


Acute Poisoning in Children in Bahia, Brazil

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**Dilton Rodrigues Mendonça, MSc¹, Marta Silva Menezes, PhD¹,
Marcos Antônio Almeida Matos, PhD¹, Daniel Santos Rebouças, MD²,
Jucelino Nery da Conceição Filho, BS², Reginara Souza de Assis, MD³,
and Leila Carneiro³**

Abstract

Acute poisoning is a frequent accident in childhood, particularly in children under 4 years of age. This was a descriptive study with data collected from standardized forms of the Poison Control Center and patient record charts. All the cases of acute poisoning in children aged 0 to 14 years during the period 2008 to 2012 were selected. The variables studied comprised characteristics of the events and toxic agents, clinical development, and outcome. A total of 657 cases of acute poisoning, with higher frequency in the age-group from 1 to 4 years (48.7%) and male sex (53.4%), were recorded. The occurrences were accidental in 92% of the cases, and 5.8% were due to suicide attempts. Among the toxic agents, medications (28.5%), venomous animals (19.3%), nonvenomous animals (10%), household cleaning products (9.0%), and raticide agents (8.7%) predominated. The majority of cases were characterized as light (73.5%) and around 18% required hospitalization, and there was low lethality (0.5%).

Keywords

adolescent medicine, general pediatrics, critical care, allergy/immunology, medical education

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Introduction

Acute poisoning is one of the main childhood accidents and is as an important public health problem.^{1,2} Among accidents, poisonings are responsible for around 7% of all cases in children under 5 years of age, and are implicated in approximately 2% of deaths of children in developed countries, corresponding to 3000 deaths per year in European countries.²⁻⁴

The American Association of Poison Control Centers has recorded an annual increase in accidents involving poisons in children. In 2012, there were 2 275 141 cases of exposure to poison notified in humans, with 48.3% of these occurring in children under the age of 6 years, mainly unintentionally. When adolescents from 13 to 19 years of age were considered, approximately 24% were intentional exposures. In children under 6 years of age, mortality was 2.4%; however, it increased to 6.1% when the entire pediatric age-group was considered.⁵

In Brazil, in 2011, only 23 of the 35 regional poison centers provided the National System of Toxic-Pharmacological System (Sistema Nacional de Informações Tóxico-Farmacológicas [SINITOX])⁶ with data, with 98 765 cases of human poisoning being registered. Approximately

36% of the notifications were made concerning children under 14 years of age, resulting in 10.4% deaths in this age-group. The most frequent occurring toxic agents were medications, in 36% of the cases, followed by household cleaning products at 18.4% and venomous animals at 12.7%.

Acute poisonings plays a relevant role in the present context of childhood accidents because of its frequency of attendances in emergency care units, the possibility of sequelae, and the corresponding health care costs. Over the past few years, due to rapid industrialization, the diversity of pharmacological and cleaning products with high toxic power has grown. These products are sold without adequate control, exposing children to greater risk of contact with these agents.^{1,7,8} In spite of this, there is a scarcity of studies with the aim of identifying

¹Escola Bahiana de Medicina e Saúde Pública, Salvador, Brazil

²Centro Antiveneno da Bahia, Salvador, Brazil

³Hospital Geral Roberto Santos, Salvador, Brazil

Corresponding Author:

Dilton Rodrigues Mendonça, Escola Bahiana de Medicina e Saúde Pública, Av. Dom João VI, nº 275, Brotas, Salvador 40290-000, Brazil.
Email: diltonmendonca@bahiana.edu.br



the epidemiological characteristics of these accidents, and which may subsidize prevention strategies to reduce the morbidity and mortality in childhood.

The present study seeks to contribute to filling this gap in researches that characterize the profile of acute poisoning in children. For this reason, the aim of this study was to describe the epidemiological characteristics and clinical development of acute poisoning in children attended to at a public hospital in Bahia.

Methods

A descriptive study was conducted of acute poisoning in children attended to at the Hospital Geral Roberto Santos (HGRS) and by the Poison Control Center ("Centro Antiveneno da Bahia [CIAVE]) of Bahia. HGRS is the largest tertiary public hospital in Bahia, and CIAVE is the only reference center in toxicology of the state, both being located in the capital (Salvador, Bahia). All the children who are victims of poisoning attended to at HGRS are notified and followed-up simultaneously by CIAVE up to the time of discharge or death.

The study population consisted of children from 0 to 14 years of age, victims of acute poisoning, attended to at the emergency unit of HGRS, and notified by CIAVE, in the period from January 1, 2008, up to December 31, 2012. Data collection was performed retrospectively in the period from June 2013 to March 2014, from the record charts of HGRS and standardized forms of CIAVE. The option was taken to use the CIAVE form, because it is filled out in accordance with the Manual for Filling out the Notification and Attendance Form, Ministry of Health, Oswaldo Cruz Foundation/SINITOX.⁹

As inclusion criteria, the following were used: report of contact with toxic agent associated with clinical manifestation. Poisoning was considered the exposure to a certain type of product and/or chemical substance, with the appearance of biochemical reaction, functional alterations, and/or clinical signs compatible with the condition of poisoning. All cases characterized as exposure or adverse reaction were excluded.⁹ The age of inclusion was based on the Statute of the Child and Adolescent of Brazil, which considers a person up to the age of 12 incomplete years to be a child, and an adolescent as one between the ages of 12 and 18 years.¹⁰ The age-group adopted in this study was, therefore, due to the fact that attendance at the pediatric service of HGRS is restricted to patients up to 14 years of age.

The variables studied were the following: age, sex, origin, time elapsed between accident and attendance, type of occurrence, circumstance, zone of occurrence, place of occurrence, pathway and type of exposure, site

of the body affected, toxic agent, main clinical manifestations, severity of poisoning, indication of observation in the emergency unit or hospitalization, time of stay in hospital, and clinical development. After data collection from the CIAVE notification form, the patient record charts of attendance at the emergency units and hospitalization were evaluated, and complementary and clinical evolution data were recorded.

Data were collected by a previously trained team and supervised by the authors, who included undergraduate medical students and resident doctors of pediatrics at HGRS. After filling out the collection instrument, all the cases were classified according to the Poisoning Severity Score.¹¹

All the variables were transferred to the database of the software program Statistical Package for the Social Sciences (SPSS), Version 21.0. From then on, the results were presented by means of descriptive statistics, using tables of distribution by frequency and percentages for categorical variables, and as mean and standard deviation, or median and interquartile interval (IQ), for quantitative variables.

This research was approved by the Ethics Committees of the Hospital Geral Roberto Santos and Bahian School of Medicine and Public Health, Report No. 05/2013. Access to the registered data was authorized by the Boards of Directors of HGRS and CIAVE.

Results

Initially, 735 notification forms were selected; however, 64 cases corresponded to exposure and 14 to adverse reaction of patients. These cases were not included because they did not meet the criteria of the "Manual for Filling out the Notification and Attendance Form/SINITOX" with reference to the terms poisoning, exposure, and adverse reaction.

Therefore, for analysis of the study, 657 cases of acute poisoning were registered. The median age was 4 years (IQ = 2.0-10)—minimum age of 1 month and maximum of 14 years. The mean number of cases per annum was 132, and in the year 2011, an increase of 20.8% occurred, totaling 166 cases. In Table 1, one observes that 349 cases (53.1%) of poisoning occurred in children under the age of 4 years. The majority of cases originated from Salvador and little variation occurred for the male sex.

The most frequently found group of toxic agents in all the periods was medications, followed by venomous animals, particularly in the last 2 years of the study. In the male sex category, there was greater frequency of accidents involving household cleaning products (54.2%) and venomous animals (63%), while in the female sex

Table 1. Sociodemographic Characteristics of Cases of Poisoning per Year of Occurrence.

Variable	Frequency of the Cases					Total, n (%)
	2008, n (%)	2009, n (%)	2010, n (%)	2011, n (%)	2012, n (%)	
Gender						
Male	72 (54.5)	69 (52.3)	52 (54.2)	84 (50.6)	74 (56.5)	351 (53.4)
Female	60 (45.5)	63 (47.7)	44 (45.8)	82 (49.4)	57 (43.5)	306 (46.6)
Age						
Less than 1 year	5 (3.8)	7 (5.3)	9 (9.4)	4 (2.4)	4 (3.1)	29 (4.4)
1 to 4 years	57 (43.2)	68 (51.5)	44 (45.8)	76 (45.8)	75 (57.3)	320 (48.7)
5 to 9 years	31 (23.5)	26 (19.7)	20 (20.8)	42 (25.3)	23 (17.6)	142 (21.6)
10 to 14 years	39 (29.5)	31 (23.5)	23 (24.0)	44 (26.5)	29 (22.1)	166 (25.3)
Place of origin						
El Salvador	111 (84.1)	111 (84.1)	85 (88.5)	146 (88.0)	103 (78.6)	556 (84.6)
Other municipalities	21 (15.9)	21 (15.9)	11 (11.5)	20 (12.0)	28 (21.4)	101 (15.4)

Table 2. Frequency of Groups of Toxic Agents According to Age Group.

Group of Agents	Age-Group				Total, n (%)
	<1 Year, n (%)	1-4 Years, n (%)	5-9 Years, n (%)	10-14 Years, n (%)	
Medications	9 (31.0)	114 (35.6)	31 (21.8)	33 (19.9)	187 (28.5)
Venomous animals	3 (10.3)	32 (10.0)	46 (32.4)	46 (27.7)	127 (19.3)
Nonvenomous animals	1 (3.4)	22 (6.9)	20 (14.1)	23 (13.9)	66 (10.0)
Domestic cleaning products	2 (6.9)	51 (15.9)	4 (2.8)	2 (1.2)	59 (9.0)
Other venomous/poisonous animals	1 (3.4)	20 (6.3)	15 (10.6)	23 (13.9)	59 (9.0)
Raticides	4 (13.8)	23 (7.2)	10 (7.0)	20 (12.0)	57 (8.7)
Industrial chemical products	3 (10.3)	31 (9.7)	3 (2.1)	1 (0.6)	38 (5.8)
Plants	1 (3.4)	7 (2.2)	2 (1.4)	3 (1.8)	13 (2.0)
Pesticide agents for household use	0 (0.0)	4 (1.3)	0 (0.0)	1 (0.6)	5 (0.8)
Abused drugs	0 (0.0)	1 (0.3)	0 (0.0)	4 (2.4)	5 (0.8)
Others	3 (10.3)	7 (2.2)	5 (3.5)	3 (1.8)	18 (2.7)
Ignored	2 (6.9)	8 (2.5)	6 (4.2)	7 (4.2)	23 (3.5)
Total	29 (100.0)	321 (100.0)	141 (100.0)	143 (100.0)	634 (100.0)

category, there was predominance of accidents involving medications (53.5%) and raticides (54.4%).

In the distribution of the groups of toxic agents according to age-group (Table 2), medications were observed to predominate in children of up to 4 years of age, accounting for 66.6% of the occurrences. Between 5 and 14 years, poisoning by venomous animals predominated in 60% of the accidents. Approximately 87% of poisoning due to household cleaning materials occurred between the ages of 1 and 4 years. The poisoning involving raticides predominated in 2 age-groups: 47.4% between 1 and 4 years of age and 35% of the cases from 10 to 14 years of age.

The occurrences were accidental in 92% of the cases, and all poisoning due to suicide attempts occurred in the age-group between 10 and 14 years (5.8%). Error of administration occurred mainly in the age-group of

under 1 year, accounting for 40% of the cases. Acts of violence occurred in all age-groups and predominated between 1 and 4 years of age (42.9%). The large majority of accidents in children under the age of 5 years occurred in the residence (94.2%), and in this age-group, around 41% occurred in an outside environment. The main exposure pathway was oral, followed by bite/sting (Table 3).

In Table 4, one observes that the majority of accidents were slight, mainly in children under 4 years of age. Cure was confirmed in 98.2% of the cases and lethality was low, with 3 deaths occurring (0.5%).

The median of time elapsed between the accident and hospital attendance was 3.0 hours (IQ = 1.5-11.0). Time of observation in emergency unit presented a median of 4.0 hours (IQ = 2.0-10.0). Hospitalization was necessary in 117 cases (17.8%), with a median of 3.0 days (IQ:

Table 3. Characteristics of Poisoning According to Age-Group.

Variable	Age-Group				Total, n (%)
	<1 Year, n (%)	1-4 Years, n (%)	5-9 Years, n (%)	10-14 Years, n (%)	
Circumstance of event					
Individual accident	20 (69.0)	303 (94.7)	124 (87.4)	117 (70.5)	564 (85.8)
Suicide attempt	0 (0.0)	0 (0.0)	0 (0.0)	38 (22.9)	38 (5.8)
Error of administration	6 (20.8)	5 (1.6)	2 (1.4)	2 (1.2)	15 (2.3)
Violence/homicide	1 (3.4)	6 (1.9)	4 (2.8)	3 (1.8)	14 (2.2)
Collective accident	1 (3.4)	4 (1.2)	8 (5.6)	0 (0.0)	13 (2.0)
Therapeutic use	0 (0.0)	0 (0.0)	2 (1.4)	1 (0.6)	3 (0.4)
Others	1 (3.4)	2 (0.6)	2 (1.4)	5 (3.0)	10 (1.5)
Location of occurrence					
Residence	29 (100.0)	283 (88.4)	78 (55.0)	90 (54.2)	480 (73.0)
Outside environment	0 (0.0)	36 (11.3)	59 (41.5)	67 (40.4)	162 (24.7)
School/day care center	0 (0.0)	0 (0.0)	2 (1.4)	3 (1.8)	5 (0.8)
Others	0 (0.0)	0 (0.0)	0 (0.0)	3 (1.8)	3 (0.4)
Ignored	0 (0.0)	1 (0.3)	3 (2.1)	3 (1.8)	7 (1.1)
Exposure pathway					
Oral	21 (72.5)	237 (74.1)	53 (37.3)	62 (37.3)	373 (56.9)
Bite/sting	5 (17.3)	78 (24.3)	84 (59.2)	95 (57.3)	262 (39.8)
Skin	1 (3.4)	4 (1.3)	4 (2.8)	7 (1.1)	16 (2.4)
Others	1 (3.4)	0 (0.0)	1 (0.7)	2 (0.3)	4 (0.6)
Ignored	1 (3.4)	1 (0.3)	0 (0.0)	0 (0.0)	2 (0.3)

Table 4. Classification by Severity and Main Outcomes of Poisoning Events.

Group of Agents	Age-Group				Total, n (%)
	<1 Year, n (%)	Years, n (%)	5-9 Years, n (%)	10-14 Years, n (%)	
Severity					
Light poisoning	24 (82.8)	252 (78.7)	93 (65.5)	114 (68.7)	483 (73.5)
Moderate poisoning	2 (6.9)	62 (19.4)	42 (29.6)	43 (25.9)	149 (22.7)
Severe poisoning	3 (10.3)	6 (1.9)	7 (4.9)	9 (5.4)	25 (3.8)
Evolution					
Cure	28 (96.5)	316 (98.8)	142 (100.0)	161 (97.0)	647 (98.3)
Cure not confirmed	1 (3.5)	2 (0.6)	0 (0.0)	2 (1.2)	5 (0.8)
Death due to poisoning	0 (0.0)	1 (0.3)	0 (0.0)	2 (1.2)	3 (0.5)
Sequela	0 (0.0)	1 (0.3)	0 (0.0)	0 (0.0)	1 (0.2)
Ignored	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.6)	1 (0.2)

2.0-6.0), with 91.4% of cases being in the infirmary and 8.6% in intensive care units. The main groups of agents that led to hospitalization were venomous animals (38.5%), followed by medications (29.9%) and raticides (13.7%).

Discussion

In the present study, cases of intoxication in children under 4 years of age were the most frequent, and in this age-group, 94.2% of the accidents occurred in the home.

The most prevalent toxic agents were medications, particularly neuroleptic agents (20.9%) and benzodiazepines (17.1%). In the age-group between 4 and 14 years, we observed predominance of poisonings by venomous animals, due to accidents with scorpions (41.7%) followed by poisonous snakes (37.8%) and spiders (20.5%). The largest portion of poisonings were classified as light (73.5%), and perhaps, for this reason, the rate of deaths was relatively low (0.5%).

The prevalence of poisonings in children aged 4 years reported in other studies has been higher than it

was in the findings of our study (53.1%).^{1,2,12} In Brazil, the agency SINITOX⁶ registered a prevalence of 67.3% in this age-group. The highest frequency of these accidents the age-group up to 4 years of age perhaps results from the peculiarities of growth and development. In the majority of instances, children in this age-group are victims of unintentional poisoning due to immaturity, making them vulnerable and defenseless to protect themselves from accidental and intentional risks. Outstanding too is their curiosity and motivation to perform tasks, inability to foresee and avoid situations of danger, greater tendency to imitate and repeat behaviors, in addition to their motor coordination not yet being fully established.¹³⁻¹⁵

The slightly higher frequency in the male gender ratifies the greater exposure of boys to toxic agents.^{1,2,4} Kouéta et al,¹⁶ in France, observed 54.4% of the cases in the male gender, and Tavares et al,¹⁵ in Brazil, also obtained a similar prevalence (52.2%). There are cultural aspects that may be involved in these findings, such as less family vigilance of boys, resulting in greater freedom to perform activities with less adult supervision. This permissiveness related to male upbringing has been found in the higher number of accidents and deaths due to external causes registered in this gender.^{1,2,7}

The domestic environment is the place where the child remains the greater part of the time, and is also the place with the highest number of accidents involving poisoning in the first 5 years of life.^{14,15} Siqueira et al⁷ also reported that 80.2% of poisonings occurred in the home. Bentur et al,¹⁷ in Israel, related that, in 89.3% of cases, the residence was the place of occurrence; however, these authors found differences with regard age-group: 92% in the group from 0 to 5 years and 79% in the group from 5 to 18 years.

The toxic agents found in the home, without adequate storage, may be transformed into a risk of accidents, as observed in a study in Spain,¹⁸ in which 75% of the accidents occurred in the residence and the family members mentioned storing products for the home in nonoriginal receptacles in 26% and medications in unsafe places in 15.6% of the cases.¹⁹ In Brazil, Lourenço et al¹⁴ observed that 81% of the accidents occurred in the residence, with 65.4% involving 5-year-old children, and the parents or grandparents were present in 69.2% of the occurrences.

The frequency of accidents with toxic agents depends on the socioeconomic and cultural conditions, the enforcement of legislation for the control of these products, climate, and the predominance of local industrial or agricultural activity.^{1,10,19} In developed countries, poisoning by medications, cosmetics, household cleaning products, and alcohol are more common.¹⁻³ In Sweden, where the majority of the population resides in urban

areas, 29 848 cases of poisoning in children under the age of 10 years were registered in 2013, with 42% involving chemical products, mainly cleaning products (44%), followed by medications (28%), plants (11%), cosmetics (8%), and only 1% by snakes/insects.²⁰

In developing countries, where the economy is based on agriculture, in addition to poisoning by medications, cases involving other agents such as insecticides and venomous animals are frequent. In a study conducted in India, Chowdhury et al²¹ verified that pesticides, mainly organophosphates, were the most frequent agents involved (53.3%), followed by chemical household products (33.7%), mainly kerosene (24%). Poisoning in children is ranked the 12th most common cause of admission to hospitals, and the authors warned about the growing use of agricultural chemical substances.

A study conducted in Mexico by Olguin et al²² mentioned that approximately 70% of acute poisonings are due to medications. In addition to the higher frequency, different from the findings of our study, the most prevalent group was analgesics (42.3%), followed by anticonvulsant (22.9%) and anxiolytic (17.9%) drugs. It is important to point out that the sale of the most frequent groups of medications in our study, neuroleptic agents and benzodiazepines, is subject to restrictions, and these drugs present potential risk of serious adverse effects. Other multiple studies also ratified that medications are the most frequent agents involved in acute poisoning in children.^{1,2,5,6}

In the majority of cases, medications are used by family members, stored in an inadequate manner, and easily accessible to children,²¹ as was verified in a case-control study in Brazil with child victims of acute poisoning.²³ In this study, it was observed that storage at a height below 150 cm presented 16 times more chances of leading to poisoning; another variable associated with a risk factor was distraction of caregivers at the time of the accident.

Household cleaning products were also prevalent agents in poisonings in our findings, with predominance of bleaching/whitening products (55%). Among the raticides, the (Pb) lead-containing product marketed illegally in Brazil was mentioned as the causal agent in 77.2% of the cases. Another study conducted in Brazil by Werneck and Hasselmann,²⁴ with children under the age of 6 years, observed predominance of chemical products for domestic use (39%), followed by medications (35%) and raticides (15%), with lead also being involved in over half of the cases. In the same way as medications, these products are stored in the kitchen and in cupboards located very low down, in packages, at times not the original ones, and easily accessible to children.^{8,15}

Another important factor associated with poisoning by medications and chemical products is lack of standardization in special child-resistant and poison prevention packaging, which has been regulated in several developed countries, with a view to making it difficult to open and handle the contents by the majority of children under the age of 5 years.^{1,2,23} After standardization of special child-resistant packaging in England, there was a reduction in deaths due to poisoning in children under 10 years of age, from 151 per 100 000 in 1968, to 23 per 100 000 in 2000.² In the United States, special child-resistant packaging was regulated in 1970, and since then, a significant reduction has been observed in the unintentional ingestion of toxic products listed in this standardization.¹ In Brazil, the draft bill of Law 4841/1994 instituting special child-resistant packaging was presented in 1994 and is still pending in National Congress.²⁵

In the age-group of 5 to 14 years, predominance of poisoning by venomous animals was observed in this study. The high frequency of these accidents in comparison with other studies may be related to the extensive rural zone of Bahia, and the fact that CIAVE, coordinator of the National Program of Control of Accident involving Venomous Animals in the State, performs the distribution and replacement of antivenom sera according to the notifications received.

In general, acute poisonings result in important morbidity and low lethality.^{8,14,26} One of the variables related to the prognosis is the time elapsed between the accident and attendance, which in the present study was a median of 3 hours. After classification of the severity, a higher frequency of light conditions was observed, which may justify a short time of hospital observation. Hospitalization was necessary in 117 cases (17.8%), with a median of 3 days, of which 91.4% were in the infirmary and 8.6% in intensive care units. In 98.3% of the cases, cure was confirmed and there was low lethality, with 3 deaths occurring (0.53%) by medications and pesticides for agricultural use. The low number of deaths may be attributed to the low level of severity of the majority of cases, early attendance, and the characteristics of the HGRS as a reference hospital in toxicology.

When the variables time of stay in hospital and development were evaluated, we observed that the majority of articles analyzed make no correlation with the severity of cases. A study conducted in Iran demonstrated a mean time between the accident and attendance of 6.9 ± 3.1 hours. Approximately 31% of the children were discharged within the first 6 hours, 51% remained under observation for a period lasting from 6 to 24 hours, and 19% remained in hospital for over 24 hours, with 5 deaths occurring (1.5%).³ Another study conducted in

Turkey, with patients who needed intensive care, observed that 57% of the children were attended in up to 2 hours and the mortality rate was 1.9%. Therefore, it was observed that there was high morbidity of poisoning in childhood; however, it presents low lethality when early initial attendance occurs, even in more severe accidents.¹²

One of the limitations of this study results from the fact that it was retrospective and depended on the quality of the records. Another aspect to consider was that it was conducted in a public hospital and reference center, and this may not be representative of other health units, wherein patients may be attended to and not be duly notified. Nevertheless, the profile of acute poisonings obtained in this study may contribute to a description of these accidents, which is broader in scope, and due to the small number of publications concerning children, this study may contribute to increasing our understanding and power of stimulating preventive measures with a view to reducing morbidity in childhood.

Conclusions

Cases of acute poisoning are frequent accidents in childhood, which result in a high level of morbidity, particularly in children under 4 years of age. Knowing the profile of these occurrences, including the frequency of toxic agents and the area under study, may subsidize the adoption of educational and other measures with a view to guaranteeing the safety of children, for example, the mandatory use of child-resistant packaging of medications and chemical products for domestic use, greater surveillance of the production and sale of illegal toxic agents, and special care with regard to the exposure of children to venomous animals.

Author Contributions

Dilton Rodrigues Mendonça, MSc Project Author, developed, coordinated all the work and approved the final text presented.

Marcos Antônio Almeida Matos, PhD Project Author, developed, coordinated all the work and approved the final text presented.

Marta Silva Menezes, PhD Project Author, developed, coordinated all the work and approved the final text presented.

Daniel Santos Rebouças, MD Performed the analysis, data logging, proofing and literature review

Jucelino Nery da Conceição Filho Performed the analysis, data logging, proofing and literature review

Reginara Oliveira Souza, MD Performed the analysis, data logging, proofing and literature review

Leila Carneiro Herrera Camargo Performed the analysis, data logging, proofing and literature review

Declaration of Conflicting Interests

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