

## MECHANICAL ASPHYXIA IN CHILDHOOD - FORENSIC ASPECTS

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### Abstract

Mortality is one of the main demographic indicators, which by its nature is important for the population as well as for its structures. A serious problem not only in Bulgaria, but also worldwide, is death in childhood and adolescence. A retrospective statistical study of forensic cases of death due to mechanical asphyxia was conducted in the Department of Forensic Medicine and Deontology at the Faculty of Medicine, Medical University, Sofia, Bulgaria for the period 2006-2015. The age range of the deceased was from 0 to 18 years. The subjects of examination were divided into five age groups, each of which was characterized by its own specific structure of causes of death. The analysis of the data on the main causes of death for each of the age groups made it possible to detect more frequent cases of this type of traumatic death at certain ages and thus to create effective and timely mechanisms for prophylaxis and prevention of these conditions.

**Key words:** *mechanical asphyxia, childhood, forensic medicine*

### Introduction

Mortality is one of the main demographic indicators, which in its essence is important for the population as well as for its structures [1]. Its values are influenced by many varied direct and indirect causes of different ethnic, cultural, social, economic, medical and other natures. A serious problem not only in Bulgaria, but also worldwide, is death in childhood and adolescence [1, 2]. The causes of death at these ages are related to various diseases, congenital or acquired malformations, as well as various traumatic injuries that occurred intentionally or as an accident. Gender distribution statistics in deceased children show that mortality in boys is significantly higher than that for girls in each age group [2, 3].

Mechanical asphyxia is an acute hypoxic condition that develops as a result of a mechanical obstruction that impedes breathing at the level of the upper respiratory tract, trachea, or lungs [1]. Children are at risk of mechanical asphyxia of various natures. The most common are accidents related to aspiration of foreign bodies, compression of the external airways in elements of the cribs in which children sleep, positional asphyxia and others [3, 4]. Homicides are most common in newborns and young children, with cases of manual and ligature strangulation and intentional compression of the external airways. Cases of suicide occur among adolescents, especially those with impaired psychoemotional status [2, 4], most often by hanging.

### Materials and methods

A retrospective statistical study of the forensic cases of deceased from the age range 0-18 years, who died as a result of mechanical asphyxia, was conducted in the Department of Forensic Medicine and Deontology at the Faculty of Medicine, Medical University, Sofia for the period

2006 -2015. A complete forensic autopsy was performed in each of the cases, and in some of them materials were taken for additional examinations in order to make the correct diagnosis. The SPSS program was used to process the survey data. To facilitate the analysis of the data, the cases studied by us were divided into age intervals as follows: deceased under 1 year; deceased from 1 year to 4 years; deceased from 5 years to 8 years; deceased from 9 years to 12 years and deceased from 13 years to 18 years.

### Results

For the period 2006-2015 in the Clinic of Forensic Medicine and Deontology, Medical faculty, Medical University, Sofia, Bulgaria, were examined a total of 10443 deceased, of whom in 292 cases death occurred during childhood (Figure 1 ). In 161 of the latter, the cause of death was of violent nature.

In 47 of the cases of violent death, the lethal outcome was associated with mechanical asphyxia of various natures. Of these, 12 cases were in the age group 0-1 years, 7 - in the group 1-4 years, 5 were children between 5-8 years, 8 cases of children between 9-12 years and 15 were cases of death in adolescence - deceased aged 13-18 years. (Table 1.)

In 2006, out of 24 deaths under the age of 18, there were 3 cases of mechanical asphyxia - all as a result of drowning. One case was observed in each of the following age periods 1-4 years, 5-8 years and 13-18 years.

In 2007, 27 autopsies were performed on deceased under 18 years of age, of which 4 died as a result of mechanical asphyxia - one case of hanging in the age group 9-12 years, one case of aspiration of gastric contents in a child under one year and 2 cases of drowning, respectively in the age groups 5-8 years and 9-12 years.

In 2008, 39 autopsies were performed on deceased under 18 years of age. Seven were cases of mechanical asphyxia, distributed as follows: one case of hanging of a person in the age group 13-18 years, one case of aspiration of gastric contents that occurred after feeding of a baby under one year of age and 4 cases of drowning, one in each age group 5-8 years and 9-12 years and two in the age group 13-18 years. A case of homicide by ligature strangulation of a newborn has also been identified.

In 2009 we observed 42 cases of death in children under the age of 18 years. In seven cases death was a result of mechanical asphyxia – all due to drowning: one case in the age group 5-8 years, 2 cases in the age group 9-12 years and 4 cases – between 13 and 18 years.

In 2010, 38 cases of death under the age of 18 were studied at the Department of Forensic medicine, of which 7 were cases of mechanical asphyxia. We observed two cases of hanging (13-18 years), two cases of drowning (9-12 years) and two cases of aspiration of gastric contents under 1 year of age and one of aspiration of food particles in the age interval 1-4 years).

In 2011, 20 autopsies were performed of deceased under 18 years of age, of which 2 cases were mechanical asphyxia due to aspiration of gastric contents in babies under 1 year of age, which occurred after feeding.

In 2012, out of 31 autopsies of deceased under 18 years of age, 6 involved mechanical asphyxia. We observed 2 cases of hanging in adolescence (13-18 years), 3 cases of drowning in the age periods, respectively - 1-4 years, 5-8 years and 9-12 years, and one case of aspiration of food particles in the age group 1-4 years.

In 2013, out of all 20 autopsies performed on deceased under 18 years of age, 3 cases in total involved death as a result of mechanical asphyxia. We observed two cases of compression of the

external airways (smothering) in newborns - the first one occurred as a result of an accident due to the fact that the baby's airways were compressed between the mother's thighs and the other one was a homicide due to manual strangulation by the mother and subsequently the baby was placed in a plastic bag and thrown in the trash. The third case of mechanical asphyxia was a case of drowning in the age group 13-18 years.

In 2014, 35 cases of death were of deceased under the age of 18. Five were cases of mechanical asphyxia as follows: one case of hanging (13-18 years), one case of drowning (1-4 years), one case of manual strangulation (homicide) of a newborn, and two cases of aspiration of gastric contents in babies under one year of age after feeding.

In 2015, 16 autopsies were performed on deceased under 18 years of age, of which 3 were cases of mechanical asphyxia - one case of manual strangulation (homicide) in the age group 1-4 years, one case of drowning - 13-18 years and one case of aspiration of food particles of a child in the group 1-4 years that was left unattended.

On Figure 2 is presented in detail graphically the causes of death described above for the studied time period, as well as their distribution by age periods.

### Discussion

For the entire studied period of 10 years, 47 cases of mechanical asphyxia of deceased in the age range of 0-18 years were registered on the territory of Sofia-city and Sofia-district, which represents about 29.2% of all cases of violent death. Of these, 76.6% were accidents due to aspiration of gastric contents or drowning, 14.9% were suicides by hanging, and 8.5% were homicides due to strangulation (manual or ligature) or compression of the external airways (smothering).

The analysis of the data shows that the most common cause of death for the study period is drowning. In second place, is the aspiration of gastric contents/food particles, followed by hanging, manual strangulation and smothering, and the last place is for ligature strangulation (Figure 3).

The most common violent cause of death in the age group under 1 year is mechanical asphyxia due to aspiration of gastric contents, which occurred after feeding the babies and subsequent rapid placement in a prone position, where they regurgitate or vomit, followed by inhalation of the vomit. It is observed in 66.6% of the studied cases. Other types of mechanical asphyxia in this age group, manual and ligature strangulation, and compression of the external airways, have a significantly lower number of cases - 8.3%, 8.3% and 16.6%, respectively. Some of the cases of mechanical asphyxia (strangulations, compression of the external airways) fall into the category of neonaticide - murder committed by the mother immediately after birth, when the woman is in a special mental state associated with the birth process. Based on the above, proper training for behavior with the baby after birth and care for the woman in the postpartum period would significantly reduce the number of mechanical asphyxia, as a cause of death in children under 1 year of age.

In children aged 1-4 years, there are again cases of aspiration of gastric contents - 42.8%; the values are lower than in the previous period. It should be noted, however, that this percentage is at the expense of another cause of mechanical asphyxia in this period of the child's development, namely drowning, the values being the same as for aspiration of gastric contents. The main reason for this type of death are the poor precautions taken around water pools and leaving the child unattended [5].

In children aged 5-8 years, cases of mechanical asphyxia are common. All reported cases are a result of a drowning accident. This shows that these deaths are again preventable, with sufficient

monitoring of the child, training in proper behavior around swimming pools and swimming skills, and proper precautions taken around water pools of different origin.

In the age group 9-12 years, mechanical asphyxia is again a common cause of death. In 87.5% of the examined cases, the death occurred as a result of drowning, and in the remaining 12.5% it was due to hanging (suicide). In this age group, suicides occur for the first time, which are usually the result of problems at school or family, as well as a result of the first love disappointments.

In those who died between the ages of 13 and 18, the most common cause of death in the group of mechanical asphyxia was again drowning. It is observed in 60% of cases. The remaining 40% were due to suicides by hanging. In contrast to the first three age periods, where suicides are not observed due to the mental state of children, as well as greater monitoring by parents, relatives and caregivers, in children between 13-18 years, they are extremely common (more common than the previous age period) and are again a result of problems at school, family or unrequited love. In this age group as well, most of the causes of death can be prevented.

### Conclusions

From the retrospective study of deceased children in the Department of Forensic Medicine and Deontology, Sofia, the following data were established. In period under one year of age, the most common cause of violent death is mechanical asphyxia, with a predominance of aspiration of gastric contents. In the period of early childhood (1-4 years) due to the increased activity of children and their social contacts, the cases of injuries in the form of accidents increase. In children between 5-8 years and 9-12 years, death is most often due to mechanical asphyxia from drowning. In the interval of 9-12 years, cases of suicide (hanging) are observed for the first time, due to lack of abstract perception of the world. Violent causes of death increase significantly between the ages of 13 and 18, suicides are common, with predisposing and accelerating factors being internal anxiety, exam stress, physical or mental illness, family problems, and more [7]. Due to the increase in the number of violent causes of death with the increase of the child's age, it is necessary to provide safe places with childcare, such as day care centers, nurseries and kindergartens, schools [6]. Ensuring a government policy on the education on developing swimming skills of children in kindergartens and schools, as well as for the basic principles of safety around water pools, is of great importance [5,7]. In addition, efforts should focus on raising public awareness and training of parents and teachers in first aid skills.

In the examined period, each age group is characterized by its specific structure of causes of death. The analysis of the data on the main causes of death for each of them makes it possible to detect more frequent cases of injuries at certain ages and thus to create effective and timely mechanisms for prophylaxis and prevention of these conditions.

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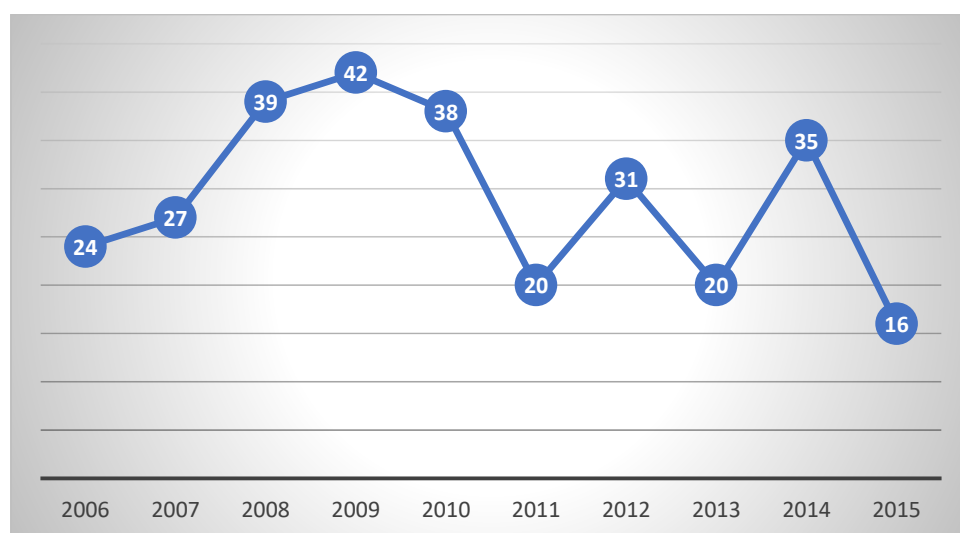


Figure 1. Number of deaths of deceased children under 18 years of age for the period 2006-2015.

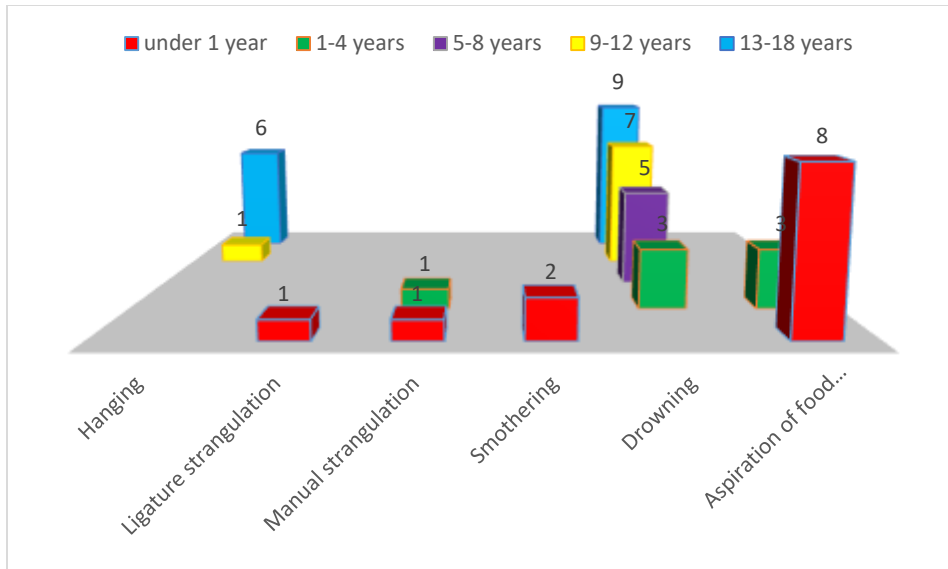


Figure 2. Distribution of the causes of death in childhood by age groups.

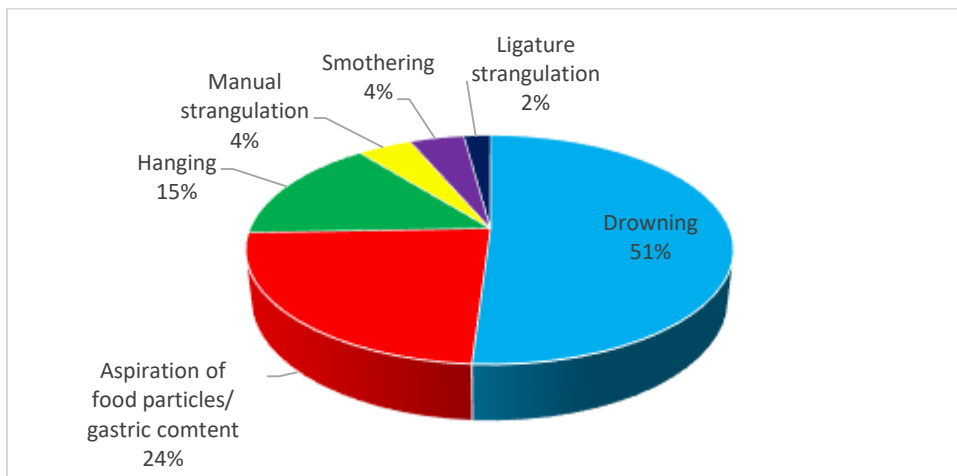


Figure 3. Percentage distribution of the causes of death of children under 18 years of age for the period 2006-2015.

	0-1r.	1-4r.	5-8r.	9-12r.	13-18r	TOTAL
<b>HANGING</b>				1	6	7
<b>LIGATURE STRANGULATION</b>	1					1
<b>MANUAL STRANGULATION</b>	1	1				2
<b>SMOTHERING</b>	2					2
<b>DROWNING</b>		3	5	7	9	24
<b>ASPIRATION OF FOOD PARTICLES /GASTRIC CONTENT/</b>	8	3				11
<b>TOTAL</b>	<b>12</b>	<b>7</b>	<b>5</b>	<b>8</b>	<b>15</b>	

Table 1. Causes of death - general and age distribution.