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ΤΟ ΒΗΜΑ ΤΟΥ ΑΣΚΛΗΠΙΟΥ

VEMA OF ASKLIPIOS

APRIL-JUNE 2002 VOLUME 1 No 2

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Original paper

The role of early enteral nutrition in burnt and multiple trauma patients
Similarities and differences

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Aim **The aim of this study was to investigate the role of Early Enteral Nutrition (EEN) in burnt and multiple trauma patients.** *Material–Method* **31 patients with burns >25% of the total body surface area and 35 patients with more than two traumas were included in our study. A nutritional support protocol was followed. Blood markers and the general condition of patients were assessed for the role of EEN.** *Results* **In burnt patients, total proteins, serum albumin and serum globulin were increased significantly between all measurements. In multiple trauma patients total proteins and serum globulin were increased significantly between the 1st and 3rd measurement (P<0.001). Serum albumin was slightly decreased between the 1st and 3rd measurement (P=0.350). For burnt patients, between the 1st and 3rd measurement, Fe was increased (P<0.008) and for multiple trauma it was slightly increased. For burnt patients TIBC was increased (P<0.001) and for multiple trauma patients was slightly decreased. There were no significant changes in the absolute number of lymphocytes neither in immunoglobulin-IgA, IgM, IgG for both patients groups. The mean serum albumin value of the burnt patient was significantly increased compared with the multiple trauma patients (P=0.012). The mean serum globulin value of the multiple trauma patients was significantly increased compared with the burnt patients (P=0.019). TIBC did not increased between groups in the 1st and 2nd measurements, but it was significantly increased in the 3rd measurement in burnt patients compared with the multiple trauma patients (P=0.005). The mean value of immunoglobulin IgG showed a significant increase in multiple trauma patients compared with the burnt patients (P=0.006).** *Conclusions* **Generally, the results of our study confirm the effectiveness of EEN in both groups of patients as well as the existence of similarities and differences.**

Περίληψη **Ο ρόλος της έγκαιρης εντερικής θρέψης σε εγκαυματίες και πολυτραυματίες. Ομοιότητες και διαφορές**. Χρ. Μαρβάκη,[1] Θ. Οικονόμου,[2] Π. Ιορδάνου,[1] Ε. Μαρβάκη,[3] Ε. Θεοδοσοπούλου,[4] Ε. Πατηράκη.[4] *[1]Τμήμα Νοσηλευτικής ΤΕΙ Αθήνας, [2]Τμήμα Πλαστικής Χειρουργικής, Μικροχειρουργικής και Εγκαυμάτων, Νοσοκομείο «Γ. Γεννηματάς», Αθήνα, [3]Νοσοκομείο "Moliere", Βρυξέλλες, [4]Τμήμα Νοσηλευτικής, Πανεπιστήμιο Αθηνών, Αθήνα. Το Βήμα του Ασκληπιού 2002, 1(2):83–88. Σκοπός* **Σκοπός της μελέτης ήταν να εξετάσει το ρόλο της Έγκαιρης Εντερικής Θρέψης (ΕΕΘ) σε εγκαυματίες και πολυτραυματίες.** *Υλικό–Μέθοδος* **Στη μελέτη μας συμπεριλήφθησαν 31 εγκαυματίες με εγκαύματα >25% της ολικής επιφανείας σώματος και 35 πολυτραυματίες με περισσότερα από δύο τραύματα. Ακολούθησε ειδικό πρωτόκολλο θρέψης και εκτιμήθηκαν εργαστηριακές παράμετροι και η γενική κατάσταση των ασθενών.** *Αποτελέσματα* **Στους εγκαυματίες, τα ολικά λευκώματα, οι λευκωματίνες και οι σφαιρίνες αυξήθηκαν σημαντικά μεταξύ όλων των μετρήσεων. Στους πολυτραυματίες τα ολικά λευκώματα και οι σφαιρίνες αυξήθηκαν σημαντικά μεταξύ 1ης και 3ης μέτρησης (P<0,001). Οι λευκωματίνες μειώθηκαν ελαφρά μεταξύ 1ης και 3ης μέτρησης (P=0,350). Στους εγκαυματίες, μεταξύ 1ης και 3ης μέτρησης, ο Fe αυξήθηκε (P<0,008). Στους πολυτραυματίες ήταν ελαφρά αυξημένος. Στους εγκαυματίες η δεσμευτική ικανότητα σιδήρου (TIBC) αυξήθηκε (P<0,001) και στους πολυτραυματίες μειώθηκε ελαφρά. Δεν υπήρξαν σημαντικές διαφοροποιήσεις στον απόλυτο αριθμό των λεμφοκυττάρων ούτε σε αυτό των ανοσοσφαιρινών IgA, IgM, IgG και για τις δύο ομάδες ασθενών. Μεταξύ των ομάδων, η μέση τιμή των λευκωματινών στους εγκαυματίες αυξήθηκε σημαντικά έναντι των πολυτραυματιών (P=0,012). Η μέση τιμή των σφαιρινών στους πολυτραυματίες αυξήθηκε σημαντικά έναντι των εγκαυματιών (P=0,019). Η TIBC των δύο ομάδων δεν αυξήθηκε μεταξύ 1ης και 2ης μέτρησης, αλλά αυξήθηκε σημαντικά στην 3η μέτρηση στους εγκαυματίες σε σχέση με τους πολυτραυματίες (P=0,005). Η μέση τιμή των ανοσοσφαιρινών IgG παρουσίασε μία σημαντική αύξηση στους πολυτραυματίες συγκριτικά με τους εγκαυματίες (P=0,006).** *Συμπεράσματα* **Γενικά, τα αποτελέσματα της παρούσας μελέτης επιβεβαίωσαν την αποτελεσματικότητα της ΕΕΘ και στις δύο ομάδες των ασθενών καθώς επίσης και παρουσία ομοιοτήτων και διαφορών μεταξύ των ομάδων.**

Key words: *Role of early enteral nutrition, nutritional markers (total proteins, blood albumin, globulin, absolute number of lymphocytes, immunoglobulin-IgA, IgM, IgG, Fe (iron) and TIBC-Total Iron Binding Capacity)*

Λέξεις κλειδιά: *Ρόλος έγκαιρης εντερικής θρέψης, εργαστηριακές παράμετροι θρέψης (ολικά λευκώματα, λευκωματίνη ορού, σφαιρίνες, απόλυτος αριθμός λεμφοκυττάρων, ανοσοσφαιρίνες IgA, IgM, IgG, σίδηρος και σιδηροδεσμευτική ικανότητα)*

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Severely burnt patients generally show a marked hypermetabolic response and their energy expenditure increases to almost twice the normal one as burn size exceeds 50% of TBSA.[1-3] Referring to multiple trauma patients, hypermetabolism occurs in most of them within 48 hours after injury.[4-6] This hypermetabolic response, for both burnt and multiple trauma patients, is accompanied by aprogressive decline of host defences, immunological abnormalities and a marked decline in the circulating number of T lymphocytes that impair survival.[7-10] Aggressive nutritional support to meet the increased energy expenditure has been considered essential for the management of burnt patients.[8] Enteral nutrition has been considered as an essential part of trauma management to minimize the catabolic loss and enhance the immunological response.[11,12] It has been shown, for both burnt and multiple trauma patients, to be an effective additional measure in stress, ulcer prophylaxis and prevention of sepsis.[13-19] The purpose of our study was firstly to evaluate the effectiveness of EEN in burnt and multiple trauma patients, in association with their post burnt and post trauma nutritional state, their immunologic response and secondly to examine similarities between the two patients' groups.

Material and method

Our study included 31 patients with burns >25% of the total body surface area, who were admitted in the department of plastic surgery and burn unit of the general state hospital (GSH) of Athens, Greece, "G. Gennimatas" and 35 patients with more than two traumas, who were admitted in the Intensive Care Unit of the GSH of Athens, Greece, "KAT" over the last 3 years.

Inclusion criteria for burnt patients were: (a) the age (≥17 years) and (b) the extent of the burn injury. Exclusion criteria included the following: (a) patients in palliative care, (b) previous or planned surgical operation, (c) patients with sepsis, (d) patients presenting allergies to the enteral fluids. Inclusion criteria for multiple trauma patients were: (a) the age (≥15 years) and (b) a trauma at least in two different organs or organ systems in different parts of the body, with at least one life-threatening organ injury. Exclusion criteria included the following: (a) patients in palliative care, (b) previous or planned surgical operation, (c) patients with sepsis, (d) presenting allergies to the enteral fluids, (e) patients with burn injury, (f) pre-existing diabetes mellitus or renal or hepatic disease and (g) pregnant women. Data were collected using an assessment chart. The two hospital's Ethic Committee approved of the study and all the patients selected gave their consent. A nutritional support protocol was followed in all patients included EEN. It started the first six hours of admission for burnt patients and the first two days of admission for multiple trauma patients (three of the patients started the 5th day). This lasted until complete healing of burn injuries and until complete treatment of multiple trauma patients. Solutions of different nutritional value were administered via nasogastric feeding tube according to the energy requirements and gastrointestinal tolerance of the patients. The enteral nutrition formulas used were: (a) Low kcal 0.5 kcal/mL with N 2 g%. (b) Standard value 1 kcal/mL with N 4 g% and (c) high kcal value 1.5 kcal/mL with N 6 g%.

Results

31 burnt patients mean aged 43.7 years-old (SD 12.2) and 35 multiple trauma patients mean aged 40.2 years-old (SD=18.6) were studied. 18 (58.1%) burnt patients were men and 13 (41.9%) women. 25 (71.4%) multiple trauma patients were men and 10 (28.6%) were women. Characteristics of burnt patients are presented in (tabl. 1). The results in burnt patients were as following: all proteins showed a significant increase between the three measurements such as: Total proteins in the 1st measurement (P=0.003), at the 2nd (P=0.004) and at the 3rd (P<0.001). In multiple trauma patients: total proteins at the 1st measurement (P=0.024), at the 2nd (P=0.010) and at the 3rd (P<0.001) (fig. 1). In burnt patients: serum albumin showed a significant increase at the 1st measurement (P=0.015), the 2nd (P=0.120) and the 3rd (P<0.005). In multiple trauma patients: serum albumin was slightly decreased at the 1st measurement (P=0.790), the 2nd mean value was decreased (P=0.270) and the 3rd mean value was decreased (P=0.350) (fig. 2). For burnt patients: serum globulin was increased significantly at all measurements, at the first measurement (P=0.05), at the 2nd (P=0.007) and at the 3rd (P<0.001). For

Table 1. Characteristics of the 31 burnt patients.

Characteristics	Mean value	SD
Body weight	73.56	10.43
Total body surface area burned %	47.40	18.67

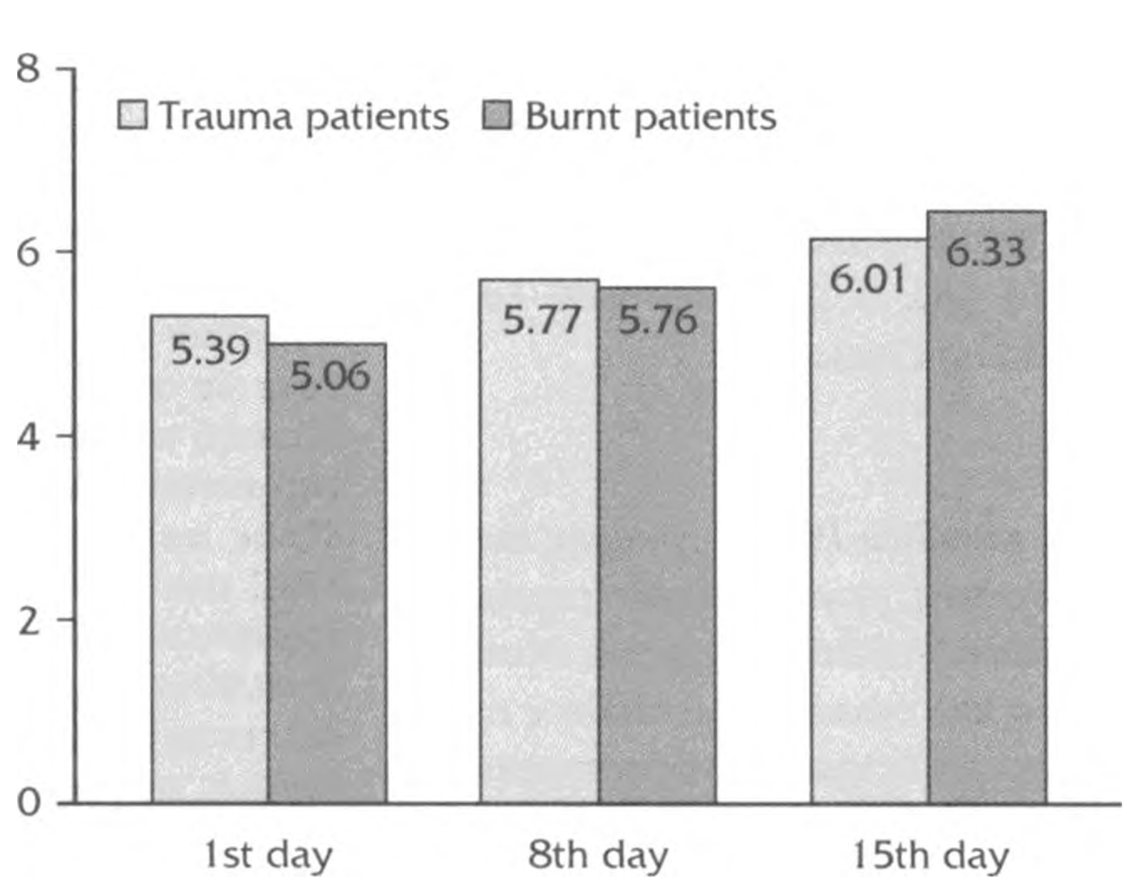

Figure 1. Mean value of total proteins (mg/dL).

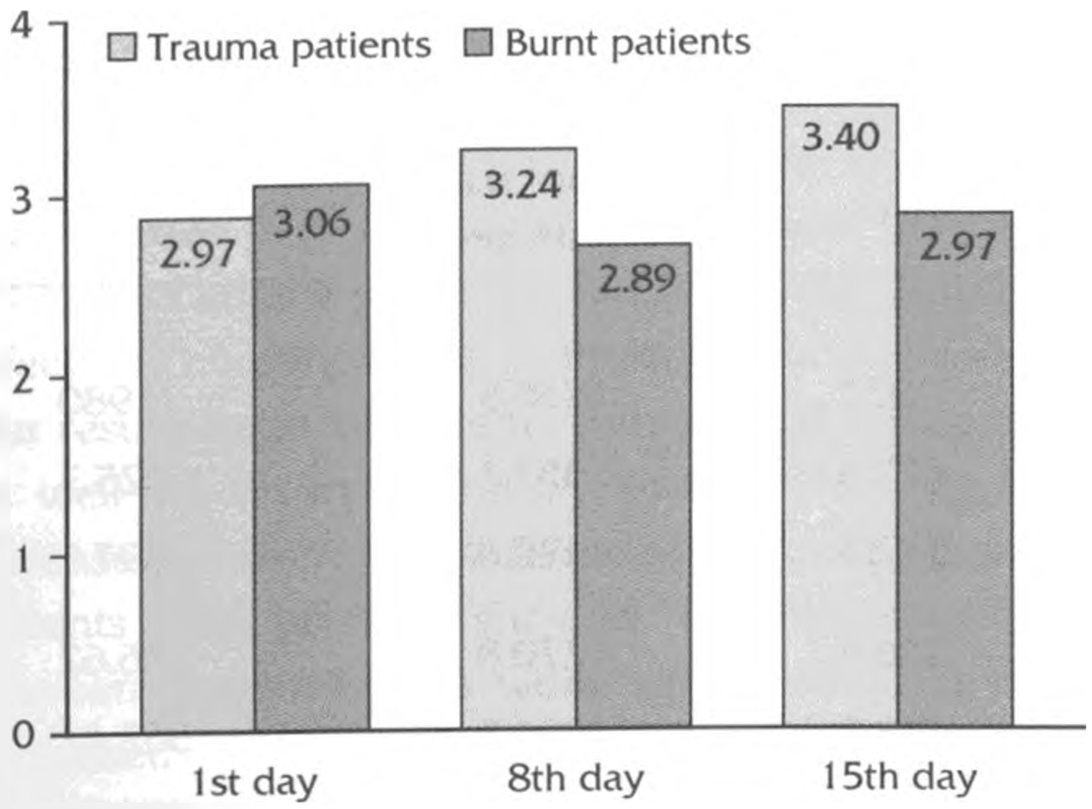

Figure 2. Mean value of serum albumin (mg/dL).

multiple trauma patients: serum globulin at the 1st measurement was increased (P<0.001), at the 2nd was slightly increased (P=0.570), and at the 3rd was increased (P<0.01) (fig. 3).

For burnt patients: Fe level did not change significantly at the 1st measurement (P=0.09) neither at the 2nd (P=0.280) but was significantly increased at the 3rd (P<0.008). TIBC was increased significantly at the 1st measurement (P<0.008). TIBC was increased significantly at the 1st measurement (P<0.001) (tabl. 2). There were no significant changes in the absolute number of lymphocytes. The mean value of immunoglobulin IgG was increased in all measurements. The mean value of immunoglobulin IgA was slightly decreased in all measurements. The mean value of immunoglobulin IgM was increased at the 1st and 2nd measurements but was decreased at the 3rd measurement. The mean value and SD of the numbers of lymphocytes, IgG, IgA, IgM, Fe and TIBC are presented in (tabl. 2). Complications related to EEN were diarrhea in 6.8% of our patients hyperglycemia in 19.4% and electrolyte disturbances in 45.2%.

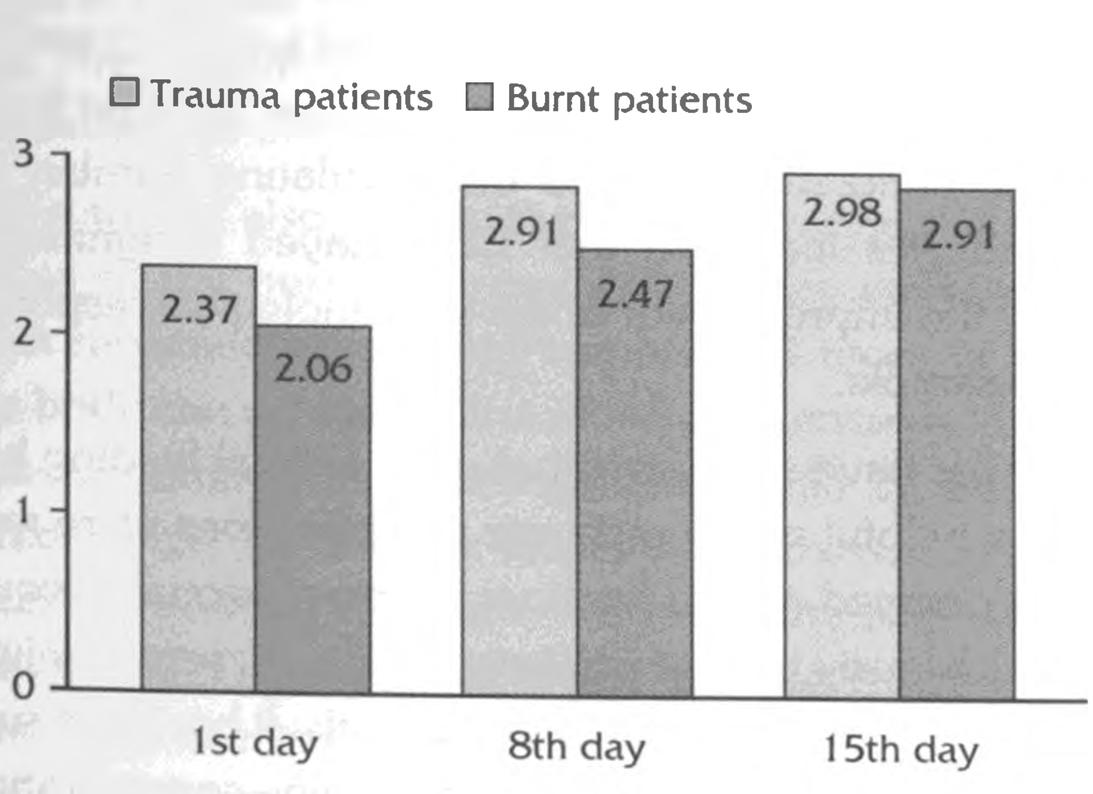

Figure 3. Mean value of serum globulin (mg/dL).

For multiple trauma patients: Fe level did not change significantly between measurements, but was slightly increased (tabl. 2). TIBC almost remained stable (tabl. 2). There were no significant changes in the absolute number of lymphocytes. The mean values of immunoglobulin IgA and IgM were slightly increased in all measurements. The mean value of immunoglobulin IgG was increased in all measurements; at the 1st measurement was increased significantly (P=0.004), at the 2nd was increased (P=0.108), and at the 3rd was significantly increased (P=0.017). The mean value and SD of the numbers of lymphocytes, IgG, IgA, IgM, Fe and TIBC are presented in (tabl. 2). Complications related to EEN were diarrhea in 11.4% of our patients, hyperglycemia in 17,1% and electrolyte disturbances in 34.3%.

Regarding the results between groups patients. There were no significant differences in mean value of total proteins between groups.

The mean serum albumin value of the burnt patients was significantly increased compared with the multiple trauma patients (P=0.012).

The mean serum globulin value of the multiple trauma patients was significantly increased compared with the burnt patients (P=0.019).

Fe level did not change significantly between groups.

TIBC was not increased between groups at the 1st and the 2nd measurements, but it was significantly increased at 3rd measurement in burnt patients compared with the multiple trauma patients (P=0.005). There were no significant changes in the absolute number of lymphocytes between groups in all measurements.

The mean values of immunoglobulin IgA and IgM were higher in multiple trauma patients but there was no significant difference. The mean value of immunoglobulin IgG showed a significant increase in multiple trauma patients compared with the burnt patients (P=0.06).

Discussion

The concept of the administration of EEN nutrition after injury is relatively new and based upon animal experiments performed more than a decade ago. Based on the animal studies, it seemed reasonable that early enteral nutrition would help to prevent the development of inflammatory and infectious complications in seriously injured patients. One of the problems was that very early enteral nutrition was difficult to applied in a great number of trauma patients.[20] Gianelli et al[21] performed

Table 2. Mean value and SD between measurements in some of the markers of 31 burnt and 35 multiple trauma patients.

Markers	Measurements	Mean value Burnt patients	SD	Mean value Multiple trauma patients	SD
Absolute number of lymphocytes (%)	1st day	1731.3	952	1456.5	980
	8th day	1426.8	677.6	1353.1	625.3
	15th day	1526.1	577.3	1420.8	697.5
IgG (mg/dL)	1st day	922.0	346.6	1270.8	526.62
	8th day	955.7	313.8	1396.8	562.47
	15th day	997.1	308.8	1495.45	488.88
IgA (mg/dL)	1st day	223.82	125.10	205.81	107.69
	8th day	211.30	83.40	204.05	82.37
	15th day	96.90	64.30	203.00	102.87
IgM (mg/dL)	1st day	91.90	61.85	166.67	83.87
	8th day	211.30	83.40	204.05	82.37
	15th day	197.80	79.75	222.05	72.93
Fe (μg/L)	1st day	34.56	19.87	49.67	21.46
	8th day	39.25	27.65	53.00	12.12
	15th day	18.11	19.66	53.33	9.87
TIBC (μg/L)	1st day	84.80	42.50	48.30	0.6
	8th day	97.80	48.60	48.00	0.0
	15th day	120.60	39.14	48.00	0.0

the first well controlled clinical study that showed early enteral nutrition compared with delayed enteral nutrition had a beneficial effect on seriously burnt patients. Nutritional therapy playes a key role in the overall management of the burnt and multiple trauma patient.[22–26] EEN has been demonstrated to minimize the catabolic loss, to enhance the immunologic response,[5,7] to prevent street ulcer[13,17,27] and to prolong survival. The presence of food in the gut has been shown to stimulate mucosal proliferation, probably as a result of both humoral and nutritional mechanisms.[28,29] Improved mucosal integrity has also been demonstrated in burnt patients who had recieved EEN. These findings suggest that EEN may help to diminish the incidence and severity of bacteria translocation by improving or preventing breach of the mucosal barrier.

Concerning the immunological status of burnt patients it has been shown that total IgG, IgA, IgM-secreting cells and B-cell number decrease in burn injuries. Both, cellular and humoral immune systems have been reported to be affected in thermal injuries leading to immunosuppresion and sepsis.[30] Similar results were presented for multiple trauma patients.[31] The results of our study showed that the administration of EEN in burnt patients can enhance their immunologic response leading to increased values of immunoglobulins IgG and IgM. Similarly, in multiple trauma patients the administration of EEN can enhance their immunologic response leading to increased values of all immunoglobulins. Although the absolute number of lymphocytes did not increase between measurements, the fact that there was nonmarked decline in the circulating number of lymphocytes indicated that EEN played a significant role in the improvement of the immunological response of the sample.

Studies have suggested that early enteral feeding has been a helpful aid to recovery complications were rare and prolonged enteral feedings were occasionally required in seriously injured patients.[32–34] Burns, sepsis, injury or surgery lower serum glutamine levels. It has been suggested that the lowered plasma glutamine concentration contributes, at least in part, to immunosuppresion.[35]

Researchers showed that enteral diet supplements with arginine in burnt rats decreases the mRNA expression of inflammatory cytokines in organs and improves the survival rate.[36] In addition, they showed that administration of enteral glutamine decreased the incidence of infectious complications in multiple trauma patients.[37] Our results in burnt patients showed that total proteins, as well as serum albumin, presented a significant increase between measurements. In multiple trauma patients total proteins showed a significant increase between measurements while serum albumin slightly decreased. This fact, for both burnt and multiple trauma patients, confirmed the positive effect of EEN on the improvement of the nutritional state of the patients.

Serum iron levels present a great number of fluctuations during the day, depending on different factors that affect iron distribution between plasma and storage organs. TIBC values are also affected by iron fluctuations and should be studied together with serum iron levels. Furthermore, low serum iron concentration is related to sepsis in burnt patients. Belmonte et al[37] studied iron metabolism in burnt children and concluded that hyposideraemiais a frequent finding in the acute phase of the burnt injury and is accompanied by increased ferritin levels and decreased transferrin concentrations. He suggested that lowiron values tend to recover without the use of iron supplementation because of an endogenous block released in the acute phase; he thus indicated that iron therapy should not be recommended in the initial period of stress in burnt patients. However, the results of our study in burnt patients showed that Fe values were slightly increased at 1st and 2nd measurements but the significant increase was at 3rd measurement. Fe value in multiple trauma patients did not change significantly between measurements, but it was slightly increased.

In our study TIBC was significantly increased at the 2nd and at the 3rd measurements in burnt patients while in multiple trauma patients it almost remained stable. These results indicated the effectiveness of EEN on the sample of our study.

We should also refer to the similarities and the differences of the burnt and multiple trauma patients that both represent severe and complicated types of injury the body can substain. One of the differences is that the enteral nutrition in burnts patients could be administered within the first six hours of admission while in multiple trauma patients within the first two days of admission. This was due to the fact that it takes more time to define the needs and the tolerance of multiple trauma patients. However there were no significant differences in mean value of total proteins between groups. It means that enteral nutrition has various potential similar advantages for both patients' groups, burns and multiple trauma, including a reduction in infectious events and improvement of the survival rate as it is already mentioned. In addition, it should be stressed that none of the sample presented sepsis. Fe level did not change significantly between groups, there were no significant changes in the absolute number of lymphocytes between groups in all measurements and the mean value of immunoglobulins was IgA and IgM higher in multiple trauma patients but there was no significant difference. The above results can be explained as an evidence of similarities existing in both patients' groups related to the effectiveness of EEN.

However, although the sample consisted of severely ill patients and despite the similarities, differences were expected due to patients' illness and to the complexity of the nutritional and to the complexity of the nutritional support. Nutritional support is a complex process involving precise evaluation of the patient's energy requirements, patient's tolerance and the type of underlying disease. Thus, the results showed the following differences: The mean serum albumin value of the burnt patients was significantly increased compared with the multiple trauma patients and the mean serum globulin value of the multiple trauma patients was significantly increased compared with the burnt patients. Furthermore the TIBC increased significantly at the 3rd measurement in burnt patients compared with the multiple trauma patients. The mean value of immunoglobulin IgG showed a significant increase in multiple trauma patients compared with the burnt patients.

Conclusion

Generally, the results of our study confirmed the effectiveness of EEN on both groups of patients as well as the existence of similarities and differences. EEN nutrition provided optimal preservation of the nutritional state of both groups burnt and multiple trauma patients. It is suggested that in severely ill patients nutritional support should be considered as integral part of basic care.

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