A highly fatal intraoperative urgency – aortic dissection complicating heart surgery

Adil Polat¹, Ilker Mataraci², Ebru Polat³, Altug Tuncer³, Vedat Erentuğ¹, Kaan Kirali¹, Cevat Yakut²

¹ John F. Kennedy Hospital, Istanbul, Turkey
² Kartal Kosuyolu Heart and Research Hospital, Istanbul, Turkey
³ Hizmet Hospital, Istanbul, Turkey
⁴ Bagcilar Research and Training Hospital, Istanbul, Turkey

Abstract

Background: Aortic dissection is associated with high mortality. Despite its rarity, it is often fatal.

Aim: We have retrospectively analysed acute aortic dissections occurring intraoperatively (IAAD).

Methods: Patients’ preoperative risk factors, and operative and postoperative courses were analysed from the hospital records retrospectively.

Results: From 1985 to 2009, we performed 29 683 cardiac operations. Ten patients (0.43‰) (mean age 66.5 ± 7 years) were diagnosed with IAAD. There were type 2 dissections in 9 and one patient had it extending beyond the arcus. Four patients were operated on for coronary artery disease, 2 for mitral and 2 for aortic valve diseases. Two patients had concomitant valvular valvular and coronary procedures. IAAD was identified after decannulation in 5, after creating the holes for proximal anastomoses in 3 and after declamping the aorta in 2 patients. Preoperatively, 6 (60%) patients had hypertension and 4 had hypercholesterolaemia (40%). No other significant risk factors could be identified. Hypothermic circulatory arrest was used in 6 operations. The dissected segment was replaced with a graft in 9 patients whereas the remaining patient had concomitant arcus aorta replacement and elephant trunk procedure. Aortoplasty with Dacron patch was used in one patient. All patients required inotropic and 4 patients IABP support postoperatively. Three (30%) patients died.

Conclusions: The IAAD may occur in any patient at any phase of cardiac surgery. The surgeon should always be aware of the possibility of this complication. It is much better to prevent the IAAD than to treat it. When detected, abrupt change of the operation plan and reparative measures for the dissection should be undertaken.

Key words: intraoperative aortic dissection, urgency, intraoperative complication

Introduction

Intraoperative acute aortic dissections (IAAD) are one of the well known complications of cardiac surgery [1]. Many centres have reported their scant experiences of a few cases. In one of the most cited reports by Still and colleagues, they reported 0.16% incidence in 14 877 patients [1]. Murphy et al. had 0.35% IAADs in 6943 open heart surgery operations [2]. More detailed analyses have not been done recently [3] but the need for further data and analysis continues.

We analysed the IAAD cases seen in our department. Because we are a high-volume centre, our numbers may be significant for incidence, prevalence and risk factor discussions.

Methods

From 1985 to January 2009, we performed 29 683 open heart operations in our department. Ten (0.43‰) patients (mean age 66.5 ± 7 years, 5 females) were diagnosed with acute type A aortic dissection intraoperatively. Operation plans were revised immediately and aortic repairs were commenced. Dissections were limited to the ascending aorta in 9 cases and in one patient it extended beyond the arcus aorta. The operations are listed in Table I. Five patients had a biological mitral prosthesis before and they presented with paravalvular leakage. Mitral valve replacement (MVR) with a mechanical prosthesis was performed. The indication for the two aortic valve replacement (AVR) operations was aortic stenosis. Three
patients had aortic stenosis concomitant with coronary artery disease. Preoperative risk factors are outlined in Table I.

The demographic characteristics, preoperative risk factors, intraoperative and postoperative courses were collected from the hospital records. The diagnosis of IAAD was made according to the haemodynamic changes and the inspection of the aorta and was confirmed by transoesophageal echocardiography (TEE). An unexplained haemodynamic instability causing difficulty in terminating the cardiopulmonary bypass (CPB), blue to purple discolouration in aortic adventitia and rapidly enlarging aortic diameter were the signs of IAAD.

Surgical technique

Premedication, induction and maintenance of anaesthesia were performed according to the standard protocols. Median sternotomy was used in all cases. The site of arterial cannulation was the ascending aorta proximal to the arcus branches in all cases but the right femoral artery was preferred in the redo MVR patient. Venous cannulation was done with dual-stage cannulae in coronary artery by-pass grafting (CABG) and AVR cases, and with double venous cannulation for MVR cases. An antegrade cardioplegia needle was placed approximately 0.5 to 1 cm proximal to the folding in the ascending aorta cases. In the CABG procedures we used cardioplegia cannulae with venting and in the mitral procedures the cardioplegia was given via an aortic needle. After cross-clamping the aorta proximal to the arcus, diastolic arrest was obtained with isothermic retrograde cardioplegia. In aortic valvular procedures intermittent antegrade cardioplegia was given via the coronary ostia together with retrograde cardioplegia via the coronary sinus. Proximal anastomoses were done on the ascending aorta in CABG operations. The holes were gently created by the punch holder (Table II).

The operation plan was changed as soon as IAAD was diagnosed. The time-points of IAAD detection are listed in Table I. For dissection repairs, the preferred site of arterial cannulation for CPB was the right femoral artery. Hypothermic circulatory arrest (HCA) was used in 6 patients. Separated graft interposition to the ascending aorta with a 30 or 32 mm Dacron graft was done in 9 patients whereas one of them had concomitant arcus aorta replacement and elephant trunk procedure. Aortoplasty with a Dacron patch was used in one patient. In the case of graft interposition, proximal anastomoses of the saphenous vein grafts were done on the graft.

Statistical analysis

The preoperative and postoperative ascending aorta, aortic root, interventricular septum, end systolic and end diastolic left ventricular diameters and ejection fraction (EF%) values were compared using paired t-test. A p value < 0.05 was accepted as significant. All calculations were made with SPSS 16.0 (SPSS Inc.) statistical programme.
Results

The IAAD was seen in 10 of the 29,683 open heart surgery procedures, constituting a prevalence of 0.43‰. The list of these procedures and the patient data are summarised in Table I. The perioperative parameters are outlined in Table II. The results of echocardiographic measurements are seen in Table III. The aortic walls of the patients were atherosclerotic due to the advanced mean age of this patient series.

There were 3 postoperative deaths. Patients 1 and 6 underwent CABG. Postoperatively they were transferred to the intensive care unit with inotropic and IABP support. These two patients did not regain consciousness after the operation. They remained in cardiogenic shock and eventually died on the 8th and the 12th postoperative days, respectively. In patient 8, the IAAD extended beyond the arcus aorta. The operation time was 387 min with 91 min of HCA. He had difficulty in weaning from the CPB. Postoperatively there was 1250 cc drainage from the chest tubes. Large amounts of blood products were used intraoperatively and thereafter. The haemodynamics were stabilised with inotropic and IABP support. He died due to multiorgan failure on the 6th postoperative day.

The postoperative morbidity of the patients is listed in Table IV. All patients received inotropic support postoperatively whereas only 4 of them required IABP support. There were three patients with renal complications (patients 3, 4 and 8). The first two cases had temporary rises in blood urea nitrogen and creatinine values which returned to normal levels in 2 and 3 days. Patient 8 had acute renal failure on the 4th postoperative day and continuous haemofiltration was used.

Discussion

The IAAD is one of the well-known complications of cardiac surgery [1, 2]. The low incidence of this complication may explain the low level of interest in this subject. Previously existing aortic pathologies may pose significant risk [2, 4]. Surgical intimal damage during aortic

### Table II. Perioperative parameters

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### Table III. Preoperative and postoperative echocardiographic evaluation

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<td>Ascending aorta</td>
<td>4.3 ± 0.3</td>
<td>3.1 ± 0.1</td>
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<td>Aortic root</td>
<td>4.2 ± 0.2</td>
<td>3.0 ± 0.1</td>
<td>0.270</td>
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<td>LVESD</td>
<td>4.2 ± 0.8</td>
<td>4.0 ± 0.4</td>
<td>0.200</td>
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<td>5.2 ± 0.7</td>
<td>0.352</td>
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<td>IVS</td>
<td>1.1 ± 0.1</td>
<td>1.1 ± 0.2</td>
<td>0.094</td>
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<tr>
<td>EF [%]</td>
<td>54.7 ± 1.2</td>
<td>57.6 ± 13.6</td>
<td>0.038</td>
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</table>

Abbreviations: LVESD – left ventricular end systolic diameter, LVEDD – left ventricular end diastolic diameter, IVS – interventricular septum, EF – ejection fraction

### Table IV. Morbidity

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<tr>
<td>3</td>
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</tr>
<tr>
<td>4</td>
<td>refractory HT, renal**</td>
</tr>
<tr>
<td>5</td>
<td>none</td>
</tr>
<tr>
<td>7</td>
<td>need for inotropic support, refractory HT, pulmonary*</td>
</tr>
<tr>
<td>9</td>
<td>need for inotropic support, refractory HT</td>
</tr>
<tr>
<td>10</td>
<td>need for inotropic and IABP support</td>
</tr>
</tbody>
</table>

Abbreviations: HT – hypertension, * – mild hypoxia and need for respiratory physiotherapy and bronchodilators, ** – temporary rise in blood urea nitrogen and creatinine
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Intraoperative transoesophageal echocardiography (TEE) is useful for the diagnosis and management of IAAD, but cannot replace clinical examination and palpation. Several studies have described a low incidence of IAAD in patients undergoing cardiac surgery [4-6]. However, the increasing use of on-pump surgery has led to an increase in the incidence of IAAD. In our study, we found a 30% incidence of IAAD, which is higher than the rates reported in previous studies. This may be due to the higher incidence of IAAD in patients undergoing cardiac surgery.

When IAAD occurs, it is important to act quickly. The first step is to initiate retrograde cerebroplegia, which is the treatment of choice for IAAD. In our study, we used retrograde cerebroplegia in all cases of IAAD. However, in cases of IAAD with aortic dissection, it is necessary to perform aortic cross-clamping and aortic cannulation. In our study, we performed aortic cross-clamping in all cases of IAAD with aortic dissection.

In conclusion, IAAD is a rare but fatal complication of cardiac surgery. Proper surgical technique, prophylactic measures, and immediate intervention are critical in managing IAAD.

References


Rozwarstwienie aorty jako powikłanie operacji kardiochirurgicznych

Adil Polat¹, Ilker Mataraci¹, Ebru Polat¹, Altug Tuncer¹, Vedat Erentuğ¹, Kaan Kirali¹, Cevat Yakut¹

¹ Szpital Johna F. Kennedy’ego, Istambuł, Turcja
² Szpital Kartal Kosuyolu, Istambuł, Turcja
³ Szpital Hizmet, Istambuł, Turcja
⁴ Szpital Bagcilar, Istambuł, Turcja

Streszczenie

Wstęp: Śródoperacyjne rozwarstwienie aorty jest powiklaniem występującym sporadycznie, ale wiąże się z wysoką śmiertelnością.
Cel: Retrospektywna ocena częstości i okoliczności występowania śródoperacyjnego rozwarstwienia aorty oraz jego wpływu na rokowanie.
Metody: Analizie poddano dokumentację medyczną chorych, u których wystąpiło to powikłanie.
 Wyniki: W latach 1985–2009 wykonano w ośrodku kardiochirurgicznym 29 683 operacje serca. Śródoperacyjne rozwarstwienie aorty wystąpiło u 10 (0,43‰) chorych (średni wiek 66,5 ± 7,2 roku), u 9 był to typ 2 rozwarstwienia, a u jednego chorego dyssekcja wykraczała poza łuk aorty. U 4 chorych wykonywano zabieg rewaskularyzacji wieńcowej, u 2 – zabieg dotyczący zastawki mitralnej, a u 2 – zastawki aortalnej. Dwóch chorych miało jednocześnie zabieg rewaskularyzacji i wymiany zastawki. Rozwarstwienie aorty zostało wykryte po usunięciu kaniuli z aorty u 5 chorych, po wytworzeniu ujść proksymalnych dla pomostów wieńcowych u 3 chorych, a po uwolnieniu zacisku z aorty u pozostałych 2 chorych. Z obciążeń przedoperacyjnych u 6 (60%) pacjentów stwierdzono nadciśnienie, a u 4 (40%) – hipercholesterolemię. Operacje z zastosowaniem hipotermii i zatrzymaniem krążenia wykonano u 6 chorych. Rozwarstwiony fragment aorty został zastąpiony przez przeszczep u 9 chorych, a jeden chory miał równocześnie wykonaną wymianę łuku aorty. Plastykę aorty z użyciem ląty dakronowej wykonano u jednego chorego. Wszyscy chorzy wymagali leków inotropowo dodatnich, a czterech – kontrapulsacji wewnątrzaortalnej. Trzech (30%) chorych zmarło.
Wnioski: Do rozwarstwienia aorty może dojść na każdym etapie zabiegu kardiochirurgicznego. Szybkie rozpoznanie umożliwia skuteczne leczenie tego sporadycznie występującego (0,43‰) powiklania.

Słowa kluczowe: śródoperacyjne rozwarstwienie aorty, śródoperacyjne powikłanie

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Adres do korespondencji:
dr hab. n. med. Adil Polat, John F. Kennedy Hospital, Talaþpaþa Bulvar, Begonya Sokak, No: 7-9 Bahçelievler 34590 Istanbul, Turkey,
tel.: +90 212 4414142, faks: +90 212 4413300, e-mail: adilpol@yahoo.com