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# Care needs of adults with spinal trauma in the prehospital and hospital setting from the perspective of patient care team: A qualitative research

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## Abstract:

**BACKGROUND:** Appropriate care of patients with definite spinal cord injury or at risk of it in the prehospital and hospital stages requires comprehensive planning in the health system. It is also the requirement of any successful program to explain the needs from the perspective of its stakeholders. Thus, this study aimed to discover the care needs of adults with spinal trauma in prehospital and hospital settings from the perspective of the patient care team.

**MATERIALS AND METHODS:** This qualitative study was conducted with the participation of urban and rural prehospital emergency personnel and emergency departments of educational and therapeutic hospitals affiliated to Isfahan, Tehran, Shiraz, Kermanshah, Ahvaz, and Yasuj Universities of Medical Sciences, through conducting 36 in-depth semi-structured interviews from September to December 2021. Using purposive sampling method, the participants were selected considering the maximum variation. The data saturation was reached after conducting interviews and group discussions with 36 subjects. Data were analyzed using conventional content analysis approach. Lundman and Graneheim approach were used for the study rigour. Data were simultaneously analyzed using MAXQDA software version 10.

**RESULT:** During the data analysis, two themes of prehospital care with two main categories (emergency care and management of secondary complications of spinal trauma) and hospital care with two main categories (emergency care and management of secondary complications of spinal trauma) emerged.

**CONCLUSION:** Emergency care and management of secondary complications of spinal cord injury in the prehospital and hospital stages can affect treatment results, improve quality of life, and reduce mortality rate, secondary injuries, and healthcare costs. Thus, identification of the care needs of the adults with spinal trauma from the perspective of the patient care team can help the authorities to plan appropriate interventions.

## Keywords:

Care team, hospitals, prehospital, qualitative research, spinal cord injuries

## Introduction

Spinal trauma is one of the most prevalent traumas of the central nervous system, which can be associated with spinal fracture and spinal cord injury.<sup>[1]</sup> Spinal trauma is a common occurrence in the United States, affecting 350 of every 1 million people,<sup>[2]</sup>

and approximately one-third of these patients are diagnosed with an unstable spinal fracture or spinal cord injury. Spinal cord injury also constitutes about 23% of all spinal traumas.<sup>[3]</sup> In Iran, based on the data registered in the National Trauma System, about 5.8% of admitted trauma patients have suffered traumatic spinal cord injury.<sup>[4]</sup>

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Moreover, its prevalence was estimated to be 1.6% in an Iranian study conducted in 2020.<sup>[5]</sup>

Bone fracture and spinal cord injury after traumatic spinal injuries cause long-term ailments,<sup>[6]</sup> sensory-motor problems, mental and social disorders, and inability to perform daily life activities such as personal hygiene, eating, and self-care.<sup>[2,7-9]</sup> It can also cause failures in the cardiovascular, respiratory, and digestive systems,<sup>[2,10]</sup> thereby leading to negative effects on the quality of life of patients<sup>[9]</sup> and imposing large economic burdens on the patient, family, and health system.<sup>[1,11-14]</sup>

Given the serious and extensive complications of spinal cord injury, its primary prevention and timely treatment are among the most essential priorities of the health system. In this regard, prehospital and hospital management can play a fundamental and necessary role.<sup>[12,15,16]</sup> Emergency medical services, as the first line of care and treatment in providing care to patients with spinal cord injury<sup>[13]</sup> and immobilization and proper transportation of them to the most suitable hospital are of great importance in preventing secondary injuries, illness, and death. Additionally, proper and timely treatment and care of these patients by the patient care team in the emergency department of the hospital is a necessity which plays a crucial role in preventing these injuries.<sup>[11]</sup>

Managing treatment and providing proper care to patients with spinal cord injuries requires a comprehensive and interprofessional evaluation of the perspectives and experiences of healthcare staff.<sup>[17]</sup> Considering the necessity of obtaining comprehensive and first-hand information about the care needs of patients with spinal trauma, qualitative study is preferred as the best source for describing the situation, needs, feelings, and experiences in the cultural context.<sup>[13,16]</sup>

To provide basic care for the patients with definitive spinal cord injury or at risk of it in the prehospital and hospital stage, extensive research needs to be conducted in this regard. It should be noted that previous studies have mainly focused on rehabilitation needs and planning for its improvement<sup>[14,18-20]</sup> and assessment of psycho-social<sup>[21-23]</sup> and sexual needs.<sup>[14,24,25]</sup> Moreover, these needs have generally been assessed from the perspective of the patients and families,<sup>[14,18-25]</sup> and the care needs of these patients in the acute and emergency phase and from the perspective of care providers have been neglected. Thus, the aim of this study was to explain the care needs of adult patients with spinal cord injury in the prehospital and hospital stages from the perspective of the patient care team.

## Materials and Methods

### Study design and setting

This qualitative study was conducted using conventional content analysis method.

This study was conducted in 2021 in urban and rural emergency medical services and emergency departments of teaching and therapeutic hospitals affiliated to Isfahan, Tehran, Shiraz, Kermanshah, Ahvaz, and Yasuj Universities of Medical Sciences.

### Study participants and sampling

The participants were selected from among the emergency medical technicians, nurses and general practitioners, and specialists working in urban and rural emergency medical services and emergency departments of the above hospitals who met the inclusion criteria having at least 3 years of experience in the emergency medical services and the emergency department of the trauma center hospitals and having willingness and sufficient time to participate in the research. Those participants who were unable or unwilling to continue their participation in the study for any reason were excluded from the study. Thirty six participants were selected. These participants included 11 emergency medical technicians, 16 nurses working in the emergency department of the hospital, five neurosurgeons and spine specialists, and four emergency medicine specialists who were chosen using purposive sampling method and considering the maximum variation in terms of gender, ethnicity, race, and education level.

### Data collection tools and technique

The data were collected from September to December 2021 using semi-structured in-depth individual interviews conducted either in-person (following health guidelines and observing social distancing for the COVID-19 pandemic) or virtually in Skyroom space, with the possibility of simultaneous transmission of audio and video or by telephone, considering the preference of the participants. All interviews that were conducted in virtual space or by phone have been recorded; a written informed consent have been obtained for audio and video recording. The interviews started after introduction and a brief description of the objectives of the study. For the researcher's familiarity with the conditions of the participants and to form the initial structure of the questions, several pilot interviews were conducted. The place and time of the interviews were determined taking into account the disposal, willingness, and ability of the interviewee to maximize their cooperation; but usually, the interviews were held in urban and road emergency medical centers, emergency departments, and nurses' break rooms, or, if available, the training center of hospitals. Each interview lasted

between 30 and 60 minutes and was guided through the guiding questions and the possibility of exploring topics through probing questions such as why? How? Explain more, and give an example. Here are some questions asked from the participants: What needs, issues, and problems do you face in your patient care? What do you think is the cause of these problems? Do you think your patient has needs which have not been paid attention in the treatment process? These questions were used in the interview and initial guiding questions were adjusted following the information obtained from the interviews. Additionally, note taking was done to complete the details in the interview. Individual interviews were conducted until data saturation was reached.

The present study was conducted based on the conventional content analysis approach, and Lundman and Graneheim approach (open coding, categorizing, and summarizing) was used for data analysis. Moreover, obtaining the consent of the participants, the interviews were recorded as much as possible and transcribed verbatim. After extracting the primary codes and classifying the similar codes, subcategories were formed and, then, the main categories were finally created by comparing the subcategories. Codes and categories were created based on the consensus of four researchers as they discussed, examined, and revised all meaning units, codes, subcategories, and categories. The data saturation was reached after conducting interviews and group discussions with 36 subjects.<sup>[26]</sup> Data were simultaneously analyzed using MAXQDA software version 10.

To increase the trustworthiness of the data, the four criteria of credibility, confirmability, dependability, and transferability were used by Lincoln and Guba. The credibility of the data was ensured by the ongoing involvement of the researcher with the subject and data of the research. To ensure confirmability, the texts of some interviews, together with the extracted codes and categories were given to research colleagues and two professors who were familiar with the method of qualitative research analysis but did not participate in the study, and they were asked to check the accuracy of the data coding process. To increase transferability, the possibility of following the research path and evaluating the applicability of the data was provided to others through providing a clear, precise, and purposeful description of the research process. Coding systems were used during the analysis process to improve dependability.

### Ethical consideration

After obtaining the necessary permits and the code of ethics (IR.MUI.NUREMA.REC.1400.043) from the ethics committee of Isfahan University of Medical Sciences, oral and written informed consent was obtained from

the participants. All interviews were recorded with the permission of the participants and they were assured that the files would be deleted after the research. They were also informed about the voluntary nature of their participation and that they could withdraw from the study at any time or not answer any questions they did not like to answer. Anonymity and confidentiality were guaranteed to all participants. All study data were securely stored in a password-protected computer accessible only to the researchers. The phone number of the researcher was given to the participants so that they could be informed about the results of the study if they liked.

## Results

In this study, 36 interviews were conducted with 36 participants including 11 emergency medical technicians (PT), 16 emergency department nurses (PN), and nine medical doctors (PD) including five neurosurgeons and spine specialists and four emergency medicine specialists whose age was between 26 and 60 years with the mean age of 39.39 years. The working experience of the participants was between 3 and 27 years with the mean of 13.75 years. The majority of participants in the study were male (63.88%) and had a bachelor's degree (44.44%). The participants described the care needs of adults with spinal trauma. During the data analysis, two themes of prehospital care with two main categories (emergency care and management of secondary complications of spinal trauma) and hospital care with two main categories (emergency care and management of secondary complications of spinal trauma) emerged. The themes and categories along with a selection of quotations are presented in Table 1. The main categories and subcategories shared in the two themes are presented together.

### 1. The main category of "emergency care" in prehospital and hospital stages

Emergency care needs in the prehospital stage included seven subcategories of experienced and sufficient emergency medical team, Proactive Safety Management, stabilization of the injured spine, triage, assessment and treatment based on ABCDE<sup>1</sup>, psychosocial support, pharmacological intervention, and pain management. Emergency care needs in the hospital stage consisted of five subcategories of safety management, assessment, and treatment based on ABCDE, stabilization of injured spine, diagnostic therapeutic interventions, and pain management.

#### *Experienced and sufficient emergency medical team in the prehospital stage*

To meet the needs of patients at risk of spinal trauma

1 Airway, Breathing, Circulation, Disability, Exposure

**Table 1: Care needs of adult patients with spinal trauma in the pre-hospital and in-hospital stages from the perspective of the participants**

Quotation	Sub-subcategory	Subcategory	Category	Theme
<p>"The technician who transports the patient must be fully trained in in this regard. I saw several patients who were brought to Isfahan during the Bam earthquake, many of whom suffered spinal cord caused by wrong transportation" (PN13).</p> <p>"Even though Level 3 deals with these traumas, many times they don't have any experience at all. They don't have the necessary equipment, such as roll bed or even Kevlar in normal condition. Generally, our emergency centers have not received the necessary training" (PNS3).</p> <p>"This is one of our major problems. In fact, there should be a trauma team for the trauma patients. Trauma team refers to skillful individuals who are trained for such conditions and know the priorities; well, every member of such a team knows their duty whenever they are present. We don't have a trauma team; by the way, once I tried to create a trauma team but I couldn't" (PD3).</p> <p>"There's a shortage of manpower and we ask people to help us. We must have at least 3 technicians. The more the number of the personnel in the scene, the higher will be the quality of the care and the outcomes" (PT7).</p> <p>"Well, when we get to the scene of the accident, the first thing we've to do is our own safety, which should be maintained. Then, we park the ambulance in a suitable place. After that, entering the scene of accident, we evaluate the safety of the scene as the most important thing" (PT3).</p> <p>"If the car is in a very dangerous condition and explosion is likely, we should use quick extrication techniques and remove the patient without any fixing; but if the scene is safe, the injured is removed using equipment such as collar and even the patient's back board shorts; and we fix the patient's pelvis before removing them" (PT2).</p> <p>"The approach in the ATLS protocol is such that in the first step, the safety of ourselves and the patient must be observed in the setting; and if the setting is likely to be dangerous, the necessary cares should be done to prevent more injuries" (PD2).</p> <p>"If the injured person is lying on the ground, we basically do this; we tie the collar and fix it. We also have a tool called immobilizer; while collar supports more flexion and extension, immobilizer supports the sides. It is not commonly used here. When there is no access to this tool, they tell us use serum as you know better" (PT1).</p> <p>"The most important principle is that the spine should be fixed from the very beginning, and there should be no additional movement. The neck is fixed with a collar and the spine with a backboard, that is, transportation should not be done without the backboard. Spine fixation is the most important principle for preventing further injuries" (PNS1).</p>	<p>Use of sufficient number and experienced personnel in the scene</p> <p>Sufficient number and experienced personnel for the transfer of the injured person</p> <p>Personnel proficient at life-saving measures and intubation in conditions of neck and spine injury</p> <p>Trained personnel for doing invasive procedures such as venipuncture, nasogastric tube insertion and bladder catheterization</p> <p>Safety management of the scene</p> <p>Safety management of personnel</p> <p>Use of safe tools and equipment</p> <p>Using safe and appropriate tools and equipment to stabilize the spine of the injured person</p> <p>No further injury during the fixation</p>	<p>Experienced and sufficient emergency medical team</p> <p>Proactive Safety Management</p> <p>Stabilization of the injured spine</p>	<p>Emergency cares</p> <p>Proactive Safety Management</p>	<p>Pre-hospital cares</p>

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**Table 1: Contd...**

Quotation	Sub-subcategory	Subcategory	Category	Theme
<p>"Regarding spinal trauma, I would like to tell you that the first priority is to be present at the scene of the accident. Moreover, ABCD that is means Airway, Breathing, Circulation and Disability should be controlled. These are basic resuscitation measures should be considered, no matter the patient is traumatic or not" (PNS4).</p> <p>"The priority is always to stabilize the patient according to the procedure of A, B, C, and then we will go to the neurologist. This A, B, C may cause a penetrating trauma to the patient's circulatory system, causing them to lose so much blood and suffer from hypotension and shock; regardless of the cause of A, B, C, if the airway and ventilation is disturbed, Ambu bag and ventilator are used" (PD4).</p> <p>"We've to follow a series of principles, which is the ABCD including the control of airway, collar and breathing. Then, circulation-related issues are checked, and finally, exposure and disability are controlled in primary and secondary assessments" (PT8).</p>	<p>Creating a safe airway</p> <p>Providing proper ventilation</p> <p>Providing adequate blood circulation</p> <p>Determining the level of the lesion</p> <p>Full examination of the nervous system</p> <p>Precise and complete evaluation and examination of other injured systems</p> <p>Controlling vital signs and stabilizing them</p> <p>Proper resuscitation in case of spine and neck injuries</p>	<p>Triage and treatment based on ABCDE</p>		
<p>"On the way, we've to calm these people down in a way that we can at least serve them easily" (PT9).</p> <p>"In fact, at the scene and if the injured person is conscious, the technician should introduce himself to them and explain the situation" (PD4).</p>	<p>Attaining the cooperation and trust of the injured person</p> <p>Gaining the trust and support of the family</p> <p>Introducing oneself to the injured person</p> <p>Informing the injured person</p>	<p>Psychosocial support</p>		
<p>"If the patient has a low blood pressure, has no active bleeding, and the lungs and heart are normal that we can hear their sounds, then only crystalloids can be used in the first step. If it doesn't work, in the next step vasopressors is used, that the best choice is dopamine and then dobutamine" (PNS3).</p> <p>"During the transfer of the patient, a very important issue is the vital signs, that the systolic pressure of a patient with a cord injury must be kept in the neuroprotective range, that is, it should be above 90, and the systolic pressure should be maintained in the range of 60-70" (PNS2).</p>	<p>Patient resuscitation</p> <p>Stabilization of the hemodynamic condition of the injured person</p>	<p>Pharmacological intervention</p>		
<p>"The technician must control the pain of the injured, which is not observed at all. I don't know why the pain control of the injured is not appropriately considered (PT1).</p> <p>"One of the important factors is talking with the patient. Many times it is possible to help the injured people by talking with them. The second way is to distract the attention of the injured person. If the patient is severely injured, painkillers such as ketorolac or pethidine can be used depending on their conditions and based on the order of a doctor" (PT3).</p>	<p>Non-pharmacological interventions for relieving the pain of the injured person</p> <p>Pharmacological interventions for relieving the pain of the injured person</p>	<p>Pain management</p>		
<p>"The patient must be observed with eyes, I can see the airway. Does s/he have stridor? Does s/he use the accessory muscles?"</p> <p>"The respiratory rate of the patient should be checked. We should consider the presence of tachycardia, Tachypnea, and respiratory distress, that is, we need to monitor the patient's respiratory system" (PT7).</p>	<p>Training of effective breathing exercises</p> <p>The need of using artificial ventilation</p> <p>Doing respiratory support measures</p>	<p>Management of the respiratory system</p>	<p>Preventive Management of the secondary complications of spinal trauma</p>	

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**Table 1: Contd...**

Quotation	Sub-subcategory	Subcategory	Category	Theme
Given the fact that these patients have injured spinal cord, if they need resuscitation, it will be done using appropriate maneuvers, and the patients should be put under cardiac monitoring immediately" (PT11). "We should immediately find a vein for the patient and if they need serum therapy, their blood pressure has to be checked regularly" (PT4).	Careful monitoring of the cardiovascular system Management of blood pressure changes Vascular access Fluid therapy and evaluation of its effects Management of types of shock and differentiating their symptoms Pharmacological interventions to improve the condition of the cardiovascular system	Management of the cardiovascular system		
"Having spinal injury, the patient may suffer from neurogenic shock, and should be examined again in terms of this shock, and the necessary measures should be taken for him, and his vital signs should be controlled" (PT5). "These patients may experience neurogenic shock, which also shows itself in through hypotension and bradycardia" (PD5).	Management of spinal shock Management of neurogenic shock Management of spinal cord edema	Management of early complications of spinal cord injury		
"In order to control the hypothermia of the injured person, we must use blankets" (PT1). "In exposure, it is important to prevent hypothermia, that is, patients are examined well in all their parts; their body temperature is maintained by using blankets; warmer is also used and their wet clothes are removed; wet bedclothes are also removed, and heating serum is used for them" (PT2).	Care interventions to prevent hypothermia Supportive interventions for the treatment of hypothermia	Management of hypothermia		
"When using a warmer, we should be careful about the patient's skin and burn site" (PT. 5). "In terms of transportation, the only thing that is used now is laying backboards, which are very rigid, and give patients a very uncomfortable feeling; they also cause the patient to get injured and slip, and we must be careful" (PT2).	Using safe tools and equipment Supportive measures to prevent and control pressure ulcers Standard and safe immobilization of the injured Observance of skin hygiene and pressure points	Maintenance of skin integrity (preventing pressure ulcers)		
"The firemen who intervene in the extrication of the injured people should receive the necessary training. In fact, they have to be educated about the factors they need to observe during the extrication so as not to increase the severity of the injuries" (PT5). "In fact, people need to receive the necessary general educations so that they learn how and in what way to help an injured person in an accident scene" (PT11).	Contact the emergency medical center as soon as possible Inform the public that they should not move the injured person until the arrival of rescue forces First aid training at the society level	The importance of public education		
"Hospital personnel should observe the principles of patient safety in transferring and reviving the injured person and prevent further injuries" (PN5). "In order to prevent more injuries to the personnel and the patient during the transportation, we must use safe equipment and devices; but the equipment that are currently available are not very advanced" (PN15).	Safety management of the injured person Using personal protective equipment Using safe and advanced tools and equipment Standard and safe transportation of the injured Continuous monitoring of the injured during the transportation	Proactive Safety Management	Emergency cares	Hospital cares

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**Table 1: Contd...**

Quotation	Sub-subcategory	Subcategory	Category	Theme
<p>"If the patient's vital signs are in the abnormal range, for example, has an airway disorder, needs to have a proper airway, does not have proper saturation, and the heart rate is irregular, we should take the necessary measures based on the ABCD principles" (PN12).</p> <p>"Patients with spinal cord injuries are usually those who have bradycardia, and we monitor them in terms of bradycardia, low BP, and low autosaturation" (PN16).</p>	<p>Safe airway management</p> <p>Proper ventilation/breathing management</p> <p>Maintain adequate blood circulation</p> <p>Determine the level of the lesion</p> <p>Complete assessment of neurological system</p> <p>Careful and complete evaluation and examination of other injured systems</p> <p>Control vital signs and stabilize them</p> <p>Proper resuscitation in case of spine and neck injuries</p> <p>Using a sufficient number of skillful personnel</p>	<p>Evaluation and treatment based on ABCDE</p>		
<p>"Our most important action is to use complete bed rest for the patient in that the patient has the least mobility, doesn't need to get out of the bed; we limit the patient so that they've the least pressure and don't have any extra movement" (PN15).</p>	<p>Advanced tools and equipment to stabilize the injured people</p> <p>No further injury during the stabilization</p>	<p>Stabilization of the injured person's spine</p>		
<p>"When the doctor feels that the patient has neurological symptoms, he quickly sends the patient for CT scan and then MRI (PD2).</p> <p>"These patients should be operated quickly if necessary. Especially in the first 24 hours, we must prevent hypotension and anemia so that progressive ischemia of the spinal cord doesn't occur. They should quickly be decompressed, yes, that's true, the pressure has to be removed" (PD1).</p>	<p>Prepare the patient for imaging</p> <p>Timely CT scan and MRI</p> <p>Imaging-related cares</p> <p>Pharmacological and therapeutic interventions to manage spinal cord injury</p> <p>Surgical interventions to stabilize the spinal cord and maintain its function</p>	<p>Diagnostic and therapeutic interventions</p>		
<p>"The patient's backboard should be removed immediately in the emergency room, that is, we should remove it from under the patient, as it can cause terrible pain" (PD2).</p> <p>"We can use different painkillers to control the pain, but it is better not to use sedatives because they may decrease the level of consciousness" (PD3).</p>	<p>Non-pharmacological interventions to relieve the injured person's pain</p> <p>Pharmacological interventions to relieve the injured person's pain</p> <p>Management and monitoring of drug side effects</p>	<p>Pain management</p>		
<p>"A very important issue is to check the patient's respiratory function, because the more the patient's lesion, the more will be the respiratory muscle involvement, and respiratory arrest is likely; so the patient who comes to the emergency room should be checked for respiratory status first" (PN13).</p> <p>"It depends which part of the spine is injured; if it is cervical part, they must be monitored and receive oxygen as it affects breathing" (PN14).</p>	<p>Improve oxygenation and prevent hypoxia</p> <p>Early exit of the injured person from the bed</p> <p>The need to use artificial ventilation</p> <p>Encourage to do breathing exercises</p> <p>Chest physiotherapy</p>	<p>Improve the function of the respiratory system</p>	<p>Preventive Management of the secondary complications of spinal trauma</p>	
<p>"Patients may experience various shocks and low blood pressure, and need to receive fluids; but too much fluid may lead to fluid overload" (PN13).</p> <p>"The heart of patients should be monitored so that appropriate measures can be taken in case of arrhythmia" (PN2)</p>	<p>Careful and continuous monitoring of the cardiovascular system</p> <p>Management of blood pressure changes</p> <p>vascular access</p> <p>Pharmacological interventions to maintain the function of the cardiovascular system</p> <p>Fluid therapy and evaluation of its effects</p> <p>Management of all types of shock</p> <p>Pharmacological interventions to improve the condition of cardiovascular system</p>	<p>Maintenance of the function of the cardiovascular system</p>		

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**Table 1: Contd...**

Quotation	Sub-subcategory	Subcategory	Category	Theme
<p>"The nurse should be aware of the digestive complications of spinal cord injury, as this injury can eventually result in constipation, intestinal perforation and ileus, and the nurse should check the patient's abdomen for tenderness and abdominal guarding and bowel sounds" (PN8).</p> <p>"It may be necessary to use NPO for patients, and if head and neck injuries are rejected, NG tube is used and their diet is started; because in the early hours, gavage of the patient is very important" (PN11).</p>	<p>Check and record the amount of fluid absorption and excretion</p> <p>The necessity of fasting</p> <p>Early feeding</p> <p>The need to prevent ileus</p> <p>Prevention of constipation</p>	Maintenance of the digestive system function		
<p>"Urinary retention is likely to happen in patients with injury above the lower back and should be examined in emergency department, and if urinary retention is diagnosed, urinary catheterization should be inserted" (PN13).</p> <p>"Another advantage of urinary catheterization in the early stages is to find out if they have bladder bleeding or not" (PN8).</p>	<p>Insert a Foley catheter</p> <p>Maintain bladder muscle tone</p> <p>Measure and monitor urinary output</p> <p>Prevent urinary tract infection</p>	Maintenance of urinary system function		
<p>"In order to prevent DVT, it is recommended to use DVT pump that is tied around the leg and improves the filling and emptying of venous return; special socks and heparin are also recommended" (PN8).</p> <p>"Patient should be monitored for coldness and edema of the lower limbs; they also should do isometric exercises. Another thing is that elastic bandages of the lower limbs should be performed for them" (PN7).</p>	<p>Pharmacological prevention of venous thrombosis</p> <p>Early exit from the bed and transportation equipment</p> <p>Supportive measures</p>	Prevention and treatment of pulmonary thrombosis and thromboembolism		
<p>"Patient should have their pressure points massaged and if they allow, that do less often, the wavy mattress can be used for them" (PN2).</p> <p>"For example, the position of these patients should change, sleep on their sides, and lubricate their skin" (PN6).</p>	<p>Use of safe tools and equipment</p> <p>Supportive measures to prevent and control pressure ulcers</p> <p>Observance of skin hygiene and pressure points</p>	Maintenance of skin integrity		
<p>"Patients who are brought to the emergency room are better to be kept warm; warmers can be used for this purpose and if not available, blankets or other equipment can be used to prevent the patient from hypothermia" (PD5).</p> <p>"We can use heating serum for trauma patients, and if necessary, heat lamps or heating blankets or other things can be used carefully in the next stages; and their body temperature should be checked regularly so that hypothermia does not occur to them" (PD5).</p>	<p>Care interventions to prevent body temperature drop</p> <p>Aggressive interventions to treat hypothermia</p> <p>Measure the injured person's temperature regularly</p>	Management of hypothermia		
<p>"When patients arrive at the emergency room, they may start yelling and screaming that I don't feel anything, what happened to my leg, my leg is heavy. Here, it is our duty to pacify them whether they like it or not" (PN5).</p> <p>"Based on the doctor's diagnosis, the patient may need psychological counseling, and the personnel of the department should maintain contact with the patient's family, who are mostly depressed, and help them overcome this condition" (PN14).</p>	<p>Psychological support of the injured person</p> <p>Emotional support of the family</p> <p>Support of relief and insurance organizations for the injured people</p> <p>Management of spiritual challenges for the injured people and their families</p> <p>The importance of psychological counseling for the injured people and their families</p> <p>Adjustment to the injury for the injured people and their families</p>	Psychosocial support		
<p>"Well, education is a continuous process and it's not like this that if you get trained once, you don't need it anymore. Even those with high levels of skills still need to update their information" (PN8).</p> <p>"We've to explain everything that happened, including the duration of the treatment and the complications of the treatment, to the patient" (PN9).</p>	<p>Educating the injured person and their families</p> <p>Continuous and specialized education for the treatment team</p>	The significance of education		



at the scene of the accident, sufficient number of experienced personnel should be presented in the scene. The emergency medical team must have sufficient skill, expertise, and experience in the field of the injured person transportation, life-saving actions and intubation in case of neck and spine injuries, intravenous cannulation, nasogastric tube placement, and urinary catheterization.

#### ***Safety management in the pre-hospital and hospital stages***

In the prehospital stage, besides maintaining their own safety, emergency medical technicians must serve injured patients by controlling the safety of the scene and using safe tools and equipment at the scene of the accident. In the hospital, emergency department nurses should observe safety protocols to protect and prevent the temporary and permanent disability of patients with spinal cord injury. These protocols include the correct and safe transfer of the patient from the ambulance to the hospital bed, such as using the safe and advanced tools and equipment for patients and continuous monitoring of the patient during the transfer. Moreover, given the priority of maintaining the safety and health of the treatment team in providing care to patients, personal protective equipment must be used regularly.

#### ***Stabilization of the injured spine in the prehospital stage***

Spinal stabilization refers to the use of some tools and strategies for immobilizing the spine after injury and, thereby, preventing further injury during extrication, resuscitation, transportation, and evaluation of trauma patients at risk of spinal instability. Additionally, to prevent more damage to the spinal cord in the injured vertebrae, this procedure should be performed by experienced emergency personnel and using safe, suitable, and advanced equipment.

#### ***Triage and treatment based on ABCDE in the prehospital and hospital stages***

As per the definition of the World Health Organization, triage refers to a process in which patients or injured people are prioritized to receive medical services, so that patients and injured people who have an urgent and vital need to receive these services are prioritized. In this regard, patients are prioritized, diagnosed, and treated by skillful personnel based on the ABCDE sequence. This sequence includes ensuring that the airway is open, checking the quantity and quality of the patient's breathing, evaluating blood circulation and bleeding, checking the patient for any possible disability (complete examination of the state of the nervous system), full exposure of the body to examine the patient properly and identify any external and internal

bleeding and control it, and examine other injured parts of the patient more completely. Additionally, in case of spinal and neck injury, determining the level of the lesion, paying attention to vital signs and stabilizing them, and performing correct resuscitation based on the patient's condition are among the principles that should be considered by emergency medical technicians and hospital emergency personnel.

#### ***Psychosocial support in the prehospital and hospital stages***

Not only do critical conditions and accidents cause physical injuries but they also cause remarkable psychological problems such as anxiety disorder for the victims and their families. Accordingly, using their communication skills and introducing themselves to the injured people, health team staff have to gain the trust of patients and their families, inform them of their current condition, and provide them with the necessary emotional and psychological support and, doing so, improve their mental health. Moreover, treatment team should take into account all aspects of physical, psychological, social, and spiritual needs of patients. Therefore, it is recommended that, in the hospital stage, the treatment team considers the physical needs of patients and their families and provide them with psychosocial support including psychological counseling, adjustment to the injury, referral to relief and insurance organizations if necessary, and spiritual support.

#### ***Diagnostic and pharmacological interventions in the prehospital and hospital stages***

Medical interventions in the prehospital stage are carried out to revive and stabilize the hemodynamic status of the injured, whereas in the hospital stage their aim is to manage spinal cord injury. In addition, in the hospital, after diagnostic imaging (by observing the preparation of the injured person for imaging and providing care during it) and stabilizing the patient's condition, surgical interventions are performed if necessary to stabilize and maintain the function of the spinal cord.

#### ***Pain management in the prehospital and hospital stages***

Pain is the first and most prevalent problem expressed by the people with spinal cord injuries, and they believe that it is the most important issue that should be addressed. Medical methods are the most powerful tools available for pain control. However, given the side effects of medications and the broad prohibitions of drug management in prehospital injured patients, such as changes in consciousness, respiratory distress, and the complex condition of the injured, nonpharmacological

methods of pain control need to be considered. These methods include the use of ice compresses, comfortable positions, cognitive behavioral interventions, psychological support, muscle relaxation techniques, and breathing exercises that can help to improve the condition of pain management and the quality of care of the injured. In the emergency department of the hospital, pharmaceutical and nonpharmacological interventions are used to relieve the pain of patients. Additionally, the side effects of the drugs should be monitored by nurses as these drugs have some adverse effects on the cardiovascular and respiratory systems.

## **2. The main category of “ Preventive management of secondary complications of spinal cord trauma “ in the prehospital and hospital stages**

Preventive care needs for secondary complications in the prehospital stage include six subcategories of respiratory system management, cardiovascular system management, prevention of early complications of spinal cord injury, hypothermia management, maintenance of skin integrity, and the importance of public training. In the hospital stage, these needs consist of nine subcategories of improving the function of the respiratory system, maintaining the function of the cardiovascular system, maintaining the function of the digestive system, maintaining the function of the urinary system, prevention and treatment of thrombosis and pulmonary thromboembolism, maintaining skin integrity, hypothermia management, psychosocial support, and the significance of training.

### ***Respiratory system management in the prehospital and hospital stages***

Pulmonary complications such as acute lung injury, acute respiratory distress syndrome, pulmonary embolism, aspiration, pleural effusion, pneumothorax, and hemothorax are fatal injuries in spinal traumatic accidents. These complications can be prevented and managed by taking measures such as teaching effective breathing exercises to the patient, using artificial ventilation device, and doing respiratory support measures by rescuers. In the hospital stage, apart from the abovementioned measures, oxygen therapy for the prevention of hypoxia, early exit of the injured person from the bed, and chest physiotherapy are necessary.

### ***Cardiovascular system management in the prehospital and hospital stages***

Identification and management of cardiovascular complications caused by spinal cord injury including arrhythmia, bradycardia, cardiac arrest, cardiogenic shock, and orthostatic hypotension are crucially

important for the improvement of long-term outcomes of patients. As such, measures such as careful monitoring of the cardiovascular system, management of blood pressure changes, vascular access, fluid therapy, management of various types of shock, and pharmacological interventions need to be taken to maintain the function and improve the condition of the cardiovascular system.

### ***Prevention of early complications of spinal cord injury in the prehospital stage***

Spinal cord injury causes temporary or permanent changes in the function of the spinal cord. Symptoms of such injury may include spinal shock, neurogenic shock, and spinal cord edema. Therefore, momentous diagnosis and management of such complications and symptoms by emergency technicians in the prehospital stage is critically important.

### ***Hypothermia management in the prehospital and hospital stages***

Hypothermia is a prevalent complication in patients with spinal trauma. In this regard, preventive and supportive interventions such as regular measurement of the temperature of the injured person, covering all parts of the body except the part that should not be covered, removing any type of wet clothing, covering the injured body with warm blankets, using warm and moist oxygen, heating the ambulance cabin, and aggressive interventions (warm fluid therapy) are necessary at the scene of the accident and in the hospital for the treatment of hypothermia in these patients.

### ***Maintenance of skin integrity in the prehospital and hospital stages***

Another secondary complication of spinal cord injury is the loss of skin integrity in the injured person. Therefore, measures such as the use of safe devices and equipment, supportive actions for the prevention and control of pressure ulcers, safe immobilization of the injured person, and observation of skin hygiene and pressure points should be considered in the prehospital and hospital stages.

### ***Maintenance of the digestive system function in the hospital***

Loss of digestive system function is also one of the most important complications caused by spinal cord injury. In this regard, measures such as checking and recording the amount of fluid absorption and excretion, fasting, early nutrition after elimination of restrictions, and preventing intestinal ileus and constipation are recommended to maintain the function of this system in the hospital stage.

### ***Maintenance of the urinary system function in the hospital***

As another complication, the urinary system may lose its function after spinal cord injury, which can affect the mental and social wellbeing of patients. The function of the urinary system can be improved by taking measures such as placing a Foley catheter, maintaining bladder muscle tone, measuring and monitoring urinary output, and preventing urinary tract infections.

### ***Prevention and treatment of thrombosis and pulmonary thromboembolism in the hospital stage***

Owing to inadequate physical activity and altered homeostasis with decreased fibrinolytic activity, patients with spinal cord injury are at higher risks of coagulation disorders and venous stasis. Thus, acute and long-term management of this complication through using pharmacological methods, early exit from the bed and transport devices, and supportive measures such as the control of vital signs, oxygen administration, creation of an intravenous line, and prescription of fluids are necessary.

### ***Significance of training in the prehospital and hospital stages***

It is necessary to educate the public to inform them about the measures needed for the management of the injured person's condition and prevention of irreparable injuries, such as not moving the injured person before the arrival of the emergency medical services. Training for patients is a skill and a responsibility and one of the basic needs of them and one of their most important rights. Accordingly, training these patients and their families by the experienced and educated treatment team is a basic principle in the management of spinal cord injury.

## **Discussion**

The present study aimed to discover the care needs of adult patients with spinal trauma in the prehospital and hospital stages from the perspective of patient care team. After data analysis, two themes of prehospital care with two main categories (emergency care and management of secondary complications of spinal trauma) and hospital care with two main categories (emergency care and management of secondary complications of spinal trauma) appeared. The main categories of the prehospital and hospital care are discussed in the following.

### **1. Emergency care in the prehospital and hospital stages**

Given the fact that the consequences of spinal cord injury depend on emergency medical services, prehospital

care is one of the substantial stages in the care of these patients to prevent secondary spinal cord injury in them. However, patients sometimes do not receive any care before arriving at the emergency room of the hospital.<sup>[27]</sup> Moreover, after entering the hospital, it is the duty of the personnel stationed in the emergency room to provide services and rapid and comprehensive treatment to these patients. The speed and quality of services provided in these centers are crucially important in reducing mortality and secondary injuries.<sup>[28]</sup>

Based on the results of the present study, one of the care needs in the prehospital stage is the use of an experienced emergency medical team with a sufficient number of personnel. Emergency medical technicians must have sufficient expertise and proficiency in the area of patient transportation and invasive procedures, which can only be provided through updating their information in the form of in-service training courses. In this regard, Hanson *et al.*<sup>[29]</sup> have emphasized the need to hold training courses for emergency medical technicians so that they can manage serious injuries in prehospital stage as an essential skill. Additionally, Habibi *et al.*<sup>[30]</sup> have pointed out the positive effect of training these personnel on the prevention of the immobility-related complications and financial costs. Various studies also indicated that the sufficient skill and expertise of technicians in doing safe interventions such as intubation, vascular access, cardiac monitoring, and pulse oximetry for patients with spinal cord injury require adequate training.<sup>[31-33]</sup> It is noteworthy here that other skills such as communication skills,<sup>[34]</sup> self-awareness in a team environment, belonging and professional identity,<sup>[35]</sup> the ability to provide social support,<sup>[36]</sup> leadership skills,<sup>[37]</sup> adjustment skills, lifelong learning, professional ethics and legal responsibilities,<sup>[38]</sup> teamwork and empathy,<sup>[32]</sup> and critical thinking and decision-making skills in the clinic,<sup>[33]</sup> which are not expressed by the participants of the present study but are mentioned in several other studies, are necessary for the emergency medical personnel.

Another finding of the present study was safety management in the prehospital and hospital stages. In this regard, Feng *et al.*<sup>[39]</sup> and Wang *et al.*<sup>[40]</sup> referred in their studies to the significance of using safe tools and equipment and systematic transfer of patients with spinal cord injury. Moreover, previous studies have referred to avoiding repeated and early transfer of patients with spinal cord injury to spine care units which results in better neurological outcomes, which was not expressed by the participants of the present study.<sup>[41-43]</sup>

Another emergency care need is the stabilization/immobilization of the injured spine, which plays a significant role in preventing spinal cord injury. In this regard, many studies have emphasized the use of safe

devices and equipment such as neck collar, spinal board, vacuum mattress in patients with stable ABCDE, scoop stretcher, and spine immobilizer vest.<sup>[30,44-46]</sup>

The emphasis of the present study was on the need for triage, evaluation, and treatment of patients with spinal cord injuries based on ABCDE in the prehospital and hospital stages as one of the emergency cares. In line with the results of other studies, the results of this study emphasized the need to ensure adequate oxygen supply, airway management, neurogenic shock management, neurological assessment, evaluation of the consciousness level, evaluation of the hidden injuries, and control of injuries caused by the external environment.<sup>[30,39,42,45,47-55]</sup>

Psychosocial support of patients and their families was another emergency care need in both prehospital and hospital stages. Emergency cares are mostly focused on the physical problems of the patients, and despite being important, the psychological and social needs of these patients are often overlooked by the healthcare team members.<sup>[56-58]</sup> However, it is recommended that the healthcare team starts psychosocial interventions along with providing emergency care and even at the surgical stage.<sup>[59]</sup> In their study, Brady emphasized the need to provide psychosocial training in undergraduate curricula.<sup>[56]</sup>

Diagnostic and pharmacological interventions were among other needs of patients with spinal cord injuries in the prehospital and hospital stages. The results of studies also referred to the use of steroids in these patients.<sup>[60-62]</sup> However, it should be noted that concerns regarding the use of steroids, such as the increased risk of wound infection, gastrointestinal bleeding, sepsis, pulmonary embolism, and death, have made healthcare team hesitant about using these medicines.<sup>[60,63]</sup> In this regard, the existing literature emphasized spine radiography (computed tomography scan, magnetic resonance imaging) for final diagnosis and examination of neurological deficits after the accident as soon as possible.<sup>[45,64-68]</sup> Once the patient's condition is stabilized, surgery should be performed within 24 hours after injury. However, because of the problems of the patient transfer and the need for presurgery examination and preparation, this is not achieved in many patients. Finally, surgical intervention should be performed at the earliest opportunity and within 3 days after the injury, which is a golden time for neurological recovery.<sup>[69-72]</sup> The results of the present study are also in agreement with these results.

Effective pain management using various pharmacological and nonpharmacological methods in the scene, during the emergency medical services and in the hospital, is a key indicator of emergency care. However, recent

related studies have referred to the inadequacy of pain management, especially in the prehospital stage.<sup>[73,74]</sup> It is worth emphasizing here that in developed countries, significant advances have been made in the use of painkillers and equipment in the prehospital emergency, and opioid painkillers, nonsteroidal anti-inflammatory medications, and Apotel are included in the list of analgesic drugs in prehospital emergency. Access to these drugs is provided as per the duties and educational qualifications of the prehospital personnel, with the coordination of the consultant doctor or by using offline clinical protocols.<sup>[75-78]</sup> In Iran, there are very limited painkillers for the prehospital emergency<sup>[79]</sup> which results in suffering and discomfort caused by untreated acute pain and the pernicious psychophysiological effects of pain in patients from the moment of the accident until reaching the hospital.<sup>[74,80]</sup> Therefore, given the existing limitations, it is recommended that emergency technicians use nonpharmacological methods of pain control, which are often without complications and prohibitions and can be used independently by these technicians.<sup>[80-82]</sup>

## 2. Management of secondary complications of spinal trauma in prehospital and hospital stages

The results of the present study emphasize the respiratory and cardiovascular system management, hypothermia management, and maintenance of skin integrity in the prehospital and hospital stages to prevent secondary complications of spinal cord injury. In this regard, in previous studies also an emphasis has been made on the significance of the respiratory system management,<sup>[62,83]</sup> the cardiovascular system management, especially blood pressure control,<sup>[45,84-89]</sup> and the prevention and management of hypothermia to lower the basal metabolic rate of the central nervous system,<sup>[90-93]</sup> preserve skin integrity, and prevent pressure ulcers.<sup>[45,94,95]</sup>

The results of the present study also revealed that the function of the digestive and urinary systems of the hospitalized patients with spinal cord injury should be maintained to prevent lifelong challenges in them. In this regard, previous studies have confirmed the significance of this issue because of the consequences such as neurogenic bowel and bladder and its debilitating effects such as constipation, fecal incontinence, gastroenteritis, gastric ulcer, urinary incontinence, urinary infection, hydronephrosis, and kidney failure.<sup>[96-100]</sup> Moreover, in hospitalized patients, there is a risk of deep vein thrombosis and pulmonary thromboembolism caused by long-term immobilization of organs. These complications need to be prevented and treated in the hospital stage by using pharmacological and physical interventions.<sup>[101,102]</sup>

The management of early complications of spinal cord injury was another finding of the present study. Neurogenic shock, spinal shock, and edema are various unpredictable and early complications of spinal cord injury, appearing in the prehospital stage in patients with normal vital signs and without any warning. Therefore, the emergency medical team should be aware of these complications in all patients with spinal trauma and different levels of injury.<sup>[103-105]</sup> Additionally, interventions such as blood pressure and heart rate control, fluid management, prescription of vasopressors, and neurological status assessment can be helpful.<sup>[106,107]</sup> These results are also in line with the results of the present study.

Based on the results of our study, an emphasis was made on the education of the public about dealing with the injured people at risk of spinal cord injury in the prehospital stage and the education of the interprofessional team members, patients, and their families in the hospital stage. In this regard, Conti *et al.* emphasized the importance of educating patients in the hospital. These researchers consider education to be a continuous process which consists of successive stages, starting with the spinal cord injury and going through the acute stages, initial rehabilitation, and discharge. They believe that individual, environmental, and social characteristics have an effect on the learning processes of patients at each stage. Nevertheless, given the confusion and discomfort experienced by patients in the acute phase, they are not able to comprehend the information provided to them and the interprofessional team members also do not spend enough time to educate them. Thus, appropriate educational methods based on the needs of the patients should be used and enough time be allocated to their education.<sup>[108,109]</sup> Various studies have emphasized the need to educate patients about nutritional, digestive, urinary, skin care, and sexual problems as the most important educational topics.<sup>[110-113]</sup> Moreover, since patient care team is responsible for educating patients, the members of this team should be trained in such a way that they can manage patients with spinal cord injuries appropriately.<sup>[27,45,53]</sup> It should be noted that regarding the necessity of public education at society level, no study was found in line with the present study.

The rehabilitation of these patients from the moment they are admitted to the hospital until their discharge from it is one of the care needs for the management of patients with spinal cord injury. Although this need had been considered in several studies, the participants of the present study did not mention it.<sup>[114-117]</sup> Based on the results of these studies, rehabilitation while reducing the incidence of pressure ulcers, deep vein thrombosis, and other complications can restore the function of

nervous system. Depending on the patient's condition, rehabilitation care including occupational therapy, physical therapy, electrical stimulation, laser therapy, and acupuncture with the support of head, neck, and back can be started after surgery.<sup>[99,115,117-122]</sup>

Given the fact that qualitative content analysis is based on the researcher's subjective interpretation of the findings, there was a risk of bias in the study. Another limitation of the study was inadequate assessment of care needs from the perspective of patients because of reasons such as reduced level of consciousness, severe pain, and unstable conditions of the patients.

## Conclusion

Identification of the care needs of adults with spinal trauma in the prehospital and hospital stages from the perspective of the healthcare team can help authorities plan appropriate interventions to manage complications; prevent secondary injuries, illness, and death; improve quality of life; and reduce healthcare costs.

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## Ethical considerations

This project was supported and approved by the ethics committee of Isfahan University of Medical Sciences with the project number IR.MUI.NUREMA.REC.1400.043 as part of the doctoral dissertation.

Depending on the type of the present study, the authors did their best to honestly review and correctly reference the articles reviewed.

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## Conflicts of interest

There are no conflicts of interest.

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