

Comparative Study of Single Dose Delnido Cardioplegia Versu Multi Dose Blood Cardioplegia in Coronary Artery Bypass Grafting [CABG]

G Kiruthikasri

Bharath institution of higher education and research

R Awasthy

aswathyr267@gmail.com

Bharath institution of higher education and research

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ORIGINAL ARTICLE

COMPARATIVE STUDY OF SINGLE DOSE DELNIDO CARDIOPLEGIA VERSU MULTI DOSE BLOOD CARDIOPLEGIA IN CORONARY ARTERY BYPASS GRAFTING [CABG]

Kiruthikasri.G¹ ,Ashwathy²

Bharath Institute of Higher Education and Research (BIHER)

Sree Balaji Medical College and Hospital (SBMCH)

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Corresponding Author : R. Aswathy (aswathyr267@gmail.com)

ORCID NO: 0009-0001-6641--5650

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ABTRACT

BACKGROUND:

Cardioplegia is an essential component of myocardial protection during coronary artery bypass grafting (CABG). Delnido cardioplegia is a single-dose cardioplegic solution that provides prolonged myocardial protection and may reduce the need for repeated cardioplegia administration. In contrast, multi-dose blood cardioplegia requires repeated administration during the procedure and provides myocardial protection through a blood-based cardioplegic solution. The choice of cardioplegia may influence operative parameters and postoperative recovery. Therefore, comparison of single-dose Delnido cardioplegia with multidose blood cardioplegia is important in adult cardiac surgery.

AIM

To compare the effectiveness of single-dose Del Nido cardioplegia with multidose blood cardioplegia in providing myocardial protection during coronary artery bypass grafting (CABG) in adult patients.

MATERIALS AND METHODS:

In this comparative study, 30 adult patients undergoing coronary artery bypass grafting were included and equally divided into two groups. Group A consisted of [n= 15]patients receiving single-dose Delnido cardioplegia, while Group B consisted of[n=15] patients receiving multidose blood cardioplegia. The intraoperative and postoperative parameters were recorded and compared between the two groups. The parameters assessed included age, cardiopulmonary bypass time, aortic cross-clamp time, ventilation time, ICU stay, hospital stay, urine output, and serum creatinine

RESULT

A total of 30 patients undergoing CABG were included, with 15 patients in the Delnido cardioplegia group and 15 in the blood cardioplegia group. Significant differences were observed between the groups in CPB time, aortic cross-clamp time, and urine output ($p<0.001$). Postoperatively, significant differences were observed in duration of mechanical ventilation, ICU stay, hospital stay, and peak serum creatinine between the two groups ($p<0.001$). Overall, patients receiving Delnido cardioplegia demonstrated more favourable intraoperative and postoperative outcomes compared with those receiving multidose blood cardioplegia.

CONCLUSION:

The present study compared single-dose Delnido cardioplegia with multidose blood cardioplegia in adult patients undergoing CABG. The findings indicate that Delnido cardioplegia provides effective myocardial protection with the advantage of requiring fewer cardioplegia administrations. Patients receiving Delnido cardioplegia demonstrated favorable postoperative outcomes, including better renal function as reflected by lower peak serum creatinine levels. Other postoperative parameters showed comparable outcomes between the two groups. Overall, single-dose Delnido cardioplegia appears to be a safe and effective alternative to multidose blood cardioplegia in adult CABG surgery. Further studies with larger sample sizes are recommended to validate these findings.

KEYWORD:

Cardioplegia coronary artery bypass grafting cardiopulmonary bypass

INTRODUCTION

Cardiovascular diseases remain one of the leading causes of morbidity and mortality worldwide. Among these, coronary artery disease (CAD) is the most prevalent condition, significantly affecting the adult population. The narrowing or blockage of coronary arteries due to atherosclerotic plaque leads to reduced myocardial perfusion, resulting in angina, myocardial infarction, and heart failure. In advanced stages, surgical intervention such as coronary artery bypass grafting (CABG) becomes essential to restore adequate blood flow to the myocardium. CABG is one of the most commonly performed cardiac surgical procedures, especially in patients with multi vessel coronary artery disease. The procedure involves grafting vessels to bypass obstructed coronary arteries, thereby improving myocardial oxygenation and overall cardiac function. Despite advancements in surgical techniques and perioperative care, myocardial injury during surgery remains a significant concern. Therefore, effective myocardial protection strategies are crucial to ensure optimal surgical outcome.

Delnido cardioplegia was originally developed for pediatric cardiac surgery in the early 1990s. It is a single-dose cardioplegic solution designed to provide prolonged myocardial protection for up to 90 minutes. The solution contains components such as lidocaine and magnesium, which help stabilize myocardial cell membranes and reduce calcium influx. In recent years, Delnido cardioplegia has gained popularity in adult cardiac surgery due to its simplicity and effectiveness. Its single-dose administration reduces the need for repeated interruptions, allowing surgeons to perform procedures more efficiently.

Blood cardioplegia is widely used in adult cardiac surgery and is considered the standard method for myocardial protection. It involves mixing oxygenated blood with crystalloid solution, typically in a 4:1 ratio. This combination provides oxygen, nutrients, and buffering capacity, thereby enhancing myocardial preservation. However, the major limitation of blood cardioplegia is its requirement for repeated administration. Frequent interruptions during surgery to deliver cardioplegia can increase cross-clamp time and cardiopulmonary bypass (CPB) duration. Additionally, inconsistent delivery may lead to uneven myocardial protection.

Both Delnido and blood cardioplegia aim to achieve effective cardiac arrest and maintain adequate myocardial protection. However, they differ in their composition, dosing strategy, and requirement for repeated administration. Single-dose Delnido cardioplegia may reduce the need for interruption and redosing, whereas multidose blood cardioplegia allows repeated supplementation of myocardial protection throughout the surgical procedure. The effectiveness of myocardial protection can be assessed through several intraoperative and postoperative parameters. Important clinical outcomes include cardiopulmonary bypass time, aortic cross-clamp time, urine output, duration of mechanical ventilation, intensive care unit (ICU) stay, hospital stay, and postoperative serum creatinine. These parameters provide useful information regarding the perioperative course, recovery, and possible effects on organ function following CABG. Therefore, comparing different cardioplegia strategies is important for determining their practical and clinical advantages in adult cardiac surgery. The present study focuses on a comparison between single-dose Delnido cardioplegia and multidose blood cardioplegia in adult patients undergoing CABG. The study evaluates selected intraoperative and postoperative outcomes to assess the differences between these two myocardial protection strategies and to determine their potential clinical benefits in adult

METHODOLOGY

A prospective comparative study was conducted among adult patients undergoing coronary artery bypass grafting (CABG) under cardiopulmonary bypass. The study was carried out in the Department of Cardiothoracic Surgery at the selected study centre after obtaining institutional ethical approval and informed consent from the participants. A total of 30 patients were included and divided into two groups of 15 patients each. Group A receiving single-dose Delnido cardioplegia.

While Group B receiving multidose blood cardioplegia for myocardial protection during surgery. Preoperative, intraoperative, and postoperative data were collected using a structured data collection proforma. The parameters assessed included cardiopulmonary bypass time, aortic cross-clamp time, urine output, duration of mechanical ventilation, ICU stay, hospital stay, and peak postoperative serum creatinine. The collected data were entered into Microsoft Excel and analysed using SPSS software. Continuous variables were expressed as mean $\pm$ standard deviation, and the outcomes between the two groups were compared using appropriate statistical tests. A p-value of <0.05 was considered statistically significant.

Comparison between delnido cardioplegia versus blood cardioplegia

Over the past decade, several studies have evaluated the effectiveness of Delnido cardioplegia in adult cardiac surgery and compared it with conventional blood cardioplegia. These studies have primarily focused on myocardial protection, operative times, and postoperative outcomes.

Mickleborough et al. (2015) conducted one of the early studies evaluating the use of Delnido cardioplegia in adult patients undergoing cardiac surgery. Their findings demonstrated that Delnido cardioplegia provided myocardial protection comparable to conventional blood cardioplegia. The study reported no significant difference in postoperative complications, suggesting that Delnido is a safe alternative in adult cardiac procedures. Mishra et al. (2018) evaluated the clinical outcomes of patients receiving Delnido cardioplegia versus blood cardioplegia. The study reported reduced operative time, decreased cardioplegia volume, and improved myocardial preservation in the Delnido group. These findings highlighted the potential benefits of adopting Delnido cardioplegia in adult cardiac surgery. Recent studies conducted in 2020–2022 have further supported these findings, demonstrating that Delnido cardioplegia provides effective myocardial protection with reduced enzyme release and improved postoperative recovery.

Tab 1 Comparison between delnido cardioplegia versus Blood cp

	Blood cp	delnido cp
Base solution [1]	pelgisol	plasma -lyste
Blood :Crystalloid ratio	4:1	1:4
Potassium	80mEq	26
Bicarbonate	30 mEq	13 mEq
Mannitol	12.5g	33g
Lidocane		0.13g
Magnesium		29

Patient selection criteria of conventional CABG and myocardial protection strategy

Patient selection criteria for conventional CABG

Patients undergoing elective conventional coronary artery bypass grafting (CABG) with cardiopulmonary bypass (CPB) were selected for the study. Adult patients who were scheduled for isolated CABG and fulfilled the study requirements were included. Patients with emergency surgery, redo CABG, combined cardiac procedures, significant pre-existing renal dysfunction, or other conditions that could significantly influence postoperative outcomes were excluded.

Myocardial protection strategy

Myocardial protection was achieved using either single-dose Delnido cardioplegia or multidose blood cardioplegia, according to the assigned study group. In the Delnido group, a single dose was administered for myocardial arrest and protection during the aortic cross-clamp period, with additional dosing when clinically required. In the blood cardioplegia group, cardioplegia was administered repeatedly at appropriate intervals during the cross-clamp period. Both groups underwent conventional CPB with

appropriate temperature, perfusion, and haemodynamic management according to institutional practice.

RESULT

A total of 30 adult CABG patients were included, with 15 patients in each group. Gender distribution was comparable between the groups ($p=1.000$). Cardiopulmonary bypass time and aortic cross-clamp time differed between the Del Nido and blood cardioplegia groups. Significant differences were observed in urine output and ICU stay ($p=0.001$). Peak serum creatinine was lower in the Del Nido group, suggesting better postoperative renal preservation.

FIGURE 1 AGE DISTRIBUTION

Comparison of Age Distribution Between Group A and Group B

AGE GROUP	DELNIDO CARDIOPLEGIA	BLOOD CARDIOPLEGIA	PERCENTAGE
45-55	15	0	50%
56-65	0	15	50%
P-VAUE	0.001		

FIGURE.2 GENDER

Comparison of Gender Between Group A and Group B

GENDER	FREQUENCY	PERCENTAGE
MALE	14	46.7%
FEAMLE	16	53.6%
P-VAUE	285	

FIGURE3 .CARDIOPULMONARY BYPASS TIME (CPB)

Comparison of CPB Time Between Group A and Group B

CARDIO PULMONARY BYPASS TIME	DELNIDO CARDIOPLEGIA	BLOOD CARDIOPLEGIA	PERCENTAGE
90 to 121	15 [8.3.37]%	3 [16.71]%	60%
122-140	0	12[80.00]%	40.0%
P value	.0001		

FIGURE 4: AORTIC CROSS CLAMP TIME

Comparison of Cross Clamp Time Between Group A and Group B

AORTIC CROSS CLAMP TIME	DELNIDO CARDIOPLEGIA	BLOOD CARDIOPLEGIA	Percentage
65 to 75	14 [93.3%]	0	46.7%
76 to 125	1[6.7%]	15[93.8%]	53.3%
pvaue	o.oo1		

FIGURE.6 :VENTILATION TIME

Comparison of Ventilation Time Between Group A and Group B

VENTILATION TIME	DELNIDO CARDIOPLEGIA	BLOOD CARDIOPLEGIA	PERCENTAGE
1 to 2	13 [86.7%]	0	43.3%
2 to 4	2 [13.3%]	15 [100.0%]	56.7%
pValue	o.ooo1		

FIGURE.7 :ICU STAY

Comparison of ICU Stay Between Group A and Group B

ICU STAY	DELNIDO CARDIOPLEGIA	BLOOD CARDIOPLEGIA	PERCENTAGE
5 to 8	14[93.3%]	1 [6.7%]	50.0%
8to 10	1 [6.7%]	14 [93.3%]	50.0%
pvalue	0.001		

FIGURE8 8: HOSPITAL STAY

Comparison of Hospital Stay Between Group A and Group B

HOSPITAL STAY	DELNIDO CARDIOPLEGIA	BLOOD CARDIOPLEGIA	PERCENTAGE
1 to 14	14[93.3%]	o	46.7%
2 to 15	1 [6.7%]	15 [93.8]	100.0%
P value			

FIGURE 9 :URINE OUTPUT

Comparison of Postoperative Urine Output Between Group A and Group B

URINE OUTPUT	DELNIDO CARDIOPLEGIA	BLOOD CARDIOPLEGIA	PERCENTAGE
800 to 1200	14 [93.3%]	0	46.7%
500 to 800	1[6.7%]	15 [100.0%]	53.3%
P vaue	0.001		

FIGURE 10 :SERUM CREATININE

Comparison of Creatinine Between Group A and Group B

SERUM CREATININE	DELNIDO CARDIOPLEGIA	BLOOD CARDIOPLEGIA	PERCENTAGE
0.8 to1.1	14 [93.3%]	0	46.7%
0.5 to 1.3	1 [6.7%]	15 [93.8%]	53.3%
P vaue	0.001		

FIGURE 1 :AGE DISTRIBUTION

Comparison of Age Distribution Between Group A and Group B

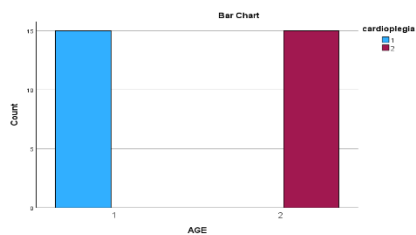


FIGURE.2: GENDER

Comparison of Gender Between Group A an

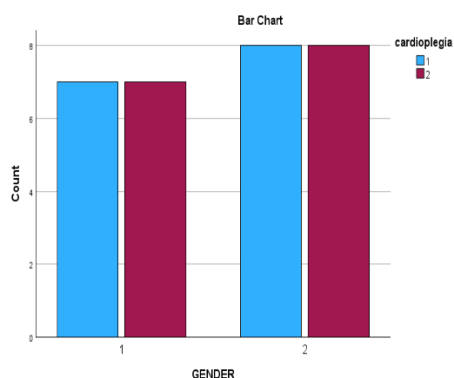


FIGURE 3: .CARDIOPULMONARY BYPASS TIME (CPB)

Comparison of CPB Time Between Group A and Group B

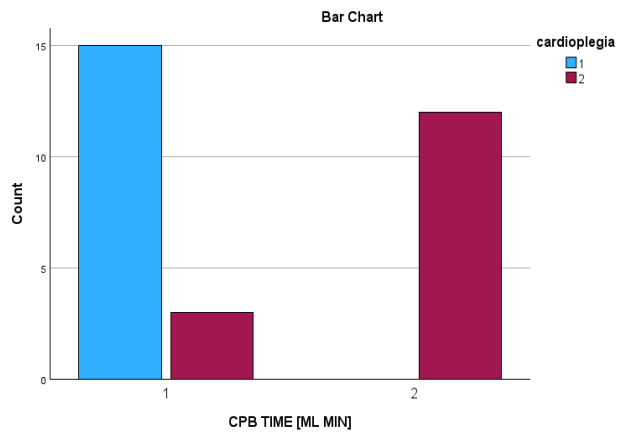


FIGURE 4 :AORTIC CROSS CLAMP TIME

Comparison of Cross Clamp Time Between Group A and Group B

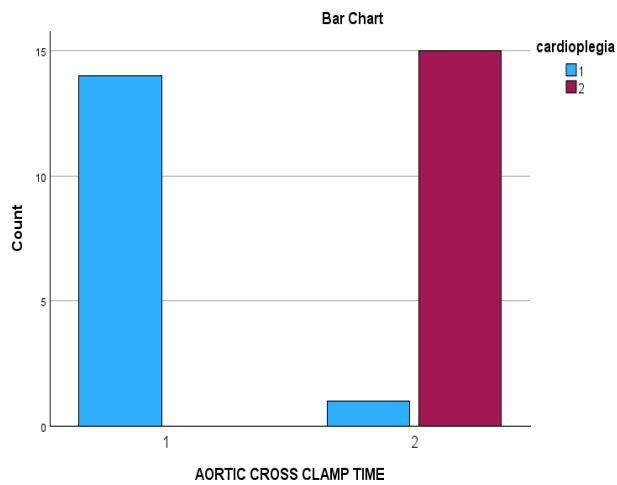


FIGURE .6 :VENTILATION TIME

Comparison of Ventilation Time Between Group A and Group B

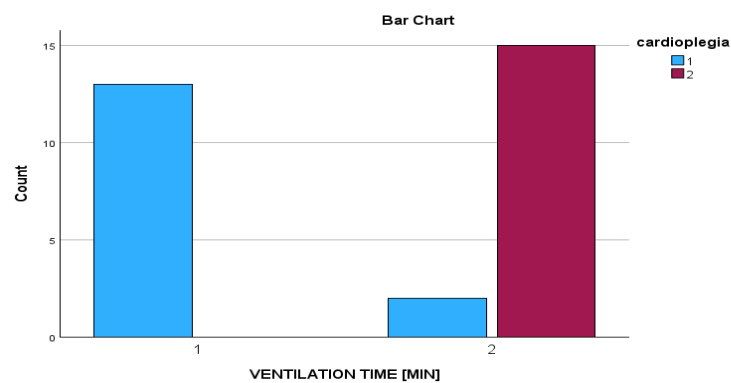


FIGURE 7: ICU STAY

Comparison of ICU Stay Between Group A and Group B

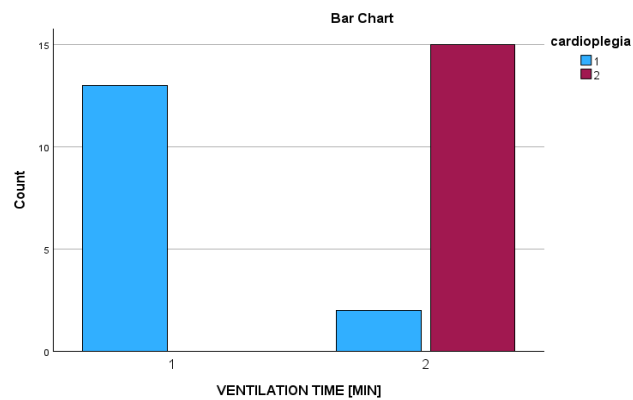


FIGURE 8; HOSPITAL STAY

Comparison of Hospital Stay Between Group A and Group B

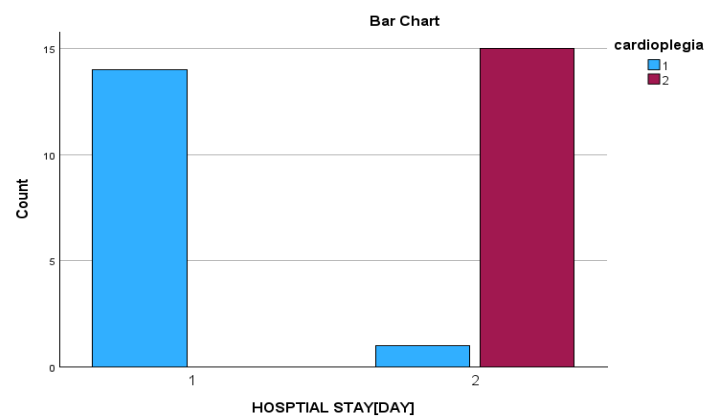


FIGURE 9: URINE OUTPUT

Comparison of Postoperative Urine Output Between Group A and Group B

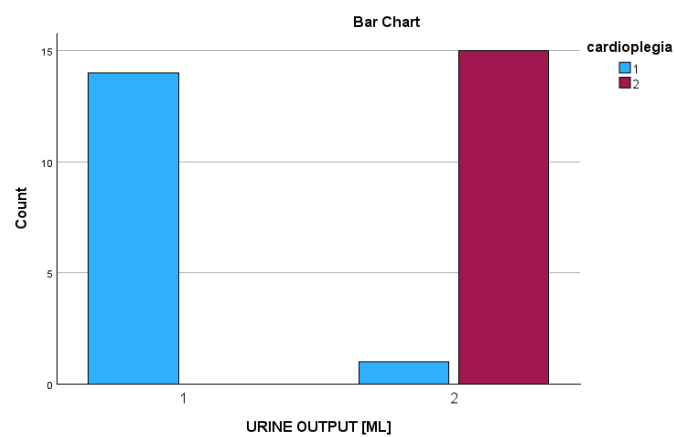
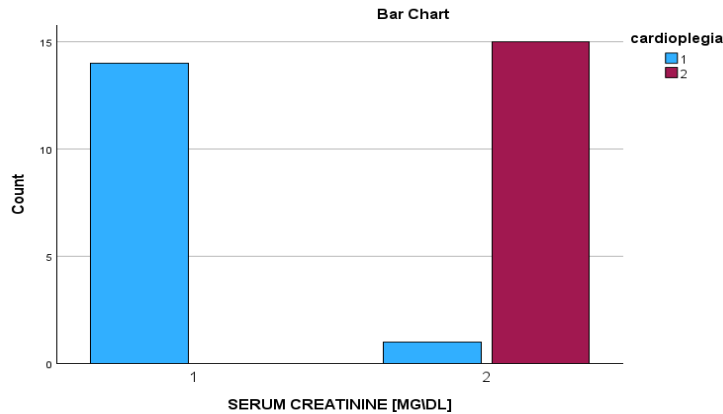


FIGURE 10:SERUM CREATININE

Comparison of Creatinine Between Group A and Group B



Intraoperative data

Tables 1 show the intraoperative outcomes for both patient groups. The CPB time showed a statistically significant difference between the two groups. In the Del Nido cardioplegia group, all 15 patients (100%) were classified in category 1, whereas in the blood cardioplegia group, 3 patients (20.0%) were classified in category 1 and 12 patients (80.0%) in category 2 ($p<0.001$). The aortic cross-clamp time also showed a statistically significant difference between the groups. Fourteen patients (93.3%) in the Delnido cardioplegia group were classified in category 1, compared with none in the blood cardioplegia group, while 1 patient (6.7%) in the Del Nido group and all 15 patients (100.0%) in the blood cardioplegia group were classified in category 2 ($p<0.001$). Urine output demonstrated a statistically significant difference between the groups, with 14 patients (93.3%) in the DelNido cardioplegia group and none in the blood cardioplegia group classified in category 1 ($p<0.001$) FIGURE1

Postoperative outcomes

FIGURE2 shows the comparison of postoperative outcomes between the Del Nido cardioplegia and blood cardioplegia groups. Duration of mechanical ventilation showed a statistically significant difference between the groups. In the Del Nido cardioplegia group, 13 patients (86.7%) were classified in category 1 and 2 patients (13.3%) in category 2, whereas all 15 patients (100.0%) in the blood cardioplegia group were classified in category 2 ($p<0.001$). ICU stay also showed a statistically significant difference, with 14 patients (93.3%) in the Del Nido cardioplegia group classified in category 1 compared with 1 patient (6.7%) in the blood cardioplegia group ($p<0.001$)

FIGURE1 Comparison of Intraoperative outcomes between delnido cardioplegia and blood cardioplegia

Intraoperative data	category	Delnido [%]	Blood [%]	p-values
CPB time	Category 1	15[100.0]	3[20.0]	<0.001
	Category 2	0 [0.0]	12[80.0]	
Aorticcross clamp time	Category 1	14[93.3]	0 [0.0]	<0.001
	Category 2	1[6.7]	15[100.0]	
Urine Output	Category 1	14[93.3]	0 [0.0]	<0.001
	Category 2	1[6.7]	15[100.0]	

Values are presented as frequency and percentage. $p < 0.05$ was considered statistically significant.

FIGURE2 Comparison of postoperative outcomes between delnido cardioplegia and blood cardioplegia

postoperative data	category	Delnido [%]	Blood [%]	p-values
Mechanical ventilation	Category 1	13[86.7]	0 [0.0]	<0.001
	Category 2	2[13.3]	15[100.0]	
ICU days	Category 1	1[6.7]	1[6.7]	<0.001
	Category 2	14[93.3]	14[93.3]	
Hospital stay	Category 1	1[6.7]	0 [0.0]	<0.001
	Category 2	14[93.3]	15[100.0]	
Serym creatinine	Category 1	1[6.7]	0 [0.0]	<0.001
	Category 2	14[93.3]	15[100.0]	

Values are presented as frequency and percentage. $p < 0.05$ was considered statistically significant

DISCUSSION

The present study compared the intraoperative and postoperative outcomes of patients undergoing CABG using single-dose Del Nido cardioplegia and multidose blood cardioplegia. The study included 30 patients, with 15 patients in each group. The findings demonstrated statistically significant differences in the major intraoperative parameters, including CPB time, aortic cross-clamp time, and urine output. The Del Nido cardioplegia group showed more favourable results compared with the blood cardioplegia group. Postoperatively, significant differences were observed in the duration of mechanical ventilation, ICU stay, hospital stay, and peak serum creatinine. The Del Nido group demonstrated more favourable postoperative outcomes, suggesting improved early postoperative recovery and renal preservation. The reduced requirement for repeated cardioplegia administration with Del Nido cardioplegia may contribute to simplified

myocardial protection and reduced interruption during surgery. Overall, the findings of the present study suggest that single-dose Del Nido cardioplegia is an effective myocardial protection strategy for adult patients undergoing conventional CABG.

Conclusion

The present study concludes that single-dose Del Nido cardioplegia provides favourable intraoperative and postoperative outcomes compared with multidose blood cardioplegia in adult patients undergoing CABG. Significant differences were observed in CPB time, aortic cross-clamp time, urine output, mechanical ventilation duration, ICU stay, hospital stay, and peak serum creatinine. Del Nido cardioplegia may therefore be considered an effective and convenient myocardial protection strategy in adult CABG, with potential benefits in early postoperative recovery.

Limitations

The present study had a relatively small sample size of 30 patients, with 15 patients in each group, which may limit the statistical power of the study. As the study was conducted at a single centre, the findings may not be generalizable to all patient populations. The follow-up period was limited to the early postoperative period, and long-term cardiac and renal outcomes were not assessed. Only selected intraoperative and postoperative parameters were evaluated. Therefore, larger multicentre studies with longer follow-up are recommended to validate the present findings.

Recommendations

Based on the findings of the present study, single-dose Del Nido cardioplegia may be considered as an effective myocardial protection strategy in adult patients undergoing conventional CABG. Further studies with larger sample sizes and multicentre participation are recommended to validate these findings. Long-term follow-up studies are also recommended to evaluate cardiac, renal, and other postoperative outcomes.

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