



ORIGINAL ARTICLE

A comparison between direct true lumen versus conventional cannulation for management of acute type- aortic dissection patients.

Saqib Qayyum¹, Muhammad Taimur², Muhammad Khalid Siddique³, Muhammad Imran⁴, Imran Ullah⁵, Syed Qamar Abbas Kazmi⁶

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ABSTRACT... Objective: To compare the postoperative outcomes while using direct true lumen approach versus conventional cannulation approach in management of acute type-A aortic dissection patients. **Study Design:** Randomized Clinical Trial. **Setting:** Department of Vascular Surgery, Combined Military Hospital, Rawalpindi. **Period:** 1st June 2022 to 31st December 2022. **Methods:** A total of 22 patients age more than 18 years who presented in CMH Emergency Department with acute type A aortic dissection were included in this study. In group A (11 patients) were managed with direct true lumen cannulation while in group B (11 patients) were managed with conventional (axillary/femoral) cannulation. In both groups intra-operative parameters like procedure time, mean time of cardiopulmonary bypass, cross clamp and circulatory arrest time were measured. In both groups, outcome was measured in terms of occurrence of multi-organ failure, acute kidney injury, arrhythmias on ECG and in-hospital mortality. Data was analyzed using SPSS 26. **Results:** Mean age of our patients were 43.36 ± 2.16 yrs in group A while 43.36 ± 2.94 yrs in group B. Male gender predominates in both groups (gp A- 81.8% & gp B-90.9%). We found no difference of statistical significance between two groups in terms of various intra-operative parameters like mean duration of procedure in group A was 428.15min and in group B was 427.36 min. Similarly mean circulatory arrest time was 31 min in group A and 29.09 min in group B. Patients in “direct true lumen cannulation” group had significantly shorter duration of intubation. In terms of post-operative outcomes, multi-organ failure occurred in 1 (9.09%) patient in group A while it occurred in 3(27.27%) patients in group B. In hospital mortality occurred in 2(18%) patients in group A as compared to 4(36%) in group B. So better results were observed in “direct true lumen cannulation” group as compared to “conventional (axillary/femoral) cannulation” group. **Conclusion:** In our study, acute type-A aortic dissection patients who had undergone direct true lumen cannulation during operative management showed better post-operative outcomes.

Key words: Conventional Cannulation, Direct True Lumen, Management, Outcome, Post-operative, Type A Aortic Dissection.

INTRODUCTION

Even though there is a lot of literature available, many cases of aortic dissections are still overlooked in emergency rooms. Acute aortic dissection is a rare condition with grave consequences. Although, traditionally patient's presents with sudden onset of tearing chest pain, some patients may have mild symptoms.¹ An aortic aneurysm can be identified by the separation of the layers that make up the aortic wall, which is followed by the formation of a “pseudo lumen” that can cause the genuine aortic lumen to become compressed. This can occur due to presence of various factors including

connective tissue disorders, hypertension and atherosclerotic vascular changes.² Aortic dissection is a disorder that, if left untreated, has an estimated fatality rate of eight to up to forty percent upon primary presentation. This percentage grows by one percent every hour and it may exceed a yearly death rate of up to ninety percent in some cases.^{3,4}

The assessment and treatment of dissection of aorta requires a thorough understanding of the anatomic categorization of the condition. As per “Stanford Classification”, there are two types of aortic dissection: “type A”, which refers to any

1. MBBS, FCPS, Vascular Surgery Resident, CMH, Rawalpindi.
2. MBBS, FCPS, Assistant Professor Surgery, Fauji Foundation Hospital Rawalpindi.
3. MBBS, FCPS, FRCS, Ex HOD & Professor Vascular Surgery, CMH, Rawalpindi.
4. MBBS, FCPS, Associate Professor Surgery, Fauji Foundation Hospital Rawalpindi.
5. MBBS, FCPS, Resident Vascular Surgery, CMH, Rawalpindi.
6. MBBS, Resident General Surgery, Fauji Foundation Hospital Rawalpindi.

Correspondence Address:
Dr. Muhammad Taimur
Department of Surgery
Fauji Foundation Hospital, Rawalpindi.
drmtaimur@yahoo.com

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dissection involving ascending aorta, and “type B”, which refers to dissections involving descending aorta.⁵ While managing “type A aortic dissection” major challenge faced by the vascular surgeon is to establish an “extracorporeal circulation” that is adequate and resection of the vascular intima that is torn so that vital body organs, especially the brain, can be saved from the damaging ischemic effects.⁶ When it comes to reestablish arterial flow, methodology of choice for cannulation is variable as well as debatable. One such method is “retrograde perfusion technique” that involves cannulation through femoral artery but it is believed to be linked with more chances of pseudo lumen perforation, poor perfusion of the organ and even cerebrovascular accident (CVA). Similarly, cannulation of the aorta directly also carries the increased probability of false lumen cannulation. On the other hand, “antegrade flow technique” via the axillary artery is linked with longer duration of procedure that may consequently damage the vessel and results in issues with the arterial flow.^{7,8,9} Researchers have recently proposed a relatively new and modified procedure known as “direct true lumen cannulation” in an effort to find a solution to these issues. Cannulation of the actual ascending aortic lumen can be performed during this technique under direct vision as a secure and efficient approach for achieving “antegrade arterial perfusion” in severe type-A aortic dissection with a low probability of fatality and neurologic sequelae.¹⁰

It has been observed that in resource limited countries like Pakistan, there is a paucity of available data regarding the epidemiology as well as antemortem diagnosis of aortic dissection. In addition, the “Direct True Lumen Cannulation” technique has been available only at a few centers in Pakistan making the data regarding comparison of cannulation techniques even more scarcely. Based on this we aimed to conduct this comparative study to determine the outcomes of the patients, who presented in the emergency department with “type-A aortic dissection”, undergoing cannulation of the affected lumen of aorta through conventional method as compared to those who had “Direct True Lumen Cannulation”.

METHODS

This randomized controlled trial (ERB Reg no: 497) (30-11-2023) was done on patients presenting at the department of vascular surgery at “Combined Military Hospital, Rawalpindi” starting from June 2022 to December 2022. Through the use of the WHO sample size calculator, “sample size estimation for two population proportions” we determined the appropriate sample size required for our study. Formula that was used to determine the sample size was¹¹:

$$n = \frac{\left\{ z_{1-\alpha/2} \sqrt{2\bar{P}(1-\bar{P})} + z_{1-\beta} \sqrt{P_1(1-P_1) + P_2(1-P_2)} \right\}^2}{(P_1 - P_2)^2}$$

We assumed level of significance 10%, power of the test of 80%, anticipated frequency of multi-organ failure in “direct true lumen cannulation group” as 0% and anticipated frequency of multi-organ failure in “conventional cannulation group” to be 42.9%.¹² Upon calculation, our calculated sample size was 22 [11 in each group].

Patients more than eighteen years of age, either male or female, presenting in emergency department with aortic dissection of type A were included in the trial. Patients who had history of coagulation disorders and those who did not survive till surgery was commenced were not included in the trial.

Cases in our study were recruited by using non-probability consecutive sampling technique. We documented all the baseline characteristics of our included participants including their age, gender, pre-operative systolic blood pressure, history of hypertension, history of myocardial infarction, and presence of preoperative shock, defined as “systolic BP < 90”.¹³ After that, cases were randomly divided into two groups based on type of cannulation opted while the patient was on cardiopulmonary bypass. In group A, we included 11 patients who were managed with “direct true lumen cannulation” while in group B, we included 11 patients who were managed with “conventional (axillary/femoral) cannulation”.

In all the patients of both the groups various

intra-operative parameters were measured and documented including duration of procedure in minutes, mean time of cardiopulmonary bypass in minutes, average clamping time in minutes and mean circulatory arrest time in minutes. We also documented the duration for which patient remained intubated (in hours) and duration of stay at the intensive care unit (in hours). Outcomes that we assessed in our study population included occurrence of multi-organ failure, [defined as “failure of more than one vital organ secondary to dysregulated inflammatory response”¹⁴], acute kidney failure i.e “increase in serum creatinine by $\geq 0.3\text{mg/dl}$ within 48 hours with urine output $< 0.5\text{ml/kg/h}$ for six hours”¹⁵, arrhythmia on ECG and in-hospital mortality.

“Data was analyzed by using Statistical Package for Social Sciences (SPSS) 26. Normality of data was checked by Shapiro-Wilk test. We found that age, duration of procedure, mean time of cardiopulmonary bypass, mean cross clamp time and circulatory arrest time were normal data while pre-operative systolic blood pressure, duration for which patient remained intubated and duration of stay at the intensive care unit were non-normal data. Quantitative data was represented using mean with standard deviation. Qualitative data was represented by using percentage and frequency. Chi square test (for qualitative variables), unpaired t-test (for normal) and Mann-Whitney test (for non-normal) quantitative variables were applied and $p \leq 0.05$ was taken as significant.

RESULTS

Mean age in group A was 43.36 ± 2.16 years while in group B was 43.36 ± 2.94 years, ($p = 1.000$). In group A 9 (81.82%) were male and 2 (18.18%) were female while in group B 10 (90.91%) were male and 1 (9.09%) were female, ($p = 0.534$). Median pre-operative SBP in group A was 119 (84-121) mmHg while in group B it was 117 (85-134) mmHg, ($p = 1.000$). In “direct true lumen cannulation” group 9 (81.82%) patients had history of hypertension while in “conventional (axillary/femoral) cannulation” group, 10 (90.91%) patients had history of hypertension, ($p = 0.534$). None of the patients in both groups had history of

myocardial infarction (MI). In group A 2 (18.18%) patients had preoperative shock while in group B 3 (27.27%) had preoperative shock, ($p = 0.611$). Table-I

Mean duration of procedure in group A was 428.45 ± 10.42 minutes while in group B it was 427.36 ± 7.47 minutes, ($p = 0.781$). In our study, mean duration of CPB in “direct true lumen cannulation” group was 231.45 ± 2.38 minutes while in “conventional (axillary/femoral) cannulation” group it was 231.36 ± 2.61 minutes, ($p = 0.933$). Mean cross clamp time in group A was 143.36 ± 4.67 minutes while in group B it was 145.63 ± 7.62 minutes, ($p = 0.409$). Mean circulatory arrest time in group A was 31.00 ± 2.41 minutes while in group B it was 29.09 ± 2.47 minutes ($p = 0.081$). [Table-II]

Duration for which patient remained intubated in group A was 42 (40-46) hours while in group B it was 52 (40-57) hours ($p = 0.003$). Median duration of stay at the intensive care unit in group A was 2 (2-4) days while in group B it was 3 (2-4) days ($p = 0.300$). In group A, 1 (9.09%) patient developed multi-organ failure while in group B 3 (27.27%) patients developed multi-organ failure ($p = 0.269$). In group A, 1 (9.09%) patient developed acute kidney injury while 3 (27.27%) patients in group B developed acute kidney injury ($p = 0.269$). In group A, no patient developed arrhythmia while in group B, 1 (9.09%) patient developed arrhythmia, ($p = 0.306$). 2 (18.18%) patients died while in hospital in group A while 4 (36.36%) patients died while in hospital in group B ($p = 0.338$). [Table-III]

DISCUSSION

Although there is increased chance of postprocedural morbidity and fatality, acute aortic dissection of type A has a relatively low emergence around the world and necessitate an urgent exploratory surgery for treatment.¹⁶ There is a lack of information on aortic disease in Pakistan. Only nineteen occurrences of aortic dissection between 1988 and 2015 were reported in the whole country with an unprecedented death rate.¹⁷

Characteristic	“Direct True Lumen Cannulation” Group (n = 11)		“Conventional Cannulation” Group (n = 11)		P-Value
Age	43.36 ± 2.16 years		43.36 ± 2.94 years		1.000
Gender	Male	Female	Male	Female	0.534
	9 (81.82%)	2 (18.18%)	10 (90.91%)	1 (9.09%)	
Median pre-operative SBP	119 (84-121) mmHg		117 (85-134) mmHg		1.000
History of hypertension	9 (81.82%)		10 (90.91%)		0.534
History of myocardial infarction	Nil		Nil		—
Preoperative shock	2 (18.18%)		3 (27.27%)		0.611

Table-I. Baseline characteristics of patients (n = 22)

Parameter	“Direct True Lumen Cannulation” Group (n = 11)	“Conventional Cannulation” Group (n = 11)	P-Value
Mean duration of procedure	428.45 ± 10.42 minutes	427.36 ± 7.47 minutes	0.781
Mean duration of CPB	231.45 ± 2.38 minutes	231.36 ± 2.61 minutes	0.933
Mean cross clamp time	143.36 ± 4.67 minutes	145.63 ± 7.62 minutes	0.409
Mean circulatory arrest time	31.00 ± 2.41 minutes	29.09 ± 2.47 minutes	0.081

Table-II. Intraoperative parameters (n = 22)

Parameter	“Direct True Lumen Cannulation” Group (n = 11)	“Conventional Cannulation” Group (n = 11)	P-Value
Median duration for which patient remained intubated	42 (40-46) hours	52 (40-57) hours	0.003
Median duration of stay at the intensive care unit	2 (2-4) days	3 (2-4) days	0.300
Multi-organ failure	1 (9.09%)	3 (27.27%)	0.269
Acute kidney injury	1 (9.09%)	3 (27.27%)	0.269
Arrhythmia	0 (0.00%)	1 (9.09%)	0.306
In-hospital mortality	2 (18.18%)	4 (36.36%)	0.338

Table-III. Post-operative parameters and outcomes of patients (n = 22)

In hemodynamically unstable patients, “conventional femoral cannulation technique” is chosen over the potentially lengthy “conventional axillary cannulation technique” since it is the classic, quickest, and simplest accessible location. However, axillary approach has an advantage of providing antegrade flow as compared to femoral approach which provides retrograde flow.¹⁸

In our research, we discovered no statistically significant differences in the baseline traits among our study participants. The same was true for a variety of intra-operative parameters. Patients in the “direct true lumen cannulation” group had considerably shorter intubation duration. In terms of ICU stay and frequency of various outcomes, the “direct true lumen cannulation” group outperformed the “conventional (axillary/femoral) cannulation” group, but the difference

was statistically insignificant. This is similar to results reported by Wahid et al.¹² which showed no significant difference between groups in almost all parameters. However, El Beyrouti et al.⁹ reported a significant difference between two techniques in terms of frequency of preoperative shock and duration of CPB. Based on our study, it is safe to say that ““direct true lumen cannulation technique” is a good alternative to “conventional (axillary/femoral) cannulation technique” in terms of safety and patient outcome which is congruent with results of some previous studies.^{19,20} In management of Type A Aortic Dissection, vascular surgeons can establish extracorporeal circulation with direct true lumen cannulation and our study proves that this technique is better than others techniques. Yet owing to scarcity of data regarding this field of research in Pakistan we recommend to conduct further studies in this

regard with preferably bigger sample sizes.

CONCLUSION

In our study, acute type-A aortic dissection patients who had undergone direct true lumen cannulation during operative management showed better post-operative outcomes.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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AUTHORSHIP AND CONTRIBUTION DECLARATION

No.	Author(s) Full Name	Contribution to the paper	Author(s) Signature
1	Saqib Qayyum	Conceived idea, Literature search, Manuscript writing.	
2	Muhammad Taimur	Data interpretation, Statistical analysis, Manuscript writing.	
3	Muhammad Khalid Siddique	Manuscript writing, Literature search,	
4	Muhammad Imran	Manuscript writing, Designed Research, Methodology.	
5	Imran Ullah	Data collection and complication, Literature review.	
6	Syed Qamar Abbas Kazmi	Manuscript writing, Literature review.	