Should we ACCEPT protocolised nutrition practice in the ICU?

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Potential conflicts

Gordon S. Doig

Relevant financial relationships with a commercial interest:

• **Fresenius Kabi**, Academic Research Grants (Past), Consultant and Speaker’s Honoraria (Current)

• **Baxter Healthcare**, Academic Research Grant (Current), Consultant and Speaker’s Honoraria (Current)

• **Nestle Healthcare**, Academic Research Grant (Current), Consultant and Speaker’s Honoraria (Current)
Overview

• Brief context and background
• Details of a protocol
• Results of a clinical trial
• Summary
The Critical Care Research Network: CCRNet
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“CCRNet is a voluntary alliance of Critical Care Units whose mission is to improve patient care and resource utilization through the development, execution and implementation of health services research protocols.”
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• in 2000, CCRNet included more than 54 hospitals across Ontario
• CCRNet has conducted numerous studies to understand care processes and improve patient outcomes
• member hospitals expressed an interest in understanding nutritional support in early 1990’s


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Structured literature review to find out ‘what we should be doing’
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- the majority of studies demonstrating any benefit of nutrition therapy were performed in severe trauma patients
- there was very little direct evidence to suggest that any form of nutritional therapy improved the outcomes of other groups of critically ill patients

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Structured literature review to find out ‘**what we should be doing**’

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Observational study to find out ‘**what we were doing**’

- nutrition therapy was started *much later* than the literature indicated
- EN was frequently stopped due to:
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Observational study to find out ‘what we were doing’

• nutrition therapy was started much later than the literature indicated

• EN was frequently stopped due to:
  • “diarrhea”
  • patient had a procedure, and forgot to restart

Structured literature search to find out ‘what we should be doing’

Observational study to find out ‘what we were doing’

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Observational study to find out ‘what we were doing’

• identified an evidence-practice gap

Structured literature search to find out ‘what we should be doing’

Observational study to find out ‘what we were doing’

• identified an evidence-practice gap

A formal study to find out if improving nutrition therapy resulted in improved patient outcomes was initiated.


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14 teaching and community hospital ICUs were contacted and invited to participate

all participants were members of CCRNet

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  • data on baseline feeding practice was collected for 16 weeks (run-in phase)
  • mid-way through this run-in period, hospitals were randomized to remain as control hospitals or to improve practice
    • practice was improved by the active implementation of an evidence-based guideline
  • participants from hospitals randomized to the improve practice were invited to participate in an evidence-based guideline development conference

Guideline development conference


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Guideline development conference

- an extensive literature search was conducted
  - MEDLINE and EMBASE were searched for controlled trials and overviews of nutritional support (EN and TPN) in critically ill or intensive care patients
  - reference lists of retrieved articles were hand searched for additional articles
  - experts were contacted and asked to search personal files

Guideline development conference

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- evidence was appraised and graded by a content area expert methodologist


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- appraisal results were circulated to participants prior to the conference.

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- evidence was appraised and graded by a content area expert methodologist
- appraisal results were circulated to participants prior to the conference.
- participants used formal Levels of Evidence to determine guideline recommendations.
- a modified Delphi approach was used to obtain consensus where no evidence existed but a recommendation was still required.


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Applies to all patients expected to remain in the ICU at least 3 days

A

At ICU admission: Should this patient be fed?

Yes

Can EN be started within 24 hours?

No

Acceptable conditions:
- Tolerating adequate oral diet
- < 24 h to oral intake
- Palliative care

Yes

Gastric challenge: Use full-strength concentration
Consider prokinetic with challenge
Goal: at least 80% of requirements at 72 h
Assess q12h

Is progression on target to reach at least 80% by 72 h?

No

Acceptable conditions:
- Acute pancreatitis*
- Enteric anastomosis*
- Ischemic bowel
- Enteric fistula
- Imminent bowel resection
- Imminent endoscopy
- Bowel obstruction
- High nasogastric losses
- Severe exacerbation of inflammatory bowel disease

*May still opt for elemental enteral feeding

Yes

Use prokinetic
Use postpyloric tube

Increase rate to 100% of requirements

Is goal met?

No

Begin TPN
Reassess q12h for EN eligibility

Yes

Continue EN to maximum tolerated
Supplement with PN
Continue EN challenges q12h

Applies to all patients expected to remain in the ICU at least 3 days

Applies to all patients expected to remain in the ICU at least 3 days

Applies to all patients expected to remain in the ICU at least 3 days.


*Clinically significant stools:
- Liquid stools > 300 mL/d or
- > 4 loose stools per day or
- Risk of contamination of wounds or catheters

†Medications that commonly cause diarrhea:
- Metoclopramide
- Quinidine
- Xylitol
- Magnesium
- Erythromycin
- Aminophylline
- Sorbitol
- Phosphorus

Is diarrhea present?

  - Yes
    - Is stool clinically significant? *
      - Yes
        - Continue same enteral feeding
      - No
        - Are medications† the possible cause?
          - Yes
            - Change medications, feed to tolerance
          - No
            - Consider elemental formulation
              - Is the patient receiving antibiotics?
                - Yes
                  - Check stool for C. difficile toxin, feed to tolerance
                - No
                  - Inflammatory bowel disease
                    - *May still opt for elemental enteral feeding
                      - Begin TPN
                        - Reassess q12h for EN eligibility

  - No
    - Continue same enteral feeding

Is the diarrhea resolved?

  - Yes
    - Advance to goal rate as tolerance improves
  - No
    - Decrease rate until tolerance achieved

Consider elemental formulation

Is the patient receiving antibiotics?

- Are medications† the possible cause?
  - Yes
    - Change medications, feed to tolerance
  - No
    - Consider elemental formulation
Applies to all patients expected to remain in the ICU at least 3 days


B

Is diarrhea present?

Yes

Is stool clinically significant? *

Yes

Are medications† the possible cause?

Yes

Change medications, feed to tolerance

No

No

Is the patient receiving antibiotics?

Yes

Check stool for C. difficile toxin, feed to tolerance

No

Consider elemental formulation

C

Assess gastrointestinal tolerance to tube feeding q4h

Intolerant patients have:

- Clinically significant stools or
- Readily apparent abdominal distension or
- Increased abdominal girth or
- Multiple emetic episodes or
- Clinically detected aspiration or
- Gastric residuals > 200 mL for nasogastric feeds

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All patients expected to remain in the ICU at least three days:

- At time of ICU admission, asked whether the patient was expected to be ‘discharged tomorrow’.


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Baseline outcomes (before practice change)

Guideline development conference

randomization

14 ICUs

Baseline run-in (16 weeks)

Study Outcomes (7 ICUs)

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## Baseline outcomes (before practice change)

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<tbody>
<tr>
<td>Patients enrolled</td>
<td>403</td>
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</tr>
<tr>
<td>Age (years)</td>
<td>65.1</td>
<td>65.1</td>
</tr>
<tr>
<td>Admission APACHE II</td>
<td>20.6</td>
<td>19.9</td>
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**Primary outcomes**

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<tr>
<td>Hospital Mortality</td>
<td>33%</td>
<td>31%</td>
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<tr>
<td>ICU LOS (days)</td>
<td>13.6</td>
<td>10.0</td>
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<td>Hospital LOS (days)</td>
<td>30.8</td>
<td>28</td>
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Percent of patients with LOS greater than 2 days who were enrolled*

*At screening, some patients were expected to be ‘discharged tomorrow’, but were not. These patients stayed longer than 2 days, but were not enrolled.

Randomized results

Guideline development conference

Baseline run-in (16 weeks)

14 ICUs

randomization

Study Outcomes (7 ICUs)

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## Randomized results: balance

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Percent of patients with LOS greater than 2 days who were enrolled*

83%  
82%

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<td>24%</td>
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<td>ICU LOS (days)</td>
<td>11.7</td>
<td>10.8</td>
<td>0.65</td>
</tr>
<tr>
<td>Hospital LOS (days)</td>
<td>34.3</td>
<td>25.4</td>
<td>0.006</td>
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Percent of patients with LOS greater than 2 days who were enrolled*

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Mortality by subgroup

Favours control

Favours Guideline

All patients n=492
Medical Admit n=132
Emerg Dept Admit n=150
Surgical Admit n=147
Emergent Sx n=81
Elective Sx n=66
From other hospital n=39
From other ICU n=15

Absolute Risk Reduction for Mortality with 95% confidence interval (test based), accounting for clustering
Active implementation of our evidence-based guideline for nutrition therapy in critical illness resulted in improvements in clinical practice:


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Summary

Active implementation of our evidence-based guideline for nutrition therapy in critical illness resulted in improvements in clinical practice:

• provided EN earlier
• provided EN on more days whilst in the ICU

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Active implementation of our evidence-based guideline for nutrition therapy in critical illness resulted in improvements in clinical practice:

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Evidence supporting benefits from early EN convinced clinicians to start EN earlier.

A practical algorithm for the management of tube feeding associated diarrhoea contributed towards the ability to provide EN on more days whilst in the ICU.

These improvements in clinical practice translated to:

- Reduced mortality
- Reduced hospital stay


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Applies to all patients expected to remain in the ICU at least 3 days

A

At ICU admission: Should this patient be fed?

Yes

Can EN be started within 24 hours?

No

Acceptable conditions:
- Tolerating adequate oral diet
- < 24 h to oral intake
- Palliative care

Yes

Gastric challenge: Use full-strength concentration
Consider prokinetic with challenge
Goal: at least 80% of requirements at 72 h
Assess q12h

Is progression on target to reach at least 80% by 72 h?

No

Acceptable conditions:
- Acute pancreatitis*
- Enteric anastomosis*
- Ischemic bowel
- Enteric fistula
- Imminent bowel resection
- Imminent endoscopy
- Bowel obstruction
- High nasogastric losses
- Severe exacerbation of inflammatory bowel disease
*May still opt for elemental enteral feeding

Yes

- Use prokinetic
- Use postpyloric tube

Increase rate to 100% of requirements

Is goal met?

Yes

- Continue EN to maximum tolerated
- Supplement with PN
- Continue EN challenges q12h

No

Begin TPN
Reassess q12h for EN eligibility
Applies to all patients expected to remain in the ICU at least 3 days

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Increase rate to 100% of requirements

Is goal met?

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- Supplement with PN
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Applies to all patients expected to remain in the ICU at least 3 days

Excessive vomiting or high losses (>1 to 2 L per day) via gastric tube on free drainage due to obstruction etc.

Applies to all patients expected to remain in the ICU at least 3 days

Applies to all patients expected to remain in the ICU at least 3 days

At ICU admission: Should this patient be fed?
- Yes
  - Can EN be started within 24 hours?
    - Yes
      - Gastric challenge: Use full-strength concentration
        Consider prokinetic with challenge
        Goal: at least 80% of requirements at 72 h
        Assess q12h
        - Is progression on target to reach at least 80% by 72 h?
          - Yes
            - Use prokinetic
            - Use postpyloric tube
            - Increase rate to 100% of requirements
            - Is goal met?
              - Yes
              - No
                - Continue EN to maximum tolerated
                - Supplement with PN
                - Continue EN challenges q12h
          - No
            - Reassess q12h for EN eligibility
    - No
      - Acceptable conditions:
        - Tolerating adequate oral diet
        - < 24 h to oral intake
        - Palliative care

- No
  - Acceptable conditions:
    - Acute pancreatitis*
    - Enteric anastomosis*
    - Ischemic bowel
    - Enteric fistula
    - Imminent bowel resection
    - Imminent endoscopy
    - Bowel obstruction
    - High nasogastric losses
    - Severe exacerbation of inflammatory bowel disease
    - *May still opt for elemental enteral feeding
  - Begin TPN
  - Reassess q12h for EN eligibility

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No

Begin TPN
Reassess q12h for EN eligibility

Acceptable conditions:
- Continue EN to maximum tolerated
- Supplement with PN
- Continue EN challenges q12h

Immediately after resuscitation:

Stable shock can be defined as:

Shock Index $\leq 1$ (heart rate $\div$ systolic blood pressure = Shock Index)

or

Systolic blood pressure $> 90$ mmHg or mean blood pressure $> 70$ mmHg for at least one hour.

Applies to all patients expected to remain in the ICU at least 3 days

A

At ICU admission:
Should this patient be fed?

Yes

No

Can EN be started within 24 hours?

Yes

Gastric challenge: Use full-strength concentration
Consider prokinetic with challenge
Goal: at least 80% of requirements at 72 h
Assess q12h

Is progression on target to reach at least 80% by 72 h?

Yes

Use prokinetic
Use post pyloric tube

Increase rate to 100% of requirements

Is goal met?

Yes

No

Acceptable conditions:
- Tolerating adequate oral diet
- < 24 h to oral intake
- Palliative care

Acceptable conditions:
- Acute pancreatitis*
- Enteric anastomosis*
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- Enteric fistula
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• Supplement with PN
• Continue EN challenges q12h

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Begin TPN
Reassess q12h for EN eligibility

Yes

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Consider prokinetic with challenge
Goal: at least 80% of requirements at 72 h
Assess q12h

Yes

Is progression on target to reach at least 80% by 72 h?

Yes

Use prokinetic
Use postpyloric tube

Increase rate to 100% of requirements

Is goal met?

Yes

No

Continue EN to maximum tolerated
Supplement with PN

Continue EN challenges q12h

Applies to all patients expected to remain in the ICU at least 3 days

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At ICU admission: Should this patient be fed?

Yes

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No

Gastric challenge: Use full-strength concentration
Consider prokinetic with challenge
Goal: at least 80% of requirements at 72 h
Assess q12h

Is progression on target to reach at least 80% by 72 h?

No

Yes

- Use prokinetic
- Use postpyloric tube

Increase rate to 100% of requirements

Is goal met?

Yes

No

C

Assess gastrointestinal tolerance to tube feeding q4h

Intolerant patients have:
- Clinically significant stools or
- Readily apparent abdominal distension or
- Increased abdominal girth or
- Multiple emetic episodes or
- Clinically detected aspiration or
- Gastric residuals > 200 mL for nasogastric feeds

Begin TPN
Reassess q12h for EN eligibility

- Continue EN to maximum tolerated supplement with PN
- Continue EN challenges q12h
Applies to all patients expected to remain in the ICU at least 3 days

A

At ICU admission: Should this patient be fed?
  Yes
  Can EN be started within 24 hours?
    Yes
    Gastric challenge: Use full-strength concentration
    Consider prokinetic with challenge
    Goal: at least 80% of requirements at 72 h
    Assess q12h
    Is progression on target to reach at least 80% by 72 h?
      Yes
      • Use prokinetic
      • Use postpyloric tube
      • Increase rate to 100% of requirements
      Is goal met?
        Yes
        • Continue EN to maximum tolerated
        • Supplement with PN
        • Continue EN challenges q12h
        No
        Begin TPN
        Reassess q12h for EN eligibility
    No
  No

B

C

Assess gastrointestinal tolerance to tube feeding q4h

Intolerant patients have:
• Clinically significant stools or
• Readily apparent abdominal distension or
• Increased abdominal girth or
• Multiple emetic episodes or
• Clinically detected aspiration or
• Gastric residuals > 200 ml for nasogastric feeds

> 500 ml

Applies to all patients expected to remain in the ICU at least 3 days

> 500 ml
Applies to all patients expected to remain in the ICU at least 3 days

### A

**At ICU admission:** Should this patient be fed?
- **No**
  - **Can EN be started within 24 hours?**
    - **Yes**
      - **Gastric challenge:** Use full-strength concentration. Consider prokinetic with challenge. Goal: at least 80% of requirements at 72 h. Assess q12h.
      - **Is progression on target to reach at least 80% by 72 h?**
        - **Yes**
          - Use prokinetic. Use postpyloric tube.
          - Increase rate to 100% of requirements.
          - **Is goal met?**
            - **Yes**
              - Continue EN to maximum tolerated.
              - Supplement with PN.
            - **No**
              - Continue EN challenges q12h.
        - **No**
          - **Clinically significant stools or:**
            - Readily apparent abdominal distension or
            - Increased abdominal girth or
            - Multiple emetic episodes or
            - Clinically detected aspiration or
            - Gastric residuals > 500 ml for nasogastric feeds

### C

**Assess gastrointestinal tolerance to tube feeding q4h**

**Intolerant patients have:**
- **Clinically significant stools or**
- Readily apparent abdominal distension or
- Increased abdominal girth or
- Multiple emetic episodes or
- Clinically detected aspiration or
- Gastric residuals > 500 ml for nasogastric feeds

*Clinically significant stools:
  - Liquid stools > 300 mL/d or
  - > 4 loose stools per day or
  - Risk of contamination of wounds or catheters

---

Applies to all patients expected to remain in the ICU at least 3 days

If diarrhea present?

- Yes
  - Is stool clinically significant? *
    - Yes
      - Change medications, feed to tolerance
    - No
      - Are medications† the possible cause?
        - Yes
          - Change medications, feed to tolerance
        - No
          - Is the patient receiving antibiotics?
            - Yes
              - Check stool for *C. difficile* toxin, feed to tolerance
            - No
              - Consider elemental formulation

  - No
    - Continue same enteral feeding

- No
  - Is the diarrhea resolved?
    - Yes
      - Continue same enteral feeding
    - No
      - Decrease rate until tolerance achieved

  - No
    - Advance to goal rate as tolerance improves

**Intolerant patients have:**
- Clinically significant stools or
- Readily apparent abdominal distension or
- Increased abdominal girth or
- Multiple emetic episodes or
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- Gastric residuals > 500 ml for nasogastric feeds

*Clinically significant stools:
- Liquid stools > 300 mL/d or
- > 4 loose stools per day or
- Risk of contamination of wounds or catheters

**Continue EN to maximum tolerated**
- Supplement with PN

**Continue EN challenges q12h**

[Diagram of decision tree for gastrointestinal tolerance]

- **Is diarrhea present?**
  - Yes: Is stool clinically significant? * 
    - Yes: Change medications, feed to tolerance
    - No: Continue same enteral feeding
  - No: Continue same enteral feeding

- **Are medications† the possible cause?**
  - Yes: Check stool for *C. difficile* toxin, feed to tolerance
  - No: Consider elemental formulation

- **Is the patient receiving antibiotics?**
  - Yes: Continue same enteral feeding
  - No: Decrease rate until tolerance achieved

- **Is the diarrhea resolved?**
  - Yes: Continue same enteral feeding
  - No: Advance to goal rate as tolerance improves

**Assess gastrointestinal tolerance to tube feeding q4h**

Intolerant patients have:

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*Clinically significant stools:*
- Liquid stools > 300 mL/d or
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†Medications that commonly cause diarrhea:
- Metoclopramide
- Quinidine
- Xylitol
- Magnesium
- Erythromycin
- Aminophylline
- Sorbitol
- Phosphorus

> 500 ml
Applies to all patients expected to remain in the ICU at least 3 days

At ICU admission: Should this patient be fed?
  - Yes
  - No

Can EN be started within 24 hours?
  - Yes
  - No

Gastric challenge: Use full-strength concentration
  Consider prokinetic with challenge
  Goal: at least 80% of requirements at 72 h
  Assess q12h

Is progression on target to reach at least 80% by 72 h?
  - Yes
  - No

- Use prokinetic
- Use postpyloric tube

Increase rate to 100% of requirements

Is goal met?
  - Yes
  - No

Acceptable conditions:
  - Tolerating adequate oral diet
  - < 24 h to oral intake
  - Palliative care

Acceptable conditions:
  - Acute pancreatitis*
  - Enteric anastomosis*
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*May still opt for elemental enteral feeding

Begin TPN
Reassess q12h for EN eligibility

- Continue EN to maximum tolerated
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- Continue EN challenges q12h

Questions?