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Errors in Differential Diagnosis of Burn Injury at the Prehospital Stage

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Burn center

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RELEVANCE An important component of the diagnostic process in combustiology is the collection of anamnesis. At the same time, verification of the very fact of a burn injury of the skin, as a rule, does not seem to be a difficult task even for a novice doctor. However, specialists from the I.I. Dzhanelidze Institute regularly encounter errors in the differential diagnosis of burn injuries at the prehospital stage on the part of both ambulance teams (EMS) and surgeons (traumatologists) of non-specialized medical institutions. Each such case attracts attention and takes up a significant part of the time resource of the entire staff of the inpatient department of the emergency medical service for the process of clarifying and verifying the correct diagnosis, as well as determining the further routing of such a patient.

AIM OF STUDY To study the structure of diagnostic errors at the prehospital stage of the EMS to optimize patient routing by improving the existing organizational and methodological standards.

MATERIAL AND METHODS A retrospective analysis of the case histories of all victims who were admitted to the inpatient department of the Emergency Medical Department of the I.I. Dzhanelidze St. Petersburg Research Institute of Emergency Medicine during the period from January 2018 to December 2019.

RESULTS 4,951 patients were admitted with a leading diagnosis of the referring institution, suggesting a history of burn injury. The incidence of diagnostic errors at the prehospital stage of emergency care was 410 cases (8.3%), while burn injury was completely excluded in 178 cases (3.6%).

CONCLUSIONS 1. The results of the analysis revealed a high incidence of diagnostic errors at the prehospital stage of emergency care (8.3%), the main reason for which is the lack of awareness of differential diagnostics within the narrow specialty (combustiology) of primary contact physicians. 2. Shown is the introduction of training practice for doctors and paramedics of emergency medical services, surgeons and traumatologists of primary care in combustiology cycles in specialized burn departments. 3. In order to ensure continuity in the process of providing medical care to patients with burns, it is necessary to create a unified database of convalescents to form a feedback channel with the outpatient clinic during the implementation of the rehabilitation complex.

Keywords: dataset, stroke, computed tomography, DICOM-images, radiomics, machine learning

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INTRODUCTION

Taking anamnesis is an important component of the diagnostic process in combustiology. At the same time, verification of the very fact of a burn injury of the skin, as a rule, does not seem to be a difficult task even for a novice doctor. The combination of anamnestic data on the effect of the etiological factor on the skin, complaints of pain in the area of wounds, a characteristic local status in most cases allows diagnosing a burn.

Everything is significantly complicated when a patient is admitted, and the collection of anamnesis is impossible. Most often, such situations occur when patients are hospitalized unconscious, in a state of severe alcohol or drug intoxication, as well as in diseases characterized by a decrease in the intellectual-mnestic status. In the available literary sources, data on the frequency of erroneous diagnoses in combustiology are sporadic and contradictory. [1]. However, specialists from the St. Petersburg Institute named after I.I. Dzhanelidze in their work regularly encounter errors in the differential diagnosis of burn injuries at the prehospital stage on the part of both ambulance teams (EMS) and surgeons (traumatologists) of non-specialized medical institutions [2, 3]. Each such case attracts attention and takes up a significant part of the time resource of the entire team of the inpatient emergency department in the process of clarifying and verifying the correct diagnosis, determining the further routing of such a patient.

The complex of measures upon admission of such a patient includes his examination, provision of consultations of related specialists (surgeons, traumatologists, angiosurgeons, dermatologists and other doctors), in-depth laboratory diagnostics, diagnosis. In the future, if there is a structural unit in the medical institution that is specialized in the specified diagnosis, a decision is made to hospitalize the patient in the appropriate department. If the established diagnosis does not allow the patient to be hospitalized in this hospital, a decision is made and his transfer to a specialized hospital through the hospitalization bureau is agreed, documents are prepared for transfer, the patient is supervised until the ambulance team arrives. The full range of such activities usually takes at least 2-3 hours. As a result, such errors in the differential diagnosis of burns at the prehospital stage lead to significant expenditures of administrative and material resources, which are advisable to use as treatment and diagnostic measures in specialized patients. At the same time, it is possible to postpone the start of specialized multicomponent therapy for true nosology, and the degree of patient's satisfaction with the quality of medical care is reduced. The frequency of detecting erroneous diagnoses when referring patient to planned hospitalization for reconstructive operations after a burn injury is minimal and does not exceed 1–1,5%. However, late verification of such serious diseases as osteomyelitis, squamous cell carcinoma at the prehospital stage can lead to an unfavorable course of the disease. Awareness of outpatient doctors about the features of differential diagnosis of burns will allow timely identification of this type of pathology.

The work on the generalization and systematization of clinical observations, in which the diagnosis was mistakenly made at the EMS stage, is relevant in terms of reducing the frequency of unsatisfactory treatment results in such patients.

Purpose of the study: to study the structure of diagnostic errors at the prehospital stage of the EMS to optimize patient routing by improving the existing organizational and methodological standards.

Tasks:

1. To analyze the case histories of patients delivered to the inpatient emergency department of the St. Petersburg Institute named after I.I. Janelidze with nosologies corresponding to the profile" Combustiology ", to determine the frequency of diagnostic errors.
2. To determine the structure of nosological forms, the manifestation of which seems to be similar in clinical symptoms to the manifestations of burn injury.
3. To propose organizational and methodological solutions aimed at reducing the frequency of such errors in the future.

MATERIAL AND METHODS

To achieve this goal and objectives, a retrospective analysis of the case histories of all victims who were admitted to the inpatient department of the GBU “St. Petersburg Institute of EMC named after I.I. Janelidze" from January 2018 to December 2019. Statistical data processing included analysis of the structure of diagnostic errors.

General characteristics of patients at the prehospital stage are presented in Table. 1.

Table 1

General characteristics of patients at the prehospital stage

Indicators	Number of patients	
	n	%
Total	4951	100
Gender Men Women	 2740 2211	 55,3 54,7
Age, years	46,2 95 (Confidence Interval: 38,3–54,12)	
Impairment of effective verbal contact	440	8,9
Lesion area in patients with burns	12,5 95 (CI: 6,06–18,37)	

RESULTS

For 2018–2019 4951 patients were delivered to the inpatient department of the emergency room with the leading diagnosis of the referring institution, suggesting the fact of a burn injury. As a result of the diagnostic process, in 178 patients (3.6%) burn injury was excluded, in 232 patients (4.7%) this nosology was not the leading pathology.

Below are the data of the main diagnostic errors at the prehospital stage (Table. 2).

Table 2

The structure of diagnostic errors at the prehospital stage when referred to a burn center

Errors identified	Number of observations	
	n	%
Elimination of diagnosis of burn injury	178	3,6
Burn injury is not a leading pathology	232	4,7
Total quantity of diagnostic errors	410	8,3
Total quantity of patients	4951	100

Treatment of patients with the prevalence of the severity of competing pathology over the significance of burn injury in most cases was carried out in the conditions of the Research Institute of Emergency Medicine due to the versatility of the hospital and the need for supervision by a combustiologist. Accordingly, in these cases, there was no violation of patient routing.

Of greatest interest in this study is the group of patients with the exclusion of the fact of thermal injury. Nosological forms simulating skin burns in patients are divided into groups and are presented in Table 3.

Table 3

The structure of diagnostic errors at the prehospital stage when referred to a burn center

Nosology	Number of patients	
	n	%
Purulent surgery		
Erysipelas	11	6,2
Necrotizing cellulofasciomyositis	10	5,6
Cellulitis	13	7,3
Post-injection soft tissue necrosis	4	2,2
Osteomyelitis	5	2,9
Total:	43	24,2
Traumatology		
Positional Compression Syndrome	19	10,7
Bedsores	15	8,4
Soft tissue injuries, including scalped wounds	13	7,1
Total:	47	26,2
Vascular pathology		
Post-injection vascular thrombosis	4	2,3
Trophic ulcers	14	7,9
Total:	18	10,2
Dermatological pathology		
Contact allergic dermatitis	25	14
Bullous dermatitis	3	1,7
Psoriasis	3	1,7
Zoster	15	8,4
Hyperkeratosis with pigmentation	5	2,9
Fungal skin lesions	8	4,5
Dermato-oncology	4	2,3
Total:	63	35,5
Systemic diseases		

Systemic vasculitis	7	3,9
Total:	178	100

The structure of differential diagnostic errors in patients referred to the burn center is shown in the diagram in Fig. 1. Analysis of the data obtained revealed the prevalence of nosologies related to the field of dermatology among the pathological disorders regarded by doctors of primary contact as a result of exposure to high temperatures or aggressive chemical compounds (63 cases; 35,4%).

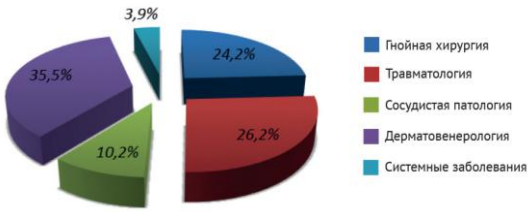

Fig. 1. The structure of differential diagnostic errors

A small group of patients with late and long-term complications of burns deserves special attention (Fig. 2). The nosologies identified in these patients (23 people) belong to various sections – vascular pathology (14 patients, 60.9%), purulent surgery (5 patients, 21.7%), dermatology (4 patients, 17,4%). All representatives of this group are united by the fact of a burn injury in the anamnesis with a duration of 2 to 20 years.

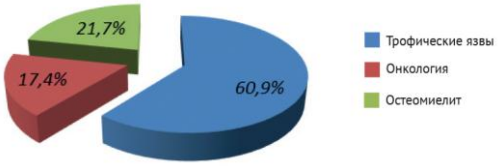

Fig. 2. The structure of long-term complications of burns

Clinical example 1

Patient A., 60 years old, was admitted to the department of emergency medical care of the State Budgetary Institution "St. Petersburg Research Institute of Emergency Medicine named after I.I. Janelidze" with a diagnosis of "Chemical burn". From the anamnesis: pains in the chest appeared two days ago. While waiting for an appointment with a neurologist, the patient suggested the development of intercostal neuralgia and used a locally irritating, warming action plaster "Dorsaplast" to treat pain. A day after removing the patch, small vesicles appeared in the application area (Fig. 3). The patient noted the appearance of a chemical burn after using this patch. The diagnosis was confirmed by the ambulance team, the patient was taken to the hospital. In the conditions of the emergency and ambulance department, the combustiologist suggested the development of Herpes Zoster, a videoconference was held with the specialist on duty at the St. Petersburg Infection Hospital named after S.P. Botkin, the diagnosis was verified, the transfer of the patient was agreed.

Fig. 3. The clinical picture of Herpes Zoster

Clinical example 2

Patient V., 57 years old, was admitted to the department of emergency medical care of the St. Petersburg Research Institute of Emergency Medicine named after I.I. Janelidze with a diagnosis of "Chemical burn" (Fig. 4).

Fig. 4. Post-injection vascular thrombosis and soft tissue necrosis of the left cubital region

From the anamnesis: for the purpose of deliberate self-harm, he injected intravenously into the left cubital area pipe cleaner "Mole". As a result of the examination, the diagnosis was established: "Post-injection vascular thrombosis (v. basilica и v. intermedia) and soft tissue necrosis of the left cubital region". Severe depressive syndrome was identified as a concomitant pathology. The patient was admitted to the department of somatopsychiatry.

The operation was performed: necrectomy with vascular ligation on the 2-nd day, delayed non-free plasty with local tissues on the 8-th day.

The stages of the patient's surgical treatment are shown in Fig. 5.

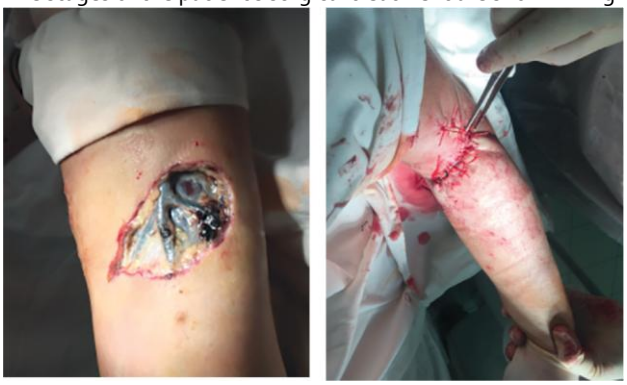

Fig. 5. Stages of surgical treatment

Clinical example 3

Patient K., 63 years old, was sent to the burn department for planned hospitalization for cicatricial post-burn deformity with ulceration in the projection of the right parietal bone. From the anamnesis: in 1996 he received an electric burn with damage to the bone structures of the cranial vault. In 2019, a non-healing defect appeared in the parietal area (Fig. 6).

Fig. 6. Osteomyelitis of the parietal bone

After the oncologist excluded neoplastic processes, the patient was referred to a burn center for reconstructive surgery. In the department, after consulting a neurosurgeon, computed tomography was performed, which revealed osteomyelitis of the right parietal bone. The operation was performed - osteonecrectomy of the right parietal bone 2.5x2 cm (Fig. 7). The bottom of the wound is represented by an unchanged dura mater. The patient was discharged for the supervision of a neurosurgeon of outpatient treatment and for preparation for reconstructive planned surgery to close the defect.

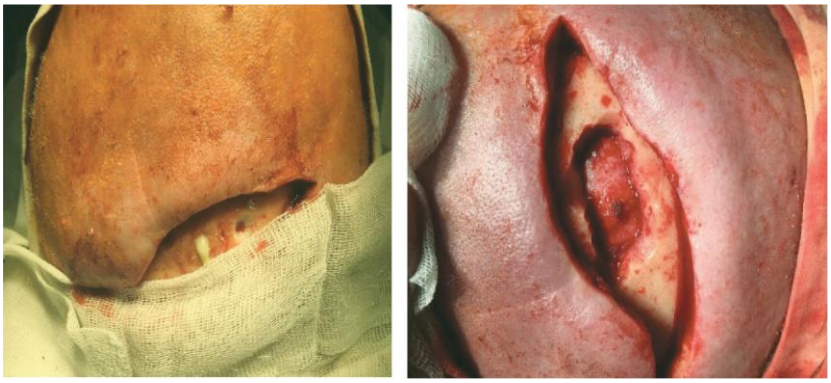

Fig. 7. Stages of osteonecrectomy of the right parietal region

DISCUSSION

The main reason for diagnostic errors in the group of patients under consideration is incomplete collection of anamnesis, including for objective reasons (impaired consciousness of various origins, intellectual-mnestic deficit), as well as, obviously, insufficient awareness of primary care physicians on the issues of differential diagnosis within a narrow specialty [1, 4].

The most frequent among dermatological diseases was allergic contact dermatitis (14%) as a manifestation of a type IV hypersensitivity reaction [3, 5]. These observations illustrate, in particular, the ignorance of doctors regarding the biphasic nature of the development of the pathological process in allergic contact dermatitis with the manifestation of characteristic clinical symptoms only after repeated contact with the allergen against the background of previous sensitization [6, 7].

The second most common cause is the simulation of skin burns by a dermatological disease of an infectious origin, Herpes Zoster, which is important in connection with the probable consequences of routing disruption due to misdiagnosis at the prehospital stage (8.4%). Болезнь развивается вследствие активации латентного вируса, сохраняющегося в нервных волокнах на фоне, как правило, ослабления иммунитета [8–10]. At the same time, the neurotropic properties of Herpes viridae come to the fore: sharp pain occurs along the affected nerve. It is at this stage that patients in the course of self-medication use a variety of therapeutic compositions, continuing treatment up to the manifestation of the epitheliotropic characteristics of the virus in the form of a vesicular exanthema simulating a chemical burn. The significance of such an error is determined by the contagiousness of the disease, especially in relation to patients with impaired immune status, contact with whom is inevitable in the process of verifying the diagnosis in an inpatient emergency department.

The main reason for incorrect diagnosis in the block of traumatological lesions (47 cases, 26.4%) is the impossibility of full collection of anamnesis in cases of rendering assistance to persons with impaired consciousness or the absence of productive contact. Nevertheless, clear ideas of primary care physicians about the peculiarities of the clinical picture of such nosological forms as positional compression syndrome, pressure ulcers, in many cases, would allow avoiding an incorrect diagnostic conclusion [2].

A different picture was recorded in the group of surgical patients (43 cases, 24.1%). Propedeutically verified collection of anamnesis of life and illness, the ability to correctly build a list of questions for the patient, attention to detail, taking into account the clinical picture and polydisciplinarity of knowledge, the ability to track causal relationships, as a rule, guarantee the establishment of the correct diagnosis [11]. Accurate differential diagnosis is of particular importance in cases of the development of necrotizing forms of infections, when a delay in the start of a pathogenetically grounded multicomponent treatment, primarily surgical, with a high degree of probability leads to manifestations of the syndrome of infectious-toxic shock and a sharp increase in the likelihood of fatally unfavorable outcomes.

Errors associated with violations of differential diagnosis within the framework of vascular pathology (18 patients, 10.2%), systemic connective tissue diseases (7 cases, 3.9%).

At the same time, in the case of background trophic disorders leading to the formation of skin defects mainly in the distal segments of the lower extremities, a delay in specialized treatment does not lead to critical consequences. The lack of alertness of outpatient doctors when working with convalescents after burns at the stages of rehabilitation in the absence of a feedback system with the medical staff of specialized hospitals determines the late treatment of patients in cases of osteomyelitis [12] or oncological transformation [13–15].

CONCLUSION

The analysis of the structure of diagnostic errors at the prehospital stage revealed a number of organizational and methodological problems within the framework of continuous professional development of primary care physicians, issues of continuity of medical care, interaction between the links of the chain of medical care, the solution of which will reduce the frequency of differential diagnostic errors, improve the quality of medical care.

FINDINGS

1. The analysis made it possible to reveal a high frequency of diagnostic errors at the prehospital stage of emergency medical care (8.3%), while disruption of patient routing (complete exclusion of burn injury) was recorded in 3.6% of cases.

2. The main groups of nosological forms that simulate burn injury are infectious-surgical pathology (19.1%), a dermatological group of diseases (30.3%), as well as pathology of an orthopedic-traumatological profile (26.2%).

3. In order to improve the qualifications of medical personnel of primary contact, it is necessary to create methodological manuals and training modules as part of improving the system of continuing medical education, and it is also advisable to introduce the practice of training doctors and paramedics of emergency medical care, surgeons and traumatologists of primary care in specialized burn departments (centers) in order to acquire visual experience and study diagnostic algorithms.

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