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Oral intake evaluation in patients following critical illness: An ICU cohort study

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Abstract

Background and problem: Timely and adequate nutrition improves health outcomes for the critically ill patient. Despite clinical guidelines recommending early oral nutrition, survivors of critical illness experience significant nutritional deficits.

Aim: Evaluate the oral nutrition intake in ICU patients who have experienced recent critical illness.

Design: An ICU cohort study.

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Methods: The oral nutrition intake of a convenience sample of ICU patients' post-critical illness was observed during a one-month period. Data pertaining to both the amount of oral nutrition intake and factors impacting on optimal oral nutrition intake were collected and analysed.

Results: Inadequate oral intake was identified in 62% of the 79 patients assessed ($n = 49$). This was noted early in the ICU stay around day 1-2 for most of the patients. A significant proportion (25%) of patients remained with poor oral intake that persisted beyond ICU day 5. Unsurprisingly these were the patients that had longer ICU stays. Critical illness weakness was a factor in poor oral intake.

Conclusions: Patients who have experienced critical illness also experience sub-optimal oral nutrition. The three key factors that were identified as impacting on optimal oral nutrition were early removal of nasogastric tubes, critical illness weakness, and poor appetite post-critical illness.

Relevance to clinical practice: Seven key recommendations are made based on this cohort study. These recommendations relate to patient assessment, monitoring, documentation, and future guidelines. Future research opportunities are highlighted, including the investigation of strategies to improve the transition of patients' post-critical illness to oral nutrition.

Key words: oral nutrition, critical care, critical illness.

Background and Problem

Iatrogenic malnutrition remains a problem in hospitals despite years of attention (e.g., "The Skeleton in the Hospital Closet"; Butterworth, 1974). Timely and adequate nutrition improves both short-term and long-term outcomes for critically ill people (Yeh et al., 2016). Malnutrition is independently associated with poorer clinical outcomes in ICU, such as, increased infections (Lew et al., 2017). Guidelines for clinical nutrition suggest early oral nutrition as the preferred mode (e.g., Weimann et al., 2017). Despite these recommendations, research indicates that survivors of critical illness and ICU experience significant nutritional deficits (Peterson et al., 2010, Peterson et al., 2011). In Australia and New Zealand (NZ), the Australasian Nutrition Care Day Survey found in 56 hospitals, 32% of the 3122 participants were malnourished and 23% consumed less than 25% of the food offered (Agarwal et al., 2013). Strategies to improve this nutritional intake are of variable success, for example, protected mealtimes (Porter et al., 2017a, Porter et al., 2017b) and mealtime assistants (Roberts et al., 2014). Furthermore, nutritional guidelines are not necessarily reflected in rehabilitation care pathways for post-ICU patients (Merriweather et al., 2014), with patients experiencing persistent energy and protein deficits which may be pre-existing (Mogensen et al., 2017) and extend throughout their hospitalisation (Chapple et al., 2016). Nor are the recommended dietary intakes reflected in oral hospital diets (e.g., Moreira et al., 2014). Anecdotal evidence from the dietitian in the local ICU suggested patients, particularly the chronically critically ill, were experiencing inadequate oral food intake throughout their in-hospital rehabilitation. This observation provided the impetus for the inception of this project.

There are many factors that affect the chronically critically ill patients' nutritional intake following extubation, decannulation, and discontinuation of enteral nutrition. These factors were identified by

Merriweather et al. (2016) as both physiological and psychological, for example, appetite, taste, satiety, pain, sleeping patterns, anxiety, low mood, social isolation, and routine changes. Naithani et al. (2008) also found physical barriers such as patients' inability to lift cutlery or feed themselves in busy wards with limited staff to help was a barrier to oral intake. Whilst Naithani et al.'s study is almost ten years old, anecdotally at a local level, physical barriers remain a significant issue.

Aim

The aim of this ICU service evaluation was to observe oral food intake in a wide variety of extubated, critically ill patients to understand potential antecedents to optimal oral nutritional intake in this population. Specifically, the study sought to capture a wide variety of information regarding patients' oral intake during their ICU stay and post-ICU discharge.

Context

The context for this service evaluation is an 18-bed general ICU in an NZ tertiary-level hospital. The ICU population includes both adults and paediatrics from a variety of specialities including neurosurgery, cardiothoracic surgery, complex medical and general surgery. The senior ICU nursing team is responsible for several key portfolios; one being 'quality and audit'. The quality and audit portfolio incorporates a system of audit and feedback to highlight opportunities to improve the quality of care. These opportunities subsequently inform quality improvement projects to enhance and optimise patient outcomes.

Methods

The convenience sample included adult ICU patients admitted in the month of June 2017, who were over the age of 16, extubated, and with no contraindications to taking an oral diet. To capture the antecedents to oral intake in the sample, three key areas of data collection occurred. Firstly, the ICU dietitian assessed all patients' food charts for the quantity of food eaten and whether any oral nutritional supplements (e.g., Fortisip™) were offered. Secondly, where less than three meals per day had been documented on the food chart, the patient's primary nurse was consulted and an estimation made regarding the likelihood that a normal intake would be reached within either two days post-extubation or their first ICU day. Thirdly, any barriers to optimal oral nutrition being achieved were documented.

Data collection forms were completed by two of the ICU nursing team, drawing data from the included patients' food charts and patient notes. The additional data collected included patient diagnoses, admission and discharge dates, date extubated or decannulated, and any enteral nutrition at any time in the ICU, and the patients' ability to independently feed themselves. Once data had been collected, a definition for 'adequate oral intake' was sought from the literature (e.g., Peterson et al., 2010) and then through expert consensus (e.g., ICU dietitian, local ICU nursing nutrition champion, and an Associate Charge Nurse Manager). Data were then analysed for the volume of oral nutritional intake and potential factors that may have impacted intake.

Ethical considerations

The service evaluation was registered within the local quality and research team at the hospital. Permission was requested from the patient at the bedside where possible and the patient's

attending nurse. According to local policy, ethical approval was not required for this non-interventional evaluation project (Capital and Coast District Health Board, 2016). Only data required for the service evaluation aims, the patient's admission date, and reason for admission was collated using the data collection tools. No other patient identifiers were recorded nor reported, and there are no conflicts of interest to report.

Results

Overall there were 84 patients assessed however, five patients were excluded due to inadequate documentation. Thus, 79 patients were included in the final analysis. Most patients presented as acute admissions (68%, $n = 54$) and elective admissions made up the remaining 32% ($n = 25$). However, the largest patient admission diagnosis was those post-cardiothoracic surgery ($n = 20$), followed by sepsis ($n = 12$), primary respiratory conditions ($n = 8$), other elective surgery ($n = 7$), neurology/neurosurgery ($n = 7$), other medical ($n = 6$), overdose ($n = 5$), and vascular ($n = 3$). A summary of this recruitment is illustrated in Figure 1.

Figure 1 goes here

Assessment of oral intake

The literature review and expert consensus defined adequate food intake as greater than 2/3 of all meals taken on a standard menu. Based on this definition, two groups were identified; those with adequate oral intake, and those with inadequate oral intake. Oral intake was quantified by considering the amount of each meal consumed from a standard menu per day and then assessed by both the project lead and ICU dietitian. A significant proportion of food charts returned were completed on days 0-5 ICU stay ($n=111$). This reflected the relatively low acuity of patients in the unit with a short ICU stay. The remaining food charts were assessed on day 6, 7 ($n = 5$), 8-14 days ($n = 3$), 15-21 days ($n = 3$), and > 22 days ($n = 10$).

Of the 79 patients included in our analysis, 38% of patients were assessed as having an adequate oral intake (see Figure 1). Commonly these patients were uncomplicated, with short ICU stays (less than 4 days) and of lower acuity, prior to transfer to the ward. These patients had a mixture of medical and surgical diagnoses. The remaining 62% of the patients were assessed as having an inadequate oral intake. These patients had a similar mix of medical and surgical diagnoses, with cardiothoracic surgery being the largest cohort ($n = 15$). Given they are also the largest group of elective patients in the local ICU, this is not surprising. When this group of patients were analysed more closely, the majority were in ICU only 1-2 days, likely reflecting lower acuity patients who progressed along an uncomplicated clinical trajectory.

Discussion and review of the literature

Extent of nutritional deficit

Although we defined inadequate oral intake as less than 2/3 of a standard menu per day, the majority (60%) of patients did not reach 1/3 of meals on a standard menu at the time of assessment, and 37 % reached only 1/3 to 2/3rds of all meals on a standard menu. This finding represents a significant energy, and nutritional deficit. Additionally, oral supplements (e.g., EnsureTM, FortisipTM, RenilonTM) were offered to only 32% patients taking an inadequate diet ($n = 16$). This finding

represents a potential missed opportunity to improve intake by supplementing the oral diet and is a significant factor already highlighted in the literature (Merriweather et al., 2014, Merriweather et al., 2016).

When we analysed the food charts in relation to ICU stay we had captured the majority of patients early, with 71% of food charts completed on ICU days 0-5 ($n = 88$). Given the physiological effects of acute illness on appetite suppression, one possible reason for poor oral intake was secondary to this. Intubation and mechanical ventilation did not appear to be a factor in poor oral intake in those with short ICU stays (<5 days). The majority were never intubated (43%), with 28% who were extubated on day 0 of their ICU stay. Eleven percent were extubated on day 1 with the remainder; 6% extubated day 2, 4% day 3, 2% day 4, and 6% day >7.

Of concern, there was a subset of patients that continued to have poor oral intake beyond five days in ICU. In total, there were nine patients with an ICU stay of > 5 days who fall into the category of the long-term patient. Their length of stay ranged from 6-23 days. Twenty-five percent of patients taking an inadequate diet were classified as long term in comparison to only 13% ($n = 4$) of long term patients classified as taking an adequate diet.

Seventeen food charts were assessed in these long-term patients. Two patients with an extended ICU stay (21 & 26 days) were followed up on the ward. These two patients were the original patients identified as potentially high risk of inadequate nutrition, and were the impetus of this cohort study. Their food charts assessed on days 21-34 showed prolonged poor oral intake which persisted well into their rehabilitation period up to discharge from the tertiary hospital. One patient with pancreatitis consistently failed to take adequate nutrition despite being offered a full diet. The patient was delivered nasogastric nutrition overnight in ICU and then on the ward to supplement nutritional intake. This patient was not included in this analysis (but was included in initial data collection) because their poor oral intake was managed by recommencing enteral nutrition. Notably, only one long term patient had oral intake supplemented with enteral nutrition. A summary of key findings related to the oral nutrition intake for this long-term patient group is provided in Table 1.

Table 1 goes here

Whilst most of the long-term patients are transferred to the ward with enteral nutrition, this highlighted the potential for a small group of patients who remain at risk for ongoing poor nutrition. This patient group includes those patients who do not have nasogastric tubes (NGT). One issue evident was the removal of the nasogastric tube after extubation or decannulation may be too early. The perception that appetite and oral intake will suddenly improve once enteral nutrition (EN) is ceased, is disputed both anecdotally and in the literature (Stratton et al., 2003).

Ability to independently feed

Anecdotally, the ability to independently feed oneself is considered a significant factor in influencing oral intake for patients following ICU discharge. This did appear to be a common factor with 26% of patients physically unable to feed themselves secondary to either critical illness polyneuropathy and/or neurological deficits (e.g., a reduced level of consciousness). The potential impact of these deficits may have been the reduction of both the patients' ability and desire to feed themselves. This

finding suggests critical illness weakness and/or neurological deficits may be a significant factor in poor oral intake in the period after critical illness.

To summarise, firstly, 62% of patients (49/79) were identified as having inadequate oral intake, and this was noted early in the ICU stay around day 1-2 for most of the patients. Aside from the two patients who were followed up post-ICU transfer to the ward, it is unknown if the remaining patients continued to have poor intake beyond this as the current project was principally focussed in an ICU. However, given the short ICU stay for most patients, the patients assessed were relatively uncomplicated and of lower acuity. Secondly, a significant proportion (25%) of patients remained with poor oral intake that persisted beyond day five. Unsurprisingly these were the patients that had longer ICU stays. Finally, long term patients do not eat enough to support rehabilitation needs and they are at risk of poor nutrition at a time when they need it the most. One possibility is because the NGT is removed too early, especially when the patients are too weak to feed themselves.

Discussing these findings considering the literature is a challenge due to the paucity of both primary research and clinical guidelines focusing on oral nutrition and the transition from enteral nutrition in the critically ill patient. For example, a systematic search of the literature identified just two primary studies related to the oral nutrition intake of ICU patients (Peterson, 2010; Pryor, 2016). Neither of these two studies focused on the transition from EN to oral nutrition, nor the criteria of removal of nasogastric tubes. Peterson (2010) found the average daily energy and protein intake failed to exceed 50% of daily requirements on all seven days for the entire population. Two key barriers to oral intake were identified, “no appetite” and nausea/vomiting. Pryor’s (2016) retrospective review of 126 patients who had received an acute tracheostomy identified that 86% returned to oral intake. Unsurprisingly, increased time to commencing oral intake was correlated with increased time to decannulation. A second systematic search of the literature exploring the timing of when to remove a naso- or oro-gastric tube returned no primary research studies. Similarly, of the three clinical practice enteral nutrition guidelines identified (McClave et al., 2016, Critical Care Nutrition, 2015, Kreymann et al., 2006) none contained recommendations related to the transition from EN to oral nutrition, nor the criteria for removal of nasogastric tubes. Given the lack of research and clinical practice guidelines related to the transition of ICU patients from enteral to oral nutrition, we now highlight opportunities for both service improvement and future research.

Opportunities for future service improvement and research:

Firstly, we suggest the addition of a section on “Transition to oral nutrition” to existing enteral nutrition guidelines. Included in this section may be seven key focal points that are now outlined:

1. Assess whether the patient is neurologically and physically able to feed themselves.
2. For a patient with significant critical illness weakness, consider delaying NGT removal until a minimum standard of oral intake is achieved.
3. Closely monitor a patient’s oral intake after decannulation or extubation, particularly for those most at risk patients.
4. Clearly document oral intake and assessment of nutritional status. For example, weight-based food records are considered gold-standard (Chapple et al., 2017).
5. Develop clearer guidelines related to the timing of NGT removal attending to the important barriers to feeding oneself.

6. Collaborate closely with the ICU dietitian in the assessment of readiness for NGT removal.
7. Develop clearer processes related to the timing and administration of oral nutrition supplements.

There are also considerable opportunities for future research in this area. For example, investigate strategies to improve the transition of patients from enteral nutrition to oral nutrition, and investigate interprofessional approaches to reducing the barriers to oral nutrition intake in the patient who is post-critical illness. We also made the assumption that the oral nutrition offered to patients was both palatable and appropriate. The appropriateness and acceptability of oral nutrition, and the associated implications for patients' oral nutrition intake are a further opportunity for future investigation.

Limitations of project

Limitations of this project include, firstly, the incomplete data collected from food charts, as the documentation of patient's oral nutritional intake was poor. Secondly, data was collected on a small cohort of patients, including both patients following cardiac surgery and also those classified as long term. Consequentially, the results are skewed and this is a limitation to the conclusions drawn. Although results were reported locally through quality improvement communication networks, the method of this project reduces the opportunity for generalisability of the findings. Thirdly, there was limited data to inform the length of time it took for patients to regain full diet as patients were not tracked all the way through their hospital journey, again, limiting the potential to analyse this aspect of the patients transition to oral nutrition.

Conclusion

Nurses are strongly positioned to positively influence patient care at a local level through quality improvement strategies (e.g., see Sutton and Jarden, 2016, Jarden and Sutton, 2014, Jarden and Quirke, 2010). This study highlights significant opportunity to enhance the provision of oral nutrition at a local level, both in an ICU and post-ICU. Integrating the assessment of outcomes into routine practice, and agreeing on the appropriate measures and timing of measures are proposed as essential for a positive and sustained impact on survivors (Aitken and Marshall, 2015). This project highlights further research opportunity to integrate appropriate measures in the transition to oral nutrition after critical illness. Seeking potential quality improvement strategies to improve oral nutrition provision to this unique and vulnerable population is an important next step. Research in this area is beginning to build, for example, family-centred interventions are being explored from a feasibility perspective (Marshall et al., 2016, Marshall et al., 2017). For example, Marshall et al. (2017) proposed that a family complete a nutrition diary once patients had resumed an oral intake. As these authors recommend, rigorous research is needed to evaluate the impact of such interventions. This project highlights seven key areas to consider in future practice guidelines when working with patients transitioning to oral nutrition. Whilst the generalisability of this cohort study is low, the potential for future practice improvements based on the insights gained remains high. Both the recommendations and suggestions for future research provide significant opportunity to improve nursing care for the patient post-critical illness.

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What is known about this topic

- Iatrogenic malnutrition remains a problem in hospital despite years of attention
- Timely and adequate nutrition improves both short-term and long-term outcomes for critically ill people
- Malnutrition is independently associated with poorer clinical outcomes in ICU, for example, increased infections
- Guidelines for clinical nutrition suggest early oral nutrition as the preferred mode
- Despite recommendations, research indicates that survivors of critical illness and ICU experience significant nutritional deficits

What this paper adds

- Patients in this cohort study who have experienced critical illness also experience sub-optimal oral nutrition.
- The three key factors that were identified as impacting on optimal oral nutrition were early removal of nasogastric tubes, critical illness weakness, and poor appetite post-critical illness.
- Seven opportunities for service improvement are made based on this cohort study. These recommendations relate to the four key areas of patient assessment, monitoring, documentation, and future guidelines.
- Future research opportunities are highlighted, including the investigation of strategies to improve the transition of patients' post-critical illness to oral nutrition.

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Figure 1. Flowchart of cohort study procedure.

Table 1. Long term patient oral nutrition summary

ICU length of stay	Extubation/decannulation summary	Oral feeding summary	Issues noted
26 days	Decannulated ICU day 24 and NGT was removed.	Assessed on day 27-34 (1-week post ICU discharge). Only taking a few spoonfuls of a standard meal per day. Offered Fortisip™ & high protein milkshakes 1-2 a day. By day 34 this patient had reached ¼ to ½ of all portions of each meal. Discharged to rehabilitation services.	Persistent pain on swallowing and found eating challenging. Significant issues with critical illness weakness and could not feed independently.
21 days	Decannulated ICU day 20 and NGT was removed.	Assessed on day 21 to day 31. Only eating a few spoonfuls of each meal. On day 32 this patient was consuming half of all portions of a standard menu. Offered one Fortisip™ per day.	Significant issues with critical illness weakness and could not feed independently.
10 days	Extubated ICU day 0. NGT out day 7.	Assessed on days 9 and 10. Consistently eating <1/3 of each meal on a standard menu.	Concussion with low GCS and periods of agitation. NGT self-removed by patient ICU day 7. Not weak but reduced GCS motor response at times impairing coordination of eating.
7 days	Extubated ICU day 4. Never EN fed (no NGT).	Assessed on days 5, 6, 7. Eating <1/3 of all portions of each meal on a standard menu. By day 7 only reaching 1/3-2/3 of standard menu. No supplements offered/taken.	Unable to feed self independently due to weakness.
7 days	Extubated ICU day 4. NGT removed day 5.	Assessed on ICU days 5, 6, 7. Eating <1/3 each meal on a standard menu taken day 5 & 6 and eating 1/3 to 2/3 prior to discharge. No supplements offered.	Unable to feed self independently due to weakness.
5 days	Extubated ICU day 0 (only 4 hrs vent). Never EN fed (no NGT).	Assessed on ICU days 3, 4, 5. Eating <1/3 of each meal on a standard menu. No supplements offered.	Unknown if patient can feed independently.
5 days	Extubated ICU day 2. Never EN fed (no NGT).	Assessed on day 5 (only data available). Eating <1/3 of each meal on a standard menu. No supplements offered.	No weakness noted.
5 days	Extubated ICU day 0. Never EN fed (No NGT).	No oral intake consumed for the entire ICU stay.	Discharged to ward. Swallow assessed by Speech Language Therapist and NGT inserted for feeding on the ward. Unable to feed self independently.

Note. ICU = Intensive Care Unit; GCS = Glasgow Coma Score; NGT = Nasogastric tube; EN = Enteral nutrition.

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