

A RETROSPECTIVE STUDY OF CHILD DEATHS AMONG CASES REFERRED TO THE EGYPTIAN FORENSIC MEDICINE AUTHORITY DURING THE PERIOD FROM JANUARY TO DECEMBER 2016

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ABSTRACT

Background and objective: Child mortality rate is an important health index affected by many socioeconomic factors and reflects countries development and status. Autopsy in cases of children death is beneficial for Forensic medicine and medical research purposes. Children autopsy is conducted in the case of unnatural children deaths especially in the age group under 19 years of age. Similar to adults, trauma is the major cause of death in children, however it is important to identify other causes and age distribution of deaths. A study done in Pakistan showed that road traffic accident, poisoning and drowning accounted for 67% and 18% of children deaths respectively. The aim of this study was to describe frequency and pattern of unnatural deaths during childhood and adolescence in Great Cairo during a period of one year. **Materials and methods :** In one year period (from 1 January 2016 till 30 December 2016), all medico-legal childhood deaths aged 0–20 years were investigated under the auspices of Forensic Medicine authority , and were retrospectively reviewed (n = 182). This number of cases represents 11.7% of the 1562 forensic autopsies performed during one year. Age, gender, cause and manner of death, autopsy findings, type of abuse and laboratory investigations were analyzed. **Results:** From this study we concluded that the total number of child deaths during one year period in the Great Cairo was around 182 cases. More than 50% of cases were males in the 2nd decade, the perpetrator was not related to the victim in more than 70% of incidents, 70% of cases showed physical abuse. Male children deaths were mainly of homicidal or accidental nature, while females were of suicidal nature. Weapons related deaths in males were mainly blunt, sharp or firearm, while in females it was either poison or burn. 50% of cases with +ve toxicologic lab findings showed elevated Co levels followed by drugs of abuse. **Conclusion:** Urgent attention is required to be taken towards the problem of injury and violence against children and adolescents occurring through the world.

Key words: child deaths, child abuse, manner of death, cause of death, autopsy.

INTRODUCTION

Maltreatment to children has existed as long as humanity has existed. The way children are treated has always been a faithful mirror reflection of the level of progress in the civility of humanity. Deaths from childhood injury are a public health problem worldwide. The death of a child is an important event in a community, and a defining marker of a society's policies of safety and health (Jenny and Isaak, 2006)

The death of any child is a heartbreaking tragedy for his family, and surrounding community. Most child fatalities result from natural or accidental causes. In cases of unexpected child deaths, law enforcement investigators are called to investigate any criminal activity involved in such deaths (Walsh, 2017).

Child fatalities related to maltreatment, abuse, and negligence occur worldwide. The detection and prevention of such crimes are the basic tenets underlying all child protective services (ACPO, 2014).

Child death as a result of abuse and neglect is a tragic outcome that occurs in all nations of the world. The true incidence of fatal child abuse and neglect is unknown. The most accurate incidence data of such deaths have been obtained from countries where multi-agency death review teams analyze the causes of child fatalities, as is done in the United States and Australia (Jenny and Isaak, 2006)

The Worldwide Health Organization (WHO) estimates that 57,000 children die annually as a result of maltreatment. Developing countries have higher rate of death than developed countries. Africa had the highest percentage of children deaths under the age of 5 due to

homicidal causes . The rate was higher for boys than girls (World Health Organization, 2006).

Child homicides, although relatively rare, represent a social and medico-legal problem which attracts public attention worldwide; such cases are also among the most difficult and challenging for forensic pathologists (Cordner et al., 2001). The incidence and other causes of these homicides may be closely related to social and economic changes within a particular society. Child maltreatment is a complex problem that stems from a variety of factors, including stress, poverty, substance abuse, and mental illness (Kajese et al., 2007)

Fatal child abuse is defined as the death of a child resulting from acts of physical violence or neglect of a child, perpetrated by a family member, caregiver or unknown perpetrators. Many researchers and practitioners believe that child deaths due to violence and neglect are still under reported. Although, it is well recognized through the medical literature, the true prevalence of child homicidal deaths is very difficult to assess (Brookman and Nolan, 2006)

Physical child violence was defined as physical aggression directed at a child by an adult, and child neglect was defined as the situation where the responsible adult fails to adequately provide for various needs, including physical (failure to provide adequate food, clothing, or hygiene), emotional (failure to provide nurturing or affection), or educational (failure to enroll a child in school) (Leeb et al., 2010)

The World Health Organization has defined child sexual abuse as: "The involvement of a child in sexual activity

that he or she does not fully comprehend, is unable to give informed consent to, or for which the child is not developmentally prepared, or that violates the laws or social taboos of society (World Health Organization, 2003).

In Egypt, a death certificate is the official record of death. Death certificates include a determination of the cause and manner of death and are often used to summarize the deaths resulting from diseases and injuries. It is, however, well documented that these vital records underestimate the prevalence of fatal child maltreatment. In Egypt there are no true data about the incidence of fatal child deaths from violence and neglect, and there are difficulties in classifying deaths from maltreatment and the reality that such deaths are not always apparent, and do not fit into any particular pattern (Moustafa and El Elimi, 2013). So, the aim of this research was to describe the frequency and pattern of unnatural deaths during childhood and adolescence in Great Cairo during a period of one year.

MATERIALS AND METHODS

A retrospective descriptive study to analyze and describe the frequency and pattern of deaths during childhood in Great Cairo during a period of one year. Data were collected through the period of one year (from 1 January 2016 till 31 December 2016), all medico-legal childhood deaths aged 0–18 years were included in our study under the auspices of the Egyptian Forensic Medicine authority (EFMA) after obtaining ethical Approval and were retrospectively reviewed (n = 182) representing 11.7%

of the total of 1562 forensic autopsies performed during one year.

• Data collection sheet included the following items:

1- Socio demographics of child deaths:

- Residence.
- Age.
- Gender
- Season.

2- Characteristics of child deaths

- Who reported the incident.
 - The caregiver responsible for the child.
 - The assailant-child relationship.
 - Type of abuse:
 - Physical abuse
 - Combined physical and sexual abuse,
 - No abuse (the incident was either accidental, self-inflicted or undetermined)
- Type of crime.
- Manner of death.

3. External examination of child deaths:

- State of clothes among the studied cases.
- External body findings.

4- Autopsy findings of child deaths:

- Regional injuries and extravasations:
 - Head and neck injuries
 - Chest and abdominal injuries
 - Limb injuries.
 - The used weapon.
 - The cause of death.

5. Laboratory findings of child deaths.

Data analysis:

Data were coded and entered using the statistical package SPSS (Statistical Package for the Social Science; SPSS Inc., Chicago, IL, USA) version 22. Data was summarized using frequency (count) and relative frequency (percentage) for categorical data. Comparisons between categorical data, Chi square (χ^2) test was performed. Exact test was used instead when the expected frequency is less than 5 (Chan, 2003). P-values less than 0.05 were considered as statistically significant.

RESULTS

1- Socio demographics of child deaths

Total numbers of 1562 medico-legal autopsies (including all age groups of both genders) were done during January to December 2016 period, Out of which 182 cases (11.7%) were children. The percent of distribution of cases was 103 cases (56.6%) in Cairo, and 79 cases (43.4%) in Giza and Qalyubia. Child deaths during summer were 67 cases (36.8%) followed by Winter 46 cases (25.3%) then, 37 cases (20.3%) during fall and 32 cases (17.6%) during spring.

Most cases were males 112 (61.5%) as compared to females 70 (38.5%) and were mostly in the second decade 94 cases (51.6%), followed by first decade children 51 cases (28%) and the least affected age group was infant 37 cases (20.4%) [Table 1].

2-Characteristics of child deaths

2.1. who reported the incident, the caregiver responsible for the child and the assailant-child relationship:

86 cases (47.3%) were reported by passing people, while 78 cases (42.9%) by parents and only 18 cases (9.9%) by hospital. One of the parents was the caregiver at the time of the incident in 109 cases (59.9%) and the caregiver was undetermined in 56 cases (30.8%) and other relatives were the caregiver in 17 cases (9.3%). In majority of cases, the assailant was either a stranger or a relative other than the parents 133 cases (73.1%), fathers were the assailant in 15 cases (8.2%) while mothers were in 10 cases (5.5%). In 12 cases (6.6%), a physician was claimed to be the assailant and in 12 cases, the incident was self-inflicted [Table 2, fig. 1].

2.2. Type of abuse

131 cases (72 %) were subjected to physical abuse as compared to 5 cases (2.7%) who were subjected to combined physical and sexual abuse, while 46 cases (25.3%) showed no abuse (the incident was either accidental, self-inflicted or undetermined) [Table 2, fig. 2].

2.3. Type of crime

As regard different types of crimes related to child deaths and their relation to different age groups. No crime (accidental, malpractice claim, parental abuse or assailant with history of psychic illness), is the most common in 92 cases (50.5%), of which 50 cases (53.2%) were in the second decade, 23 cases (45.1%) in the first decade and 19 cases (51.4%) infants. Fighting or robbery was the second common type of crime representing 44 cases (24.2%) of which 30 cases (31.9%) were in second decade, 9 cases (17.6%) in first decade and 5 cases (13.5%) were infants. In 20 cases (11%) the type of crime was undetermined. Malpractice was claimed

in 12 cases (6.6%) divided equally (6 infants and 6 in first decade). Crimes of honor/illegal child were reported in 8 cases (4.4%) of which 3 cases (3.2%) were in the second decade, 2 cases (3.9%) in the first decade and 3 cases (8.1%) infants. Sexual assault was the crime in only 6 cases (3.3%) of which 5 cases (5.3%) were in the second decade, 1 case (2%) in the first decade [Table 3].

2.4. Manner of death

As for the manner of death, 62 cases (34.1%) were homicidal, of which 47 cases (42%, $p < 0.001$) were males and 15 cases (21.4%) were females. 52 cases (28.6%) were accidental, of which 33 cases (29.55) were males while 19 cases (27.1%) were females. 27 cases (14.8%) were either difficult labor, prematurity or malpractice claim, of which 16 cases (14.3%) were males and 11 cases (15.7%) were females. 26 cases (14.3%) were suicidal, of which 7 cases (6.2%) were males and 19 cases (27.1%) were females. and only 15 cases (8.2%) were pathological, of which 9 cases (8%) were males and 6 cases (8.6%) were females [Table 4, fig. 3].

3- External examination of child deaths

3.1. Clothes

Concerning clothes of the studied cases, the report of 7 cases (3.8%) didn't mention the state of clothes, while 85 cases (46.7%) showed no abnormality, 27 cases (14.8%) were presented with either tear, burn or blood and 43 cases (23.6%) were naked. While, 8 and 12 cases (4.4% and 6.6%) were wearing wet clothes or hospital gown respectively [Table 5].

3.2. External body findings

External examination of the studied cases revealed no findings in 48 cases (26.4%). Blunt injury (abrasion, contusion, contused wound) was the commonest type observed in 74 cases (40.7%), followed by physical injury in 23 cases (12.6%) then penetrating injury in 22 cases (12.1%). While decomposition was reported in 11 cases (6%). Both old scars and external bleeding were observed in 2 cases (1.1%) for each [Table 5].

4- Autopsy findings of child deaths

4.1. Regional injuries

Analyzing the site of trauma has showed that, multiple trauma regions were the commonest form present in this study 80 cases (44%) including 3 cases with injury to genitalia. Head was the region where maximum number of injuries were observed, 29 cases (16%) followed by the chest 21 cases (11.5%), while neck, abdomen and lower limb injuries presented 9 cases (5%), 7 cases (4%) and 6 cases (3.3%) respectively. 30 cases (16.2%) revealed negative autopsy findings. Extravasations was observed in 103 cases (56.6%) [Table 6, fig. 4].

4.2. Head and neck injuries

On evaluating cases with head injuries; cerebral contusion or laceration was the commonest, representing 60 cases (33%), followed by skull fractures 28 cases (15.4%), then subdural, extradural, subarachnoid and combined meningeal hemorrhage in 14, 12, 10 and 5 cases (7.7%, 6.6%, 5.5% and 2.7%) respectively. While, neck injuries were in the form of hyoid fracture; 15 cases (8.2%) and vascular injury in 10 cases (5.5%) [Table 7, fig. 5]. On examining cases with head and neck injuries in relation to the age group, subarachnoid hemorrhage showed statistically significant higher % in infants as

compared to other age groups. While, hyoid fracture showed statistically significant higher % in second decade victims as compared to other age groups [Table 8].

4.3. Chest and abdominal injuries

On considering cases with chest injuries; lung or heart laceration was the commonest, representing 62 cases (34.1%), followed by hemo/pneumo thorax 42 cases (23.1%), then fracture ribs and soot in airway in 18 and 3 cases (9.9% and 1.6%) respectively. While, abdominal injuries were in the form of visceral laceration; 36 cases (19.8%) and hemoperitoneum in 24 cases (13.2%). On analyzing cases with chest and abdominal injuries in relation to the age group, rib fractures, lung/heart laceration/ congestion as well as hemoperitoneum showed statistically significant higher % in second decade victims as compared to other age groups [Table 7,8].

4.4. Limb injuries

On evaluating cases with limb injuries; lower limb injuries were more common than upper limb. Among upper limb injuries, bone fracture and muscular injury were seen in 6 cases for each (3.3%) while, vascular injury was present in one case (0.5%). As regard lower limb injuries, Fracture bones were the commonest injury, representing 11 cases (6%), followed by muscular injury 7 cases (3.8%), and the least was vascular injury in 6 cases (3.3%) [Table 9].

4.5. Underlying cause of death

Concerning the underlying cause of death; trauma was the commonest cause of death (38.4%), followed by malpractice claims or pathological in 52 cases (28.6%). Asphyxia was the third cause in 30 cases (16.5%) followed by

thermal agent in 23 cases (12.6%) and the least cause was poison in 7 cases (3.8%)[Table 10, fig. 6].

Blunt trauma was the commonest cause of death (37 cases, 20.3%), followed by penetrating (18 cases, 9.9%) and the least was firearm injury (15 cases, 8.2%) [Table 10].

On analyzing the relation between the underlying cause of death and gender, males showed statistically significant higher incidence than females with trauma, asphyxia and thermal injury, representing 50, 21, 12 (18.8%, 44.7%, 10.7%) respectively. While, females showed statistically significant higher incidence than males in death with poison (5 cases, 7.1%) [Table 10, fig. 7].

4.6. The direct cause of death

As regard the direct cause of death, 66 and 65 cases (36.3% and 35.7%) died due to respiratory and cardiovascular failure respectively, while 31 cases (17%) due to central nervous system failure. The cause of death in 20 cases (11%) was either not documented or unknown [Table 11].

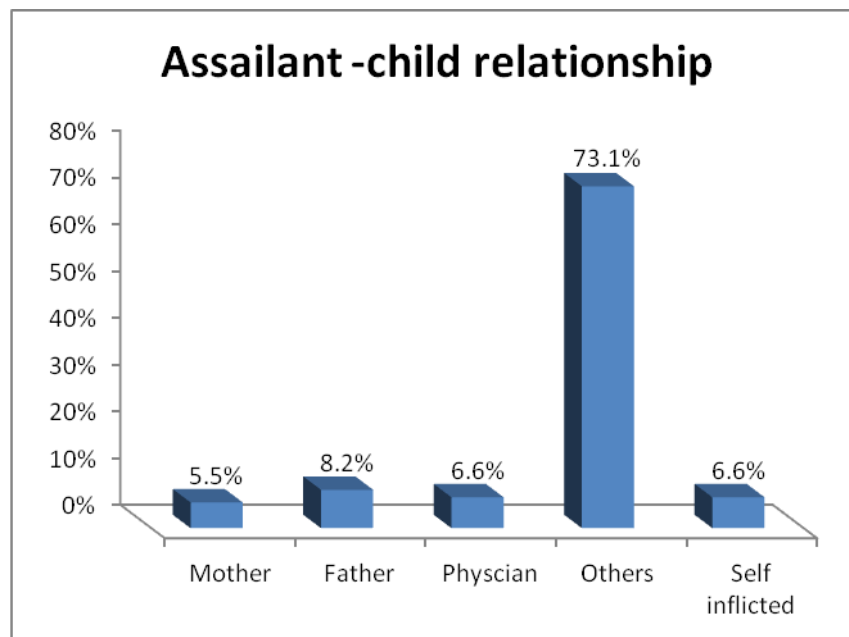
5- Laboratory findings of child deaths

As for the laboratory findings, 40 cases (28%) their laboratory results were not available, 108 cases (59%) were negative for toxicologic screening. 24 cases (13%) were positive, 50% of these cases were positive for carbon monoxide, 16.7% and 4.2% were positive for tramadol and hashish respectively and only 4.2% were positive for organophosphate. 4 out of 5 cases with combined physical and sexual abuse were positive for semen [Table 12, Fig. 8].

Table 1: Distribution of child deaths according to season, age group, gender and residence (n = 182).

Season	n	%	Age group	n	%	Gender	n	%	Residency	n	%
Summer	67	36.8	^a Infant	37	20.4	Male	112	61.5	Cairo	103	56.6
Fall	37	20.3	^b 1st decade	51	28	Female	70	38.5	^c Outside Cairo	79	43.4
Winter	46	25.3	2nd decade	94	51.6						
Spring	32	17.6									

n=number of cases, ^a: 0-2 y, ^b: 2-10 y, ^c: Giza & Qalyubia

**Figure 1.** Distribution of the assailant-child relationship

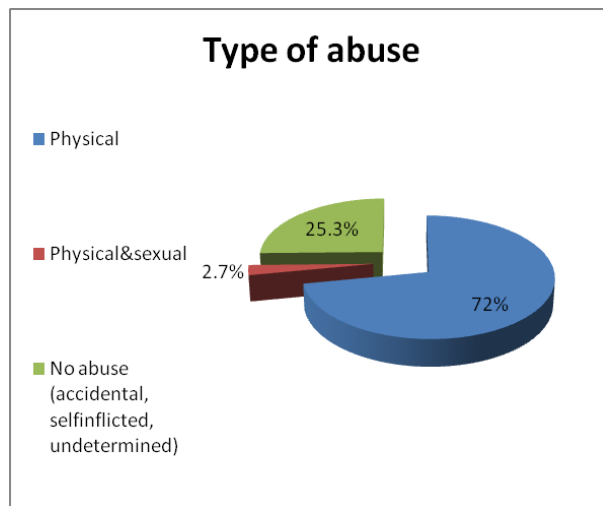


Figure 2. Distribution of the type of abuse

Table 2: Distribution of child deaths according to who reported the incident, the caregiver responsible for the child, the relation of assailant to child and the type of abuse:

	<i>n</i>	%
Who reported the incident		
Parents	78	42.9
Hospital	18	9.9
Passing people or Others	86	47.3
Total	182	100
Caregiver responsible for child		
Undetermined	56	30.8
Parent	109	59.9
Others	17	9.3
Total	182	100
Relation of assailant to child		
Mother	10	5.5
Father	15	8.2
Physician	12	6.6
Others	133	73.1
Self-inflicted	12	6.6
Total	182	100
Type of abuse		
Physical	131	72
Physical & sexual	5	2.7
No abuse	46	25.3
Total	182	100

n=number of cases

Table 3: Distribution of The type of crime and the relation between type of crime and age group

Type of crime	Total cases		Age groups						P value
			^a Infant		^b 1st decade		2nd decade		
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	
No crime	92	50.5	19	51.4	23	45.1	50	53.2	
Fighting/robbery	44	24.2	5	13.5	9	17.6	30	31.9	
Honor/illegal child	8	4.4	3	8.1	2	3.9	3	3.2%	
Malpractice claim	12	6.6	6	16.2	6	11.8	0	0	< 0.001*
Sexual assault	6	3.3	0	0	1	2	5	5.3	
Undetermined	20	11	4	10.8	10	19.6	6	6.4	
Total	182	100	37	20.4	51	28	94	51.6	

n=number of cases, *: significant, ^a: 0-2 y, ^b: 2-10 y

Table 4: Distribution of manner of death and the relation of manner of death and gender

Manner of death	<i>n</i>	%	Gender				P value
			Male		Female		
			<i>n</i>	%	<i>n</i>	%	
Pathological	15	8.2	9	8	6	8.6	
Homicidal	62	34.1	47	42	15	21.4	
Suicidal	26	14.3	7	6.2	19	27.1	< 0.001*
Accidental	52	28.6	33	29.5	19	27.1	
Difficult labor, prematurity, malpractice	27	14.8	16	14.3	11	15.7	
Total	182	10	112	61.5	70	38.5	

n=number of cases, *: significant

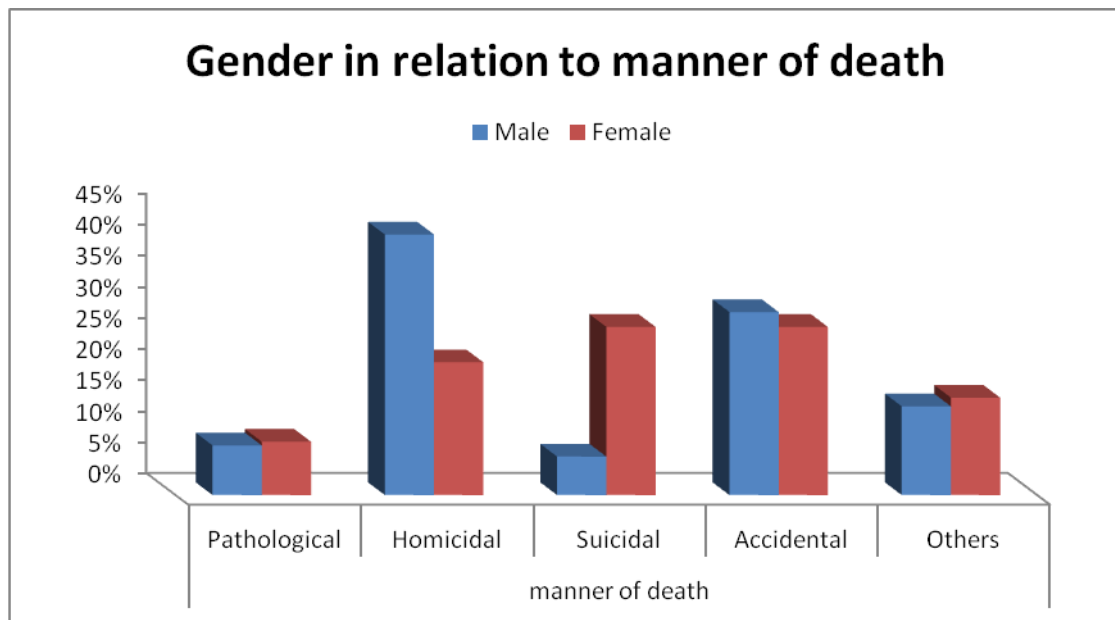


Figure 3. Relation of gender to manner of deaths

Table 5: Distribution of clothes state and external examination findings of child deaths

Clothes	<i>n</i>	%	External findings	<i>n</i>	%
Not mentioned	7	3.8	No findings	48	26.4
No tears or blood	85	46.7	Blunt trauma	74	40.7
Tears, burn or blood	27	14.8	penetrating trauma	22	12.1
Naked	43	23.6	decomposition	11	6
Wet	8	4.4	thermal injury	23	12.6
Gown	12	6.6	old scars	2	1.1
Total	182	100	bleeding	2	1.1

n=number of cases

Table 6: Distribution of child deaths according to the regional injury and extravasations

Regional injury	<i>n</i>	%	Extravasations	<i>n</i>	%
Head	29	16	Yes	103	56.6
Neck	9	5	No	79	43.4
Chest	21	11.5	Total	182	100
Abdomen	7	4			
Lower limb	6	3.3			
Multiple regions including genitalia	80	44			
No injury	30	16.2			
Total	182	100			

n=number of cases

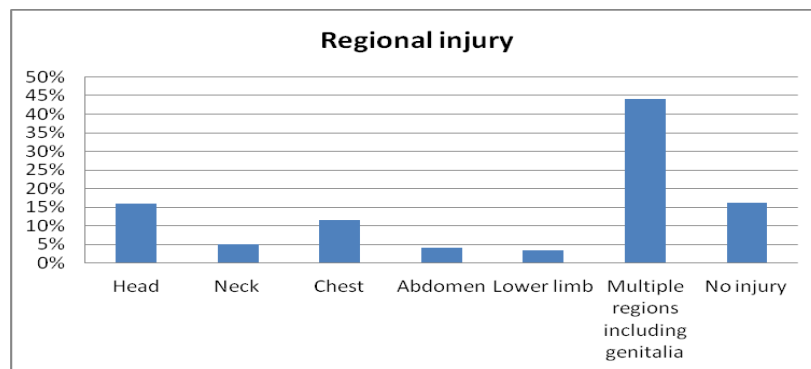


Figure 4. Distribution of child deaths according to the regional injury

Table 7: Distribution of child deaths with head, neck, chest and abdominal injuries

Head and neck injuries	<i>n</i>	%	Chest and abdominal injuries	<i>n</i>	%
Skull fracture	28	15.4	Fracture ribs	18	9.9
Extradural hemorrhage	12	6.6	Lung/heart laceration/ congestion	62	34.1
Subdural hemorrhage	14	7.7	Hemo-/pneumo-thorax/pneumonia/pus	42	23.1
Subarachnoid hemorrhage	10	5.5	Soot in airway	3	1.6
Cerebral contusion/laceration/edema/infection	60	33	Abdominal organ laceration/congestion	36	19.8
Meningeal hemorrhage	5	2.7	Hemoperitoneum	24	13.2
Hyoid fracture	15	8.2			
Vascular injury (Neck)	10	5.5			

n=number of cases

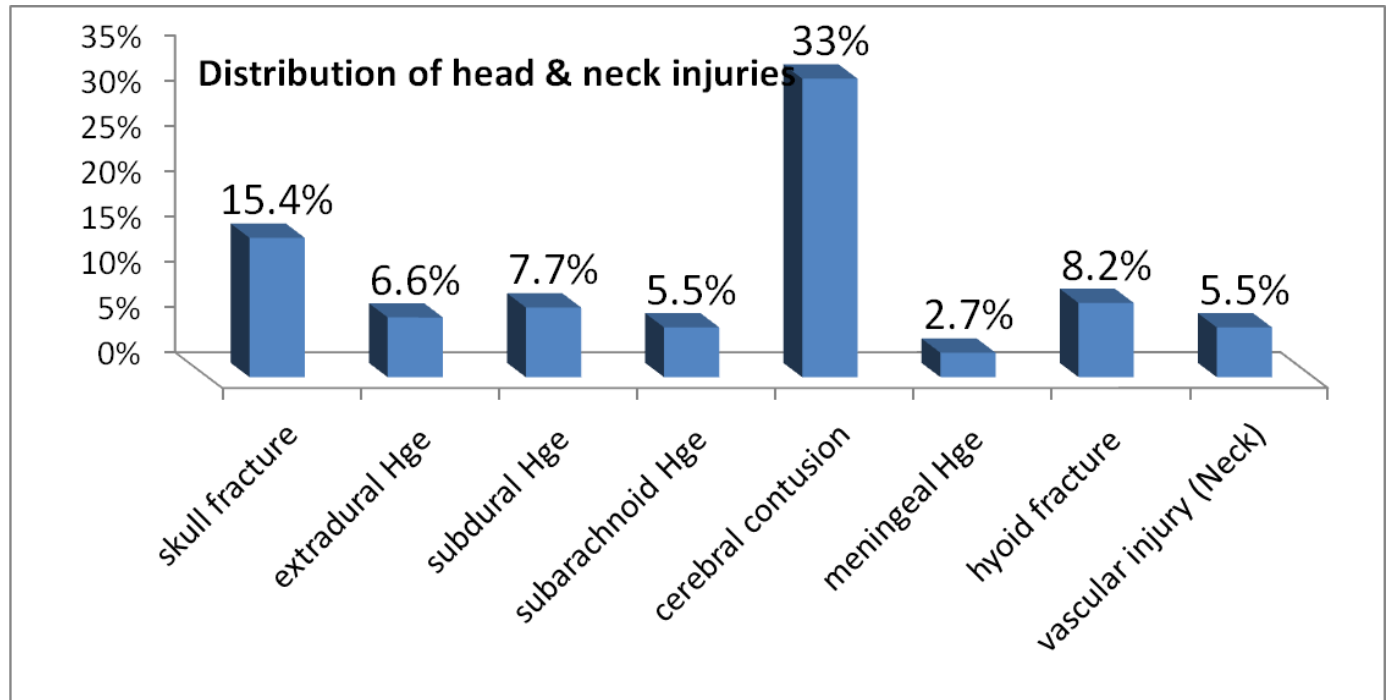


Figure 5. Distribution of child deaths with head and neck injuries

Table 8: The relation between different regional injuries and age groups

Regional injury	Age groups						P value	
	^a Infant <i>n</i> =37		^b 1st decade <i>n</i> =51		2nd decade <i>n</i> =94			
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%		
Subarachnoid hemorrhage	Yes	6	16.2	2	3.9	2	2.1	0.008*
	No	31	83.8	49	96.1	92	97.9	
Hyoid fracture	Yes	0	0	2	3.9	13	13.8	0.013*
	No	37	100	49	96.1	81	86.2	
Fracture ribs	Yes	1	2.7	2	3.9	15	16	0.019*
	No	36	97.3	49	96.1	79	84	
Lung/heart laceration/ congestion	Yes	10	27	12	23.5	40	42.6	0.042*
	No	27	73	39	76.5	54	57.4	
Hemoperitoneum	Yes	5	13.5	2	3.9	17	18.1	0.04*
	No	32	86.5	49	96.1	77	81.9	

n=number of cases, *: significant, ^a: 0-2 y, ^b: 2-10 y

Table 9: Distribution of child deaths with upper and lower limb injuries

Upper and lower limb injuries	<i>n</i>	%
Upper limb fracture	6	3.3
Upper limb muscle injury	6	3.3
Upper limb vascular injury	1	0.5
Lower limb fracture	11	6
Lower limb muscle injury	7	3.8
Lower limb vascular injury	6	3.3

n=number of cases

Table 10: Distribution of used weapon in child deaths and the relation between the used weapon and gender

Underlying cause of death	<i>n</i>	%	Gender				P value
			Male		Female		
			<i>n</i>	%	<i>n</i>	%	
Malpractice claims/ pathological deaths	52	28.6	27	24.1	25	35.7	0.044*
Wounds	70	38.4	50	44.7	20	28.5	
<i>Blunt</i>	37	20.3	25	22.4	12	17.1	
<i>Sharp</i>	18	9.9	13	11.6	5	7.1	
<i>Firearm</i>	15	8.2	12	10.7	3	4.3	
Poison	7	3.8	2	1.8	5	7.1	
Asphyxia	30	16.5	21	18.8	9	12.9	
Thermal injury	23	12.6	12	10.7	11	15.7	
Total	182	100	112	61.5	70	38.5	

n=number of cases, *: significant

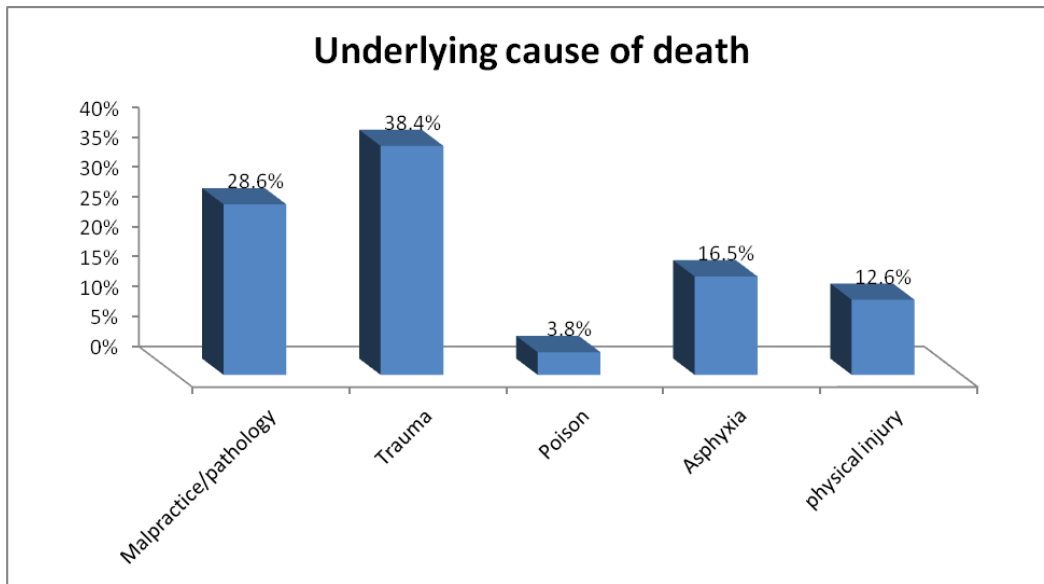


Figure 6. Distribution of the underlying cause of death among the studied cases

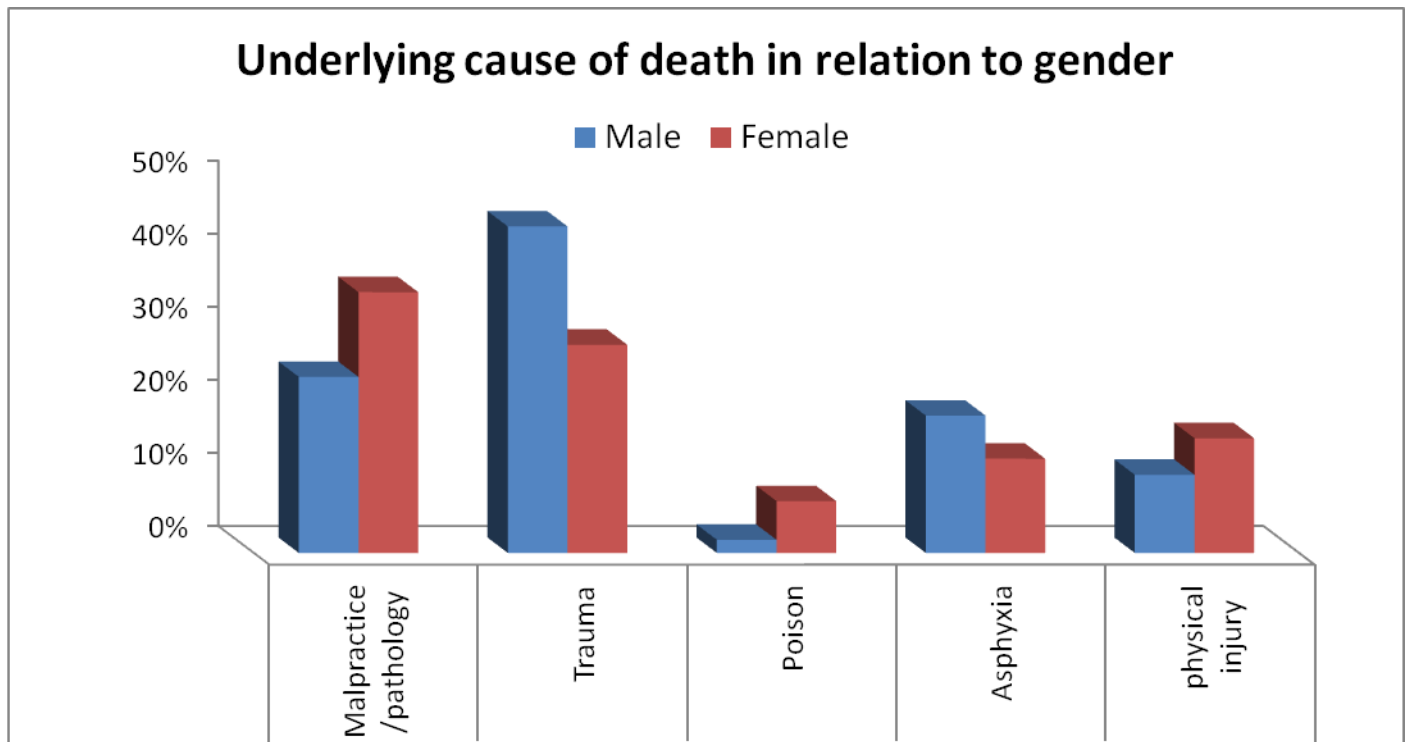


Figure 7. Relation between the underlying cause of death and gender

Table 11: Distribution of cause of death in child deaths

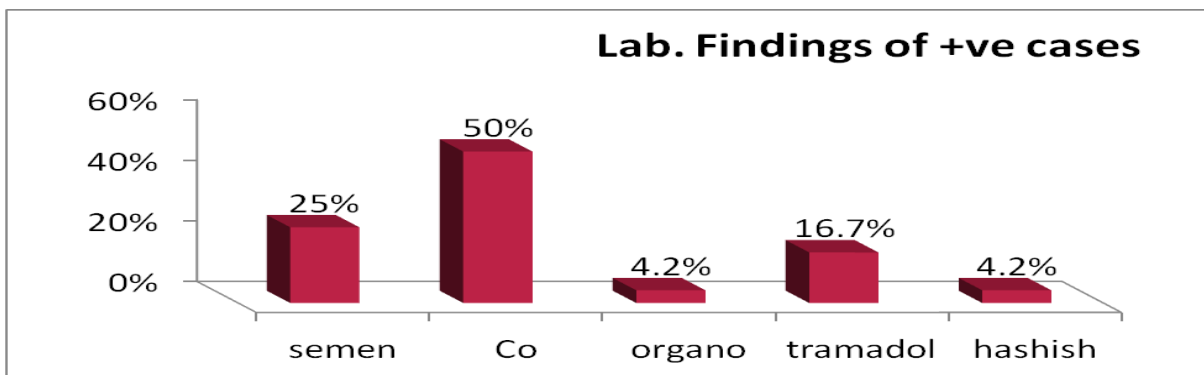
Cause of death	<i>n</i>	%
Not documented/ Unknown	20	11
Cardiovascular failure	65	35.7
Central nervous system failure	31	17
Respiratory failure	66	36.3
Total	182	100

n=number of cases

Table 12: Distribution of laboratory findings in child deaths and Distribution of cases with positive laboratory findings

Laboratory Findings	<i>n</i>	%	Laboratory Findings of +ve cases	<i>n</i>	%
Not available	50	27.5	Semen	6	25
+ve	24	13.2	Co	12	50
-ve	108	59.3	Organophosphates	1	4.2
Total	182	100	Tramadol	4	16.7
			Hashish	1	4.2

n=number of cases

**Figure 8.** Distribution of cases with positive laboratory findings

DISCUSSION

Abusive behavior at home is a human rights crime and a costly public health problem all over the world. The grave impact of violence affect all countries. Consistently, it causes over 1.6 million deaths per year (**Haddad et al., 2011**).

Incidence of homicides is constantly changing as it's closely related to socio-economic changes within a particular community (**Baralic et al., 2010**). Various factors may increase the child deaths incidence, such as overpopulation, daily life depression, revolution, terrorism, drug abuse and easy accessibility for weapons (**Patel, 2012**).

Unfortunately, Egypt has no reliable statistics about the child deaths. So, the aim of this study was to draw attention to socio demographics, characteristics, autopsy findings and laboratory results of such cases in Great Cairo through the year 2016 in order to achieve Knowledge base for detection and assessing child deaths and thus proper documentation of such phenomena hoping to decrease such crimes.

The total number of autopsied cases was 1562 in Great Cairo during the year of the present study. 182 of these cases were children representing (11.7%).

This is higher than the percent had been recorded in Port-Said and North Sinai during the period from 2000 to 2007 which was 89 representing 2.73% of the total deaths (**El-Elemi and Moustafa, 2013**).

This may be clarified by the culture of Port-Said and North Sinai that consider

notification to authorities is a dishonorable conduct or may be due to lack of data base, also the use of traditional solving of domestic troubles in Arabian sitting may have a role.

Concerning the seasonal variation in our study it was found that, the highest incidence of Child deaths was observed during Summer (36.8%).

The rate of crimes tends to be higher in the summer than during other seasons of the year due to a variety of factors, including the following: Better weather during the warmer months means more people are out and about, including more thieves and burglars. Also, Warm weather encourages people to enjoy outdoor activities before colder weather arrives. Empty homes more often give criminals an ideal chance for stake out and breaking in. In fact, the heat can make some people irritable. It's possible that the discomfort caused by elevated temperatures can contribute to a rise in criminal behavior, which can lead to crime.

Opposite results were reported by **Al-Hawari and El-Banna, (2017)** who stated that, spring months had the highest percentage of child deaths (28.1%), then they declined throughout winter and summer months (25.8% and 25% respectively), to reach 21.1% % in autumn months

The higher hospital admissions, mood disorder severity, electroconvulsive therapy use, and worsening of depression scores in spring may point out a connection between spring and aggravation of mood disorders (**Goodwin**

& Jamison 2007, Postolache et al. 2010).

The current study revealed that the highest percentage of child deaths was found in the age group between 10 - 18 years that represents 94 case (51.6%).

Similar results were observed by **Kotb and Ibrahim, (2014)** and **Athani et al, (2017)** who found that, the highest percentage of child deaths was mainly in the age groups between 16 -18 years and 15-18 respectively.

The high incidence in this age group is because they are prone to commit suicide and they use different means of transportations, so they are also more prone to road traffic accidents.

Findings of the current work are not in agreement with those of **El-Elemi and Moustafa,(2013)** who stated that, 41% of the victims were less than 1 year old.

This may be due to that infanticide cases are mostly not reported in official records if the delivery was unattended or performed outside hospitals.

By analyzing the child deaths gender in the present study, the number of male cases was 112 representing 61.5% of cases and 70 cases were females which represents 38.5% of cases. Our results were similar to studies of **Cekin et al., (2005)** and **Parakkari et al., (2017)** where males outnumbered females because of their more adventurous nature, violent attitude and open-air activities like swimming, riding motorcycles and the motor tricycle (toktok).

On the other hand, this observation is in contrast to previous studies which found that female infants are particularly at risk for infanticide (**Byard, 2004**). In China, it was reported that girls are more prone to be killed at birth or particularly aborted because of their perceived decreased societal value, leading to a marked imbalance in the male : female *ratio* (**Coale and Banister, 1994**).

The present study revealed that 103 cases (56.6%) of child deaths reside Cairo while 79 cases (43.4%) of cases reside Giza and Qalyubia. Similar to **kotb and Ibrahim, (2014)**, **Kajese et al., (2011)** and **El-Hak et al., (2009)** who found that more than 50 % of victims were from rural areas with low socioeconomic status.

This result is in contrast with the results of **El-Elemi and Moustafa, (2013)** who documented that 73% of victims were from urban areas with moderate and high socioeconomic levels.

In the current work, the assailant was either a stranger or a relative in 133 cases (73.1%), father was the assailant in 15 cases (8.2%) while mother was only in 10 cases (5.5%).

Schnitzer and Ewigman, (2005) stated that, children living with unrelated adults were 50 times more prone to fatal injury than were children living with their parents. These results are in accordance with a study done in Belgrade, in which 69.4% of the victims were murdered by relative (**Baralic et al., 2010**).

Meanwhile, the study of **El-Elemi and Moustafa, (2013)** showed that the assailant was a stranger in (45%),

colleague or neighbor in (22.5%), and a first degree family member in (9%) of cases.

On the other hand, the Turkish study by **Karakus et al., (2003)**, indicated that mothers were the assailant in 70% of cases. Also **Baralic et al., (2010)**, reported that more than half of the victims (69.4%) were killed by parents. The mother was the single assailant in most of these cases (52.2%). Seemingly, **Kotb and Ibrahim, (2014)** showed that the majority of known assailants were the child's relative and neighbors (58%) and the parents outnumbered other relative assailant.

In our study the fathers outnumbered the mothers as single assailant in the child abused cases, similar to a study done in Malaysia which reported that mothers are less likely to kill their children in developing countries (**Kasim et al., 1995**).

This parents engagement in such fatal injuries may be due to that, Egyptian parents will in general use force through beating to discipline the child, particularly when the child shows troublesome behavior, law-breaking and noncompliance at home or school. This could increase in severity and may be lethal in low socio-economic families (**Atta and Youssef, 1998**).

The physical abuse was the commonest type of violence (131 cases, 72 %) as compared to 5 cases (2.7%) who were subjected to combined physical and sexual abuse.

These findings are contradictory with those of **Al-Hawari and El-Banna,**

(2017) who reported that, sexual abuse was the commonest type. This difference may be because Al-Hawari and El-Banna study included alive cases of different age groups subjected to domestic violence only in South region of Jordan.

Fighting or robbery was the commonest type of crime representing 44 cases. 30 cases of them were in second decade. The teenagers are more prone to outdoor violence as they are more independent from their parents than first decade children, the researchers of the current study also recorded a number of cases in which the teenager was a toktok driver (motor tricycle) and the violence was inflicted to facilitate robbery.

Crimes of honor/illegal child were reported in 8 cases of which 3 cases were in the second decade, 2 cases in the first decade and 3 cases were infants.

These findings were very serious as crimes of honor in Egypt appear to receive insignificant attention. A number of studies on honor crimes by the Center for Islamic and Middle Eastern Law at the School of Oriental and African Studies in London include a study on the legal system in Egypt, noting the bias against women in favor of men in general, and in particular Article 17 of the Penal Code Egyptian: discretionary power to allow toleration in certain circumstances, often used in the case of honor crimes (**Cusak and Cook, 2007**).

The analysis of manner of death was based on history, eye witnesses, police information, circumstantial evidence and the autopsy findings. Our study revealed that 34.1% of cases were homicidal,

28.6% were accidental and 14.3% were suicidal.

Number of male victims was higher than females in homicidal and accidental deaths, while suicidal deaths were more in females.

Our results are partially in line with the study conducted by **Kotb and Ibrahim, (2014)** where homicidal deaths (42.5%) were more than accidental deaths (36.4%) and suicidal were the least. In spite of the fact that men will in general complete suicide more often than women, women attempt suicide far more frequently than men. This pattern is frequently referred to as the "gender paradox" of suicidal behavior (**Beautrais, 1996**).

Our results were in contrast with **Athani et al., (2017)** who found accidental cases were more than suicides. this contrast could be due to different socio-behavioral tendency related to each country.

External examination of the studied cases revealed that blunt injury (abrasion, contusion, contused wound) was the commonest type observed in 74 cases, followed by thermal injuries in 23 cases then penetrating injury in 22 cases. These findings are supported by **Subedi et al., (2013)**.

As for the site of trauma, the current study showed that, multiple regions were mostly involved in 80 cases (44%) including 3 cases with injury to genitalia. Head was the region with highest number of injuries (29 cases, 16%) followed by the chest 21 cases (11.5%), while neck, abdomen and lower limb injuries

presented 9 cases (5%), 7 cases (4%) and 6 cases (3.3%) respectively. 30 cases (16.2%) revealed negative autopsy findings. Extravasations was observed in 103 cases (56.6%).

Similar results were reported by **El-Hak et al., (2009)** and **Okoye and Okoye, (2011)** who found that abusive head trauma was the commonest type of injury. Our studies are also in accordance with those of **Kotb and Ibrahim, (2014)** who observed that, multiple regions were injured in most cases, while head showed the greatest number of injuries, followed by the neck.

On analyzing cases with head injuries; cerebral contusion or laceration was the commonest, representing 33%, followed by skull fractures 15.4%, then subdural, extradural, subarachnoid and combined meningeal hemorrhage in 7.7%, 6.6%, 5.5% and 2.7% respectively. While, neck injuries were in the form of hyoid fracture 8.2% and vascular injury 5.5%.

This is in contrast with **Gill et al., (2009)** who conducted a study on infant and revealed that subdural and subarachnoid hemorrhage was more common than skull fractures in head injury deaths.

This contrast could be attributed to type of trauma as head injuries may involve contact and/or acceleration-deceleration forces. Contact forces cause focal lesions (scalp contusion, skull fracture, epidural hemorrhage), while acceleration-deceleration (mainly rotational forces) results in diffuse lesions (e.g., subdural hemorrhage, diffuse

axonal injury, intermediate contusion) (Gill et al., 2009).

subarachnoid hemorrhage showed statistically significant higher % in infants as compared to other age groups. Hochstadter et al., (2014) retrospectively analyzed 171 cases of severe traumatic brain injury (TBI), children who had CT head imaging within the first 24 h of hospital admission. Subarachnoid hemorrhage was present in 50% children with severe TBI, and it was indicative of TBI severity.

On considering cases with chest injuries; lung or heart laceration was the commonest (62 cases), followed by hemo/pneumo thorax then fracture ribs. The lungs occupy most of the rib cage, and thus are probably more vulnerable to injury when compared to the heart. This is in line with the studies done on road traffic incident victims in India by Kumar et al., (2011) and Reddy et al., (2014).

Visceral laceration and hemoperitoneum were manifested in most of the cases with abdominal injuries (36 and 24 respectively). The abdomen is vulnerable to injury since there is minimal bony protection for underlying organs. This is supported by Subedi et al., (2013) who studied the profile of abdominal and pelvic injuries in medico-legal autopsy in Nepal.

On evaluating cases with limb injuries; lower limb injuries were more common than upper limb. This result is supported by Enweluzo et al., (2008).

Regarding the underlying cause of death in the current study, trauma was the commonest cause of death (38.4%), while 28.6% of cases were due to various malpractice claims and pathological deaths. Asphyxia was the third cause in 16.5% of cases followed by thermal injuries in 12.6%, and the least cause was due to poison in 3.8% of cases.

These results are partially supported by those of Kotb and Ibrahim, (2014) who documented that trauma was the commonest cause of death, followed by asphyxia, pathological causes then poisoning and Burns. El-Hak et al., (2009) also reported in their study in Egypt that trauma was the most common cause of death in childhood.

Regarding to the underlying cause of death in relation to gender, males showed statistically significant higher incidence of death with asphyxia, blunt injury, penetrating injury, thermal injury and firearm than females. While, females showed statistically significant higher incidence than males with death by poison, this may be explained by the aggressive nature of males.

Consistently, in 2017 a study conducted in USA reported that males ages 15 to 19 were more than seven times more likely to die from firearm-related incidents (CDC, 2017).

As for, the type of wound in the current study, blunt injury (bruises and lacerations) was the commonest type followed by sharp injury (cut and stab wounds) and firearm injury was the least. The high rate of using blunt objects could be clarified by the easy accessibility to

such objects at a particular moment in time (these include stick, fists and feet and other bodily parts of the perpetrator) (**Baralic et al., 2010**).

These observations are in line with a study in Nebraska, where injuries were due to blunt-force trauma (32%) followed by asphyxia (26%) (**Okoye and Okoye, 2011**).

Considering the cases with positive laboratory findings of poisoning, 50% of these cases were positive for carbon monoxide, 16.7% and 4.2% were positive for drugs of abuse (tramadol and hashish) respectively and only 4.2% were positive for organophosphate.

These results agree with those of **Kotb and Ibrahim, (2014)** which showed that 42% of poisoning cases were by organophosphorus, followed by carbon monoxide intoxication in 36.8% and 21% of cases showed drugs of abuse.

Child abuse is a global phenomenon occurring in all socio-economic classes. Yet, it is still underrated and unrecorded due to poor cooperation (**Jenny and Isaac, 2006**). This frequently resulted in failure to explain the phenomenon of child abuse and deaths. Commonly, the degree of child abuse and deaths in Arab countries is not well recognized (**Haj-Yahia and Shor, 1995**).

Collaboration of different authorities is needed to Document the actual incidence and details of child abuse and deaths cases.

CONCLUSION AND RECOMMENDATIONS

Although great efforts has been made in child survival mainly in the past decade, it has not been enough. Millions of child deaths are caused by avoidable causes while we have the means to deliver affordable interventions. The growing motivation towards strengthening of national civil registration in developing countries carries great guarantee for improvement of the accuracy and precision of child cause-of-death rating. From this work we concluded that the total number of child deaths during one year period in the Great Cairo was 182 cases. Majority of incidents were in summer, over 50% of cases were males in the 2nd decade, the perpetrator was not related to the victim in more than 70% of incidents, 70% of cases showed physical abuse. Male children deaths were mainly of homicidal or accidental nature, while females were of suicidal nature. Weapons related deaths in males were mainly blunt, sharp or firearm, while in females it was either poison or thermal agent. 50% of cases with +ve toxicologic lab findings showed elevated Co levels followed by drugs of abuse. On autopsy, cases showed higher incidence of cerebral contusion and skull fracture, followed by lung or heart laceration and lower limb fractures. Urgent attention is required to take the problem of injury and violence against children and adolescents occurring through the world. In Egypt specifically, driving tuktok should be prohibited for the children below 18 years. There has been a great shift in the epidemiological patterns of child deaths. Although great progress has been made in prevention of infectious diseases, the exposure of children and adolescents to the risk of injury and violence has been increasing

and is projected to continue in the future. Internationally, the focus of child health interventions has been made to reduce the under 5 child mortality rate, but the children between 5 and 20 unfortunately received limited attention, which is of particular concern, given that injuries during this period, constitute the greatest burden.

DECLARATIONS

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Research was performed with the approval of Research Ethics Committee at faculty of Medicine for Girls Al-Azhar University (Committee's reference number is 2018122001). Data access permission has been issued from the Egyptian Forensic Medicine authority. Data collection was anonymous.

CONSENT FOR PUBLICATION

Not applicable

COMPETING INTERESTS

None of the authors have any competing interests in the manuscript.

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الملخص العربي

دراسة مرجعية عن وفيات الأطفال بين الحالات المحالة إلى مصلحة الطب الشرعي المصرية خلال الفترة من يناير حتى ديسمبر ٢٠١٦

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أ قسم الطب الشرعي و السموم الإكلينيكية- كلية الطب بنات-جامعة الأزهر، ب قسم الطب الشرعي و السموم الإكلينيكية كلية طب القصر العيني، ج مصلحة الطب الشرعي،

مقدمة: يعتبر معدل وفيات الاطفال مؤشر صحي هام و يتأثر بعوامل اجتماعية و اقتصادية متعددة و يعكس تقدم البلدان. يعد التشريح في حالات وفيات الاطفال مفيد للطب الشرعي و البحوث الطبية. يتم التشريح في حالات الوفيات غير الطبيعية خاصة في الفئة العمرية دون التسعة عشر عام. تعد الإصابات هي السبب الرئيسي للوفاة بين الاطفال، الا انه من الهمية تحديد الأسباب الأخرى و التوزيع العمري للوفيات. وفاة اي طفل هو بمثابة كارثة لاسرته و للمجتمع المحيط. تنتج معظم وفيات الاطفال من الاسباب الطبيعى او الحوادث. يتم استدعاء جهات التحقيق في حالة وفاة الاطفال الغير متوقعة للبحث عن اي دافع اجرامي وراء الحادث. تحدث وفاة الاطفال الناتجة عن سوء المعاملة و الاهمال في كل انحاء العالم. الكشف عن هذه الجرائم و العمل علي منعها هو الاساس في كل الخدمات التي تحمي الطفل .

الهدف: هو وصف تواتر و نمط الوفيات غير الطبيعية في مرحلتى الطفولة و المراهقة في القاهرة الكبرى خلال فترة سنة واحدة .

طرق البحث: تم جمع البيانات خلال فترة سنة واحدة (من ١ يناير ٢٠١٦ حتى ٣١ ديسمبر ٢٠١٦)، تم تسجيل كل وفيات الاطفال المحالة لمصلحة الطب الشرعي و الذين تتراوح اعمارهم بين ٠ و ١٨ سنة باثر رجعى. و هي دراسة وصفية لتحليل ووصف تواتر و نمط وفيات الأطفال في القاهرة خلال فترة سنة واحدة و عددهم ١٨٢ حاله هذا العدد يمثل ١١,٧% من اجمالي ١٥٦٢ وفيات تم تشريحها في هذه المدة. تم تحليل النتائج الخاصة بالحالات من حيث السن، النوع، سبب و اسلوب الوفاة، نتائج التشريح، نوع سوء المعاملة و اخيرا النتائج المعملية .

سرية البيانات :

تم شطب اى -تم الحصول على موافقة خطية من رئيس مصلحة الطب الشرعي المصريه في جمع البيانات من السجلات - بيانات تتعلق بهوية الحالات خلال جمع و تحليل البيانات كما قام الباحثين بوضع أكواد للبيانات الأخرى