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EFFECT OF EARLY ENTERAL NUTRITION IN CRITICALLY ILL PATIENTS AND THEIR OUTCOMES

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Abstract:-

Nutritional support is an essential component in critical care unit. In Intensive/critical care unit, Malnutrition has been associated with poor outcomes as indicated by increasing morbidity, mortality and total length of stay in ICU as well as hospital. Lots of evidence suggested that in ICU patients with a good gut function; early enteral nutrition play a positive role in their outcomes. So, nutrition should be administered through the enteral route.

Keyword- Intensive care unit, Malnutrition, Morbidity, Mortality, Enteral Nutrition.

Introduction:-

European Society for Parenteral and Enteral Nutrition (ESPEN) and the Academy of Nutrition and Dietetics (AND) published a consensus document outlining for diagnosing severe and non-severe malnutrition. Each malnutrition cause is either Systemic inflammatory response syndrome (SIRS) or Multiple Organ Dysfunction Syndrome (MODS). The prevalence of malnutrition is a very common problem in critically ill patients. Patients who have prolonged hospitalization in intensive care unit (ICU) or starvation for more than two weeks increases the risk of malnutrition. Malnutrition leads to poor outcomes.

The importance of nutrition in the critically ill is increasingly acknowledged, especially in patients with long stay in the intensive care unit (ICU), who often require prolonged life-sustaining support and go through a state of severe catabolism. Some aspects of the nutrition practice such as the preferential use of the early oral/ enteral nutrition (EN) over gut rest and the acceptance of delaying provision of amounts of nutrients calculated to match the losses and expenditure, while other aspects can raise controversial views. International guidelines have been recently updated by the American Society of Parenteral and Enteral Nutrition (ASPEN)/Society of Critical Care Medicine (SCCM) and the European Society of Clinical Nutrition and Metabolism (ESPEN), with various levels of

supporting evidence. A group of experts in critical care nutrition from different regions of the world was commissioned to discuss some of the practicalities of early EN (listed in Table 1) and supported in the corresponding sections, to use and to complement the guidelines by providing tips inspired by the current knowledge and clinical experience of the experts. Importantly, nutritional requirements will vary according to the phase of critical illness, our tips are general in nature, and an individualized approach should always be used.

Table 1

Question	Suggested answer	ASPEN/SCCM guidelines	ESPEN guidelines
When to start?	Start within 24–48 h of ICU admission	**Recommendation:** start early EN within 24–48 h (quality of evidence: very low)	Start early EN (within 48 h) rather than delaying EN (grade of recommendation: B strong consensus) Start early EN (within 48 h) rather than early PN (grade of recommendation: a strong consensus)
What to do in case of vasopressor agents?	Start low-dose enteral nutrition Hold EN for patients who are being actively resuscitated or unstable	**Suggestion:** In the setting of hemodynamic instability, hold EN until the patient is fully resuscitated and/or stable Consider initiation/re-initiation of EN with caution in patients undergoing withdrawal of vasopressor support (expert consensus)	EN should be delayed if shock is uncontrolled. Low-dose EN can be started as soon as shock is controlled, while remaining vigilant for signs of bowel ischemia [grade of **recommendation**: Good practice point (GPP)]
How to achieve enteral access?	**Short-term (< 4 weeks)**: use nasogastric tube or post pyloric in case of delayed gastric emptying) **Long-term (> 4 weeks)**: place percutaneous enteral access (gastrostomy or jejunostomy)	**Suggestion:** in most critically ill patients initiate EN in the stomach {Expert consensus} **Recommendation:** Infuse EN lower in the GI tract in patients who are at high risk for aspiration or with intolerance to gastric EN (quality of evidence: moderate to high)	Use gastric access as the standard approach to initiate EN **(grade of recommendation**: GPP strong consensus) Use post pyloric feeding in patients with gastric feeding intolerance not solved with pro kinetic agents **(grade of recommendation:** B strong consensus)

			Consider post pyloric, mainly jejunal feeding in patients at high risk for aspiration **(grade of recommendation:** GPP strong consensus)
How much energy?	Accept below energy expenditure during the early phase and increase energy to match energy expenditure later (4–7 days)	Suggestion: patients at low nutrition risk with normal baseline nutrition status and low disease severity (e.g., NRS 2002 ≤ 3 or NUTRIC score ≤ 5) do not require specialized nutrition therapy over the first week of hospitalization in the ICU (expert consensus) **Recommendation:** Start either tropic or full nutrition by EN for patients with acute respiratory distress syndrome (ARDS)/acute lung injury (ALI) and those expected to have a duration of mechanical ventilation ≥ 72 h (quality of evidence: high) Suggestion: advance EN toward goal over 24–48 h while monitoring for re-feeding syndrome in patients who are at high nutrition risk (e.g., NRS 2002 ≥ 5 or NUTRIC	Administer hypo caloric EN (not exceeding 70% of EE) in the early phase of acute illness **(grade of recommendation:** B strong consensus) Increase caloric delivery can be increased up to 80–100% of measured EE after day 3 **(grade of recommendation** : 0 strong consensus)

		score ≥ 5, without interleukin 6) or severely malnourished (expert consensus)	
When should energy-dense formulas be used?	Use energy-dense formulas in patients with GI intolerance of full-volume isocaloric enteral nutrition, patients needing fluid restriction or during transitioning to oral nutrition (intermittent-feeding schedule)	No specific recommendation	No specific recommendation
How much protein?	Low dose (e.g., 0.8 g/kg/day) during the early phase—to be increased to > 1.2 g/kg/day later	**Suggestion:** Administer sufficient (high-dose) protein in the range of 1.2–2.0 g/kg actual body weight per day and may likely be even higher in burn or multi trauma patients (quality of evidence: very low)	During critical illness, 1.3 g/kg protein equivalents per day can be delivered progressively **(grade of recommendation**: 0: strong consensus)
When should high protein formulas be considered?	During the late stable phase—monitoring of renal function/acid–base status	No specific recommendation	No specific recommendation
How and when to start micro nutrient supplement	Thiamin upon admission—others when insufficient amounts by enteral nutrition	We suggest that a combination of antioxidant vitamins [including vitamins E and C (ascorbic acid)] and trace minerals	No specific recommendation

ation?		(including selenium, zinc, and copper) in doses reported to be safe in critically ill patients be provided to those patients who require specialized nutrition therapy (quality of evidence: low)	
How to screen and manage patients for re-feeding syndrome?	Plasma phosphate levels at least once a day when starting enteral nutrition Low-dose enteral nutrition, supplemental thiamin and phosphate	Monitor closely serum phosphate concentrations and replace phosphate appropriately when needed **suggestion:** (expert consensus)	Electrolytes (potassium, magnesium, phosphate) should be measured at least once daily for the first week [**grade recommendation**: GPP strong consensus (92% agreement)] In patients with re-feeding hypophosphatemia (< 0.65 mmol/ l or a drop of > 0.16 mmol/l), electrolytes should be measured 23 times a day and supplemented if needed [**grade recommendation**: GPP strong consensus (100% agreement)] In patients with re-feeding hypophosphatemia energy supply should be restricted for 48 h and then gradually increased [**grade recommendation:** B strong consensus (100% agreement)]
How to assess	At the start of low-dose EN: high	**Suggestion:** Do not use GRVs as part of routine	No specific recommendation statement

gastrointestinal tolerance?	gastric residual volume (optional—threshold 500 ml/6 h), vomiting, pain, distension, elevated/increasing intra-abdominal pressure, absent bowel sounds—dynamic ileus	care to monitor ICU patients receiving EN **Suggestion:** for those ICUs where GRVs are still utilized, avoid holding EN for GRVs < 500 mL in the absence of other signs of intolerance (quality of evidence: low)	

Both parenteral and enteral nutrition are the form of a liquid diet. Enteral nutrition is used when the gut is partially working, but the patient is unable to eat or absorb enough nutrients to stay healthy. Enteral feeding is delivered directly into the stomach or intestine through a feeding tube. Enteral nutrition can be administered via Trans oral (oral ingestion of food), Trans nasal (administration of liquid feeds through feeding tube through the nose), percutaneous Trans gastric routes (through stomach), and by a route into the small intestine called a jejunostomy or percutaneous endoscopic jejunostomy. Hence enteral nutrition is called tube feeding.

Enteral nutrition is a method of providing adequate nutrition that is expected to prevent, improve or reverse malnutrition in patients who are unable to receiving adequate nutrition orally.

Indications for enteral tube feeding for adults

Indications	Conditions
Neurological Indications	• Severe head injury due to road traffic accident/physical assault/any other reason • Cerebrovascular accidents • Neurological coma • Neurological tumors • Neurological disorder related dysphagia
Surgical Indications	• Jaw and facial surgeries • Head and neck surgeries due to cancer or any other reasons • Oropharyngeal surgeries • Polytrauma associated with extensive abdominal surgeries • Pharyngoesophageal surgeries • Patients with burn for surgeries unable to take oral nutrition • Surgery complicated with sepsis
Hyper metabolism	• Postoperative major surgery

	• Sepsis • Trauma, Burns, Organ transplant, Acquired immune deficiency syndrome (AIDS)
Gastrointestinal Disease	• Short bowel syndrome (if absorptive capacity of remaining bowel is sufficient e.g. approximately a minimum 100cm jejunal and 150 cm of ileal length of functioning small bowel with ileocecal value intact) • Inflammatory bowel disease • Minimal gastrointestinal tract fistula output (less than 500ml per day) • Pancreatitis • Esophageal obstruction • Malabsorption • Fistulas
Organ system failure	• Respiratory failure • Renal failure • Cardiac failure • Central nervous system failure • Hepatic failure • Multiple organ system failure
Cancer	• Oral malignancies • Oropharyngeal Malignancies • Nasopharyngeal malignancies • Head and neck malignancies • Esophageal malignancies • Gastric malignancies • Chemotherapy • Radiation therapy
Resistance to oral intake	• Anorexia • Dysphasia • Severe depression
Malnutrition	• Protein energy malnutrition (PEM) with inadequate oral intake for at least 5days • Malnutrition related to pre-operative and post-operative • Malnutrition in cancer patient due to lack of food intake orally • Malnutrition in patient with Acquired Immune Deficiency Syndrome (AIDS), who are unable to take oral nutrition • Malnutrition in debilitated aged patients

Once the indication for enteral nutrition is established then the questions arises that what are the types of enteral feeds/formula feeds that are available and can be delivered to the particular patient? The Drug and Food Administration (FDA), USA recognizes enteral formulas as a category of product independent from regular foods, dietary supplements or drugs.

Types of Enteral feeds and their specific characteristics

Enteral feeds/Formula feeds	Specific Characteristics
• **Polymeric formulas:** This is the general purpose, most widely prescribed feed. It is the sole source of nutrition intake for critically ill individuals with or near normal gastrointestinal function.	• It is providing nitrogen as whole protein, often casein, egg white or soy protein. • Carbohydrate is providing as corn syrup, maltodextrins glucose oligosaccharides, with sucrose added for sweetness in oral formulas. • Fat is usually providing as soy oil, although corn oil, sunflower oil, olive oil and safflower oil may be used. Medium chain triglycerides (MCT oil) are rarely used.
• **Oligomeric formulas:** It is also called elemental or semi-elemental diets. Oligomeric diets are predigested and formulated to require minimal digestion by the gastrointestinal tract. In other words, these diets are complete diet.	• Most of these formulas provide enough protein, calories, water, electrolytes, minerals, vitamins and trace elements in two liters per day for most non-stressed patients. • It provides nitrogen as oligopeptides from partially hydrolyzed whole protein or as crystalline amino acids. • Carbohydrates tend to be provided as glucose oligosaccrides or glucose. • In this formula, fat is usually present in small quantities, enough to meet the requirement for linoleic acid (an essential fatty acids), which is about 2-4% of total calories. Medium chain triglycerides (MCT) oil is also added to some formulas. • Oligomeric diets have been commercially promoted as ideal for patients with decreased bile output (cholestasis), pancreatic insufficiency and short bowel syndrome.
• **Modular formula or feeds:** It is used when a particular component of the diet requires an increased intake or if a patient requires a special blend of diets. These modules are not required for the majority of patients and are rarely used.	• Modular formulas are those that contain or predominantly contain one kind of nutrient. • There are commercially available modules for protein, fat, carbohydrates, vitamins, electrolytes and trace elements. Examples of this might include burns or protein losing enteropathy, if more protein is to be given; or liver disease, if less protein is to be given.
• **Blenderized feeds:** It is very common for critically ill patients with normal gastrointestinal functions	• It is very easy to prepare by mixing the ingredients and delivered in an easily digestive form. • It provides carbohydrates, proteins and fats as same amount as balance diet. • It is very safe and cost effective nutritional management for long term. • In this feed, all natural food items are used.

• **Opportunistic feeds:** It is very specialized feed with nutritional addition and substitution which are suggested to improve various aspects of organ function.	• In this feed, addition or substitution of carbohydrates, proteins, fats, vitamins, minerals, trace elements, immune-nutrients and fibre may vary as per patient's requirements.
• **Disease specific feeds:** These are disease specific formulated polymeric enteral feeds as per disease.	• For diabetic disease patients: - Diabetes formula feed. • For Kidney disease patients: - Renal formula feed and for dialysis patient dialysis formula feed. • For liver disease patients: - Hepatic formula feed oligomeric formula feed • For major surgery or infections or burn or severe catabolic patients: - High protein formula feed. • For cancer patients: - Immuno-nutrition formula feed with high calorie and protein.

Therefore, it is evident that various enteral formulas are available for infusion but which one is the best for the particular patient? So, the following factors to consider when choosing an enteral formula include:

- Better gastrointestinal function
- Types of protein, fat, carbohydrate and fibre in the formula as related to the patients digestive and absorptive capacity
- Density of calorie and protein (i.e. kcal per ml, gm protein per ml and calorie: nitrogen ratio)
- Total sodium, potassium, magnesium and phosphorus content of the formula, especially for patients with cardio pulmonary, renal and hepatic failure
- Methods of feeding and viscosity of the formula related to tube size

Once the indication for enteral nutrition is established then the questions arises that what are the types of enteral feeds/formula feeds that are available and can be delivered to the particular patient? The Drug and Food Administration (FDA), USA recognizes enteral formulas as a category of product independent from regular foods, dietary supplements or drugs.

Complications in enteral feeds:

Enteral feeding patients are at risk for complications such as aspiration, diarrhea, metabolic abnormalities, dislodgment or tube mal positioning, refeeding syndrome, medication-related complications, fluid imbalance, insertion-site infection, agitation and mechanical complications, etc.

Aspiration:

There are different types of strategies to reduce aspiration include post-pyloric feeding, enteral feeding via a percutaneous gastrostomy (PEG) tube, backrest elevation, and administration of motility agents to promote gastric emptying. The rationale for most of these strategies is the belief that aspiration and reflux of gastric contents

increases the risk for nosocomial pneumonia. Promptly using medication and elevating the head of the bed can reduce aspiration risk. Administration of motility agents (e.g. erythromycin, metoclopramide) solely for the purpose of decreasing aspiration should not be routinely performed because this approach does not appear to be beneficial most of the time.

Diarrhoea:

It has been observed that feeding related diarrhea is commonly associated with concomitant administration of medications (e.g. antibiotic, proton pump inhibitors) or medications in suspension or using sorbitol (a non-absorbable sugar). Enteral nutrition (EN) should not be automatically interrupted for diarrhea but rather that feeds are continued while evaluating the basic cause of diarrhea in critically ill patients to determine appropriate treatment.

Metabolic Abnormalities:

Hyperglycemia, re-feeding syndrome and micronutrient deficiencies are the basic adverse metabolic consequences of enteral feeding. Malnourished patients are given rapid enteral feeding may cause of re-feeding syndrome resulting from rapid changes in fluids and electrolytes. It is defined primarily by manifestation of hypomagnesemia, hypokalemia and severe hypophosphatemia (including respiratory failure, cardiovascular collapse, seizures and delirium). Slow regulated and avoidance of high concentrated enteral feed may help to tackle these problems.

Fluid intake related complications: All enteral feeding products consist of 70 to 80 percent water. As a result, they are unable to meet patient's normal water requirements alone. Enteral feed providing 25 kilocalories per kilogram body weight with 1 kilocalorie per milliliter formula provides an average of only 20 milliliters per kilogram of water. This enteral feed may be beneficial for patients who require fluid restriction but most patients require another source of water. Feeding tubes must be flushed regularly with water to avoid clogging.

Mechanical complications:

Bowel distention and constipation is a well-known consequence of enteral feed support. Patients who receive enteral feeding through a PEG tube are at risk for multiple complications related to PEG tube. Insertion of a nasoenteric or nasogastric tube can also cause mechanical complications, such as insertion into the lung. Feeding through nasoenteric or nasogastric tubes should not begin until its proper position has been confirmed radiographically.

Conclusion-

Early enteral nutrition provides sufficient nutrition when oral intake is not possible or adequate as per requirement of the patient. It has following other benefits also.

- It is easier to administer, present fewer metabolic and infectious complications as compared to parenteral route.
- It is very easy to provide sufficient quantity with proper monitoring.
- It is very easy to access, gut integrity and mortality.
- It reduces the incidence of pathogen entry or bacterial translocation into the stomach cavity or circulation.
- It provides more complete energy, protein, trace elements as well as fibre.
- It provides atrophic effects on the gut by promoting pancreatic and biliary secretion, as well as endocrine and neural factors that helps to promote the physiological and immunologic integrity of the gastrointestinal tract.
- It is very cost effective and readily available as compared to parenteral nutrition.

Early enteral nutrition has shown to promote gut motility, reduces bacterial translocation, prevents mucosal atrophy and stimulates the secretion of IgA that helps to reduce infectious complications, improves nutritional outcomes and results in greater wound healing.

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5. Bukhari, et, al., (2020) concluded early enteral feeding with high protein, polymeric formula is beneficial for non-traumatic brain injury (non- TBI) patients.
6. Blaser, et, al., (2017) suggested using early enteral nutrition in the majority of critically ill under certain precautions. Due to lack of evidence, they suggest delaying enteral nutrition in critically ill patients with uncontrolled shock, uncontrolled hypoglycemic and acidosis , uncontrolled upper GI bleeding, gastric aspirate > 500 ml per 6 hours, bowel ischemia, bowel obstruction, abdominal compartment syndrome and high output fistula without feeding access.

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8. Sun, et, al., (2013) suggested that early enteral nutrition did not increase IAP (intra- abdominal pressure). Early enteral nutrition could improve disease severity and clinical outcome, but did not decrease mortality of SAP (severe acute pancreatitis).
9. Woo, et, al., (2010) concluded that early enteral nutrition decreases the length of stay in ICU and on ventilator, lower the incidence of pneumonia, reduces the mortality but there were no any differences in incidence of bacteremia.