Comparative Effects of Single Dose Cardioplegic Techniques With Different Ischemic Time Protocols

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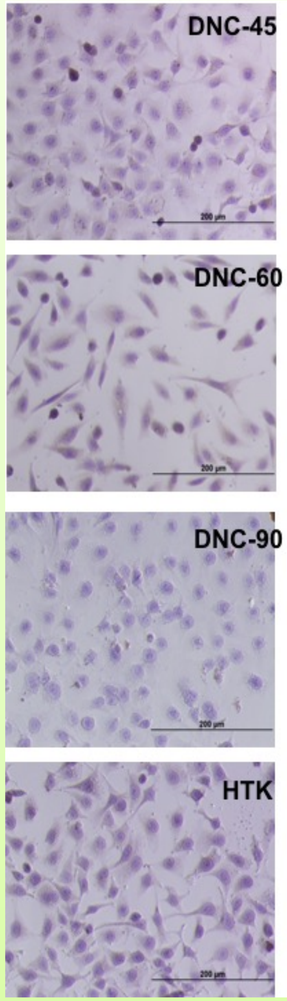
Objective

- The convenience of most cardioplegic solutions targets the good myocardial preservation—even for prolonged ischemic times—and the ease of delivery
- Although these techniques have been studied extensively, evidence on the satisfactory protection strategy during minimally invasive cardiac surgery (MICS) is still disputed
- This study aims to compare different strategies of del Nido cardioplegia (DNC) compared to histidine–tryptophan–ketoglutarate (HTK) solution in minimally invasive aortic valve replacement (mini-AVR) to discuss the safety level of myocardial protection and rationale for redosing intervals

Methods

- During the period from January 2017 to June 2019, 80 patients undergoing mini-AVR with concomitant procedures were prospectively randomized (N=20 in each group) to receive DNC in every 45, 60 and 90 min (DNC-45, DNC-60, DNC-90) versus HTK for 90 min single strategy as control:
  - ✓ DNC-45
  - ✓ DNC-60
  - ✓ DNC-90
  - ✓ Control-HTK-90 (Custodiol HTK, Germany)
- All patients received the calculated dose under controlled pressure within the predefined duration (20 mL/kg in 5 to 7 minutes via 80 to 100 mm Hg pressure)
- Left atrial venting was applied for every case and started as soon as the CPB initiated
- Patients receiving additional doses received half dose
- Redosing was performed via coronary ostia with specific cannula
- Ultrafiltration was employed at the end of CPB for every group until reaching 25% hematocrit level
- Sensitive biomarkers (interleukin-6, syndecan-1 and aquaporine-4), in addition to routine biochemistry, were documented at
  - ✓ Baseline (T1)
  - ✓ After cessation of cardiopulmonary bypass (T2)
  - ✓ On the first postoperative day (T3).
- Transmural myocardial biopsies were sampled for staining

Aquaporine–4 Staining

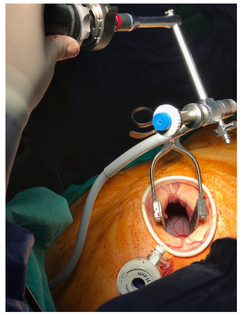


Results

	(DNC-45) (N=17)	(DNC-60) (N=18)	(DNC90) (N=17)	(HTK) (N=18)
Preoperative STS Score (%)	8.2±3	7.7±3	8.4±3	7.9±3
Aortic cross clamp (min)	79±15	88±15	83±15	85±15
IL-6 at T2 ($pg.mL^{-1}$)	101±25	90±20	**187±35***	120±30
Syndecan-1 at T2 ($pg.mL^{-1}$)	145±35	160±50	**265±60***	175±60
Myocardial AQP-4 at T2 (relative mRNA)	0.70±.05	0.65±.05	**0.35±.05***	0.65±.05
Ultrafiltration (mL)	1000±450	900±400	950±350	1100±450
AFib (n/Permanent)	2/0	2/0	4/1	1/0
AV Block/Permanent PM	0/0	1/0	3/1	1/0
ICU Stay (days)	1.4 (1.1-2.5)	1.5 (1.1-2.5)	**2.6 (1.9-3.6)***	1.3 (1.1-1.7)

- In two patients from DNC-45, two in DNC-60, one in DNC-90 and one in HTK, there was a need for conversion to full sternotomy and were excluded
- ,Two patients in the DNC-90 and one in the HTK group needed earlier redosing (<90 minutes; heart started beating/fibrillation) and were excluded
- One patient in the DNC-45 group required a third dose of cardioplegia and was excluded
- Interleukin-6 and syndecan-1 levels in DNC-90 group were statistically higher than control at T2.

- Immunoperoxidase staining confirmed blood samples
- AQP-4 levels were significantly competetive in DNC-45 and HTK groups
- AQP-4 response was unsatisfactory in DNC-60 and DNC-90 vs Control (HTK)





Minimally Invasive Approach: (RAT /J Sternotomy)

Conclusion

- In this study, the authors aimed to include additional sensitive parameters to give a broader comparison
- The impact of the inflammatory response (via IL-6) to understand any initial steps of endothelial injury and novel biomarker EG shedding for early cellular dysfunction were studied
- AQP-4 levels were also studied to understand the response to volume overload, especially in additional doses
- DNC-45, DNC-60 and HTK provided acceptable myocardial protection
- DNC-90 had significantly deranged levels of biomarkers, more arrhythmia/AV block incidence resulting in more extended ICU stay indicating inappropriate cellular protection up to 90 min ischemic time

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