

Impact of Drain Retained Blood on Outcome after Cardiac Surgery

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Introduction

Introduction: Pleural and pericardial effusion, tamponade and hemothorax and thereof resulting interventions are serious complications despite chest tubes are placed in every patient after cardiac surgery [1,2]. The clogging of chest tubes may contribute to the occurrence of such like complications. Purpose of this study was to identify the incidence of complications associated with the retention of blood in pericardial and pleural cavities in a large database and to determine its impact on patient outcome after cardiac surgery.

Methods

Single center, retrospective, observational cohort study at Charité- University Medicine Berlin, Germany. After IRB approval, electronic records from all adult patients undergoing cardiac surgery between 2006 and 2013 were extracted from the patient data management system. Statistical analyses of the anonymized dataset were undertaken with a p value below 0.05 regarded as significant. Significance among groups was univariately analyzed by the exact nonparametric Mann-Whitney U test. Exact Chi-Square tests were used for qualitative data. Logistic regression adjusted for all variables using stepwise backwards selection was performed for multivariate analyses.

| | All Patients N=6909 | No Retained Blood N=5924 | Retained Blood N=985 | p value |
|--|------------------------|-----------------------------|-------------------------|---------|
| Basic data: | | | | |
| Age [y] | 69.0 [61.0;75.0] | 69.0 [61.0;74.0] | 71.0 [64.0;77.0] | <0.001 |
| Sex: F | 1964 (28.4%) | 1615 (27.3%) | 349 (35.4%) | <0.001 |
| Body Mass Index (BMI) | 26.9 [24.3;30.1] | 27.0 [24.3;30.2] | 26.1 [23.8;29.4] | <0.001 |
| Surgery: | | | | |
| Type of surgery: | | | | <0.001 |
| CABG | 3954 (57.2%) | 3552 (60.0%) | 402 (40.8%) | |
| Valves | 2093 (30.3%) | 1691 (28.5%) | 402 (40.8%) | |
| Both | 862 (12.5%) | 681 (11.5%) | 181 (18.4%) | |
| Duration of surgery [m] | 195 [160;240] | 195 [159;240] | 205 [165;255] | <0.001 |
| Priority of surgery: | | | | <0.001 |
| elective | 4361 (76.8%) | 3783 (78.1%) | 578 (69.6%) | |
| urgent | 519 (9.15%) | 430 (8.88%) | 89 (10.7%) | |
| emergency | 795 (14.0%) | 632 (13.0%) | 163 (19.6%) | |
| RBC transfusion (pat. %) | 1829 (29.6%) | 1441 (27.0%) | 388 (45.6%) | <0.001 |
| RBC transfusion [units] | 1.95 (1.05) | 1.90 (1.01) | 2.15 (1.18) | <0.001 |
| ACEF score | 1.28 [1.13;1.60] | 1.27 [1.12;1.55] | 1.44 [1.22;1.95] | <0.001 |
| APACHE II | 18.0 [14.0;24.0] | 18.0 [14.0;24.0] | 20.0 [16.0;26.0] | <0.001 |
| Preexisting medical conditions: | | | | |
| Coronary heart disease | 5383 (77.9%) | 4674 (78.9%) | 709 (72.0%) | <0.001 |
| Left heart failure (>NYHA II) | 2069 (29.9%) | 1629 (27.5%) | 440 (44.7%) | <0.001 |
| COPD | 1184 (17.1%) | 955 (16.1%) | 229 (23.2%) | <0.001 |
| Endocrine disease | 6334 (91.7%) | 5392 (91.0%) | 942 (95.6%) | <0.001 |
| Peripheral vascular disease | 1333 (19.3%) | 1087 (18.3%) | 246 (25.0%) | <0.001 |
| Atrial fibrillation | 2054 (29.7%) | 1571 (26.5%) | 483 (49.0%) | <0.001 |
| Chronic renal insufficiency | 1684 (24.4%) | 1336 (22.6%) | 348 (35.3%) | <0.001 |
| Haematocrit pre op | 41.0 [37.0;43.0] | 41.0 [37.0;43.1] | 39.0 [35.0;43.0] | <0.001 |
| Haemostatic disorder | 754 (10.9%) | 627 (10.6%) | 127 (12.9%) | 0.036 |
| Antiaggregation | | | | 0.28 |
| Mono antiplatelet th. | 2309 (45.5%) | 2035 (45.9%) | 274 (42.6%) | |
| Dual antiplatelet th. | 1097 (21.6%) | 952 (21.5%) | 145 (22.6%) | |

Table 1: Patient characteristics

Results

Data from 6,909 adult patients admitted were included in analyses. Retention of blood defined as pleural and pericardial effusion, tamponade and hemothorax requiring thoracentesis or re-exploration was diagnosed in 1125 (16.3%) patients after cardiac surgery. Basic patient characteristics, surgery related data, and preexisting medical conditions are presented in table 1. Pleural effusions were found in 613 (8.9%) patients, pericardial effusions in 73 (1.1%) patients, hemothorax in 226 (3.3%) patients, and tamponade in 40 (0.6%) patients. Surgical re-exploration was required in 464 (6.7%) patients. Patients with retained blood related complications showed increased mortality, length of stay, time of ventilation, incidence of hemodialysis and postoperative transfusion of packed red blood cells (see Table 2). Adjusted odds ratios are shown in figure 1.

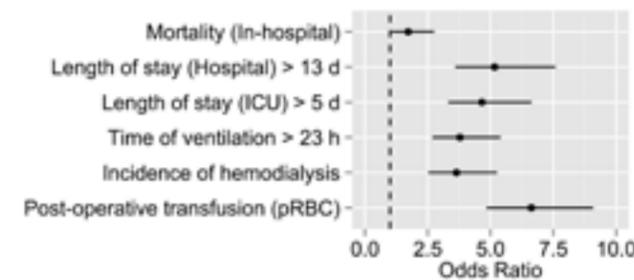


Figure 1: Adjusted odd ratios for selected outcome parameters

| | All Patients N=6909 | No Retained Blood N=5924 | Retained Blood N=985 | p value |
|-----------------------------------|--------------------------|-----------------------------|-------------------------|---------|
| Mortality (In-hospital) | 475 (6.88%) ^w | 303 (5.11%) | 172 (17.5%) | <0.001 |
| LOS (Hospital) [d] | 13.0 [9.00;21.0] | 12.0 [9.00;18.0] | 27.0 [17.0;49.0] | <0.001 |
| LOS (ICU) [d] | 5.00 [3.00;9.00] | 5.00 [3.00;8.00] | 15.0 [7.75;33.0] | <0.001 |
| Time of ventilation [h] | 23.0 [10.0;54.0] | 20.0 [9.00;43.0] | 84.0 [29.0;303] | <0.001 |
| Incidence of hemodialysis | 1117 (16.2%) | 684 (11.5%) | 433 (44.0%) | <0.001 |
| Post-operative transfusion (pRBC) | 1273 (18.4%) | 734 (12.4%) | 539 (54.7%) | <0.001 |

Table 2: Selected outcome parameters

Conclusions

Complications related due to retained blood in pleural and pericardial cavities are common after cardiac surgery. The use of active clearing techniques to prevent clogging of chest tubes may treat the underlying cause and counteract preventable events [3]. This could result in better outcome after cardiac surgery and requires prospective and controlled evaluation.

[1] Kuvin JT, Harati NA, Pandian NG, Bojar RM, Khabbaz KR. Postoperative cardiac tamponade in the modern surgical era. Ann Thorac Surg 2002;74:1148-53 [2] Čanádýová J1, Zmeko D, Mokráček A. Re-exploration for bleeding or tamponade after cardiac operation. [3] Shiose A, Takaseya T, Fumoto H, Arakawa Y, Horai T, Boyle EM, Gillinov AM, Fukamachi K. Improved drainage with active chest tube clearance. Interact Cardiovasc Thorac Surg. 2010;10(5):685-8