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Open versus Closed Tube Feeding in Critically Ill Patients – Which is the Best?

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Abstract

Although, Enteral Nutrition (EN) is a long established practice in critical care but, the ideal prescription and administration still represent a challenge. Patients admitted to intensive care unit, always receive less EN than the prescribed volume, leading to increase the risk of malnutrition, and contributing to negative hospital outcomes. Also contamination of the enteral formulations is very common and might lead to the occurrence of nosocomial infections in the form of diarrhea, bacteremia and pneumonia. EN delivery is available in two main systems: An Open System (OS) or Closed System (CS) which sometimes called a «Ready to Hang» system (RTH). Despite recognition of the importance of nutrition within the modern health agenda, evaluation of the efficacy of how such feeds are delivered (open or closed) is very limited. This review highlights current practice and areas of concern and establishes our current knowledge in this field.

Keywords: Enteral nutrition; Diarrhea; Pneumonia; Contamination

Introduction

Although Enteral Nutrition Therapy (ENT) is the optimum treatment option for patients with intact gastrointestinal tracts, the ideal prescription and administration still represent a challenge [1]. Patients admitted to hospital always receive less Enteral Nutrition (EN) than the prescribed volume, leading to increase the risk of malnutrition, and contributing to negative hospital outcomes (Figure 1) [2,3]. Enteral feeding is an excellent environment for microbial growth and has been associated with contamination and nosocomial infections [4,5].

A lot of studies have linked the occurrence of nosocomial infections in the form of diarrhoea, bacteremia and pneumonia to contamination of enteral feeding. Different factors are involved with the contamination of enteral formulations, including:

1. The quality of the ingredients.
2. Hygiene of the environment.
3. The people involved with preparation, distribution and administration of this feeding [6,7].

What are the Differences between Open, Closed and Semi-closed?

Open tube system

It needs a lot of manipulations.

Example: Ready-to-use cans and Powdered/sterilized formulas-both requiring reconstitution with water.

Kitchen made tube feeds are usually stored for 24 h after preparation.

Recommended hang times are: 4 h for unsterilized formulas.

8-12 h for sterilized formula (hospital=8 h; home=12 h).

Modulars and additives need to be blenderized in a mixer.

Less than full strength as well and all these are considered manipulations (Figure 2) [8].

Semi-closed tube system: Semi-closed TF delivery systems consist of a semi-rigid container that requires a filtered vent to avoid air-lock, which can stop flow of the formula, with a normal hang time approximately 24-36 h.

Closed tube system

Completely closed non-air dependent collapsible bag system has a hang time of 24-48 h. It consists of 500 mL, 1000 mL, and 1500 mL sterile formulas [9,10]. It is sometimes called RTH.

It has been developed mainly to reduce the nursing time needed to administer enteral nutrition and reduce the risk of bacterial contamination by requiring less handling [11,12].

What to Consider When Prescribing EN in Critically Ill Patients-Open, Semi-closed or Totally Closed Tube System?

In terms of patient safety and care, many questions have to be answered first before choosing the appropriate system:

1. Can we limit any source of contamination and infection?
2. How can we meet at least 60% of the patient's nutrient needs safely?
3. Can we use the nursing time more efficiently?
4. Can we cut the cost–long-term cost?
5. Can we keep our staff satisfied and retain good people?

The answer to all these questions is yes if we used closed tube system because of it is very adventitious.

Does the use of a closed system for enteral feeding result in better outcomes when compared to an open system in the critically ill adult patient?

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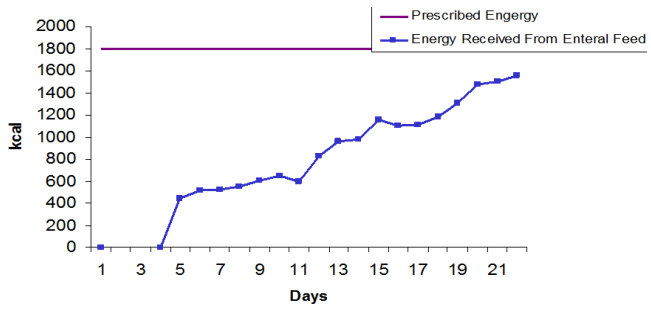

Figure 1: Difference between prescribed energy and energy received from Enteral Feed.

Figure 2: Example of Open Tube Feeding.

We have to understand that, the formula itself is sterile in open system (but not the bag it hangs in), while, the entire closed system (RTH) is sterile because it is not exposed to the outside environment. So, it is definitely associated with a reduced risk of contamination [13,14].

Therefore, potential risk reduction from nosocomial infection from contamination of enteral nutrition encourages many clinicians to select closed over open system. However, prospective trials did not reveal significant impact on the outcome. Clostridial difficile infection is one of the most life-threatening infections associated with hospitalized patients, especially those on EN and one of the measures to prevent this infection is by avoiding food contamination [15,16].

Only One level 2 study compared the incidence of bacterial contamination and diarrhoea using a closed system vs. an open system. The study concluded that less incidence of bacterial contamination and diarrhoea were more observed with the use of a closed system/aseptic technique of enteral nutrition administration vs. open system/routine ($p=0.06$) [17].

Some other studies revealed the association between longer hang times in the closed feeding system and increased percentage of prescribed EN, that actually received by the patient because of the longer hangs time [7,18].

Also Atkins and Phillips [19], revealed that open system provided patients with 74% (range 43-104%) of the ordered EN volume compared to 84% (range 59-101%) with closed system. Despite it involved a small number of patients, (n=60), this study suggests that the closed system may provide patients with a greater volume of their caloric needs, and confirms results found in other studies [7,18].

What are the criteria of unacceptable contamination of EN based on FDA Guidelines?

1. Any aerobic plate count for sample >10000 colony forming unit/mL.
2. Three or more samples exceeding 1000 cfu/mL.
3. Any pure culture of Bacillus cereus, Listeria monocytogenes, Staphylococcus aureus, or coliforms [20].

Where is the closed tube system in the current guidelines?

Guidelines endorse the use of closed systems: The National Institute for Clinical Excellence (NICE) Guidelines recommends strongly using closed feeding system [21]. ASPEN Guidelines stated that, usage of closed system enteral administration sets has been demonstrated to be safe for 24-48 h [22,23].

Conclusion

Open systems in acute care settings are linked to decreased nutritional intake and increased formula waste.

Significantly larger quantities of the prescribed diet were infused with the closed system compared with the open one. Formula waste varied from 20 to 60% with the open system compared with 3% for the closed system.

Closed system is very practical way of EN because of ease of use, longer hanging time, safety including less contamination and associated with better staff satisfaction and saves more nursing time. Any measures that can be taken to prevent bacterial contamination and a culture of safe practices while prescribing EN should be the goal.

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