

Characteristics of the Medical Nutrition of the Polytraumatized Patients in Presence of Obesity

Charakterystyka żywienia leczniczego u otyłych pacjentów po urazie wielonarządowym

DOI: 10.36740/ABAL202201112

Orest M. Chemerys¹, Sergii D. Khimich²¹Danylo Halytsky Lviv National Medical University, Lviv, Ukraine²National M.I. Pirogov Memorial Medical University, Vinnytsia, Ukraine

SUMMARY

Aim: To determine the characteristics of the Medical Nutrition of the Polytraumatized Patients in presence of obesity.**Materials and Methods:** The clinical material is represented by 42 polytraumatized patients hospitalized at the Department of Surgery of the Municipal Non-Profit Organization "8th Municipal Clinical Hospital of Lviv".**Results:** The posttraumatic catabolic condition requires the energy balance with the early substitution of protein and hypercaloric nutrition. The patients with obesity in the presence of massive severe injuries not receiving the necessary nutrition within the first days after the trauma may develop the cumulative deficit of calories and proteins that conditions the development of the severest complications related to the repeated infecting, and, consequently, the multiple organ dysfunction. The early enteral nutrition for the injured patients with obesity demonstrated a convincing positive result in the form of the prevention of infectious diseases and, correspondingly, improved the results and period of treatment.**Conclusions:** The patients with obesity in the presence of massive severe injuries not receiving the necessary nutrition within the first days after the trauma may develop the cumulative deficit of calories and proteins that conditions the development of the severest complications related to the repeated infecting, and, consequently, the multiple organ dysfunction,**Key words:** obesity, polytrauma, medical nutrition**Słowa kluczowe:** otyłość, uraz wielonarządowy, żywienie medyczne

Acta Balneol, TOM LXIV, Nr 1(167);2022:61-64

INTRODUCTION

The issue of polytrauma is a subject of many publications in the world literature, as well as the diagnostics and treatment of polytraumatized patients remains one of the topical issues not only of Emergency Surgery but also of many allied medical specialties. It has already been mentioned that the concomitant injuries and multiple bodily injuries cause the development of the traumatic disease, the fatality rate of which ranges from 10.7% to 69.7%, depending upon the severity of injuries [1, 2]. However, these data mostly concern people with normal body weight. Speaking of the obesity that actually becomes the world pandemic, it creates an additional financial burden for the healthcare system around the world. Judging by the USA data, the annual expenses related to the diseases caused by obesity, exceed those of the patients with the normal body weight by about 1500 USD [3]. Besides, obesity is one of the factors increasing the risk of traumas both in everyday life

and at the workplace, and the concomitant injuries caused by the traffic accidents occupy one of the leading positions in the overall structure of the modern polytraumas of this category of patients that cumulatively causes the substantial challenges in the sphere of medicine [4, 5]. To our point of view, the increased risk of polytraumas for people with obesity can be caused by multiple factors. Such people, due to the overweight, cannot promptly respond to the danger or avoid it, eliminate the traumatizing factors or provide adequate self-aid.

To our point of view, the belief that a substantial layer of fat of obese people protects them during the trauma due to the better amortization feature of the fat tissue is absolutely erroneous.

Besides, B.H. Waibel provides the results of his studies that are very much to the point where he states that in case of the closed abdominal trauma of the patients with obesity,

the subcutaneous tissue has no essential protective effect and the fatty liver infiltration rather causes even more severe ruptures and the higher the BMI, the higher the rupture level [6]. Concerning the level of the spleen rupture, the substantial correlation with the obesity level has also been observed, however, this phenomenon has not been explained from the pathomorphological point of view.

Considering the above, the patients suffering from obesity occupy a special position in the totality of the polytraumatized patients. Actually, each fifth injured hospitalized patient is with a $BMI \geq 30 \text{ kg/m}^2$ that corresponds to class II obesity [7]. Among the factors aggravating the condition of such patients is the injury of the chest organs, abdominal cavity, and large retroperitoneal hematomas. However, despite the substantial incidence (frequency of the diseases) of traumas, the diagnostic and treatment approaches to polytraumas of people with obesity, except for the specialized injury surgery departments, do not practically differ from the general bases of diagnostics and treatment of the surgical diseases applied to the patients with the normal body weight [8]. Noteworthy that the injuries of the polytraumatized patients in presence of obesity were much severe as compared to the people with normal body weight that is confirmed by the metabolic system disorders, morphological symptoms of dysfunctions, and growing connective tissue with the further stroma – vascular dystrophy [9].

AIM

To determine the characteristics of the medical nutrition of the polytraumatized patients in presence of obesity.

MATERIALS AND METHODS

The clinical material is represented by 42 polytraumatized patients hospitalized at the Department of Surgery of the Municipal Non-Profit Organization "8th Municipal Clinical Hospital of Lviv". Out of them, 23 (54.8%) patients had concomitant blunt trauma of the chest, blunt trauma of the abdomen, and closed craniocerebral injury. The pelvic or limbs fractures were observed in 19 (45.2%) patients. The age of the patients ranged within 18 - 87 (average age: 43.6 ± 1.3 yrs.), men: 28 (66.7%), women: 14 (33.3%), working-age persons: 34 (80.9%).

Depending upon the BMI, all patients were subdivided into three clinical groups. The first group included 14 patients with a normal body weight ($BMI \geq 24.9 \text{ kg/m}^2$), the second one included 17 patients with overweight and class I obesity. ($BMI=26.2-34.2 \text{ kg/m}^2$) and the third one: 11 injured patients with class II-III obesity. ($BMI=35.3-41.9 \text{ kg/m}^2$).

RESULTS

The amount of medical aid to the injured patients at the pre-hospitalization stage depended upon the subjective assessment of the patient's general condition by the emergency teams. Initially, the severity condition was assessed, the presence of the well-functioning fluid-administration sets, the quality of immobilization of the injured segments, and the conditions and time of injuries were clarified. Correspondingly, the condition of 19 (45.2%) patients was determined as moderately

severe, 15 (35.7%) – as severe, and 8 (19.1%) – as extremely severe. Besides, 34 (80.9%) patients were verbally accessible that allowed to gather the medical history and 8 (19.1) were in the altered state of consciousness. Out of 19 patients, 9 (47.4%) belonged to the I clinical group, 10 (52.6%) – to the II clinical group. The overweight patients and patients with obesity were the most problematic in this group of patients since practically every second patient (4 persons) was diagnosed with the mistakes, mainly, the fractures of one and more ribs (2 persons) aggravated by the hemopneumothorax, non-diagnosed intra-abdominal hemorrhage (3 persons) 2 more patients have not been timely diagnosed the verified multiple pelvic fractures and femur bone fractures.

Out of the patients in the serious condition 7 patients (46.7%) belonged to the II clinical group and the other 8 patients (53.3%) to the III clinical group. The typical mistakes for this group of patients were as follows: non-verified fractures of the rib cage aggravated by the hemopneumothorax in all injured patients with class II-III obesity, intra-abdominal hemorrhage in 6 patients (40.0%), and pelvic or limbs fractures in 4 patients of the II clinical group. No respiratory support during the closed chest injury in 10 (23.8%) patients as of the moment of hospitalization caused the development of the long-time hypoxia that was hard to manage at the stage of hospitalization which conditioned the durable application of the artificial lung ventilation apparatus and prolonged the period of stay at the intensive care unit by 4.7 ± 1.3 days (> 0.03) on average.

On the other hand, noteworthy that in case of the inadequate assessment of the severity of the patient's condition the inappropriate antishock therapy was administered. It is commonly known that the femur fracture causes a blood loss of more than 500ml, pelvic fracture: about 2,000 ml, and concomitant injuries: 3,000 ml that is about 90% of the blood volume (BV) [10]. In case of blunt trauma of the abdomen with the injury of the parenchymal organs of the abdominal cavity (liver, spleen) the blood loss may range between 500-3,000 ml. [11]. Thus, for 6 (14.3%) patients with undiagnosed skeleton fractures, no transport immobilization was provided that could cause the additional injuries with the bone fragments. For 13 (31.0%) patients with the confirmed limb fractures, the splinting was carried out using the standard and impromptu means, however, for 5 of them, no immobilization was provided of at least two joints adjacent to the place of injury that resulted in an unstable fixation. The BV was replenished with the isotonic and hypertonic colloid and crystalloid solutions calculated as not less than 20ml of infusion solution per 1 kg of body weight of the patient depending upon the type of injury and severity of the patient's condition. Correspondingly, the stable hemodynamic parameters as of the moment of the patient inspection and non-verified injuries in 22 (52.4%; $p > 0.04$) constituted the reason for the denial of the adequate antishock therapy at the pre-hospitalization stage, mainly, the narcotic pain medication at the skeleton injury of 15 (35.7%; $p > 0.05$) patients have not been injected, the BV has not been adequately replenished at the pelvic fractures, femoral fractures, and intra-abdominal hemorrhage of 12

(28.6%; $p > 0.05$) patients that consequently substantially aggravated the condition of the injured (considering the presence of different classes of obesity of the patients before the hospitalization).

Out of the patients in the serious condition, 5 (62.5%) were with the normal body weight, 3 (37.5 %) with class II obesity. For the last sub-group of the patients, the emergency team applied all available means of emergency management at polytrauma according to the common standards.

All patients after the hospitalization were immediately examined by the Surgeon, Emergency Physician, Neurosurgeon, and Traumatologist. In 87.5% of cases, the Cardiologist or General Practitioner were involved. After the receipt of the initial data of the physical examination, the Surgeon determined the list and sequence of the additional examination methods.

To assess the informative value of the traditional examination methods at the hospitalization stage, the sensitivity and specificity of the diagnostic tests were assessed. The objective examination of the thoracic organs (palpation ($s=72.4\%$, $f=95.9\%$), percussion ($s=76.1\%$, $f=97.1\%$), auscultation ($s=79.1\%$, $f=96.8\%$)) of the patients of I clinical group allowed determining the precise diagnosis of practically all the patients (95.0%).

Besides, for the patients with obesity the value of these examinations was reduced. Thus, in the II clinical group the preciseness of the methods was as follows: palpation ($s=66.4\%$, $f=87.9\%$, $p>0.05$), percussion ($s=71.4\%$, $f=91.4\%$, $p>0.05$), auscultation ($s=75.1\%$, $f=90.1\%$, $p>0.04$), and for the III group it was substantially reduced: palpation ($s=61.4\%$, $f=75.9\%$, $p>0.05$), percussion ($s=67.2\%$, $f=62.1\%$, $p>0.05$), auscultation ($s=64.4\%$, $f=77.5\%$, $p>0.03$), that necessitated the pleural puncture for the injuries diagnostics.

For the diagnostics of the organs of abdominal cavity for the patients of the I clinical group, the objective examination methods were enough, the sensitivity and specificity of which for the people with the normal body weight is high: (palpation ($s=73.6\%$, $f=96.1\%$), percussion ($s=77.2\%$, $f=96.9\%$), auscultation ($s=82.3\%$, $f=97.7\%$)), which is confirmed by the U/S examination results which showed the free liquid in the abdominal cavity ($s=82.7\%$, $f=98.9\%$). All patients got operated, the laparotomy was carried out, the hemorrhage was arrested with the elimination of injuries and drainage of the abdominal cavity.

For the patients of II clinical group, the diagnostic value of the objective methods was reduced (palpation ($s=71.6\%$, $f=90.2\%$, $p>0.05$), percussion ($s=75.2\%$, $f=94.1\%$, $p>0.04$), auscultation ($s=80.1\%$, $f=91.2\%$, $p>0.05$)), however, the meaning of U/S remained high enough ($s=80.6\%$, $f=4.1\%$, $p>0.05$), that permits diagnosing the injuries without the invasive tests.

However, for the patients of III clinical group the sharp reduction of the diagnostic adequacy of the palpatory examination was observed ($s=64.7\%$, $f=79.1\%$, $p>0.05$), percussion ($s=66.8\%$, $f=84.4\%$, $p>0.05$), and auscultation ($s=62.4\%$, $f=62.1\%$, $p>0.03$), besides, the sensitivity and specificity of U/S also reduced and amounted to $s=70.9$ and $f=81.4\%$ ($p>0.03$) correspondingly. Thus, the absence of the clear diagnostic criteria created the grounds for the abdominal

paracentesis of all patients in presence of obesity that finally allowed diagnosing the intra-abdominal hemorrhage. These patients got operated, the laparotomy was carried out, the hemorrhage was arrested with the elimination of injuries and drainage of the abdominal cavity.

DISCUSSION

The progression of the traumatic disease of people with obesity is characterized by the low level of compensation ability of the body connected with the presence of multiple chronic diseases of cardiovascular, pulmonary system, locomotor system, and functional disorders of the organism that substantially reduces the possibility of the positive result in treatment of this group of patients [12].

The matter is that the severe concomitant trauma causes substantial changes of the physiological condition through the change of the metabolic pathways and activation of the inborn immune system, especially for the patients suffering from obesity and overweight [13, 14]. The post-traumatic metabolic changes depend upon the level of obesity and are characterized by hypermetabolism with the increased energy consumption, intensified catabolism of proteins, insulin resistance connected with the hyperglycemia, inability to tolerate the glucose loading and high level of insulin in plasma, the so-called "traumatic diabetes" [2, 8]. The changes of the physiological metabolic pathways result in the development of hyperglycemia and metabolic acidosis at hyperlactatemia [9]. If the increased need for oxygen is not met, the hypermetabolic state of the patients substantially aggravates due to the intensified consumption of mitochondrial oxygen [1, 13].

The posttraumatic catabolic condition requires the energy balance with the early substitution of protein and hypercaloric nutrition [4, 11]. The patients with obesity in the presence of massive severe injuries not receiving the necessary nutrition within the first days after the trauma may develop the cumulative deficit of calories and proteins that conditions the development of the severest complications related to the repeated infecting, and, consequently, the multiple organ dysfunction. In other words, it should be kept in mind that the organism of the person with obesity which is used to consuming much food, at polytrauma is very much stressed due to the lack of the necessary energy, vitamins, microelements that causes the development, among other things, of the post-traumatic catabolic condition. Now, it has to be said that we agree to the conception of the early enteral nutrition for the patients with obesity that demonstrated the positive effect preventing the infectious complications and, correspondingly, improved the results and period of treatment [9, 12]

CONCLUSIONS

The patients with obesity in the presence of massive severe injuries not receiving the necessary nutrition within the first days after the trauma may develop the cumulative deficit of calories and proteins that conditions the development of the severest complications related to the repeated infecting, and, consequently, the multiple organ dysfunction. Such patients need the special approach with the substantial analysis of the

provisions concerning the studying of the diagnostic value of the clinical, instrumental, and special examination methods, elaboration of the program of differential complex treatment of patients with obesity considering the peculiarities of the traumatic disease and condition of the macroorganism where the obesity is a severe aggravating factor as well.

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Conflict of interest:

The Authors declare no conflict of interest

Received: 09.07.2021

Accepted: 23.12.2021

ADDRESS FOR CORRESPONDENCE:

Orest M. Chemerys

Danylo Halytsky Lviv National Medical University

16 Sakharova st., 79000 Lviv, Ukraine

phone: +380979534443

e-mail: orestchemerys@gmail.com

ORCID ID and AUTHORS CONTRIBUTION

0000-0001-8550-6980 – Orest M. Chemerys (A, B, C, D)

0000-0002-8643-2140 – Sergii D. Khimich (E, F)

A – Research concept and design, B – Collection and/or assembly of data, C – Data analysis and interpretation, D – Writing the article, E – Critical review of the article, F – Final approval of article

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