

POSTOPERATIVE INFECTION RATE FOLLOWING CARDIAC SURGERY WITH ALLOGENEIC VS OTHER BLOOD MANAGEMENT TECHNIQUES

A. Shander, M.D.¹, C.A. Walawander, M.A.², L. Shore-Lesserson, M.D.³ and D. Adams, M.D.⁴
 Englewood Hospital and Medical Center, Englewood NJ, ²Cognigen Corporation, Buffalo, NY, ³Mt Sinai School of Medicine, New York, NY, ⁴University of Vermont, Fletcher Allen Health Care, Burlington, VT

ABSTRACT

Objectives. Infection rates associated with allogeneic blood transfusion versus other blood management techniques were prospectively compared in elective cardiac surgery patients (anticipated blood loss > 1000 mL).
Methods. Patients from seven participating hospitals were grouped into those receiving any allogeneic transfusions and those receiving no allogeneic transfusion (but may have received autologous blood, volume replacement or transfused blood). The relative risk +/- 95% CIs for postoperative inpatient infection and 30-day post discharge infection obtained through a nurse telephone interview were compared (p < 0.05). Post discharge quality of life outcomes were also examined.
Results. Overall, 253 of 455 patients (56%) received allogeneic transfusions. Infections occurred in 44 (17.4%) of these patients during hospitalization compared to 19 (9.4%) patients in the other transfusion group. (RR=1.9; 95% CI (1.1, 3.1), p=0.014). This association remained after adjustment for age, gender, ASA class, race, and pre-existing medical conditions such as respiratory, gastrointestinal, and hematologic disease. A post discharge interview was conducted with 350 patients (53% allogeneic vs 47% other). In the allogeneic blood group, 14.2% had an infection after discharge compared to 9.4% in the other transfusion group. Post discharge quality of life outcomes were less likely to be impaired. Patients who received allogeneic transfusion were less likely to be readmitted, 30 days post discharge (59% vs 76%, p=0.001), were more likely to be feigned (69% vs 55%, p=0.038), and exhibited a trend towards a lower likelihood of complete independence (90% vs 61%, p=0.083).

Conclusions. Allogeneic blood transfusion was associated with an increased risk of infection during hospitalization for cardiac surgery, but was not observed in patients surveyed 30 days after discharge. A negative impact on post discharge quality of life outcomes was evident in patients who had received allogeneic products, however.
INTRODUCTION
 • Blood loss with major elective surgery can be substantial and often requires postoperative transfusion with allogeneic or autologous blood.
 • Specific risks associated with allogeneic blood transfusions include the transmission of blood-borne infections and immunomodulatory effects.
 • Experimental and epidemiologic observations indicate that allogeneic transfusions are associated with an increased prevalence of postoperative bacterial infections.
 • A number of allogeneic blood options can potentially reduce or eliminate the need for allogeneic blood.
 • This study compared the infection rates associated with blood management techniques in patients undergoing cardiac surgery where blood loss was anticipated to exceed 1000 mL.
OBJECTIVE
 • To compare the post-operative infection rate in patients undergoing major cardiac surgery utilizing allogeneic versus non-allogeneic blood management and to evaluate post discharge outcomes.

METHODS

Study Design
 • In-patient, sequential sampling design study conducted at seven community hospitals.
 • Observational, sequential sampling design study conducted at seven community hospitals.
 • Standard data collection form used to record: demographic information, pre-existing medical conditions/risk factors (categorized by cardiovascular, endocrine, gastrointestinal, hepatic, renal, hematologic/oncology, social history, respiratory, neurologic, surgical, and other), medical history, laboratory preoperative tests, surgical and anesthesia procedures, blood transfusion and volume replacement information, and postoperative infections.
 • Telephone calls made by a nursing service 30 days post discharge from the hospital involved collecting the following information from the patient: occurrence of an infection, antibiotic prescription, blood transfusions, remaining of activities, activity level, independence scale, fatigue scale.
 • Protocol received IRB approval and informed consent was obtained prior to patient enrollment.

Inclusion Criteria
 • In-patient surgeries including: coronary artery bypass graft, replacement of any heart valve (with prosthetic/tissue graft), and thoracic vessel resection with replacement.
Exclusion Criteria
 • Age < 18 years, immunocompromised from current malignancy, systemic viral or bacterial infection, trauma requiring multiple surgeries, or incompetent to provide consent.
Blood Management Definitions
 • Allogeneic: transfusion of donor-supplied red blood cells, plasma, platelets, or cryoprecipitate with or without receipt of other blood management techniques.
 • Other: autologous blood transfusions, and/or CT autotransfusions, cell salvage, or ANH and/or volume replacement with collets and/or crysallets.

Clinical Outcome: Postoperative Infection Rate
 • Infections included pneumonia, sepsis, UTI, incisional or deep surgical wound infection, catheter-associated infection, osteomyelitis, septic arthritis, and cardiovascular infection (all as defined by COCI), and other infections defined by the primary investigator that occurred between the time of surgery until 30 days post hospital discharge.
Statistical Methods
 • Blood management comparisons performed using chi-square or Fisher exact test for categorical variables, and t-tests or Wilcoxon rank-sum tests for continuous variables.
 • Logistic regression analysis assessed influence of blood management technique and other patient factors on postoperative infection risk.
 • Univariate models – factors tested included: demographic factors, pre-existing medical conditions, blood management technique.

RESULTS

• Data were obtained from 455 patients. There were 253 and 202 patients in the allogeneic and other groups respectively. The mean (SD) age was 60.9 (12.1) years for the allogeneic group and 60.9 (12.1) years for the other group. 45% were ASA class 2 and 54% were ASA class 4. The overall postoperative infection rate during hospitalization was 13.9%.
Table 1. Demographic Characteristics Stratified by Postoperative Nosocomial Infection.

Demographic Characteristic	Postoperative Nosocomial Infection		P-Value	Relative Risk (95% CI)
	No	Yes		
Age (year)	392	63	0.025	
Number of Subjects	65.9 (10.8)	69.1 (10.8)		
Median	27-66	38-87		
Min-Max				
Gender				
Female, n (%)	95 (61.2%)	22 (18.8%)	0.072	1.55 (0.97, 2.5)
Male, n (%)	259 (69.2%)	41 (12.1%)		
Blood Management Technique				
Allogeneic, n (%)	209 (62.8%)	44 (17.4%)	0.014	1.9 (1.1, 3.1)
Other, n (%)	154 (68.0%)	19 (9.4%)		
Race				
Caucasian, n (%)	332 (68.8%)	56 (14.3%)	0.531	1.3 (0.6, 2.6)
ASA Class				
2-4, n (%)	208 (64.6%)	38 (15.4%)	0.283	1.3 (0.8, 2.1)
5, n (%)	154 (68.0%)	25 (12.0%)		

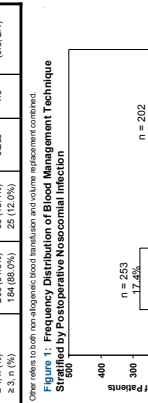


Table 2: Multivariable Logistic Regression Model for Postoperative Nosocomial Infection.

Parameter	Odds Ratio	P-Value
Allogeneic Blood	1.89	0.0316
Pre-existing Renal Disease	2.69	0.072

Table 3: Multivariable Logistic Regression Model for Patients Receiving an Allogeneic Transfusion.

Parameter	Odds Ratio	P-Value
ASA Class 4	0.444	0.0002
Caucasian	1.495	0.0329
Age (10 yr increments)	1.49	0.0001
Pre-existing gastrointestinal disease	1.91	0.0101
Nematoid†	0.688	0.001

Table 4: Cost Information

	No infection (n=253)	Infection (n=202)
Total Hospital Cost \$ (100's)	Mean (SD) 270 (143)	Mean (SD) 461 (245)
Allogeneic	Mean (SD) 162	Mean (SD) 302 (150)
Other	Mean (SD) 104	Mean (SD) 15

Table 2: Occurrences of Postoperative Nosocomial Infections Stratified by Blood Management Technique

Postoperative Infection	Allogeneic Transfers (n=253)	Other (n=202)
Pneumonia	12 (4.74%)	3 (1.5%)
Sepsis	1 (0.40%)	2 (1.0%)
UTI	10 (3.94%)	2 (1.0%)
Urinary Tract Infection	13 (5.14%)	3 (1.5%)
Incisional Surgical Wound Infection	2 (0.80%)	0
Deep Surgical Wound Infection	2 (0.80%)	0
Catheter Associated Infection	4 (1.58%)	0
Osteomyelitis	0	1 (0.5%)
Septic Arthritis	0	0
Cardiovascular Infection	0	2 (1.0%)
Other†	7 (2.8%)	7 (3.5%)

† Other refers to both non-allogeneic blood transfusion and volume replacement combined.

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Other	Mean (SD) 104	Mean (SD) 15

Table 6: Post Discharge Information

	Allogeneic (n=253)	Other (n=202)	P-value
Infection**	105 (41.2%)	25 (12.4%)	0.608
Returned activities	105 (59.3%)	118 (75.8%)	0.001
Complete independence	89 (50.3%)	94 (51.4%)	0.083
Modified independence	85 (48.0%)	59 (39.3%)	
Complete assistance	3 (1.7%)	4 (2.8%)	
Flagged†	117 (66.1%)	84 (55.0%)	0.038

* There was a 73% response rate to the 30 day post discharge telephone survey.
 ** Only of those patients who did not have a postoperative infection. This category of post discharge outcome included infection in the hospital, 30 day post discharge, or within 90 days post discharge.

CONCLUSIONS

- The overall risk of postoperative infection in patients undergoing cardiac surgery with estimated blood loss of >1000 mL was 13.9%.
- Allogeneic blood management was shown to double the risk of postoperative infection during hospitalization compared to other transfusion techniques, hematocrit and hemoglobin measures, and pre-existing disease.
- A negative impact on post discharge quality of life outcomes was evident in patients who received allogeneic products.

BLOOD MANAGEMENT DEMONSTRATION GROUP

- ¹ Ayveth Shander, M.D., Englewood Hospital and Medical Center, Englewood, NJ;
- ² David Adams, M.D., University of Vermont, Burlington, VT, Jim Rahmeti, M.D., University of Vermont, Burlington, VT, Linda Shore-Lesserson, M.D., Mt. Sinai School of Medicine, New York, NY, Jeff Silverstein, M.D., Mt. Sinai School of Medicine, New York, NY, Robert Bartlett, M.D., Palmioto Health, Columbia, SC;
- ³ Michael O'Connor, M.D., University of Chicago, Chicago, IL, Kathleen MonCholas, M.D., Christiana Care Health Services, Newark, DE, Richard Spence, M.D., Baptist Health System, Birmingham, AL, Ched Singelmann, M.D., Baptist Health System, Birmingham, AL, Nader D. Naber, M.D., Veterans Administration Medical Center, Buffalo, NY, Cynthia Walawander, M.A., Cognigen Corporation, Buffalo, NY

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