

NUTRITION SUPPORT COMPLICATIONS IN PATIENT WHO UNDERWENT CARDIAC SURGERY

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Summary

Background: The nutrition support complications after cardiac surgery should be detected and treated on time.

Aim: To show the incidence and type of nutritional support complication in patients after cardiac surgery.

Methods: The prospective study included 415 patients who underwent cardiac surgery between 2010 and 2013 in Clinic for Cardiovascular Disease of University Clinical Center Tuzla. Complications of the delivery system for nutrition support (NS) and nutrition itself were analyzed.

Results: The analysis showed that 95 (22.80%) patients received enteral nutrition (EN) and 47 (11.30%) total parenteral support (TPN). 41.54% patients who received EN had complications and 33.09% of those who received TPN had complications with no significant difference per support. The complications with highest incidence in group with EN were associated with gastrointestinal (GiT) tract dysfunction with diarrhea (14.04%) and high gastric residuals in (10.56%). The most significant complications in patients with TPN were hyperglycemia (16.90%) and catheter-related infection (11.97%). Complications in EN group were associated with commercial solutions ($p < 0.05$).

Conclusion: Complications of NS in Cardiac Surgery Intensive Care Unit are very frequent, diarrhea and hyperglycemia presenting the highest incidence. NS careful monitoring and strict protocols could decrease incidence of complications in patients underwent cardiac surgery and realize benefits of NS.

Keywords: nutrition support, enteral nutrition, parenteral nutrition, cardiac surgery, complications

Introduction

Complications of nutritional support and problems with the delivery system or the nutrition in cardiac surgery patients were studied. Many studies suggest that early metabolic support can improve the recovery patients after surgery (Fearon and Luff, 2003). Nutritional support guidelines recommend starting enteral nutrition early within 24 to 48 hours of Intensive Care Unit (ICU) admission, to reduce infectious complications and duration of hospitalization (Kattelman et al., 2006). The enteral route is generally favored over the parenteral. The importance of maintaining gut integrity is to reduce the translocation of bacteria from the gut because it is reduced risk of infections and sepsis (Macfie et al., 2006). Enteral nutrition is frequently associated with gastrointestinal tract dysfunction (Montejo, 1999). A major decision with enteral nutrition is the delivery method. Parenteral nutrition is used when the enteral route is unable to provide or sustain sufficient caloric intake. TPN is also indicated when the enteral route cannot provide enough nutrition (Kemper et al., 1992). In ICU patients this occurs because of diarrhea, vomiting, poor stomach emptying, feeding tube displacement and surgery (Nehra et al., 1999). The incidence of central venous catheter-related bloodstream infections ranges from 0.3 to 30 per 1000 catheter-days. Morbidity attributed to catheter-related infections is as high as 25% (Heyland et al., 2001).

Patients and methods

We investigated a total of 415 patients who had cardiac surgery between 2010 and 2013 in Clinic for Cardiovascular Disease of University Clinical Center Tuzla. Standard anesthetic protocol with central vena cava catheter (CVC) and arterial line for intensive monitoring was performed. After surgery all patients were admitted in ICU. We preferred nutritional support guidelines who recommend starting enteral nutrition early within 24 to 48 hours of ICU admission. 95 patients (66.90%) in ICU had enteral nutrition, and 47 (33.09%) patients had TPN. In EN group, patients who could not independently take the food, naso-gastric (NG) tube was placed. Every 3 hours patients were feeding with appropriate liquid-purred food, with prior aspiration of gastric contents. 17 (17.90%) patients in EN group received commercial solutions, and 78 (82.10%) patients received hospital non-commercial solutions. Solutions selection was random, depending on the availability of commercial preparations. Patients unable to tolerate enteral intake had total parenteral nutrition. We detected the number and type of complications in group patients with enteral nutrition and total parenteral nutrition. The patient's length of stay in ICU department was followed.

Definition of complications: according to the protocols implemented in our institution and the

clinical experience of the researchers, the following complications per type of NS were defined.

High gastric residual (HGR): residual with nutritional characteristics greater than 150 ml. **Diarrhea:** more than five stool movements of liquid consistency during a 24-hour period or two stools with a volume above 1000 cc/day. **Constipation:** patient who does not have a stool movement every three days once EN is started. **Abdominal distension** occurs when substances accumulate in the abdomen causing its outward expansion beyond the normal girth of the stomach and waist. **Regurgitation** is expulsion of material from mouth, pharynx or esophagus characterized by presence of food.

Parenteral nutritional support - Hyperglycemia (HG): if for every three values obtained during the day, at least two of these were greater than 8 mmol/L. **Catheter-related bloodstream infection (CRBSI)** is defined as the presence of bacteremia originating from an intravenous catheter. **Exit-site infection** is indicated by the presence of erythema, swelling, tenderness, and purulent drainage around the catheter exit and the part of the tunnel external to the cuff.

Thrombophlebitis was defined as an inflammation of the vein, and was recognized as warmth, erythema, swelling, tenderness, or a palpable venous cord.

The SPSS statistical software for statistical analysis Windows (SPSS, Chicago, IL, USA) was used for data analysis. Continuous variables were expressed as mean ± standard deviation (SD). Data were compared by the Wilcoxon signed -rank test so that value of p<0.05 was considered significant in all tests.

Results

The final population included 142 patients of which 97 (68.30%) were male and 45 (31.69%) were female. The mean age was 57.5±12.4 years. 95 patients (66.90%) in ICU had EN, and 47 (33.09%) patients had TPN. Of the total number of patients 67 had coronary artery bypass grafting, 45 valve replacement and 30 aortic aneurysm repairs. Table 1 describes the general characteristics of the study population per type of support, cardio surgical procedure and length of ICU stay (Table 1).

Table 1. Clinical data (p=0.04)

	n	Age	ICU stay<10(d)	ICU stay>10(d)	CABG	VR	AAR
EN	95	55±12	78 (82.10%)	17 (17.90%)	49	29	16
TPN	47	61±13	29 (61.70%)	18 (38.30%)	18	16	14
Overall	142	57±12	107	35	67	45	30

*CABG - Coronary Artery Bypass Grafting
VR - Valve Replacement
AAR - Aortic Aneurysm Repair*

The duration of the NS was on average 9±11 days with a minimum of 2 days and maximum of 29 days. The total of days for EN was 689 days and for TPN it was 408 days with significant difference ICU stay more than 10 days between TPN and EN patients (p=0.04).

41.54% patients who received enteral support had complications and 33.09% of those receiving TPN had complications with no significant difference per type of support. For the enteral nutrition the most significant complications were associated with gastrointestinal tract dysfunction (37.32%), then mechanical problems with

the feeding tubes, dislodgment into the esophagus and obstruction in 6.33% and overload in 4.22%. The incidence of gastrointestinal complications (37.32%) and were due to diarrhea (14.08%), high gastric residuals (10.56%), constipation in (4.92%), abdominal distension in (4.22%) and regurgitation in (3.52%). The results revealed significant difference in the incidence of the GiT complications per type of EN support. Subgroup of patients who received non-commercial solution had less complication than subgroup of patients with industrial commercial solutions (Table 2).

Table 2. Incidence of EN GiT complications (p=0.03)

	Type of EN support				Overall	
	Commercial sol.		Non-commercial sol.			
EN GiT complications	n	%	n	%	n	%
Diarrhea	18	12.67	2	1.40	20	14.08
High gastric residuals	10	7.04	5	3.52	15	10.56
Constipation	4	2.81	3	2.11	7	4.92
Abdominal distension	3	2.11	3	2.11	6	4.22
Regurgitation	3	2.11	2	1.40	5	3.52
	38	26.74	15	10.54	53	37.32

In TPN, the complication of greatest incidence was hyperglycemia 16.90%. Catheter related infections were the second with 11.97% incidence with 4.22% cases of skin site irritation central venous access. Infections were caused by *Acinetobacter baumani*, *Staphylococcus*

epidermidis, *Staphylococcus aureus* and *Candida albicans*. Peripheral venous access with a short peripheral venous catheter line result in thrombophlebitis in 6 (4.22%) TPN patients. We had no complication related to the placement of central venous access (Table 3).

Table 3. Incidence of TPN support complications

	N (patients)	%
Hyperglycemia	24	16.90
Catether related infections	17	11.97
CVP skin irritation	6	4.22
Thrombophlebitis	6	4.22

Discussion

A key question is whether nutritional support improves patient outcome, and whether it lowers mortality and mobility and reduces ICU and hospital lengths of stay (Heyland et al., 2001). In our study length of ICU stay patients with EN is shorter than patients with TPN. Enteral nutrition is frequently associated with gastrointestinal tract dysfunction. There is delayed gastric emptying in about 50% of mechanically ventilated patients (Montejo, 1999). Gastrointestinal complications enteral nutrition patients with incidence 41.54% we found. Most patients had diarrhea and high gastric residuals. Diarrhea is a particularly unpleasant (for patient and staff) complication of enteral nutrition. Its reported incidence, depending on its definition, ranges from 2% to 53% of patients. Fiber-containing formulations might reduce diarrhea, but not consistently (Yang et al., 2005). In a multicenter prospective study of 400 ICU patients fed mainly via nasogastric tubes, gastrointestinal complications occurred in 62.8% and were due to diarrhea (14.70%), constipation (15.70%), high gastric residuals (39%) (Montejo, 1999). Catheter-related infection was identified in 17 (11.97%) patients. *Staphylococcus epidermidis* in (23.50%) and *Acinetobacter baumani* in (47.13% cases) we found. According to some authors the incidence of central venous catheter-related bloodstream infections ranges from 0.3 to 30 per 1000 catheter-days and are most often caused by *Staphylococcus epidermidis* or *Staphylococcus aureus* or *Candida species*. Complications of catheter insertion include pneumothorax secondary to subclavian or internal jugular vein catheterization, hemothorax, brachial plexus injury, and catheter misplacement in the azygos vein, right ventricle, or retrograde into the jugular vein (Heidegger et al., 2007). We had no complication related to the

placement of central venous access. Incidence of skin site irritation central venous access was in 7 (4.92%) patients. Peripheral venous access with a short peripheral venous catheter line resulted in thrombophlebitis in 6 (4.22%) TPN patients. Hyperglycemia is a common problem, especially with severe stress, steroid use, and diabetes mellitus requiring treatment with insulin (Kemper et al., 1992). Hyperglycemia as a metabolic complication we detected in 24 (16.90%) TPN patients. In 7 (4.92%) TPN patients nutritional overload worsening of chronic heart failure. Excessive parenteral nutrition may lead to fluid overload, especially problematic with reduced cardiac or renal function (Heyland et al., 2001). Caring for cardio surgical patients in ICU requires that clinicians consider the consequences of the metabolic and inflammatory responses to injury and sepsis. Practical actions such as modulating the response itself (e.g., with epidural anesthesia) and modifying end-organ responses (e.g., β -adrenergic blockade), could prevent hyperglycemia and some NS complications. These interventions improve patient outcome and maintain NS beneficence (Nunnally, 2005; Koretz, 2007).

Conclusion

NS is followed with gastrointestinal, metabolic, infectious and metabolic complications. Most of them are described in Intensive Care Units. The usually complication of nutrition support in cardiac surgery ES patients were gastrointestinal tract dysfunction as diarrhea and high gastric residuals. The most common complications of the delivery system in patients with TPN were hyperglycemia, as a metabolic complication, and catheter-related infection. NS careful monitoring and strict protocols could decrease incidence of complications in patient's underwent cardiac surgery and realize benefits of NS.

List of abbreviations

AAR - Aortic Aneurysm Repair
CABG - Coronary Artery Bypass Grafting
CRBSI - Catheter-related bloodstream infection
CVC - vena cava catheter
EN - enteral nutrition
ETP - total parenteral support
GiT - gastrointestinal tract
HG - Hyperglycemia
HGR - High gastric residual
ICU - Intensive Care Unit
NG - naso-gastric
NS - nutritional support
SD - standard deviation
VR - Valve Replacement

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