

## Research Article

# Perioperative Immunonutrition in Spine and Total Joint Surgery

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## Abstract

**Background:** In the current era of adding value to healthcare, modifiable risk factors have become a major focus. Quality and outcomes are now measured, reported, and tied to reimbursement. Recent studies in orthopedic surgery and spine surgery have shown nutritional status to be one of the most significant risk factors for post-operative complications. Our purpose for this study is to evaluate if perioperative nutritional support can reduce post-operative complications and improve outcomes in total joint and spine surgery patients

**Methods:** We prospectively collected data for inpatient total joint replacements and spine surgeries for 12 months beginning November 2016 and ending October 2017. All patients were followed for a minimum of 90 days after surgery. Patients were excluded if they were receiving radiation or chemotherapy at the time of surgery or were noncompliant with our nutrition protocol. The Immunonutrition (IMN) group was instructed to consume two 8 oz bottles of Ricochet Nutrition (Revive medical, Brighton, MO USA) each day for 6 days before and 6 days after surgery. We collected outcome data for reoperations, readmission, and complications including: Surgical Site Infections (SSI), Pneumonia, UTI, Sepsis, and Acute MI.

**Results:** A total of 125 patients were included and no difference was found between the two groups regarding surgery type, comorbidities, sample size, and demographics. The control group had a total of 8 patients with complications after surgery: (1 pneumonia and sepsis, 3 UTIs, 1 incisional hernia, 2 deep SSI). There was a total of 3 reoperations and 4 readmissions in the control group. The IMN group had no reoperations, no readmissions, and no complications.

**Conclusions:** Our study provides evidence that perioperative immunonutrition (containing Arginine, Glutamine, Omega 3 FAs and Nucleotides) reduces complications, reoperations and readmission for inpatient total joint and spine surgery patients. Patient optimization prior to surgery should include optimizing nutritional status with immunonutrition.

## Introduction

In the current era of healthcare, efficiency of cost has become a major priority. There is now a heavy focus on driving down costs in the surgical and hospital setting. Quality and outcomes are now measured and reported at a higher level than ever before. This data of quality and outcomes is now heavily tied to reimbursement. It has become a major focus of much research to find more efficient and better ways to treat patients. One area that has continued to receive increasing attention is the role of nutrition in surgery.

In 2002, Braga released a study showing decreased complications after nutritional supplementation perioperatively<sup>1</sup>. Since then, multiple studies have been done on immunonutrition and its effects on postoperative complications. These studies brought to light the favorable role of immunonutrition in decreasing postoperative complications. Many of these early studies focused on nutritional replacement in gastrointestinal, urological, and head/neck surgery patients.

In the past two years, there have been numerous studies in orthopedic and spine surgery showing nutritional status to be one

of the most significant risk factors for post-operative complications. Despite numerous studies researching the effects of malnutrition on increasing the risk of complications in orthopedic and spine surgery, there has not been any studies on the effect of immunonutrition on outcomes of orthopedic and spine surgery.

Our purpose for this study is to evaluate if perioperative nutritional support with immunonutrition containing Arginine, Glutamine, Omega 3 FAs, and Nucleotides can reduce post-operative complications and improve outcomes in orthopedic and spine surgical patients.

## Materials and Methods

For a 12-month period from November 2016 to October 2017 we prospectively collected data for inpatient total joint replacements and spine surgeries occurring at two hospitals. Surgeries were performed by one of two fellowship trained Orthopedic spine surgeons. Patients were excluded from the study if they were receiving radiation, or chemotherapy, at the time of surgery or were noncompliant with our nutritional protocol. Included patients were adults over the age of 18 undergoing elective spine or total joint replacement surgery. Patients

were followed for minimum of 90 days after the surgical day. Both malnourished and well-nourished patients were included.

A total of 125 patients were included in the study. Patients chose to either be in the immunonutrition group or control group. The immunonutrition group was instructed to consume two 8oz bottles of Ricochet Nutrition (Revive medical, Brighton, MO USA) each day for 6 days before and 6 days after surgery. The two groups were similar in size with 62 patients receiving Immunonutrition and 63 patients in the control group. No difference was found between the two groups regarding surgery type, comorbidities, and demographics. Data for reoperations, readmissions, and complications was collected. Complications included: Surgical Site Infections (SSI), Pneumonia, Urinary Tract Infections (UTI), sepsis, Clostridium difficile colitis, incisional hernia, and acute Myocardial Infarction (MI).

### Statistical methods

Of a total of 125 patients included in the study, there were 62 patients in the Immunonutrition (IMN) group and 63 patients in the control group. Given the nature of the obtained data, Absolute Risk Reduction (ARR) and Number Needed to Treat (NNT) were calculated to evaluate our results.

### Results

The two groups were similar in age, demographics, and comorbidities. There was a total of 10 complications in 8 patients in the control group (N=63). One patient had pneumonia and sepsis, one patient had Clostridium difficile colitis and myocardial infarction. 6 other patients had complications (3 UTIs, 1 incisional hernia, and 2 deep surgical site infections). There was a total of 3 reoperations and 4 readmissions in the control group.

ARR and NNT were calculated as shown in Table 1. The calculations show that by using immunonutrition, the absolute risk for post-operative UTI has been reduced by 4.76%. The ARR for pneumonia, deep SSI, incisional hernia, sepsis, acute MI and Clostridium difficile colitis are 1.59%, 3.17%, 1.59%, 1.59%, 1.59% and 1.59% respectively. The NNT for UTI, pneumonia, SSI, hernia, sepsis, acute MI and Clostridium difficile colitis are 21, 63, 32, 63, 63, 63 and 63 respectively. The ARR for total complications is 15.87% and the NNT is 6.

### Discussion

The results of this study are similar to other studies evaluating the efficacy of perioperative immunonutrition on surgical outcomes within other surgical specialties. It provides strong evidence that perioperative immunonutrition (containing Arginine, Glutamine, Omega 3 fatty acids, and Nucleotides) reduces complications, reoperations, and readmissions for inpatient orthopedic and spine surgery patients. This study builds upon previous research showing the importance of proper nutrition, and the benefits of immunonutrition supplementation.

In 2002 and 2005 Braga et al. [1,2] showed perioperative immunonutrition was a valuable approach to support malnourished patients in surgery. In the 2002 study, they looked at 150 patients undergoing major elective surgery of the gastrointestinal tract for malignancy. They were divided into 3 groups (control, preoperative nutritional support, and Pre/peri operative nutritional support.

**Table 1: Data along with calculated ARR and NNT values.**

Attributable Risk Reduction (ARR) and Number Needed to Treat (NNT) have been calculated for the data as shown in Table 1. The calculations show that by using immunonutrition, the attributable risk for post-operative UTI has been reduced by 4.76%. The ARR for pneumonia, SSI, hernia, sepsis, acute MI and C. Diff colitis are 1.59%, 3.17%, 1.59%, 1.59%, 1.59% and 1.59% respectively. The NNT for UTI, pneumonia, SSI, hernia, sepsis, acute MI and C. Diff colitis are 21, 63, 32, 63, 63, 63 and 63 respectively. There were overall 10 complications out of 63 in the control group and none in the IMN group. The ARR for total complications is 15.87% which is pretty significant and the NNT is 6, indicating that by using immunonutrition intervention, just for every 6 patients we can prevent complications in 1 patient. This could mean significantly better patient recovery. Additional studies and with larger patient populations can shed further light on the effectiveness of immunonutrition.

		Control Group	IMN Group	ARR%	NNT
	<b>Number of Patients</b>	63	62		
<b>Post-Op Complications</b>	<b>UTI</b>	3	0	4.76	21
	<b>Pneumonia</b>	1	0	1.59	63
	<b>SSI</b>	2	0	3.17	32
	<b>Hernia</b>	1	0	1.59	63
	<b>Sepsis</b>	1	0	1.59	63
	<b>Acute MI</b>	1	0	1.59	63
	<b>C.Diff Colitis</b>	1	0	1.59	63
	<b>Total Complications</b>	10	0	15.87	6
	<b>Readmissions</b>	4	0	6.35	16

Length of stay was significantly decreased in both preoperative and pre/peri operative groups. Postoperative complications were also significantly reduced in the pre/peri operative group. The 2002 study was followed up by a study in 2005 evaluating hospital costs for postoperative complications in patients undergoing elective GI surgery for malignancy and evaluate whether preoperative supplementation with Omega 3 fatty acids and arginine might lead to cost savings in patient care. The results showed that preoperative supplementation could decrease the large burden caused by postoperative morbidity by decreasing complications.

A report in the World Journal of Surgical Oncology in 2012, by Mauskopf published a study evaluating the impact of costs of IMN formulas used in patients undergoing GI surgery for cancer. Average cost per day was estimated using data from Healthcare Costs and Utilization Project 2008 Nationwide inpatient sample. These estimates were then compared against cost of IMN *versus* the increased cost of complications or length of stay. The study found an average estimated decrease in cost of \$3300 based on complication reductions and an average estimated savings of \$6000 based on decreased length of stay.

In a review published in Gastroenterology Report in 2016, Bharadwaj et al [4] argued for IMN to be the standard of care in patients undergoing elective surgery. This paper cites the American Society of Parenteral and Enteral Nutrition (ASPEN) which recommends patient who undergo major neck or abdominal cancer surgery, trauma, burns, or are critically ill and on mechanical ventilation receive enteral formulations that are supplemented with arginine, glutamine, nucleic acid, omega fatty acids, and antioxidants.

Recently, there have been numerous studies on the effects of malnutrition in orthopedic surgery. One study Published in Injury

2017 by Ihle et al. [5] analyzed the prevalence of malnutrition in hospitalized orthopedic and trauma patients and evaluate the relationship between malnutrition and selected clinical outcomes. In evaluating 1055 patients from 6/2014 to 6/2015 it was found that 22.3% of patients were malnourished. They found that patients with malnutrition were more likely to have prolonged hospitalization, delayed postoperative mobilization, and delayed mobilizations after conservative treatment. In conclusion, they stated that, “malnutrition is widespread regarding hospitalized patients in the field of orthopedic and trauma surgery and results in suboptimal clinical outcome. It should be considered as an important factor that significantly contributes to delayed recovery”.

In another study published 2016 by The Musculoskeletal Journal of the Hospital for Special Surgery, Fu et al [6] studied the prevalence of hypoalbuminemia in obese patients undergoing TKA and the independent morbidity risk of malnutrition. Relative to obesity. The researchers found that hypoalbuminemia was a stronger and more consistent independent risk factor for complications after TKA than obesity.

In Journal of Arthroplasty 2013, Huang et al [7] “sought to more clearly define the effect of malnutrition on the results of elective Total Joint Arthroplasty (TJA) by prospectively collecting nutritional markers in a large consecutive cohort of patients undergoing primary and revision joint arthroplasty”. They Compared complications in well-nourished and malnourished patients, examined incidence of malnourishment of obese patients undergoing TJA, tried to identify nutritional markers, and develop effective methodology for identifying patients at risk for complications. They found serum transferrin and albumin as good predictors of malnutrition and recommended screening of patients over 55 years of age who were undergoing TJA.

Our study was limited in size making small changes have more influence on final numbers. Also, patients were not randomly assigned to either control or IMN group [8-10]. This could have been biased as it is likely that patients who were more conscious about health would have partaken in IMN supplementation.

The results of this study are similar to other studies evaluating the efficacy of perioperative immunonutrition on surgical outcomes within other surgical specialties. Our study provides strong evidence that perioperative immunonutrition – containing arginine, glutamine, omega 3 fatty acids, and nucleotides – reduces complications, reoperations, and readmissions for inpatient orthopedic and spine surgery patients [11-16]. Patient optimization prior to surgery should include optimizing nutritional status with immunonutrition.

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