

Tactics of ship's doctor in the occupational open fractures of members of vessel's crew of the Northern Water's Basin

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Abstract

Introduction: Providing qualified emergency assistance to members of vessel's crew on flights with occupational open fractures in a ship medical center, choosing the right tactics and adequate treatment allows to reduce the number of complications, shorten rehabilitation periods and retain personnel in the fleet.

Material and methods: An analysis of the treatment of 151 patients with occupational open fractures that were injured in the ship's conditions during the performance of cruise tasks in the Northern Water's Basin was carried out. The control group consisted of 705 victims who had closed fractures on ships. Analytical and statistical methods were used when working on the material. The significance of differences was calculated using Student's t-criteria for independent samples.

Results: In the structure of the total occupational traumatism of members of vessel's crew of the Northern Water's Basin, fractures of bones of different localization amounted to 38.6%, then open among them - 17.6% (10.7 frequency per 1000 workers) or 6.8% of the total number of injuries. Two thirds of occupational open fractures (60.8%) were received by sailors and engine mechanics. Alcohol intoxication was observed in 4.5% of victims. In flights, open fractures occur much more frequently (42.1%) than closed ones (34.6%). When performing flights at high latitudes, their share is higher (17.3%) compared to closed ones (13.9%), which is associated with the adverse effect of the complex of meteorological factors of polar navigation. After the occurrence of injuries were hospitalized in the surgical hospital in the first 6 hours - 71.1% of victims, the first day - 84.7%. The frequency of surgical treatment of open fractures is 1.8 times higher than with closed ones. The number of complications with open fractures is also almost 1.9 times higher than in the control group, and their proportion reaches 32.2%.

Discussion: Based on the structure and localization of open fractures, the ship's doctor faces complex tactical measures in providing adequate qualified assistance, conducting diagnostic procedures, primary surgical treatment of wounds, manual reposition of bone fragments and imposition of transport immobilization during the evacuation of the victim. Antibacterial therapy for open fractures is carried out with therapeutic and preventive purposes in all cases. All victims of the number of members of vessel's crew with open fractures should be prevented from tetanus and anaerobic infection with the introduction of tetanus toxoid and antifungal serum.

Results: Occupational open fractures of members of vessel's crew of the Northern Water's Basin, fractures of bones of different localization amount to 17.6% (10.7 frequency per 1000 workers) of the total number of fractures or 6.8% of the total number of injuries.

1. The highest risk of receiving open fractures when performing ship works related to: servicing and repairing machinery of the engine room, deck equipment, mooring operations, loading and unloading by the crew, closing the holds and hatches. As a result of a fall on a metal surface, 5.9% of open fractures occurred.
2. A typical localization of open fractures of members of vessel's crew is as follows: hand - 52.3%, skull bones - 16.0%, shoulder - 11.1%, shin - 9.7%, foot - 4.8%, hip and forearm - by 2.3%, knee joint - 1.5%.
3. In order to preserve and restore the functions of the injured limb, the ship's medical officer must: 1) Prevent the development of infection; 2) Eliminate the displacement of fragments and create conditions for their immobilization; 3) Save or restore soft tissue and skin above the fracture zone; 4) To create optimal conditions for the fusion of adjusted fragments.
4. If it is impossible to solve these tasks, a staged treatment with emergency evacuation to coastal specialized medical institutions is shown.

Introduction

Diagnosing of open fractures is not difficult for ship health workers. At the same time, their treatment refers to the most difficult issues of traumatology due to the possible infection of the skin and deep-lying tissues of the open wound, as well as the resulting infectious complications in the process of treatment and rehabilitation [1,2]. Therefore, the provision of qualified urgent assistance to a floating compound on ships during flights with production open fractures in a ship medical center, choosing the right tactics and adequate treatment reduces the number of complications, shortens the rehabilitation period and retains personnel in the fleet [3,4].

Material and methods

An analysis of the treatment of 151 patients with occupational open fractures that were injured in the ship's conditions during the performance of cruise tasks in the Northern Water's Basin was

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carried out. The control group consisted of 705 victims who had closed fractures on ships.

When working on the material used methodological approaches: systemic, integrated, integration, functional, dynamic, process, regulatory, quantitative, administrative and situational. Analysis methods included: analytical and comparison. For the analysis, the following techniques were used: grouping, absolute and relative values, average values, detailing and generalization. The reliability of the results obtained was estimated by calculating the student coefficients. Methodical approaches were used: system, integrated, integration, functional, dynamic, process, regulatory, quantitative, administrative and situational, as well as methods: historical, analytical and comparison. The following techniques were used: grouping, absolute and relative values, average values, detailing and generalization. The results were processed statistically on a personal computer. The arithmetic mean and standard deviation with the normal type of distribution of variables were used as the main characteristics of descriptive statistics. Qualitative features were presented in the form of relative frequencies with the definition of a confidence interval. The significance of differences in quantitative traits between groups with a normal distribution of quantitative variables was calculated using Student's t-criteria for independent samples. The error threshold for statistically significant differences was set at 0.05.

Results

If in the structure of the general occupational traumatism of members of vessel's crew of the Northern Water's Basin, fractures of bones of different localization were 38.6%, then open one among them - 17.6% (10.7 frequency per 1000 workers) or 6.8% of the total number of injuries. Men received open fractures 3.7 times more often (11.6) than women from members of vessel's crew (3.1) [5]. Open fractures are mainly received by persons under the age of 20 years (10.3%; 38.1). In the older age groups, their frequency consistently decreases, including by 3.5 times in members of vessel's crew of 20–29 years (11.0) and 6.2 times - 50 years and older (6.1). Among the injured were 56.3% of the seafarers of the transport fleet (14.2), 19.0% of the river fleet (13.1), and 15.8% of the fishing fleet (7.4) [6-8].

Two thirds of open fractures (60.8%) were received by sailors and engine mechanics. Among ship specialists, their highest frequency is noted: among masters of fish processing (2.8%; 50.4); mining masters (1.6%; 34.8%); skippers (4.3%; 20.4); canning masters (1.6%; 19.1). Mechanics make up 14.6% (14.0); navigators - 7.3% (8.3); captains - 2.8% (10.1); boatswains - 1.4% (7.0); other specialists - 13.0% [9-11].

The fourth part of open fractures (27.5%; 36.8) occurs in young sailors with work experience on vessels up to 1 year. Increasing professional experience by the end of the first year of work in combination with organizational measures for occupational safety has a decisive influence on a significant reduction in this type of injury in people with 1-3 year experience (more than 7.8 times). The frequency of open fractures remains low and for a long-term of members of vessel's crew (3-5, 10-15 and more than 15 years) 4.5-5.8 times as compared with the first year of work. The highest risk of open fractures in the performance of ship operations related to: maintenance and repair of machinery for machinery (24.1%; 2.4); deck equipment (15.3%; 1.5); mooring operations (13.5%; 1.3); loading and unloading by the crew (9.2%; 0.9); closing of holds and hatches (9.2%; 0.9). As a result of a fall on a metal surface, 5.9% of open fractures occurred [12-14].

Alcohol intoxication was observed in 4.5% of victims. In the structure of the weekly cycle, the proportion of open fractures is higher

in the first half compared to closed ones, and, conversely, at the end of the week, closed fractures prevailed over open ones ($P > 0.05$). Most open fractures of members of vessel's crew occur in the summer (39.0%; 4.2) and autumn periods (26.2%; 2.8). A smaller number of them in the winter and spring periods is explained by long ice formation and the characteristics of the circumpolar region. In flights, open fractures occur much more frequently (42.1%) than closed ones (34.6%). When performing flights at high latitudes, their share is higher (17.3%) compared to closed ones (13.9%), which is associated with the adverse effect of the complex of meteorological factors of polar navigation.

Polytrauma of members of vessel's crew, occurring on ships in 26.0% of victims (2.8), is accompanied by open fractures, while closed ones - only 15.8% (8.3). Their probability with multiple polytrauma is somewhat higher than with combined ($P > 0.05$). If closed fractures are combined in 2.0% of cases with head injuries; 0.7% - dislocations; 0.4% - multiple bruises; 0.4% - other injuries, then open - only with head injuries and traumatic amputations. Localization of open fractures of members of vessel's crew is as follows: hand - 52.3%, skull bones - 16.0%, shoulder - 11.1%, shin - 9.7%, foot - 4.8%, thigh and forearm - 2 each, 3%, knee joint - 1.5% [15-17].

Provision of urgent qualified medical assistance to members of vessel's crew with open fractures is carried out in the most favorable time. After the occurrence of injuries were hospitalized in the surgical hospital in the first 6 hours - 71.1% of victims, the first day - 84.7%. The frequency of surgical treatment of open fractures is 1.8 times higher than with closed ones. The number of complications with open fractures is also almost 1.9 times higher than in the control group, and their proportion reaches 32.2%. Therefore, a longer hospitalization of patients in the surgical departments is quite reasonable. Thus, with open fractures, the average bed-day (47.3) exceeds the same indicator when closed (34.7) by 36.3%, while the periods of disability (respectively 62.1 and 60.6) differed slightly ($>$ by 2.4%). The second group of disability is set at 2.8% of victims. Mortality was also high at open fractures, amounting to 6.2%.

Discussion

Based on the structure and localization of open fractures, the ship's doctor faces complex tactical measures in providing adequate qualified assistance, conducting diagnostic procedures, primary surgical treatment of wounds, manual reposition of bone fragments and imposition of transport immobilization during the evacuation of the victim.

When viewed at the scene of an incident, it is necessary to establish the diagnosis of an open fracture on the basis of existing skin disorders, complaints of severe pain in the damaged segment, swelling of surrounding soft tissues, shortening of the limb, its deformation or unnatural position, bone crepitus. The goal of treatment of open fractures is to preserve and restore the functions of the injured limb. For this, the ship's medical officer needs to solve the following important tasks: 1) Prevent the development of infection; 2) Eliminate the displacement of fragments and create conditions for bone fragments to be without movement (immobilization); 3) Save or restore soft tissue and skin above the fracture zone; 4) To create optimal conditions for the fusion of adjusted fragments.

Painkillers are administered to the patient (preferably narcotic analgesics), an aseptic dressing is applied, transport immobilization is performed and the victim is evacuated to the ship's medical center. The duration of the evacuation under favorable navigation conditions

in the case of open fractures in 93.7% of cases could be reduced to 15 minutes [18-21]. After transportation it must re-examine the victim, assess his condition and clarify the diagnosis. In the presence of traumatic shock, unstable vital signs, anti-shock therapy is performed. Refusal of anti-shock measures aggravates the condition of the patient and prevents the treatment of open fractures. Only after normalization of hemodynamic parameters can further manipulations continue. If the vessel has an X-ray machine, then confirmation of the diagnosis of a fracture does not cause serious difficulties. His absence poses a crucial task for the ship's doctor: on the basis of clinical data, diagnose a fracture or, rejecting it, focus on the diagnosis of a hurt wound. Therefore, after removal of the transport immobilization and bandage, the injured segment is re-examined. All doubts must be attributed in favor of a fracture. Carrying out a blockade with a 0.25% solution of Novocain at the site of the intended fracture when it enters the resulting hematoma allows not only to provide pain relief, but also to obtain additional data in favor of the diagnosis of a fracture. The blockade should not be carried out through a skin wound due to its possible infection. After the blockade of the fracture zone, they proceed to the primary surgical treatment of the wound. It should begin with anesthesia of the wound edges with a 0.25% solution of Novocain with the addition of 1-2 million units of penicillin or another broad-spectrum antibiotic. This method allows simultaneously with anesthesia to carry out the prevention of infectious complications [22-24].

The next stage of treatment is wound dissection, which allows for revision of deep-lying tissues, as well as improving blood circulation in muscles and tissues crushed by traumatic edema. A wide dissection of fascia-covering muscles and aponeuroses leads to decompression of deep-lying tissues, improves their microcirculation and tissue nutrition.

Bacteriological examination revealed 62.0% of victims with open fractures in wounds before treatment found *Staphylococcus aureus*, *Proteus*, *Pseudomonas aeruginosa* and other microbes. When mechanically cleaning a wound, it is necessary to completely remove foreign bodies, and then proceed to the excision of non-viable tissues. According to the testimony excised edges and bottom of the wound. It is extremely economical to approach the excision of the skin. In the prevention of purulent complications, an important place is given to the full drainage of wounds, especially the active aspiration of hematomas. Primary surgical treatment of open fractures of the leg and foot is better to finish the imposition of reserve seams on the wound.

Antibacterial therapy for open fractures is carried out with therapeutic and prophylactic purposes. Local antibiotic infiltration of the tissues around the wound is used as a single dose in cases where the operation of primary surgical treatment is delayed by the term with minor destruction of tissues and small wounds. Intraosseous and intra-arterial routes of administration of antibiotics with extensive crumbling of tissues in the active early development of the inflammatory process are difficult to ensure in the ship's conditions even if the doctor's hospital has experience of such work. For this reason, antibiotics for generalization of infection to ensure the spread of anti-inflammatory drug throughout the body, is administered intravenously or intramuscularly. On the first day after the injury, large doses (20-40 million units) of penicillin are shown, since wound contamination occurs by "street" microbial strains, usually sensitive to such preparations. In the subsequent antibacterial drugs prescribed based on the results of bacterial control. If the operation of primary surgical treatment is postponed for a significant period due to meteorological conditions or ice conditions that prevent the evacuation of the victim

to coastal medical institutions, it is necessary to apply preparations to which the flora is sown in the department, as usually occurs secondary infection of the wound.

All victims of members of vessel's crew with open fractures should be comprehensive prevention of tetanus and anaerobic infection with the introduction of tetanus toxoid and antifungal serum.

Early and radical primary surgical treatment in this complex should always occupy a decisive place. All previously unvaccinated to tetanus from the number of floating compounds with open fractures and wounds should be injected subcutaneously with tetanus toxoid serum (3000 IU adults) and tetanus toxoid (1 ml adults and 0.5 ml children). Re-injected toxoid at a dose of 0.5 ml in 30-40 days. Only toxoid (0.5 ml) is injected to those vaccinated against tetanus.

In the case of extensive crush of soft tissues, it is advisable to inject anti-gangrenous serum. Despite certain difficulties, the ship's doctor needs to assess the extent of their damage and introduce a prophylactic and, if indicated, a therapeutic dose. Prevention of anaerobic infection consists of primary surgical treatment, early introduction of polyvalent anti-gangrenous serum and early chemotherapy, including antibiotics. The preventive dose of serum is 30000 ME, which is administered intramuscularly, previously diluted with threefold amounts of saline. Before administration of serum, the sensitivity of the victim to a foreign protein by intradermal test of serum diluted 1: 1000 is determined [25-32].

Secondary surgical treatment of wounds to the studied contingent of the floating composition was not carried out.

In case of gross deformations of the limbs, it is impossible to abandon the manual reposition of debris in order to restore the correct axis of the limb. On some vessels it is possible to make X-rays to establish both the initial position of the damaged bones and the results of the reposition. In this case, it is possible to achieve satisfactory reduction results already in ship conditions.

When applying circular gypsum dressings, it is necessary to take into account that active exudative processes continue in the damaged segment, even after the initial surgical treatment of the wound, including, including, dissection of fascia and aponeuroses. Therefore, tissue edema may increase. A plaster bandage in such cases causes tissue ischemia. To prevent this from happening in all cases of the imposition of circular gypsum dressings in ship dispensaries, it is necessary to dissect them using a previously laid conductor. A secondary displacement of the debris does not occur, and due to the increasing swelling of the tissues, the bandage can move apart on its own and thereby prevent tissue ischemia. Contradicting the proposed method, the imposition of a dissected plaster bandage strengthening bandage which eliminates pushing its edges.

To observe wounds, change wet-drying dressings and drainages in the area of open fractures in a plaster cast, sufficiently sized "windows" are made. As a rule, patients with open fractures receive long-term antibiotic therapy with a reasonable change of drugs.

Tactical mistakes of ship doctors when providing urgent assistance to members of vessel's crew with open fractures consist of incorrect diagnosis of the damage received, the condition of the victim and the possible consequences for his life. Early first aid with open fractures, timely anti-shock therapy, early and complete surgical treatment of the fracture are the main measures to prevent complications. Errors made in the first stages are difficult to correct during the stay of victims with open fractures in the surgical departments of coastal medical institutions.

Results

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1. The highest risk of receiving open fractures when performing ship works related to: servicing and repairing machinery of the engine room, deck equipment, mooring operations, loading and unloading by the crew, closing the holds and hatches. As a result of a fall on a metal surface, 5.9% of open fractures occurred.
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Conflicts of interest

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