MEDIZINISCHE UNIVERSITÄT INNSBRUCK

Magnetresonanztomographie beim Frühgeborenen

Möglichkeiten und Perspektiven

Pädiatrische Traunseeklausur 2024
Neonatologie und Notfallmedizin

Dr. Marlene Hammerl, PhD
Department für Kinder- und Jugendheilkunde
Pädiatrie II, Neonatologie
Medizinische Universität Innsbruck

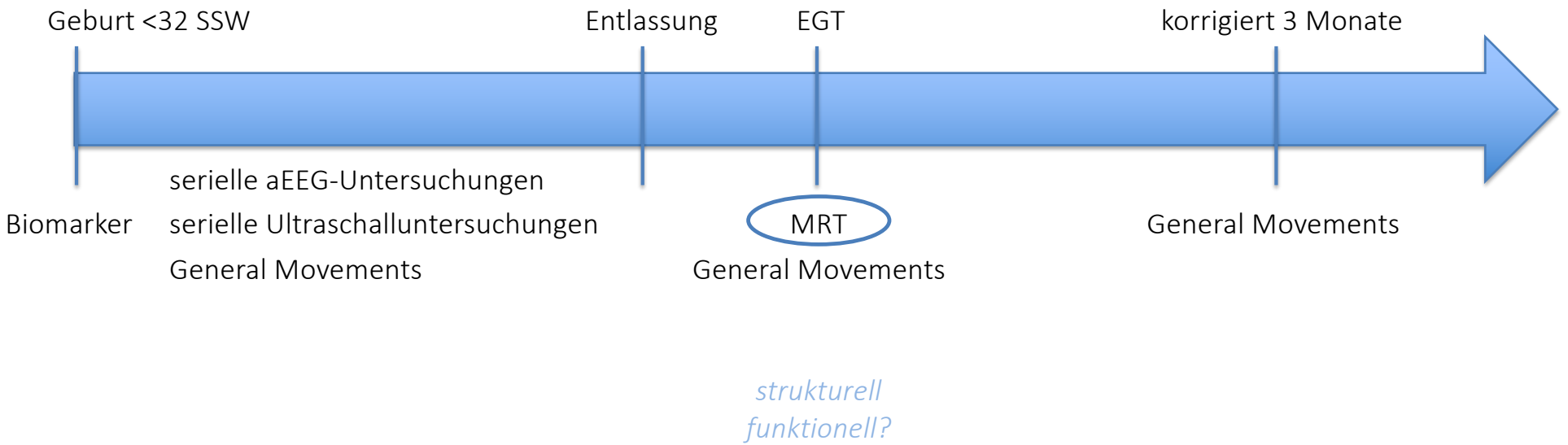
Inhalt

MEDIZINISCHE UNIVERSITÄT INNSBRUCK

- Einleitung
- aktuelle Möglichkeiten: Routine-Sequenzen – und was sagen sie uns?
- Perspektiven

Prognostische Tools

MEDIZINISCHE UNIVERSITÄT INNSBRUCK



Magnetresonanztomographie

MEDIZINISCHE UNIVERSITÄT INNSBRUCK

- höhere Auflösung – auch in Bereichen, die für US nicht gut zugänglich sind
- genauere Detektion von Gehirnschädigung & Abbildung der Reife
- verschiedene Sequenzen je nach Fragestellung
- teuer & zeitaufwändig
- Durchführung beim kritisch-kranken Patienten schwierig
- Sedierung (?)

Wie alles begann…

MEDIZINISCHE UNIVERSITÄT INNSBRUCK

Acta Pædiatrica ISSN 0803–5253

REGULAR ARTICLE

Feasibility of cerebral MRI in non-sedated preterm-born infants at term-equivalent age: report of a single centre

V Neubauer (vera.neubauer@i-med.ac.at)[1,*], E Griesmaier[1,*], K Baumgartner[1,2], A Mallouhi[3,4], M Keller[1,2], U Kiechl-Kohlendorfer[1]

1.Department of Paediatrics IV, Division of Neonatology, Neuropaediatrics and Metabolic Disorders, Innsbruck Medical University, Innsbruck, Austria
2.Department of Paediatrics I, Essen University Hospital, Essen, Germany
3.Department of Radiology II, Innsbruck Medical University, Innsbruck, Austria
4.Department of Radiology, Division of Neuroradiology and Musculoskeletal Radiology, Vienna Medical University, Vienna, Austria

Keywords
Brain, MRI, Preterm, Sedation, Term-equivalent age

Correspondence
V Neubauer M.D., Department of Paediatrics IV, Division of Neonatology, Neuropaediatrics and Metabolic Disorders, Innsbruck Medical University, 6020 Innsbruck, Austria.
Tel: +43-(0)512-504-82337 |
Fax: +43-(0)512-504-27308 |
Email: vera.neubauer@i-med.ac.at

Received
5 April 2011; revised 30 May 2011; accepted 17 June 2011.

DOI:10.1111/j.1651-2227.2011.02388.x

*These authors equally contributed to this work.

ABSTRACT

Aim: MRI is gaining in importance as an imaging tool for brain development and injury in preterm infants. The aim of this study was to evaluate the feasibility of performing MRI in non-sedated preterm-born infants at term-equivalent age (TEA).

Methods: A total of 89 infants born before 32 gestational weeks were recruited. Infants were scanned without sedation. Duration of the entire examination including scan repetition and interruptions was registered.

Results: Of the 89 infants, 56 (63%) underwent MRI at TEA. Out-patients required a significantly shorter total MR examination time than did in-patients (32 ± 12 vs. 54 ± 10 min, $p < 0.01$). Of the 56 infants, 39 (69.6%) were examined without interruption. Only four (7.2%) of the 56 scans were unusable because of motion artefacts. Mean duration of all scans was 36 ± 14 min. In cases with no interruptions, sessions were completed within 32 ± 12 min; MR sessions with interruption lasted 45 ± 13 min.

Conclusion: A well-trained team is indispensable in obtaining best-quality images as a prerequisite for good counselling. From our experience, we worked out a guideline to ensure that scans in stable non-sedated preterm-born infants at TEA run smoothly and provide high-quality images.

Einleitung

Ablauf

MEDIZINISCHE UNIVERSITÄT INNSBRUCK

- Routine-Untersuchung für alle Frühgeborenen <32 Schwangerschaftswochen
- am errechneten Geburtstermin
- meist nach Entlassung – i.R.d. Kontrolle an der Nachsorgeambulanz
- Zeit zum Füttern eingeplant
- ärztliche Begleitung – Sicherstellung Bildqualität, Überwachung

Ablauf

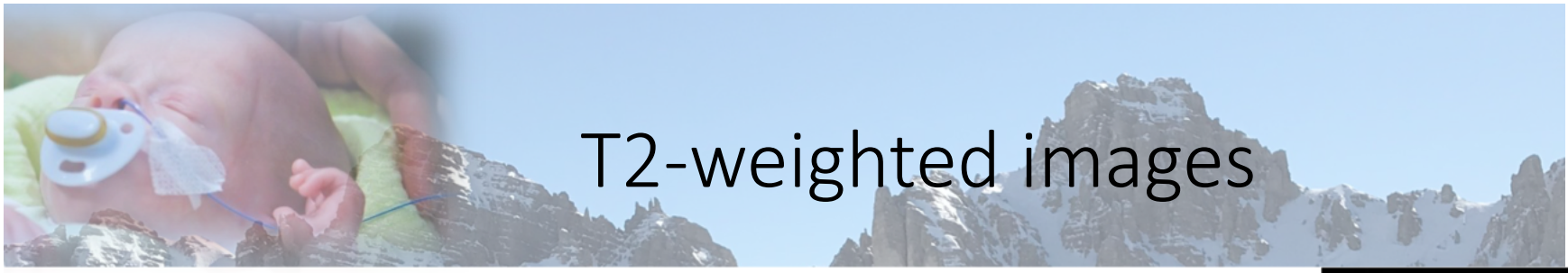
MEDIZINISCHE UNIVERSITÄT INNSBRUCK

- Feed and Wrap – postprandialer Schlaf
- Vakuummatratze *(VacFix®, Par Scientific A/S, Odense S, Denmark)*
- Überwachung mittels Pulsoxymetrie
- 3-Tesla-MRT – 60 Minuten Timeslot eingebucht
- Kontrolle Bild-qualität nach jeder Sequenz – ggf. WH

Sequenzen im Routine-MRT

MEDIZINISCHE UNIVERSITÄT INNSBRUCK

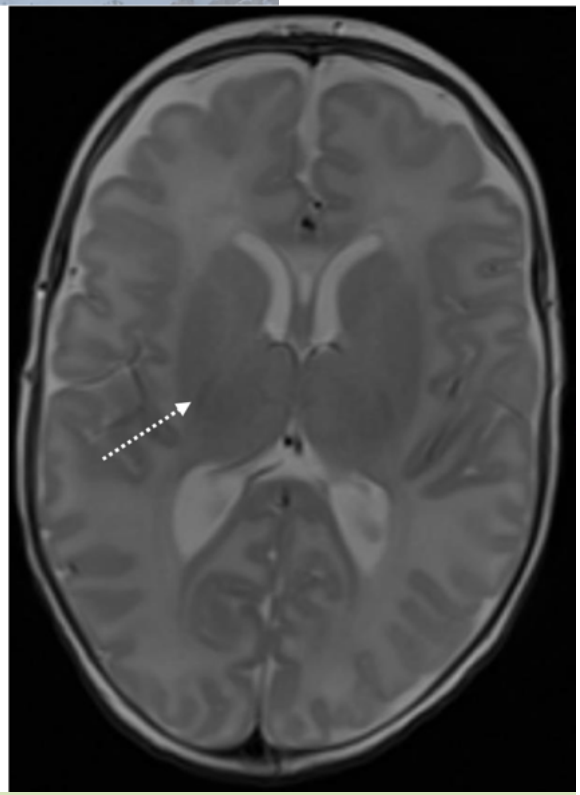
- T2-weighted images
- T1-MPRage
- Susceptibility weighted images
- Diffusion Tensor Imaging



T2-weighted images

MEDIZINISCHE UNIVERSITÄT INNSBRUCK

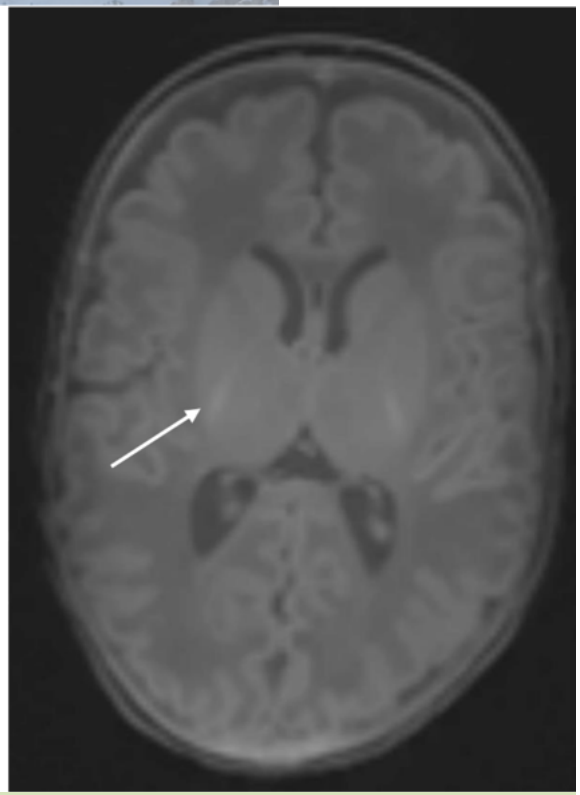
- Kontrast durch Zeit in der MR-Signal abnimmt
- Liquor hell, Hirnparenchym ebenfalls hell (erhöhter Wasseranteil, geringe Myelinisierung)
- PLIC wird mit zunehmender Reifung dunkler



T1-MPRage

MEDIZINISCHE UNIVERSITÄT INNSBRUCK

- Kontrast durch Zeit in der sich die Spins erholen
- Liquor dunkel, Fett hell
- PLIC wird mit zunehmender Reifung heller



T2WI & T1-MPRage

MEDIZINISCHE UNIVERSITÄT INNSBRUCK

Neonatology

Neonatology 2015;107:179–184
DOI: 10.1159/000369199

Received: August 18, 2014
Accepted after revision: October 16, 2014
Published online: January 24, 2015

Bronchopulmonary Dysplasia Is Associated with Delayed Structural Brain Maturation in Preterm Infants

Vera Neubauer[a] Daniel Junker[b] Elke Griesmaier[a] Michael Schocke[b]
Ursula Kiechl-Kohlendorfer[a]

[a]Neonatology, Department of Paediatrics II, and [b]Department of Radiology, Innsbruck Medical University, Innsbruck, Austria

Myelinisierung
Kortikale Faltung
Germinale Matrix
Zellmigration

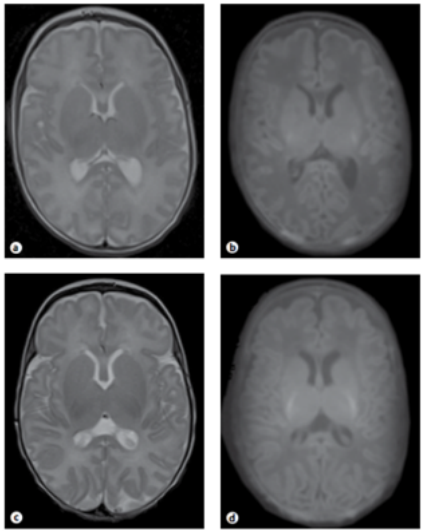


Fig. 2. Representative T2-weighted (**a**, **c**) and T1-weighted (**b**, **d**) MRI at TEA. **a**, **b** Infant 1, GA at birth 30 0/7 weeks, scanned at 40 3/7 weeks. TMS: 11.5 (myelination: 2.5, cortical folding: 3, germinal matrix: 3, bands of migrating cells: 3). **c**, **d** Infant 2, GA at birth 30 1/7 weeks, scanned at 40 4/7 weeks. TMS: 17.0 (myelination: 5, cortical folding: 4, germinal matrix: 4, bands of migrating cells: 4).

Abstract

Background: In recent years, cerebral magnetic resonance imaging (MRI) has been increasingly used to depict the wide spectrum of preterm brain injury. Furthermore, it has already been demonstrated by MRI at term-equivalent age (TEA) that preterm infants show delayed brain maturation as compared to term infants, and this delay has been related to neurobehavioral outcome. ***Objectives:*** The aim of the current study was to investigate the influence of prevalent neonatal risk factors for adverse outcome on structural brain maturation in very preterm infants at TEA. ***Methods:*** One hundred and thirty very preterm infants born at a mean gestational age of 29.7 weeks were included. MRI was performed at TEA and given a validated 'total maturation score'. Brain maturation scores were compared with neonatal data. ***Results:*** In univariate analysis, bronchopulmonary dysplasia (BPD), late-onset sepsis and retinopathy of prematurity were significantly associated with delayed brain maturation. Furthermore, infants with delayed maturation had been ventilated significantly longer and more often suffered from severe arterial hypotension. In multivariate analysis, BPD remained significant as predictor of delayed brain maturation. ***Conclusions:*** This study is the first to show that delayed structural brain maturation as evaluated by MRI at TEA is preceded by BPD, which is known to be a predictor of adverse outcome in preterm infants. This finding adds further evidence to show that adverse outcome in preterm infants may have additional neural correlates that exceed common brain injury.

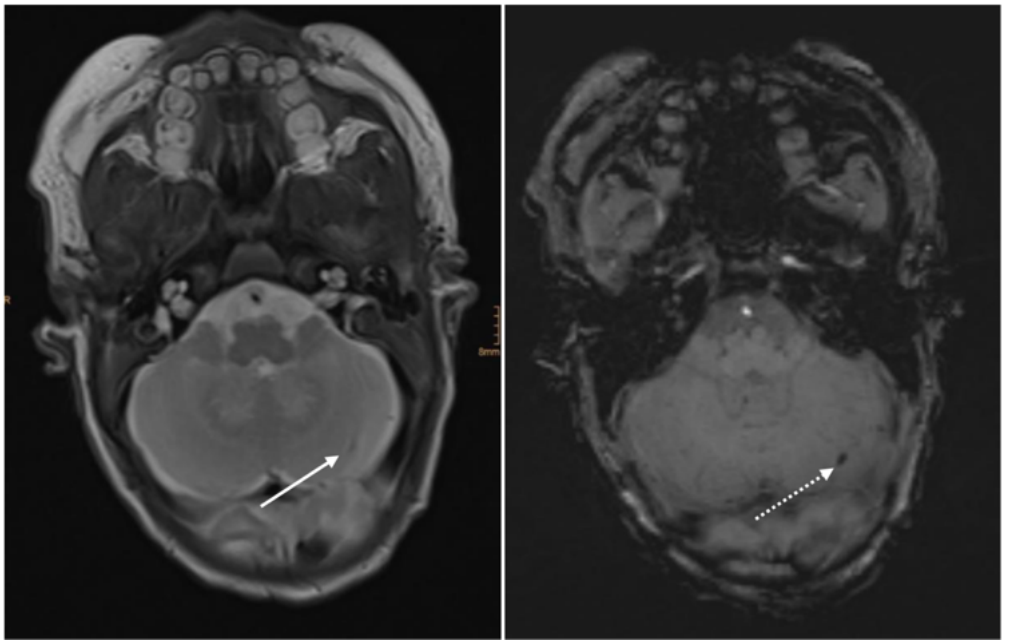
© 2015 S. Karger AG, Basel

Sequenzen – und was sagen sie uns?

Susceptibility-weighted images

MEDIZINISCHE UNIVERSITÄT INNSBRUCK

- empfindlich gegenüber Stoffen, die Magnetfeld verzerren (Signalverlust)
- Erkennen von Hämosiderinablagerungen



T1-MPRage & SWI

MEDIZINISCHE UNIVERSITÄT INNSBRUCK

RESEARCH ARTICLE

Routine Magnetic Resonance Imaging at Term-Equivalent Age Detects Brain Injury in 25% of a Contemporary Cohort of Very Preterm Infants

Vera Neubauer[1]*, Tanja Djurdjevic[2], Elke Griesmaier[1], Marlene Biermayr[1], Elke Ruth Gizewski[2,3], Ursula Kiechl-Kohlendorfer[1]

1 Department of Paediatrics II, Neonatology, Medical University of Innsbruck, Innsbruck, Austria, **2** Department of Neuroradiology, Medical University of Innsbruck, Innsbruck, Austria, **3** Neuroimaging Core Facility, Medical University of Innsbruck, Innsbruck, Austria

Introduction

In recent years, significant investigation has been undertaken by means of magnetic resonance imaging (MRI) in an attempt to identify preterm infants at risk for adverse outcome. The primary objective is to provide a comprehensive characterization of cerebral injury detected by conventional MRI at term-equivalent age in an unselected, consecutive, contemporary cohort of preterm infants born <32 gestational weeks. Secondly, this study aims to identify risk factors for the different injury types in this population.

Methods

Data for all preterm infants born <32 gestational weeks and admitted to Innsbruck Medical University Hospital were prospectively collected (October 2010 to December 2015). Cerebral MRI was evaluated retrospectively using a validated scoring system that incorporates intraventricular haemorrhage (IVH), white matter disease (WMD) and cerebellar haemorrhage (CBH).

PLOS ONE

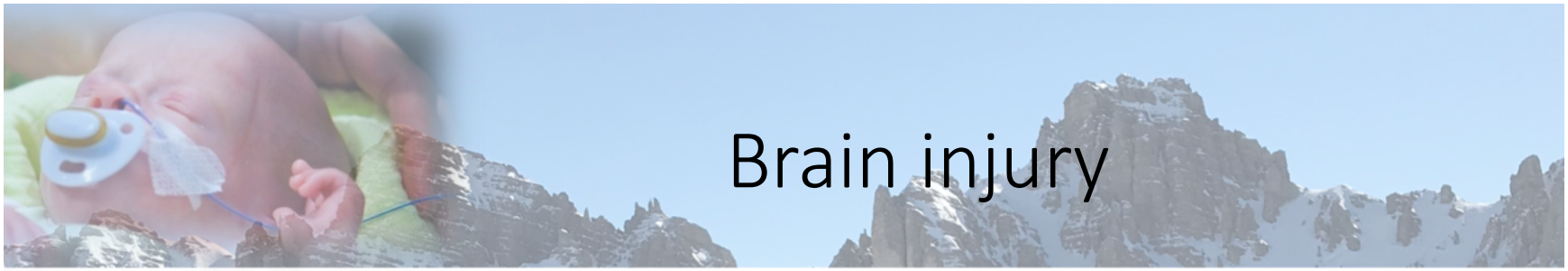
Results

300 infants were included in the study. MRI showed 24.7% of all infants to have some form of brain injury. The most common injury type was IVH (16.0%). WMD and CBH were seen in 10.0% and 8.0%. The prevalence of common neonatal risk factors was greater within the group of infants with CBH. In particular indicators for respiratory disease were observed more often: longer ventilation duration, more frequent need for supplemental oxygen at day 28, higher rates of hydrocortisone treatment. Catecholamine treatment was the only neonatal risk factor that was overrepresented in infants with WMD

Discussion

Cerebral MRI at term-equivalent age, as addition to cranial ultrasound, detected brain injury in 25% of preterm survivors. The diagnosis of IVH was already made by neonatal ultrasound in most cases. In contrast, only a minority of the CBH and none of the non-cystic WMD have been detected prior to MRI. Decreasing gestational age and neonatal complications involved with immaturity have been identified as risk factors for CBH, whereas WMD was found in relatively mature infants with circulatory disturbances.

Sequenzen – und was sagen sie uns?



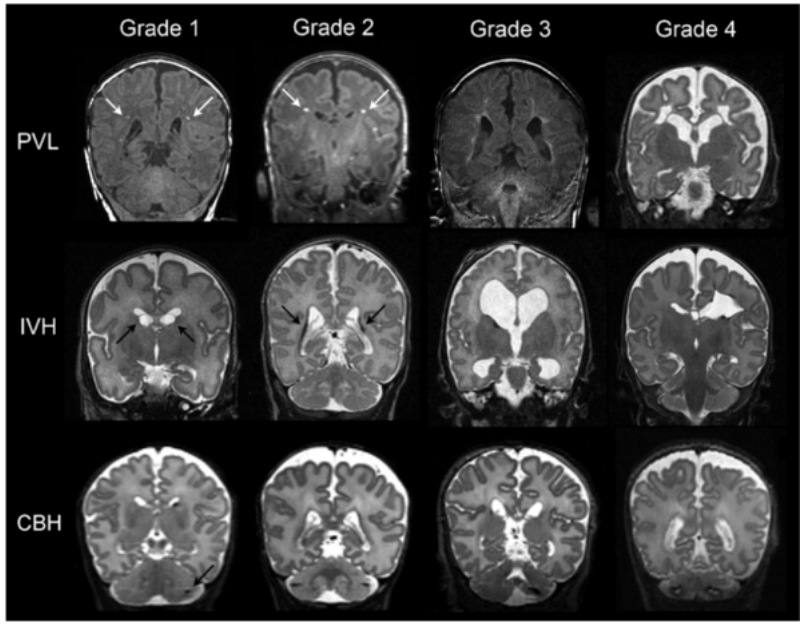
Brain injury

MEDIZINISCHE UNIVERSITÄT INNSBRUCK

Schädigung der weißen Substanz/White matter disease

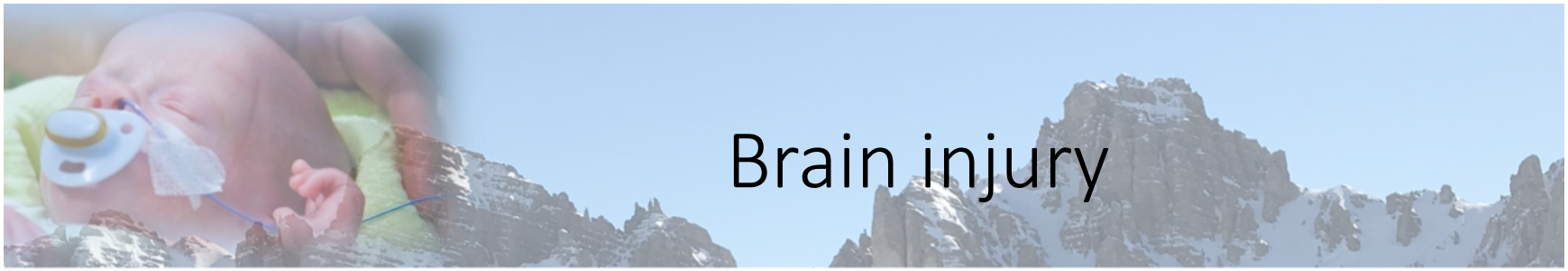
Intraventrikuläre Blutung/ Intraventricular hemorrhage

Kleinhirnblutung/ Cerebellar hemorrhage



Kidokoro et al., 2014

Sequenzen – und was sagen sie uns?



Brain injury

MEDIZINISCHE UNIVERSITÄT INNSBRUCK

- Hirnschädigung bei ca. 25 %
- schwere Hirnschädigung bei 6,3 %

	Pathologie	Sonographie %	MRI % (Grad 3-4 %)
	≥1 Pathologie	17,0	24,7 (6,3)
2/3 isoliert	IVH	15,3	16,0 (1,7)
	PVL	1,0	10,0 (3,3)
2/3 kombiniert mit supra-tentorieller Läsion	CBH	0,7	8,0 (2,0)

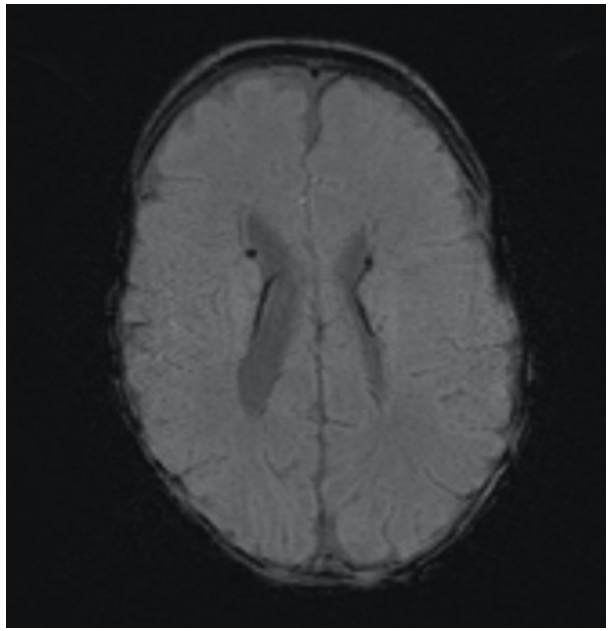
Sequenzen – und was sagen sie uns?

Intraventrikuläre Blutung

MEDIZINISCHE UNIVERSITÄT INNSBRUCK

Sonographie

MRT



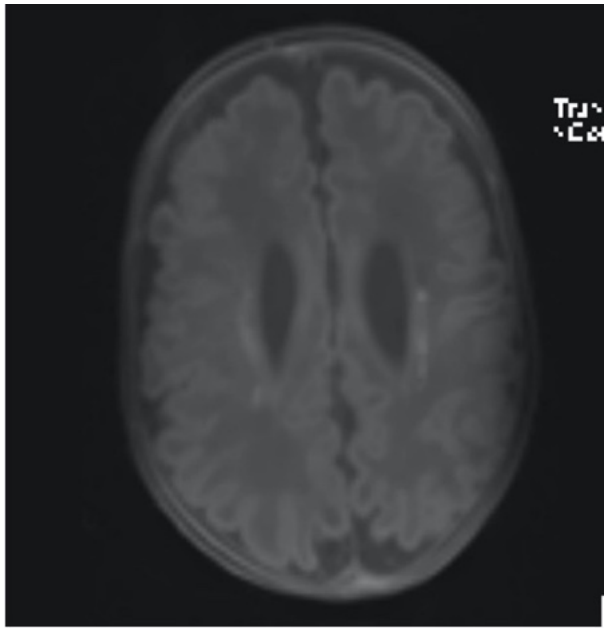
Sequenzen – und was sagen sie uns?

White Matter Disease

MEDIZINISCHE UNIVERSITÄT INNSBRUCK

Sonographie

MRT



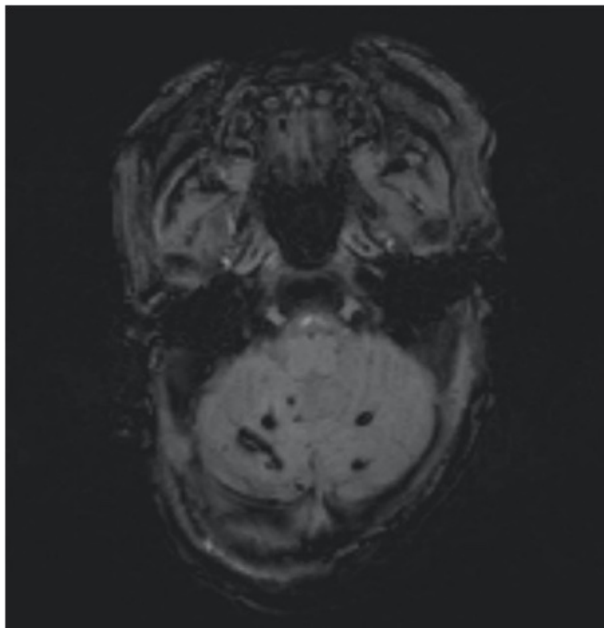
Sequenzen – und was sagen sie uns?

Kleinhirnblutung

MEDIZINISCHE UNIVERSITÄT INNSBRUCK

Sonographie

MRT



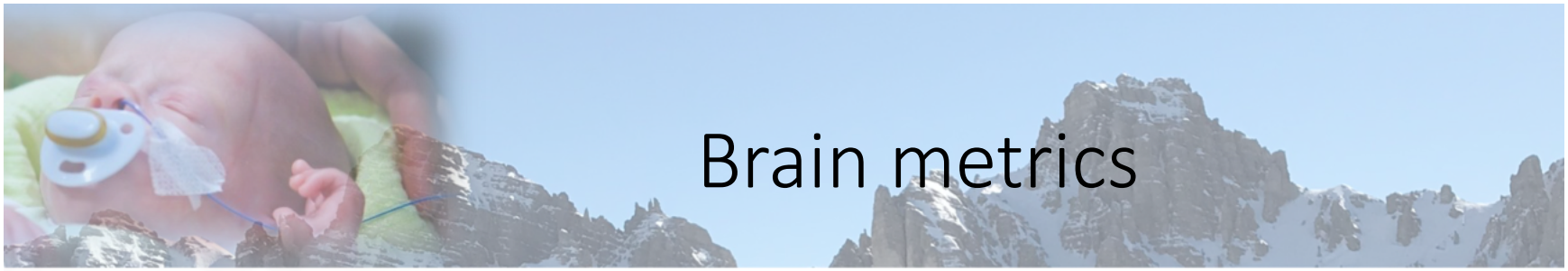
Sequenzen – und was sagen sie uns?

Brain injuries und Outcome

MEDIZINISCHE UNIVERSITÄT INNSBRUCK

- IVH I-II° mit Entwicklungsverzögerung assoziiert
  Patra et al., 2006; Bolisetty et al., 2014
- schwere PVL mit auffälligem MDI und PDI im Alter von 1 und 2 Jahren assoziiert
  Kidokoro et al., 2014; Hammerl, 2020
- Kleinhirnblutungen:
  - Effekte auf Motorik, Kognition, Sprache, Sozialverhalten, Autismus
    Limperopoulos et al., 2007; Hortensius et al., 2018; Hammerl, 2020
  - höhere Raten an Entwicklungsverzögerung (auch bei milder CBH)
    Hammerl, 2020

Sequenzen – und was sagen sie uns?



Brain metrics

MEDIZINISCHE UNIVERSITÄT INNSBRUCK

- FG <32 SSW haben ein kleineres Gehirn in der Adoleszenz – Gehirnvolumen erklärt 20-40% der IQ- und Bildungsoutcome-Unterschiede

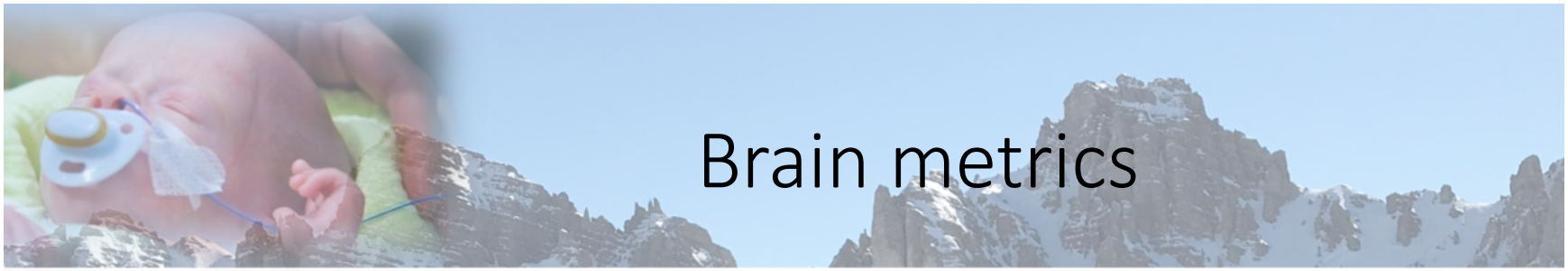
  Cheong et al., 2013

- bereits am errechneten Termin Unterschiede in den Gehirnvolumina feststellbar

  Lind et al., 2010; Keunen et al., 2016

- 2D-Messungen als (leicht einsetzbare) Alternative

  Nguyen The Tich et al., 2009



Brain metrics

MEDIZINISCHE UNIVERSITÄT INNSBRUCK

- Kinder ohne Gehirnläsion gelten als „Low-Risk“ Gruppe für auffälliges Outcome
- entwicklungsneurologische Auffälligkeiten häufiger als Gehirnläsionen

Serenius et al., 2013; Blencowe et al., 2012; Hammerl et al., 2019

Neonatology

Original Paper

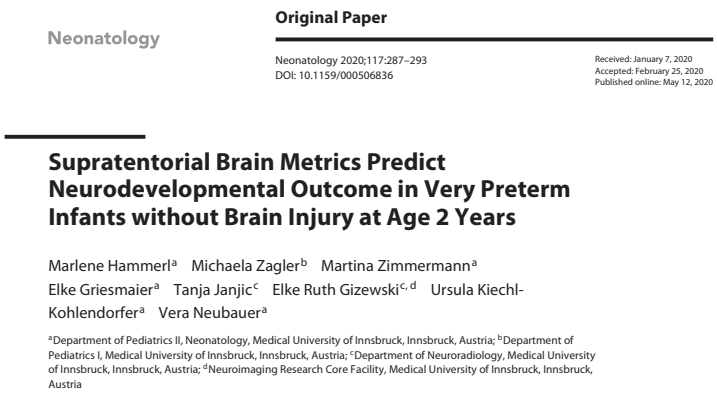
Neonatology
DOI: 10.1159/000502491

Received: June 7, 2019
Accepted after revision: August 1, 2019
Published online: September 3, 2019

Reduced Cerebellar Size at Term-Equivalent Age Is Related to a 17% Lower Mental Developmental Index in Very Preterm Infants without Brain Injury

Marlene Hammerl[a] Michaela Zagler[b] Elke Griesmaier[a] Tanja Janjic[c] Elke Ruth Gizewski[c, d] Ursula Kiechl-Kohlendorfer[a] Vera Neubauer[a]

[a]Neonatology, Department of Pediatrics II, Medical University of Innsbruck, Innsbruck, Austria; [b]Department of Pediatrics I, Medical University of Innsbruck, Innsbruck, Austria; [c]Department of Neuroradiology, Medical University of Innsbruck, Innsbruck, Austria; [d]Neuroimaging Research Core Facility, Medical University of Innsbruck, Innsbruck, Austria



Neonatology

Original Paper

Neonatology 2020;117:287–293
DOI: 10.1159/000506836

Received: January 7, 2020
Accepted: February 25, 2020
Published online: May 12, 2020

Supratentorial Brain Metrics Predict Neurodevelopmental Outcome in Very Preterm Infants without Brain Injury at Age 2 Years

Marlene Hammerl[a] Michaela Zagler[b] Martina Zimmermann[a] Elke Griesmaier[a] Tanja Janjic[c] Elke Ruth Gizewski[c, d] Ursula Kiechl-Kohlendorfer[a] Vera Neubauer[a]

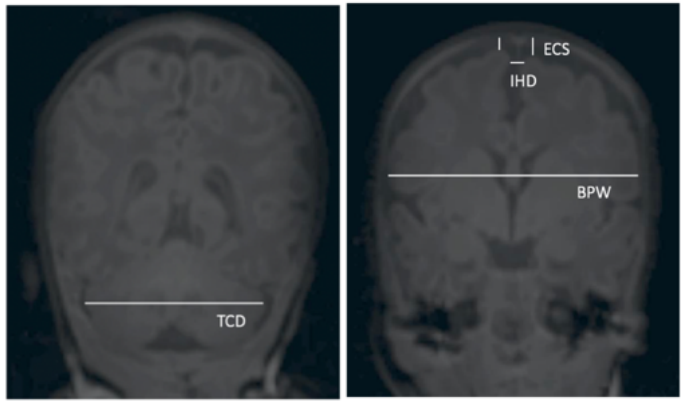
[a]Department of Pediatrics II, Neonatology, Medical University of Innsbruck, Innsbruck, Austria; [b]Department of Pediatrics I, Medical University of Innsbruck, Innsbruck, Austria; [c]Department of Neuroradiology, Medical University of Innsbruck, Innsbruck, Austria; [d]Neuroimaging Research Core Facility, Medical University of Innsbruck, Innsbruck, Austria

Sequenzen – und was sagen sie uns?

Brain metrics und Outcome

MEDIZINISCHE UNIVERSITÄT INNSBRUCK

- Messung u.a. der biparietalen Weite, des Interhemisphärenspaltes und des transcerebellären Durchmessers in T1-MPRage Bildern
- PPV:
  - BPW z-score <-0,5 und IHD ≥4 mm:
    41% für auffälliges Outcome im Alter von 1 a
  - TCD <50 mm:
    45% für auffälliges Outcome im Alter von 2 a
- NPV – keine abnormalen Brain metrics:
  - 97% für kognitive Auffälligkeiten im Alter von 1 a
  - 96% für motorische Auffälligkeiten im Alter von 2 a



Hammerl et al., 2019; Hammerl et al., 2020; Hammerl, 2020

Brain metrics und Outcome

MEDIZINISCHE UNIVERSITÄT INNSBRUCK

- kleineres Gehirn (BPW oder TCD auffällig)
  → niedrigerer Verbal-IQ (WPSSI-III)
- TCD <50 mm: Verbal-IQ <85 häufiger
  (50% vs. 2%)

Hammerl, 2020

Diffusion Tensor Imaging

MEDIZINISCHE UNIVERSITÄT INNSBRUCK

- unterschiedliche Diffusionseigenschaften von Wassermolekülen in Abhängigkeit von ihrer Umgebung
- Brown‘sche Molekularbewegung

isotrope Diffusion (z.B. in Liquorräumen):
Wassermoleküle sind in ihrer Bewegung kaum beeinträchtigt – mehr Diffusion – starke Signalreduktion – in der Aufnahme dunkel

Stegemann et al., 2006

Diffusion Tensor Imaging

MEDIZINISCHE UNIVERSITÄT INNSBRUCK

- weiße Substanz: strukturelle Barrieren für Wassermoleküle (Zellmembranen, Myelinscheiden) - schnellere Bewegung in der Längsrichtung der Axone = anisotrope Diffusion

Wassermoleküle sind durch strukturierte Anordnung des Gewebes in der Diffusion stark eingeschränkt
– in der Aufnahme hell

Apparent Diffusion Coefficient

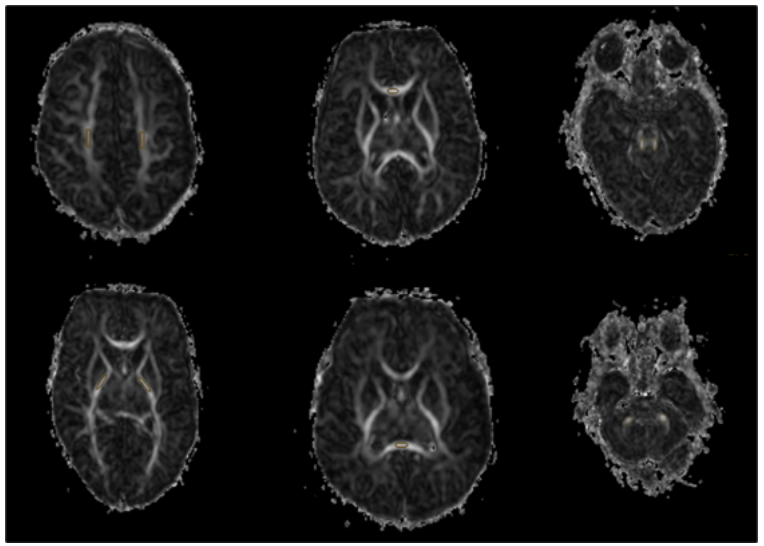
MEDIZINISCHE UNIVERSITÄT INNSBRUCK

- scheinbarer Diffusionskoeffizient, ADC
- durchschnittliche Diffusionsgeschwindigkeit der Wassermoleküle in der Richtung des geschalteten Gradienten
- niedrig bei Diffusionsbarrieren

Fraktionale Anisotropie (FA)

MEDIZINISCHE UNIVERSITÄT INNSBRUCK

- Maß für die Stärke der Anisotropie ohne Berücksichtigung der Vorzugsrichtung
- Grad der Anisotropie liefert Informationen über die strukturelle Integrität
- höhere Werte bei stark vorgegebener Richtung (z.B. viele Faserstränge)



Diffusion Tensor Imaging

MEDIZINISCHE UNIVERSITÄT INNSBRUCK

Neonatology

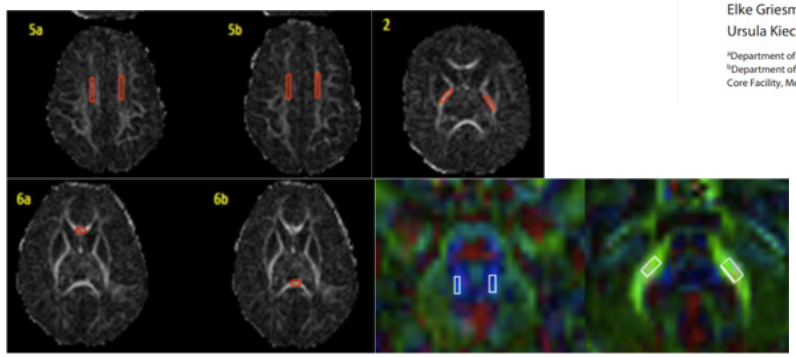
Neonatology 2018;113:93–99
DOI: 10.1159/000480695

Received: May 14, 2017
Accepted after revision: August 26, 2017
Published online: November 9, 2017

The Cerebellar-Cerebral Microstructure Is Disrupted at Multiple Sites in Very Preterm Infants with Cerebellar Haemorrhage

Vera Neubauer[a] Tanja Djurdjevic[b] Elke Griesmaier[a] Marlene Biermayr[a]
Elke Ruth Gizewski[b, c] Ursula Kiechl-Kohlendorfer[a]

[a]Department of Paediatrics II, Neonatology, [b]Department of Neuroradiology, and [c]Neuroimaging Core Facility, Medical University of Innsbruck, Innsbruck, Austria



Neonatology

Original Paper

Neonatology
DOI: 10.1159/000521948

Received: October 7, 2021
Accepted: January 12, 2022
Published online: February 17, 2022

Prophylactic Low-Dose Paracetamol Administration for Ductal Closure and Microstructural Brain Development in Preterm Infants

Maria Sappler[a] Marlene Hammerl[a] Yasmin Pellkofer[a]
Elke Griesmaier[a] Michaela Höck[a] Tanja Janjic[b, c] Elke Ruth Gizewski[b, c]
Ursula Kiechl-Kohlendorfer[a] Vera Neubauer[a]

[a]Department of Pediatrics II, Neonatology, Medical University of Innsbruck, Innsbruck, Austria; [b]Department of Neuroradiology, Medical University of Innsbruck, Innsbruck, Austria; [c]Neuroimaging Research Core Facility, Medical University of Innsbruck, Innsbruck, Austria

RESEARCH ARTICLES | AUGUST 25 2023

The Effect of Postnatal Cytomegalovirus Infection on (Micro)structural Cerebral Development in Very Preterm Infants at Term-Equivalent Age

Subject Area: Women's and Children's Health

Yasmin Pellkofer; Marlene Hammerl; Elke Griesmaier; Maria Sappler; Elke Ruth Gizewski; Ursula Kiechl-Kohlendorfer; Vera Neubauer

Neonatology (2023) 120 (6): 727–735.
https://doi.org/10.1159/000532084 Article history
PubMed:37634498

Sequenzen – und was sagen sie uns?

Traktographie

MEDIZINISCHE UNIVERSITÄT INNSBRUCK

- basierend auf DTI – 3D Rekonstruktion
- ermöglicht Darstellung und Analyse von Nervenfaserbündeln im Gehirn

DEVELOPMENTAL MEDICINE & CHILD NEUROLOGY ORIGINAL ARTICLE

Tractography of white-matter tracts in very preterm infants: a 2-year follow-up study

FRANCISCA T DE BRUÏNE[1] | GERDA VAN WEZEL-MEIJLER[2] | LARA M LEIJSER[3] | SYLKE J STEGGERDA[3] | ANNETTE A VAN DEN BERG-HUYSMANS[1] | MONIQUE RIJKEN[3] | MARK A VAN BUCHEM[1] | JEROEN VAN DER GROND[1]

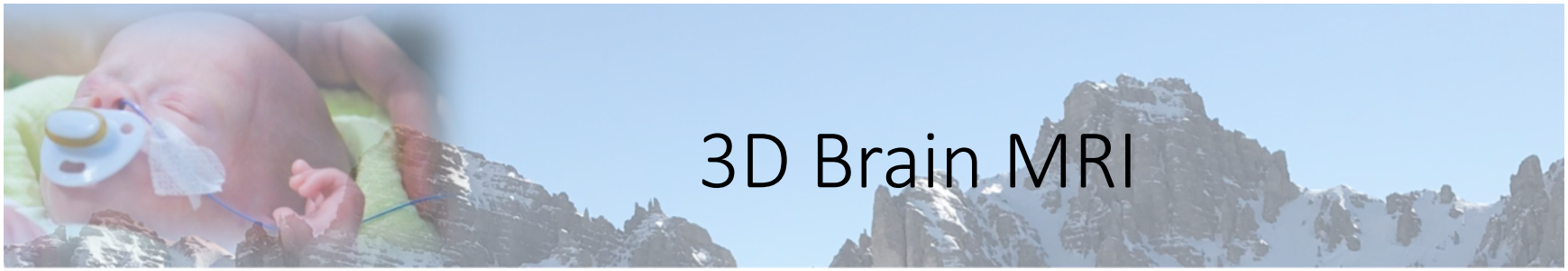
1 Department of Radiology, Leiden University Medical Center, Leiden; **2** Department of Neonatology, Isala Hospitals, Zwolle; **3** Department of Neonatology, Leiden University Medical Center, Leiden, the Netherlands.

Funktionelles MRI

MEDIZINISCHE UNIVERSITÄT INNSBRUCK

- misst Veränderungen der Gewebsdurchblutung, die durch Energiebedarf von Nervenzellen hervorgerufen werden
  - Blutflussmessung: erhöhte Durchblutung in aktiveren Gehirnregionen
  - Sauerstoffgehaltmessung: sauerstoffreiches Blut magnetisch reaktiver → BOLD-Effekt
- resting state fMRI: keine bestimmten Aufgaben müssen ausgeführt werden
  → spontane Aktivität wird gemessen
- aktuell laufende Studie in Innsbruck

Lordier et al., 2019



3D Brain MRI

MEDIZINISCHE UNIVERSITÄT INNSBRUCK

ORIGINAL ARTICLES

www.jpeds.com • THE JOURNAL OF PEDIATRICS

Brain Volumes at Term-Equivalent Age in Preterm Infants: Imaging Biomarkers for Neurodevelopmental Outcome through Early School Age

Kristin Keunen, MD[1,2], Ivana Išgum, PhD[2,3], Britt J. M. van Kooij, MD, PhD[1], Petronella Anbeek, PhD[1,3], Ingrid C. van Haastert, PhD[1], Corine Koopman-Esseboom, MD, PhD[1], Petronella C. Fieret-van Stam, PhD[4], Rutger A. J. Nievelstein, MD, PhD[5], Max A. Viergever, PhD[2,3], Linda S. de Vries, MD, PhD[1,2], Floris Groenendaal, MD, PhD[1,2,*], and Manon J. N. L. Benders, MD, PhD[1,2,*]

Pediatr Radiol (2011) 41:953–961
DOI 10.1007/s00247-011-2071-x

ORIGINAL ARTICLE

Associations between regional brain volumes at term-equivalent age and development at 2 years of age in preterm children

Annika Lind · Riitta Parkkola · Liisa Lehtonen · Petriina Munck · Jonna Maunu · Helena Lapinleimu · Leena Haataja · PIPARI Study Group

OPEN ACCESS Freely available online

PLOS ONE

Contribution of Brain Size to IQ and Educational Underperformance in Extremely Preterm Adolescents

Jeanie L. Y. Cheong[1,2,3*], Peter J. Anderson[2,4,6], Gehan Roberts[2,5,6], Alice C. Burnett[2,4], Katherine J. Lee[2,6], Deanne K. Thompson[2,7,8], Carly Molloy[2], Michelle Wilson-Ching[2], Alan Connelly[8], Marc L. Seal[6,7], Stephen J. Wood[9], Lex W. Doyle[1,2,3]

1 Neonatal Services, Royal Women's Hospital, Melbourne, Australia, **2** Victorian Infant Brain Studies, Murdoch Childrens Research Institute, Melbourne, Australia, **3** Department of Obstetrics & Gynaecology, University of Melbourne, Melbourne, Australia, **4** School of Psychological Sciences, University of Melbourne, Melbourne, Australia, **5** Royal Children's Hospital, Melbourne, Australia, **6** Department of Paediatrics, University of Melbourne, Melbourne, Australia, **7** Developmental Imaging, Murdoch Childrens Research Institute, Melbourne, Australia, **8** Florey Institute of Neurosciences and Mental Health, Melbourne, Australia, **9** School of Psychology, University of Birmingham, Edgbaston, United Kingdom

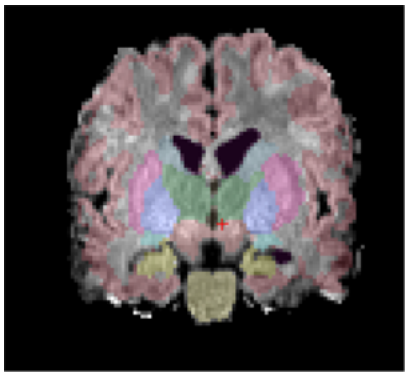
Chou et al., 2012

Perspektiven

Automatisierte Segmentierung

MEDIZINISCHE UNIVERSITÄT INNSBRUCK

- verschiedene Programme/Atlanten
- FreeSurfer Infant: Erkennen von 31 Gehirnregionen - Volumetrie



https://surfer.nmr.mgh.harvard.edu

Artificial intelligence/Radiomics

MEDIZINISCHE UNIVERSITÄT INNSBRUCK

- artificial intelligence:
  - imitiert menschliche Intelligenz
  - maschinelles Lernen/Deep Learning – Verbesserung der Interpretation Entscheidungsfindung
- Radiomics:
  - quantitative Analyse von Bildmerkmalen, die über das hinausgehen, was das menschliche Auge erkennen kann

Artificial intelligence

MEDIZINISCHE UNIVERSITÄT INNSBRUCK

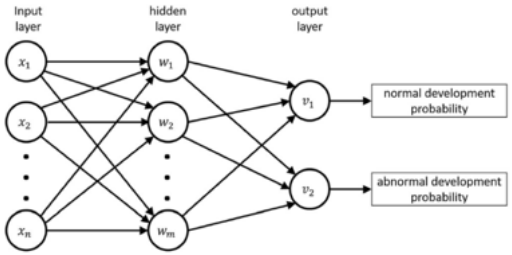
European Radiology (2020) 30:6441–6451
https://doi.org/10.1007/s00330-020-07053-8

NEURO

Check for updates

Feed-forward neural networks using cerebral MR spectroscopy and DTI might predict neurodevelopmental outcome in preterm neonates

T. Janjic[1,2] · S. Pereverzyev Jr[1,2] · M. Hammerl[3] · V. Neubauer[3] · H. Lerchner[1,2] · V. Wallner[1] · R. Steiger[1,2] · U. Kiechl-Kohlendorfer[3] · M. Zimmermann[3] · A. Buchheim[4] · A. E. Grams[1,2] · E. R. Gizewski[1,2]



Results By employing the constructed fNN predictors, we were able to predict cognitive delays of VPIs with 85.7% sensitivity, 100% specificity, 100% positive predictive value (PPV) and 99.1% negative predictive value (NPV). For the prediction of motor delay, we achieved a sensitivity of 76.9%, a specificity of 98.9%, a PPV of 90.9% and an NPV of 96.7%.

Artificial Intelligence In Medicine 132 (2022) 102384

Contents lists available at ScienceDirect

Artificial Intelligence In Medicine

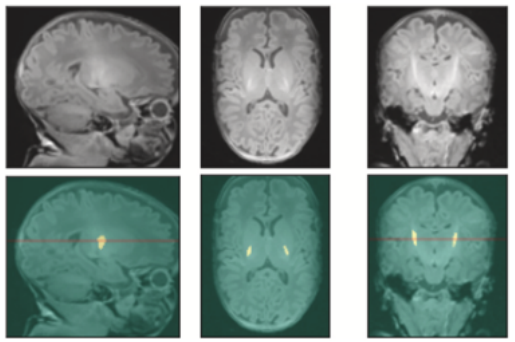
journal homepage: www.elsevier.com/locate/artmed

Research paper

A deep learning pipeline for the automated segmentation of posterior limb of internal capsule in preterm neonates

Nadja Gruber[a,b,1], Malik Galijasevic[c,d,1], Milovan Regodic[f,g], Astrid Ellen Grams[c,d], Christian Siedentopf[c,d], Ruth Steiger[c,d], Marlene Hammerl[e], Markus Haltmeier[b], Elke Ruth Gizewski[a,c,d], Tanja Janjic[c,d,*]

[a] VASCage-Research Centre on Vascular Ageing and Stroke, Innsbruck, Austria
[b] Department of Applied Mathematics, University of Innsbruck, Austria
[c] Department of Neuroradiology, Medical University of Innsbruck, Austria
[d] Neuroimaging Research Core Facility, Medical University of Innsbruck, Austria
[e] Department of Paediatrics II, Neonatology, Medical University of Innsbruck, Austria
[f] Department of ENT, Medical University of Innsbruck, Austria
[g] Department of Radiation Oncology, Medical University of Vienna, Austria



Perspektiven

Vielen Dank!

Dr. Marlene Hammerl, PhD
Marlene.Hammerl@i-med.ac.at

Department für Kinder- und Jugendheilkunde
Pädiatrie II, Neonatologie