Medico-legal Study of the Delayed Causes of Death in Burns

Yasser Salem Selman Al-Yessary MBChB, FIBMS (Forensic pathology). *

Abstract:

Background: Despite society's ability to prevent most of accidental fires, burn injuries and deaths continue to afflict victims of all age groups and pose significance among public health problems; Death may delay three days or more after burn's injury.

Objective: To determine the most important causes lead to delayed death after different types of burns, in hope to prevent these causes of death in future.

Methods: This prospective study was performed in medico-legal institute in Baghdad for (8) month duration from (1-2-2011) to (1-10-2011). The data were obtained from all burn cases referred to that institute. Proper autopsy examination was done including external and internal examination.

Results: The study included (48) cases (21) men and (27) women whom ages ranged between (From birth-70) years. The most affected age group was (21-30) most of them were burned by flame, and the most common delayed cause of death in burns was septic shock in (15) cases most of them were died in the ninth day.

Conclusion: The epidemiology of burns varies from one part of the world to another and even in the same culture over time. It is a function of civilization, industrialization, culture, and societal stability. A significant association was found between the day of death and delayed cause of death**.**

Key words: Medico-legal, Delayed causes, Burns.

Introduction:

Burns are injuries to skin caused by heat which includes (flame, hot liquids electricity, radiation, or chemicals). Most commonly, burns result from heat exposure including fire, steam, tar, or hot liquids [1].

Burns caused by chemicals are similar to thermal burns, whereas burns caused by radiation, sunlight and electricity tend to differ greatly, Thermal and chemical burns usually occur because heat or chemicals contact part of the body's surface, most often the skin [2]. Severe surface burns may penetrate past the skin to deeper body structures, such as fat, muscle, or bone, when skin tissue is burned, fluid leaks from the blood vessels causing swelling and pain. In addition, damaged skin and other body surfaces are easily infected because they can no longer act as a barrier against invading organisms [3].

Burn effects are measured by exposure to heat based on temperature and duration. Additionally, location of the burn is also taken into account to determine the effects of burns because skin varies in thickness, water and oil content, fat, and blood vessels, The severity of burns depends on how deep the injury is and how much of the body has been burned [4]. It is common for a person with a large burn injury to have burns of different depths. The deepest injury is usually at the center of a burned area. The deeper the burn injury is, the greater the number of layers that are damaged [5]. Sweat glands and the roots of hair follicles are in the deeper layers and will be destroyed with a deep burn. Deep injuries heal more slowly, are more difficult to treat, and are more likely to have complications than superficial injuries [6].

The most common system of classifying burns categorizes them as first-, second-, or third-degree. Sometimes this is extended to include a fourth or even up to a sixth degree, but most burns are first- to third-degree, with the higher-degree burns typically being used to classify burns postmortem [7].

Burns can also be assessed in terms of total body surface area (TBSA), which is the percentage affected by partial thickness or full thickness burns (superficial thickness burns are not counted). The rule of nines is used as a quick and useful way to estimate the affected (TBSA) [8].

Burns and deaths due to burns are remaining an important public health problem due to infection of the burnt area and its complications. Burns cause devitalization of tissues, leaving extensive raw areas, which usually remain moist due to the outflow of serous exudates [9]. This exposed, moist area along with the dead and devitalized tissue provides the optimum environment favoring colonization and proliferation of many microorganisms, which is further enhanced by the depression of the immune response. All these factors, i.e., disruption of the skin barrier, a large cutaneous bacterial load, the possibility of the normal bacterial flora turning into opportunistic pathogens and the severe depression of the immune system, contribute towards sepsis in a burns victim, which usually is life threatening [10]. Despite various advances in infection control measures, early detection of microorganisms and newer, broader spectrum antibiotics, management of burn septicemia still remains a challenge. Pulmonary, cardiac and other complications also contribute to the delayed deaths following severe burn [11].

The general delayed causes of death (after three days and more) in burns can theoretically be grouped into six types [12]:

1-Toxic situation: The burn shock phase is presented as a result of absorption and the release of toxic burn products [13].

2- Septic shock: The patients suffered septic shock.

3- Acute renal failure (ARF): After some days the renal indices fell progressively, with high levels of

uremia and creatinaemia. The etiological factor of development of (ARF) is the great mass of tissue damaged by the thermal agent [14].

4- Multiple organ failure: The massive wounds became chronic and eventually lead to multiple organ failure.

5- Cardiac arrest: Considered to be a specific later cause of death in burns as a result of myocarditis. Clinically, it observed as low cardiac output with consequences in the peripheral microcirculation [15].

6- Respiratory failure: Respiratory failure was defined as death caused by failure of the pulmonary system. It was categorized as death due to acute respiratory distress syndrome (ARDS), as defined clinically; it reflects injury to the pulmonary alveolar microvasculature and alveolar wall that leads to the exudation of fluid and plasma proteins that overwhelm the local lymphatic drainage [16].

Methods:

This is a prospective autopsy study of cases belong to people died after (3) days and more of burns. The study was conducted in the medico-legal institute in Baghdad over a period of (8) month's from (1-2-2011) to (1-10-2011).

The data were obtained from all burn cases admitted to the burns unit in different hospitals in Baghdad and died after (3) days and more of burns and then referred to medico-legal institute in Baghdad over a period of study.

Hospital records of all cases involved in this study were reviewed to provide summary of the clinical course. The important data included: age, sex, etiology of burn ,body site affected, total surface area burnt (TSAB) according to the rule of nine, degree (depth) of burns according to six degrees, complications, date of admission, and date of death (after 3 days and more of burn).

The proper autopsy examination was done for all cases (full and complete) which including external and internal examination to determine the gross changes of burns in different body organs. Tissue specimens from important body organs like (lungs, brain, kidneys, heart, and liver) were sent to the laboratory of the medico-legal institute for microscopic pathological examination to determine the complications of burns in these organs and causes of death latter.

The primary causes of death in all cases were determined by the integration of the clinical information, the gross changes and the microscopic findings.

All results are converted to figures and tables. Statistical analyses were applied like P value to show the significance of some results.

Results:

The study included (48) cases that their ages ranged between (From birth - 70) years; (21) men (43.8%) and (27) women (56.2%).

Table (1) shows the distribution of study sample according to age and gender groups. Notice that the most affected age group was (21 - 30) years included (12) cases (25%) seven of them were females and five males, followed by the age group (31 - 40) years included (10) cases (20.8%) four of them were females and six males.

The most common etiology of burns was flame included (18) cases (37.5%) most of victims were females (10) and (8) males, followed by hot liquid included (13) cases (27.1%) most of them were also females (7) and (6) males, as show in table (2).

Table (3) shows the total burns surface area (TBSA) in correlation with age. Notice that the most (TBSA) was (46–60%) in (19) cases (39.6%) most of them in age group (31-40) years in (4) cases (8.3%) from the total number of cases.

Figure (1) shows the degree of burns (depth) in correlation with age. Notice that the most common one was the third degree burn in (27) cases (56.2%) most of them in age group (21-30) years in (7) cases (14.6%) from the total number of cases.

The most common delayed cause of death in burns in correlation with age was the septic shock in (15) cases (31.2%) most of them in age group (41-50) years in (4) cases (8.3%) from the total number of cases, as shown in figure (2).

Table (4) shows the day of death in burns in correlation with delayed causes of death. Notice that the most common one was the ninth day in (9) cases (18.7%) most of victims were died due to septic shock in (4) cases (8.3%) from the total number of cases, and the P value of this table was (0.0001) which it is mean so significant.

Table -1. Age and gender distribution of cases

Age group years	Gender		Total	(%) No=48
	Male	Female		
From birth –10	2	2	4	8.3
11–20	3	4	7	14.6
21–30	5	7	12	25
31–40	4	6	10	20.8
41–50	4	4	8	16.7
51–60	2	3	5	10.4
61–70	1	1	2	4.2
Total	21	27	48	100

Table -2. Etiology of burns and gender distribution

Etiology	Gender		Total	(%) No=48
	Male	Female		
Flame	8	10	18	37.5
Hot liquid	6	7	13	27.1
Chemical	4	5	9	18.7
Electricity	2	4	6	12.5
Radiation	1	1	2	4.2
Total	21	27	48	100

Table 3. Total burns surface area (TBSA) in correlation with age

Age group years	(TBSA)					Total
	1–15%	16–30%	31–45%	46–60%	61–75%	
From birth –10	1	2	1	Nil	Nil	4
11–20	Nil	1	2	4	Nil	7
21–30	Nil	2	3	5	2	12
31–40	Nil	1	4	4	1	10
41–50	Nil	2	3	3	Nil	8
51–60	Nil	1	2	2	Nil	5
61–70	Nil	Nil	1	1	Nil	2
Total	1	9	16	19	3	48
(%) No=48	2.1	18.7	33.3	39.6	6.3	100

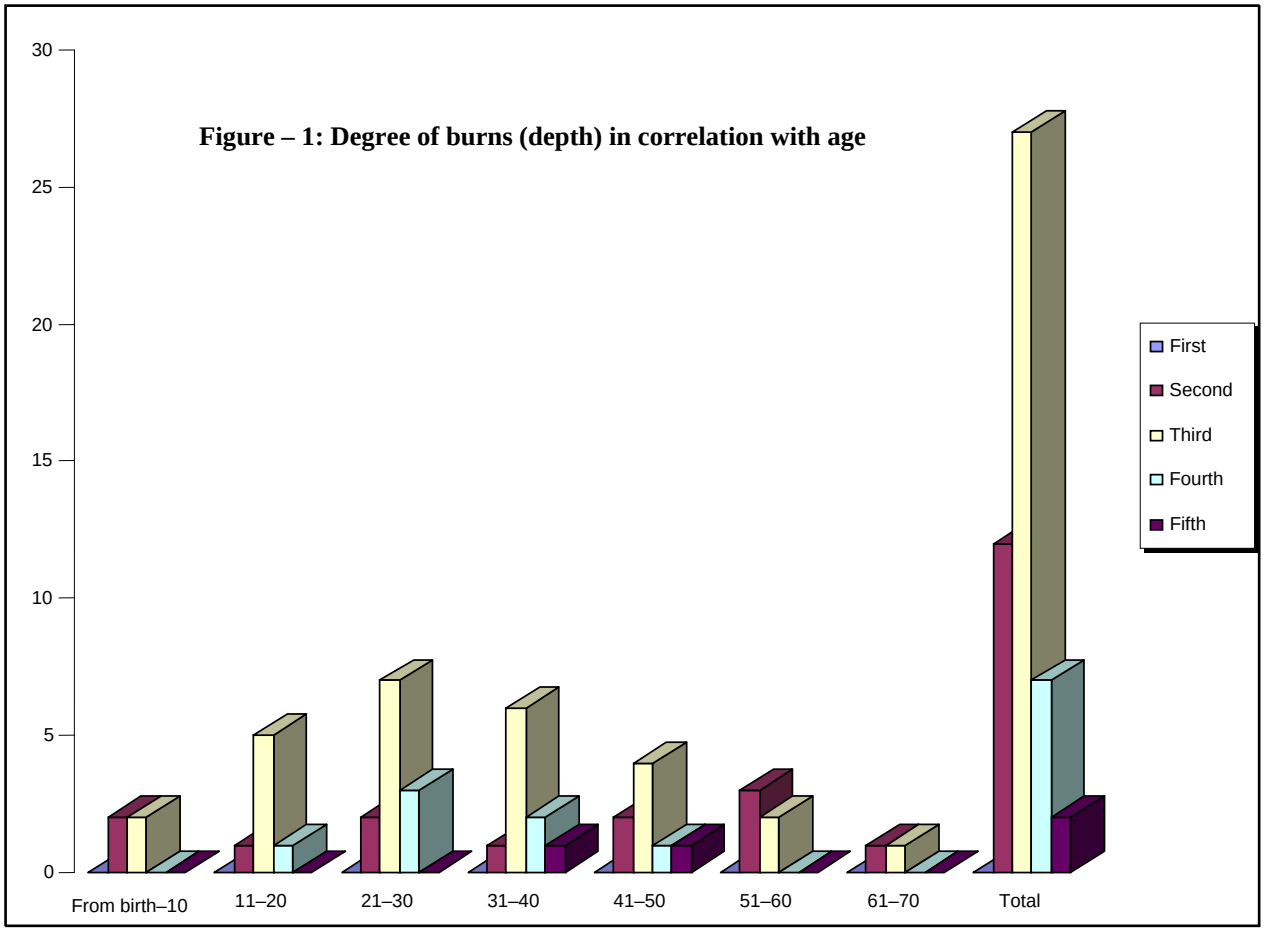

Figure – 1: Degree of burns (depth) in correlation with age

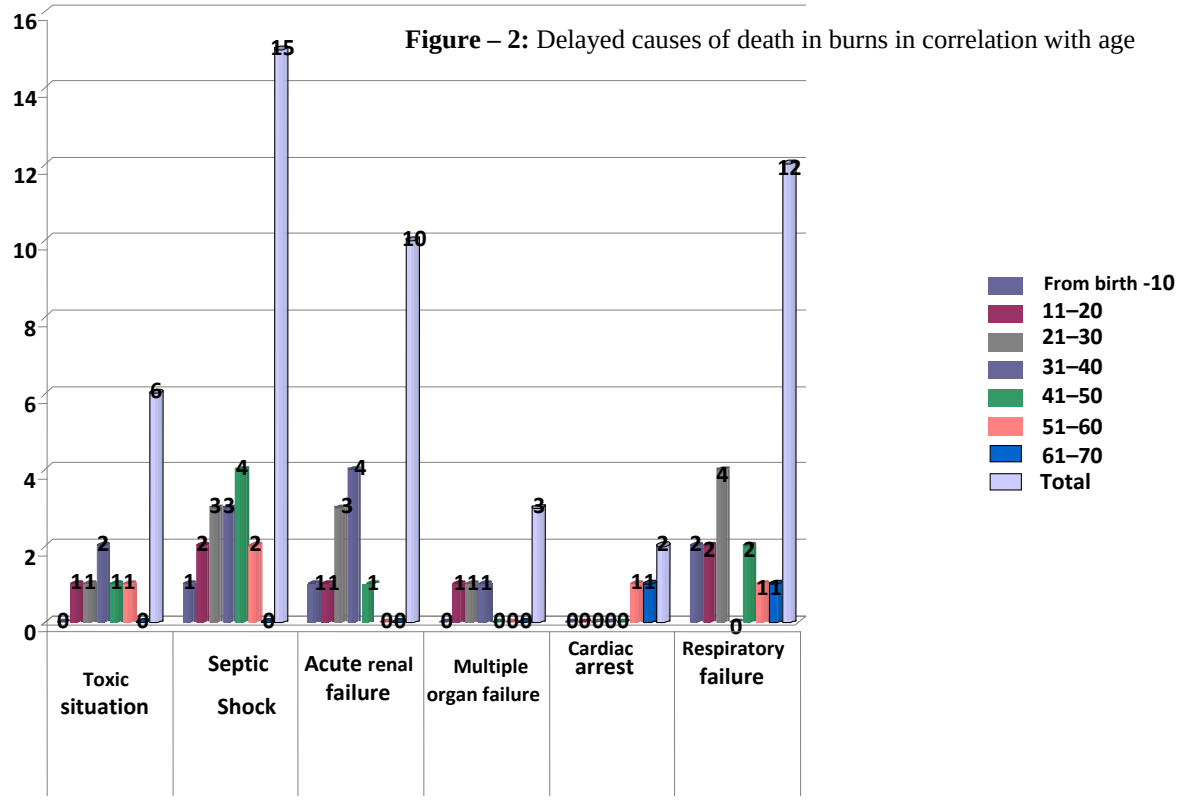

Figure – 2: Delayed causes of death in burns in correlation with age

Table- 4. Day of death in burns in correlation with delayed causes of death

Causes Of death	Day of death												Total
	4th	5th	6th	7th	8th	9th	10th	11th	12th	13th	14th	15th	
Toxic situation	2	1	1	1	1	Nil	Nil	Nil	Nil	Nil	Nil	Nil	6
Septic shock	1	1	2	1	2	4	2	1	1	Nil	Nil	Nil	15
Acute renal failure	Nil	Nil	Nil	1	1	3	2	1	1	1	Nil	Nil	10
Multiple organ failure	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	1	1	1	3
Cardiac arrest	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	1	1	2
Respiratory failure	Nil	Nil	Nil	1	1	2	2	1	2	1	2	Nil	12
Total	3	2	3	4	5	9	6	3	4	3	4	2	48
(%) No=48	6.3	4.2	6.3	8.3	10.4	18.7	12.5	6.3	8.3	6.3	8.3	4.2	100%

P value: (0.0001)

Discussion:

The epidemiology of burns varies from one part of the world to another and even in the same culture over time. It is a function of civilization, industrialization, culture, and societal stability.

There are six factors which were significantly associated with mortality of burns in general and lead to delayed death after three days or more of burn injury; these factors were (age, sex, TSAB, degree, etiology, and complications of burn).

The high age incidence was among young adults (21-30) years, this is not surprising because in this age people are active probably more aggressive, and prone to trauma, this pattern means that burns tend to occur more in certain age groups reflecting the particular developmental or behavioral patterns associated with age, on the other hand, that may be explained by the fact that the members of the above mentioned age group are generally active and exposed to hazardous situations both at home and at work.

And as regards to sex distribution, the female preponderance in all age groups, might be explained by the involvement of females in domestic activities, similar results have been reported from Egypt [17].

Considering to the type of burn injury (etiology), flame was the most common type, followed by hot liquid; that is because these types of burns are highly individualized in each country, similar results have been reported from Japan in spite of differences in standard of living and lifestyle between two societies [18].

Considering to the TSAB and degree (depth) of burn in correlation with age, most common TBSA was (46–60%) and most common degree was third and both of them were happened in young age groups; that may indicate the differences in treatment protocols which influence ultimate high mortality even in young age groups [19].

In the present study, a significant association was found between the day of death and delayed cause of death because the most common cause of death was septic shock in (4 - 9) days after burn and this may be due to delayed or inefficient management of burn patients in general hospitals and delayed referral of those severely injured patients who need more specialized care and also may be due to high rate of pseudomonas infection among hospitalized burn patients, similar results have been reported from Hungary in (2009) [20].

Conclusion:

The most common delayed cause of death in burns was septic shock due to infections, so that the burn's patients often require considerable attention because they need repeated grafting procedures, hygienic precautions, treatment of infections and supportive care to minimize deaths rates, and so we found the benefits of medico-legal studies for other medical branches.

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** Lecturer in the Department of Pathology and Forensic Medicine/ Al-Kindy College of Medicine.*