CASE REPORT

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Caffeine Toxicity: A Case of Child Abuse by Drug Ingestion

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ABSTRACT: The case of a 14-month-old child who died of caffeine toxicity is presented. The evidence for prolonged toxicity associated with inappropriate delay in the seeking of medical care and the presence of various recent and healing injuries are diagnostic of child abuse. Fatal caffeine toxicity and child abuse by drug/substance administration are uncommonly reported. Relevant medical literature is reviewed.

KEYWORDS: pathology and biology, child abuse, caffeine

Child abuse is considered to occur in several clinical patterns, including the "battered child," child neglect, and sexual abuse; however, child abuse by chemical or drug administration has rarely been described although it has been suggested that such a category be added to the classification of child abuse [*1*]. Recently we encountered a case of fatal child abuse by caffeine ingestion. It is presented here with a brief review of caffeine poisoning in children and child abuse by drug and chemical ingestion.

Case Report

A 14-month-old girl died shortly after admission to the emergency room with a history of vomiting. Earlier in the evening, the ambulance had been called to her home for a complaint of severe vomiting but then was sent away by the mother because the child was okay. Three hours later the ambulance was called back when the child was obviously moribund.

Examination in the emergency room revealed an unconscious infant with fixed and dilated pupils and cardiopulmonary resuscitation (CPR) in progress. The patient was intubated, and extensive resuscitation attempts were made (including administration of epinephrine, calcium gluconate, sodium bicarbonate, atropine, and glucose 25%). She was pronounced dead 43 min after arrival.

The child was born at 30 weeks gestation to a 21-year-old gravida 6, para 1 woman. Birth weight was 1360 g. The neonatal course was complicated by initial feeding problems, apnea of prematurity treated with aminophyline, jaundice treated with phototherapy, and a Grade

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3 intraventricular hemorrhage documented by ultrasound which improved during the postnatal hospitalization period. Various social problems were identified in the home situation. The child was discharged after 6 weeks, apparently healthy, growing, and feeding well.

During the next year difficulties were encountered in the followup of this child, including broken appointments with various agencies. Several community pediatricians were involved in her care although the family never consistently kept appointments with one physician. At age six months she was seen in the emergency room for otitis media, oral thrush, and a viral syndrome. At age eleven months the child was brought to the emergency room following an episode of choking on formula while in the care of her babysitter, who fed the child on her back. When examined in the emergency room, she seemed vigorous and healthy.

Eleven days before her death she was admitted to the hospital for lethargy, irritability, and unexplained bruises. Examination revealed a small child who initially shied away when approached. Bruises of varying ages were noted, particularly over the left side of the abdomen and thorax and left parieto-temporal region of the head. Length, head circumference, and weight were all less than the fifth percentile, although history indicated a consistent growth rate for length and head circumference. The child had had no weight gain since about the age of one year. Laboratory findings included a hypochromic, microcytic anemia (hemoglobin 8.6 gm/dL and hematocrit 28.8%). A computerized axial tomography (CT) scan and skeletal X-rays revealed no evidence of trauma. An electroencephalogram (EEG) was normal. During hospitalization she developed a positive urine culture and she was started on amoxacillin. No satisfactory explanation for the bruises was offered, even when the mother was directly confronted. Referral to the appropriate social service agency was made, and she was discharged five days before her death on amoxacillin and iron replacement therapy.

The events of the next five days are unclear; however, in the morning at least 18 h before her death, she developed vomiting and diarrhea. Despite the illness her mother went out that evening, leaving the child in the care of a boyfriend, and returned about 11 p.m. when she made the first ambulance call. After some discussion, the ambulance was sent away only to be recalled about 3 h later for the final emergency room admission.

Autopsy revealed a dehydrated, white, female infant measuring 73.3 cm in length (less than the fifth percentile) and weighing 6495 g. The head circumference equaled 43.7 cm (less than the fifth percentile). There was poor skin turgor, and the eyes were soft. Dehydration was confirmed by vitreous chemical studies, including a sodium of 162 meq/L and blood urea nitrogen (BUN) of 41 mg/dL (other vitreous chemistries: potassium 10 meq/L; chloride 142 meq/L; creatinine 4.3 mg/dL; glucose 23 mg/dL). Microscopically, bland fibrin thrombi were noted in the brain and lungs, also consistent with dehydration. There was a recent scalp contusion in the left parieto-frontal region, but no internal injuries to the head. Superficial mucosal tears at the gastroesophageal junction were observed associated with bright red blood in the stomach and heme positive contents of the small intestine. Petechial hemorrhages of the gastric mucosa were also noted. Colonic contents were not heme positive. There was a patchy, acute bronchopneumonia and mild, acute laryngo/tracheitis.

Significant internal injuries included healing fractures of left ribs seven, nine, and ten, and a healing laceration and hematoma of the spleen. Microscopical features of the splenic injury included vascular proliferation, reactive fibroblasts, and early deposition of collagen, while in the case of the fractures there was a well-developed callus consisting of a cellular collar including osteoid material, fibroblasts, and vascular proliferation. These changes suggested that injury occurred at least 1 1/2 to two weeks previously. Ecchymoses on the skin were not noted.

Other significant autopsy findings included erythroid hyperplasia and iron depletion of the bone marrow characteristic of iron deficiency anemia, severe thymic involution suggesting generalized stress, and periventricular leukomalacia and gliosis consistent with the perinatal history.

Toxicologic examination revealed a serum iron of 201 μg/dL,[2] blood caffeine of 117.3 mg/L, and blood theophylline of 35.9 mg/L.[3]

Subsequent investigation revealed that there was available in the child's home abundant "amphetamine look-alike" caffeine capsules. These were ordered from an out-of-state drug warehouse by the mother's boyfriend for sale on the street. Mother was known to often "abuse" these pills. Each capsule contained 175 mg of caffeine according to the label on the bottle. The presence of caffeine was confirmed in the capsules by chemical testing. Caregivers of the child have steadfastly denied knowledge of how the child ingested the caffeine and how the injuries to the baby were incurred.

Discussion

Two aspects of this case merit emphasis: lethal caffeine poisoning and child abuse by drug ingestion.

Although caffeine is an ubiquitous substance, fatal caffeine poisoning is relatively uncommon [*2*]. Approximately 16 cases of fatal caffeine poisoning have been reported in the medical literature [*2–6*]; however, only 2 of these were children [*4*]. One case involved a 15-month-old child who died some 5 h after inadvertent ingestion of 90 mL of 20% caffeine solution. Symptoms and signs included vomiting and tetanic spasms; the postmortem caffeine concentration was 1040 mg/L. The other case was a 5-year-old girl who ingested a large number of caffeine containing diuretic pills and died some 6 h after ingestion. Her presenting complaints were "cold chills" and "stomach cramps." Blood caffeine was 158.5 mg/L [*4*]. Some of the clinical features in the nonfatal, caffeine poisoning case of a 12-month-old girl who ingested approximately 1 to 1.5 g of drug are similar to our case. Symptoms and signs included the vomiting of coffee ground emesis, tachycardia and hypertension, alternating agitation and listlessness, hyperglycemia, and diuresis. She recovered in hospital after about 3 days. Caffeine concentration in serum approximately 6 h after ingestion was 46 mg/L [*7*].

The metabolism of caffeine involves three main compounds in the plasma: paraxanthine, theophylline, and theobromine [*8*]. The paraxanthine route appears to be the major metabolic pathway [*8*], but measurable levels of theophylline have been documented in the blood of volunteers following ingestion of standard doses of caffeine. In one such study, the maximum plasma concentration of caffeine occurred between 0.5 and 1.5 h after ingestion of a 300-mg dose of caffeine in four adults (peak mean concentration—7.6 mg/L), while maximum theophylline concentrations occurred between 7.5 and 24 h (range 0.160 to 0.195 mg/L) [*9*]. Although infants less than one month of age fail to metabolize caffeine and thus excrete it largely unchanged in the urine, the change to the adult pattern of caffeine metabolism appears to occur at about three to five months of age [*10*]; therefore, we expect the adult pattern to hold in our patient.

Although it is not known when or how this child ingested caffeine, the clear evidence of prolonged vomiting and the accumulation of significant levels of theophylline in the blood attest to a long period of severe toxicity during which essentially no medical help was sought. These facts, as well as recent retardation in normal weight gain, chronic iron deficiency anemia, thymic involution, and unexplained severe trauma to the left upper abdomen and thorax are diagnostic of child neglect and abuse. However, fatal child abuse by substance ingestion is not commonly described.

[2]Colorimetry, DEMAND Iron Test, Worthington Diagnostic Systems, Inc., 511 Benedict Ave., Tarrytown, NY.

[3]Quantification of both drugs by high pressure liquid chromatography (HPLC) after organ extraction, MetPath Laboratories, 4 Fenway Plaza, Boston, MA.

Six fatal and two nonfatal cases of child abuse poisoning are reported in the medical literature. Two of the six fatal cases involved asphyxia by pepper administration [*11,12*], one involved transdermal absorption of isopropanol applied to burns [*13*], and the remaining three involved poisoning with various drugs: ethanol [*14*], aspirin and ethanol [*15*], and thioridazine [*16*]. The case of the poisoning of a three-year-old child by aspirin and alcohol has a number of features similar to the currently reported case, particularly the delay in the seeking of medical care in the face of a toxic, vomiting child [*15*].

At least two reports of deliberate parental poisoning of children with medications have been reported in the pediatric literature, involving the drugs perphenazine [*1*] and chloral hydrate [*17*]. Interestingly, both of these poisonings occurred in the hospital, and the difficulties encountered in the investigation of such cases, even in a situation where the children are relatively closely monitored, are illustrated in these reports. The detection and documentation of such cases in the community must even certainly be more difficult.

Conclusion

In summary, it is clear that child abuse by drug or substance ingestion occurs, but a high index of suspicion is required to identify such cases. The importance of complete toxicologic analysis in suspected cases of child abuse is illustrated by this unusual case of caffeine poisoning.

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