

## Continuing Enteral Nutrition in Prone Ventilation

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Enteral nutrition (EN) is safe and essential to overall patient outcomes especially for the critically ill and therefore should be continued during ventilation in prone position as these patients by default tend to be the most critically ill. The incidence of vomiting, increased gastric residual volume (GRV) and ventilator associated pneumonia (VAP) are not increased when compared to feeding in supine position. It is important to keep the bed in inverse Trendelenburg position of 30 degrees while continuing enteral feed in prone position. Prokinetics are indicated for patients with high GRV. Naso-gastric (NG) feeding is not inferior to post pyloric feeding.

**Key words:** enteral nutrition, prone ventilation, naso-gastric feeding, gastric residual volume, post pyloric feeding

### Introduction

Nutrition is a fundamental part of the critical care management. It modulates the immune system, improves wound healing and maintains muscle mass leading to reduced ventilated days, overall intensive care duration of stay and mortality. Thus, it is essential to continue focus on delivering nutrition to patients to improve overall outcomes which gains even more importance in the current era of COVID 19 where increasing numbers of patients are being ventilated in prone position for longer duration of time.

### Background

Traditional teaching till recently has been to stop NG feeding in the prone position for fear of feed intolerance and perceived risk of micro aspiration leading to VAP. In general, patients who are ventilated in prone position tend to be sicker which might in itself be contributory to reduced gastrointestinal mobility and higher GRV. Prone positioning itself, if not done correctly tends to

increase the intra-abdominal pressure and decrease the gastro oesophageal barrier pressure which may subsequently lead to increased gastro oesophageal regurgitation and micro aspiration. Sedation for ventilation with opioid infusion further compounds and contributes to this decreased intestinal motility.

Ventilation in prone position became a proven popular therapy to improve oxygenation after the Proseva study. In the context of acute respiratory distress syndrome (ARDS) due to COVID 19 infection, it has been a successful strategy to improve oxygenation of patients. In this context, patients are ventilated in prone position for up to 16 hours per day to gain the intended benefit. Patients in the in the critical care unit that the author works in have been ventilated in prone position due to COVID 19 pneumonia for up to 3 to 10 days on average. These patients therefore would have ended up being fed only for one third of the time if the traditional teaching had been adopted and followed.

### Commencing the feed

According to the European Society for clinical nutrition and metabolism (ESPEN), any critically ill patient admitted to critical care for more than 48 hours is at risk of malnutrition. ARDS patients usually have minimum of 5 days in critical care and are at increased risk of malnutrition. Nutrition should commence in the first 24-48 hours of admission to intensive care if there are no contraindications to do so. Enteral nutrition could be delayed in patients with uncontrolled

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haemodynamic instability, hypoxaemia, hypercapnia and acidosis if required. European Society of Intensive Care Medicine's (ESICM) clinical practice guidance suggests that EN should not be delayed solely because of prone positioning.<sup>12</sup>

Ideally energy expenditure should be assessed with indirect calorimetry. But in the era of COVID 19 and risk of aerosol generation, this would not be advised. It is suggested to provide hypocaloric nutrition in the early stage of acute critical illness not exceeding 70% of energy expenditure. It should be increased to 80-100% over 72 hours.<sup>13</sup> The energy provided by Propofol infusion for sedation should be included in these calculations.

### **Continuous vs Bolus feeding**

Meta-analysis by ESPEN found a significant decrease in diarrhoea with continuous feeding when compared to bolus enteral feeding. ASPEN doesn't recommend bolus feeding as well. Hypothetically, bolus feeding could lead to increased GRV but the author couldn't identify randomised controlled trials comparing continuous vs bolus feeding in prone ventilation.

### **EN during prone ventilation**

Detailed literature review on continuing enteral nutrition during ventilation in prone position was only able to identify a small number of studies with limited strength. A lot of these studies were conducted in single centres with limited population size most having less than 75 patients in the study population. The author believes that this only goes on to reflect the fact that prior to the COVID 19 pandemic ARDS patients requiring ventilation in prone position were likely not NG fed in significant numbers and therefore the motivation and drive to challenge the 'traditional thinking' model might not have been largely prevalent prior to COVID 19. While awaiting large prospective cross-over studies to be conducted in this view, we will have to depend on the findings of the studies that have been published up to now.

Measuring GRVs has been the traditional way of monitoring the tolerance of enteral feeding. Studies in the past have questioned the reliability and effectiveness of this as a clinical measure. A multi-centre randomised controlled trial found that not monitoring GRV was not inferior to routine GRV monitoring while continuing enteral nutrition. In the prospective comparative study

conducted in France, it was noted that there was an increased incidence of vomiting and stopping of feeding due to higher GRV in the group of patients who were ventilated intermittently in prone position. It was interesting to note these patients were being fed higher rates of nasogastric feed compared to the rates that are currently used. Apart from placing a pillow under the head of the patient in prone position in this study, there was no change in the bed position with a focus on reverse Trendelenburg which is the standard practice in the critical care unit that the author works in. These factors might explain the study's findings.

A prospective cross over study conducted in the Netherlands found that the GRV in the prone and supine position do not differ significantly. The prospective observational study in Spain concluded that feeding in prone position is feasible, safe and not associated with an increased risk of gastrointestinal complications. The findings were replicated in the prospective observational study conducted in India.

A before and after study was conducted in France looking at the practicalities of NG feeding in prone position and included interventions such as bed tilting 25 degrees head up, prophylactic intravenous erythromycin with the first prone positioning and increased acceleration to target rate enteral nutrition. This study concluded that these interventions enabled them to deliver NG feeding without increases in GRV, vomiting, or VAP.

### **Prokinetic**

ESPEN defines GRV at or above 500ml as high for feeding in critically ill patients. The studies which looked at enteral nutrition in prone ventilation have considered a range of 150ml to 500ml with 300ml of GRV as the most recognised cut off value. In addition, UK and Australian guidance commonly suggests 300ml as the cut off value in COVID 19 patients due to increased incidence of gastro intestinal issues.

According to ESPEN's meta-analysis, intravenous Erythromycin is the first line prokinetic therapy in high GRV. Alternatively, metoclopramide or both could be used. The risk of prolonged QT, arrhythmias and small incidence of seizures should be assessed against benefits of nutrition and reduction in aspiration risks. Both agents are known to have the effect of tachyphylaxis in prolonged use.

### NG vs Post pyloric feeding

Post pyloric feeding has been suggested to decrease the risk of VAP without negative effects on mortality, duration of invasive ventilation and length of intensive care stay. In the prospective randomised study, where micro aspiration was compared between NG and post pyloric feeding in prone ventilation, the difference was minimal 22% vs 18%.

Post pyloric tube placement in the critical care unit that the author works in involves endoscopic guided placement. Other methods are to use Fluoroscopy guidance or guide wired naso-jejunal tubes. The post pyloric tubes are commonly known to migrate into stomach and changing the position of the patient can increase this incidence. As per ESPEN and ESICM guidance, post pyloric feeding should only be considered in patients with high GRVs not improved by prokinetic agents.<sup>12,13</sup> Parenteral nutrition should not be commenced till all efforts are taken to improve enteral nutrition tolerance.

### Practical aspect

British Dietetic Association and Critical Care Specialist Group COVID-19's Best Practice Guidance outlines the practical aspects of continuing enteral nutrition in prone ventilation. Error! Bookmark not defined.

#### *Before proning*

It is more practicable to site the NG tube after intubation if the patient didn't have one before. Chest x-ray done for the general imaging can also utilized to confirm position of NG tube. NG feeding should be stopped and tube aspirated 1 hour prior to proning as there have been witnessed episodes of emesis and aspiration particularly when transitioning from the supine to prone position and back.

#### *Before restarting feeds*

Recheck for NG tube position before commencing to feed as changing the position is known to cause the tube to move. Bed should be in reverse Trendelenburg position of 30 degrees to minimize passive regurgitation.

#### *Feeding in the prone position*

Continuous feeding is the best mode to use compared to bolus feeding. The feeding shouldn't increased more than 60-85 ml/hour to avoid inducing enteral feeding intolerance. GRV should be measured as per protocol every 4-6 hours.

#### *Managing feed intolerance*

If no contraindications, recognized feed intolerances should be commenced on erythromycin as the first line prokinetic of choice. Second line prokinetic agent can then be added as needed if no response is seen in 24-48 hours. Clinicians should be vigilant for the possibility of prolonged QT intervals and arrhythmias especially during prolonged periods of use. Post pyloric feeding should be considered if no improvement is seen with prokinetics. Parenteral nutrition can also be considered after 72 hours if enteral nutrition intolerance continues despite all the suggested measures above to mitigate it.

#### *Before deproning*

Feeding should be stopped one hour prior to changing the position. The gastric contents should again be aspirated.

#### *Once deproned*

NG tube position should be checked prior to recommencing the feeding as per local protocol.

### Conclusion

It is best practice to continue enteral nutrition in patients ventilated in prone position especially where the patients are likely to spend significant periods of time in prone position and are critically unwell. Prokinetics should be utilised in cases where GRV is recognised to be high. Post pyloric feeding should be initiated for those who continue to have enteric nutrition intolerance despite prokinetics. Parenteral nutrition should be considered as the last option.

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