Impaired cerebral cortex development in human fetuses with posterior brain abnormalities and diagnosed open neural tube defects at 11-13 weeks

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Objective
To evaluate fetal cerebral cortex development at 11-15 weeks of gestation in human fetuses with posterior brain abnormalities (BS-BSOB-ratio >95th centile, CM <5th centile) and confirmed diagnosis of neural tube defects such as open spina bifida during their 11-13–week scan, and to compare it with normal development (Fietz et al. 2010, Lachmann et al. 2011, Scheier et al. 2011).

Methods
Pregnant women were referred to our first trimester clinic for measurement of nuchal translucency and combined risk assessment for pre-eclampsia, premature birth, fetal growth restriction, chromosomal abnormalities and showing posterior brain abnormalities with diagnosis of open neural tube defects. After deciding for termination of pregnancy, the women were invited to take part in our study to evaluate if brain development in fetuses with such congenital abnormalities is already impaired at 11-15 weeks of gestation. Neural stem and progenitor cell subpopulations in the fetal human neocortex were analyzed by immunofluorescence for established molecular makers (Fietz et al. 2010). Four fetuses with open neural tube defects were examined and compared with normal fetuses at similar gestational age.

Results
Cerebral cortex development in fetuses with posterior brain abnormalities was found to be impaired already at a gestational age of 11 weeks. Specifically, we found a reduction in the abundance of a distinct neural progenitor subpopulation in the subventricular zone of a fetus with posterior brain abnormalities when compared to control of similar gestational age. This suggests a differential sensitivity of the various neural progenitor subpopulations to the changes induced by posterior brain abnormalities related to open neural tube defects.

Conclusion