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Original Article

Can Open Distal Repair Be Safely Used in All Patients with Type A Acute Aortic Dissection?

Georgi Manchev,[1,2] Vassil Gegouskov,[1,2] Vladimir Kornovski,[3] Georgi Yankov,[4] Valya Goranovska,[1,2] Vicktoria Ilieva,[5] and Vicktoria Petrova[5]

Purpose: The distal suture line during aortic dissection repair can be performed by a closed technique or by an open technique. This study presents a retrospective comparison of both methods regarding their postoperative outcomes.
Patients and Methods: 120 patients who underwent surgery for acute aortic dissection type A were divided into two groups. In group A (n = 81), open distal anastomosis was performed under hypothermic circulatory arrest and selective cerebral perfusion. In group B (n = 39), distal anastomosis was performed with the aorta cross-clamped under mildly hypothermic cardiopulmonary bypass. Primary outcomes were operative mortality, neurologic morbidity, and long-term survival.
Results: Hospital mortality (17.3% for the open group vs. 12.8% for the closed group, $p = 0.53$), permanent neurologic dysfunction (8.7% vs. 8.3%, $p = 1.0$), and temporary neurologic dysfunction (31.9% vs. 22.2%, $p = 0.298$) were not significantly different between groups. No significant difference in actuarial 5- and 10-year survival was observed (88% vs. 86% and 53 vs. 73%, respectively, $p = 0.396$). After propensity-score adjustment, the technique of distal aortic repair was not found to be a predictor of the primary outcomes.
Conclusion: We conclude that the open repair can be used in most if not all cases of surgical repair of type A acute aortic dissection.

Keywords: aortic dissection, distal anastomosis, open versus closed

[1]*Department of Cardiac Surgery, St. Anna University Hospital, Sofia, Bulgaria*
[2]*Medical University Pleven, Pleven, Bulgaria*
[3]*Department of Cardiac Surgery, Heart and Brain University Hospital, Burgas, Bulgaria*
[4]*Department of Thoracic Surgery, Ivan Rilski University Hospital, Sofia, Bulgaria*
[5]*Department of Anesthesia and Intensive Care, Ivan Rilski University Hospital, Sofia, Bulgaria*

Received: May 10, 2023; Accepted: August 17, 2023
Corresponding author: Georgi Manchev. Department of Cardiac Surgery, St. Anna University Hospital, Dimitar Mollov Str. 1, Sofia, Bulgaria
Email: georgi.manchev@ymail.com

Introduction

The surgical treatment of acute aortic dissection type A involves resection of those segments of the thoracic aorta that include the entry tear, most commonly the ascending aorta or aortic arch, and their replacement with a vascular graft. The purpose of such treatment is prevention of intrathoracic rupture, correction of acute aortic valvular regurgitation and side branch ischemia, and possibly closure of the false lumen in the remaining aorta. Prosthetic replacement of the aorta requires at least two anastomoses – a proximal and a distal one. The distal suture line may be carried out by a closed technique with the aorta clamped and whole-body perfusion maintained, or by an open technique with the aorta unclamped and whole-body perfusion suspended. The main benefit of the closed technique is avoidance of circulatory arrest. The main benefits of the open technique are better precision of distal aortic repair and more complete resection of the diseased aorta. The superiority of one technique over the other is debatable although there is a trend toward better long-term results with the open technique.[1–4)]

This report evaluated retrospectively our experience with both methods (open and closed) for distal anastomosis in patients with acute aortic dissection type A. Our purpose was to elucidate whether there was any difference in postoperative outcomes, specifically neurologic morbidity and operative mortality, as well as long-term survival. The cohort included patients from the current era when mild-to-moderate hypothermia and antegrade cerebral perfusion have proved their safety and efficacy in aortic dissection surgery.[5)]

Patients and Methods

Study population

The hospital database was interrogated and data extracted about all patients who presented with acute type A aortic dissection between January 2010 and December 2022. As it was a retrospective analysis, patient consent was not sought. Approval from the local ethics committee was obtained. Surgical treatment was undertaken in 120 patients, who were included in the analysis. There were no exclusion criteria for surgery such as even advanced age or critical preoperative state. Four patients, who presented to the emergency room unresponsive (3–4 points of Glasgow Coma Scale [GCS]), were treated conservatively and were not eligible for the analysis.

Study outline

The cohort was divided into two groups based on the technique of distal aortic repair. Group A included patients in whom open distal anastomosis was performed under conditions of hypothermic circulatory arrest (HCA) and bilateral selective antegrade cerebral perfusion (SACP). Group B included patients in whom closed distal (clamp-on) anastomosis was performed under mildly hypothermic cardiopulmonary bypass (CPB). Preoperative and intraoperative parameters were compared between the two groups. Primary outcome variables were operative mortality, neurologic morbidity, and long-term survival. Data about long-term survival were obtained through a national health system database and contact with patients' primary care physicians or patients' relatives. After establishing any between-group differences in primary outcomes and reviewing the best evidence in recent literature, a conclusion is made about the efficacy of both techniques.

Surgical technique

All procedures were performed by a few experienced surgeons. The surgical technique described below was uniform over the years. From 2014 onward, we gradually assumed more moderate temperatures of HCA (mean temperature of 24.1°C before 2014 vs 27.8°C thereafter, p <0.001). CPB was established by direct cannulation of the dissected ascending aorta and right atrium. Only two patients underwent femoral cannulation earlier in the series. The Elongated One-Piece Arterial cannula was inserted using the Seldinger technique into the true lumen under transesophageal echo guidance and advanced to the proximal descending aorta. Body cooling was commenced with a temperature gradient of 6°C–8°C. The ascending aorta was clamped as distally as possible. The aorta was then transected. Cold crystalloid cardioplegic solution was delivered directly into the coronary ostia. Attention was turned to proximal aortic repair. Should additional procedures have been required, they were performed before the root surgery. The aortic root was inspected and based on that and echocardiographic data, decision was made whether to reconstruct or replace the root and the aortic valve. The presence of an entry tear restricted to the ascending aorta and good tissue quality favored the choice of the closed technique and cooling was stopped at 32°C rectal temperature. In all cases where the initial plan involved closed anastomosis, the aorta was unclamped at 32°C for a brief inspection of the aortic arch and origins of arch vessels to exclude the presence of additional intimal disruptions. If the intima and orifices of the brachiocephalic vessels looked sound, the aorta was reclamped and systemic perfusion resumed. If the intimal tear was found in the arch or tissue quality of the aorta was poor, the body was cooled to 26°C–28°C in preparation for HCA and open distal anastomosis. If no entry was found in the visible aorta, whole arch replacement was undertaken. The presence or absence of false lumen thrombosis in the ascending aorta was not a factor in the selection of open versus closed anastomosis. Bilateral SACP complemented HCA in all patients (**Fig. 1**). Isolated HCA or retrograde cerebral perfusion was not used. The distal anastomosis was always reinforced with a strip of Teflon felt. The ascending aorta was replaced with an appropriately sized

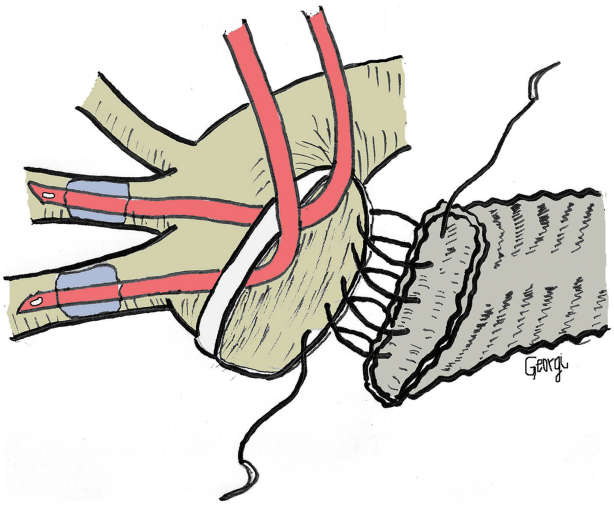

Fig. 1 Schematic representation of an open distal anastomosis with transostial cannulation of brachiocephalic arteries for antegrade brain perfusion.

gelatin-impregnated Dacron graft. Fibrin sealant was spread over the suture lines although it was not used to unite dissected layers. At the end of the HCA, the prosthetic graft was cannulated with a standard aortic cannula and CPB was recommenced.

Statistical methods

Continuous variables were summarized as mean ± standard deviation or as median with interquartile range. Categorical variables were presented as absolute and relative frequency (percentage). Student's t-test was used to compare the means of independent samples. X^2-square or Fischer's exact test (where appropriate) was used to assess the independence of two categorical variables from each other. Predictors of the primary outcome events (postoperative neurological dysfunction and death) were determined by creating multivariable logistic regression model using the forward elimination method. After propensity-score adjustment of multiple preoperative and intraoperative variables, the influence of the two operative techniques on the primary outcome variables was determined. Survival functions were calculated using the Kaplan–Meier method. Univariate comparison between groups for late survival was performed using the log-rank test. Outliers (values with a Z score >3) were identified and excluded from further analysis. A p value less than 0.05 was considered statistically significant. The statistical analysis was performed with SPSS v.26.0 software (SPSS; IBM Corporation, Armonk, NY, USA).

Results

Clinical presentation

A total of 87 (72.5%) patients were male and the mean age was 59.3 ± 12.1 years (range 27 to 83 years). In all, 95 (79.2%) patients presented with type I dissection and 25 (20.8%) with type II dissection. A total of 29 (24.2%) patients had some form of aortopathy, of which 17 (14.2%) had bicuspid aortic valve and 12 (10%) had family history of aortic aneurysms or dissection. Additional four patients (3.3%) had Marfan syndrome. The majority of patients (104 patients, 86.7%) had intact neurologic status on initial examination. Four patients (3.3%) presented with motor deficit (hemiparesis), another four had decreased level of consciousness (GCS <12 points), three (2.5%) were delirious, and five (4.2%) reported syncope before admission. In all, 34 patients (28.3%) had unstable hemodynamics requiring vasopressors or inotropes to maintain systolic blood pressure more than 100 mmHg. A total of 35 patients (29.2%) had limb malperfusion and 12 (10%) had mesenteric malperfusion. Limb malperfusion was defined as absence or perceivable decrease in any brachial/femoral artery pulse on palpation with correspondent non-enhancement on CT scan. Mesenteric malperfusion was defined as severe elevation of liver function tests and/or abdominal pain on palpation with corresponding non-enhancement of the celiac trunk or superior mesenteric artery.

Some differences in the clinical presentation were noted between groups (**Table 1**).

Operative data

Surgical procedure

A total of 81 patients underwent an open distal repair. In all of them, HCA was complemented by SACP. In all, 39 patients underwent closed distal repair under mildly hypothermic whole-body CPB. Ascending aortic replacement was performed in 75 patients (62.5%) and another 13 patients (10.8%) needed whole-arch replacement as well. Root replacement with mechanical valved conduit was performed in 23 (19.2%) patients and aortic valve replacement with root preservation in nine (7.5%) patients. Valve-sparing root replacement was not considered in the emergency setting. Seven (5.8%) patients were transferred to the intensive care unit with open chest and mediastinal packing due to uncontrolled bleeding. In all, 11 (9.2%) patients were returned to the operating room for reexploration due to excessive postoperative hemorrhage.

Table 1 Univariate comparisons between open and closed repair groups

Variables	Open distal (group A), n = 81	Closed distal (group B), n = 39	*p*
Age	60.3 ± 11.3	57.0 ± 13.6	0.17
Gender (male)	59 (72.8%)	28 (71.8%)	0.90
Morphology (De Bakey)			**<0.001**
Type I	74 (91.4%)	21 (53.8%)	
Type II	7 (8.6%)	18 (46.2%)	
False lumen thrombosis	8 (9.9%)	4 (10.3%)	1.0
Bicuspid aortic valve	8 (9.9%)	9 (23.1%)	0.052
Aortopathy			**<0.01**
Nonsyndromic	13 (16.0%)	16 (41.0%)	
Marfan syndrome	2 (2.5%)	2 (5.1%)	
Acute myocardial ischemia	7 (8.6%)	1 (2.6%)	0.27
Neurologic symptoms			0.21
Motor deficit	2 (2.5%)	2 (5.1%)	
Stupor	3 (3.7%)	1 (2.6%)	
Syncope	5 (6.2%)	0 (0%)	
Psychosis	3 (3.7%)	0 (0%)	
Hemodynamic instability	26 (32.1%)	7 (17.9%)	0.10
Acute kidney injury	32 (41.6%)	9 (23.1%)	**0.049**
Limb ischemia	25 (30.9%)	10 (25.6%)	0.56
Mesenteric ischemia	8 (9.9%)	4 (10.3%)	1.0
Tamponade	8 (9.9%)	1 (2.6%)	0.27
Aortic regurgitation ≥II grade	36 (44.4%)	19 (48.7%)	0.66
Ejection fraction	57.4 ± 5.9	57.7 ± 7.6	0.82
Redo	1 (1.2%)	3 (7.7%)	0.10

Statistically significant if p <0.05.

Some differences were noted in operative data between the two groups (**Table 2**).

HCA/antegrade cerebral perfusion (group A)

Median duration of HCA/SACP was 26 minutes (19–33 minutes). Mean brain perfusion pressure was 70 ± 12 mmHg. Median brain perfusion flow was 600 mL/min (500–800 mL/min). The temperature of the nasopharynx during SACP was 26.8 ± 2.7°C. The median duration of body cooling to target temperature was 57 minutes (45–67 minutes). The median duration of rewarming after resumption of systemic perfusion was 96 minutes (75–110 minutes).

Outcome

Operative mortality and neurologic morbidity

Overall hospital mortality was 15.8% (19/120 patients). Four patients (3.3%) died in the operating room and another four (3.3%) succumbed in the intensive care unit before the end of the first day. In all, 37.1% (54/120) of patients suffered from some form of neurologic injury. The overall incidence of permanent neurologic dysfunction was 8.6% and the incidence of temporary neurologic dysfunction was 28.6%. In more detail, 5.7% (6) of patients experienced stroke with permanent motor deficit, 21% (22) had acute psychosis, 7.6% (8) had late awakening from surgery (after 24 hours), and 2.9% (3) remained in coma until death.

Comparative analysis

There were no significant differences in the primary outcome although some secondary outcome variables differed between the open and closed anastomosis groups (**Table 3**).

Predictors of primary outcome

The multivariable logistic regression analysis pointed out two variables as independent predictors of postoperative neurologic injury: preoperative acute kidney injury (odds ratio [OR]: 4.3, 95% confidence interval [CI]: 1.7–11.0, p = 0.003) and intraoperative hematocrit levels. For every percent increase in hematocrit, the risk of postoperative neurologic injury decreased by 0.79 (95% CI: 0.69–0.91, p = 0.001).

Table 2 Intraoperative patient characteristics

Variables	Open distal n = 81	Closed distal n = 39	p
Operation			**<0.01**
Ascending aorta	55 (67.9%)	20 (51.3%)	
Total arch	12 (14.8%)	0 (0%)	
Bentall	10 (12.3%)	14 (35.9%)	
Ascending aorta + AVR	4 (4.9%)	5 (12.8%)	
Additional procedure	5 (6.2%)	4 (10.3%)	0.47
CABG	4 (4.9%)	3 (7.7%)	
Mitral repair	1 (1.2%)	1 (2.6%)	
Pharmacologic protection			0.29
Steroids	63 (77.8%)	34 (87.2%)	
Thiopental	3 (3.7%)	2 (5.1%)	
Combination	15 (18.5%)	3 (7.7%)	
Open chest	6 (7.4%)	1 (2.6%)	0.27
Operative time (minutes)	323 ± 95	276 ± 70	**<0.01**
CPB (minutes)	161 (137–199)	138 (107–170)	**0.01**
Myocardial ischemia (minutes)	103 ± 28	86 ± 39	**0.02**
Perfusion pressure (mmHg)	63 ± 5	65 ± 6	0.20
Hematocrit (average, %)	23.8 ± 3.3	24.8 ± 4.4	0.19
Hematocrit (nadir, %)	20.2 ± 3.6	21.8 ± 5.0	0.07
Blood glucose (mmol/L)	12.9 ± 2.7	10.7 ± 3.1	**0.02**
Lactate (mmol/L)	5.1 ± 2.3	2.8 ± 1.5	**0.001**
Nasopharyngeal T (nadir, °C)	26.8 ± 2.7	31.4 ± 2.4	**<0.001**
Rectal temperature (nadir, °C)	29.2 ± 2.5	32.7 ± 2.7	**<0.001**
End temperature (°C)	36.6 ± 0.6	36.6 ± 0.4	0.76

Statistically significant if p <0.05. AVR: aortic valve replacement; CABG: coronary artery bypass grafting; CPB: cardiopulmonary bypass

The multivariable logistic regression analysis showed four variables to be independent predictors of hospital mortality. Advanced patient age increased the risk of early death (OR: 1.06, 95% CI: 1.01–1.11, p = 0.015). Type I aortic dissection also appeared to be associated with higher mortality than type II dissection (OR: 7.0, 95% CI: 1.3–38.0, p = 0.024). The development of postoperative lung injury and the need for renal replacement therapy were independently associated with hospital mortality (OR: 8.5, 95% CI: 1.7–42.4, p = 0.009 and OR: 13.0, 95% CI: 3.2–53.2, p <0.001, respectively).

After propensity-score adjustment, it was found that the performance of an open distal repair under HCA and SACP was not a predictor of either postoperative neurologic injury (OR = 1.14, 95% CI = 0.33–3.9, p = 0.833) or hospital mortality (OR = 1.05, 95% CI = 0.32–3.5, p = 0.936).

Survival

Mean postoperative survival of hospital survivors was 10.9 years (standard error [s.e.] = 0.5, 95% CI = 9.7–11.7 years). Estimated 5- and 10-year survival was 87% and 53%, respectively.

Univariate comparison between group A and group B using the log-rank test showed no significant difference in survival function (p = 0.396). Mean postoperative survival was 9.5 years (s.e. = 0.6, 95% CI = 8.4–10.6 years) for the open distal group versus 11.5 years (s.e. = 1.0, 95% CI = 9.5–13.4 years) for the closed group. In all, 5- and 10-year survival was 88% and 53% for the open group and 86% and 73% for the closed group (**Fig. 2**).

After propensity-score adjustment, the Cox-regression analysis revealed that the open distal repair under HCA and SACP did not influence long-term survival (OR: 1.05, 95% CI: 0.24–4.7, p = 0.949).

Discussion

Aortic surgery, whether elective or emergent, necessitates construction of at least two anastomoses – a proximal and a distal one, using an appropriate vascular prosthesis. The aorta is a major vessel that ought to be

Table 3 Postoperative outcome for the open and closed repair groups

Variables	Open distal n = 81	Closed distal n = 39	*p*
Blood loss (24 hours)	450 (360–810)	420 (280–1100)	0.79
Reexploration	8 (9.9%)	3 (7.7%)	0.49
Blood products			
RBCs	5 (4–7)	3 (3–6)	**0.03**
Fresh frozen plasma	5 (3–8)	3 (3–5)	**0.02**
Mechanical ventilation (days)	4 (1.5–7.0)	1 (0.8–5.4)	**0.01**
ICU stay (days)	6.5 (4–11)	5 (3.1–7.4)	**0.04**
Hospital stay (days)	11 (9–17)	11 (9–13)	0.83
Lung injury			
ARDS	9 (11.1%)	2 (5.1)%	0.27
TRALI	3 (3.7%)	4 (10.3)%	
Inotropic support >24 hours	41 (50.6%)	19 (48.7%)	0.85
Intra-aortic balloon	8 (9.9%)	2 (5.1%)	0.50
Hemoglobin (average postoperative, g/L)	100.8 ± 11.3	106.5 ± 13.4	**0.02**
Lactate (peak, mmol/L)	7.2 (4.4–12.4)	4.7 (3.1–8.1)	**0.02**
Creatinine (peak, µmol/L)	199 (135–366)	151 (118–223)	**0.04**
Renal replacement therapy	14 (20.9%)	8 (22.2%)	0.88
SIRS	5 (7.5%)	3 (8.3%)	0.88
Bacterial sepsis	6 (9%)	0 (0%)	0.09
Neurological outcome			
PND	6 (8.7%)	3 (8.3%)	1.0
TND	22 (31.9%)	8 (22.2%)	0.30
Hospital mortality	14 (17.3%)	5 (12.8%)	0.53
Intraoperative/24 hour	7 (8.6%)	1 (2.6%)	

Statistically significant if $p < 0.05$. RBCs: red blood cells; ICU: intensive care unit; ARDS: acute respiratory distress syndrome; TRALI: transfusion-related acute lung injury; PND: permanent neurologic dysfunction; SIRS: systemic inflammatory response syndrome; TND: temporary neurologic dysfunction

cross-clamped in order to perfuse the body during heart surgery. However, the introduction of HCA into clinical practice changed this requisite and allowed surgery on the open aorta.[6] Thus, the distal graft-to-aorta anastomosis may be performed via two approaches: suturing the graft to a slit-like cuff of aortic wall beneath the cross-clamp with whole-body perfusion (the closed technique) or carrying out the suture line to the circular opening of the unclamped aorta under HCA (the open technique).[1] The open technique offers advantages that may be useful or even obligatory during surgery for acute aortic dissection. First of all, the avoidance of the cross-clamp saves the aorta from the risk of further mechanical injury on a fragile wall. Then it allows maximal resection of the diseased aorta and ensures conditions for an even and precise suture line. Furthermore, the open aorta allows inspection of the aortic arch, the origin of arch vessels, and the proximal descending aorta for entry tears, mobile atheroma, or other lesions. Finally, replacement of aortic arch is only possible on the open aorta and arrested circulation. However, hypothermic circulatory presents a serious alteration of body homeostasis with its potential for complications.[7] The addition of cerebral perfusion methods and the implementation of mild-to-moderate hypothermia over the years lessened the negative impact of isolated deep HCA on the brain and other organs.[8–10] On the other hand, aortic clamping and blind replacement of the ascending aorta may leave residual entry tears in the arch and lead to worse early results, late survival, and false lumen patency.[11]

The operative mortality is a principal outcome measure of the surgical treatment of acute aortic dissection type A and hovers around 20%.[12] Stroke rates vary widely but are generally around 10%.[13] The incidence of temporary neurological dysfunction has been dependent on the definition but may be as high as 30%.[14] Long-term survival has been reported to be 78% and 68% at 5- and 10-years, respectively.[1] As surgical factors do often affect patient outcomes, we sought to reveal whether the technique of distal aortic anastomosis had an early and late impact on

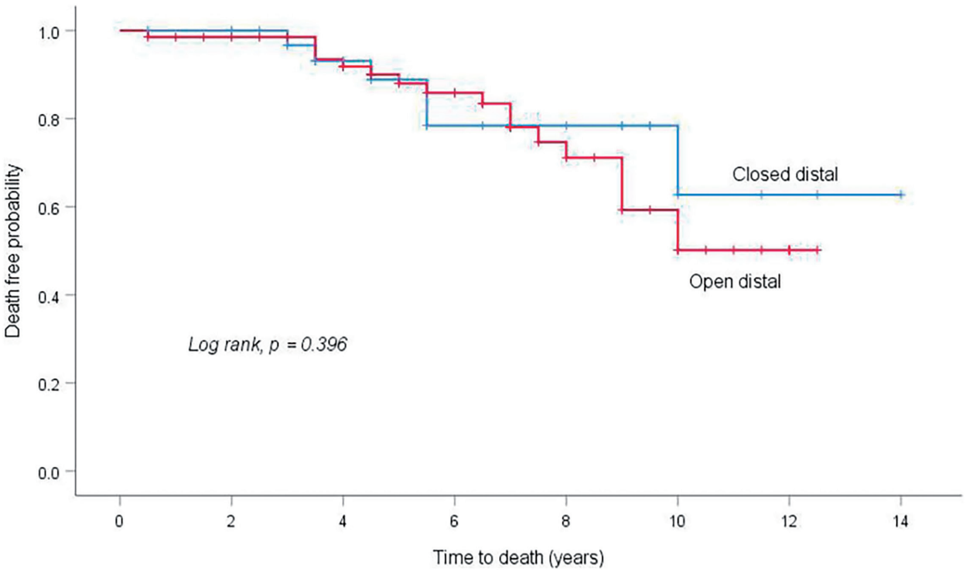

Fig. 2 Estimated survival of both groups. The log-rank test shows that there is not a significant difference in long-term survival between patients with open repair and those with closed repair.

our patients. We have employed two methods of distal aortic repair – closed (clamp-on) anastomosis under mildly hypothermic (32°C–34°C) CPB and open (clamp-off) anastomosis under deep or moderate HCA (20°C–28°C) and bilateral SACP. Even when undertaking the open technique, we initially clamp the aorta during the cooling phase and repair the aortic root as appropriate to spare pump time. Some surgeons prefer not to clamp the dissected aorta at all for fear of pressurizing the false lumen with consequent malperfusion and risk of rupture. However, Seldinger-guided true lumen cannulation negates such risks. Indeed, some papers show similar early outcome with or without aortic cross-clamping during the cooling phase.[15,16] Our main motive to cross-clamp the aorta was utilizing the cooling time to complete the proximal anastomosis or any root procedures before HCA, thus shortening bypass duration. Aortic clamping may also inflict injury on the dissection arterial wall. In the open group, the respective segment is excised. In the closed group, it is retained. This constitutes one reason for our current preference of open repair. We chose the method of distal repair based on several anatomical factors. In general, limited extent of dissection (ascending only, partial circumference), good tissue quality (somewhat subjective assessment), and absence of entry tears in the aortic arch or proximal descending aorta on the CT scan favor closed repair. Extensive dissection (beyond ascending aorta, near-whole circumference), friable tissues, and entry tears in the distal ascending aorta or arch favor open repair. Thus, the patients were not randomized into either method. However, the two groups did not differ significantly in most preoperative clinical variables. As a notable difference, type I dissection was much more prevalent in the open repair group and type II in the closed repair group. This is not unexpected since type I dissection presents greater structural derangement of the aorta. Also, aortopathy was more common in the closed group.

The duration of CPB was longer in the open repair group, probably related to the longer cooling and rewarming period of hypothermic arrest. Blood glucose and lactate were also higher in the open group and may reflect metabolic derangements of HCA such as insulin resistance and tissue hypoxia.

Intra-aortic ballon pump complemented inotrpic support in nearly 10% of all patients. It is generally contraindicated in the setting of aortic dissection. Nevertheless, it served as a last resort measure to support failing hearts upon weaning from CPB. No cases of aortic rupture or organ ischemia were provoked by the intra-aortic ballon in our group.

We found no difference in primary outcome variables – *operative mortality* and *neurologic morbidity*, according to the distal repair strategy. Although some secondary outcome variables did differ significantly between groups, they obviously did not influence the primary outcome. The utilization of blood products, duration of mechanical ventilation, and length of intensive care unit stay were higher in the open repair group, expressing the effects of HCA. After propensity-score adjustment, the technique of distal aortic repair did not turn out to be a predictor of early mortality or neurological complications. No difference between repair strategies was found in *late survival*. Indeed, after adjustment for other variables, open versus closed repair did not appear as a predictor of late mortality. These results correspond to those of other studies of similar design.[1,4,17,18] Some studies even show better long-term survival with the open technique.[19] Currently, there is a prevailing opinion that the open distal anastomosis should be considered the technique of choice.[20]

Despite the similar early results of both techniques, there are potential problems with the closed repair discussed by some authors. The cross-clamp inflicts further injury on a segment of the otherwise disrupted aorta and this injured portion is retained beyond the suture line. Accurate reapproximation of the aortic layers may be compromised as there may be distortion of the aortic edges especially at the posterior tip, which is a frequent source of bleeding.[21] As the anastomosis is forced to be more proximal, there is less complete resection of the dissected aorta.[21] Advocates of the closed technique claim that it allows shorter CPB time and avoids circulatory arrest with cerebral perfusion with their inherent complications.

The evolution of operated acute aortic dissection is characterized by persistence of the false lumen in some patients, which may have a prevalence of around or more than 50%.[22,23] Unfortunately, we did not have later image confirmation of false lumen persistence in our series. The mechanisms of continued perfusion of the false lumen may be avulsed side branches or distal reentry tears, which provide communication with the true lumen. The distal suture line of the synthetic graft has been shown to be a source of blood flow to the false lumen in some cases as well. Thus, the technique of distal aortic anastomosis probably has an impact on the persistence of false lumen at least in some patients. The presence of intimal flap and false lumen perfusion had a higher incidence on follow-up in patients with closed repair compared to patients who had undergone open distal repair.[1,24] As the outer wall of the false lumen does not have all anatomic layers, its strength is compromised and in time it is prone to expansion. False lumen patency has been linked to enhanced growth rate of the remaining aorta.[22,25] The mean growth rate varies from about 1 mm/year in patients with thrombosed false lumen to nearly 4 mm/year in those with patent false lumen.[22,26] False lumen patency has also been a risk factor for distal reintervention.[27] Aneurysmal dilatation of the dissected aorta necessitates reoperation or may cause acute rupture before diagnosed. A patent false lumen has been associated with an increased risk of aortic rupture, reoperation, and decreased survival in the long term.[23,27,28] On the other hand, there is no firm evidence that the open repair technique is associated with a lower reoperation rate in the long term.[2]

The open distal repair is technically more efficient, although undoubtedly a more aggressive approach. Previously our protocol had been to undertake open repair in cases of extensive dissection of the aorta (type I, near-circumferential dissection), fragile aortic wall, and entry tears in the arch. All other less severe cases were eligible for closed repair. Exclusions were made sometimes by the operating surgeon for elderly patients and those in critical preoperative state in whom minimal surgery was carried out in order to get them off the table. However, our strategy has changed recently and nearly all patients are now done with open distal anastomosis based on the better long-term outcome.

Study limitations

Due to its retrospective observational nature, the study was prone to several weaknesses. Treatment bias was inevitable since the choice of technique was based on certain pathologic findings rather than on random assignment. Also, the nonrandomization of patients may leave possible differences in study groups although comparative analysis refuted such concerns. Patients in the open group presented with more friable aorta and tears extending to the arch. Thus, the open technique offers correction of more complex anatomy in higher risk patients with non-inferior results. Again, due to its retrospective design, not all definitions were strictly prespecified but the authors tried to present them as uniform as possible. Another limitation is the small number of patients, especially in the closed group. We had a limited amount of imaging data on follow-up, which prevented adequate conclusions about the long-term fate of the distal aorta including distal aortic reinterventions in our group. Although the surgical technique did not change throughout the years, some elements such as adoption of higher arrest temperatures and variations in perioperative management occurred over time as did the preference of open replacement. Thus, the overall surgical conduct was not invariable throughout the years.

Conclusion

The primary objective when treating patients with acute aortic dissection type A has been to discharge patients alive. However, maximizing the chance for closure of the false lumen is nearly as important since it affects the fate of the distal aorta. Based on our results and those of others, the open and closed techniques were associated with similar safety profile and long-term outcomes with a tendency toward lesser false lumen persistence with the open repair. The latter may translate into a lower rate of distal reintervention. Of note, open repair tends to be used in patients with more complex anatomy (type I dissection) who would otherwise fair worse with the closed technique. Thus, we consider that the open distal repair under HCA and bilateral SACP may be preferred over closed repair in the treatment acute type A aortic dissection. However, larger studies are needed to establish this method as a standard approach.

Disclosure Statement

No conflict of interest.

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