Falling out of Bed: A Relatively Benign Occurrence

Thomas J. Lyons and R. Kim Oates, MD, MHP, FRACMA, FRCP, FRACP, FAFPHM, DCH

ABSTRACT. *Objective.* **To determine the likelihood of injuries occurring to infants and children who fall out of bed.**

Methods. **A review of hospital records where children were documented to have fallen from a crib or bed and where the children were immediately assessed and examined following the fall.**

Patients. **Two hundred seven children younger than 6 years of age. One hundred twenty-four falls were from cribs and 83 from beds. The heights of the falls were 25 inches from beds or 41 inches when the child climbed over the bed rails and then fell, and 32 inches from cribs or 54 inches for those who fell after climbing the crib rails.**

Results. **There were 29 superficial injuries such as contusions or minor lacerations. One simple skull fracture was noted incidentally on skull roentgenogram and there was one fractured clavicle. There were no serious, multiple, visceral, or life-threatening injuries. Calculation of the momentum of impact between the injured and noninjured showed no significant difference.**

Conclusions. **Because falls from short distances are unlikely to produce serious injury, the reliability of the history should be questioned when a child has significant injuries said to have resulted from a short fall.** *Pediatrics* **1993;92:125–127;** ***injury, head injury, falls.***

Sometimes when a child is brought for medical attention and is found to have a significant injury such as a subdural hematoma, skull fracture, or broken limb, the individual providing the history states that the injury occurred when the child fell out of bed or from a piece of furniture. How likely is it that a fall from a relatively low object, such as a bed, could cause such an injury?

Studies of injuries to children from falls can be put into three groups: (1) those in which the incident is reported by a parent or caretaker but not corroborated by any other person, (2) those in which the incident is corroborated by another person, and (3) comparisons of injuries from corroborated and noncorroborated falls.

In group one, a review of 61 children[1] who had fallen from a height of three stories or less found no deaths. A review of 68 children who were taken to the hospital after falling from a bunk bed[2] found that only 8 had fallen from the bottom bunk and that none of these had injuries serious enough to warrant hospital admission. Six children who fell from the top bunk required hospital admission—4 with concussion, 1 with a skull fracture and subdural hematoma, and 1 with a laceration. In contrast, a review of autopsy records of children who died after falls[3] found that 18 of the 44 deaths were said to be from falls of less than 3 feet. This paper was subsequently criticized[4,5] because of lack of adequate clinical information to exclude the possibility that the children may have suffered inflicted injuries. Chadwick et al[6] found that of 118 children who were taken to a children's trauma center following a fall of between 10 and 45 feet, there was only one death. By contrast, there were seven deaths among 100 children reported to have fallen less than 4 feet. They concluded that the most likely explanation for the much higher mortality in falls from the shorter distance was that the histories in these cases were false.

In the second group with corroborated reports, Nimityongskul and Anderson[7] reviewed 76 falls of children 16 years or younger which occurred while the children were patients in a hospital. There was only one child with a questionable skull fracture and a second child with osteogenesis imperfecta who had a nondisplaced tibial fracture.

Comparing corroborated falls with noncorroborated falls, Helfer et al[8] reviewed the histories of 246 children 5 years or younger who fell out of bed. One hundred sixty-one were brought to a pediatrician by their parents after the fall, and 85 fell in the hospital. The self-report group had six fractures, an incidence of 3.7%, while in the hospital group there was one fracture, an incidence of 1.2%. There were no serious head injuries in this series. A study of 106 falls from a variety of heights[9] which were witnessed by a person other than the child's caretaker found three serious, but not life-threatening, injuries in those children who fell less than 10 feet. These three injuries were small, depressed skull fractures from falling against edged surfaces. There was no loss of consciousness in these cases. This contrasted with 53 children whose falls were not independently witnessed, where there were two deaths in falls said to be from less than 5 feet.

While these studies have provided valuable information, with some of them suggesting the need to investigate very carefully any serious injuries said to have been caused by a short fall, some are biased in that they comprise patients brought to trauma services because of an injury while in others the number of corroborated cases, especially in younger children, is small. For these reasons we studied a large number of children aged 5 years or younger who fell from

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From the Sydney University Department of Paediatrics and Child Health, The Children's Hospital, Camperdown, Australia.
Reprint requests to (R.K.O.) Dept of Paediatrics and Child Health, The Children's Hospital, Camperdown NSW 2050, Australia.

bed while in the hospital to determine the likelihood of significant injury.

METHODS

Despite close observation it is inevitable that a small proportion of children admitted to a hospital will fall out of bed. When such an incident occurs at the Camperdown Children's Hospital, the child is promptly assessed by nursing staff and one of the house medical staff is immediately called to fully assess the child and decide whether any investigations are needed. An incident form is completed in triplicate—one copy for the medical records, another for nursing administration, and one filed centrally for auditing. All reports and medical records between January 1983 and August 1992 were reviewed. Children older than 6 years of age and those admitted to the hospital because of head injuries were excluded. From the estimated height of the fall and the weight of the child, the momentum on impact was calculated in each case using the equation $N = Mv$, where N is the momentum in newtons, M = the mass in kilograms, and v = the velocity in meters per second (ms^{-1}). Using $v^2 = u^2 + 2AS$ where u is the initial velocity, A = acceleration, and S = the height of the fall, and assuming $U = 0$ and $A = 10\ ms^{-2}$, the simplified equation for momentum is $N = 2M\ (5S)^{0.5}$. The momentum on impact for children who were injured was compared with the momentum of the noninjured group.

RESULTS

There were 235 documented falls from bed among children 6 years or younger. Two hundred seven records contained adequate data for review. There was a predominance of boys in all age groups (Table 1). Falls occurred most frequently in the 1- to 2-year age group.

In the hospital children younger than 36 months sleep in cribs and older children sleep in beds. Cribs are 32 inches high with the sides down and 54 inches with the sides up. As the beds have adjustable heights, 30 occupied beds in five wards were measured for height and averaged 25 inches. This figure was used for the bed height with an additional 16 inches added for children who climbed over the bed rails and then fell. There were 124 falls from cribs. In 15% of these cases, the child had climbed over the crib rails, falling 4½ feet. Eighty-three children fell from their beds, with 18% of these children having climbed over the bed rails, a distance of 3 feet, 5 inches. In all cases the fall was either witnessed by a member of the nursing staff or the child was seen by a nurse within seconds of the fall.

There were 31 injuries. These consisted of 29 trivial injuries such as contusions or small lacerations that required no sutures. The remaining two injuries were a fractured clavicle and a fractured skull. In no child was loss of consciousness reported, although three children were described as being drowsy immediately after the fall. Two of these children had recently received presurgery medication. The third recovered within an hour. The injuries sustained in the different age groups and the site of impact are shown in Table 2. Twenty-six (84%) of the injuries were to the head. In nine of these cases, a skull roentgenogram was done.

The fractured clavicle occurred in a 21-month-old child who climbed over the crib rails and landed on his shoulder. The skull fracture occurred in a 10-month-old child who fell from his crib. This child had no contusions and no neurological signs, although a simple, linear fracture was noted on the roentgenogram.

Seven of the nine lacerations involved the face, either the lips or supraorbital ridge. The other two were to the legs, one child landing on her knees and the other scraping his leg on the crib rails while falling. No falls produced more than one injury and there were no visceral injuries.

Table 3 shows the mean momentum on impact in each age group for the noninjured children compared with the mean momentum on impact for the injured group. It shows no significant difference in the mean momentum between the injured and the noninjured children in any of the age groups. The momentum on impact of the child with the skull fracture was 39 N, and the momentum of the child with the fractured clavicle, who fell after climbing the cot rails, was 103 N.

DISCUSSION

This series of 203 independently documented falls from bed, while substantially larger than other series of 76[7] and 85,[8] also demonstrates that such falls are relatively benign. Only 15% of children showed any visible evidence of trauma. There were two minor fractures, no multiple or visceral injuries, and no life-threatening or serious injuries. Hospital beds are somewhat higher than the beds used in most homes, which average 19 to 20 inches, and the floors of the hospital wards were covered in hard vinyl, compared with carpet, which has been shown to have a protective effect,[2] found in many home bedrooms. Only one child sustained a clinically significant injury, a fractured clavicle. The force he generated on impact was more than five times his body weight. Children landing on their heads from a similar height sustained only minor injuries.

Although most injuries were to the head, none were serious. Severe head injuries are more likely to occur when the brain moves within the skull during impact, tearing the subdural bridging veins and causing bleeding. Such injuries usually occur when there is angular or rotational acceleration of the head.[10] Most falls from short distances produce mainly a translational (linear) force to the head[11]

TABLE 1. Age and Sex of 207 Children Who Fell out of Bed*

	Age, Months					
	<12	12–23	24–35	36–47	48–59	60–71
Male	19	37	26	19	20	10
Female	14	11	17	10	15	9
Total	33	48	43	29	35	19

* Values represent numbers of children.

TABLE 2. Injuries at Different Ages and Site of Impact*

	Age, Months					
	<12	12–23	24–35	36–47	48–59	60–71
Contusion	3	5	5	2	4	1
Laceration	0	1	2	3	3	0
Fracture	1	1	0	0	0	0
Impact site						
Head	4	6	5	4	7	0
Other	0	1	2	1	0	1

* Values represent numbers.

TABLE 3. Momentum of Impact of Children Who Were Injured Compared with Those Who Were Not Injured*

	Age, Months					
	<12	12–23	24–35	36–47	48–59	60–71
Mean momentum of children with no injury	36	49	60	62	71	78
Mean momentum of injured children	41	48	70	51	72	46
Significance (*P*)	.57	.8	.15	.053	.9	.28

* Momentum is given in newtons.

which may cause simple fractures but is only of clinical significance when an epidural hematoma is produced.[10]

In contrast to the simple linear fracture, which may occur from a short-distance fall, a comparison by Hobbs[12] of skull fractures caused by child abuse with skull fractures caused unintentionally showed that fractures in abused children were more likely to be multiple or complex, to have associated intracranial injury, to be wide, and to involve more than one cranial bone.

In this series, presumably due to the relatively short distances fallen, there was no significant difference between the momentum on impact of the injured and the noninjured children. The height of the fall and the momentum of the impact are just two factors in a complex event. Whether the full force of the impact is received on a relatively small area or distributed over a greater area may influence the occurrence of an injury. The surface of impact can also play a significant role, with falls onto concrete and asphalt being more likely to produce serious injury than falls onto a mat or packed earth.[13]

What is clear from this and other studies is that falls from short heights do not produce multiple or visceral injuries and that clinically significant injuries are uncommon. It follows that when children who are said to have had minor falls are found to have life-threatening, multiple, or severe injuries, the reliability of the history should be seriously questioned.

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SOUND FAMILIAR?

I asked if [the French] government had any plans to ban [vasodilator] drugs, considering the lack of proof of their efficacy. "No," was the reply, "We're not certain that they *don't* work."

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Submitted by Student