Injuries to the head and face in 0-4-year-old child victims of fatal external causes in Campina Grande, PB, Brazil

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SUMMARY: Cavalcanti AL, Barros de Alencar CR. Injuries to the head and face in 0-4-year-old child victims of fatal external causes in Campina Grande, PB, Brazil. Turk J Pediatr 2010; 52: 612-617.

We evaluated the presence of injuries to the head and face in Brazilian 0-4-year-old child victims of fatal external causes by analyzing forensic medical reports derived from all autopsies performed in 0-4-year-old children at the Department of Forensic Medicine of the city of Campina Grande, PB, Brazil, between January 2003 and December 2007. The study sample consisted of 81 reports (1.8%) referring to children who were confirmed to have died from external causes. Most victims were males (56.8%) and 1 year of age (27.2%). Drowning (34.6%) and motor vehicle accidents (22.2%) were the most common causes of death. Injuries to the head and to the face were found in 33.3% and 34.6% of the victims, respectively. There was a strong association between the occurrence of motor vehicle accidents and the presence of injuries to the head ($p<0.01$; odds ratio [OR]=21.25 [5.29-85.31]) and to the face ($p<0.01$; OR=19.23 [4.83-76.56]). There was also an association between the existence of injuries to the head and presence of maxillofacial injuries ($p<0.01$; OR=5.09 [1.87-13.84]). Drowning and motor vehicle accidents were the main causes of death in children aged 0 to 4 years. Parents should adopt measures to make the home environment safer and prevent fatal accidents by limiting their children's access to pools and cisterns. Reduction in child mortality from motor vehicle accidents involves parental vigilance in the road traffic environment and home education on driveway safety.

Key words: infant, mortality, facial injuries, epidemiology.

Accidental deaths in children represent a considerable health burden and are a global cause of concern[1]. Mortality rates in infancy and childhood serve as good indicators of the population's well-being[2]. Mortality and morbidity data on childhood injury are used to construct developmentally appropriate intervention strategies and to guide pediatric anticipatory counseling on injury-prevention topics[3]. Children aged 4 years or younger have been reported to have the highest death rate, being 50-100% higher than for other age groups[4]. Previous studies revealed differences in overall rates and specific causes of injury by year of age[2,3,5-8].

Suffocation, drowning, falls, and motor vehicle accidents are the most common causes among the under 4-year-olds. Victims of motor vehicle accidents may suffer multiple injuries including maxillofacial injuries[9,10], the most common injuries being to the head and extremities[11]. Many children are unrestrained in cars at the moment of a crash, which increases significantly the risk for serious injuries or death. Sitting in the rear seat and using an age-appropriate restraint device significantly and independently decrease the risk of severe or fatal injuries to children involved in serious automobile crashes[12].

Few studies have addressed the incidence of mortality among the total population of young children[1,2,6,8,13,14]. The purpose of the present study was to evaluate the presence of injuries to the head and face in Brazilian 0-4-year-old child victims of fatal external causes.

Table I. Distribution of Victims According to Gender and Age (Years)

	Age					
Gender	<1 yr n (%)	1 yr n (%)	2 yr n (%)	3 yr n (%)	4 yr n (%)	Total n (%)
Male	8 (17.4)	15 (15.2)	8 (17.4)	8 (17.4)	7 (15.2)	46 (56.8)
Female	4 (11.4)	7 (20.0)	7 (20.0)	12 (34.3)	5 (14.3)	35 (43.2)
Total	12 (14.8)	22 (27.2)	15 (18.5)	20 (14.8)	12 (14.8)	81 (100.0)

Material and Methods

This study was conducted in compliance with the ethical guidelines issued by Resolution 196/96 of the Brazilian National Health Council/Ministry of Health on research involving human subjects. The research project was independently reviewed and approved by the Research Ethics Committee of the State University of Paraíba, Brazil.

A retrospective study design was undertaken by the analysis of forensic medical reports derived from all autopsies performed in 0-4-year-old children at the Department of Forensic Medicine of the city of Campina Grande, PB, Brazil, between January 2003 and December 2007. From a universe of 4,430 reports issued in this time span, the study sample consisted of 81 reports (1.8%) referring to children who were confirmed to have died from external causes. The cause of death was encoded according to the International Classification of Disease - 10th Revision (ICD-10)[15]. According to the Brazilian legislation, all deaths from external causes and cases of sudden or suspicious death are autopsied at the Bureaus of Forensic Medicine.

Data referring to the victims' gender, age, date of death, time of death, cause of death, number of existing injuries, injured region of the body, and presence of maxillofacial injuries were obtained from the forensic medical reports and transferred to registration forms. The circumstances around the death were examined by review of the police reports that accompanied the forensic medical reports[2].

All statistical analyses were performed using the Epi Info 2007 software (Centers for Disease Control and Prevention, Atlanta, GA, USA). The absolute and percent frequencies were obtained for descriptive data analysis. Comparisons of data were analyzed statistically using the Fisher's exact test at a significance level of 5% ($p<0.05$). Odds ratios (OR) with confidence intervals to 95% were calculated (95%CI).

Results

There was a 1.3:1 male-to-female ratio, with a sample of 46 boys (56.8%) and 35 girls (43.2%). Twelve children (14.8%) were under 1 year of age, 22 (27.2%) were 1 year old, 15 (18.5%) were 2 years old, 20 (24.7%) were 3 years old, and 12 (14.8%) were 4 years old (Table I).

Review of the time of deaths showed that most cases occurred in the afternoon (n=32; 39.5%), 22 (27.2%) occurred in the morning, 10 (12.3%) at night, and 6 (7.4%) at dawn. No information about the time of death could be found in 11 (13.6%) forensic medical reports. Thirty-seven percent of the fatal injuries occurred during the weekend (Saturday or Sunday).

Table II lists the causes of deaths by age. The leading major causes of injury were drowning (34.6%) followed by road motor vehicle accidents (22.2%), and falls and firearms (10.2% each). Age-related differences were detected within each major cause of injury. Intent of death was unknown for more than 16% of injury deaths.

Regarding the motor vehicle accidents, 11 children (61.1%) were pedestrians, 6 (33.3%) were passengers in the motor vehicles involved in the accident, and 1 (5.6%) died in a motorcycle accident. In all 6 cases of children who were passengers, it was not possible to identify whether they were restrained or unrestrained at the moment of crash. For 13 deaths (16% of all injury deaths), the circumstances of death were undetermined.

The forensic medical reports revealed that 46.9% of the children did not present any body injury, 13.6% presented single injuries and 39.5% presented multiple injuries. There

Table II. Distribution of Victims According to the Cause of Death and Age (Years)

Cause of Death	Age										Total	
	<1 yr		1 yr		2 yr		3 yr		4 yr			
	n	%	n	%	n	%	n	%	n	%	n	%
Drowning	0	0.0	8	28.6	7	25.0	8	28.6	5	17.8	28	34.6
Motor vehicle accident	1	5.6	4	22.2	4	22.2	7	38.9	2	11.1	18	22.2
Fall	1	20.0	2	40.0	2	40.0	0	0.0	0	0.0	5	6.2
Firearm	0	0.0	0	0.0	0	0.0	3	60.0	2	40.0	5	6.2
Poisoning	0	0.0	1	50.0	1	50.0	0	0.0	0	0.0	2	2.5
Burn	0	0.0	2	66.7	0	0.0	1	33.3	0	0.0	3	3.7
Electricity	0	0.0	1	100.0	0	0.0	0	0.0	0	0.0	1	1.2
Other	2	33.3	2	33.3	1	16.7	0	0.0	1	16.7	6	7.4
Undetermined	8	61.5	2	15.4	0	0.0	1	7.7	2	15.4	13	16.0
Total	12	14.8	22	27.2	15	18.5	20	24.7	12	14.8	81	100.0

was a statistically significant difference between genders regarding the number of injuries ($p<0.01$).

Injuries to the head and face were found in 33.3% and 34.6% of the victims, respectively, with no statistically significant difference between the genders regarding the presence of injuries in these regions ($p>0.05$) (Table III). When the cause of death was associated with the existence of injuries to the head and face, a strong association was observed only for motor vehicle accidents ($p<0.01$) (Table IV). Child victims of motor vehicle accidents presented 21-fold and 19-fold greater chance of suffering injuries to the head and to the face, respectively.

A statistically significant difference ($p<0.01$) was found when the number of injuries (single or multiple) was associated with the existence of maxillofacial injuries. There was a strong association between the presence of injuries to the head and the presence of maxillofacial injuries ($p<0.01$; OR=5.09 [1.87-13.84]). Among the 28 victims with maxillofacial injuries, 89.3% (n=25) presented soft tissue lacerations and 10.7% (n=3) presented bone fractures. The injured facial bones were the nasal, zygomatic and orbital bones and the mandible. Among the 5 children with oral injuries (6.2%), 4 presented only soft tissue lacerations and 1 child presented tooth fractures.

Discussion

Injury is the most common cause of death among children and adolescents in Europe and is a major public health problem worldwide[16]. Most injury deaths are preventable. Therefore, detailed information on the occurrence and circumstances surrounding particular types of injury needs to be collected and analyzed if effective interventions are to be developed[17].

In the present study, boys were recognized as a more vulnerable group, and drowning and motor vehicle accident were the causes of the majority of the deaths, which is consistent with causes of death reported in previous studies[6,13,14].

Table III. Distribution of Victims According to the Presence of Injuries to the Head and Face and Gender

Injured region	Male		Female		Total		p value
	n	%	n	%	n	%	
Head							
Yes	13	28.3	14	40.0	27	33.3	0.38
No	33	71.7	21	60	54	66.7	
Face							
Yes	12	26.1	16	45.7	28	34.6	0.10
No	34	73.9	19	54.3	53	65.4	

Table IV. Distribution of Victims According to the Presence of Injuries to the Head and Face and Children's Involvement in Motor Vehicle Accident

	Motor vehicle accident		Other external causes		OR (95%CI)	p value
	n	%	n	%		
Head					1	
Yes	15	55.6	3	5.7	21.25 (5.29-85.31)	0.01
No	12	44.4	51	94.3		
Face					1	0.01
Yes	15	53.6	3	5.7	19.23 (4.83-76.56)	
No	13	46.4	51	94.3		

OR: Odds ratio. CI: Confidence interval.

Children aged 1-3 years are at a high risk of death from drowning[2], which is an important cause of mortality among children in the city of Campina Grande, where the present study was conducted. Some interventions are recommended to reduce the number of fatal drowning episodes, which include: (a) increasing awareness among parents and close family members about the risk of drowning, (b) installation of door-fencing and (c) filling of unused ditches and covering of cisterns around households[18].

Motor vehicle accidents were the second most common cause of death among children aged 0 to 4 years, which is in agreement with the findings of injury mortality in this age group in different countries like Estonia[2], India[13] and the United Arab Emirates[19]. Motor vehicle accidents were found to be the most common cause of injury deaths among children in Canada, followed by suffocation and drowning[8].

In the present study, "run over" was the main cause of death in the category of motor vehicle accidents, and most cases occurred with unsupervised children. Never allowing young children outside unsupervised on the pavement or road and walking between them and the traffic are simple but frequently overlooked rules. Parental vigilance of children in the traffic and home education on driveway safety should always be reinforced. Children are impulsive and have difficulty judging speed, spatial relations, distance, and velocity, so drivers should constantly scan roadways for children who may be running across the street, particularly around schools and in residential areas.

Although it was not possible to determine whether the children involved in the six fatal car accidents as passengers were restrained or unrestrained at the moment of crash, the severity and extent of the injuries described in the forensic medical reports lead us to assume that they were not securely accommodated in the rear seat. Properly fastened and adjusted child restraints may also reduce non-crash injuries to child passengers by preventing falls both within and out of the vehicle. The Brazilian road traffic legislation specifies a requirement that child restraint seats be used for all children under the age of four.

The results showed that one child died due to a motorcycle accident. The transportation of young children on motorcycles is a common practice in small- and medium-sized Brazilian cities, such as Campina Grande, where the present study was conducted, because this is the main means of transportation among the low socioeconomic status population. However, the Brazilian traffic road legislation classifies the transportation of children under the age of seven on motorcycles as an extremely serious violation, liable to penalties and driver's license suspension.

Only 6.2% of all infant deaths were due to homicide. Infant homicide is particularly disturbing because the perpetrator is often the infant's parent[20]. The information on intentional deaths in infancy is scarce[2]. This study also showed a high incidence of deaths with undetermined causes, especially in infants. In some cases, the corpses are found in an advanced stage of decomposition, which makes it difficult for the forensic medical expert to establish the cause of death. Often, forensic

pathologists do not attend the examination of the scene of death, and their conclusions about the intent of death are based only on the autopsy findings[2]. Determining the intent of death is especially difficult in children under one year of age, which may lead to considerable underestimation of infant homicide.

Demographic variables and environmental factors, both independently and jointly, are critical in the examination of child injury mortality. For children, the types of injuries sustained often relate to developmental stage and the environment in which they live[14].

Head injuries are the most common cause of injury-related mortality and morbidity[21]. The results obtained in this study revealed that injuries to the head and face were found in more than one-third of the victims, though without statistically significant difference between genders regarding the presence of injuries in these regions of the body. Injuries to the maxillofacial complex represent one of the most important health problems worldwide. Previous reports identified motor vehicle accidents as the most common cause of maxillofacial trauma[22,23]. As clearly demonstrated by our data, motor vehicle accidents were the most prevalent cause of facial injuries in this study, with association between the occurrence of motor vehicle accidents and injuries to the head and face ($p<0.01$). The findings of the present study showed that child victims of motor vehicle accidents presented a 21-fold greater chance of suffering injuries to the head and 19-fold greater chance of suffering injuries to the face

Another important finding of the present study was that children with injuries to the head have a five times greater chance of sustaining maxillofacial injuries. Almost all victims with maxillofacial injuries presented soft tissue lacerations. Among the children with facial fractures, the affected bones were the nasal, zygomatic and orbital bones and the mandible. According to Cavalcanti and Melo[10], nasal fractures and fractures of the zygomatic-orbital complex are the most common types in children that sustain maxillofacial trauma.

There is ample evidence that the correct use of seat belts and child restraints in motor vehicles reduces the risk of death in the event of a crash. In order to minimize child fatality risk, parents should seat children in the rear of the vehicle while using the proper child restraint system, especially in vehicles with passenger airbags[24]. Seating position in the vehicle during a crash also contributes to the risk of injury, and the location of impact relative to the occupant's seating position is an important factor[12].

This study revealed a high frequency of injuries to the head and face in children in the 0-4-year-old age range who are fatal victims of motor vehicle accidents. It clearly demonstrates that driver and pedestrian compliance with traffic laws and regulations must be accompanied by the promotion of traffic safety educational campaigns and an additional effort by traffic and health authorities to properly inform the population in order to reduce the number of fatal victims in accidents.

In conclusion, drowning and motor vehicle accidents were the main causes of death of children aged 0 to 4 years. These findings show the importance of parents adopting measures to make the home environment safer and prevent fatal accidents by limiting their children's access to pools and cisterns. Reduction of children's mortality from motor vehicle accidents involves parental vigilance in the road traffic environment and home education on driveway safety. Never allowing young children out on roads unsupervised, walking between them and the traffic, and maintaining a tight hold on their hands are simple but frequently overlooked rules. Prevention of road traffic casualties in this age range also involves strictly following safety policies for transportation of infants and children in motor vehicles with the use of adequate, certified and correctly installed child restraints like baby seats, child seats, booster seats, or booster cushions.

Acknowledgements

The authors would like to acknowledge the Paraiba State Research Foundation (FAPESQ) for financial support (Grant #073.2007).

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