ASSESSMENT OF THE SAFETY, EFFICACY AND VERSATILITY OF MODIFIED DEL NIDO CARDIOPLEGIA

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Introduction

Cardiovascular diseases (CVDs) are the leading cause of death and disability world wide .During cardiac surgery, it is imperative for the heart to be non-beating and a blood-free field . The easiest way to achieve this is clamping the aorta by aortic cross clamp and redirecting the circulation to the heart–lung machine . Halting the heart's activity reduces metabolic demands, revolutionizing cardiac operations for enhanced safety and control. The heart's vulnerability during this critical period underscores the importance of effective myocardial protection.Myocardial injury during cardiac surgery is the leading cause of post-operative morbidity and significant mortality, so that myocardial protection methods are important .Those methods can be enumerated as ; hypothermia , the use of refrigerated saline in the pericadial sac and cardioplegia solution.Cardioplegic solution is the corner stone of myocardial protection there are 2 primary types of cardioplegia solutions: crystalloid cardioplegia and basic solutions that comprise the constituents of blood. Del Nido cardioplegia was developed by Dr. Pedro J. del Nido, a pediatric cardiac surgeon, in the early 1990s. The del Nido cardioplegia (DNC) is a crystalloid solution (Plasmalyte-A, lidocaine, mannitol) which is mixed with blood in a 1:4 ratio (blood/crystalloid),) This cardioplegia provides excellent protection for 90 minutes of cross-clamp duration when administered at a dosage of 20 mL/kg, The administration pressure is 100 to 120 mm Hg and the administration flow is 200 to 300 mL/mi. As the base solution of del Nido cardioplegia is (plasma Lyte A) world wide availability is limited so The present study carried to assess the safety, versatility and efficacy of modified del Nido cardioplegia in adult cardiac surgery.

Aim of the work

The aim of the present study is to evaluate and to assess the safety, efficacy and versatility of modified del Nido cardioplegia.

Patient and methods

After approval of the Ethical Committee of Faculty of Medicine Alexandria University and having an informed consent from every patient included in the study, the present study was carried out in Alexandria University Hospital on 50 adult patients undergoing an elective cardiac surgery. Patients below 16 years old , Patients with low ejection fraction below 35 %.& Patient's who refused to participate in the study were excluded.

All patients was subjected to the followings preoperatively: **1**.Detailed history taking. **2**.Full clinical examination. •Routine laboratory investigations. •CBC. •Kidney function tests. •Prothrombin time and International Normalized Ratio (INR). Serum electrolytes. •Lipid profile. •Liver function tests. **3**.Chest radiography in the form of chest X-ray or CT chest if indicated. **4**.Electrocardiograph (ECG) and oxygen saturation. **5**.Echocardiogram. **6**.Coronary Angiography for CABG cases and all cases above the age of 40 years old.Operative procedureOnce the cross clamp is placed on the aorta, a single dose of antegrade del Nido cardioplegia is delivered over 1-4 minutes at a rate of 250-450 ml/min.

As the original del Nido cardioplegia, Modified del Nido cardioplegia is given at 4c, A single dose of Modified del Nido cardioplegia which was kept refrigerated before usage contains 500 ml ringer acetate plus:

1) 8.5 ml mannitol 20% **2)**10 ml MgSO4 **3)** ml NaHCO3 **4)** 3.5 ml xylocaine **5)** 6.5 ml KCL **6)** 125 ml blood.**7)** 1500 ml are given at the start then 300-500 ml every 90 minutes.

The following points were being studied intra operative:

•The interval between starting cardioplegia infusion and complete cardiac arrest.
•The interval between release of the cross clamp and regain of normal sinus rhythm.
•Initial rhythm after reperfusion : The initial rhythm will be quantified as: sinus vs bradycardia vs tachyarrhythmias and unstable rhythms (ventricular fibrillation & ventricular tachycardia).
•Need for DC shock.
•Fluid balance intra operative.

Postoperative data and methods:

1)Assessment of the ICU stay of the patient and for how long.
2)Recording any ECG changes ie ST elevation, arrhythmias.
3)Documentation of postoperative myocardial infarction.
4)Estimating the balance and renal function assessment.
5)Postoperative ejection fraction (during day 1 &day 2 post operative).
6)The need of inotropes and vasopressors.
7)Postoperative cardiac enzemes level and renal function (Urea & Creatinine levels).

Results

Table (1): Distribution of the studied cases according to initial rhythm" Intraoperative" (n = 50), it shows the initial cardiac rhythm after cross clamp removal as following:

	No.	%
Initial rhythm#		
Regular	37	74.0
Paced	1	2.0
VF	6	12
AF	4	8.0
Heart block	1	2.0
Junctional	1	2.0

The majority of cases "37 case or 75% of cases "had regained a regular sinus rhythm after cross clamp release. The need of DC shock for cases after removal of cross clamp intraoperatively was also assessed and Only 6 cases '12%" needed DC shock

Table (2): Comparison between the three measurements according to ejection fraction "EF" (n = 50)

Ejection fraction (EF) (%)	Preoperative (n = 50)	Day 1 (n = 50)	Day 2 (n = 50)	Fr	p
Min. - Max.	45.0 – 78.0	40.0 - 65.0	45.0 - 70.0	39.642*	<0.001*
Mean ± SD.	59.70 ± 8.26	54.30 ± 6.31	57.24 ± 6.76		
Median (IQR)	60.0 (55.0 – 66.0)	52.50(50.0 - 60.0)	57.0 (50.0 - 60.0)		
Sig. bet. measurements	p_1<0.001*, p_2=0.040*, p_3<0.001*				

Fr: Friedman test, Sig. bet. Periods were done using Post Hoc Test (Dunn's)
p: p value for comparing between the three periods
p1: p value for comparing between Preoperative and Day 1
p2: p value for comparing between Preoperative and Day 2
p3: p value for comparing between Day 1 and Day 2
*: Statistically significant at $p \leq 0.05$.

During Comparing between the three measurements of ejection fraction; preoperative ejection fraction and postoperative ejection fraction during day 1 & day 2 as showed at table 6: "p1<0.001*, p2=0.040*, p3<0.001* "

That means there is a highly statistically significant result between preoperative EF & postoperative during day 1 "P1", preoperative EF & postoperative EF during day 2, also between postoperative EF during day 1 &day

Conclusion

The study demonstrated that modified del Nido cardioplegia is a safe and effective method for myocardial protection in adult cardiac surgery. It provides reliable cardiac arrest with a high rate of spontaneous sinus rhythm recovery and a low incidence of intraoperative arrhythmia requiring intervention. Postoperative cardiac function, as reflected by ejection fraction and cardiac enzyme levels, showed significant improvement, indicating preserved myocardial integrity. Renal function remained stable, and the requirement for inotropic support was within acceptable limits.