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Artículos Científicos

Nutrición enteral temprana con inmunonutrientes en pacientes con traumatismo craneoencefálico en la unidad de cuidados intensivos

Early Enteral Nutrition with Immunonutrients in Patients with Traumatic Brain Injury in the Intensive Care Unit

Nutrição enteral precoce com imunonutrientes em pacientes com trauma cranioencefálico em unidade de terapia intensiva

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Resumen

El traumatismo craneoencefálico (TCE) es la tercera causa de muerte en México dentro de la categoría de muertes violentas y accidentes, por lo que se considera un grave problema de salud pública. Se ha observado un beneficio de la inmunonutrición temprana en pacientes con TCE. El objetivo de este trabajo fue determinar el impacto de la nutrición enteral temprana con inmunonutrientes (NETI) en la morbimortalidad de pacientes con TCE dentro de la Unidad de Cuidados Intensivos (UCI) del Hospital General de Mexicali. Se trata de un ensayo clínico aleatorizado en el que se incluyeron todos los pacientes con TCE que ingresaron a la UCI del 1 de agosto de 2016 al 30 de junio de 2017. Se conformaron dos grupos: el grupo de estudio sometido a NETI y un grupo control que fue sometido a nutrición enteral temprana licuada (NETL).

Del total de pacientes, 16 fueron hombres (72.7 %) y 6 mujeres (27.3 %), con una media de edad de 34.7 años. Las principales causas del TCE fueron por atropellamiento y accidente de tránsito (54.6 %). El grupo con NETI, en relación con el grupo control, presentó aumento de peso (t de Student de 23.73; p = 0.001), de proteínas totales (t de Student de 13.40; p = 0.001), de leucocitos (t de Student de 2.05; p = 0.002) y linfocitos al egreso de la UCI (t de Student de 7.09; p = 0.001), con disminución en casos de neumonía (t de Student de 13.78; p = 0.001), infección de vías urinarias (t de Student de 8.07; p = 0.001), días de estancia en la UCI (X^2 Spearman -.432; p = 0.05), días sometidos a ventilación mecánica (X^2

Spearman -.432; p = 0.05) y de nutrición enteral (X^2 Spearman -.425; p = 0.05). La mortalidad fue menor en el grupo de NETI sin reportarse una diferencia significativa.

Los pacientes con TCE que recibieron NETI presentaron una disminución en la incidencia de complicaciones infecciosas, así como respecto al tiempo de estancia intrahospitalaria, gracias a lo cual es posible mejorar en menos tiempo la salud del paciente y a la vez reducir costos debidos a la hospitalización.

Palabras clave: nutrición enteral temprana, nutrición enteral con inmunonutrientes, traumatismo craneoencefálico, unidad de cuidados intensivos.

Abstract

Early enteral nutrition is initiated in the first 24-48 hours after injury or admission to the intensive care unit (ICU). It is a nutritional support method with beneficial effects that improves the patient's outcome. Traumatic brain injury (TBI) is the third cause of death in México related to accidents and violence; therefore, it is considered a serious public health problem.

The objective of this study was to determine if early enteral nutrition with immunonutrients (EENI) supplied to TBI patients diminishes morbidity and mortality in Mexicali´s General Hospital ICU.

It was a randomized clinical study. Patients that were included were those admitted to the ICU during the time period from August 1st of 2016 to June 30th of 2017 that fulfilled the inclusion criteria. Two groups were formed: one was the control group submitted to early enteral nutrition with blended diet and the other group of study which was submitted to EENI.

The study included 16 males (72.7%) patients and 6 females (27.3%), with an average age of 34.7 years. The main causes of TBI were run over and motor vehicle accidents in 54.6%. The group with EENI, when compared to the control group, showed an increase in weight (Student T 23.737, p=.001), total proteins (Student T 13.40, p=.001), white blood cells (Student T of 2.05, p=.002) and lymphocytes (Student T of 7.09, p=.001) at their discharge from the ICU, with decrease in pneumonia (t de Student 13.78, p=0.001), urinary tract infection (t de Student 8.07, p=0.001) and the length of stay at the ICU (X^2 Spearman -.432, p=0.05), the days of mechanical ventilation (X^2 Spearman -.432, p=0.05) and enteral nutrition (X^2 Spearman -.425, p=0.05). The mortality was less in the EENI group without any significant difference reported.

EENI can have a positive impact, decreasing the incidence of infectious complications and length of stay in the ICU, therefore improving patient´s health in less time and also reducing hospitalization costs.

Keywords: early enteral nutrition, enteral nutrition with immunonutrients, traumatic brain injury, intensive care unit.

Resumo

Lesão cerebral traumática (TCE) é a terceira causa de morte no México dentro da categoria de mortes e acidentes violentos, razão pela qual é considerado um grave problema de saúde pública. Um benefício da imunonutrição precoce foi observado em pacientes com TCE. O objetivo deste estudo foi determinar o impacto da imunonutrientes primeiros Nutrição Enteral (NETI) sobre a morbidade e mortalidade de pacientes com TCE na Unidade de Terapia Intensiva (UTI) do Hospital Geral de Mexicali. Este é um ensaio clínico randomizado em que todos os pacientes com TCE internados em UTI 01 de agosto de 2016 a 30 de Junho de 2017. Foram estudados dois grupos foram incluídos: o grupo de estudo sob Neti e um grupo controle que foi submetido a nutrição enteral precoce liquefeita (NETL).

Do total de pacientes, 16 eram homens (72,7%) e 6 mulheres (27,3%), com idade média de 34,7 anos. As principais causas do TCE foram atropelamento e acidente de trânsito (54,6%). O grupo neti, em relação ao grupo de controlo mostrou aumento de peso (t de Student 23,73; p = 0,001), total (t de Student 13,40; p = 0,001) de proteína, de leucócitos (t de Student 2,05; p = 0,002) e linfócitos para descarregar da UTI (t de Student 7,09; p = 0,001), com diminuição dos casos de pneumonia (t de Student 13,78; p = 0,001), infecção do trato urinário (t estudante 8,07; p = 0,001) dias, o UTI (X2 Spearman -.432; p = 0,05), dias sob ventilação mecânica (X2 Spearman -.432; p = 0,05) e nutrição entérica (X2 Spearman -425, p = 0,05). A mortalidade foi menor no grupo NETI sem relatar uma diferença significativa. pacientes com TCE que receberam NETI mostraram uma diminuição na incidência de complicações infecciosas e com o tempo de permanência hospitalar, graças ao qual é possível melhorar em menos tempo a saúde do paciente e, ao mesmo tempo, reduzir os custos devido à hospitalização.

Palavras-chave: nutrição enteral precoce, nutrição enteral com imunonutrientes, traumatismo cranioencefálico, unidade de terapia intensiva.

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Introduction

Nutritional support has become an essential component in the management of critically ill patients (Torres et al., 2008, García and Rodríguez, 2009). The metabolic response in critically ill patients is characterized by marked increases in energy expenditure, accelerated catabolism and hyperdynamic circulatory changes (Chávez and Sánchez, 2009). If these changes persist, this response can lead to a considerable loss of body mass, organic dysfunction and decreased reparative and immune bodily functions (Torres et al., 2008, Rodríguez, 2012). Such processes, especially if they are exaggerated, can produce caloric-protein malnutrition, greater infectious morbidity, prolonged dependence on the ventilator, longer hospital stay and increased mortality (Kompan, Kremzar and Gardzijev, 1999, Omura, 2000).

These findings have caused a change in the orientation of nutritional therapy: from simply being a support in a hypermetabolic state and reaching the nutritional requirements to have the opportunity to manipulate the local and systemic inflammatory and immune response (Seron, Zamora, Labarta and Mallor , 2013; Hernández and Chávez, 2008).

The implications of nutritional therapy are not exclusively dietary, but also a pharmacological means through which intestinal function and structure is improved (thereby limiting the progression of multiple organ failure), a means to improve the immune response and modify the inflammatory response (Helmy, Vizcaychipi and Gupta 2007, Wang et al., 2013).

Two thirds of all patients experience deterioration of their nutritional status during their hospital stay (Ninska de la Hoz, Camargo and Vargas, 2013). The acute disease exacerbates the poor nutritional status of the patient by increasing metabolic demands and hindering the use of nutritional substrates. In our case, patients in critical condition frequently receive inadequate nutritional support during their stay in the intensive care unit (ICU), because doctors underestimate their nutritional needs, in addition to enteral diets with immunonutrients are not contemplated of the basic table of medicines of the health institutions, which implies an expense for the patient; reasons why the start of nutritional support is often delayed. In addition, there is no record of the benefits of early enteral nutrition with immunonutrients (NETI), which means that the doctor does not consider it necessary (Fernández, Lobo, Ruiz y Pérez de la Cruz, 2009; Sánchez, Gutiérrez y Arzola, 2006).

The response to aggression can manifest itself with varying intensity, depending on the degree of injury. However, the malnutrition syndrome will occur if adequate and timely nutritional income is not available. When malnutrition occurs, survival and a satisfactory evolution of the patient can be compromised, which increases the risk of infectious complications, days of hospital stay and even multiple organ dysfunction and, therefore, cause death (Vizzini and Aranda, 2011; Martinuzzi and Ferraresi, 2011; Jacobs et al., 2004).

Several studies suggest that the initiation of nutritional support in patients within the first 24 hours once admitted to the ICU is associated with an improvement in the clinical outcome, lower percentages of infection and a decrease in hospitalization time (Fuchs, 2009; Agudelo and Giraldo, 2008). Enteral nutrition is preferred over parenteral nutrition because it is more physiological, is less associated with hepatobiliary dysfunction and metabolic disorders and is much cheaper (Ramírez, Gutiérrez, Domínguez and Barba, 2008).

Enteral nutrition is based on the contribution of nutrients with a chemically defined formulation through the digestive tract, using the viable gastrointestinal tract for its correct absorption. It is a therapeutic weapon for the doctor, in addition to reducing bacterial translocation and allowing an adequate functioning of the intestinal immune system (Rodríguez et al., 2012).

On the other hand, although it is a technique that has been used since time immemorial, in the last 25 years a considerable development has been experienced: it went from being a secondary therapeutic element, destined exclusively to feed the patient, to currently occupying a important role that goes far beyond the simple act of nurturing (González and García, 2013).

Early enteral nutrition, defined as one that begins during the first 24-48 hours of injury or admission to the ICU, is a method of nutritional support which has been described beneficial effects for the patient, in addition to the caloric and protein intake. , such as the maintenance of intestinal tropism and its involvement in the prevention of bacterial translocation, stimulation of intestinal motility and improvement in the resistance of tissues in healing (Guzmán, 2008; Alted, Bermejo y Chico, 2009; MacFie, 2000).

It is known that the time of hospitalization after the injury is directly related to the time when the feeding is restarted. These considerations allow to notice the importance of the early start of enteral feeding, since malnourished patients are exposed to longer healing periods, suffer more complications and have high rates of morbidity and mortality with an increase in costs (Montoya and Múnera, 2014 ; Abdel, Abdel, Sánchez and Gómez, 2005; Leibson et al., 2012).

From the biological point of view, in addition to its role in digestion and absorption of nutrients, the digestive tract actively regulates and processes circulating substrates and performs important endocrine, metabolic and immunological functions, while acting as an efficient barrier, avoiding passage of microorganisms and their degradation products into the circulation.

In turn, the digestive tube is maintained largely through the elements found in its light. Enteral feeding contributes half of the nutrients of the small intestine and more than 80% of those of the large intestine; is the presence of food the most important stimulus for your tropism. If there is no intake, the digestive tract depends on endogenous principles such as glutamine or ketone bodies that quickly become depleted, so it is imperative to reinstate food as early as possible (García and Grau, 2005).

Starvation leads to shortening of the jejunum and ileum with decreased height of the villi, the fall of cellularity and the deterioration of the intercellular junctions (responsible for the barrier function). On the other hand, the reinitiation of food stimulates the production of enterotrophic hormones (enteroglucagon and gastrin), enhances the renewal of enterocytes and helps maintain the height of the villi. (García y Grau, 2005).

Enteral feeding also helps to maintain bowel function, enhances the absorption of essential amino acids and stimulates defecation, which reduces the penetration pressure of endotoxins and bacteria. Likewise, the immune response (cellular and humoral) is influenced by the entry of nutrients (Mesejo and Blasco, 2000).

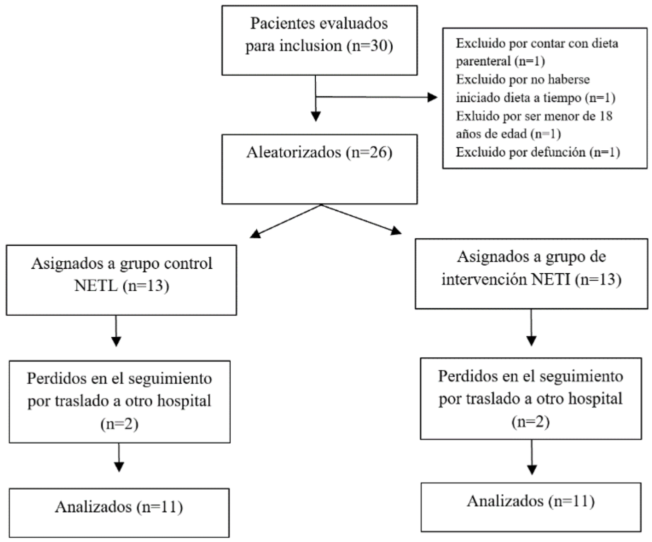
On the other hand, immunonutrition was born in the early 90s with the idea of being a way with which, in addition to administering the nutritional requirements to the patient, his immunological status could be improved with the contribution of nutritional substrates with immunomodulatory capacity and thus minimize the response to surgical or traumatic aggression (Silva et al., 2016). The components of these diets have demonstrated the modification of the immune response: they favor the replication of the lymphocytes, stimulate the production of certain types of cytokines and eicosanoids and decrease the release of others, which leads to the inflammatory response to a balance, all which results in a faster recovery of the patient and, as it has been observed, in a decrease of the morbidity and mortality, as well as causes the decrease of the days of hospital stay and, by extension, the reduction of the costs both for the patient and for the institution (Silva et al., 2016).

Taking into account everything mentioned so far, this study aims to determine the impact of NETI on morbidity and mortality in patients with traumatic brain injury (TBI) in the Intensive Care Unit of the General Hospital of Mexicali, Mexico, for the purpose of that, based on the results, updated and relevant information is provided for the benefit in the nutritional management of the patient.

Material and methods

It was a randomized clinical study to determine if the NETI in patients with TBI, compared with liquefied enteral nutrition (NETL), reduces morbidity and mortality in the Intensive Care Unit of the General Hospital of Mexicali. This study was conducted from August 1, 2016 to June 30, 2017. The sample was probabilistic, randomized. We included 22 patients out of 30 who were admitted to the ICU with TBI (see figure 1); patients who in the previously established period, with a diagnosis of TBI, met all the inclusion criteria (over 18 years of age, indistinct sex, Glasgow <8 and informed consent by the closest relative). The following exclusion criteria were considered: patients with severe hemodynamic instability; patients with any mechanical or functional gastrointestinal pathology; patients with life expectancy less than 24 hours; patients with severe malnutrition with the following parameters: IMC < 16 kg/m^2, albúmina < 2 g/dL y < 800 linfocitos/mm^3; patients with morbid obesity (IMC > 40), pregnancy, chronic obstructive pulmonary disease (COPD) or acquired immunodeficiency syndrome (AIDS), and patients included in other research studies.

Figura 1. Diagrama de flujo de participantes en el estudio



Fuente: Elaboración propia

The sampling technique was randomized in the following way: the physician assigned to the area of surgery (MAC) selected and systematically randomized the patients as they were admitted to the ICU. The control group was administered NETL and the intervention group, NETI. In both cases within the first 24 to 48 hours of stay in the ICU. In addition, the assigned physician established a management plan (management protocol in the patient with TBI), medication, laboratory and cabinet examinations, general measures and assigned the patient with TBI to the corresponding group (NETL or NETI group), as well as the filling of the patient's file (general data, nutritional assessment, anthropometry, etc.). Subsequently, the calculation of energy requirements was made and the Department of Nutrition and Nursing was notified for the administration of the diet as the case may be.

Prior to the patient's ICU discharge, anthropometry was performed again and the file was reviewed.

Selection of the enteral formula

For both groups, 25 cal / kg per day, 33% carbohydrate, 27% protein and 40% lipid were estimated.

The control group with NETL was given powdered polymer diet (100 g): energy 330 kcal, carbohydrates 59.4 g, fiber 2 g, proteins 17.5 g, lipids 12.6 g, water 1600 ml, sodium 147 mg, potassium 790 mg. It was added (liquefied) to the powder: olive oil 125 mg, fruit 80 g, vegetable 60 g and cereals without fat 19 g, which was prepared by the Department of Nutrition of the General Hospital and managed by the nursing staff of the ICU . Diet was administered to the patient intubated with the head elevated at 30º-45º, through a 16 Fr nasogastric tube placed in a plastic bag for nutrition and its administration was by gravity for 12 hours (50 cc / hour), divided into Two shots, in the mornings and in the afternoons. Gastric residue was measured, and the probe was irrigated at the end of each session.

On the other hand, the intervention group with NETI was administered the Supportan Drink formula, formed as follows: energy 300 kcal, kcal / ml 1.5, carbohydrates 24.80 g (33.0%), fiber 3 g, proteins 20 g (27.0) %), nitrogen 3.20 g, lipids 13.40 g (40.0%), water 76 ml, sodium 95 mg, potassium 256 mg, omega-3 fatty acids 1429 mg, osmolarity 435 mOsm / L. The presentation of the bottle was 200 ml. All the above plus glutamine plus, which contains 80 kcal and 10 g of glutamine per sachet; 30 g per day was administered, which was elaborated and administered by the nursing staff of the ICU. In the same way as in the other group, the diet was administered to the patient intubated with the headpiece raised to 30º-45º, through a 16 Fr nasogastric tube placed in a plastic bag for nutrition, although in this case its administration was for Infusion pump for 12 hours (50 cc / hour), divided into two doses, in the morning and in the afternoon. Monitoring of the tolerance of early enteral nutrition was carried out continuously, monitoring the presence of abdominal distention, gas channeling, type of evacuations, presence of residual gastric volumes <500 ml and assessment of aspiration risk.

It should be mentioned that the researchers, aware that their primary interest is the health of the patients, as well as the integrity of the research, were not influenced by a secondary interest of an economic or personal nature, since none of the members involved in the investigation directly or indirectly received compensation from the manufacturer of the formula.

Results

Of the 22 patients included in the study with severe TBI, 85% had a Glasgow coma coma score of 3 (72.7% NETL and 100% NETI). Eleven patients in group A (control group) with NETL were included in a randomized manner; and 11 in group B (intervention group) with NETI. In both groups, nutrition began within the first 24 to 48 hours of admission to the ICU. The calculation of both diets was at a rate of 25 kcal / kg / day.

In relation to the characteristics of the population, 16 were men (72.7%) and 6 women (27.3%), with an average age of 34.7 years (in the NETL group, 5 patients in the range of 18-32 years and 6 patients in the range of 33-52 years, and in the NETI group, 6 patients in the range of 18-32 years and 5 patients in the range of 33-52 years). The main causes of the TBI were by running over and traffic accident (54.6%), without finding significant differences (table 1).

Tabla 1. Causas de TCE al ingreso a la UCI

Tipo de accidente	NETL Frecuencia (%)	NETI Frecuencia (%)	Total Frecuencia (%)
Caída	0	4 (36.4)	4 (18.1)
Atropellamiento	4 (36.4)	2 (18.2)	6 (27.2)
Accidente de tránsito	3 (27.3)	3 (27.3)	6 (27.2)
Accidente de motocicleta	1(9.1)	0	1 (4.5)
Agresión física	3 (27.3)	2 (18.2)	5 (22.7)
Total	11(100)	11 (100)	22 (100)

(N = 22)

Fuente: Elaboración propia

When evaluating the nutritional status of the patient and his response to trauma, upon admission and discharge from the ICU, the group with NETL found a decrease in anthropometric measurements, decrease in albumin and total proteins, of lymphocytes and leukocytes (t de Student 3.308; $p = 0.007$) (see tabla 2).

On the other hand, in the group with NETI you can observe an increase in weight (t de Student de 23.737; $p = 0.001$), total proteins (t de Student de 13.40; $p = 0.001$), leucocitos (t Student de 2.05; $p = 0.002$) and linfocitos (t de Student de 7.09; $p = 0.001$) at the exit of the UCI (tabla 2).

Tabla 2. Características del estado nutricional en la población en estudio

Características	**NETL Media (*DS*)**		**NETI Media (*DS*)**	
Total	11		11	
	Ingreso	Egreso	Ingreso	Egreso
IMC (kg/m^2)	26.6 (3.0)	25.4 (2.6)	27.0 (8.0)	25.6 (5.9)
Peso (kg)	54.1 (18.2)	52.4(17.9)	70.2 (10.7)	75.0 (18.4) *
Pliegue tricipital (cm)	14.7 (7.5)	15.2 (8.5)	16.9 (9.2)	15.7 (9.3)
Diámetro medio braquial (cm)	33.9 (11.2)	33.4 (11.4)	30.2 (5.5)	28.7 (4.1)
Perímetro muscular medio braquial (cm)	37.2 (24.7)	17.2 (9.2)	27.2 (7.1)	26.5 (5.6)
Albúmina (g/dL)	2.8 (.86)	2.3 (.82)	2.8 (1.0)	2.8 (.63)
Proteínas totales (g/dL)	5.3 (1.0)	4.9 (1.6)	4.9 (.96)	5.5 (1.3) *
Leucocitos (mg/dL)	9,793 (37)	8,559 (82.2) *	19,732 (17.0)	25,343 (40.8) *
Linfocitos (mg/dL)	11.7 (10.6)	11.17 (10.6)	8.10 (43)	15.4 (7.2)*

(N=22); *$p<0.001$

Fuente: Elaboración propia

Patients in the NETI group presented a greater type of pathologies associated with TBI upon admission to the ICU, such as parenchymal hemorrhage, epidural, subdural hematoma and fractures, without finding significant differences (see tabla 3).

Tabla 3. Patologías asociadas al TCE al ingreso a la UCI

(N = 22)

Morbilidad	NETL N = 11 Frecuencia (%)	NETI N = 11 Frecuencia (%)
Daño axonal difuso	1 (9.1)	1 (9.1)
Hemorragia parenquimatosa	0	1 (9.1)
Hematoma epidural	1 (9.1)	2 (18.2)
Hematoma subdural	1 (9.1)	4 (36.4)
Fractura de cráneo	5 (45.5)	2 (18.2)
Fractura costal	2 (18.2)	3 (27.3)
Fractura de tórax	1 (9.1)	3 (27.3)
Otras facturas (pelvis, fémur)	0	3 (27.3)

Fuente: Elaboración propia

The main morbidity that occurred in both groups was pneumonia (diagnosed by clinical picture, radiological method and culture of bronchial secretions), and a statistical significance was found in the NETI group with pneumonia. (t de Student de 13.78, p = 0.001) and urinary tract infection diagnosed by urine and urine culture (t de Student de 8.07, p = 0.001), compared to the group NETL (tabla 4).

Tabla 4. Morbimortalidad de la población en estudio

Morbimortalidad	**NETL** ***N* = 11** **Frecuencia (%)**	**NETI** ***N* = 11** **Frecuencia (%)**
Fiebre	7 (63.3)	4 (36.3)
Neumonía	7 (63.3)	4 (36.3) *
Infección de vías urinarias	3 (33.0)	2 (22.0) *
Falla renal	2 (18.2)	0
Choque séptico	1 (11.1)	0
Mortalidad	1 (11.1)	0

$N = 22$; $^*p < 0.001$

Fuente: datos obtenidos del expediente clínico

Both the days of stay in the UCI (X^2 Spearman -.432, $p = 0.05$), mechanical ventilation (X^2 Spearman -.432, $p = 0.05$), as of enteral nutrition (X^2 Spearman -.425, $p = 0.05$), were smaller in the NETI group compared to NETL (tabla 5).

Tabla 5. Estancia hospitalaria de la población en estudio

Características de la estancia hospitalaria	**NETL** ***N* = 11** **Media (*DS*)**	**NETI** ***N* = 11** **Media (*DS*)**
Días de ventilación mecánica en UCI	16.1 (10.2)	9.7 (6.0) *
Días de estancia hospitalaria en UCI	17.18 (10.2)	10.7 (6.8) *
Días de nutrición enteral en UCI	15.9 (10.3)	9.7 (6.0) *

$N = 22$; $^*p < 0.05$

Fuente: Elaboración propia

Discussion

The present study agrees with previous studies that have reported that the TCE occurs more frequently in men than in women, in a 3: 1 ratio, and that it mainly affects the population of 15 to 45 years.

As mentioned in previous studies, the most frequent causes of TBI are traffic accidents (42%), falls (23%) and assaults (14%) (4); Similar results were found in the present study, since it is reported that the main cause of the TBI was due to traffic accidents (27.20%) and running over (27.20%), followed by physical aggression (22.7%).

As mentioned above, TBI usually occurs in previously healthy patients with good nutritional status. Despite this, the metabolic changes caused by the traumatic aggression place these patients immediately in a situation of nutritional risk (Ninska de la Hoz et al., 2013). With reference to the foregoing, it can be observed that 100% of the studied patients were found on admission to the ICU, normonutridos, in relation to the anthropometric measurements; however, the levels of albumin, total proteins and leukocytes demonstrate alterations typical of the hypermetabolic state. At the time of discharge, there was a decrease in anthropometric measurements in both groups, although in the group with NETI there was an increase in weight, albumin was maintained and an increase in total proteins was detected, which is not present in the NETL group, whose members entered a category of moderate malnutrition (Jiménez, 2003).

Previous studies report that anthropometric indicators do not show significant differences in protein-calorie malnutrition. However, a tendency to decrease body weight at discharge has been found in 92.3% of patients in relation to admission (96.1%) (Jiménez, 2003). On the other hand, in similar studies it has been pointed out that these anthropometric indicators are not indexes of great specificity to define protein-calorie malnutrition, since their results imply a certain degree of error and mediate changes in body fluids (Ponce, Cornejo, Pérez and Mayagoitia, 2015)

Several authors consider that serum albumin can identify patients with a higher risk of morbidity and mortality, but, due to its prolonged half-life of 14 to 20 days, it does not reflect the rapid nutritional changes; even so, this parameter is taken as a reference for protein-calorie malnutrition (Arias, s.f.). On the other hand, serum albumin is affected in situations of stress or acute illness. Thus, in the critically ill patient, it has been found that a concentration lower than 3.5 g / dL is related to an increase in morbidity and mortality (Arias, S. f.). In the study by Jiménez (2003), mild hypoalbuminemia was reported after discharge from the ICU, which coincides with the results obtained in the present study.

On the other hand, the determination of total proteins is another parameter to consider, and it is an indirect data to evaluate the state of the visceral proteins. In the present study, an increase in serum levels of total proteins was found upon discharge from the ICU in the group with NETI; Not so in the group with NETL.

Another important aspect is the initial immunoinflammatory response of the patient with TBI, accompanied by an immunosuppressive effect, due to an excess in the production of cytokines, eicosanoids and tissue exudative damage, with an increase in proteases and free oxygen radicals, coming from leukocytes. polymorphonuclear cells and macrophages (Kieft et al., 2005). That is why the leukocyte count can be a marker of the patient's immune response. In previous studies, 27.8% of patients admitted to the ICU had decreased total lymphocyte count (LRT) in blood tests (Kieft et al., 2005), as in the study by Jiménez (2003), where 38.8 % of malnourished patients showed a decrease in LTR, and 23.6% of non-malnourished patients also had LRT affected ($p < 0.05$). Similar results were found here, where it can be observed that the group with NETL presented a decrease in total leukocytes and lymphocytes; Not so in the group with NETI ($p < 0.001$).

The risk of nosocomial infections is especially high among ICU patients. This risk of infection is 10 times higher compared to the rest of the patients admitted to other areas of the hospital. According to European studies, in the ICU the main types of infection are the following: pneumonia and lower respiratory infections (65%), urinary tract infection (18%) and bloodstream infection (12%). A similar American study found mainly four systems involved: 1) the respiratory tract (31%), 2) the urinary tract (24%), 3) the bloodstream (16%) and 4) the surgical wounds (8%.) (17, 18). In reference to the aforementioned, and in relation to the present study, it can be observed, when comparing both groups (NETL vs NETI), the presence of respiratory tract infections: 45.5% versus 36.4%; and of the urinary tract: 36.4% versus 9.1%. That is, a lower incidence was found in patients with NETI, which agrees with several studies conducted in patients with TBI. (Ramírez *et al.*, 2008; Rodríguez *et al.*, 2012; González y García, 2013).

That is why, currently, the criterion of nutrition in critical patients has been modified, with the fundamental objective of reducing complications, such as infection and reduction of the systemic inflammatory response, regardless of their nutritional status at admission.

On the other hand, in terms of mortality, only one death occurred in the group with NETL, which may be conditioned to the early feeding administered in both groups, which shows that it can be associated with fewer infections and a trend towards better results. in terms of survival (Ramírez et al., 2008; Rodríguez et al., 2012).

Previous studies report the beneficial effect in terms of the decrease in morbidity and mortality and days of hospital stay in patients who have received NETI (Minard, Kudsk, Melton, Patton and Tolley, 2000). Today it is known that every patient with trauma has a state of immunosuppression and therefore a risk of nosocomial infections.

Currently, it has been proven that the use of some immunonutrients in the diet such as glutamine, arginine, omega-3 fatty acids and nucleotides cause an improvement in the immune response in critically ill patients, mainly in the trauma patient. The possible beneficial effects of the diet with immunonutrients are several and are described in the literature, particularly glutamine, since it acts as an energy substrate of rapidly dividing cells (enterocytes), lymphocytes and macrophages (Rugeles, 2009).

On the other hand, the study by Falcao de Arruda (2004) reports a significant decrease in infections in patients with TBI when receiving a diet enriched with glutamine and probiotics. In this way, emphasis is placed on the beneficial effect of the NETI for the prevention of infections in patients with TBI admitted to the ICU, as well as for the reduction of days of ventilatory support and hospital stay.

In agreement with the above, in the present study, despite the fact that the group with NETI presented a greater type of pathologies associated with TBI upon admission to the ICU, it received fewer days of mechanical ventilatory support, days of enteral nutrition and days of hospital stay. In this regard, similar results are reported in previous studies where it can be seen that nutrition added with immunonutrients led to fewer days of hospitalization and mechanical ventilation (González and García, 2013).

Thus, its use must be part of a therapeutic strategy that minimizes infectious complications, maintains nutritional effectiveness and reduces the length of hospital stay.

Conclusions

According to the results obtained in this study, the use of immunonutrients positively impacts the patient with head trauma, as it decreases the incidence of infectious complications, as well as the length of stay in the ICU. And from the above it is possible to improve the patient's health in less time and at the same time reduce costs due to hospitalization.

Showing the results obtained with the NETI to the medical personnel assigned to the Intensive Care Unit as well as to the community of the General Hospital of Mexicali is very important, since paradigms can be broken in terms of the benefits of early nutrition and the use of immunonutrients, as well as contribute to new lines of research.

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