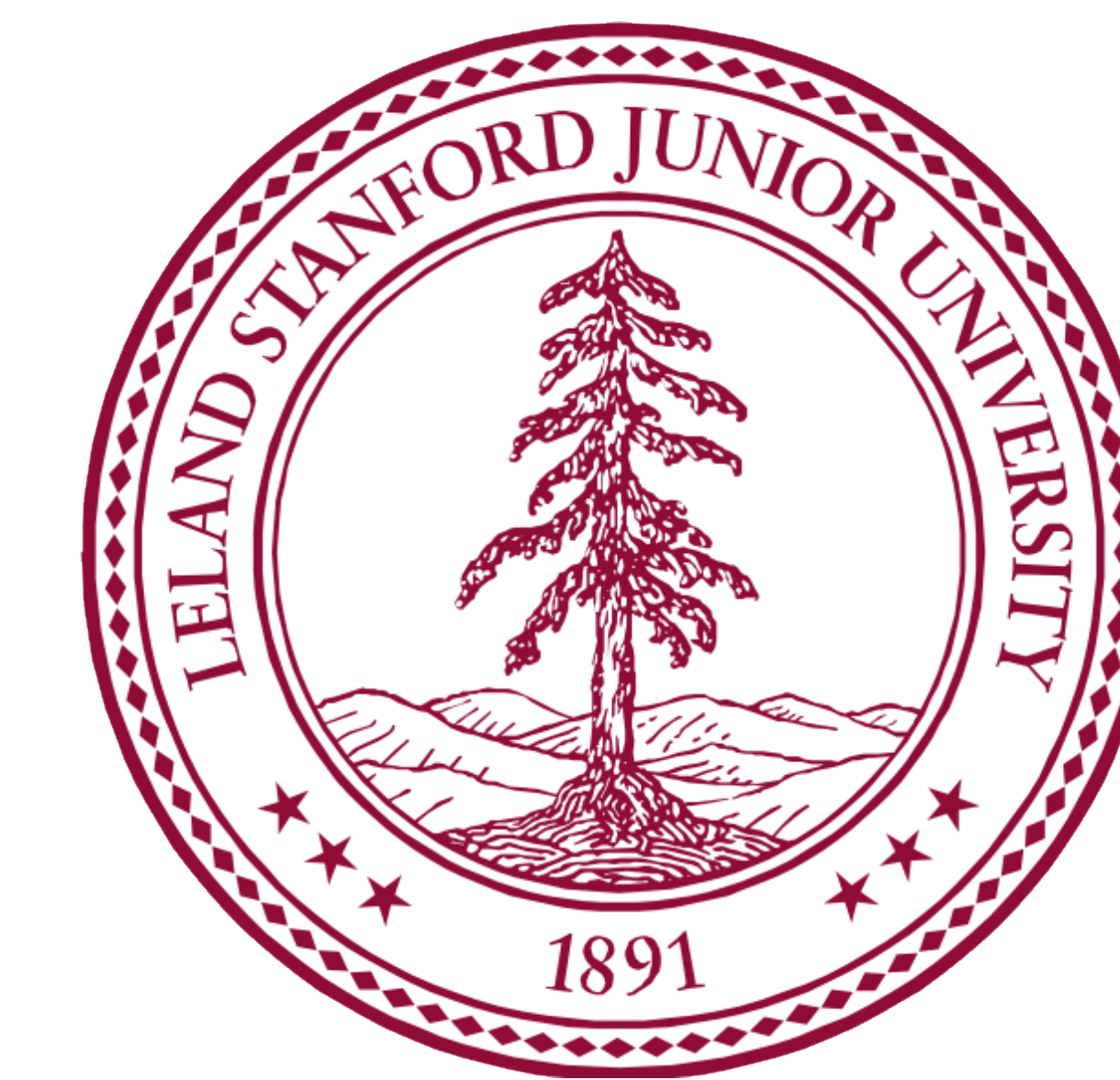


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An Innovative Chest Tube System for Active Blockage Detection and Automated Line Clearance After Routine Cardiac Surgery



17TH ANNUAL PERIOPERATIVE AND CRITICAL CARE CONFERENCE

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INTRODUCTION

- Chest tube drainage is an essential component of postoperative management in cardiac surgery to prevent cardiac tamponade and pleural effusion.
- Conventional chest tubes exhibit a **36% occlusion rate** when used after cardiac surgery [1].
- Enhanced Recovery After Surgery (ERAS) Guidelines emphasize the importance of maintaining chest tube patency and avoiding manual “stripping” or “milking” of tubes [2], but few chest tube systems capable of automated line clearance are currently available.

AIM

- We assessed the safety and efficacy of an innovative chest tube system capable of active blockage detection and automated line clearance.

METHOD

- Single-center, prospective, open-label study.
- Adult patients (n=18) who underwent non-emergent, first-time isolated coronary artery bypass grafting (CABG) between 2/2019-10/2019 were consented and enrolled. These patients received only automated-clearance chest tubes in the mediastinal and pleural spaces (total n=45 automated-clearance chest tubes).
- Consecutive adult patients (n=33) who underwent the same operation performed during the months immediately preceding the study (9/2018-2/2019) served as a control group. Control patients received conventional chest tubes at the surgeon’s discretion (total n=79 conventional chest tubes).
- Data presented as counts with percentages (compared using Fisher’s exact test) or as median with interquartile range (compared using the Mann-Whitney test).

RESULTS

Table 1	Conventional n=33 patients	Automated Clearance n=18 patients	P-value
Age (years)	71.0 [64.0-76.0]	67.0 [58.0-73.0]	0.236
Male	30 (90.9%)	12 (66.7%)	0.052
Body-Mass Index (kg/m ²)	29.0 [25.3-30.3]	27.2 [24.0-32.3]	0.528
Ejection Fraction (%)	57.5 [51.9-60.0]	58.6 [45.4-65.9]	0.601
Total Bypasses	3 [2-3]	3 [2-3]	0.842
Total Chest Tubes	79	45	
Tubes Per Patient	2.0 [2.0-3.0]	2.5 [2.0-3.0]	0.597
Tube Size (Fr)	24.0 [24.0-24.0]	20.0 [20.0-20.0]	<0.001
Tube Duration (hr)	71.9 [64.1-94.5]	75.3 [65.5-86.9]	0.358
1 Hour Output (mL)	60.0 [37.0-175.0]	105.0 [70.0-200.0]	0.440
6 Hour Output (mL)	261.5 [217.5-385.0]	305.0 [155.0-470.0]	0.856
24 Hour Output (mL)	660.0 [427.5-870.0]	780.0 [450.0-1020.0]	0.271
Final Output (mL)	1040.0 [750.0-1590.0]	1330.0 [755.0-1950.0]	0.768
Takeback for Bleeding	0 (0.0%)	0 (0.0%)	N/A
Pneumothorax	0 (0.0%)	0 (0.0%)	N/A
Pleural Effusion Drained	0 (0.0%)	0 (0.0%)	N/A
Pericardiocentesis	0 (0.0%)	0 (0.0%)	N/A
Readmit for Effusion	2 (6.1%)	1 (5.6%)	1.000

Table 1.

- Patients receiving conventional and automated-clearance chest tubes had similar baseline characteristics and underwent CABG with similar numbers of total grafts and chest tubes.
- Although the automated-clearance chest tubes were smaller in caliber, the drainage profile was similar to that of the conventional chest tubes, and no chest tube-related complications were encountered as inpatient.

CONCLUSIONS

- With a very low occlusion rate (2.4%), no complications prior to chest tube removal, and a similar drainage profile as larger-caliber thoracostomy tubes, this automated-clearance 20 Fr chest tube system represents a safe and effective option for surgical drainage after routine cardiac surgery.
- In addition to CABG, use of this automated-clearance chest tube in patients with mitral valve, aortic valve, and aortic aneurysmal disease has also demonstrated good results, although further study is needed.

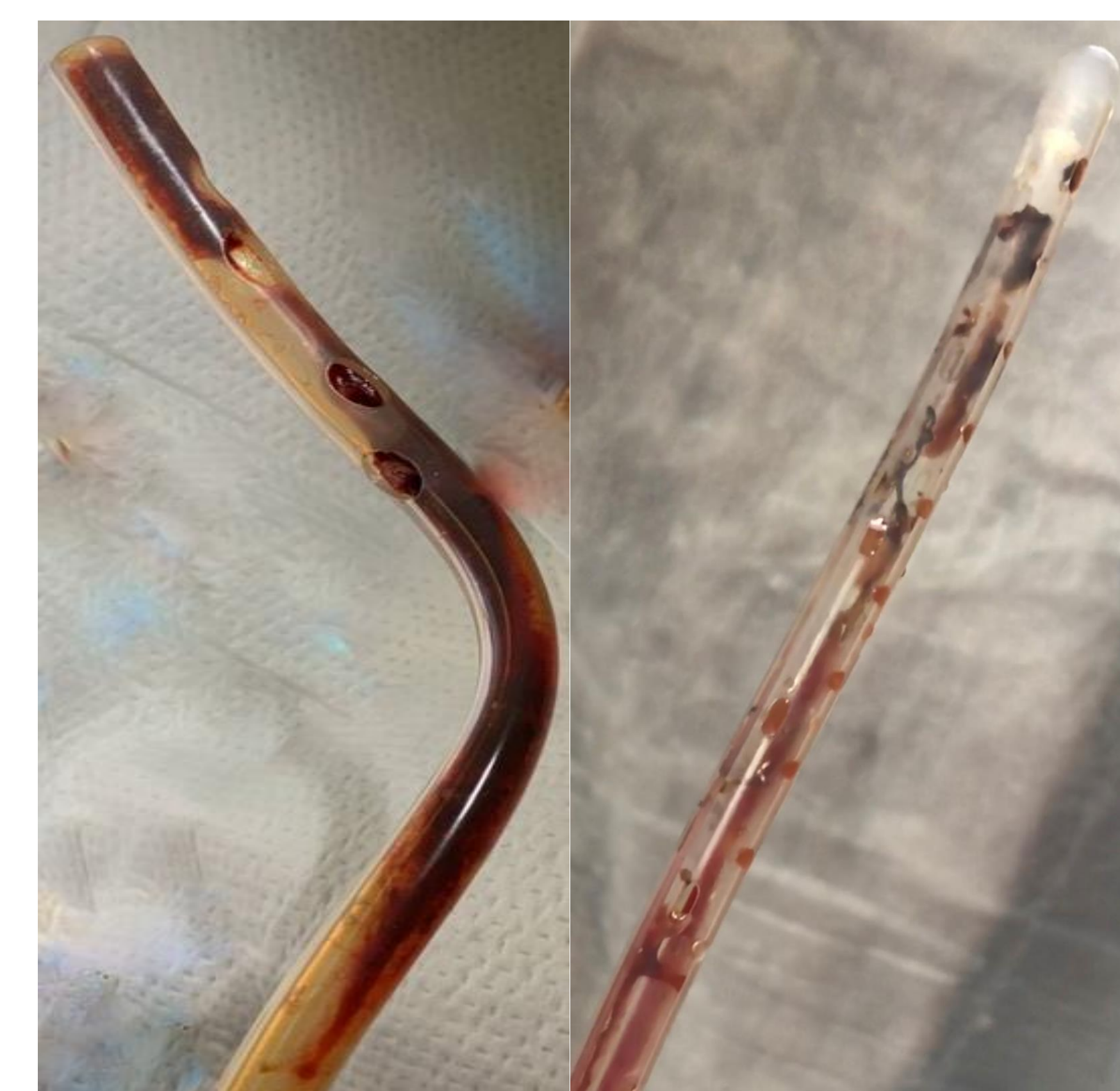


Figure 1.

- Left, conventional chest tube with significant clot burden.
- Right, 20 Fr automated-clearance chest tube. No obstruction and minimal clot burden noted.

Automated-Clearance Chest Tubes:

2.4% Occlusion Rate

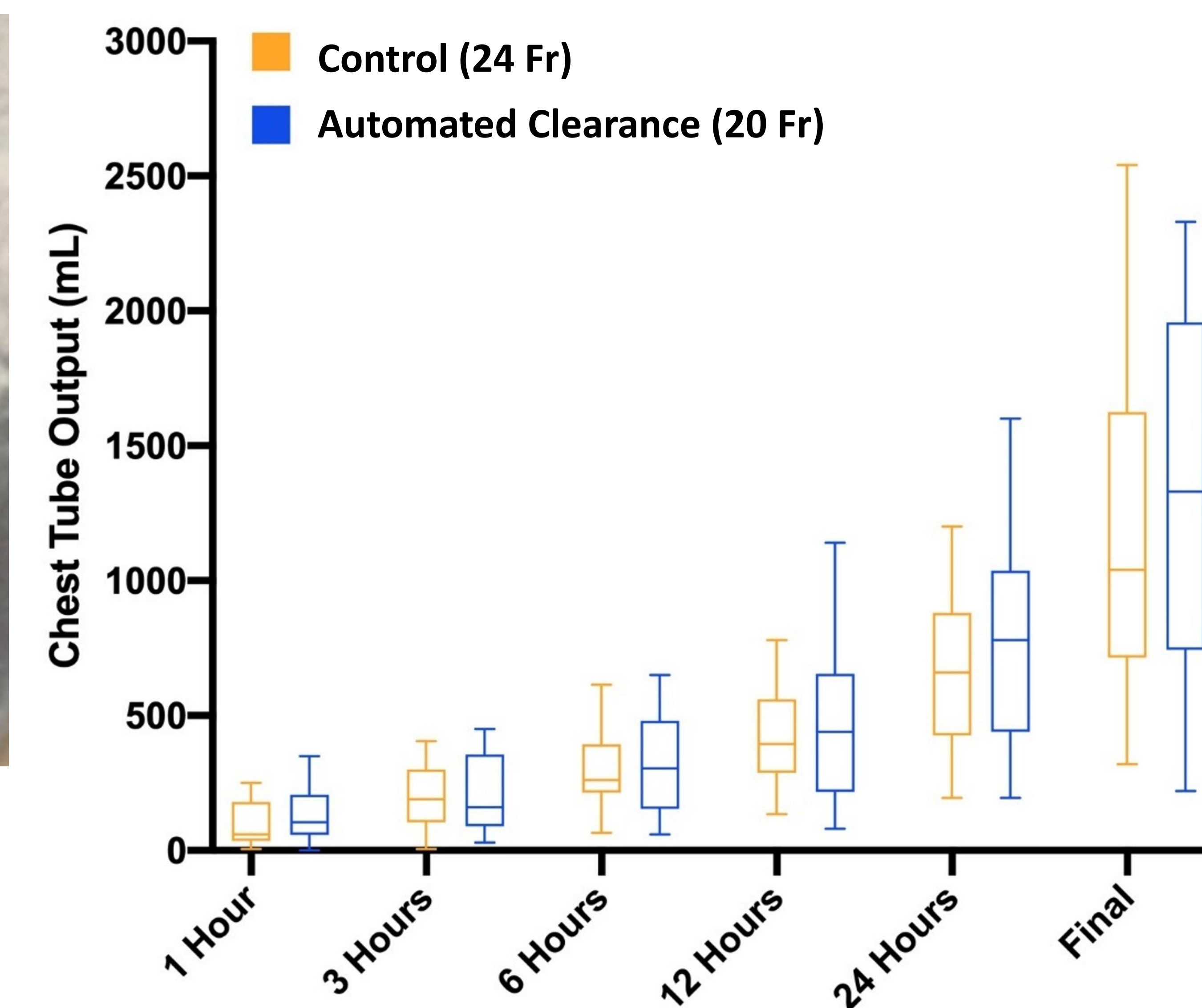


Figure 2.

- Although smaller in caliber, the automated-clearance chest tubes produced a similar drainage profile as conventional control chest tubes at all time points examined.

REFERENCES

- Karimov et al. Incidence of chest tube clogging after cardiac surgery: a single-centre prospective observational study. Eur J Cardiothorac Surg 2013, 44:1029.
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