$ ), osteonecrosis (sSBRT/pSBRT: 14.3%/16.7%,  $p=.89$ ) or bone marrow fibrosis (sSBRT/pSBRT: 42.9%/33.3%,  $p=.69$ ). Tumor bed necrosis was more common after sSBRT (81.3%/42.9%,  $p=.066$ ). Radiological tumor progression correlated with viable/proliferative tumor ( $p=.03$ / $p=.006$ ) and tumor bed necrosis ( $p=.03$ ). Fractures were increased with bone marrow fibrosis ( $p=.07$ ), but not with osteonecrosis ( $p=.53$ ) or soft tissue necrosis ( $p=.19$ ). Neurological symptoms were common in patients with radiological tumor progression ( $p=.07$ ), but not in those with fractures ( $p=.18$ ). In both, patients with tumor progression ( $p=.72$ ) and those with pathological fractures ( $p=.19$ ), the occurrence or progression of pain was independent of the radiological findings.

#### Conclusion

Histopathological changes were similar after sSBRT and pSBRT. Neurological symptoms were chiefly attributable to tumor progression. Pathological fractures were neither associated with osteonecrosis nor tumor progression. Evidence of viable tumor in most specimens calls for an aggressive treatment with sSBRT and pSBRT.

#### PO-0846 Stereotactic ablative radiotherapy for spinal metastasis with epidural spinal cord compression

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#### Purpose or Objective

To investigate the effectiveness and safety of spinal stereotactic ablative radiotherapy (SABR) in spinal metastasis with epidural spinal cord compression (ESCC).

#### Material and Methods

From 2013 to 2016, 149 spine metastases of 105 patients who were treated with single-fraction (12-24 Gy) spinal SABR were reviewed. ESCC status was stratified according to the Bilsky grade (0, bone-only; 1, epidural impingement; 2, cord compression with visible cerebrospinal fluid (CSF); and 3, no CSF visible around the cord). Local progression (LP) and vertebral compression fracture (VCF) rates after SABR were evaluated by using cumulative incidence function in competing risks data and univariate and multivariate competing-risk regression analyses.

#### Results

Median follow-up was 8.8 months (0.5-56.6 months). One-year cumulative incidence of LP in the Bilsky grade 0 ( $n=80$ ), 1 ( $n=21$ ), 2 ( $n=9$ ) and 3 ( $n=9$ ) groups were 3.0%, 8.4%, 0%, and 24.9%. On multivariate competing-risk regression analysis, ESCC (the Bilsky grade 2 and 3) did not increase LP rate (No LP in the grade 2 group; subdistribution hazard ratio [SHR] of the grade 3 compared to the grade 0, 4.301, 95% confidence interval [CI], 0.386-47.956,  $p=0.236$ ), while small tumor extent ( $p<0.001$ ), breast origin ( $p<0.001$ ), blastic lesion ( $p<0.001$ ), and radiation dose  $>20$  Gy ( $p<0.001$ ) were favorable prognostic factors for LP. One-year cumulative incidence of VCF in the Bilsky grade 0, 1, 2, and 3 groups were 7.5%, 5.9%, 19.1%, and 13.6%, respectively. Multivariate competing-risk regression analysis for VCF demonstrated that ESCC may increase the risk of VCF (HR of the Bilsky grade 2 compared to the grade 0, 5.368, 95% CI 1.129-25.530,  $p=0.035$ ; HR of the grade 3, 2.215, 95% CI 0.269-18.248,  $p=0.460$ ). Complete or partial pain response rates after SABR were 79%, 78%, 53%, and 63% in the Bilsky grade 0, 1, 2, and 3, respectively ( $p=0.008$ ). No grade  $\geq 3$  side effect was observed.

Figure 1. Cumulative incidence of local progression (LP) in spinal metastasis after stereotactic ablative radiotherapy (SABR) according to epidural spinal cord compression (ESCC, the Bilsky grade) using univariate regression model in the presence of competing risks.

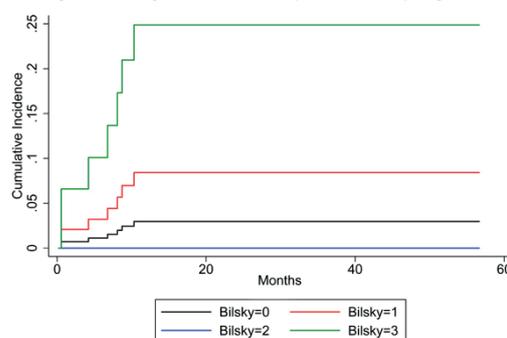
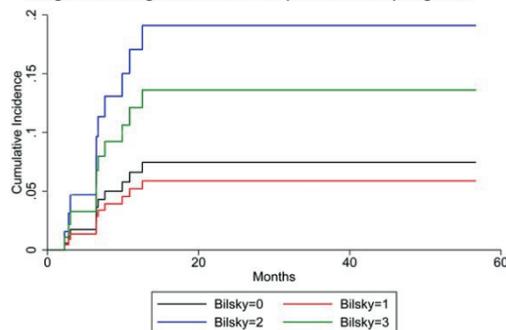


Figure 2. Cumulative incidence of vertebral compression fracture (VCF) in spinal metastasis after stereotactic ablative radiotherapy (SABR) according to epidural spinal cord compression (ESCC, the Bilsky grade) using univariate regression model in the presence of competing risks.



#### Conclusion

Spinal SABR for the patients with ESCC did not increase LP rate and grade 3 or more neurotoxicity probability with moderate VCF and pain response rates. Spinal SABR may serve as an effective and safe treatment option for the patients with ESCC.

#### PO-0847 Pain response and quality of life with survival post palliative radiotherapy for bone metastases

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### Purpose or Objective

Palliative radiotherapy for bone metastases is offered in patients with a life expectancy of at least 4 weeks and provides improved pain control in 60%. Short time to pain response (median 2-3 weeks) and improved health-related quality of life (HRQoL) in responders has increased radiotherapy use in those with expected short survival. In general, HRQoL deteriorates towards death. It is not clear, if in this period, the association between pain response and HRQoL is maintained. This study investigated the relationships between survival, pain response and QoL outcomes.

### Material and Methods

Weekly questionnaires collected from the Dutch Bone Metastasis Study cohort (1996-1998) in the first 12 weeks following radiotherapy were used to assess pain response (using International consensus guidelines), and HRQoL in relation to survival. In this trial, in 1157 patients, 8 Gray was equivalent in terms of pain response to 24 Gray in 6 fractions. A random-effects linear regression model was used to assess the relationship between each reported pain response and change in HRQoL (using the EQ-5D visual analogue scale). To investigate the relationship between pain reduction and probability of change from baseline in EQ-5D domain responses with varying survival, we used an ordered logistic regression model. All models included all available weekly responses, clustered within patients and adjusted for baseline and time varying co-variables. The models were used to predict outcomes in relation to survival.

### Results

Pain response was less likely in those with shorter survival: 17%, 45%, 54% and 74% of patients surviving <4 weeks, 4-8 weeks, 8-12 weeks and >12 weeks respectively reported response ( $p < 0.001$ ). Improvement in EQ-VAS was associated with age >65 ( $p = 0.02$ ), pain response ( $p < 0.001$ ) and increasing survival ( $p < 0.001$ ) (Fig 1), whilst pain progression ( $p < 0.001$ ), re-treatment ( $p < 0.001$ ), higher baseline EQ-VAS ( $p < 0.001$ ) and presence of other bony metastases ( $p = 0.005$ ) were associated with less improvement in EQ-VAS. Treatment site, baseline performance status and visceral/brain metastases had no significant association with change in EQ-VAS. The probability of improvement in all EQ-5D domains decreased with reducing survival time ( $p < 0.001$ ). This was most marked in mobility, self-care and activity domains where those with pain response had a higher predicted probability of deterioration than improvement if survival was less than 12 weeks (Fig 2).

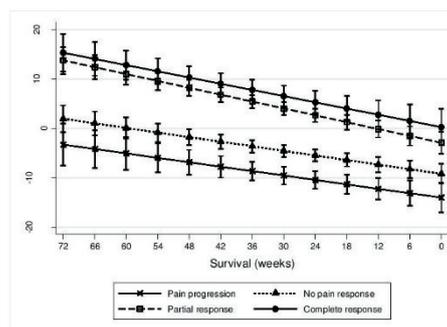


Figure 1. Predicted change in EQ-VAS with response to treatment in weekly questionnaires during the first 12 weeks following palliative radiotherapy to bone metastases with varying survival post treatment.

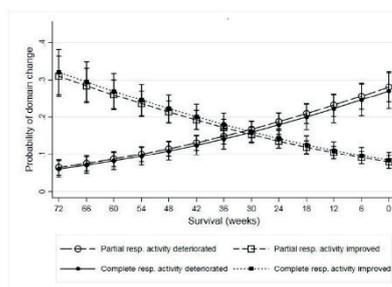


Figure 2. Predicted probability of change in EQ-5D activity domain in weekly questionnaires (predicted stable responses not shown) within the first 12 weeks following palliative radiotherapy for bone metastases with partial and complete pain response at varying survival post treatment.

### Conclusion

Pain reduction in the first 12 weeks following palliative radiotherapy for bone metastases was less likely for patients with limited survival. Additionally, pain response was associated with significantly lower improvements in global HRQoL and lower probability of improvement in other domains of HRQoL as measured by the EQ5D in these patients. Both clinicians and patients should be aware of these findings when considering radiotherapy for painful bone metastases near the end of life to ensure that expectations of treatment benefits are realistic.

### PO-0848 Dose escalation and hypofractionation for SBRT of lymph node oligometastases on the 1.5T MRI-Linac

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### Purpose or Objective

SBRT of lymph node oligometastases on the 1.5T MRI-Linac may allow for the use of smaller PTV margins and can incorporate daily patient anatomy. This opens up opportunities for dose escalation and hypofractionation towards a higher biologically equivalent dose (BED) associated with improved local tumour control. The aim of this study is to investigate the feasibility of dose escalated and hypofractionated fractionation schemes for treatment on the 1.5T MRI-Linac.

### Material and Methods

Patient imaging data and delineations from five patients with advanced cervical cancer with a combined total of 17 lymph nodes in the pelvic and para-aortic region were used for simulating treatment of lymph node oligometastases using SBRT. Three treatment plans were created for each lymph node with a prescribed dose of 5x7Gy, 3x12Gy and 1x24Gy using a 3mm isotropic PTV margin. Additionally a 1x24Gy plan was created using a