

Active Clearance Technology: An Effective Drainage System to Prevent Postoperative Atrial Fibrillation



Samuel St-Onge MSc, Walid Ben Ali MD PhD, Ismail Bouhout MD MSc, Louis P. Perrault MD PhD, Denis Bouchard MD PhD, Philippe Demers MD MSc

Department of Cardiac Surgery, Montreal Heart Institute, Université de Montréal School of Medicine, Quebec, Canada



Background

- Postoperative atrial fibrillation (POAF) is one of the most frequent complications encountered after heart surgery (local baseline incidence: 33%) and is associated with stroke, increased mortality, prolonged hospital stay and greater health care expenditure.¹
- An obstructed chest tube, leaving unevacuated blood within the pericardium, can lead to atrial inflammation and oxidative stress, which can trigger POAF.
- The active clearance technology (ACT) has been developed in order to prevent chest tube obstruction, which could reduce the incidence of POAF.²

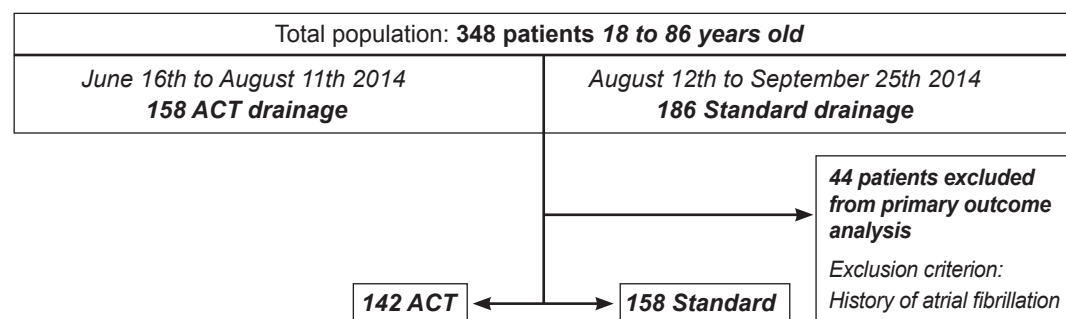


Active clearance technology drainage system

AIM:

To assess the effectiveness of chest drainage incorporating ACT system in reducing the rate of POAF.

Material and Methods



- Primary end-point:** New-onset POAF lasting at least 60 minutes
- Secondary end-point:** Occurrence of Retained Blood Syndrome (RBS)³
- Re-exploration for bleeding or tamponade
 - Interventions for hemothorax
 - Drainage procedure for pericardial or pleural effusion

Propensity score covariates:

- Gender
- CKD ≥ 3
- Hepatic dysfunction
- Heparin use prior to surgery
- Antiplatelet Rx not discontinued
- Minimally invasive procedure
- Emergent surgery
- Redo surgery
- Recent MI
- MVR indication
- CABG + Valve replacement
- Surgical AF ablation

Results

Table 1: Demographic and operative characteristics

	ACT (n= 158)	Standard (n= 186)	P-value
Age [y, mean ± SD]	66.5 ± 12.1	66.6 ± 10.8	0.93
Male [no. (%)]	119 (75)	118 (63)	0.02
HTN [no. (%)]	131 (83)	150 (81)	0.59
Diabetes [no. (%)]	54 (34)	72 (39)	0.39
Dyslipidemia [no. (%)]	124 (79)	146 (79)	> 0.99
Coronary artery disease [no. (%)]	116 (73)	145 (78)	0.33
COPD [no. (%)]	27 (17)	25 (15)	0.35
Chronic AF [no. (%)]	7 (4)	10 (5)	0.69
History of paroxysmal AF [no. (%)]	9 (6)	18 (10)	0.17
Chronic kidney disease ≥ 3 [no. (%)]	27 (17)	30 (16)	0.81
Liver dysfunction [no. (%)]	4 (3)	3 (2)	0.71
Recent MI [no. (%)]	33 (21)	39 (21)	0.99
Preoperative heparin [no. (%)]	77 (49)	79 (43)	0.25
Discontinued antiplatelet therapy [no. (%)]	69 (44)	58 (31)	0.02
Elective surgery	141 (89)	162 (87)	0.54
OPCAB [no. (%)]	6 (4)	27 (14)	0.001
Redo surgery [no. (%)]	8 (5)	12 (7)	0.58
MVR indication [no. (%)]	17 (11)	25 (13)	0.45
CABG + Valve replacement [no. (%)]	21 (13)	26 (14)	0.85
Concomitant MAZE procedure [no. (%)]	6 (4)	8 (4)	0.81

Table 2: Postoperative outcomes

	ACT (n= 158)	Standard (n= 186)	P-value
Atrial fibrillation [no. (%)]	29 (20)	57 (36)	0.003
Retained blood syndrome (Composite) [no. (%)]	9 (5.7)	9 (4.8)	0.72
Re-exploration [no. (%)]	4 (2.5)	4 (2.2)	> 0.99
Hemothorax [no. (%)]	1 (0.6)	3 (1.6)	0.63
Pericardial interventions [no. (%)]	3 (1.9)	3 (1.6)	> 0.99
Pleural interventions [no. (%)]	2 (1.2)	1 (0.5)	0.60
Total chest tube output [ml, median (IQR)]	725.0 (498.0; 1230)	810.0 (530.0; 1195)	0.325
Allogeneic blood transfusion [no. (%)]	59 (37)	83 (45)	0.19
RBC [no. (%)]	48 (30)	73 (39)	0.091
Stroke	2 (1)	2 (1)	> 0.99
AKI	18 (11)	15 (8)	0.30
Total hospital length of stay	5.0 (4.0; 7.0)	6.0 (5.0; 8.0)	0.03
Mortality	5 (3)	5 (3)	> 0.99

Table 3: End-points after propensity score

	OR	95% CI	P-value
Atrial fibrillation [no. (%)]	0.46	0.27-0.79	0.005
Retained blood syndrome (Composite) [no. (%)]	1.24	0.47-3.29	0.67
Re-exploration [no. (%)]	1.21	0.29-5.11	0.80
Hemothorax [no. (%)]	1.26	0.24-6.66	0.78
Pericardial interventions [no. (%)]	1.86	0.16-22.03	0.62
Pleural interventions [no. (%)]	0.39	0.04-3.98	0.43

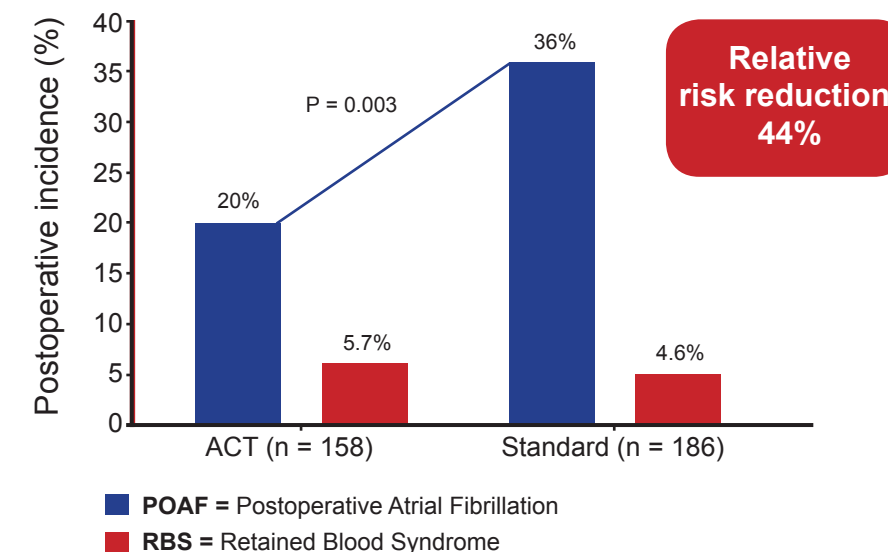


Figure 1: Incidence of POAF and RBS in both drainage groups

Conclusion

- Implementation of an ACT chest drainage protocol was associated with a significant reduction of POAF in patients undergoing heart surgery.
- The study was not powered to make conclusions about RBS.
- Shorter hospital length of stay and a trend toward less RBC transfusion were associated with ACT.

The use of a drainage protocol using active clearance technology was associated with reduced POAF. This highlights the relevance of maintaining chest tube patency in order to improve outcomes after heart surgery.

- Maisel WH, Rawn JD, Stevenson WG. Atrial fibrillation after cardiac surgery. *Ann Intern Med.* 2001;135:1061-73.
- Arakawa Y, Shiose A, Takaseya T, Fumoto H, Kim HI, Boyle EM, et al. Superior chest drainage with an active tube clearance system: evaluation of a downsized chest tube. *Ann Thorac Surg.* 2011;91:580-3.
- Boyle EM Jr, Gillinov AM, Cohn WE, Ley SJ, Fischlein T, Perrault LP. Retained Blood Syndrome After Cardiac Surgery: A New Look at an Old Problem. *Innovations.* 2015;10:296-303.