Nutrición enteral en pacientes con traumatismo cráneo encefálico: revisión sistemática de ensayos clínicos

Enteral nutrition in patients with traumatic head injury: systematic review of clinical trials

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Resumen

El Traumatismo Cráneo Encefálico (TCE) representa un serio problema de salud pública que requiere un manejo hospitalario adecuado. En los últimos años se ha podido comprobar que la nutrición enteral temprana mejora el pronóstico del paciente con TCE; sin embargo, son escasos los estudios donde se muestran las experiencias relacionadas con el soporte nutricional en este tipo de pacientes. El propósito del presente estudio fue realizar una revisión sistemática de ensayos clínicos de nutrición enteral en pacientes con TCE, para evaluar la eficacia nutricional, su efecto en la morbilidad, mortalidad y días de estancia hospitalaria. Se llevó a cabo una búsqueda electrónica de estudios realizados en los últimos diez años en bases de datos MEDLINE/PubMed, EBSCO, Elsevier, Cochrane library, con las siguientes palabras clave: "Traumatic brain injury, enteral nutrition, nutritional support, nutritional care of TBI, nutrición enteral, traumatismo cráneo encefálico, alimentación enteral, alimentación enteral temprana y

tardía". Se analizaron 8 estudios, en los cuales se evaluó la eficacia de la nutrición enteral temprana (NET) versus la tardía (NETA), inicio de la nutrición, suministro de calorías, complicaciones y días de estancia hospitalaria en la Unidad de Cuidados Intensivos (UCI). Se concluye que la NET ha mostrado ventajas importantes en la evolución de los pacientes con TCE, entre las que se pueden mencionar la disminución de la morbi-mortalidad y la reducción de la estancia hospitalaria en la UCI.

Palabras clave: Nutrición enteral, traumatismo cráneo encefálico, alimentación enteral, alimentación enteral temprana y tardía.

Abstract

The Traumatic Brain Injury (TBI) represents a serious public health problem that requires an adequate hospital management. In recent years is has been found that early enteral nutrition improves the prognosis of the patient with TBI; However, there are a few studies showing the experiences related to nutritional in this type of patient support. The purpose of this study was to conduct a systematic review of clinical trials of enteral nutrition in patients with TBI, to evaluate the nutritional efficacy, its effect on morbidity, mortality and hospital stay. It was conducted an electronic search of studies in the past ten years in MEDLINE/PubMed, EBSCO, Elsevier, Cochrane database library, with the following key words: "Traumatic brain injury, enteral nutrition, nutritional support, nutritional care of TBI, nutrición enteral, traumatismo cráneo encefálico, alimentación enteral, alimentación enteral temprana y tardía". 8 Studios, where we evaluated the efficacy of early enteral nutrition (EEN) versus late (LEN), home of the nutrition, supply of calories, complications, and days of hospital stay in the unit of intensive care (ICU) were analyzed. It is concluded that the EEN has shown significant advantages in the evolution of patients with TBI, which include the reduction of morbidity and mortality and the reduction of hospital stay in the ICU.

Keywords: Enteral nutrition, enteral feeding, traumatic head injury, enteral feeding, early and late.

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Introduction

Currently the Traumatic Brain Injury (TBI) represents a public health problem as it arises from endemic both in developed and developing countries. The TBI in Mexico is the third leading cause of death, which corresponds to violent deaths and accidents, with 35 567 deaths; a mortality rate of 38.8 per 100 thousand inhabitants, with higher incidence in men and in people 15 to 45 years.1

The patient with TBI is a hypermetabolic state with energy demands increased, result of metabolic stress.2,3 In this phase an increase is in the production of hormones anti - regulatory and proinflammatory cytokines, with inhibition of protein synthesis and increased proteolysis, mobilization of deposits of fat, increased glycogenolysis and gluconeogenesis; in this way, the persistence of the critical state is accompanied by a progressive degradation of body cell mass, muscle atrophy and protein loss is triggered a deep nutritional depletion, immune depression and growing organic functional deterioration, leading to greater reliance on determinants, ventilatory support for morbidity and mortality.2-5

The response to aggression can manifest itself with variable, depending on the degree of injury. However, malnutrition Syndrome will occur if there is with proper and timely nutritional income. Introducing malnutrition can be compromised survival and a satisfactory evolution of the patient, increasing the risk of infectious complications, days of hospitalisation even organic dysfunction multiple, leading him to death.6,7 During the past 30 years have made great advances in the management of TCE in the Intensive Care Unit (ICU) and nutritional support has been a mainstay in the care crítico.7

Currently, there are clear advances in the management of patients in critical condition with significant declines in mortality; however, there are still large areas of patient care with TBI represent a therapeutic challenge. A systems approach to management allows rationalization and the best results of therapeutic actions, within which should contemplate nutrition patient.7

Malnutrition associated with metabolic response to trauma and prolonged hospital stay must be seen as a fundamental aspect of the critical state, so that nutritional support is a major component of manejo.10-12

When the patient is able to keep you meet your nutritional requirements orally and not taking nutrients at least twelve hours, you can submit atrophy of the intestinal mucosa, reduction of lymphoid tissue and increased intestinal permeability, facilitating the passage of bacteria

bacteriana- -traslocación toxic, sometimes it favors the onset of organ dysfunction múltiple.13-16

Thus, early enteral nutrition (NET) prevents the above mentioned changes in the intestinal mucosa following the endoluminal nutritional deprivation. 17,18

Thus, nutritional support is considered essential in the treatment of critically ill patients, which is the case of the patient with TCE.19

NET is one that is preferably initiated within the first 24 hours after injury, after the patient has estabilizado.20-22

The main purpose for the administration of enteral nutrition is preserve gut barrier function and restore intestinal integrity. Recent studies in multiple trauma and TBI patients, it is concluded that not only administer enteral nutrition helps to prevent or reduce intestinal permeability, but also establish it early, that is, not later than the first 24 hours of admission to intensivos.23,24 care unit

In order to compare the NET late enteral nutrition (NETA) and intragastric enteral nutrition with jejunal analyzing the nutritional effectiveness and its effect on morbidity and mortality of critically ill patients, Pereira et al. (2005) 8 conducted a systematic review of randomized clinical trials published from 1992 to 2002. They analyzed nine studies and the results showed that compared to the NET NET can reduce infectious complications; also jejunal nutrition showed no benefit compared with intragastric. Moreover, Marik et al. (2001) 4 conducted a systematic review of 15 clinical trials, controlled, prospective aletorizados in which compared against NET NET in postoperative adult patients, trauma patients with head trauma, burns, and hospitalized in the ICU, and they found a Low NET significant association with the incidence of infection (RR 0.45; 95% CI, 0.30 to 0.66, p = 0.00006), with a reduction in hospital stay of 2.2 days; 95% CI, 0.81-3.63 days (p = 0.004). No significant difference in mortality and no infectious complications between the two patient groups were found. With regard to patients with TBI, these had an average of 7 days in hospital compared with the control group, which was 10 days. It concludes by demonstrating the benefits of NET; however, the results should be taken with caution due to the heterogeneity of the study groups. 23,24

In the meta-analysis by Perel et al. (2006) 9 11 studies were analyzed aiming to quantify the effect of alternative strategies of nutritional support following head injury on mortality and

morbidity. The results of this analysis led to the conclusion that early nutrition may be associated with fewer infections and a trend towards better outcomes in terms of survival and disability. Observing that require further study and should not only report the results of nutrition, but also the effect on death and disability is made.

In 2013, Xiang et al.10 performed a systematic review and meta-analysis of 13 prospective randomized trials of 1980-2012, whose objective was to compare the effects of different ways of enteral or parenteral nutrition, home nutrition (early or late), and types of nutrients, immuno nutrients (probiotics, arginine, glutamine, nucleotides). The most important results were a significant association when comparing versus NET NET in relation to mortality (RR = 0.35; 95% CI, 0.24 to 0.50), and infectious complications (RR = 0.77; 95% CI, 0.59 to 0.99). And infectious complications when comparing enteral parenteral nutrition with a slight tendency to reduce the mortality rate (95% CI, 0.34-1.09 RR = 0.61) was found (RR = 0.89; 95% CI, 0.66-1.22) although not statistically significant. A significant reduction of infection with the use of formulas with immune nutrients compared to the standard formula (RR = 0.54; 95% CI, 0.35 to 0.82) was found, whereas nutrition small intestine compared to nasogastric showed a decrease pneumonia rate (RR = 0.41; 95% CI, 0.22 to 0.76).

It has records from the nineties clinical trials in critically traumatized, post-surgical, burn and TBI patient, in which the effect of nutrition on the outcome studied, compared NET versus NET, enteral nutrition versus parenteral nutrition, or jejunal intragastric administration, showing the most improvement in clinical outcomes. However, these studies are weak, heterogeneous groups of patients, with underreporting of data and, therefore, with little results significativos.19 25-27 Because there are few recent studies on the use of enteral nutrition after TBI, the purpose of this study was to conduct a systematic review of clinical trials of enteral nutrition in patients with head trauma, to assess the nutritional effectiveness, its effect on morbidity, mortality and length of hospital stay, in order to have a clearer and updated view of nutritional intervention in patients with TBI and be a benchmark for future studies.

Methodology

Search strategy

Exhaustive search was performed using the keywords "Traumatic brain injury, enteral nutrition, nutritional support, nutritional care of TBI, enteral nutrition, head trauma, enteral nutrition, early and late enteral nutrition" of randomized prospective clinical studies available on the use of enteral nutrition in the treatment of patients with acute phase TCE in databases MEDLINE / PubMed, EBSCO, Elsevier, Cochrane library and search of references to other articles or reviews.

Selection criteria

Studies published in English and Spanish from 2000 to 2013 on the effect of enteral nutrition in the TEC, prospective and comparative clinical trials, assessed with the Glasgow Coma Scale (Glasgow Outcome Scale [GOS]), which analyzed included the least one of the following variables: type of managed diet, time the (early or late) diet, nutritional parameters (anthropometric and biochemical), presence of infectious complications, hospital length of stay and hospital mortality was instituted. No pediatric studies were carried out in patients with TBI and animal studies were excluded.

Data Extraction

Two researchers (GP and EP) Independent reviewed and selected articles, any discrepancy among researchers was clarified by a third author (JMC). Finally, data extraction which included first author, year of publication, sample size, gender, average age, early nutrition, type of nutrition, infectious complications, nutritional changes (anthropometric and biochemical), was held days of hospital stay and mortality (Table 1).

Results

174 items found in the initial search, after a detailed review of each of the summaries were removed that did not meet the inclusion criteria, besides the items mentioned in the original articles were reviewed. Thus, only 8 studies were included because they met the inclusion

criteria, carried out in the countries of the United States, Brazil, Cuba, India and Taiwan (Figure 1).

A description of the selected in this research in order to analyze the most important aspects that have been found concerning the enteral nutrition and its benefits in patients with TBI studies done, as detailed below.

Minard et al. (2000) 28 Falcao (2004) 29 evaluated the use of NET immunonutrients in patients with TCA. The first was a prospective randomized study, conducted in 32 patients with TBI severe closed with a Glasgow Coma Scale of 3-11, to which were given early enteral nutrition within the first 72 hours after injury through nasoenteric endoscopic probe. And the group with late enteral nutrition nasogastric tube was placed after recovering the gastroileal function. Group two patients were removed by NET probe problems with nutrition and patient group NET death within 72 hours. Of the remaining 27, five died (group 1 and 4 NET NET group). There were no significant differences between groups in days of stay in the ICU, infections and ECG. Inverse correlation between ECG and infections ($R = -0.0$, $p < .003$) was found; the time to reach 14 ECG was significantly longer in patients with infection compared to what had not ($p < 0.02$). Finally it is shown that there is no difference in the stay and infectious complications in groups versus NET NET. The severity of the head injury is associated with the presence of infection. Moreover, in the second study29 evaluated the results of the NET glutamine and probiotics in 20 patients with TBI (Glasgow 5-12) randomized into two groups, the control group with polymeric diet ($n = 10$) and another with the same formula but with glutamine and probiotics ($n = 10$), both groups were given diet for a minimum of 5 days (range 5-14 days), The diet was isocaloric and isonitrogenous (35 kcal / kg / day) and 1.5 g protein / kg / day. A higher rate of infection in the control group (100%) was reported when compared with the study group (50%) $p = 0.03$. The average number of infections per patient was significantly higher in the control group ($p < 0.01$) compared to the study group. The days of stay in the ICU was higher in the control group compared with 22 the Study Group 10 ($p < 0.01$); and the days of fan control group were 14 to 7 in the study group ($p < 0.04$).

Hartl et al. (2008) 11, performed prospective study database adults with severe TBI in the United States, to assess the effect of the start and the amount of nutrition in early mortality within the first two weeks of injury in the TEC. The study was conducted from 2000 to 2005 in 797 patients with severe head injury with a Glasgow Coma Scale <9, treated 22 trauma centers. Patients who

were not fed within 5-7 days after TCE were 2 and 4 fold increase in the chance of death, respectively. The amount of nutrition in the first five days was associated with death, 10 Kcal which decreased caloric intake was associated with 30-40% in increased mortality rates. Nutrition is a significant predictor of death due to ECT. Along with the prevention of hypotension, hypoxia and intracranial hypertension is one of the few therapeutic interventions that can directly affect the outcome or results of the TEC, as it was shown that NET may have a protective effect in patients with intracranial hypertension.

Sivashanmugam et al. (2012) 12 conducted a prospective non-randomized, comparative study in patients 20 to 60 years who were admitted to the department of neurosurgery at New Delhi from June to December 2005, with an evolution of 24 hours after TBI and a scale Glasgow Coma 4-8; 114 patients, 19 died before giving enteral nutrition were studied. The purpose was to determine several nutritional parameters in patients receiving enteral nutrition modular (AE) in the first three days, 4-7 days and after 7 days of entry by TCE and evaluation at 3 and 6 months. The prospective evaluation three weeks said there is a significant difference in anthropometric measurements, total protein, albumin level and clinical malnutrition and mortality among three groups features. 80% of the fed before three days had a favorable outcome at three months compared with 43% who were subsequently fed, OR 5.29 (95% CI 1.03-27.03) ($p = 0.04$). The difference of which were fed 3 to 4-7 days was not significant at 6 months although those who were fed before 7 days had a significant outcome compared to those who were fed after 7 days (OR 7.69, $p = 0.002$). Multivariate analysis of favorable outcomes were not significant in those fed after 3 days ($p = 0.03$) and 7 ($p = 0.01$). In severe TBI, unfavorable results were significant and associated with the beginning of the administration of full enteral diet after 3 days and more when it was after 7 days of the injury.

Thus, in the study by Small and Hernandez (2009) 13 it is a clinical, prospective, analytical, longitudinal study in a University Hospital, from January to December 2006 in 67 patients with TBI, to evaluate the performance nutrition. 44.8% was found in the age group 30-44 years. 62.7% of TBI patients present malnutrition. Frequent fasting influenced the emergence of malnutrition. 64.2% had complications, of these 86.0% presented malnutrition. The prevalence of malnutrition is increased as the patient's stay was prolonged. Mortality was 43.3%, and higher in malnourished patients with 79.3%. The stay was most often less than five days with 49.3%.

Enteral nutrition was the most used nutritional support option. We conclude stating that inadequate nutritional intake for patients with TBI, leads to complications during ICU stay.

Moreover, in the study by Meirelles and Aguilar-Nascimento (2011) 14, whose objective was to compare 22 patients enteral nutrition (EN) or parenteral early (NPT) in relation to the supply of calories and protein modifications Serum glucose and the acute phase response in patients with TBI (Glasgow between 9 to 12). The daily amount of calories (25-30 kcal / kg / day and 1.5 kg / day of protein) was established to be fulfilled after three days of admission to the ICU. The daily amount of calories and nitrogen (N) to be supplied, nitrogen balance, and serum glucose levels daily, C-reactive protein, and albumin were collected for 5 consecutive days. The mortality was 9.1% with a case in each group. The average stay in the ICU was 14 days in both groups, with a range of 5-26 days in the NE and 6-24 days in the TPN group ($p < 0.86$). Four cases of complications (two of pneumonia and sepsis two) in the group of NPT (40%) and two cases of pneumonia in the NE group (16.7%) occurred. A progressive caloric deficit occurred in both groups ($p < 0.001$) with no difference between them. The mean serum glucose level of patients with NPT (134.4, 95% CI 122.6 to 146.2 mg / dl) was significantly higher than in NE group (102.4, 95% CI 91.6 to 113.2 mg / dl) ($p < 0.001$). a trend ($p < 0.06$) was observed in urinary N loss in 24 h NPT higher in the group receiving N greater amount of the NE group ($p < 0.05$). However, nitrogen balance was similar in both groups. There was no difference in any of the clinical outcome variables or acute phase response. It is concluded that both routes were able to provide greater amounts of calories daily for patients with brain injury. The NP provided greater amounts of nitrogen, but losses were also higher. The nitrogen balance was similar for both types of therapy. The NP compared to NE it leads to greater hyperglycemia. There was no influence of the route, both in the early inflammatory response and clinical outcomes.

Discussion

This study provides some important findings despite being the review of eight prospective clinical studies related to early enteral nutrition, late enteral nutrition, its effect on nutritional status, energy intake and its impact in infectious complications, length of stay hospital and mortality.

The most relevant findings can be summarized as follows. First, the NE was the most used nutritional support option, which is consistent with that reported by Nery de Souza (2012) 16;

Hartl et al. (2008) 11 and Sivashanmugam D, et al. (2012) 12, because the NE is associated with a significant reduction in infectious complications. Second, patients were fed within the first three days of TCE had a better outcome and less likelihood of death. Vizzine (2011) 31 talks about the benefits of .NET within the first 24-72 hours after TBI, such as reduced complications and better neurological outcome. Moreover, it can be observed in the study by Small (2009) 13 a lower risk of mortality in the absence of malnutrition in patients who were nourished before the first 72 hours of TCE.30,31 In the study by Nery de Souza (2012) 16 reported that the NE must begin between 24-48 hours of admission to the ICU because it reduces the secretion of catecholamines, maintains body weight, muscle mass and decreases intestinal bacterial overgrowth. Similarly, the Association of Parenteral and Enteral Nutrition (ASPEN) recommends that NE must be indicated within the first 28-48 hours of admission to the UCI.17 Third, there is a significant relationship between the maximum contribution provided nutrients and death since the decrease of 10 Kcal / Kg in caloric intake is associated with 30-40% increased mortality rates; today it is known that the TCE is the energy requirement from 120% to 250% of the basal energy expenditure, however, should be careful not to fall into a supercharger with consequent repercusiones.11 Fourth, the results showed a significant relationship with regard to early onset of nutritional support and hospital stay, as studies by Hartl et al. (2008) 11 and Sivashanmugam D, et al. (2012) 12. However, the study by Kattelmann et al. (2006) 20 showed no benefit when compared PN with EN in terms of length of hospital stay and, on the other hand, if a NET association with decreased hospitalaria20 day stay.

In studies by Sivashanmugam D, et al. (2012) 12 Small and Hernandez (2009) 13 reported malnutrition in hospitalized patients presented related to the delayed establishment of nutrition and how this factor affects different aspects of evolution in the presence of complications, the condition Exit and length of stay in the ICU.

Study limitations

The main limitation was not having a sample robust study because it is a subject rarely studied, however, has several studies critical in which patients this is another limitation because they are studies in heterogeneous samples (patient ; poly trauma, burns, etc.) and therefore the results can

not be seen objectively, not be included in this work after surgery moreover, the variables studied are not in all items studied.

Conclusion

According to the information presented in this systematic review, one can conclude that the NET patient with TBI is still a subject little studied, perhaps because of the lack of importance that clinicians give in their performance in the critically ill patient. Studies show the benefits of .NET, it is also clear that prolonged fasting contributes to malnutrition and development of infectious complications during ICU stay. Nutrition is a significant predictor of death in the TEC. Finally it is concluded that the advantages to be gained from the NET as decreased morbidity and mortality and length of hospital stay justify the administration of it, particularly in patients undergoing major stress.

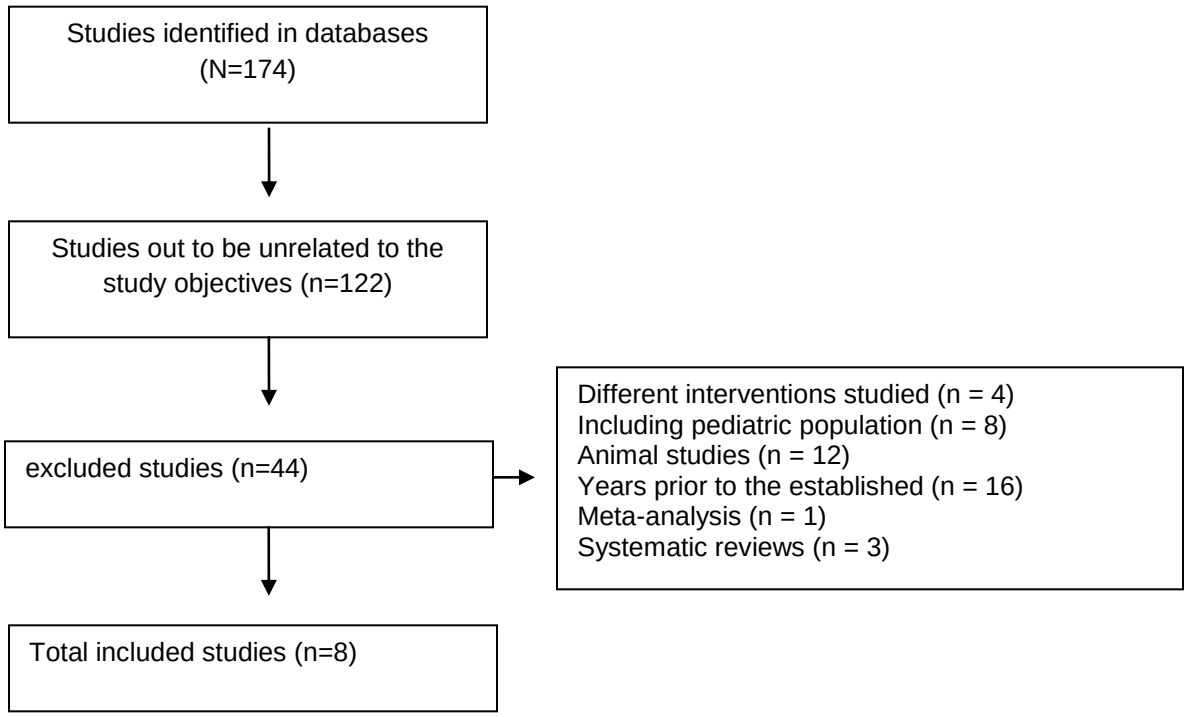
Tabla 1. Características de los estudios de nutrición enteral en el paciente con traumatismo cráneo encefálico.

Referencia	**Diagnóstico al ingreso, Glasgow**	**N**	**Edad**	**Tipo de NE**	**Inicio de la dieta (días)**	**Ingesta calórica (Kcal/Kg/día)**	**Estancia media (días)**	**Infección**	**Otras complicaciones**	**Mortalidad (%)**
Minard et al. EU (2000)	3-11	27	>15	Dieta con inmuno-nutrientes Impact	Temprana 33±15 h Tardía 84±41 h	27 Kcal/Kg/día	Temprana 18.5 días Tardía 11 días	Neumonía 50 %	ND	18.5
Falcao et al. Brasil (2004)	5-12	20	16-50	Dieta polimérica dieta con glutamina y probióticos	48 hrs	35 kcal/kg/día 2400 - 2390	22/10 días	Neumonía 100% - 50 %	Sépsis 33.3 % grupo control	No
Hartl et al. EU (2008)	<9	797	16-60	Estándar	1-3 días 4-5 días 6-7 días	25 Kcal/Kg/día	ND	ND	ND	9.9
Small y Hernández. Cuba (2009)	ND	67	15 >60	Estándar	<12 h 12-24 h 24-48 h 48-72 h <72 h	ND	10	Respira-torias Sépsis 64.2 %	Desnutrición el 62.7 %	43.3
Meirelles J.et al. Brasil (2011)	9-12	22	18-60	Dieta de soya/NP	ND	NE 5,958 NP 3,619 25-30Kcal/día	14	Neumonía 40% NP/16.7 % NE	Sépsis	9.1
Chourdakis et al. EU (2011)	≥9	59	18-70	Dieta polimérica	24-48 h	ND	24/28	Neumonía	Bacteriemia, infecciones de vías urinarias	8.7
Chiang et al. Taiwan (2012)	4-8	297	0-99	Dieta polimérica	48 h	500 Kcal/día	7	ND	ND	ND
Sivashanmugam D. India (2012)	4-8	67	20-60	Artesanal modular	1-3 días 4-7 días >7 días	1,330 Kcal 50Kcal/Kg/día, 2 g/kg proteína.	ND	ND	Muerte, incapacidad severa estado vegetativo persistente	13.4

NE: Nutrición enteral

ND: No disponible

Figure 1. Flow chart of the search and selection of items



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