Timing of initiation of Rehabilitation in Pediatric traumatic brain injury-How early is Right?

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Patients who suffer traumatic brain injury (TBI) need a demanding and expensive care over a long period of time, including intensive care management and rehabilitative treatment. Enhancements in emergency medical aid and intensive care has improved survival rates and its outcomes also implies a rise in the number of patients submitted to rehabilitation, which the health care system has to deal with. However there are no international guidelines for early rehabilitative treatment in children available yet.
Children are not small adults

- Severe brain injury occurs less frequently
- Mortality is lower for children
- Focal injuries, such as subdural, extradural and intracerebral haematomas are less frequent in children (15% to 20%) compared to adults (30% to 40%) and are associated with lower mortality
- They present with diffuse brain injury and cerebral swelling with resultant intracranial hypertension (up to 44%) more commonly
- Children are at higher risk of diffuse axonal injury
- Immediate post-traumatic seizures occur much more frequently
When to Initiate?

- Assessment and therapies are started in the acute care setting as soon as child is deemed medically and surgically fit (Brain Injury Rehabilitation in Children—Hwee-Ling Yen and Janice TY Wong)
- we start with the rehabilitation program at the earliest opportunity, usually in the intensive care unit (N. KOS: Patients with brain trauma and brain diseases – the meaning of early rehabilitation, 2016)
- Andelic et al. [9] and Sörbo et al. Described the Importance of an unbroken chain of rehabilitation for the outcome of severe TBI patients and confirmed the need for an early start of rehabilitative care
• Kunik et al demonstrated that early admission to rehabilitation resulted in better functional outcomes and a reduced length of stay in rehabilitation centers.
• In order to optimize and accelerate the treatment process patients should receive rehabilitative treatment as soon as possible. Mammi P, Zaccaria B, Franceschini M. Early rehabilitative treatment in patients with traumatic brain injuries: outcome at one-year follow-up.
How early is early?

• It would begin as soon as the physicians managing the acute phase of injury determined, in concert with rehabilitation consultants, that the child was stable enough to tolerate initiation of phase of recovery.

• Tepas et al proposed ideal starting benchmark for this transition from critical care to rehabilitation be set at 24 hours, thereby defining a “golden day.”
Concerns for early Initiation

• Recent trials in critically ill adults have shown benefit to early initiation of therapy prior to extubation
  • In children there is unique risk of worsening of intracranial hypertension with physical movement and stimulation
  • Risk usually passes by around Day 7 of illness
    Bennett et al
Early vs late rehabilitation

• Early onset enhances medical improvement and social reintegration potential
• reduces complications
• Reduces length of stay in hospitals
• Zampolini et al emphasized the importance of early rehabilitation interventions to allow for the best possible outcomes and Any delayed admission to rehabilitation may influence the rehabilitation process and result in poorer outcomes
• Malec and Basford: In most cases, early rehabilitation was more effective than delayed intervention
• Tepas et al demonstrated an inverse relationship between delay to rehabilitation and functional outcome and efficiency of rehabilitative care.
Rest in acute phase

- to observe more restrictive physical and cognitive activity during the first several days after mTBI in children (moderate evidence) (CDC Guideline on the Diagnosis and Management of Mild Traumatic Brain Injury Among Children)
- Historically, “rest” has been a foundation in the treatment of acute mTBI. Scientific evidence supporting its timing, duration, and efficacy is limited (Silverberg ND, Iverson GL. Is rest after concussion “the best medicine?” recommendations for activity resumption following concussion in athletes, civilians, and military service members. J Head Trauma Rehabil. 2013;28(4))

- Related evidence suggests that early rest (within the first 3 days of injury) may be beneficial, inactivity beyond this period for most children may worsen their self-reported symptoms. (Penninx BW, Kriegsman DM, van Eijk JTM, Boeke AJ, Deeg DJH. Differential effect of social support on the course of chronic disease: a criteria-based literature study)
What is early rehabilitation?

• Early rehabilitation aims at improving motor, cognitive and functional recovery while preventing or treating complications as soon as possible.

• Starting rehabilitation during the acute phase of trauma.
• Rehabilitation provides the necessary experiences for stimulating neuronal plasticity.

• The nature of paediatric rehabilitation is to stimulate the child through real-world demands via the provision of an "enriched environment.

• It is the setting that provides the necessary experiences for stimulating neuronal re-organisation following TBI.
Delayed recovery seen in

- increased risk for ongoing impairment, more severe symptoms, or delayed recovery (< 1 year post-injury)
- Premorbid histories
- Lower cognitive ability (for children with an intracranial lesion)
- Neurological or psychiatric disorder
- Learning difficulties
- Behavioral problems
- Increased pre-injury symptoms (i.e., similar to those commonly referred to as “postconcussive”)
- Family and social stressors
Multidisciplinary Approach

- Physiotherapist
- Occupational Therapist
- Speech Therapist
- Psychologist
- Psychiatrist
- Social worker
- Paediatrician
- Developmental therapist
- Neurologist
- Specialist education services
Process of rehabilitation

• first step in the rehabilitation process is to determine whether referral to a dedicated neurorehabilitation team is necessary and to decide on the need for inpatient rehabilitation.
• severity of injury,
• general health status,
• level of arousal and ability to participate in therapy
• mobility status
• need for multiple disciplines
• family social situation and
• choice of discharge placement
Acute rehabilitation deficits

- In the acute rehabilitation setting, deficits may be noted in
- arousal and alertness,
- orientation,
- attention,
- intellectual functioning,
- memory,
- expressive and receptive language,
- motor skills,
- visuoperceptual and visuospatial abilities, construction skills, executive and self-regulatory skills, and academic skills
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<th>Initial rehabilitation goals</th>
<th>Acute rehabilitation goals</th>
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<td>Determin rehab readiness</td>
<td>Therapy focus:</td>
<td>Therapy focus:</td>
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<td>Therapy focus:</td>
<td>- Foster age-appropriate</td>
<td>- Transition to home</td>
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<td>- Reduce sensory deprivation</td>
<td>- independence in daily</td>
<td>- Transition to community</td>
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<td>- Preventative care for limbs,</td>
<td>- activities</td>
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<td>joints, skin</td>
<td>- Management of daily</td>
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<td>- Improve environmental</td>
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<td>awareness</td>
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<td>- Stabilize day-night cycle</td>
<td>- base</td>
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<td>- Shape automatic behaviors</td>
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<td>- Increase participation in</td>
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<td>familiar daily activities</td>
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<td>Family training:</td>
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<tr>
<td>- Injury-impairment</td>
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<tr>
<td>education</td>
<td>- or home school program</td>
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<tr>
<td>- Brain-behavior education</td>
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<td>- Participation in daily care</td>
<td>- Treatment compliance</td>
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<td>- Therapeutic strategies that promote adaptation</td>
<td>- Treatment follow through</td>
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<td>- Behavioral consistency</td>
<td>- Treatment maintenance</td>
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<tr>
<td>- Rehabilitation generalization</td>
<td>- Treatment generalization</td>
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Goals

- Primary goal in acute rehabilitation - to focus on capacity to perform age-appropriate self-care and daily living activities
- Prevent complications of reduced mobility (contractures and pressure sores)
- Reduce negative effects of sensory deprivation
- Improve awareness of surrounding environment and ongoing daily events,
- Stabilise sleep-wake cycle
- Prompt and shape automatic behaviours (feeding)
- Promote active participation in familiar daily activities
Post acute rehabilitation

• establishing a structured daily routine
• Improving basic cognitive processes (attention, concentration, information processing speed);
• re-establishing well-learned and knowledge-based skills
• compensatory strategies for minimising residual deficits such as those in short-term memory, judgement, problem-solving and social skills,
• emotional and behavioural regulation
• hospital-based school education system
Early solicitation and involvement of the family has been found to reduce long-term dependence on hospital-based systems and subsequently reduce the cost of caring for children.

Family members are the individuals best equipped to ensure treatment compliance and follow through with treatment recommendations, in maintaining treatment gains.

In generalizing treatment effects beyond the medical settings.
Factors that impact outcome

<table>
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<tr>
<th>Injury-related</th>
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<td>Injury severity</td>
<td>Time to rescue arrival</td>
<td>Age-at-injury</td>
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<td>Length/depth of coma</td>
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<td>Contusions</td>
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<td>Diffuse axonal injury</td>
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<td>Depressed skull fractures</td>
<td>Medications</td>
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<td>Secondary injury events</td>
<td>Time to rehabilitation</td>
<td>Intellectual disorders</td>
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<td>Hemorrhage/hematoma</td>
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<td>Cerebral edema</td>
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<td>Psychosocial/family issues</td>
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<td>Seizures</td>
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<td>Educational resources</td>
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The ultimate challenge for pediatric rehabilitation is to determine the timing, dosing, duration, and conditions that make the comprehensive multidisciplinary approach necessary for successful outcome.

The optimal time for initial evaluations and therapy during hospital course is not known, but delay correlated with worse functional outcome and rehabilitation efficiency.

Rehabilitation should be initiated as early as possible after child is medically and surgically fit.

Multidisciplinary involvement.

Educating and involving family is of utmost importance.
Thank you

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