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Occurrence of hypothermia in a prehospital setting, southern Sweden

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Abstract Severe accidental hypothermia mainly affects victims of outdoor accidents. However, hypothermia can also occur in non-traumatized indoor patients. The aim of this study was to examine the occurrence of hypothermia obtained at the scene of the rescue in patients classified as priority 1 cases during two three-month periods in southern Sweden.

This prospective, clinical cohort study was performed in a prehospital setting, southern Sweden. Ninety-four patients were included during two three-month periods. According to where the patients were found they were split into two groups, outdoor or indoor and then separated into three categories; general medicine-, trauma- and intoxicated patients. The environment temperature was measured on arrival according to the location where the rescue occurred and core temperatures (tympanic membrane) of patients were measured in connection with the monitoring in the ambulance before departure and at the time of arrival to the emergency room at the hospital.

This study demonstrated that the only group that shows body core temperature below 36 °C, was the outdoor intoxication-group during the winter-period (35.7 ± 1.3 °C). We conclude that intoxicated patients are at higher risk for hypothermia than minor trauma patients.

Introduction

It has earlier been concluded that hypothermia was found in 80% of patients with minor trauma at the time of rescue (Kober et al., 2001). Severe accidental hypothermia mainly affects victims of outdoor accidents who have been exposed to a cold environment or immersion in cold water. Most urban environment reports are associated with drug or alcohol abuse, elderly person with serious illness, suicide or sports accidents (Brát et al., 2004). However, hypothermia can also be found in non-traumatized indoor patients (Russo et al., 2005). The function of the human body is optimal with a core temperature between 36.4–37.5 °C and the definition of

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accidental hypothermia is an unintentional decrease of the core body temperature to <35 °C (Kempainen and Brunette, 2004; Mallet, 2002; Hildebrand et al., 2004). However other studies has defined hypothermia as a core temperature <36 °C because even mild hypothermia is associated with several physiological complications (Kober et al., 2001).

Thermal discomfort contributes to fear, pain and an overall sense of dissatisfaction (Kober et al., 2001). Hypothermia induces pathophysiologic changes in the body organ system, and physiological alterations depend on the degree of hypothermia. Mild hypothermia increases sympathetic activity with vasoconstriction and tachycardia increasing cardiac output to four or five times the resting volume. Atrial or ventricular arrhythmias can occur. Decreasing body temperature to severe hypothermia decreases heart rate and cardiac output. Central stimulation of the respiratory centre increases the respiratory rate during mild hypothermia. As the hypothermia worsens the stimulation will be depressed leading to a decrease in respiratory rate, tidal volumes and oxygen delivery and the depression of cerebral metabolism leads to a progressive depression of consciousness (Hildebrand et al., 2004). It is therefore important to identify the hypothermic patient and start rewarming and supporting vital signs (Kempainen and Brunette, 2004).

In the present study we defined hypothermia as core temperature <36 °C, measured by tympanic membrane temperatures, because even mild hypothermia is associated with several complications and thermal discomfort. The aim of this study is to examine occurrence of hypothermia obtained at the scene of the rescue in southern Sweden during two three-month periods.

Methods

In this study patients classified as a priority 1 case (most urgent transport) by the ambulance team during two three-months periods (June—August and December—February) were prospectively included. According to where the patients were found they were split into two groups, outdoor or indoor. In order to reduce bias, the measurements were carried out by senior teams from Falck Ambulance Ltd., department of Sjobo and Lund in southern Sweden. The environment temperature was measured on arrival according to the location where the rescue occurred. Temperatures were measured with calibrated thermometers (Voltcraft 230). The range of the temperature probe is −35 to +230 °C and with an accuracy of ±2 °C.

Core temperatures (tympanic membrane) of patients were measured in the ambulance before departure and at the time of arrival to the emergency room at the hospital. Core temperature was measured with a calibrated thermometer (Genius® Modell 3000A) with accuracy within ±0.05 °C. Measurements were made on both left and right ear and are presented as mean values.

The patients were insulated with one blanket and the temperature in the ambulance was maintained at 20 °C. A 16G intravenous cannula were sited on the back of the left hand and warm (37 °C) intravenous fluids (lactated Ringer's solution) were given according to protocols, i.e. to maintain systolic blood pressure ⩾90 mmHg.

All data collected were transferred to one single database designed for this study and an anonymous ID number was given to each patient included. Data pooling, analysis and statistical calculations were performed using SPSS version 14.5 (SPSS Inc., Chicago, IL). Results are presented using descriptive statistics according to numbers of patients (*n*), mean and standard deviation (SD).

Findings

The core body temperatures were measured on 94 patients during two three-month periods. Forty-one patients were studied during a summer-period (June—August, 2007) and 53 patients during a winter-period (December—February 2007/2008). Demographic data showed similar populations within the summer- and winter-periods (Table 1). No measurement problems were recorded during the study.

All patients were covered with one blanket and the temperature inside the ambulance was maintained at 20 ± 2 °C. Warm fluids (lactated Ringer's solution), were given according to protocol; i.e. maintain systolic blood pressure ⩾90 mmHg (Table 1). The time of transport was 27 ± 14 min during the summer-period and 30 ± 16 min during the winter-period. The mean outdoor on scene-temper-

Table 1 Demographic data of the patients, vital signs, infused fluids and time of care in the ambulance, described in the summer-period versus winter-period. Values presented as mean ± SD.

	Summer-period (*n* = 41)	Winter-period (*n* = 53)
Age (year)	58 ± 23	59 ± 24
Sex (F/M)	14/29	21/32
Weight (Kg)	78 ± 22	79 ± 19
Vital signs		
Heartrate (BPM)[a]	90 ± 24	94 ± 35
Systolic NIBP (mmHg)[a]	138 ± 26	140 ± 39
Fluids (ml)[b]		
General	175 ± 41	284 ± 405
Trauma	139 ± 40	356 ± 445
Intoxication	0 ± 0	0 ± 0
Time of care (min)		
General	26.7 ± 14.3	30.6 ± 16.6
Trauma	26.4 ± 10.3	33.7 ± 16.9
Intoxication	20.4 ± 17.7	21 ± 13.5

[a] Values obtained on scene.
[b] Warm lactated Ringer's solution.

Table 2 On scene temperatures (°C) obtained at indoor- and outdoor patients, in the summer- versus winter-period, respectively. Values presented as mean ± SD.

	Summer-period	Winter-period
Indoor	24.1 ± 2.3 (*n* = 22)	22.2 ± 3.5 (*n* = 35)
Outdoor	20.8 ± 5.3 (*n* = 19)	9.4 ± 2.4 (*n* = 18)