Clinical Presentation of Concussion in Young Children in a Multidisciplinary Concussion Clinic

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INTRODUCTION

- Concussion, or mild traumatic brain injury, is "a complex pathophysiological process affecting the brain, induced by biomechanical forces…. the acute clinical symptoms largely reflect a functional disturbance." [1]
- Concussion has emerged as a significant public health concern:
  - Of 1.7 million annual traumatic brain injuries, 75% are concussions[2, 3,]
  - 1 in every 220 pediatric patients seen in ED is diagnosed with concussion[4]
- Concussion in both children and adults presents with physical, cognitive, emotional and/or sleep complaints.
- Concussion in children occurs in the context of a developing brain, thus current data reflecting injury and recovery in teenagers or adults may not be applicable to younger children.
- Data suggest children have a prolonged course of recovery after concussive injury[6,7]; however, specific premorbid and post-injury factors that may impact recovery either negatively or positively remain unclear.
- Our goal was to describe the clinical presentation and course of recovery from a clinical sample of children younger than 13 years of age seen in a multidisciplinary concussion clinic.

PARTICIPANTS

- 51 children younger than 13 years presented for clinical care to the Neurorehabilitation Concussion Clinic at the Kennedy Krieger Institute between 6/2010 – 3/2012.
  - 6-8 years: N=12
  - 9-12 years: N= 39
- Children presenting beyond 50 days from time of injury were excluded.
- Average time from injury to initial presentation was 19 days (range 4 to 48 days).
- As per clinical practice, children were followed until asymptomatic or the acute concussion was felt to have resolved based on clinical judgment.

METHODS

Retrospective chart review of initial and follow-up evaluations.

- Concussion history:
  - Cause of injury (sports, falls…)
  - Associated loss of consciousness
  - Number of prior concussions
- Concussion symptoms:
  - At time of initial evaluation based on Acute Concussion Evaluation (ACE)[8] Symptom list:

Physical		Cognitive	Emotional	Sleep
Headache	Sensitivity to light	Feeling mentally foggy	Irritability	Drowsiness
Nausea	Sensitivity to noise	Problems concentrating	Sadness	Sleeping more than usual
Fatigue	Numbness/Tingling	Problems remembering	Feeling more emotional	Sleeping less than usual
Visual problems	Vomiting	Feeling slowed down	Nervousness	Trouble falling asleep
Balance problems	Dizziness			

  - Number of days until discharge from clinic
- Number of missed school days (due to concussion).

RESULTS

Demographics: (Table 1 and 2)

Table 1: Concussion history by age group

Age	N	Gender		Cause of concussion		Loss of Consciousness
		Male	Female	Sport	Other	Yes or suspected
6 - 8 years	12	6 (50%)	6 (50%)	3 (25%)	9 (75%)	7 (58%)
9 - 12 years	39	26 (67%)	13 (33%)	21 (54%)	18 (46%)	10 (26%)
Total	**51**	**32 (63%)**	**19 (37%)**	**24 (47%)**	**27 (53%)**	**17 (33%)**

Table 2: Cause of concussion

Sports – related		Other
Football: 6	Gymnastics: 2	Fall (ex. from bike, on playground): 15
Soccer: 5	Baseball: 1	"Bumped head" (ex. while playing): 6
Basketball: 4	Wrestling: 1	MVA/struck by car: 5
Ice Hockey: 2	Horseback: 1	Unknown: 1
Cheerleading: 2		

Loss of consciousness did not correlate with total number of symptoms at initial evaluation (r = .191, p =.18) or time to discharge from clinic (r = -.009, p= .95)

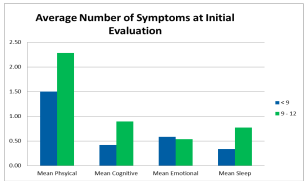
- 18 children (35%) reported having already sustained one or more prior concussions (range 0-3).

Concussion Symptoms: (Table 3 and 4)

Table 3: Number of children with symptoms at initial evaluation

	Physical	Cognitive	Emotional	Sleep
6-8 y/o	8 (67%)	4 (33%)	5 (42%)	3 (25%)
9-12 y/o	30 (77%)	22 (56%)	16 (41%)	21 (54%)
Total	**38 (75%)**	**26 (51%)**	**21 (41%)**	**24 (47%)**

Table 4



Total number of symptoms at initial visit correlated with time to discharge from clinic (r = .376, p = 0.009).

- Patients were followed until symptom free: 82% were followed 2 weeks post-injury; 50% followed beyond 1 month

School Attendance

- Average number of school days missed by initial evaluation was 4.8 (range 0-35).

Number of missed school days did not correlate with number of total symptoms (r = .179, p = .219).

DISCUSSION

- In this clinical sample presenting to a multidisciplinary concussion clinic, younger children present, on average, more than 2 weeks after injury. The delay from time of injury to evaluation may reflect that children are seen by a primary care provider and referred once symptoms persist beyond a certain time period.
- While focus has been given to "sports related concussions," our clinical sample indicates that non-sports related injuries are also causes of concussion in young children. Families may not directly relate "sports-related" concussion symptoms and management to a concussion that results from other means. Educational opportunities should include the concussive risk of other injuries and emphasize proper management independent of cause.
- Given the unknown impact of multiple concussions on the developing brain, it is notable that more than one third of children in our sample report 1-3 prior concussions. This highlights the need to understand the effects of multiple concussions in children.
- In our sample, 50% continued to be followed for at least one month following injury; it is important that providers are skilled in the management of concussion with a focus on how to safely promote functional recovery even with persistent symptoms.
- This clinical sample indicates that school attendance may be adversely impacted; however, the number of missed school days does not correlate with the number of symptoms at initial evaluation. Other factors, such as recommendations of another provider, parents or school comfort with return to school, or pre-injury variables, may contribute to missed school days and will need to be explored.

FUTURE DIRECTIONS

- Further work toward understanding the clinical presentation and typical course of recovery is needed to provide an evidence based approach to the evaluation and management of young children with concussion. These data will help inform investigations of clinical or biological markers of injury and recovery as well as potential interventions that may improve outcome for concussions in young children.

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