THE INCIDENCE AND CLINICAL OUTCOME OF CARDIAC TAMPONADE FOLLOWING AN OPEN HEART SURGERY IN A DEVELOPING COUNTRY

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ABSTRACT

Introduction: Pericardial effusion is not uncommon following an open heart surgery, thus, it may progress to cardiac tamponade. This is a retrospective cross sectional analysis evaluates the incidence, the potential perioperative and surgical risk factors causing cardiac tamponade following an open-heart surgery of patients during the period 2001-2006 at Ahmed Gasim Cardiac Center in Khartoum, North Sudan.

Methods: Diagnosis of cardiac tamponade was based on clinical and echocardiographic findings. Univariate analysis was performed to assess possible risk factors related to both, early and late cardiac tamponade.

Results: Among the 890 patients who underwent open heart surgery in this study, 47(5%) patients developed tamponade (early 49% or 51%). Early cardiac tamponade was found to be present with significant cardiac compromise and can easily be detected using echocardiography. In contrast the presentation of late cardiac tamponade, atypical and echocardiography was inconclusive. The mean age of patients was 31 ± 12 with slight female predominance. The main indication for the operation was rheumatic heart disease (89%), mainly mechanical valve replacement of the mitral valve. Eight (17%) patients were receiving warfarin preoperatively. Oozing wounds and blocked drains were encountered in 27% and 37%, respectively. About 6% of the patients recollect tamponade after decompression and one in-hospital death directly related to the cardiac tamponade.

Conclusion: Significant cardiac tamponade was associated with preexisting rheumatic heart disease, (preoperative warfarin use), mechanical valve replacement in the mitral position, oozing wounds and blocked drain. Echocardiography was reliable in early diagnosis, but not late, hemodynamically significant cardiac tamponade.

Keywords: Tamponade, Open heart surgery complication; Low cardiac output treatment

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INTRODUCTION
Pericardial effusions are common following open heart surgery (OHS) with an incidence as high as 85%[1,2]. Few pericardial effusions; however, progress to become hemodynamically significant and results in cardiac tamponade (CT). The reported incidence ranges between 0.1% - 6%[1-5]. There are many factors that can contribute to the development of the condition, including prior anticoagulant and perioperative factors. It can occur early within the first day following cardiac surgery or at a later stage. The diagnosis of the CT can be challenging, especially the late type[3]. Cardiac surgery in Sudan is a new frontier and started within the last two decades. This study is carried out to analyze the population at risk of developing postoperative CT, and in identifying potential perioperative and surgical risk factors leading to this condition. It also examines the risk factors affecting early and late CT as well as to evaluate the impact of CT on patient outcomes.

MATERIALS AND METHODS
This study conducted a retrospective cross-sectional analysis of consecutive patients who underwent open-heart surgery (OHS) during the period 2001 to 2006 at Ahmed Gasim Cardiac Center in Khartoum, North Sudan, which is the main tertiary referral hospital in the country for cardiac disease. All patients were assessed for the development of CT and followed closely after discharge for 30 days succeeding surgery, primarily at the referred clinic at Ahmed Gasim Cardiac Centre. If a patient required readmission to another hospital, they were sent back to our institution. Medical records for those treated elsewhere were obtained using a predesigned questionnaire. Following surgery, CT occurring in the first day or after the first week is labeled as early or late. Surgery was classified as either valve surgery, coronary or “other”. Other groups included aortic surgery of the root, congenital cardiac defects and cardiac tumors.

Cardiac tamponade were suspected clinically in patient with increasing shortness of breath, hypotension or signs of heart failure or CT. Echocardiograms were performed on 57.4% of the patients who were suspected to have had CT clinically. Those patients who developed CT following OHS (47 patients out of 890 patients) were examined further for the possible contributing factors and causes, including timing and type of OHS, duration of cardiopulmonary bypass, aortic cross-clamp time, intraoperative use of antifibrinolytic agents and number, and site of chest-tubes used. Other pre and post-surgical parameters, such as blood samples for anticoagulation levels, renal function and blood count were also collected. Data was analyzed using simple percentages and univariate analysis was performed to assess the risk factors for the development of early and late CT.

RESULTS
Among the 890 patients who underwent OHS, only 47 (5%) developed postoperative CT. Approximately 60% of the surgical procedures were considered elective. The mean duration of cardiopulmonary bypass was 98.02 ± 9 min, with a mean cross-clamp time of 71.14 ± 6 min. Most patients (95%) received intraoperative antifibrinolytic agents as part of the standard operative regimen. Eighty-seven percent of patients with CT had received anticoagulation with warfarin or heparin within the first 3 days following OHS. Chest tubes were removed within 2 days after surgery. PACing wires were used only in 8.5% of patients, and both mediastinal and chest tube drainage was used in 25.5% of patients.

Table 1 demonstrated that about 49% had “early” CT; while 51% had “late” CT. Of the 47 patients with CT; 35 patients were detected and treated during the initial hospitalization, while 12 patients were readmitted to the hospital for diagnosis and treatment. The age of the patients ranged from 9 months to 65 years with an average of 31.2 ± 12 years. There was slight female predominance (51%). The main underlying disease was Rheumatic heart disease in 89% (Table 1). Eighty-seven percent of patients had an INR of less than1.3, while only eight patients (17%) received anticoagulation with warfarin prior to surgery (Table 1).

Regarding the type of operation associated with post-operative CT, the mitral valve replacement (MVR) represented the largest group (57.4%), while aortic valve replacement (AVR) and double valve replacement (DVR) were found in 21% and 12.5%, respectively. Other operative procedures include correction of tetralogy of fallot (TOF) and ventricular septal
defect (VSD), noticed in 8.6% of patients (Table 2). Eighty-nine percent of the prostheses implanted were mechanical valves and 2% were tissue valves (Table 3).

Regarding treatment outcome, fifty-seven percent of patients with CT underwent surgical drainage of the pericardial effusion by resternotomy; while 43% underwent subxiphoid incision. The bleeding site was identified in 19 patients (about 40%) and 85% of them developed CT within the first 24 hrs.

After decompression of the heart, majority (94%) of patients improved satisfactorily while a small percentage (3.6%) developed recurrent CT. In this study, one in-hospital cardiovascular death occurred (Table 4).

The volumes of pericardial collections ranged between 0.5-2 liters. Table 5 showed the amount of pericardial fluid drained from patients developed CAMP. The size of the pericardial effusion was mild to moderate (0.5-1 liters) in 61.7% and large (more than 1 liter) in 37.3% of cases (Table 5).

Univariate analysis of the data collected was performed to characterize the features to differentiate between early and late tamponade. It was found that the clinical symptoms of dyspnoea, tachycardia, chest tightness and palpitation were very significantly associated with early tamponade, whereas, the most statistically significant features associated with late tamponade were a prolonged INR and the huge effusion of more than 500 ml. Also noticed that echocardiography was not conclusive in majority of patients with late tamponade (95.8%) though it was useful in the diagnosis of early tamponade (83%). Perioperative factors, such as wound oozing tend to be more associated with early rather than late CT (Table 6).

**DISCUSSION**

Although pericardial effusions are common following OHS with an incidence as high as 85%[1,2], only few pericardial effusions progress to become hemodynamically significant and result in CT. The reported incidence of CT ranges between 0.1% -6%[1,3-5]. In this study, among 890 patients who underwent OHS over a 5-year period, the incidence was found to be 5.2%, conforming to the findings of other. There was slight female predominance, with tendency of CT to occur earlier in the postoperative period in women. This is consistent with findings other workers in the field[1]. Mean time of the diagnosis of CT was 16 days after OHS, which was much higher than what was reported in other studies[1]. This is probably because only one patient was presented after more than one year, which cause skewing to the data and increased the average mean value.

Though the incidence of CT has been reported to be higher in the early postoperative period in other studies[6], more than 50% of the cases in our study were found to occur late. “Early” CT is usually related to surgical bleeding or coagulopathy due to the morbid effect of the heart-lung machine. However, late CT seems to be multifactorial in origin; it may present with nonspecific symptoms and may develop without clear-cut clinical signs[7]. Also observed that in early tamponade (<7days), effusions were small in size.
Additionally patients with this condition presented with clear clinical features of cardiac compromise compared to those seen with late tamponade, where the clinical presentation was atypical. This emphasizes the importance of high index of clinical suspicion in the latter group and the importance of long term follow up. Similarly, echocardiography was found of be more help in the diagnosis of early, rather than late CT. In fact, echocardiography was performed in 57.4% of patients to confirm the diagnosis of CT. In seven patients offered echocardiography, the reports were negative, but clinical and operative findings were diagnostic. Echocardiography is useful for the detection of pericardial effusions following OHS and allows for rapid, safe and accurate localization of the effusion and estimation of its size\[8\]. It should be noted that the size of postoperative pericardial effusion does not necessarily reflect the likelihood of developing CT. In 7 cases of our study, despite the exclusion of CT by echocardiography, still CT remained clinically detectable and this was confirmed intraoperatively'.

Table 6. Showing the univariate analysis of the variables associated with early and late cardiac tamponade.

| Variable                      | Early N (%) | Late N (%) | P   |
|-------------------------------|-------------|------------|-----|
| Main Diagnosis (Rheumatic/non rheumatic) | 6 (26%)     | 0          | .009|
| Duration of Disease           | 16 (70%)    | 23 (96%)   | .02 |
| Duration of symptoms of tamponade | 2 (9%)      | 24 (100%)  | .000|
| Dyspnoea                      | 10 (44%)    | 0          | .000|
| Tachypnoea                    | 10 (44%)    | 0          | .000|
| Chest Tightness               | 15 (65%)    | 0          | .000|
| Palpitation                   | 18 (78%)    | 0          | .000|
| Fever                         | 20 (87%)    | 1 (4.2%)   | .000|
| Vomiting                      | 23 (100%)   | 4 (16%)    | .000|
| Chest X-ray                   | 9 (39%)     | 0          | .001|
| Echocardiography              | 19 (83%)    | 1 (4.2%)   | .000|
| INR                           | 0           | 11 (46%)   | .000|
| Volume on Drainage            | 11 (48%)    | 24 (100%)  | .000|
| Drain Site                    | 9 (39%)     | 3 (13%)    | .038|
| Oozing surgical wound         | 10 (44%)    | 0          | .000|
| Blocked Tubes                 | 7 (30%)     | 0          | .000|
| Effusion                      | 15 (65%)    | 24 (100%)  | .002|
| Prosthesis                    | 5(22%)      | 0          | .022|

INR = international normalized ratio

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more than one third of the patients were taking aspirin and were receiving heparin or warfarin therapy prior to surgery. Most patients received aspirin within the first 24 hrs after surgery, while heparin or warfarin was usually given within 3 days after surgery. Antiplatelet therapy has therefore been considered a major contributing factor in the development of intrapericardial bleeding and CT. The INR in our series is found to be elevated but still within the therapeutic levels and is significantly associated with late CT.

The adverse effects of cardiopulmonary bypass (CPB) on coagulation parameters are well known and likely have a role in the pathogenesis of postoperative pericardial effusions\(^8\). In this study, patients had a mean duration CPB of 98.02 ± 9 min and the mean cross-clamp time was 71.14 ± 6 min. An increased time of those two parameters is more likely to be associated with increased risk of bleeding, and probability of developing pericardial effusions and CT following surgery. Because CT can potentially be fatal, early decompression is required as soon as it is confirmed. CT occurring within 24 hrs is almost always treated surgically, since it is essential to identify the source of bleeding, ‘Late’ CT has been traditionally drained surgically by a subxiphoid incision or a full resternotomy. However, CT has been successfully treated by percutaneous pericardiocentesis under echocardiographic and fluoroscopic guidance, which may allow for shorter hospital stay and decreased morbidity. This technique has proved to be effective in the treatment of anterior and circumferential effusions, but surgery is usually required for loculated posterior effusions\(^9\). One in-hospital death occurred in our study related to CT after developing recurrent CT. All other patients were discharged either home or to rehabilitation.

There are several limitations to this study. It is a retrospective analysis of patients who developed CT after OHS and the findings are not compared with a control group other than those in similar reports in the literature. In addition, not all patients underwent an echocardiogram after OHS; therefore, the incidence of pericardial effusions or CT after OHS may be underestimated. While our nursing staff follows all postoperative patients closely after hospital discharge, it is possible that some cases of CT were missed and were not used for this analysis. In addition, each patient examined in this study underwent full cardiopulmonary bypass. Furthermore, this study was conducted before newer antiplatelet agents were started to be commonly used. Thus, with the recent advances in cardiology and OHS, it is unclear how these findings will reflect the real picture of this complication in the present-day cardiac surgery. Nevertheless, cardiac surgery is new in Sudan and hence, these findings are important to be presented, so subsequent improvement can be compared with.

**CONCLUSION**

In conclusion, this study indicated that CT following OHS is a serious and potentially fatal condition that can be clinically challenging from diagnostic and therapeutic perspectives. However, when diagnosed and treated promptly, postoperative CT should not significantly increase mortality. This study found that CT after OHS was more common following valve surgery. Pre and postoperative use of anticoagulants is related to the development of CT. In addition, women appear to have a slightly higher risk for developing postoperative CT than men, which is not statistically significant.

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