

# Drowning and near drowning victims in Chania area

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- Drowning
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**SUMMARY. AIM:** The purpose of our study is to present the number of drowning and near-drowning victims that have been admitted to the Emergency Department of the General Hospital of Chania during the period of May 2012 to September 2013. **DESIGN:** Twenty-seven victims have been admitted to the Emergency Department (18 males and 9 females), aged 18-88 years old with a mean age  $65.5 \pm 3.75$  years old. 60% of them were foreigners and the rest were Greeks. 25% were admitted dead, all in seawater. All patients who admitted alive in the Emergency Department had respiratory failure. All incidents occurred accidentally during swimming mainly in the seawater. The time that victims spent under the water was unknown, while nobody has had injuries. 30% were hospitalized in the Intensive Care Unit (with mean age: 71.6 years old) with approximately a three-day hospitalization. **RESULTS:** There was a statistically significant relationship between the prognosis of the patients and their age, the degree of acidosis and the hypercapnia. Specifically, the advanced age, the great degree of acidosis and hypercapnia, were associated with the admission of patients in intensive care unit. None of the patients, who came alive, died subsequently. **CONCLUSIONS:** Acute respiratory failure with severe disorders in the blood gases, are able to prefigure the outcome of the victims. Elderly and tourists are specific subgroups on whom drowning prevention programs must target. *Pneumon 2014, 27(3):231-235.*

## INTRODUCTION

Drowning is defined as the death due to primary respiratory impairment from submersion or immersion in a liquid medium immediately after the incident, or necessarily within the first 24 hours of immersion. "Near-drowning" is defined as an episode of immersion in water with sufficient severity so as to require medical care with high morbidity and mortality (after 24 hours of the event)<sup>1</sup>. Drowning constitutes a cathedral problem affecting approximately half a million victims all over the world every year, while the incidence of near-drowning is 20-500 times higher<sup>2</sup>. In other words,

a human drowned almost every minute around the world. In Greece approximately 300 people per year lose their lives by drowning. The death rate is nearly double in our country compared to Europe. The preventive and public health strategies aiming to reduce risk of drowning are still limited, while a small number of drownings recorded due to an unreliable recording system. We submit our own experience of fatal and non-fatal drownings, that have been transported to the emergency department of the General Hospital of Chania, during the period of May 2012 to September 2013.

## MATERIAL AND METHOD

We present a descriptive, retrospective study of drowning or near-drowning victims that have been admitted to the emergency department of the General Hospital of Chania during the period of May 2012 to September 2013. A protocol has been designed including their demographic characteristics (age, gender, ethnicity), description of the accident (place, time), their co-morbidities, the initial vital signs, the Glasgow scale and their outcome. Conclusions and correlations were exported by statistical analysis. Results are expressed as the mean $\pm$ SEM. The Kolmogorov-Smirnov test was used to analyse the normal distribution of the variables. Quantitative data without a normal distribution were analysed with parametric tests. One way ANOVA statistical analysis was used. P value less than 0.05 was considered statistically significant.

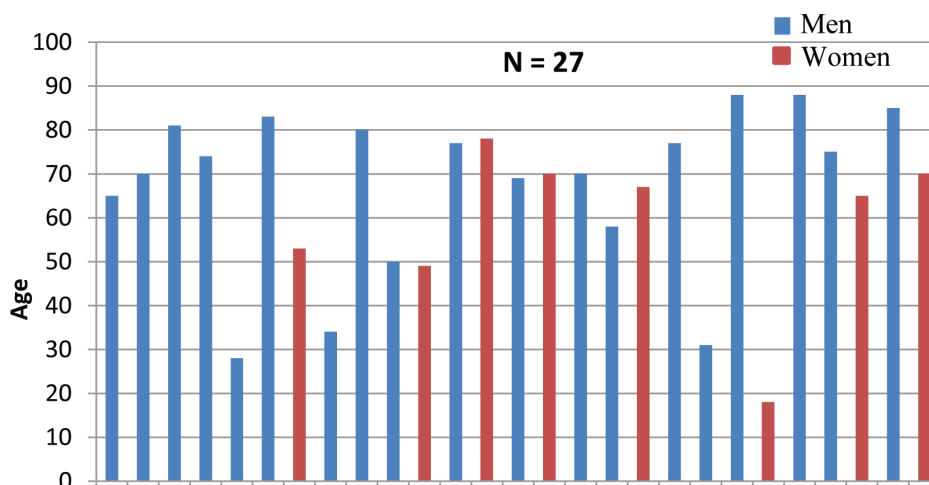
## RESULTS

Twenty seven patients were transported to the emergency department, 70% of whom were males and 30% females, aged: 18 to 88 years old. The mean age was 65.5 ( $\pm$  3.75) years old. 69% of them were above 65 years old (Figure 1).

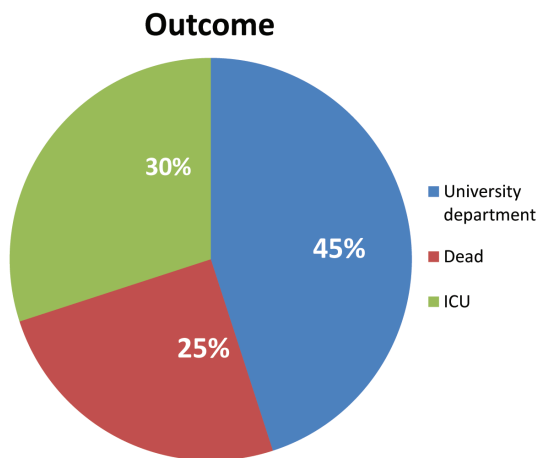
60% were foreigners and 40% were Greeks. All incidents resulted from accidental immersion during swimming, predominantly in salt water (85%) and in pool (15%). 26% of the victims had co-morbidities that determined their prognosis. In most patients, the duration of the accident was unknown and there were no injuries to anyone. In two cases, prior alcohol use was reported, while in other two cases a medical history of epilepsy was reported (with subtherapeutic serum levels of valproic acid). 25% were transported dead (with mean age: 77.1 years old) with unknown circumstances surrounding their drowning, everybody in seawater. 30% were intubated and transferred to the intensive care unit (ICU) (with mean age: 71.6 years old). These patients have presented with low level of consciousness (Glasgow Scale below: 13/15). 45% were admitted to the Respiratory Medicine Department (with mean age: 55.58 years old) (Figure 2).

Correlation was found between the age of the patients and their outcome. [ $F(2, 25) = 3.850, p = .036$ ] (Figure 3).

All patients attended to the emergency department had respiratory failure. All victims presented with metabolic acidosis (PH <7.35), while mixed type of acidosis with  $PCO_2 > 45$ mmHg was presented to 25%. The PH value was



**FIGURE 1.** Age and gender of victims of drowning and near-drowning that have been transported to the ICU, during the period of May 2012 to September 2013. Total number of individuals, n = 27.



**FIGURE 2.** Outcome of drowning and near-drowning victims that have been transported to the ICU during the period: May 2012 - September 2013.

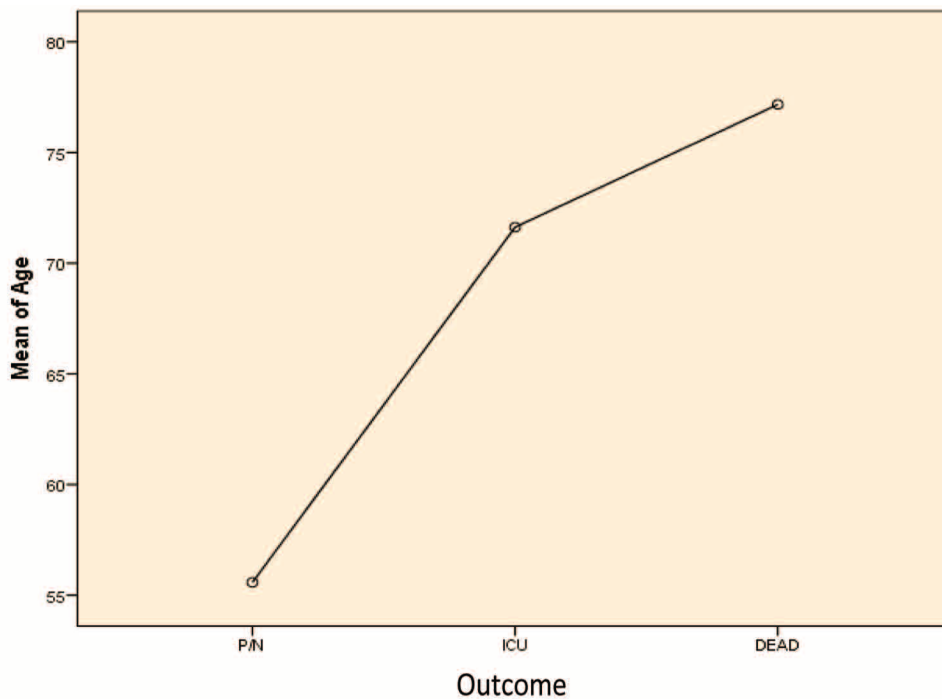
not correlated with the type of liquid (seawater or pool water). It was found that the degree of acidosis, ( $H(2) = 17.204, p = 0.000$ ) and hypercapnia, [ $F(1, 19) = 8.232, p = 0.010$ ] in arterial blood gases, determine the outcome of patients with a statistical significance (Figure 4).

From the alive the 60% fulfilled the criteria for mild

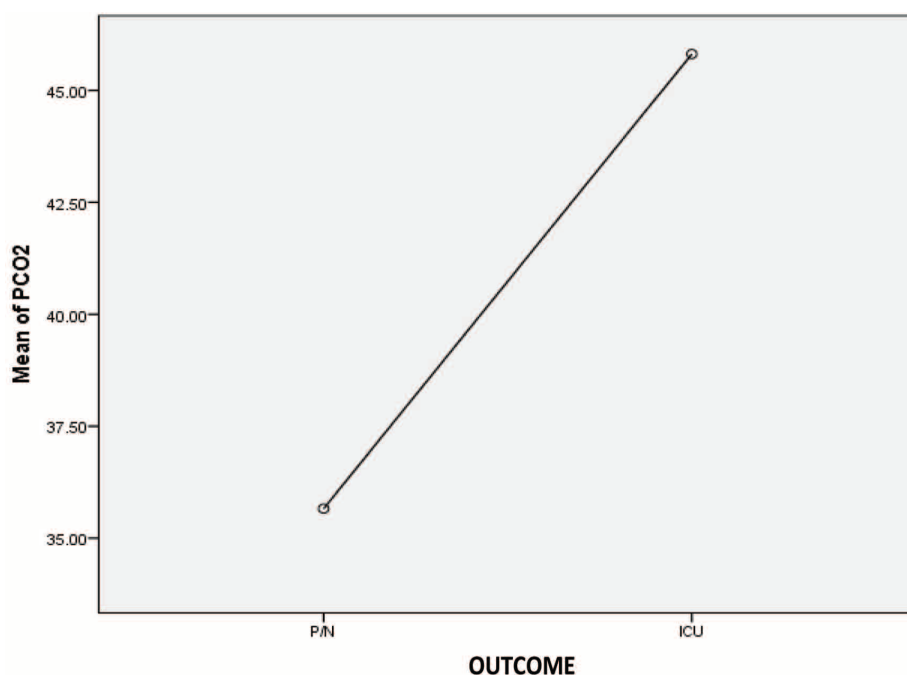
ARDS with a  $PaO_2/FiO_2$  value  $<300$ , 35% fulfilled the criteria for moderate ARDS with a  $PaO_2/FiO_2$  value  $<200$  and 5% had severe ARDS with a  $PaO_2/FiO_2$  value  $<100$ , according to the new definition of Berlin for ARDS<sup>3</sup>. Patients with a  $PaO_2/FiO_2$  value  $<200$  had been intubated immediately, while patients with mild ARDS were treated with high oxygen mixtures, with a good clinical outcome. Radiologically, 70% were presented with bilateral alveolar opacities, such as non-cardiogenic pulmonary edema. 20% had localized alveolar infiltrates and 10% had normal chest radiography, despite their respiratory insufficiency. The average time of hospitalization in the ICU was 3 days. None of the patients who came alive to the ICU died or had neurological disorders.

### DISCUSSION

The predominance of males as victims of accidental submersion has been shown by many authors<sup>4,5</sup>. Adult males are in high risk. It is estimated that nearly 80% of the victims are males<sup>5</sup>. Possible reasons for this predominance of men are the greater exposure to aquatic environments, and especially to high exposure activities, the overestimation of their abilities in swimming, and the



**FIGURE 3.** Correlation between the age and the outcome of drowning and near-drowning victims that were transported to the ICU during the period: May 2012 - September 2013, [ $F(2, 25) = 3.850, p = 0.036$ ].



**FIGURE 4.** Correlation between hypercapnia and the outcome of drowning and near-drowning victim that have been attended to the ICU, during the period: May 2012 - September 2013, [F (1, 19) = 8.232, p = 0.010].

risky behavior of men compared to women<sup>7</sup>. Children aged 1 to 4 years old have the highest drowning rates particularly in pools<sup>6</sup>. The percentage of the accidents in lakes, rivers and oceans increases in relation to the age<sup>6</sup>. No pediatric population was included in our study. From our study a correlation between the age of patients and their outcome was found. The mean age of the patients admitted to the emergency department was 71.6 years old and the mean age of those were hospitalized in the Respiratory Medicine Department was 55.58 years old. Probably this is due to the co-morbidities of the victims. Arithmetical superiority of tourists that have been transported to the emergency department raises many questions. It is not the first time that this superiority is observed in epidemiological studies, especially in tourist destinations<sup>8,9</sup>. The danger for foreigners is three to four times higher<sup>8</sup>. Tourists, as observed in our study, come mainly from countries of Europe with a different lifestyle and they often inexperienced with the sea of Crete as well.

Furthermore, this study confirms and extends the observation that arterial hypoxemia, metabolic acidosis and hypercapnia are the main pathophysiological disorders after an immersion incident<sup>10-12</sup>. We should not forget that alcohol consumption is a major risk factor for submersion. By the review of the bibliography, alcohol

has been implicated as a significant contributing factor in many drowning cases. Among adolescents and adults, the 70% of drowning accidents and the 25% of the cases of near drowning are related to alcohol<sup>6,8</sup>. Alcohol use affects crisis, and its hangover effects are exacerbated by exposure to sun and high temperature<sup>8,13</sup>. It is also worth to mention that among people with epilepsy, drowning is the most common cause of death by unintentional injury<sup>14</sup>.

## CONCLUSIONS

Although the final result of the course of patients with near-drowning is mainly related to the presence or absence of anoxic encephalopathy<sup>15</sup>, our patients presented with acute respiratory insufficiency with severe disruptions of blood gases, able to prefigure the outcome of their hospitalization. The elderly and tourists are specific sub-populations on whom the prevention programs about drowning should focus.

## CONFLICT OF INTEREST

None of the authors has any conflict of interest related to the present manuscript.

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