

Relationship of blood transfusion and increased risk of atrial fibrillation after coronary artery bypass graft surgery



Radmehr H. , Salehi M. , Bakhshandeh A.R. , Soleimani A.A. , Torfi Y.

Abstract:

Background: New onset atrial fibrillation after cardiac surgery contributes to increased morbidity , hospital length of stay and resource utilization. Although many aspects of atrial fibrillation after cardiac surgery is obvious , the mechanism by which cardiac surgery predispose patients to AF is unknown as yet . Recent evidence support an inflammatory role in development of AF . Blood transfusion augmented the inflammatory response and so incidence of postoperative AF. **Method** : Retrospective study from January 2005 to July 2007 on 2095 patients who underwent isolated CABG with or without valve replacement . Variables associated with development of new onset AF were identified by logistic regression. **Results** : Blood transfusion was performed in 487 patients that was associated with a significant increase in new onset of AF (45.9% vs 37.9% ; $p < 0.01$) . **Conclusion** : Blood transfusion can increase the incidence of new onset AF after cardiac surgery . This factor should be considered in identifying patients who might benefit from prophylaxis to prevent this common postoperative complication and its adverse consequences .

Keywords: Blood transfusion, Atrial fibrillation CABG.

Introduction

New onset atrial fibrillation occurs in 10 to 43% of patients in hospital after cardiac surgical procedures(1-6) . It has been reported to contribute to increased morbidity(1-4), hospital length of stay(1-3) , and resource utilization (2 , 3). Although demographic , clinical , electrophysiologic substrates and perioperative risk factors have been identified , the mechanism by which cardiac surgery predisposes patients to AF is unknown . Usually the incidence

of AF is greater in patients with previous AF , COPD , RCA stenosis , valve surgery , increased P wave duration , patients not receiving β – blocker after operation and in those with low LVEF . Also technical consideration that may predispose to AF includes , venting through the SPV , more systemic hypothermia , division of anterior aortic fat pad and postoperative RA pacing . Appropriate management of AF requires identification and treatment of potential risk factors . Likewise AF can results from ischemia , atrial distention , increased sympathetic tone , electrolyte imbalance particularly hypokalemia and hypomagnesemia precipitated by diuresis , acid base disturbance , sympathomimetic medications , pneumonia atelectasis and pulmonary edema .

Recent evidences support an inflammatory mechanism in the development of AF(7-9). Red blood cell transfusion modulates the inflammatory response to cardiac surgery by changing plasma concentrations of inflammatory mediators and augmenting the inflammatory response (10) . Therefore , we tested the hypothesis that RBC transfusion increases risk of postoperative AF for patients undergoing cardiac surgery with cardiopulmonary bypass .

Methods

This study was performed between January 2005 and July 2007 in Imam Khomeini Tehran university hospital on 2095 patients who underwent isolated CABG with or without valve replacement. Patient and procedural variables associated with development of new onset AF were identified by logistic regression. All patients during hospital course through 24h telemetry . Total numbers of transfused blood and its products in operation room and ICU was accurately detected in files .

Table 1 : Preoperative patients characteristics

Mean age	62± 15 y
Total number	2095
Gender	
Male	1155(55.14%)
female	940(44.96%)
NYHA 1/2/3/4	15/48/37/0 %
Diseased coronary artery	3± 0.5
Associated condition	MR++ :232
	MR+++ : 395
	TR++ :35
	TR+++ : 11

Results

In addition to older age , prior history of AF , β – blocker withdrawal , longer aortic clamp time , and intensive care unit inotropic usage , ICU blood transfusion increased risk for AF (odds ratio unit transfused , 1.16 ; 95%confidence limits , 1.14 , 1.24 ; p<0.001) . ICU blood transfusion was done in 487 patients (fig. 1) that was associated with a significant increase in new onset of AF (45.9% vs 37.9% ; p<0.01)(fig. 2)

Table 2 : Transfused blood products and risk of AF

variable	AF	NO AF	P value
Total transfused blood units	2± 2.8	1.1± 2	<0.01
Transfused blood units in OR	1± 1.8	0.7± 1.4	<0.01
Transfused blood unit in ICU	1.2± 2.2	0.5± 1.3	<0.01
Platlet in OR %	10.2%	5.9%	<0.01
Platlet in ICU %	10.4%	5.2%	<0.01
FFP in ICU %	11.4%	6.8%	<0.01

Table 3 : Relation of patient and procedural variables with AF

variable	AF	NO AF	P value
History of AF	18%	31%	<0.001
Mean cross clamp time	58.9min	65.6min	<0.01
Aspirin	65.2%	62.1%	0.84
Preop β - blocker	54.4%	7.9%	0.01

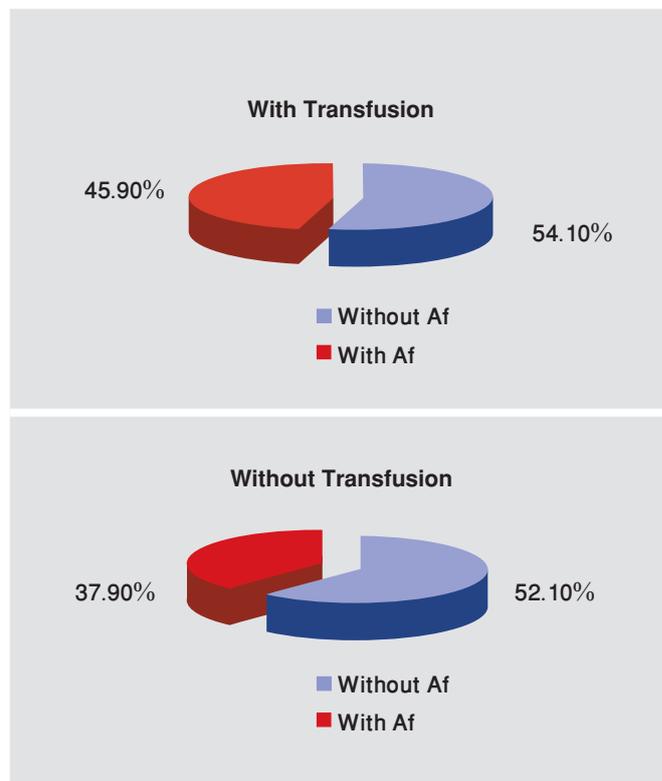
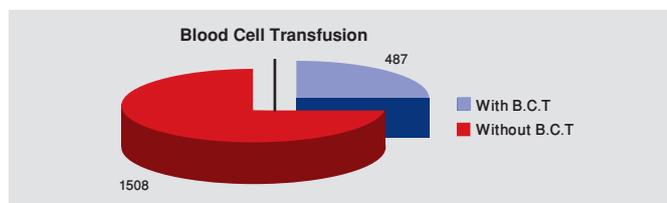


Fig 2 : ICU blood transfusion was associated with a significant increase in new onset AF

Discussion

Our finding offer important prognostic information for development of postoperative AF beyond traditionally described risk factors . We are unaware of any investigations that examined risk for postcardiac surgery AF related to perioperative RBC transfusion .Whether the increased occurrence in patients receiving a transfusion is related to inflammatory changes or it is through another mechanism is unknown ; nevertheless , transfusion is strongly and consistently associated with increased risk for AF .Perioperative identification of factors related to development of AF is valuable because AF is a frequent complication associated with postoperative morbidity and cost . To successfully risk – stratify patients for interventional pharmacologic trials aimed at reducing AF , needs to acquire a clearer understanding of the factors that predispose patients to development of AF in the postoperative period . Trasfusion of RBC is a modifiable process of care variable that increases the risk for this common postoperative complication .Strategies to reduce

the complication after cardiac surgery will impact morbid outcomes and hospital resource utilization . ICU blood transfusion is associated with increased occurrence of postoperative AF after cardiac surgery . This factor should be considered in identifying patients who might benefit from prophylaxis to prevent this common postoperative complication .

References

1. G.H. Almassi, T. Schowalter and A.C. Nicolosi et al., *Atrial fibrillation after cardiac surgery: a major morbid event?*, *Ann Surg* 226 (1997), pp. 501–513.
2. D. Amar, W. Shi and C.W. Hogue Jr et al., *Clinical prediction rule for atrial fibrillation after coronary artery bypass grafting*, *J Am Coll Cardiol* 44 (2004), pp. 1248–1253.
3. S.F. Aranki, D.P. Shaw and D.H. Adams et al., *Predictors of atrial fibrillation after coronary artery surgery Current trends and impact on hospital resources*, *Circulation* 94 (1996), pp. 390–397.
4. S. Borzak, J.E. Tisdale and N.B. Amin et al., *Atrial fibrillation after bypass surgery: does the arrhythmia or the characteristics of the patients prolong hospital stay?*, *Chest* 113 (1998), pp. 1489–1491.
5. M. Funk, S.B. Richards, J. Desjardins, C. Bebon and H. Wilcox, *Incidence, timing, symptoms, and risk factors for atrial fibrillation after cardiac surgery*, *Am J Crit Care* 12 (2003), pp. 424–435.
6. M. Hravnak, L.A. Hoffman, M.I. Saul, T.G. Zullo, G.R. Whitman and B.P. Griffith, *Predictors and impact of atrial fibrillation after isolated coronary artery bypass grafting*, *Crit Care Med* 30 (2002), pp. 330–337.
7. J.L. Anderson, C.A. Allen Maycock and D.L. Lappe et al., *Frequency of elevation of C-reactive protein in atrial fibrillation*, *Am J Cardiol* 94 (2004), pp. 1255–1259.
8. B. Lo, R. Fijnheer, A.P. Nierich, P. Bruins and C.J. Kalkman, *C-reactive protein is a risk indicator for atrial fibrillation after myocardial revascularization*, *Ann Thorac Surg* 79 (2005), pp. 1530–1535.
9. R.J. Aviles, D.O. Martin and C. Apperson-Hansen et al., *Inflammation as a risk factor for atrial fibrillation*, *Circulation* 108 (2003), pp. 3006–3010.
10. E. Fransen, J. Maessen, M. Dentener, N. Senden and W. Buurman, *Impact of blood transfusions on inflammatory mediator release in patients undergoing cardiac surgery*, *Chest* 116 (1999), pp. 1233–1239.