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Interventions and Management

1. Manual dexterity, but not cerebral palsy, predicts cognitive functioning after neonatal stroke.

Thébault G, Martin S, Brouillet D, Brunel L, Dinomais M, Presles É, Fluss J, Chabrier S; AVCnn Study Group.

Dev Med Child Neurol. 2018 Apr 6. doi: 10.1111/dmcn.13752. [Epub ahead of print]

AIM: To disentangle the respective impacts of manual dexterity and cerebral palsy (CP) in cognitive functioning after neonatal arterial ischaemic stroke. METHOD: The population included 60 children (21 females, 39 males) with neonatal arterial ischaemic stroke but not epilepsy. The presence of CP was assessed clinically at the age of 7 years and 2 months (range 6y 11mo-7y 8mo) using the definition of the Surveillance of CP in Europe network. Standardized tests (Nine-Hole Peg Test and Box and Blocks Test) were used to quantify manual (finger and hand respectively) dexterity. General cognitive functioning was evaluated with the Wechsler Intelligence Scale for Children, Fourth Edition. Simple and multiple linear regression models were performed while controlling for socio-economic status, lesion side, and sex. RESULTS: Fifteen children were diagnosed with CP. In simple regression models, both manual dexterity and CP were associated with cognitive functioning (β=0.41 [p=0.002] and β=0.31 [p=0.019] respectively). However, in multiple regression models, manual dexterity was the only associated variable of cognitive functioning, whether or not a child had CP (β=0.35; p=0.007). This result was reproduced in models with other covariables (β=0.31; p=0.017). INTERPRETATION: As observed in typically developing children, manual dexterity is related to cognitive functioning in children having suffered a focal brain insult during the neonatal period. WHAT THIS PAPER ADDS: Manual dexterity predicts cognitive functioning after neonatal arterial ischaemic stroke. Correlations between manual dexterity and cognitive functioning occur irrespective of sex, lesion side, presence of cerebral palsy, and socio-economic status. Residual motor ability may support cognitive functioning.

PMID: 29624666

2. Age-related Changes in Postural Sway During Sit-to-stand in Typical Children and Children with Cerebral Palsy.

Pavão SL, de Campos AC, Rocha NACF.

J Mot Behav. 2018 Apr 5:1-8. doi: 10.1080/00222895.2018.1454396. [Epub ahead of print]

OBJECTIVE: To assess age-related changes in postural sway during sit-to-stand (STS) in typical children (TC) and children with mild cerebral palsy (CP). METHODS: Thirty-five TC and 23 children with mild CP were allocated in four different age groups: 5-6, 7-9, 10-12, and 13-15 years; they all performed STS movements over a force plate. Anterior-posterior and medial-lateral amplitude of center of pressure (CoP) displacement, area and velocity of CoP sway were analyzed and compared between the age groups for TC and children with CP. RESULTS: TC at 5 to 6 years of age showed higher values of anterior-posterior CoP displacement and Area of CoP sway than at 10-12 years, during the stabilization phase. There were no age-related changes for CP. CONCLUSION: TC change their postural sway during the last STS phase over the years, reducing their body sway. Children with CP did not show age-related changes in sway during STS, reflecting a distinct rhythm of postural control development in this population.

PMID: 29621425

3. Assessing the Risk-Benefit Ratio of Scoliosis Surgery in Cerebral Palsy: Surgery Is Worth It.

Miyanji F, Nasto LA, Sponseller PD, Shah SA, Samdani AF, Lonner B, Yaszay B, Clements DH, Narayanan U, Newton PO.

BACKGROUND: The true benefits of scoliosis surgery in cerebral palsy (CP) remain uncertain. Our aims were to determine the benefits of spinal fusion according to health-related quality of life (HRQoL) improvement at long-term follow-up and to explore the effect of surgery-related complications on clinical outcomes. METHODS: The cases of consecutive patients who had Gross Motor Function Classification System (GMFCS) level-IV or V cerebral palsy with 5-year follow-up from a prospective, longitudinal, multicenter database were analyzed. Caregivers completed the Caregiver Priorities and Child Health Index of Life with Disabilities (CPCHILD) questionnaire and 4 Likert-type anchor questions preoperatively and at 1, 2, and 5 years of follow-up. Data on complications were collected prospectively. Preoperative CPCHILD scores were compared with postoperative scores at the 1, 2, and 5-year follow-up evaluations. Preoperative CPCHILD scores were compared with postoperative scores at the 1, 2, and 5-year follow-up evaluations using repeated-measures analysis of variance (ANOVA). Spearman correlation coefficient was used to explore the association between changes in the CPCHILD at 1, 2, and 5-year follow-up and the reported complications within the follow-up period. Similarly, a comparative analysis between the percentage distribution of the answers to the 4 anchor questions and the reported complications was also performed. RESULTS: Sixty-nine patients with a mean age (and standard deviation) of 13.4 ± 2.6 years at enrollment were analyzed. The major Cobb angle was a mean of $81.9° \pm 26.7°$ preoperatively and improved to a mean of $28.7° \pm 14.4°$ at 2 years and $30.7° \pm 15.3°$ at 5 years postoperatively. Significant improvements in CPCHILD personal care, positioning, and comfort domains were noted at all time points. The mean increase in the total score was 7.19 ($p < 0.001$) at 1 year, and the score gain was maintained at 2 and 5 years postoperatively. The overall complication rate was 46.4% at 1 year, 1.4% between 1 and 2 years, and 4.3% at 2 to 5 years postoperatively, with surgical intervention required in 6 patients within 1 year and in 2 additional patients within 5 years following scoliosis surgery. There was no correlation between complications and CPCHILD scores postoperatively at all time points, with the only exception of a weak correlation (ρ = -0.450, $p = 0.002$) with CPCHILD comfort score at 1 year after surgery. CONCLUSIONS: Scoliosis surgery in patients with CP leads to a significant improvement in HRQoL, which is maintained 5 years following surgery. The substantial complication rate does not correlate with HRQoL changes postoperatively, suggesting that the benefits of surgery outweigh the risks in this fragile population.

PMID: 29613924

4. Spasticity in children with cerebral palsy: what are we treating?

Gough M.

[This commentary is on the original article by Willerslev-Olsen et al.]

PMID: 29624670

5. Femoral anteversion assessment: Comparison of physical examination, gait analysis, and EOS biplanar radiography.

Westberry DE, Wack LI, Davis RB, Hardin JW.

BACKGROUND: Multiple measurement methods are available to assess transverse plane alignment of the lower extremity. RESEARCH QUESTION: This study was performed to determine the extent of correlation between femoral anteversion assessment using simultaneous biplanar radiographs and three-dimensional modeling (EOS imaging), clinical hip rotation by physical examination, and dynamic hip rotation assessed by gait analysis. METHODS: Seventy-seven patients with cerebral palsy (GMFCS Level I and II) and 33 neurologically typical children with torsional abnormalities completed a comprehensive gait analysis with same day biplanar anterior-posterior and lateral radiographs and three-dimensional transverse plane assessment of femoral anteversion. Correlations were determined between physical exam of hip rotation, EOS imaging of femoral anteversion, and transverse plane hip kinematics for this retrospective review study. RESULTS: Linear regression analysis revealed a weak relationship between physical examination measures of hip rotation and biplanar radiographic assessment of femoral anteversion. Similarly, poor correlation was found between clinical evaluation of femoral anteversion and motion assessment of dynamic hip rotation. Correlations were better in neurologically typical children with torsional abnormalities compared to children with gait dysfunction secondary to cerebral palsy. SIGNIFICANCE: Dynamic hip rotation cannot be predicted by physical examination measures of hip range of motion or from three-dimensional assessment of femoral anteversion derived from biplanar radiographs.

PMID: 29605796

6. Equinus Correction During Multilevel Surgery in Adults With Cerebral Palsy.

Putz C, Mertens EM, Wolf SI, Geisbüsch A, Niklasch M, Gantz S, Döderlein L, Dreher T, Klotz MC.

Foot Ankle Int. 2018 Mar 1:1071100718765161. doi: 10.1177/1071100718765161. [Epub ahead of print]

BACKGROUND: Equinus foot deformity constitutes a common gait disorder in ambulatory adults with bilateral spastic cerebral palsy (BSCP). The outcome after intramuscular aponeurotic lengthening in the context of single-event multilevel surgery (SEMLS) in adulthood has not been investigated. METHODS: We followed a group of 31 ambulatory adults with BSCP and equinus who underwent SEMLS including gastrocnemius-soleus intramuscular aponeurotic recession or Achilles tendon lengthening. All patients were analyzed preoperatively and at least 1 year (mean follow-up period: 1.6 years) postoperatively by clinical examination and 3-dimensional instrumented gait analysis including the Gait Profile Score (GPS). RESULTS: Clinical examination showed no significant improvement of ankle dorsiflexion (P = .5) and an unchanged plantarflexion (P = .7) with knee extended but a significant postoperative reduction of spasticity in the calf muscle (P = .0001) as measured by clinical examination following the modified Ashworth scale. Significant improvement of mean ankle dorsiflexion in stance and swing (P = .0001) was found. The GPS decreased and improved significantly (15.9 ± 4.6 to 11.4 ± 3.1; P = .0001). Persistence of equinus and calcaneal gait indicating under- and overcorrection at follow-up was found in 1 patient (3%), respectively. CONCLUSION: Intramuscular gastrocnemius-soleus aponeurotic recession is part of multilevel surgery corrected equinus deformity in adults. The increase in muscle length led to significant improvement of kinetic and kinematic parameters during walking without a loss of muscle strength and push-off capacity. The risk of overcorrection after equinus correction in adults with BSCP was found to be relatively low.

PMID: 29606023

7. Non-Invasive Brain Stimulation in Children With Unilateral Cerebral Palsy: A Protocol and Risk Mitigation Guide.

Gillick BT, Gordon AM, Feyma T, Krach LE, Carmel J, Rich TL, Bleyenheuft Y, Friel K.

Front Pediatr. 2018 Mar 16;6:56. doi: 10.3389/fped.2018.00056. eCollection 2018.

Non-invasive brain stimulation has been increasingly investigated, mainly in adults, with the aims of influencing motor recovery after stroke. However, a consensus on safety and optimal study design has not been established in pediatrics. The low incidence of reported major adverse events in adults with and without clinical conditions has expedited the exploration of NIBS in children with paralleled purposes to influence motor skill development after neurological injury. Considering developmental variability in children, with or without a neurologic diagnosis, adult dosing and protocols may not be appropriate. The purpose of this paper is to present recommendations and tools for the prevention and mitigation of adverse events (AEs) during NIBS in children with unilateral cerebral palsy (UCP). Our recommendations provide a framework for pediatric NIBS study design. The key components of this report on NIBS AEs are (a) a summary of related literature to provide the background evidence and (b) tools for anticipating and managing AEs from four international pediatric laboratories. These recommendations provide a preliminary guide for the assessment of safety and risk mitigation of NIBS in children with UCP. Consistent reporting of safety, feasibility, and tolerability will refine NIBS practice guidelines contributing to future clinical translations of NIBS.

PMID: 29616203

8. Non-invasive cerebellar stimulation in cerebellar disorders.

Ferrucci R, Di Nuzzo C, Ruggiero F, Cortese F, Cova I, Priori A.

CNS Neurol Disord Drug Targets. 2018 Apr 3. doi: 10.2174/1871527317666180404113444. [Epub ahead of print]

Non-invasive brain stimulation (NIBS) might be a valuable therapeutic approach for neurological diseases by modifying the cortical activity in the human brain and promoting neural plasticity. Currently, researchers are exploring the use of NIBS on the cerebellum to promote functional neural changes in cerebellar disorders. In the presence of cerebellar dysfunction, several movement disorders, such as kinetic tremor, ataxia of gait, limb dysmetria and oculomotor deficits, become progressively more disabling in daily life, and no pharmacological treatments currently exist. In the present mini review, we report the main evidence concerning the use of NIBS in three specific cerebellar dysfunctions, cerebellar ataxias (CA), essential tremor (ET) and ataxic cerebral palsy, in which abnormalities of neuroplasticity and cortical excitability can be important pathophysiological factors.

PMID: 29623859

9. A computer vision-based system for monitoring Vojta therapy.

Khan MH, Helsper J, Farid MS, Grzegorzek M.

Int J Med Inform. 2018 May;113:85-95. doi: 10.1016/j.ijmedinf.2018.02.010. Epub 2018 Feb 25.

A neurological illness is t he disorder in human nervous system that can result in various diseases including the motor disabilities. Neurological disorders may affect the motor neurons, which are associated with skeletal muscles and control the body movement. Consequently, they introduce some diseases in the human e.g. cerebral palsy, spinal scoliosis, peripheral paralysis of arms/legs, hip joint dysplasia and various myopathies. Vojta therapy is considered a useful technique to treat the motor disabilities. In Vojta therapy, a specific stimulation is given to the patient's body to perform certain reflexive pattern movements which the patient is unable to perform in a normal manner. The repetition of stimulation ultimately brings forth the previously blocked connections between the spinal cord and the brain. After few therapy sessions, the patient can perform these movements without external stimulation. In this paper, we propose a computer vision-based system to monitor the correct movements of the patient during the therapy treatment using the RGBD data. The proposed framework works in three steps. In the first step, patient's body is automatically detected and segmented and two novel techniques are proposed for this purpose. In the second step, a multi-dimensional feature vector is computed to define various movements of patient's body during the therapy. In the final step, a multi-class support vector machine is used to classify these movements. The experimental evaluation carried out on the large captured dataset shows that the proposed system is highly useful in monitoring the patient's body movements during Vojta therapy.

PMID: 29602437

10. Assessment of oral and dental health status in children with cerebral palsy: An exploratory study.

Sedky NA.

Int J Health Sci (Qassim). 2018 Jan-Feb;12(1):4-14.

OBJECTIVES: Evaluating oral and dental health status in Egyptian children with cerebral palsy (CP) in relation to gross motor skills and types of CP. METHODS: A Cross-sectional study was conducted at el-Shatby Hospital for Children, Alexandria-Egypt. Oral examination for 62 children with CP between the age ranges 3-12 years was performed and decay missing filling-tooth/decay filling-tooth (DMFT/dft), simplified oral hygiene index (OHI-S), and modified gingival index (MGI) indices were charted. Maxillofacial defects, dental problems and drooling of saliva were assessed. Children's CP type, motor milestone, and gross motor skills were determined. All statistical analyses were performed at $P < 0.05$ and 0.01. RESULTS: About 84.0% of children had spastic quadriplegia, 41.9% were sit supported, 32.3% had Level IV gross motor function classification system (GMFCS), and 29.0% had Level V. No maxillofacial defects, 14.5% had dentine exposure >1/3 of the surface, and 22.6% had frequent/severe drooling saliva. Caries prevalence comprised 54.8%, 53.2% had poor oral hygiene (OHI-S index), and 43.6% had severe gingival inflammation (MGI index). The first best predictor variable for dft was "Motor Milestone." GMFCS (Level IV and V) was the first best predictor variable for DMFT, OHI-S, and MGI indices. CONCLUSION: The majority of children had dental caries, poor oral hygiene, and severe gingival inflammation. Children who were sit supported had no neck support and stand supported were suffering from dental caries (dft) more than children who were sitting and walking alone. Children with Levels IV/V GMFCS were prone to have dental caries (DMFT), susceptible to suffer from bad oral hygiene, and older children experiencing severe gingivitis more than younger ones.

PMID: 29623011

Prevention and Cure

11. Towards more accurate prognostication after preterm birth.

Morgan C.

Dev Med Child Neurol. 2018 Mar 30. doi: 10.1111/dmcn.13765. [Epub ahead of print]

[This commentary is on the original article by Peyton et al.]

PMID: 29603719

12. The Association Between Maternal Age and Cerebral Palsy Risk Factors.

Schneider RE, Ng P, Zhang X, Andersen J, Buckley D, Fehlings D, Kirton A, Wood E, van Rensburg E, Shevell MI, Oskoui M.

BACKGROUND: Advanced maternal age is associated with higher frequencies of antenatal and perinatal conditions, as well as a higher risk of cerebral palsy in offspring. We explore the association between maternal age and specific cerebral palsy risk factors. METHODS: Data were extracted from the Canadian Cerebral Palsy Registry. Maternal age was categorized as ≥35 years of age and less than 20 years of age at the time of birth. Chi-square and multivariate logistic regressions were performed to calculate odds ratios and their 95% confidence intervals. RESULTS: The final sample consisted of 1391 children with cerebral palsy, with 19% of children having mothers aged 35 or older and 4% of children having mothers below the age of 20. Univariate analyses showed that mothers aged 35 or older were more likely to have gestational diabetes (odds ratio 1.9, 95% confidence interval 1.3 to 2.8), to have a history of miscarriage (odds ratio 1.8, 95% confidence interval 1.3 to 2.4), to have undergone fertility treatments (odds ratio 2.4, 95% confidence interval 1.5 to 3.9), and to have delivered by Caesarean section (odds ratio 1.6, 95% confidence interval 1.2 to 2.2). These findings were supported by multivariate analyses. Children with mothers below the age of 20 were more likely to have a congenital malformation (odds ratio 2.4, 95% confidence interval 1.4 to 4.2), which is also supported by multivariate analysis. CONCLUSIONS: The risk factor profiles of children with cerebral palsy vary by maternal age. Future studies are warranted to further our understanding of the compound causal pathways leading to cerebral palsy and the observed greater prevalence of cerebral palsy with increasing maternal age.

PMID: 29622489

13. Combined Analysis of Interleukin-10 Gene Polymorphisms and Protein Expression in Children With Cerebral Palsy.

Xia L, Chen M, Bi D, Song J, Zhang X, Wang Y, Zhu D, Shang Q, Xu F, Wang X, Xing Q, Zhu C.

BACKGROUND: Interleukin-10 (IL-10) is an important anti-inflammatory and immunosuppressive cytokine, and it has indispensable functions in both the onset and development of inflammatory disorders. The association between persistent inflammation and the development of cerebral palsy (CP) has attracted much attention. OBJECTIVE: The purpose of this study was to investigate whether IL-10 gene polymorphisms and plasma protein expression are associated with CP and to analyze the role of IL-10 in CP. METHODS: A total of 282 CP patients and 197 healthy controls were genotyped for IL-10 polymorphisms (rs1554286, rs1518111, rs3024490, rs1800871, and rs1800896). Among them, 95 CP patients and 93 healthy controls were selected for plasma IL-10 measurement. RESULTS: The differences in the rs3024490 (p = 0.033) and rs1800871 (p = 0.033) allele frequencies of IL-10 were determined between CP patients and controls. The frequencies of allele and genotype between CP patients with spastic tetraplegia and normal controls of IL-10 polymorphisms showed significant differences for rs1554286, rs151811, rs3024490, rs1800871, and rs1800896 (pallele = 0.015, 0.009, 0.006, 0.003, and 0.006, pgenotype = 0.039, 0.018, 0.027, 0.012, and 0.03, respectively). The plasma IL-10 protein level in CP patients was higher than normal controls (9.13 ± 0.77 vs. 6.73 ± 0.63 pg/ml, p = 0.017). IL-10 polymorphisms and protein association analysis showed that the TT genotype had higher plasma IL-10 protein levels compared to the GG + GT genotype at rs3024490 (11.14 ± 7.27 vs. 7.44 ± 6.95 pg/ml, p = 0.045, respectively) in CP cases. CONCLUSION: These findings provide an important contribution toward explaining the pleiotropic role of IL-10 in the complex etiology of CP.

PMID: 29623066

14. Long-term cognitive outcome of very low birth-weight Saudi preterm infants at the corrected age of 24-36 months.

Sobaih BH.

To assess infants' cognitive function at the corrected age of 24-36 months, and to identify factors associated with adverse outcome and examine the correlation between Bayley Infants Neurodevelopmental Screener (BINS) score and Gesell Schedule of Child Development (GSCD). Methods: This retrospective study was performed on Saudi very low birth-weight (VLBW) infants born in King Khalid University Hospital, Riyadh, Saudi Arabia between 1997 and 2014 by the use of BINS as screening test and GSCD as definitive test. Results: Of 561 enrolled infants, 367 (65.4%) continued to follow-up. Three-hundred and fifteen infants (85.6%) had a normal cognitive function. In addition to lower birth weight (beta = -0.003) (p less than 0.001), male gender (OR =3.9) (p=0.001)and cerebral palsy (OR =33.9) (p less than 0.001) were the strongest factors associated with poor cognitive outcome. Approximately 75.4% of infants with normal BINS score had normal cognitive

function and 7.6% of total infants had sever cognitive impairment. Conclusion: The majority of VLBW infants in our center have normal cognitive function at the corrected age of 24-36 months. Male gender, lower birth weight, and cerebral palsy are major predictors of poor outcome. The BINS scores were correlated with GSCD as a valid predictor for future developmental outcome.

PMID: 29619488

15. Paediatric musculoskeletal disease in Kumi District, Uganda: a cross-sectional survey.

Alves K, Penny N, Kobusingye O, Olupot R, Katz JN, Sabatini CS.

Int Orthop. 2018 Apr 2. doi: 10.1007/s00264-018-3915-x. [Epub ahead of print]

PURPOSE: The purpose of this study is to estimate the burden of musculoskeletal disease among children treated in Kumi District, Uganda, to inform training, capacity-building efforts, and resource allocation. METHODS: We conducted a retrospective cohort study by reviewing the musculoskeletal (MSK) clinic and community outreach logs for children (age < 18 years) seen at Kumi Hospital in Kumi, Uganda, between January 2013 and December 2015. For each patient, we recorded the age, sex, diagnosis, and treatment recommendation. RESULTS: Of the 4852 children, the most common diagnoses were gluteal and quadriceps contractures (29.4% (95% CI 28.1-30.7%), 96% of which were gluteal fibrosis), post-injection paralysis (12.7% (95% CI 11.8-13.6%)), infection (10.5% (95% CI 9.7-11.4%)), trauma (6.9% (95% CI 6.2-7.6%)), cerebral palsy (6.9% (95% CI 6.2-7.7%)), and clubfoot (4.3% (95% CI 3.8-4.9%)). Gluteal fibrosis, musculoskeletal infections, and angular knee deformities create a large surgical burden with 88.1%, 59.1%, and 54.1% of patients seen with these diagnoses referred for surgery, respectively. Post-injection paralysis, clubfoot, and cerebral palsy were treated non-operatively in over 75% of cases. CONCLUSION: While population-based estimates of disease burden and resource utilization are needed, this data offers insight into burden of musculoskeletal disease for this region of Sub-Saharan Africa. We estimate that 50% of the surgical conditions could be prevented with policy changes and education regarding injection practices and early care for traumatic injuries, clubfeet, and infection. This study highlights a need to increase capacity to care for specific musculoskeletal conditions, including gluteal fibrosis, post-injection paralysis, infection, and trauma in the paediatric population of Uganda.

PMID: 29610937

16. Outcome reporting across randomised trials and observational studies evaluating treatments for Twin-Twin Transfusion Syndrome: a systematic review.

Perry H, Duffy JMN, Umadia O, Khalil A; International Collaboration to Harmonise Outcomes for Twin-Twin Transfusion Syndrome (CHOOSE).

Ultrasound Obstet Gynecol. 2018 Apr 1. doi: 10.1002/uog.19068. [Epub ahead of print]

BACKGROUND: Twin-Twin Transfusion syndrome is associated with significant mortality and morbidity. Potential treatments require robust evaluation. The aim of this study was to evaluate outcome reporting across observational studies and randomised controlled trials assessing treatments for twin-twin transfusion syndrome (TTTS). METHODS: Cochrane Central Register of Controlled Trials, EMBASE and Medline were searched from inception to August 2016. Observational studies and randomised controlled trials reporting outcomes following a treatment for TTTS in monochorionic-diamniotic twin pregnancies and monochorionic-triamniotic or dichorionic-triamniotic triplet pregnancies were included. We systematically extracted and categorised outcome reporting. RESULTS: Six randomised trials and 94 observational studies, reporting data from 20,071 maternal participants and 3,199 children, were included. Six different treatments were evaluated. Included studies reported sixty-two different outcomes, including 10 fetal, 28 neonatal, 6 early childhood and 18 maternal outcomes. The outcomes were inconsistently reported across trials. For example, when considering offspring mortality, 31 studies (31%) reported live birth, 31 studies (31%) reported intrauterine death, 49 studies (49%) reported neonatal mortality, and 17 studies (17%) reported perinatal mortality. Four studies (4%) reported respiratory distress syndrome. Only 19 (19%) of studies were designed for long-term follow-up and 11 of these studies (11%) reported cerebral palsy. CONCLUSIONS: Most studies evaluating treatments for TTTS, have often neglected to report clinically important outcomes, especially neonatal morbidity outcomes. Most studies are not designed for long-term follow-up. The development of a core outcome set could help standardised outcome collection and reporting in Twin-Twin Transfusion syndrome studies.

PMID: 29607558