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**Słowa kluczowe:**  
centra urazowe, opieka zdrowotna, ratownictwo medyczne

**Key words:**  
trauma centers, health care, paramedics

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## Practical issues involved in introducing new national emergency care system- concerning Trauma Centers in Poland

Praktyczne zagadnienia związane z wprowadzeniem nowego systemu Państwowego Ratownictwa Medycznego - dotyczące utworzenia Centrów Urazowych w Polsce

Ratownicy medyczni oraz lekarze, jako część systemu centrów urazowych, są zobowiązani do zapoznania się z zasadami kwalifikowania pacjentów do przyjęcia do centrum urazowego. Celem niniejszej pracy było sprawdzenie znajomości kryteriów przyjmowania rannych pacjentów do centrów urazowych wśród personelu medycznego wchodzącego w skład systemu ratownictwa medycznego w Polsce. Przeprowadzone badanie ankietowe zawierało pytania z zakresu kwalifikacji pacjentów do leczenia w centrach urazowych zgodnie z Rozporządzeniem Ministra Zdrowia. Grupa badana składała się z losowo wybranych 88 lekarzy (średnia wieku: 42,3 ± 2) i 130 ratowników (średnia wieku 31,1 ± 3). Największe problemy sprawiło pytanie dotyczące kryteriów anatomicznych i fizjologicznych kwalifikacji pacjentów do leczenia w centrum urazowym. Tylko 5% ratowników i 25% lekarzy zaznaczyło poprawne odpowiedzi (p < 0,00001). Z powyższej pracy wynika, iż poprawa funkcjonowania centrów urazowych powinna polegać na budowaniu dobrych fundamentów wiedzy, dobrej komunikacji i współpracy między ratownikami i lekarzami. Rozwój systemu opieki zdrowotnej i centrów urazowych powinien opierać się nie tylko na wprowadzeniu odpowiednich regulacji prawnych, ale również na przeprowadzaniu szkoleń dla personelu medycznego.

### Introduction

The treatment of severely injured patients is a challenge for preclinical and clinical treatment systems. It also causes financial aspects of increasing importance for health care system. Trauma center levels I or II are able to support the full range of treatment for the severely injured. Level I center is a regional resource hospital that is central to trauma care system and provides total care for every aspect of injury, from prevention through rehabilitation. It maintains resources and personnel (trauma, neuro and orthopedic surgeons 24h/7J) for patient care, education and research and provides leadership in education, research and system planning to all hospitals caring for injured patients in the region. Level II center provides comprehensive trauma care, regardless of severity of the injury and works in collaboration with a Level I center.

Paramedics and medics as a part of the trauma system are obliged to acquaint with the criteria of admitting patients to the Trauma Centers. The aim of this research is to examine knowledge of criteria of admitting injured patients to trauma centers in Poland among medical staff included in emergency medical system. A study questionnaire with three tasks concerning criteria of patients' qualification to treatment in Trauma Centre according to the decree of Ministry of Health in Poland was conducted. The examined group consisted of randomly selected 88 doctors (mean age: 42.3±2) and 130 paramedics (mean age: 31.1±3) practicing emergency medicine. The most problematic was the question about general principle for patient's qualification for treatment in the trauma center, concerning the number of anatomical and physiological criteria. Only 5% of the Paramedics and 25% of MDs marked the correct answer (p<0.00001). Improvement of the functioning of Trauma Centers should rely on building the good fundamentals of knowledge, good communication and cooperation between paramedics and doctors. Development of health care system and Trauma Centers should be based not only on introducing legal regulations, but also on organizing series of trainings for medical staff.

It provides 24-hour availability of all essential specialties, personnel, and equipment [1]. The level of trauma system development in Europe shows country-by-country variation. Haas et al. concluded that the distribution of trauma center levels I or II in central and Western Europe is sufficient and can be specified with 1 center per 1 million inhabitants. However, the authors found that less than half of these patients are treated in levels I or II trauma centers and better utilization of trauma centers is needed [2].

The experiences of others countries indicate that treatment patients after trauma should be conducted by Trauma Team, consisted of professionals [3]. The need for creation of trauma centers in Poland have been reported by the Society of Polish Surgeons. The main objective was to reduce the number of

complications and the mortality of patients after trauma. For this purpose, it was planned to create scattered around the country Trauma Centers in hospitals that have Emergency Department, Anesthetic and Intensive-care unit, Operating Suite, Surgical and Neurosurgical Wards which can provide comprehensive care for victims in the hardest cases. The creation of the Trauma Centers and Patients Trauma System has begun in 2006 in Poland, and it has been validated by the Ministry of Health in decree about Trauma Centers from 18th of June, 2010 [4,5]. Since then Polish health care system includes 13 Trauma Centers (according to plan there should be 14). The strict criteria was prepared by surgery experts to prevent Trauma Centers from dealing with less injured patients who can be healed on other wards. Only people in life-threatening condition, who have suffered heavy injuries fulfilling two anatomical and two physiological criteria are qualified for treatment in Trauma Centers [5,6]. Daily practice shows that the reality looks different than the assumptions. Trauma Centers have to deal with many patients with minor injuries a day instead of just polytrauma ones. The main reason of this problem seems to be qualification of patients in the place of accident by paramedics or medics. People who are responsible for doing triage prefer to deliver patients with minor trauma to Trauma Centers. Paramedics and medics as a part of the trauma system are obliged to acquaint with the criteria of admitting the injured to the Centers. Although both of these decisive groups undergo different training and their roles in the trauma system vary, their knowledge of the above mentioned criteria is crucial for proper functioning of the whole system.

#### Aim of study

The aim of this research is to examine knowledge of criteria of admitting injured patients to trauma centers in Poland among medical stuff (emergency medicine specialists and paramedics) included in emergency medical system.

#### Material and method

A study questionnaire was conducted among 218 randomly selected doctors and paramedics currently practicing in emergency system in Lodz voivodeship. The group consisted of 88 doctors (meanage: 42.3±2) and 130 paramedics (mean age: 31.1±3). Respondents were given a questionnaire with three tasks concerning criteria of patients' qualification to

treatment in Trauma Center according to the decree of Ministry of Health in Poland about Trauma Centers. In the first item they were asked to choose out of 13 given conditions/injuries (anatomical criteria), which of them should be treated in trauma center. In the second, they were presented 9 physiological parameters and asked to choose those qualifying patients to management in trauma center (physiological criteria). In the last question respondents were to point how many anatomical and physiological criteria are needed to send a patient to a trauma center. Finally, the questionnaire contained questions related to respondents' age, sex and profession (doctor or paramedic) (Appendix A)

#### Statistical analysis

The analysis between statistical features correlation was done with chi-squared test. Differences between correct answers given by doctors and paramedics in each question and point were examined. The level of significance was  $p < 0.05$ .

Statistical analysis was conducted using a STATA 9 statistical package.

#### Results

Our questionnaire survey was attended by 88 doctors and 130 paramedics. The most problematic for both groups was the question about general principle for patient's qualification to the trauma center (Question 3). Only 5% of the Paramedics and 25% of MDs marked the correct answer what presented a statistically significant value ( $p < 0.00001$ ) (Table I).

In the first question respondents were asked about anatomical criteria which qualify patients to admission to trauma center. We observed that above 80% of physicians and paramedics properly pointed on the answers: penetrating wounds of the head and trunk and extensive crushing of the limbs. Unfortunately more than half of respondents wrongly believed that II and III degree burns qualify patient to trauma center. Statistical significance was observed in four subsections.

**Table I.**  
Respondents' answers to the questions asked in the questionnaire and comparison of medics' and paramedics' answers.

	Medics	Paramedics	Total		
	N (%)	N (%)	N (%)	p	chi <sup>2</sup>
<b>Question 1</b>					
<b>Ans. a*</b>	<b>80 (91%)</b>	<b>107 (82%)</b>	<b>187 (86%)</b>	<b>0,07441</b>	<b>3,18286</b>
Ans. b	60 (68%)	96 (74%)	156 (72%)	0,36305	0,8273
<b>Ans. c*</b>	<b>60 (68%)</b>	<b>99 (76%)</b>	<b>159 (73%)</b>	<b>0,19366</b>	<b>1,68955</b>
Ans. d	18 (20%)	43 (33%)	61 (28%)	0,04166	4,14892
Ans. e	42 (48%)	66 (51%)	108 (50%)	0,6594	0,19426
<b>Ans. f*</b>	<b>58 (66%)</b>	<b>98 (75%)</b>	<b>156 (72%)</b>	<b>0,12812</b>	<b>2,31512</b>
<b>Ans. g*</b>	<b>72 (82%)</b>	<b>105 (81%)</b>	<b>177 (81%)</b>	<b>0,84582</b>	<b>0,03781</b>
<b>Ans. h*</b>	<b>62 (70%)</b>	<b>79 (61%)</b>	<b>141 (65%)</b>	<b>0,14213</b>	<b>2,15477</b>
<b>Ans. i*</b>	<b>46 (52%)</b>	<b>87 (67%)</b>	<b>133 (61%)</b>	<b>0,02956</b>	<b>4,73487</b>
Ans. j	14 (16%)	30 (23%)	44 (20%)	0,19577	1,67362
Ans. k	16 (18%)	35 (27%)	51 (23%)	0,13471	2,2374
Ans. l	6 (7%)	32 (25%)	38 (17%)	0,00068	11,5486
<b>Ans. m*</b>	<b>60 (68%)</b>	<b>107 (82%)</b>	<b>167 (77%)</b>	<b>0,01564</b>	<b>5,84287</b>
<b>Question 2</b>					
<b>Ans. a*</b>	<b>56 (64%)</b>	<b>67 (52%)</b>	<b>123 (56%)</b>	<b>0,07716</b>	<b>3,12373</b>
Ans. b	24 (27%)	26 (20%)	50 (23%)	0,21016	1,57035
Ans. c	8 (9%)	19 (15%)	27 (12%)	0,22441	1,47594
<b>Ans. d*</b>	<b>54 (61%)</b>	<b>65 (50%)</b>	<b>119 (55%)</b>	<b>0,09826</b>	<b>2,7336</b>
<b>Ans. e*</b>	<b>58 (66%)</b>	<b>71 (55%)</b>	<b>129 (59%)</b>	<b>0,09601</b>	<b>2,77061</b>
Ans. f	16 (18%)	25 (19%)	41 (19%)	<b>0,84582</b>	<b>0,03781</b>
<b>Ans. g*</b>	<b>66 (75%)</b>	<b>84 (65%)</b>	<b>150 (69%)</b>	0,10442	2,63671
<b>Ans. h*</b>	<b>22 (25%)</b>	<b>29 (22%)</b>	<b>51 (23%)</b>	<b>0,64501</b>	<b>0,21225</b>
Ans. i	52 (59%)	74 (57%)	126 (58%)	0,75051	0,10111
<b>Question 3</b>					
Ans. a	15 (17%)	25 (19%)	40 (18%)	<b>0,00001</b>	<b>19,4794</b>
Ans. b	8 (9%)	18 (14%)	26 (12%)		
Ans. c	10 (11%)	15 (12%)	25 (11%)		
<b>Ans. d*</b>	<b>22 (25%)</b>	<b>6 (5%)</b>	<b>28 (13%)</b>		
Ans. e	28 (32%)	63 (48%)	91 (42%)		

Note. Correct answers showed in bold and (\*)

Paramedics more frequently than physicians marked incorrectly the answer "multiple wounds of the scalp" ( $p=0.0416$ ) and "distortion of crurotalar joint" ( $p=0.00067$ ). However, paramedics more often correctly answered that patients with limb fractures with nerve and vessels damage ( $p=0.0295$ ) as well as those with fracture of at least two proximal bones of extremity or pelvic bones ( $p=0.01564$ ) should be admitted to the trauma center (Table I).

In the second question concerning abnormal physiological parameters qualifying to treatment in trauma center, 75% of medics and 65% of paramedics knew that state of consciousness in Glasgow scale at or below 8 qualifies to the trauma center. More than half of medics and paramedics had difficulties in deciding whether arterial oxygen saturation at or below 80% during oxygen therapy is a physiologic criterion – they wrongly pointed on it as a correct answer. However, no statistical differences between M.Ds' and paramedics' answers were observed ( $p.>0.05$ ) (Table I).

### Discussion

In this study, our questionnaire survey showed that the knowledge among doctors and paramedics, crucial for an accurate functioning of the Trauma Centers in Poland, needs improvement. It is interesting that the paramedics gave more correct answers as well as more incorrect answers. Number of correct and incorrect answers among doctors was similar. It shows that paramedics would qualify majority of injured patients to trauma centers. This may result from their precaution of misjudgment of patient condition. Data from our questionnaire survey indicate that doctors and paramedics in Poland should put more attention on their ability to recognize which conditions/injuries (anatomical criteria) and physiological parameters (physiological criteria) qualifies patients to Trauma Centers. Vast majority of them also did not know that more than one criterion fulfilled is needed to admit patient to trauma center. The results suggest that apart from theoretical basis there is a need to introduce a set of trainings emphasizing practical aspect of applying these criteria. Concerning central Europe, Germany has the most efficient hospitals that provide the various levels of care needed, but those with serious injuries should be treated in appropriate level one or level two trauma centers.

Since trauma system was introduced, it has been shown that the trauma mortality rate in Germany is still falling [7]. It was found that the trauma mortality rate in Germany has continued to fall in recent years and was 12% for the patients registered with the trauma registry in 2007 [8]. The case fatality rates of American trauma centers were lower than those of non-trauma centers [9] Biewener et al. [10] found similar superiority of patient care at trauma centers in Germany. Although the level of trauma care in Germany belongs to one of the best worldwide some studies showed significant differences in the death rates of patients in individual German trauma centers. Hilbert et al. found that there are significant differences in the pre-hospital and clinical care of patients admitted to German trauma centers concerning mainly an immediate and complete diagnostic approach by means of whole-body CT and a liberal fluid resuscitation [11].

In the United States of America trauma system has been implemented early 80s. Mullins et al. presented their analysis of the risk of death in hospitalized injured patients in pretrauma, early trauma and established trauma systems using data from 18 hospitals in Portland. The authors concluded that establishment of a trauma system shifted the more seriously injured patients to level I trauma centers and was connected with a significant reduction in the adjusted death rate [12]. Also other studies have shown that after institution of a trauma system, an evident improvement in survival occurs. Moreover, it was found that the designation of regionalized level I trauma centers, where severe trauma patients are treated, leads to lower death rate in this group [13,14]. To achieve a high standard of trauma service an annual treatment rate of 300-400 polytrauma patients should be reached. The claim of the American College of Surgeons that a trauma surgeon should treat 50 severely injured patients per year would then be possible [2]. American and German experiences in trauma system development supports the well-known conclusion that the quality of care increases with the number of patients treated. Another crucial issue while introducing trauma system is development of trauma registry - research program which enables objective assessment of the level of advancement of the process [15].

### Conclusions

Improvement of the functioning of Trauma Centers should rely on building the good fundamentals of knowledge, good communication and cooperation between paramedics and doctors. Development of health care system and Trauma Centers should be based not only on introducing new law, but also on organizing series of trainings for medical staff. To our knowledge, this study is the first to demonstrate the need of improvement the cognizance about principle for patient's qualification to the trauma center in Poland among professionals and potential employees in such kind of institutions.

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## Questionnaire

*According to the decree of Ministry of Health in Poland about Trauma Centres (TC) from 18th of June, 2010 there are strict criteria of patients' qualification to treatment in Trauma Centre.*

*Please, answer the questions below concerning these criteria.*

I am :  a doctor  a nurse  paramedic

### 1. Chose, from the listed below, anatomical criteria that qualify a patient to treatment in the TC

- a) penetrating wounds of the head and trunk
- b) hand amputation
- c) blunt injuries with symptoms suggesting internal organs damage,
- d) multiple wounds of the scalp,
- e) II and III degree burns,
- f) limb amputation proximal to the knee or elbow,
- g) extensive crushing of the limbs,
- h) spinal cord injury,
- i) limb fractures with nerve and vessels damage,
- j) cerebral concussion
- k) eye-ball injury
- l) distortion of crurotalar joint,
- m) fracture of at least two proximal bones of extremity or pelvic bones

### 2. Chose, from the listed below, physiological criteria that qualify a patient to treatment in the TC:

- a) blood pressure at or below 80 mm Hg,
- b) blood pressure at or below 90 mm Hg,
- c) pulse rate more than 100 per minute,
- b) pulse rate more than 120 per minute,
- c) respiration rate lower than 10 or more than 29 per minute,
- d) state of consciousness in Glasgow scale (GCS) at or below 10,
- e) state of consciousness in Glasgow scale (GCS) at or below 8,
- f) arterial oxygen saturation at or below 90%,
- g) arterial oxygen saturation at or below 80% during oxygen therapy

### 3. A patient should be admitted to the TC if the following combination of criteria is present (chose one answer):

- a) 1 anatomical and 1 physiological
- b) 1 anatomical and 2 physiological
- c) 2 anatomical and 1 physiological
- d) 2 anatomical and 2 physiological
- e) number of criteria is not taken into consideration while qualifying a patient to treatment in the Trauma Centre