

## Trying to get out of the box

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### Abstract

**Dr. Paul E. Marik suggests thinking outside the box when we use enteral nutrition support in the intensive care unit where the administration of formula in bolus theoretically presents greater benefit in preserving lean mass against con-**

**tinuous feeding. But what happens when we use parenteral nutrition support? It is to this that we propose a new administration scheme based on amino acids bolus and safety limits by a central line.**

**Key words:** Bolus, parenteral, nutrition, intensive care.

*"We cannot solve our problems  
with same level of thinking  
that created them"  
Albert Einstein*

As defenders of the enteral route in the critically ill patient we met along our way with different dilemmas on how to improve nutritional support at the intensive care unit (ICU). At first it was assumed that nutrition support was an irrelevant issue and now is known as a fundamental part of the management, reducing morbidity and mortality, then we assumed that parenteral nutrition (PN) would solve this issue and now we know it worsens or at least does not generate any benefit. (1,2) We took the task of doing everything possible to feed our patients early with enteral nutrition, using continuous enteral nutrition on the ground of trying to reduce the risk of vomiting and high gastric residual volumes, even when there is no concrete recommendation about using one method (continuous) over the others (bolus or intermittent). (3)

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When we thought we had everything under control using our enteral feeding protocol (4) Dr. Paul E. Marik showed us that for more than one reason we are thinking inside a box with a limited vision feeding our patients with a continuous enteral (and parenteral by the way) nutrition protocol. By exposing on physiological grounds the mistake we are doing by infusing nutrients the 24 hours of the day, ignoring the benefit of bolus feeding in relation to preserve muscular mass (promoting protein synthesis) (5,6) which is one of the main goals of nutrition support in the ICU. (7) We took 5 days of academic discussions to decide whether or not change our nutrition protocol, an argument that is now dangerous to us is: "Why change something that is working well?", now we know that we were inside a box and we could not see our own mistakes for this reason. **Table 1** shows our previous enteral nutrition protocol and **Table 2** shows the new protocol of bolus feeding, which requires neither a calculator to get the volumes per bolus of formula.

As a second point we follow one of the most relevant premises of Dr. Marik: "If the bowel works, use it (and if it doesn't work, make it works)". (8) For this reason we categorized PN in: 1) Avoidable PN and 2) Unavoidable PN. During a year we managed to avoid PN, but when we found ourselves in an "unavoidable PN situation" (obstructive gastric cancer, frozen abdominal cavity and severe undernutrition) it came to our heads the concept of bolus vs continuous nutrition. Traditionally all PN are administered by continuous infusion but "Why not make this necessary evil somewhat less harmful?"

In a step outside the box we developed a new PN

protocol based on bolus of aminoacids, the most relevant component according to recent evidence, (6,9) always being careful with the safety limits of every component, as it is shown in **Table 3**. (10) Dextrose is infused continuously (24 hours) in the order to prevent hyperglycemia or excessive dextrose administration in a given moment (>4 mg/kg/min). Lipids are infused intermittently because using a separate container the administration time should not exceed 12 hours, calculating the adequate infusion rate without exceeding 0.125 g/kg/h (6 to 12 hours). (10)

This is the first time we try to get out of the box having in mind that this allow us to see the issues and mistakes that we had when we were inside, which place us in a bigger box and give us the new challenge of getting out. More important now we know that every comfort area is a box that does not allow us to see future opportunities and present errors (**Figure 1**).

**Acknowledgements**

All authors declare that there are no conflicts of interest.

**Table 1.** Continuous enteral nutrition protocol

Weight (kg)	Day 1: mL/h for 24 hours	Total kcal (kcal/kg)	Day 2: mL/h for 24 hours	Total kcal (kcal/kg)	Day 3: mL/h for 24 hours	Total kcal (kcal / kg)
40	10	480 (12)	20	960 (24)	21	1008 (25)
50	10	480 (9)	20	960 (19)	26	1248 (24.9)
60	10	480 (8)	20	960 (16)	32	1536 (25.6)
70	10	480 (6)	20	960 (13)	37	1776 (25)

Legend: Using a 2 kcal/mL formula

**Table 2.** Bolus enteral nutrition protocol

Weight (kg)	Day 1*: mL in 1 hour every 4 hours	Total kcal (kcal/ kg)	Day 2***: mL in 1 hour every 4 hours	Total kcal (kcal/ kg)
40	40	480 (12)	80	960 (24)
50	50	600 (12)	100	1200 (24)
60	60	720 (12)	120	1440(24)
70	70	840 (12)	140	1680 (24)

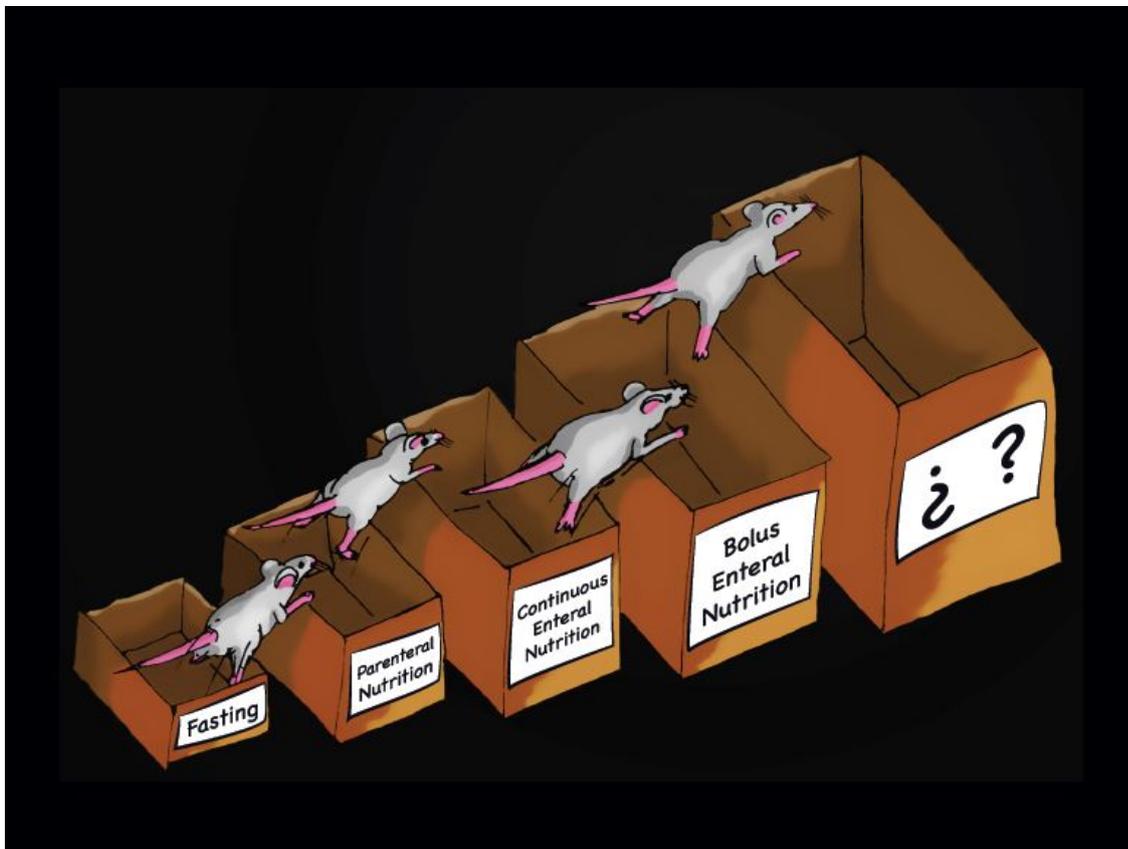
Legend: Using a 2 kcal/mL formula; \*=bolus of 1 mL/kg; \*\*\*=bolus of 2 mL/kg

**Table 3.** Our proposed parenteral nutrition protocol with amino acids bolus

10% amino acids	
• Total g	75
• g/kg	1.07
• mL in 1 hour every 4 hours	125
• Security limit	0.2 g/kg/h
50% dextrose	
• Total g	150
• mg/kg/min	1.48
• mL/h for 24 hours	12.5
• Security limit	4 mg/kg/min
20% lipids	
• Total g	34
• g/kg/h	0.048
• mL/h for 10 hours every 24 hours	17
• Security limit	0.125 g/kg/h

Legend: Weight=70 kg; total kcal=1116; kcal/kg=15.9. Increasing the infusion rate (within the security limits) of dextrose and lipids until achieving goals (25 kcal/kg). This protocol is only possible through a central line.

**Figure 1.** From one box to another  
*How we are jumping from box to box*



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