Evidence-Based Immunonutrition to Help Promote Recovery in Surgical and Trauma Patients
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Introduction

Nestlé HealthCare Nutrition, Inc. leads the way in innovative products backed by high levels of clinical research. This booklet provides health care professionals with study summaries of the key clinical trials and meta-analyses providing evidence for the role of IMPACT® formulas in supporting improved patient outcomes.

Guidelines Met By IMPACT® Formulas

Professional medical and multi-disciplinary organizations including Society of Critical Care Medicine (SCCM), American Society for Parenteral and Enteral Nutrition (A.S.P.E.N.) and European Society for Parenteral and Enteral Nutrition (ESPEN) have acknowledged the vast body of evidence for the therapeutic use of immune-modulating nutrients in the most recently published guidelines*.

CRITICAL CARE NUTRITION GUIDELINES¹

E1. “Immune-modulating enteral formulations (supplemented with agents such as arginine, glutamine, nucleic acids, omega-3 fatty acids, and antioxidants) should be used for the appropriate patient population (major elective surgery, trauma, burns, head and neck cancer, and critically ill patients on mechanical ventilation), with caution in patients with severe sepsis.”
(Surgical ICU: Grade A; Medical ICU: Grade B)

Guideline references 8 studies using IMPACT® formulas

GUIDELINES ON ENTERAL NUTRITION: SURGERY²

“Use EN preferably with immuno-modulating substrates (arginine, omega-3 fatty acids and nucleotides) perioperatively independent of the nutritional risk for those patients:
• undergoing major neck surgery for cancer (laryngectomy, pharyngectomy)
• undergoing major abdominal cancer surgery (oesophagectomy, gastrectomy, and pancreatoduodenectomy)
• after severe trauma.”
(Grade A)

“Whenever possible start these formulae 5–7 days before surgery and continue postoperatively for 5 to 7 days after uncomplicated surgery.” (Grade C)

Guideline references 18 studies using IMPACT® formulas

GUIDELINES ON NUTRITIONAL SUPPORT THERAPY DURING ADULT ANTI-CANCER TREATMENT³

“Immune-enhancing enteral formulas containing mixtures of arginine, nucleic acids, and essential fatty acids may be beneficial in malnourished patients undergoing major cancer operations.” (Grade A)

Guideline references 10 studies using IMPACT® formulas

*The above statement does not constitute an endorsement of IMPACT formulas or any other Nestlé HealthCare Nutrition products by SCCM, A.S.P.E.N or ESPEN.
IMPACT® Formulas: An Evidence-Based Choice

Proper oral supplement and tube feeding formula selection is vital for surgical and critically ill patients. Certain risks associated with major elective surgery and trauma may be reduced by modifying specific nutrients in the diet. IMPACT® formulas have been studied in a variety of surgical, critically ill and trauma patients. The results of more than 40 positive-outcome studies, including several meta-analyses, demonstrate that early feeding of IMPACT® formulas improves patient outcomes by providing a blend of key nutrients—arginine, dietary nucleotides and omega-3 fatty acids—shown to effectively modulate the immune system and help improve outcomes in a variety of patient populations.

*IMPACT® formulas have more Level 1 evidence, in more patients, with more positive outcomes than any other immunonutrition formula.*

Mechanisms of Action

The IMPACT® family of enteral formulas contains a unique blend of three synergistic immunonutrients:

**Arginine:**
- Supports host immune response by promoting T-lymphocyte growth and replication, and nitrogen retention\(^4\)-\(^7\)
- Increases levels of hydroxyproline, the main precursor for collagen, thereby playing a role during wound management\(^4\)-\(^7\)
- Increases gut oxygenation and colonic microperfusion\(^8\)
- Stimulates synthesis of nucleotides in vitro\(^9\)

**Dietary Nucleotides:**
- Support replication of the rapidly dividing cells of the immune system, i.e., T-lymphocytes, by providing a source of purine and pyrimidine bases for DNA/RNA production\(^10\)

**Omega-3 Fatty Acids:**
- Modulate cytokines to produce less inflammatory and less immunosuppressive mediators\(^11,12\)
- Produce less inflammatory prostaglandins (PGE3) to help to alleviate arginine deficiency by reducing induction of arginase I.\(^13\)
Clinical Trial Outcomes

Use of IMPACT® nutritional therapy has been shown to support improved outcomes in a variety of ways. Significantly improved postoperative outcomes in patients supplemented with IMPACT® formula have been measured, including:

- Hospital LOS reduction on average by 15% - 20% \(^\text{14}\)
- 39%-61% reduction in postoperative infectious complications: \(^\text{15}\)
  - Anastomotic leaks: by 44% (p=0.004)
  - Pneumonia: by 47% (p<0.0001)
  - Wound infections: by 40% (p=0.005)
  - Abdominal abscesses: by 54% (p=0.001)
  - UTI: by 47% (p=0.011)
- Use of antibiotics reduced by 1.9–2.7 days\(^\text{14}\)

In clinical trials conducted on the early enteral use of IMPACT® formulas in critically ill patients, results also include significant reductions in:

- ICU LOS: on average, 4.5 days\(^\text{17}\)
- Hospital LOS: 4.5-8 days\(^\text{17, 18}\)
- Ventilator Days: on average, 4.5 days\(^\text{17}\)
Health Economic Outcomes

IMPACT® Nutritional Therapy Health Economic Model (Complications Method)
Potential Estimated Cost Savings in GI Cancer Surgery$^{16,21}$

Potential estimated savings of $2,192 per patient stay based on US average GI cancer surgery complication rate of 20.8%

These calculations are designed to help illustrate the potential cost savings to a facility with the use of a specific immunonutrition formula. They are not intended to guarantee any specific reductions in cost, infectious or other complication rates.

*The improvement in outcome shown by these calculations is based on the observed decrease in infectious complications analyzed for perioperative use of IMPACT® Nutritional Therapy by Waitzberg et al. The potential estimated cost savings shown by these calculations is based on hospital cost data from the HCUP database computed in 2010 dollars. Formula cost is per published distributor prices.
**IMPACT® Clinical Study Reference**

**Health Economic Outcomes**

**IMPACT® Nutritional Therapy shown to help reduce nosocomial pneumonia and reduce cost of care in trauma and burn patients**

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<th>POPULATION</th>
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<th>COST</th>
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<td>Nosocomial Pneumonia (%)</td>
<td>Estimated ICU Cost**</td>
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<tr>
<td>Trauma and burn patients receiving IMPACT® 1.5 formula</td>
<td>$686</td>
<td>12</td>
<td>$79,200</td>
</tr>
<tr>
<td>Trauma and burn patients receiving Promote** formula</td>
<td>$60</td>
<td>52</td>
<td>$91,200</td>
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*IMPACT® Nutritional Therapy has been associated with reduced cost of hospital care despite its higher purchase price vs. standard formulas. Assumess patients received 14 days of isocaloric/isonitrogenous feedings of IMPACT® 1.5 formula or Promote®. Formula cost in these financial calculations is based on the cost of formula referenced in the study. Actual pricing will vary.**

**Assumes cost of incremental care is $2400/day.**

†These financial calculations are based on certain estimates and assumptions, are for illustrative purposes only and are not a prediction or guarantee of savings at any specific institution.

◊Promote® is a registered trademark of Abbott Laboratories.

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Pneumonia is the second most frequent cause of readmission for surgical patients.
Randomized controlled trial done to investigate the effect of early post-op immunonutrition on outcomes in gastric cancer patients undergoing gastrectomy (n=109). Post-operative feedings were administered 6 hours post-op via jejunal tube and continued until post-op day 7. Formulas were isonitrogenous and isocaloric, however the study group tube feeding contained supplemental L-arginine, n-3 fatty acids and nucleotides and the control group received standard formula. Infectious complications in the study group were significantly lower than in the control group (7.4% vs. 20%, p<0.05), as was the rate of anastomotic leak (3.7% vs 7.3%, p<0.05). LOS for the intervention group was 3.2 days less than for the control group (p=0.029).

Mauskopf JA, Candrilli SD, Chevrou-Séverac H, Ochoa JB.  
This study was completed to create a health economic model to determine the impact on hospital costs of immunonutrition (IMPACT® formulas) used in patients having major elective surgery for gastrointestinal (GI) cancer). United States (US) hospital costs were taken from the Healthcare Cost and Utilization Project’s Nationwide Inpatient Sample (HCUP-NIP) database. These costs were used to estimate the effect of immunonutrition on hospital costs using reductions in length of stay (LOS) and risk of complications from a meta-analysis of 14 RCTs studying use of IMPACT® formulas in GI cancer surgery patients (n=889). Meta-analysis estimates show perioperative use of IMPACT® resulted in savings per patient of $6000 when costs were based on reduction in LOS, and a $3300 savings when costs were based on a reduction in infectious complications. The sensitivity analysis showed cost savings were present for baseline complication rates above 3.5%. When US baseline rates for LOS and infectious complications for upper and lower GI cancer surgery were inserted in the model, cost savings continued to present (range, $1200 to $6300).  
Use of immunonutrition for patients undergoing elective surgery for GI cancer was concluded an effective and cost-saving intervention.

Thirty-five randomized controlled trials (n=3,438) of major elective surgical patients are reviewed in this meta-analysis to compare outcomes with enteral nutrition supplemented with arginine vs. standard formula. Twenty-five studies involved GI surgery patients and the other 10 studies represented other elective surgical procedures. Twenty-three of 35 studies utilized IMPACT® formula administered pre-, peri- or post-surgically. Although, no difference in mortality was noted, arginine-supplemented diets were associated with a 41% reduction in infectious complications (p<0.00001 and a 2.38 day reduction in length of stay (LOS) (p<0.00001), on average. Tests for heterogeneity were not significant in regards to reduced overall infectious complications (p=0.11), but were significant in regards to reduced LOS (p<0.00001). Sub-analyses found greater reductions in infectious complications and LOS associated with perioperative vs. pre- or post-operative use (p=0.03, p=0.001), and more benefit associated with IMPACT® formula vs. other immunonutrition formulas (p<0.0001). Authors support implementing use of perioperative nutritional therapy containing arginine and omega-3 fatty acids to support considerable reduction in morbidity for high-risk elective surgery patients and a substantial reduction in costs for the health care system.


In this prospective randomized study, 30 pancreaticoduodenectomy patients were divided into three groups: A perioperative group received ORAL IMPACT® containing supplementary arginine, omega-3 fatty acids and nucleotides for 5 days before surgery and at least 7 days of enteral infusion after surgery. Another group received the same immunonutrition post-operatively only, and a third group was given total parenteral nutrition (TPN) postoperatively.

The primary endpoint was immune responses and the perioperative immunonutrition group was found to have significantly higher levels of lymphocyte proliferation, natural killer cell activity, mRNA levels of T-bet, interferon-γ, related orphan receptor, and interleukin-17F. A secondary endpoint was the rate of infectious complications. The perioperative immunonutrition group was found to have a significantly lower rate of infectious complications than either of the two other groups (10% vs 60% vs 60%, p<0.05). Of additional interest, there was a statistically significant difference in SIRS days between the perioperative group and the TPN group (2.4 vs 3.6 days, p<0.05).

Investigators concluded that perioperative immunonutrition reduced immunosuppression induced by a major stressful surgical procedure.

*IMPACT ADVANCED RECOVERY® Advanced Nutrition Drink is the oral form of IMPACT® formula offered in the United States.
Marik P, Zaloga G.

This meta-analysis reviewed 21 prospective controlled trials (n=1,918) to evaluate the effect of immune-modulating nutrition vs. control formula on clinical outcomes of high-risk elective surgery patients. Sixteen of 21 studies utilized IMPACT® formula pre-, peri- or post-surgically with GI, Head & Neck or Cardiac surgery patients. Studies were stratified by formula type and timing of initiation. Although no difference was noted in mortality across groups, intention-to-treat analyses showed immunonutrition associated with a 38%-61% reduction in hospital acquired infections (p<0.0001), a 9%-60% reduction in wound complications (p=0.02), and on average, a 3 day reduction in hospital LOS (p<0.001). Benefits were found to be similar for peri- and postoperative use; however, formulas containing both arginine and fish oil (as opposed to a single immunonutrient) were required, presumably due to synergistic effect. As the majority of studies utilized a product containing arginine, fish oil, nucleotides and antioxidants, it is unclear if benefits can be extrapolated to immune-modulating formulas of differing composition. Although optimal timing is a matter for further research, authors suggest beginning immunonutrition 5 days preoperatively and continuing into the postoperative period, when feasible.


A randomized, double-blinded, prospective study done to evaluate that immunonutrition supplemented with arginine, RNA and n-3 fatty acids improves outcomes in head and neck cancer patients with squamous cell carcinoma undergoing surgery. Formulas were isocaloric and the study group received ORAL IMPACT® 5 days prior to surgery and IMPACT® tube feeding post-surgery. The control group received no supplemental nutrition before surgery and standard tube feeding post-surgery. Major complications included pneumonia, UTI, fistula and wound infection, and were followed until discharge (median = 12 days). Rate of major complications was significantly lower in the immunonutrition vs. the standard group (5% vs. 25%; p<0.05). Perioperative IMPACT® in head and neck cancer surgery patients may influence postoperative outcomes by reducing infections and wound complications.

Retrospective comparison of 40 patients undergoing elective esophagectomy for esophageal squamous cell carcinoma. The 3 groups were randomized to: Group A control (n=20) with a standard tube feeding for 14 days postoperatively, Group B, (n=6) IMPACT® tube feeding for 14 days postoperatively or Group C (n=14) 5 days of preoperative IMPACT® and 14 days of postoperative IMPACT® tube feeding. Results demonstrate that compared to the control group (A), the perioperative IMPACT® group (C) had, on average, a significantly lower incidence of incisional wound infection (0% compared to 30%, p=0.031); significantly shorter length of ICU stay (5.5 days vs. 7 days, p=0.047) and a significantly shorter duration of postoperative SIRS response (p=0.046). Postoperative lymphocyte counts in group C were somewhat higher than group A (p=0.07) and significantly higher than group B (p=0.03). Authors note that preoperative oral supplementation with an immune-modulating formula “may be crucial for rapid improvement of lymphocyte counts, which is related to activation of the host defense mechanisms after esophagectomy.”


A meta-analysis where 1,410 gastrointestinal cancer surgery patients received either standard intravenous fluid, total parenteral nutrition, standard enteral nutrition or immune-modulating enteral nutrition (IMPACT® formula). Postoperative complications were recorded, as well as, morbidity. Also noted were correlating factors of pancreatic surgery, advanced age, weight loss, low serum albumin and nutrition support. Patients who received enteral nutrition (specifically immune-modulating nutrition) had significantly reduced postoperative morbidity (p<0.001).

A prospective, randomized study to measure outcomes of the addition of glycine to an oral immune-enhancing nutrition supplement (ORAL IMPACT®+ glycine) as compared to a standard oral immune-enhancing nutrition supplement (ORAL IMPACT®) and a control group receiving standard nutrition. Each nutrition supplement was administered for a minimum of 5 preoperative days. Patients (n=70) were 70 years of age or older and were planned for mitral valve surgery. Outcomes of morbidity, organ function and postoperative recovery were analyzed. In both groups receiving the ORAL IMPACT® formula, infectious morbidity was decreased (17%/23% vs. 50%) as compared to the control (p=0.02). Conclusions of the study were that use of preoperative ORAL IMPACT® formula reduces the rate of infectious morbidity and results in more hemodynamic stability. The addition of glycine did not result in any additional benefit.


This article reviewed 17 studies (n=2,305) where IMPACT® formula was used before and/or after major elective surgery and the clinical outcomes reported were included in this meta-analysis. Ten studies compared preoperative or perioperative IMPACT® formula provision vs. control and 7 studies looked at postoperative nutrition. Fourteen studies examined IMPACT® formula used with gastrointestinal (GI) cancer surgeries. IMPACT® formula supplementation was associated with significant reductions in postoperative infectious complications (39-61%) and a significant decrease in hospital stay by an average of 2 days. Anastomotic leaks were found to be less prevalent in gastrointestinal surgery patients who received IMPACT® formula perioperatively. Overall, 500 mL-1 L of IMPACT® formula 5-7 days preoperatively contributed to improved outcomes in GI, cardiac, and head/neck elective surgery patients.

Clinical trial of predominantly trauma patients prospectively identified to be enterally fed with IMPACT® 1.5 formula and compared with a historical cohort of similarly identified patients receiving standard nutrition. No differences in mean calories or protein received, days to feeding initiation or days to goal rate were observed between groups.

A reduction in nosocomial pneumonia (12% in IMPACT® 1.5 formula patients vs. 52% in those on standard feeding, p=0.01) was shown. Although not statistically significant, the patients receiving IMPACT® 1.5 formula required 3 fewer days of ventilator support and had a 5 day shorter ICU stay, on average, than those receiving standard feeding.

Using previously published costs of ICU care, cost of formulas and the difference in length of ICU stay, an economic analysis identified a savings of $11,374 for each patient receiving IMPACT® 1.5 formula.


A prospective, randomized study to determine the effect of early postoperative enteral immunonutrition (IMPACT® formula) on wound management in patients undergoing surgery for gastric cancer. Sixty-six patients were randomized to receive IMPACT® formula or an isocaloric, isonitrogenous control formula. The wound management process was analyzed, as well as, development of surgical wound management complications in sixty patients. Those patients who received IMPACT® formula had significantly increased hydroxyproline levels (p=0.0018) and decreased incidence of wound management complications (p=0.005). Authors concluded that early provision of IMPACT® formula postoperatively improves wound management substrates and decreases wound complications.

Cited by:

GUIDELINES ON NUTRITIONAL SUPPORT THERAPY DURING ADULT ANTI-CANCER TREATMENT

GUIDELINES ON ENTERAL NUTRITION: SURGERY

This article uses results from a prospective, randomized, placebo-controlled study of preoperative immunonutrition supplementation (IMPACT® formula) to calculate hospital costs for post-operative complications, and analyze for the possibility of cost savings in upper and lower GI cancer patients. A blinded cost-analysis for hospital length of stay (LOS) and in-patient resource utilization for infectious and non-infectious complications were referenced to the National List of Sanitary Costs, Italian Ministry of Health. Mean cost of treating infectious complications was significantly lower in the IMPACT® formula vs. conventional group (p=0.05). Because patients receiving preoperative IMPACT® formula had significantly fewer infectious complications and significantly shorter LOS, total cost per patient was €5668 vs. €7092 for conventional treatment. Preoperative immunonutrition with IMPACT® formula resulted in a net hospital savings per patient of €1424, as compared to conventional care.

Cited by:
GUIDELINES ON ENTERAL NUTRITION: SURGERY²


This article uses a current review on the literature of published outcomes of studies using clinical outcomes with immune-modulating diets to determine the potential economic benefit associated with the use of specialized nutritional formulations in elective surgical trauma and medical patients. Data was obtained from a large national database of 126 member hospitals and over 1 million patients. Data was collected on patient type, subservice, complication, mean length of stay, mean cost and incremental cost per complication (if experienced). For the medical patient population, specialized nutritional formulations found a 51% decrease in infectious complications and decreased length of stay of 9.7 days resulting in a net cost savings of $2,066 per patient. Net cost savings for surgical and trauma patients was $688 and $308 per patient respectively. This data demonstrated that specialized formulations are a cost-effective way to improve clinical outcomes while reducing resource consumption.

Cited by:
GUIDELINES ON ENTERAL NUTRITION: SURGERY²

In this study, 40 patients undergoing gastrointestinal surgery were prospectively randomized to receive ORAL IMPACT® formula 5 days preoperatively or an isocaloric diet, in addition to their oral hospital diet. The supplemented IMPACT® formula provided 3.3 g of polyunsaturated eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). During surgery, samples of liver, gut mucosa and tumor were obtained and analyzed for EPA/DHA content. Compared to the control group, IMPACT® formula supplemented patients had increased levels of EPA and DHA in liver tissue, gut mucosa and tumor tissue (p<0.05), which indicates a possible effect on post-operative inflammatory response after abdominal surgery.


A prospective, randomized study of 305 well nourished patients with cancer of the gastrointestinal tract comparing either ORAL IMPACT® formula 5 days preoperatively, ORAL IMPACT® formula 5 days preoperatively plus, IMPACT® formula jejunally postoperatively, or no nutrition before or after surgery. A significantly decreased infection rate (p=0.006 p=0.02) and length of hospital stay (p=0.008 p=0.03) occurred in both IMPACT® formula treatment groups. Thus, using IMPACT® formula preoperatively was as effective as perioperative immunonutrition in improving outcomes in well nourished patients and is superior to conventional treatment.

Cited by:

**GUIDELINES ON NUTRITIONAL SUPPORT THERAPY DURING ADULT ANTI-CANCER TREATMENT**

16
Braga M, Gianotti L, Nespoli L, Radaelli G, Di Carlo V.

Prospective, randomized, controlled trial of 150 patients requiring major elective surgery of the GI tract for malignancy. All enrolled patients were malnourished with ≤10% body mass loss and randomized to 3 groups. Group 1 (Perioperative Treatment Group) was supplemented preoperatively with 1 liter per day ORAL IMPACT® formula for 7 consecutive days and tube fed with IMPACT® formula postoperatively. Group 2 (Preoperative Group) was supplemented with 1 liter per day of ORAL IMPACT® formula for 7 consecutive days preoperatively and standard formula post-op. Group 3 (Control Group) received standard tube feeding post-operatively. All diets were isocaloric and isonitrogenous. Results reveal that the perioperative treatment group experienced decreased complications (p=0.02), and both treatment groups had a reduced length of hospital stay as compared to the control group (p=0.01, p=0.001).

Cited by:

GUIDELINES ON NUTRITIONAL SUPPORT THERAPY DURING ADULT ANTI-CANCER TREATMENT³
GUIDELINES ON ENTERAL NUTRITION: SURGERY²

Braga M, Gianotti L, Vignali A, Di Carlo V.

A prospective, randomized, controlled trial of 200 patients with colorectal neoplasm requiring surgical resection. The 4 groups were randomized to: Group 1, perioperative supplementation with ORAL IMPACT® formula for 5 days preoperatively + ORAL IMPACT® or IMPACT® tube feeding postoperatively; Group 2, preoperative ORAL IMPACT® for 5 days; Group 3 (control), isonitrogenous/caloric oral supplement preoperatively for 5 days; and Group 4; no supplementation before or after surgery (conventional therapy). Immune response (p<0.05), gut oxygenation (p<0.01) and microperfusion (p<0.02) were found to be significantly better for Groups 1 and 2. Overall, Groups 1 and 2 fed IMPACT® formula both perioperatively and preoperatively had outcomes of decreased infectious complications (p<0.02 p<0.04); reductions in antibiotic therapy days (p<0.005, p<0.004) and length of hospital stay (p<0.0005) as compared to the control and conventional therapy groups.

Cited by:

GUIDELINES ON NUTRITIONAL SUPPORT THERAPY DURING ADULT ANTI-CANCER TREATMENT³
GUIDELINES ON ENTERAL NUTRITION: SURGERY²

A prospective, randomized, double-blind, placebo-controlled study of 50 patients scheduled for coronary artery bypass. The preoperative treatment group consumed 1 liter of an oral immune-enhancing nutritional supplement (ORAL IMPACT®) for at least 5 days prior to surgery. The control group received an isocaloric, isonitrogenous amount of a control nutritional supplement. After surgery, patients requiring tube feeding received either an immune-enhancing or an isocaloric, isonitrogenous control formula until extubation. Study group patients had significantly higher preoperative expression of HLA-DR epitopes on monocytes (109%) than those in the control group compared with baseline (p=0.01). Post-op concentration of IL-6 was significantly lower in the study group than in the control group (p=0.032). Patients receiving ORAL IMPACT® had a significant reduction in total infectious complications (p=0.013), and had significantly fewer cases of pneumonia (p=0.047).

Investigators concluded preoperative intake of an immune-enhancing nutritional supplement for 5-10 days enhanced the outcome of high-risk cardiac patients undergoing surgery, improved preoperative host defense and reduced the number of postoperative infections.

Cited by:


A prospective, randomized, double-blind trial of 154 patients undergoing surgery for cancer of the upper gastrointestinal tract. In the study, patients were randomized to receive ORAL IMPACT® formula or an isonitrogenous, isocaloric supplement for 5 days prior to surgery. Patients in both groups consumed 1 liter each day by mouth. Following surgery, patients who consumed the ORAL IMPACT® formula were started on IMPACT® formula and patients who consumed the standard control were started on a standard tube feeding formula. All patients were fed via needle-catheter jejunostomy, initiated 12 hours after surgery and continued on the prescribed diet for at least 5 days after surgery. Patients who received IMPACT® formula had significantly fewer infections occurring after postoperative day 3 (p=0.04), and fewer complications overall (48% reduction, p=0.05) than patients who received the standard diet.

Cited by:
Snyderman CH, Kachman K, Molseed L, et al.

A prospective, randomized, double-blind, study of 136 head and neck cancer patients who received IMPACT® formulas pre- and postoperatively or postoperatively alone versus a standard formula pre- and post-operatively or postoperatively alone. IMPACT® formula-fed patients (pre- and postoperatively and post-operatively only) had nearly half as many infections compared to patients in the standard formula groups (p=0.02 p=0.04). There was no difference in length of stay; however, there was a trend toward shorter length of ICU stay and potential cost savings for patients fed IMPACT® formula.

Cited by:

**GUIDELINES ON ENTERAL NUTRITION: SURGERY**


One hundred and seventy-one patients who required major surgery for gastric, pancreatic or colorectal cancer were randomized in a double-blind fashion to receive either a formula supplemented with arginine, omega-3 fatty acids and dietary nucleotides (IMPACT® formula, n=102), or an isocaloric, isonitrogenous control (n=104). For seven days prior to surgery, patients consumed 1 liter/day of either the control or the supplemented formula. After surgery, patients received the same preoperative formulas via jejunal feeding and continued on the formula for 7 days. Patients who received the IMPACT® formula perioperatively had significant reduction in postoperative infection (9/85 in the supplemented group compared to 21/86 in the control group, p=0.02). There was also significant reduction in length of hospitalization for the group that received IMPACT® formula (p=0.01).

Cited by:

**GUIDELINES ON ENTERAL NUTRITION: SURGERY**


An extension of earlier, prospective, randomized trials of patients undergoing surgery for pancreatic cancer. In the study, 182 patients undergoing pancreaticoduodenectomy were randomized to receive IMPACT® formula, standard enteral feeding or total parenteral nutrition (TPN). Postoperative nutrition was initiated within 6 hours after surgery. Each of the groups received the same amount of calories and nitrogen per day. Despite the invasive surgery, early postoperative enteral feeding was well tolerated and did not increase the rate of complications. Compared to the TPN group, there was a 36% reduction in number of patients with infectious complications and the hospital stay was 4 days shorter for patients fed IMPACT® formula (p<0.05). Both findings were statistically significant. Patients with pancreatic resection who receive IMPACT® formula as part of an early enteral nutrition program have fewer infection-related complications and a shorter length of hospitalization.


In this prospective, randomized, double-blind trial, 32 patients with multiple severe injuries were randomized to receive IMPACT® formula or an isonitrogenous, isocaloric control. Patients also received TPN initially. During the course of the study, patients who received IMPACT® formula had fewer numbers of days with SIRS (8.3 days/patient versus 13.3 days/patient on the control). During the high-risk period of 8-14 days after trauma, patients on IMPACT® formula had less than half the incidence of SIRS (3.0 days with SIRS/patient versus 6.2 days with SIRS/patient on the control). Patients who received IMPACT® formula also had a significant reduction in MOF score during this critical period. High-risk patients who receive IMPACT® formula are less likely to develop SIRS or MOF than patients who receive standard enteral feeding following severe trauma.

Cited by:

1. CRITICAL CARE NUTRITION GUIDELINES
2. GUIDELINES ON ENTERAL NUTRITION: SURGERY

A prospective, randomized trial of 166 patients undergoing surgery for gastric or pancreatic cancer randomized to receive IMPACT® formula, standard enteral formula or total parenteral nutrition (TPN). The nutritional regimens were isocaloric and isonitrogenous. Patients receiving IMPACT® formula had the fewest number of postoperative infections (p<0.05) and a shorter hospital stay compared to the standard formula or TPN. In sub-groups of malnourished patients and patients who received homologous transfusions, administration of IMPACT® formula compared more favorably than TPN at reducing severity of infection and length of hospital stay (p<0.05). This study included data from a 1995 study published in Infusionsther Transfusionmed with an additional 89 patients.


A prospective, randomized, multi-center study of 164 patients with upper GI cancer who underwent major surgery and received early postoperative feeding with IMPACT® formula or an isonitrogenous, isocaloric control formula without supplemental arginine, dietary nucleotides or fish oil. Patients who received IMPACT® formula had 53% fewer infectious and wound complications occurring after day five postoperatively (p<0.05). The average cost for treating complications was 32% lower for the IMPACT® formula group.

Cited by:

GUIDELINES ON ENTERAL NUTRITION: SURGERY^2

GUIDELINES ON NUTRITIONAL SUPPORT THERAPY DURING ADULT ANTI-CANCER TREATMENT^3

Prospective, randomized, controlled trial of 260 post-upper GI surgical cancer patients who received standard enteral feeding, IMPACT® formula or TPN. Patients who received IMPACT® formula had a significantly lower sepsis score than patients on either standard enteral or TPN (p<0.01). Mean hospital LOS was shorter for patients in the IMPACT® formula group compared to either of the other groups (16.1 days for the IMPACT® formula group versus 19.2 days for the standard enteral and 21.6 days for TPN, p=0.004 p=0.01). IMPACT® formula favorably affects host immune response resulting in infectious complications that are less severe compared to infectious complications that occur in patients who receive standard enteral or TPN.

Cited by:

**CRITICAL CARE NUTRITION GUIDELINES**

**GUIDELINES ON NUTRITIONAL SUPPORT THERAPY DURING ADULT ANTI-CANCER TREATMENT**

**GUIDELINES ON ENTERAL NUTRITION: SURGERY**

Chendrasekhar A, Fagerli JC, Prabhakar G, Landreth K, Timberlake GA.  

A prospective, randomized, dual center trial of 20 patients with severe closed head injury who received IMPACT® formula or a standard enteral formula. Following one week of the two different nutrition support regimens, IMPACT® formula-fed patients had significant improvements in various immune parameters (p<0.05). Patients who received IMPACT® formula had a significant reduction in infection rate compared to patients who received the standard formula (9.1% versus 100%, p<0.0001). The authors concluded IMPACT® formula improves antigen processing to promote immune function and thereby reduce risk of infection in severe closed head injury patients.

* TraumaCal® is no longer available.
Perioperative immunonutrition in “high risk” cardiac surgery patients improves immunological parameters and clinical outcome. Presented at the European Society of Surgical Infection Meeting, Oslo, June 1997.

A prospective, randomized, placebo controlled double-blind study of 50 patients undergoing heart surgery. Patients consumed ORAL IMPACT® formula or an isocaloric control formula for 5 – 10 days before surgery. Patients who received ORAL IMPACT® formula had significantly fewer lower respiratory tract infections (0 of 22 vs. 5 of 23, p=0.022) and 65% reduction in total infections compared to the group that received the control formula (p=0.009).

Daly JM, Weintraub FN, Shou J, Rosato EF, Lucia M.


A prospective, randomized, double-blind study of 60 patients with upper GI cancer who underwent abdominal surgery and received early postoperative feeding with either IMPACT® formula or TraumaCal® formula*. Patients fed IMPACT® formula had 77% fewer infectious and wound complications (p<0.005) and had a six day shorter mean length of hospitalization than patients in the TraumaCal® group (p=0.02).

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◊ Osmolite® is a registered trademark of Abbott Laboratories.


Randomized clinical trial of 42 patients with upper gastrointestinal malignancies who received either IMPACT® formula or an isonitrogenous and isocaloric control formula postoperatively to evaluate the effects of providing early postoperative feeding on the immune system. Enteral feeding of IMPACT® formula significantly improved immune function as measured by Immunoglobin M (IgM) (p<0.05) and Immunoglobin G (IgG) (p<0.05), as well as, significantly higher T-lymphocyte concentrations (p<0.05) compared to standard enteral feeding.

Cited by:

Bower RH, Cerra FB, Bershadsky B, Licari JJ, Hoyt DB, Jensen GL, Van Buren CT, Rothkopf MM, Daly JM, Adelsgerg BR.


A prospective, randomized, double-blind multi-center study of 326 critically ill, ICU tube-fed patients (84% trauma, 12% MICU, 4% SICU) who received either IMPACT® formula or Osmolite® HN. Patients fed IMPACT® formula who met all requirements for study completion had a 28% reduction (eight days) in length of hospital stay, as compared to the control group (p<0.05). IMPACT® formula-fed patients who were septic had a ten day shorter hospital stay (p<0.05) and a 60% lower incidence of new infections compared to septic patients fed Osmolite® HN (p<0.01).

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GUIDELINES ON ENTERAL NUTRITION: SURGERY²

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References to nutritional guidelines in this document do not constitute endorsements by or on behalf of any organization.

References:
