Accidents in Childhood

Review of Cases in the Emergency Room and Hospitalized Cases

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Accident mortality in childhood is a big problem not only in Japan but also in many other countries. We have reviewed our experience of 4,502 patients below 18 years of age who visited our emergency room in the fiscal year 1990. The number of cases of accidents other than traffic accidents was 243 and was almost double the 131 children involved in traffic accidents. Children with ordinary injuries (trauma) were excluded from accident patients.

The most common non-traffic accident in childhood was foreign body ingestion or inhalation. The gastrointestinal tract was the most common site of foreign body ingestion or inhalation.

Forty-two children with bronchial foreign bodies and 38 cases of near-drowning who were admitted to our hospital from 1975 to 1991 were also studies.

Among the bronchial foreign bodies, we had a high rate of peanut inhalation. Foods the included peanuts accounted for more than 80% of the bronchial foreign bodies.

Among the 38 near-drowning cases, we had five fatal cases, three cases with severe neurological sequelae and 30 intact survivors. Bathtubs at home were the most common site of near-drowning, particularly for young children.

(Key Words: Childhood accidents, Bronchial foreign bodies, Drowning)

INTRODUCTION

Recent advances in medical science and the improvement of socioeconomic conditions have brought about remarkable changes in health problems in Japan. Tuberculosis, which showed the highest mortality rate 40 years ago, underwent a marked decline thereafter and disappeared from the top ten causes of death in the latter half of the 1970s. Gastroenteritis, the fifth rank in 1950, disappeared earlier from the top ten in the latter half of the 1960s. Among other infectious diseases, only pneumonia and bronchitis remained in the top ten at 4th place in 1990 (11).

The three diseases with the highest mortality rates in Japan at present are malignant neoplasms, cardiac diseases and cerebrovascular diseases. Although the actual number of deaths due to accidents such as suffocation, drowning and traffic accidents has not changed significantly, decreases in deaths due to infectious diseases have raised accidents to the 5th place in the top ten causes of death (11).

Deaths from accidents in children

Deaths from accidents are particularly important in children. Almost one-fifth of pediatric deaths in due to accidents. As shown in Fig. 1, accidents rank 5th in causes of death in the total population, but in pediatric age groups, from 1 to 4, 5 to 9 and 10 to 14 years of age, accidents are the No. 1 cause of death. Even in infants below one year of age, accidents were in the 3rd rank, next to congenital anomalies and difficult deliveries or birth injuries. The
mortality rate of accidents in infants is higher than that of total population (31.8 to 25.4 per 100,000 of the population). Since the infant mortality rate has significantly decreased in recent years due to the decline in severe gastroenteritis and respiratory infections, prevention of deaths from accidents has become the main concern in the field of child health together with the early detection of malignant neoplasms.

Characteristics of deaths from accidents in different age groups

(a) Infancy: The majority of deaths from accidents in infancy, 72% was caused by suffocation in 1988. Mechanical obstruction of the airways results from aspiration, and accidental covering of the infant's nose and mouth by a blanket or a soft mattress or the mother's breast. The so-called sudden infant death syndrome (SIDS) may have been included in the reported deaths from suffocation in this group.

(b) One to 4 years of age: Drowning accounts for 42% of total accidental deaths and is ranked as the top cause in this age group, followed closely by traffic accidents. Even though almost one half of the deaths from drowning in the whole Japanese population happened in the sea according to the official police report in 1990, the majority of drownings or near-drownings in this age group happen at home. Modern types of bathtubs in Japanese homes are potential hazards for younger children once they start to creep around.

In the case of traffic accidents, most fatal cases in this age group are pedestrians.

(c) Five to 9 years of age: Drowning decreased in this age group and traffic accidents replaced drowning as the No. 1 cause of death from accidents. Deaths from traffic accidents made up more than 50% of total accident mortality in this age group. Until the second grade in primary school (8 or 9 years of age), deaths as pedestrians were more common than deaths while riding bicycles or tricycles. However, from the third grade, percentages of bicycle riding deaths increased as the age increased.

(d) Ten to 14 years of age: As in the previous age group, deaths from traffic accidents took the first place and those from drowning came next. Deaths from traffic accidents again accounted for more than half of total accident mortality.

Deaths from drowning showed a slight decrease in percentage in comparison with other pediatric age groups but were still at a higher percentage than in the total population.
Pediatric accident patients in the emergency room in 1990

In fiscal 1990, 4,502 children below 18 years of age visited the emergency section of Tokai University Hospital, which was close to 50% of the total patients, and 243 (5.4%) of these cases were non-traffic accident patients. Other reasons for emergency visits were illness in 3,021 cases (67.1%), trauma in 1,076 cases (23.9%), traffic accidents in 131 cases (2.9%) and others in 30 cases (0.6%) as shown in Fig. 2.

(a) Foreign bodies

The most common cause of accidents in these children was foreign bodies. Foreign bodies were found in various parts of the bodies of children. As shown in Fig. 3, 80 foreign bodies were present in the gastrointestinal tract, 29 in the nasal cavities, 18 in the ears, three in the lower respiratory tract, three on the cornea and one beneath a nail. Among them, only one case of a bronchial foreign body required hospitalization.

Common articles found as foreign bodies in children's digestive tracts were cigarette butts in 23 cases, fish bones in 18 cases and coins or medals in eight cases. Ingestion of cigarette butts was limited to infants or very young children. The age range of these children was from 7 months to one year and 4 months with an average of 10 months. Therefore, smoking parents with very young children should be much more careful with ashtrays. Coins or medals were usually swallowed by older children (ranging from one year to 5 years and 4 months with an average of 3 years and 11 months). Button type batteries were swallowed by 4 children from 9 months to one year and 5 months of age. Fish bones as upper digestive tract foreign bodies are noticed in all age groups. The youngest case of fish bone ingestion in this study was one year and 4 months old and the average age was 7 years and 2 months.

Drugs and household chemicals were also frequently ingested accidentally by children. These items should be stored out of children's reach.

Although they do not usually have a serious outcome, the incidence of nasal foreign bodies is not low in children. Toys such as plastic bullets, marbles, peas or nuts are frequently encountered. There were 16 girls and 13 boys in this group. Their age range was from 2 years and 1 month to 5 years and 9 months with an average of 3 years and 3 months.

In case of foreign bodies in the ears, the average age was 7 years, which was much higher than that for nasal foreign bodies. There were 14 boys and 4 girls in this group. The most common articles found in children's ears were plastic bullets in 11 children. Insects were found in three children, who were older than those with foreign bodies in other sites, with an average age of 9 years and 9 months.

Traffic accidents 2.9%
Accidents 5.4%
non-patho 0.6%

Fig. 2 Emergency Patients (0 to 17 yrs.)
(b) Burns
The second most common accident, burns, were found in 50 children. In addition to ordinary hot water, kettles, bathtubs and stoves or other heaters, seven cases were caused by firecrackers and three cases by spray can explosions. Burns from firecracker accidents are important because they are frequently accompanied by burns of the cornea and/or cornea foreign bodies. Throwing gas containing cans such as hair-spray into flames is also dangerous.

Pediatric patients hospitalized after accidents from 1975 to 1991

(a) Foreign bodies in the respiratory tract
Almost all tracheal or bronchial foreign bodies happen after reflex inhalation of the article in the oral cavity. Therefore, the majority of articles inhaled are foodstuffs. Since the region in which our hospital is located is famous for the production of peanuts, more than half of hospitalized cases in the pediatric ward of Tokai University Hospital during 1975 and 1991, 22 out of 42, were due to inhalation of peanuts as shown in Fig. 4.

Inhaled peanuts are difficult to extract because they are easily broken. They can be chemical stimulating factors and result in development of pneumonia or pyothorax in some cases. Therefore the duration of hospitalization tends to be longer in cases of peanut inhalation than for inhalation of other articles as shown in Table 1.

We had only one fatality out of 42 cases. This girl, 2 years and 3 months old at the time of the accident, was fed a muscat grape. The skin of the grape became a bronchial foreign body, and she developed anoxic encephalopathy and died after about 6 years' hospitalization.
(b) Drowning or near-drowning
In total, 38 children have been hospitalized for near-drowning in Tokai University Hospital. The most characteristic finding is that more than two-thirds of near-drowning, 25 cases, happened in bathtubs at home as shown in Fig. 5.

Among the other 13 cases, the sites of near-drowning were swimming pools in five cases, in the sea in three, in drains in two, in a well, a pond and a river in one case each.

Near-drowning in bathtubs happened almost evenly throughout the year, while near-drowning in the sea was concentrated in the summer. Cases in swimming pools and other site showed no particular seasonal tendency.

Most children, 23 out of 25, hospitalized for near-drowning in bathtubs were below two years of age, ranging from 9 months to one year and 11 months. The average age of these 23 cases was one year and three months. One of two exceptional cases was a 9 year-5 month-old boy with epilepsy and the other was a 2 year-7 month-old boy with Prader-Willi syndrome. The average age of all 25 cases was still as low as one year and 7 months, showing a sharp contrast with 8 years and 5 months for the sea group, 4 years and 9 months for the swimming pool group and, 3 years and 2 months for the
Table 1. Age and Duration of Hospitalization in Children with Bronchial Foreign Bodies (1975 to 1991)

<table>
<thead>
<tr>
<th>Inhaled articles</th>
<th>Age (average)</th>
<th>Duration (average days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peanuts</td>
<td>1 yr. 11 mo.</td>
<td>16.7</td>
</tr>
<tr>
<td>Other Foodstuffs</td>
<td>1 yr. 10 mo.</td>
<td>8.0*</td>
</tr>
<tr>
<td>Others</td>
<td>3 yr. 2 mo.</td>
<td>9.3</td>
</tr>
<tr>
<td>Total</td>
<td>2 yr. 1 mo.</td>
<td>12.9*</td>
</tr>
</tbody>
</table>

*Excluding one fatal case who died from anoxic encephalopathy after 2,194 days' hospitalization.

<table>
<thead>
<tr>
<th>Age</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bathtubs (25 cases)</td>
<td>♣</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Swimming Pools (5 cases)</td>
<td></td>
<td>♣</td>
<td>♣</td>
<td>♣</td>
<td>♣</td>
<td>♣</td>
<td>♣</td>
<td>♣</td>
<td></td>
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<tr>
<td>Seaside (5 cases)</td>
<td></td>
<td></td>
<td>♣</td>
<td>♣</td>
<td>♣</td>
<td>♣</td>
<td>♣</td>
<td>♣</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Other Sites (5 cases)</td>
<td></td>
<td></td>
<td></td>
<td>♣</td>
<td>♣</td>
<td>♣</td>
<td>♣</td>
<td>♣</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

(1) Prader-Willi Syndrome (2) Epilepsy (3) Suicide attempt by the mother

Fig. 5. AGE & SITES OF NEAR-DROWNING IN CHILDHOOD (Hospitalized Cases from 1975 to 1991)

other site group.

Five cases or 13.8% of total admission died from anoxic encephalopathy and other complications after hospitalization. The duration of hospitalization ranged from 2 days to 1,034 days. Four of the 25 bathtub cases (16.0%) died after hospitalization. The boy with Prader-Willi syndrome is included in this group. The average age at the time of the accidents was one year and four months. The other fatal case was a 7 year-4 month-old boy who was found drowned in a drain. He died only two days after hospitalization. We had no fatal cases among the swimming pool or sea groups. The reason why we had only three cases of near-drowning in the sea may be the location of our hospital, which is approximately 12 kilometers north of Sagami Bay. Therefore, the majority of near-drowning patients in Sagami Bay might have been brought to hospitals nearby.

Severe sequelae of anoxic encephalopathy were noticed in three cases in addition to the fatal cases. Two cases were in the bathtub group and the other was found in a well. Three cases in the bathtub group were complicated with pneumonia but all were relatively mild. Another case was complicated with burns because of hot water in the bathtub, but this burn was also relatively mild. Pulmonary edema was noticed as a complication in a 8 year-3 month-old boy in the sea group but this also was relatively mild.

Prognosis of childhood near-drowning depends greatly on early discovery and immediate cardiopulmonary resuscitation. The presence of severe acidosis in the first blood gas analysis strongly suggests fatal outcomes or the development of severe neurological sequelae such as anoxic encephalopathy as shown in Table 2.

DISCUSSION

Accidents in childhood have been a major problem not only in Japan but also in many
The majority of accidents in early childhood and almost one half of the fatal accidents in this age group happen at home (3) and frequently in the presence of the parents (15). Prevention of accidents in childhood depends on public education. Not only children themselves but also their parents and other adults should be informed of the importance of prevention of fatal accidents in childhood (7) (10) (20) (24) (26).

Fortunately, deaths from traffic accidents in children are decreasing, or at least not increasing steadily at present. This owes much to the public education system. However, since there is still high traffic accident mortality among bicycle-riding children, the importance of teaching traffic rules and safe riding techniques to school-children should be stressed (5) (27). Although the traffic accident mortality in infancy is still low in Japan, the increase in automobiles should result in higher accident rates even in this age group. However, safety for children in automobile accidents is virtually neglected at present. More attention should be paid to this problem (9) (21) (22) (23). Such efforts should also be made to prevent other kinds of childhood accidents.

Various articles are swallowed or inhaled by children, and the kinds of commonly inhaled articles differ in each country (15). Health care professionals must be familiar with regional characteristics.

Giving peanuts or other kinds of peas or nuts to young children is reckless even with the assistance of adults. An infant 9 months of age was given peanuts and suffered from a bronchial foreign body complicated with pneumonia and atelectasis. Among 22 cases of peanut inhalation, 15 cases or 68.2% were under 2 years of age. In addition to peanut inhalation, we had three young children (under 2 years of age) with bronchial foreign bodies consisting of an almond, a soy-bean and a macadamia nut.

Bronchial foreign bodies of non-food origin were more common in older children. However, we experienced two infant cases, one with the heat seal of a drug and the other with a piece of a plastic toy. Toys or baby goods such as pacifiers are frequently made from plastic. They should be of one-piece construction of study non-toxic materials (14) (26).

Accidental ingestion of medicines and other household chemicals may sometimes result in serious poisoning. Most recently, poisoning due to fluoride preparations for dental protection was reviewed by Augustin (1). Since these agents are also widely used in Japan, they demand attention. Such articles should be kept out of children's reach or stored in safe containers (8) (15). We experienced 4 cases of battery ingestion in 1990. All were the button-type and were extracted safely. Administration of emetics is not recommended in such cases (13).

In cases of near-drowning, the most important factors for intact survival were early rescue and immediate cardiopulmonary resuscitation (19) (25). Our five cases occurring in swimming pools survived without any sequelae owing to early discovery and rescue by bystanders.

Different effects of salt water and fresh water on the prognosis of near-drowned children have been discussed in the literature (6) (16) (18). However, we had only three cases of intact survival from the sea, and we have no data to shed light on this matter.

Many cases of adult drowning are related to alcoholism or drinking (4), and children with epilepsy have high risk of drowning. Pearn (17) reported that 0 to 5.4% of childhood drownings were related to epilepsy. We had one epileptic case of near-drowning, a 9-year-5 month-old boy, with intact survival.

Table 2. Blood Gas Analysis and Prognosis of Near-Drowning Children

<table>
<thead>
<tr>
<th></th>
<th>No.</th>
<th>pH</th>
<th>pCO₂ (mmHg)</th>
<th>pO₂ (mmHg)</th>
<th>Base Excess (mEq/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fatal or severe sequelae</td>
<td>6</td>
<td>6.96*</td>
<td>45.1</td>
<td>210.5</td>
<td>-22.4*</td>
</tr>
<tr>
<td></td>
<td>(7.06)</td>
<td></td>
<td></td>
<td></td>
<td>(-14.3)</td>
</tr>
<tr>
<td>Intact survival</td>
<td>14</td>
<td>7.35</td>
<td>33.2</td>
<td>78.0</td>
<td>-6.2</td>
</tr>
</tbody>
</table>

*Excluding cases who were already given sodium bicarbonate
Recently, bathtubs are frequently blamed for near-drownings of young children in the Japanese literature, but they do not appear very often in the foreign literature (17). The reason of this difference in the incidence of near-drownings may be differences in the shapes of Japanese bathtubs from those in other countries.

SUMMARY

(a) In fiscal 1990, 4,502 children below 18 years of age, approximately one half of the total patients, visited the emergency clinic of Tokai University Hospital. Among them, 243 (5.4%) were accident patients. The most common accident was foreign body inhalation in 134 cases or 55.1% of all children with accidents, followed by 50 cases with burns.

(b) Forty-two children with bronchial foreign bodies were admitted to the pediatric ward of Tokai University Hospital in 17 year period since 1975. Fortunately, we had only one fatal case due to anoxic encephalopathy. Characteristically, children with peanut inhalation accounted for more than half of the total cases.

(c) We experienced 38 pediatric hospitalized cases of near-drowning in the same period. The mortality rate among admitted cases was 13.8%. There were 3 children with severe neurological sequelae due to anoxic encephalopathy among the 33 surviving cases. Their prognosis depends greatly on early rescue and immediate cardiopulmonary resuscitation.

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