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Epidemiology of blunt head trauma in children in U.S. Emergency Departments

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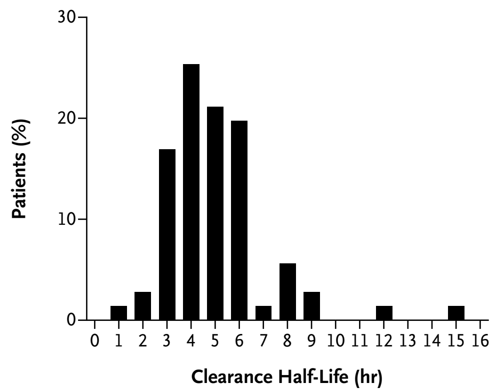

Figure 1. Distribution of Parasite Clearance Half-Lives for 91 Ugandan Children with Severe Malaria Treated with Intravenous Artesunate, 2011–2013.

Nearly half the patients had a clearance half-life longer than 5 hours, a threshold for delayed clearance used in previous research.[1]

sunate efficacy for severe pediatric malaria in sub-Saharan Africa.

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Epidemiology of Blunt Head Trauma in Children in U.S. Emergency Departments

TO THE EDITOR: Traumatic brain injury is the leading cause of death and disabilities in children older than 1 year of age.[1] Detailed data about head trauma in children are needed to better understand the rates and unique age-related risks of injury. We examined the characteristics of children with blunt head trauma from a large, prospective, observational study conducted in the United States through the Pediatric Emergency Care Applied Research Network (PECARN).

We previously derived and validated prediction rules for clinically important traumatic brain injuries in children with minor blunt head trauma in 25 PECARN emergency departments from 2004 through 2006.[2] In this planned secondary analysis, we provide clinical details for the entire cohort of children with head injuries of all severities, ranging from 3 (deep coma) to 15 (normal neurologic status) on the Glasgow Coma Scale (GCS). We categorized children into three age groups (<2 years, 2 to 12 years, and 13 to 17 years) and three categories of head-injury severity on the basis of the initial GCS score (mild [GCS score, 14 or 15], moderate [GCS score, 9 to 13], and severe [GCS score, ≤8]).

Of the 57,030 eligible patients, 43,904 (77%) were enrolled. After exclusions, the final study population was 43,399, and of these patients 98% had mild head trauma. (The patients' demographic characteristics and mechanisms of injury are described in Table 1, and in Table S1 and Fig. S1 in the Supplementary Appendix, available with the full text of this letter at NEJM.org.) Falls were the most frequent mechanism of injury for children under the age of 12 years. Injuries among adolescents were more frequently caused by assaults, sports activities, and motor vehicle crashes. The top three mechanisms of injury according to age group are provided in Table S2 in the Supplementary Appendix.

Table 1. Demographic Characteristics and Mechanisms of Injury in Children with Head Trauma.

Variable	Traumatic Brain Injury on CT (N=1157)*	No Traumatic Brain Injury on CT (N=14,751)	No CT (N=27,491)	All Patients (N=43,399)
Age — no. (%)				
<2 yr	335 (29)	3,161 (21)	7,416 (27)	10,912 (25)
2–12 yr	536 (46)	7,006 (47)	15,715 (57)	23,257 (54)
13–17 yr	286 (25)	4,584 (31)	4,360 (16)	9,230 (21)
Score on Glasgow Coma Scale — no. (%)				
3–8	214 (18)	113 (1)	27 (<1)	354 (<1)
9–13	160 (14)	430 (3)	25 (<1)	615 (1)
14–15	783 (68)	14,208 (96)	27,439 (99)	42,430 (98)
Admitted to hospital — no. (%)	1057 (92)	3,140 (21)	349 (1)	4,546 (10)
Isolated head injury — no. (%)	857 (74)	12,210 (83)	25,570 (93)	38,637 (89)
Head injury plus other substantial injury — no. (%)	291 (25)	2,476 (17)	1,800 (7)	4,567 (11)
Death — no. (%)	51 (4)	3 (<1)	24 (<1)	78 (<1)
Mechanism of injury				
Occupant in motor vehicle crash				
All patients — no. (%)	183 (16)	1,628 (11)	2,099 (8)	3,910 (9)
Restraint used — no./total no. (%)	88/183 (48)	994/1628 (61)	1413/2099 (67)	2495/3910 (64)
Pedestrian struck by moving vehicle — no. (%)	124 (11)	813 (6)	496 (2)	1,433 (3)
Bicycle rider struck by automobile				
All patients — no. (%)	45 (4)	270 (2)	241 (1)	556 (1)
Helmet worn — no./total no. (%)	3/45 (7)	36/270 (13)	26/241 (11)	65/556 (12)
Bicycle crash or fall from bike while riding				
All patients — no. (%)	50 (4)	701 (5)	950 (3)	1,701 (4)
Helmet worn — no./total no. (%)	3/50 (6)	137/701 (20)	174/950 (18)	314/1701 (18)
Other motorized-transport crash — no. (%)	39 (3)	339 (2)	173 (1)	551 (1)
Fall from standing position or while walking or running — no. (%)	44 (4)	1,506 (10)	3,183 (12)	4,733 (11)
Collision with stationary object while walking or running — no. (%)	9 (1)	431 (3)	2,015 (7)	2,455 (6)
Fall from elevation				
Any distance — no. (%)	366 (32)	3,688 (25)	7,829 (28)	11,883 (27)
<3 ft (<1 m) — no./total no. (%)	76/366 (21)	1345/3688 (36)	4673/7829 (60)	6094/11,883 (51)
3–10 ft (1–3 m) — no./total no. (%)	208/366 (57)	1959/3688 (53)	2941/7829 (38)	5108/11,883 (43)
>10 ft (>3 m) — no./total no. (%)	68/366 (19)	268/3688 (7)	82/7829 (1)	418/11,883 (4)
Unknown — no./total no. (%)	14/366 (4)	116/3688 (3)	133/7829 (2)	263/11,883 (2)
Fall down stairs — no. (%)	46 (4)	734 (5)	2,128 (8)	2,908 (7)
Sports activity — no. (%)	46 (4)	1,573 (11)	1,360 (5)	2,979 (7)
Assault — no. (%)	37 (3)	1,095 (7)	1,884 (7)	3,016 (7)
Accidental blow to head — no. (%)	55 (5)	623 (4)	2,480 (9)	3,158 (7)
Other or unknown mechanism — no. (%)	113 (10)	1,350 (9)	2,653 (10)	4,116 (9)

* Traumatic brain injury as seen on computed tomography (CT) was defined as intracranial hemorrhage or contusion, cerebral edema, traumatic infarction, diffuse axonal injury, shearing injury, sigmoid sinus thrombosis, midline shift or sign of brain herniation, diastasis of the skull, pneumocephalus, and skull fracture with depression by at least the width of the skull. Percentages may not total 100 because of rounding and missing data.

Cranial computed tomography (CT) was performed in 15,908 of the 43,399 children (37%), including 32% of those under the age of 2 years, 32% of those between the ages of 2 and 12 years, and 53% of those between the ages of 13 and 17 years. Traumatic brain injuries were identified in 1157 (7%) children who underwent CT, and an additional 500 (3%) had skull fractures without intracranial findings. Of all the children who were evaluated, 78 (0.2%) died.

The rate of traumatic brain injury as seen on CT was 5% for children with mild injuries, 27% for those with moderate injuries, and 65% for those with severe injuries. Overall, subdural hematoma was the most common injury, followed by subarachnoid hemorrhage and cerebral contusion, with great variability according to age and GCS score (Tables S3 and S4 and Fig. S2, S3, and S4 in the Supplementary Appendix). Nearly half of children with traumatic brain injuries on CT had more than one type of brain injury.

Neurosurgical procedures were performed in 200 children (0.5%), representing 17% of those with traumatic brain injuries identified on CT; 43% of these children underwent more than one procedure. Types of neurosurgical procedures, stratified according to age and GCS score, varied greatly (Tables S5 and S6 in the Supplementary Appendix).

This prospective, multicenter study provides more detailed and representative clinical and radiographic information about the spectrum of traumatic brain injuries in children than is available in previous studies of administrative databases or from single institutions.[3-5] Our findings may be useful in the development of future injury-prevention measures and age-stratified targeted interventions, such as campaigns to promote the use of bicycle helmets and automobile restraints.

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