Background:
Brain contusion is a common lesion type in patients with traumatic brain injury (TBI). We aimed to use lesion mapping to investigate frequency and distribution of contusions on early MRI in moderate and severe TBI combined and separately, and in different outcome groups.

Methods:
A total of 301 patients (age 8-70 years) admitted to St. Olav's University Hospital or Oslo University Hospital with moderate (n=123) or severe TBI (n=178) and with contusion(s) on early MRI performed within 6 weeks after injury (moderate TBI; median 6 days, severe TBI; median 10 days) were included. Outcome was assessed with the Glasgow Outcome Scale-Extended (GOSE) at 12 months. 3D Slicer was used for manually volumetric segmentations of contusions on fluid attenuated inversion recovery (FLAIR) MRI sequences. The segmentations were combined into lesion frequency distribution maps for the combined group, for moderate and severe TBI separately and for three outcome groups. Voxel-based lesion-symptom mapping (VLSM) was used to examine the relationship between lesion distribution and outcome.

Results:
Predilection sites for contusions were the frontal and temporal lobes in all lesion frequency distribution maps. Similar frequency distribution patterns of contusions were found in moderate and severe TBI, and there was no significant difference in total lesion volume between the two groups (median moderate TBI: 15.8 cm3, median severe TBI: 13.6 cm3, p=0.303). The contusions covered larger areas of the brain in the patients with poor outcome (GOSE score 1-4) compared to the other outcome groups (GOSE scores 5-6 and 7-8). Within the patients with favorable outcome, contusions were more frequent in those with GOSE 5-6 compared to those with GOSE 7-8. VLSM did not reveal any significant association between lesion distribution and GOSE score.

Conclusion:
By making lesion frequency distribution maps, we made a visual presentation of the distribution of brain contusions in a large cohort of patients with moderate and severe TBI. We found similar contusion distribution and equal contusion volumes in moderate and severe TBI. We found no association between contusion distribution and 12-month outcome in voxel-based analyses.