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Introduction
General Introduction

Each year around 180,000 infants are born according to the Perinatal Registry in the Netherlands. Eight percent of them are born prematurely (gestational age <37 weeks) and around 2% are born very prematurely (gestational age <32 weeks) (Stichting PRN, 2011).

Despite improvements in neonatal care, very preterm infants who survive the neonatal period are still at risk of neurodevelopmental disabilities as a result of injury to the brain. Neurodevelopmental delay is seen twice as often in infants born between 30 – 33 weeks as compared to term born infants and spasticity can even be seen seven times as often.¹

Therefore neurodevelopmental delay is an important problem not only for the surviving infants themselves, but also for their parents or caretakers and for health care and society in general. Hence there is an urgent need for clinicians to provide parents and caretakers with predictive information on the neurological development of their preterm born infant and brain imaging has become standard care of very preterm infants.

Cognitive and motor impairment are associated with peri- and intraventricular hemorrhage (P/IVH) and white matter injury.²,³ Over the last years there has been a gradual change from cystic periventricular white matter injury, readily depicted by cranial ultrasound, to a more diffuse form of white matter injury.⁴,⁵,⁶ Apart from P/IVH and cystic periventricular leucomalacia, diffuse white matter injury is thought to be the main determinant for a poorer outcome in these very preterm infants.³ Cranial ultrasound is an easily accessible and reliable tool to detect P/IVH and cystic periventricular leucomalacia.⁷ MRI potentially detects more subtle white matter damage, but is less accessible, due to the necessity to transport the infant to the radiology department. The use of MRI compatible incubators has largely overcome this problem.

Cranial ultrasound seems to underestimate diffuse white matter injury and as 25 – 50% of very preterm infants with diffuse white matter injury develop cognitive problems,³ this may prompt the use of MRI. Advanced MRI techniques such as diffusion tensor imaging (DTI) allow assessment of brain microstructure and quantification of brain growth and development and potentially detect brain injury; however it is still uncertain if MRI should be used on a routine basis in a clinical setting.
AIM AND OUTLINE OF THE THESIS

The aim of the thesis is to investigate the diagnostic value of MRI performed around term equivalent age in evaluating brain injury and predicting neurodevelopmental outcome at two years corrected age in very preterm infants (gestational age <32 weeks).

Chapter 2 is a review on the radiological assessment of white matter injury in very preterm infants.

In chapter 3 we investigate the association between DTI values of white matter tracts and age, white matter injury and clinical factors.

In chapter 4 we assess whether DTI tractography performed around term equivalent age can independently predict neurodevelopmental outcome of very preterm infants at two years.

In chapter 5 we examine the reliability of a classification system for white matter injury on sequential cranial ultrasound performed in the perinatal period to detect diffuse white matter injury, using MRI performed around term equivalent age as reference standard.

In chapter 6 we evaluate the practical implications of ultrasound detection of white matter injury in very preterm neonates. The predictive values of ultrasound abnormalities for white matter injury on MRI and for neurological outcome are assessed and recommendations are proposed for neuro-imaging in very preterm infants.

In chapter 7 we evaluate the clinical implications of MR imaging findings in the white matter in very preterm infants in relation to clinical follow up at two years.

In chapter 8 we investigate the incidence and findings of cerebellar injury in very preterm infants on cranial ultrasound and MRI.

In chapter 9 we study the clinical value of gradient echo MRI for brain imaging in very preterm infants.

In chapter 10 the diagnostic value of MR brain imaging in very preterm infants at term equivalent age is summarized and discussed. Concluding remarks are made and future perspectives discussed.
REFERENCES


