



Protecting The Aged Heart During Cardiac Surgery: Use of del Nido Cardioplegia Provides Superior Functional Recovery in Isolated Hearts

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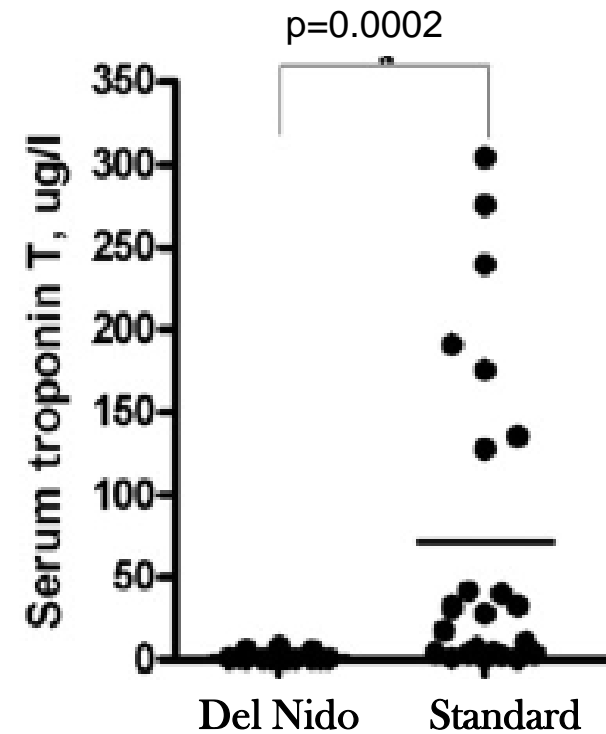
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No Disclosures

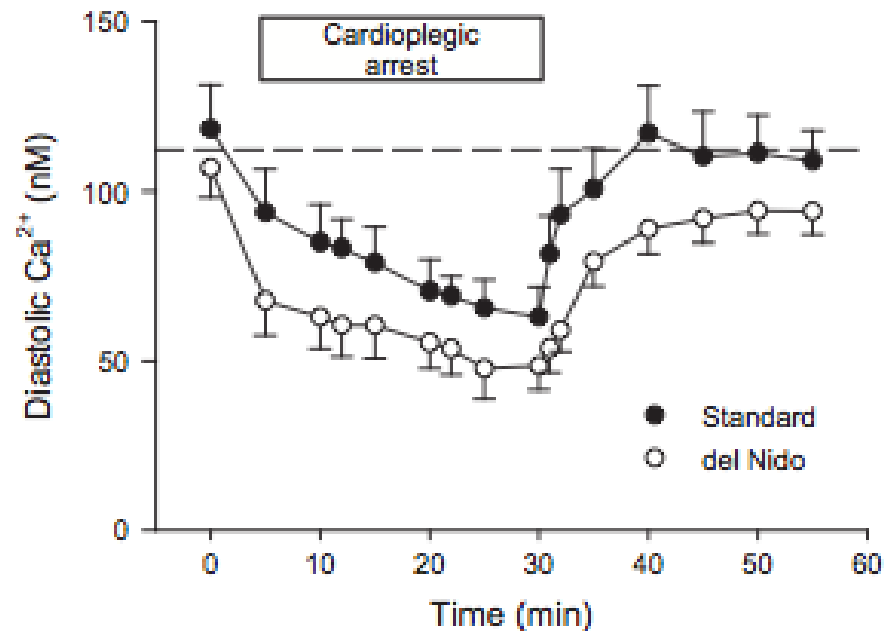
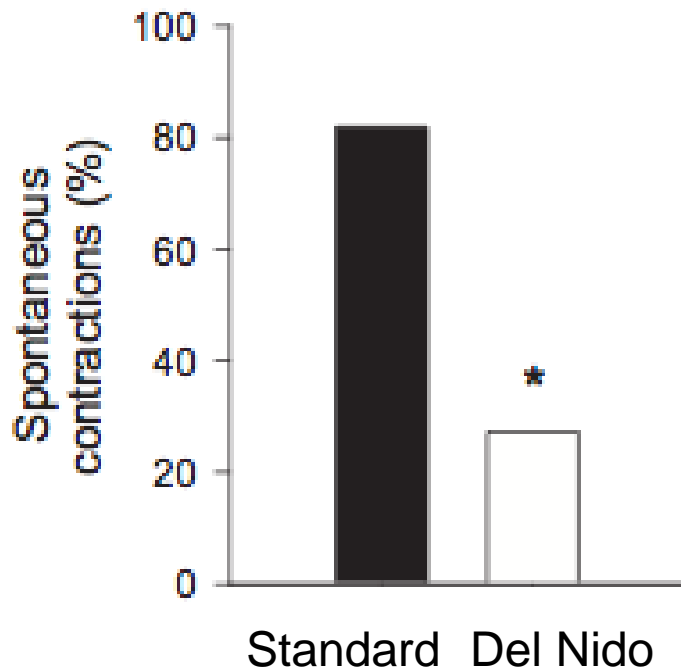


- Elderly hearts are not as well protected by some cardioplegia solutions
- The aged heart is similar to the immature heart
 - more susceptible to ischemia reperfusion injury
 - poorly equipped to handle intracellular calcium overload
- Our hypothesis:
 - A cardioplegia strategy developed for **immature hearts** may also provide superior myocardial protection for **aged hearts**

	del Nido	'Standard'
Base solution	Plasmalyte A	D5 0.225% NaCl
Dilution (blood:cardioplegia)	1:4	4:1
Final Composition		
Hematocrit (%)	≈6	≈25
K ⁺ (mmol/L)	24	18
Ca ²⁺ (mmol/L)	0.24	1.0
Glucose (mmol/L)	1	51
Lidocaine (mmol/L)	0.36	-
Strategy	Single dose	Induction + maintenance every ≈ 20 min



Del Nido cardioplegia is associated with less activity during arrest and lower intracellular Ca^{2+} in aged cardiomyocytes.



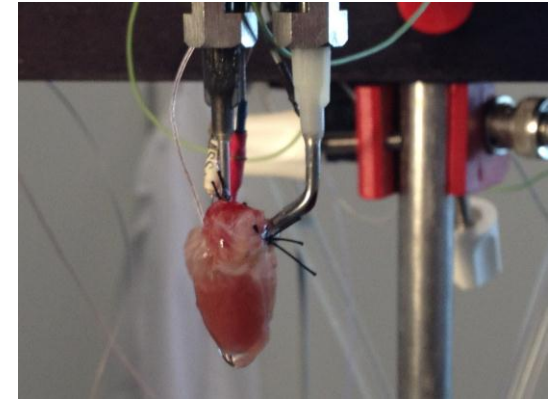


The objective of this study:

Determine if the benefits of del Nido cardioplegia seen in isolated cardiomyocytes from elderly animals translates into improved function in the whole heart

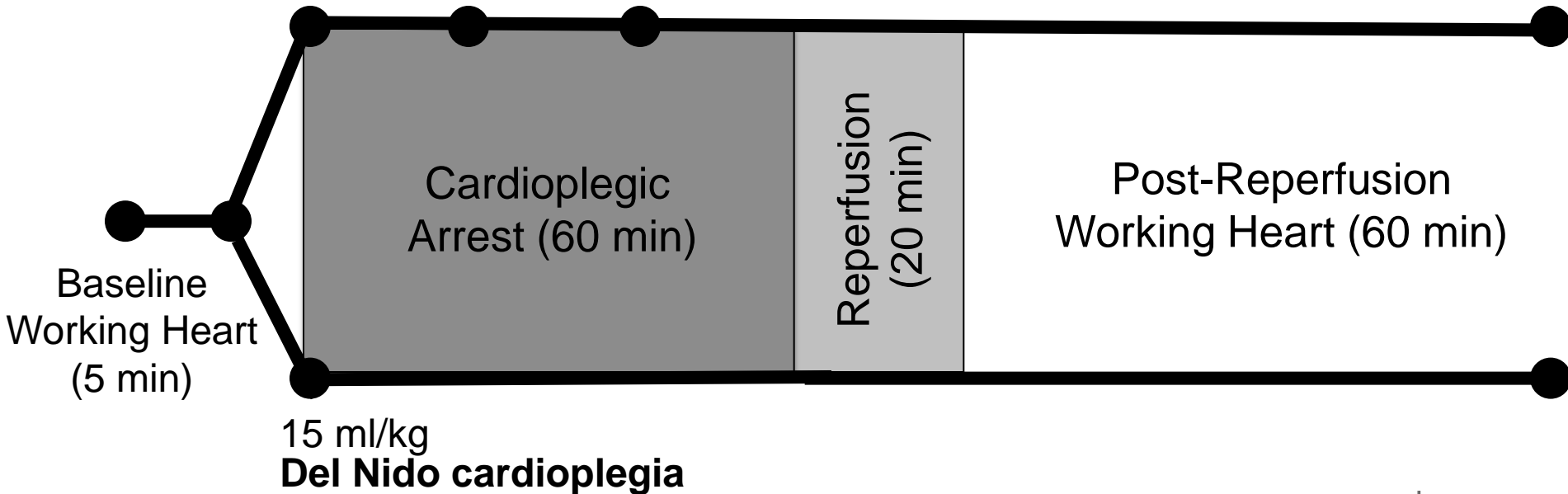


- Elderly Rat Hearts (22-24 months)
- Isolated Working Heart Preparation
- Troponin release measured during reperfusion
- Flow measurements standardized to dry weights of ventricles



Standard Cardioplegia

15 ml/kg 5 ml/kg 5 ml/kg

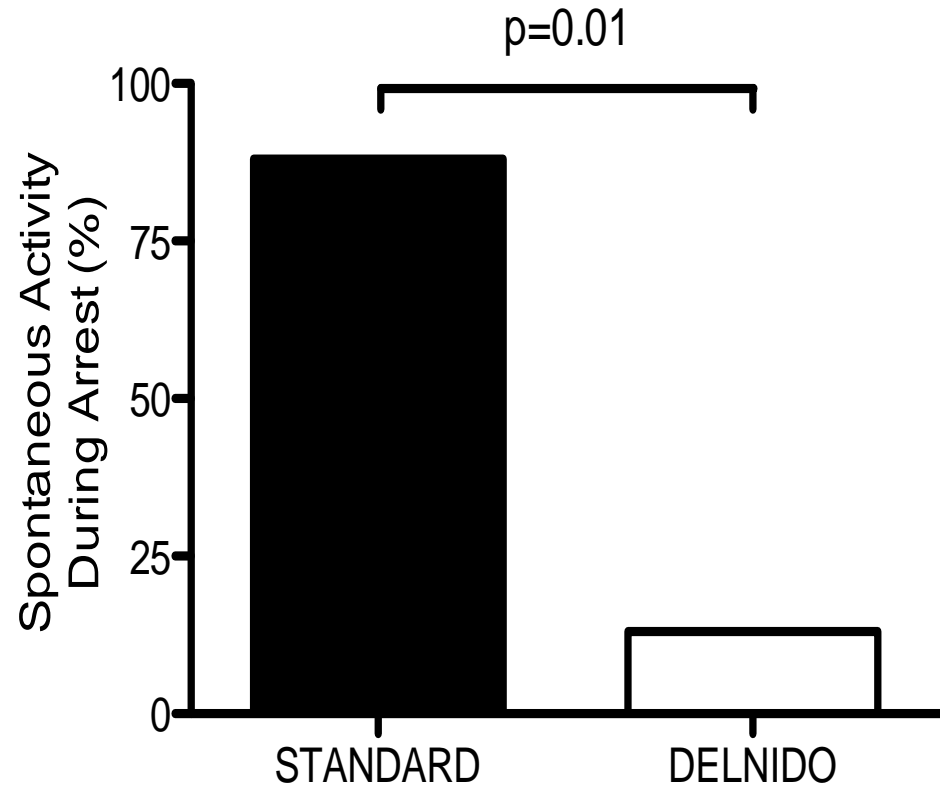
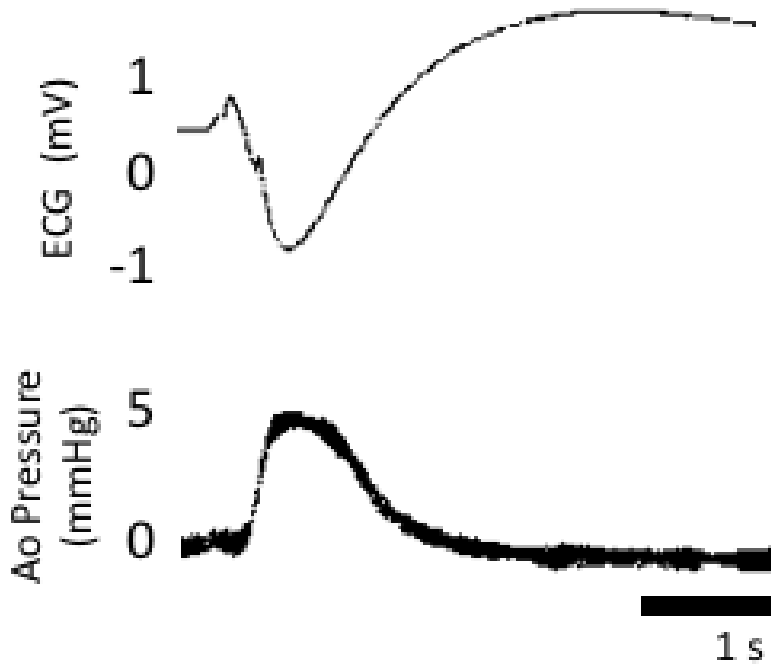




Results

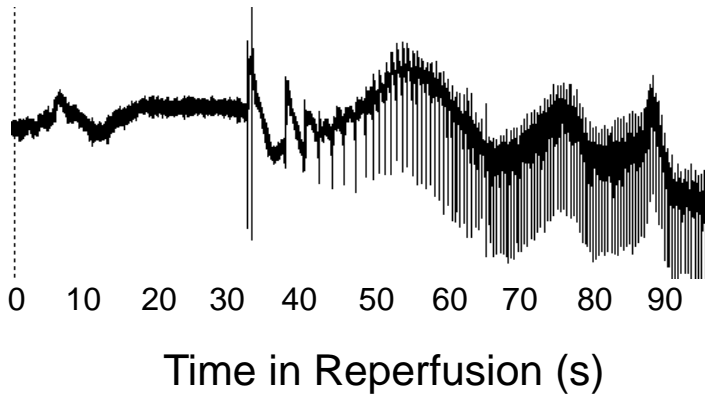
- 16 of 20 (80%) hearts met baseline inclusion criteria:
 - Heart rate > 200 bpm
 - Regular rhythm
 - Cardiac output > 25 mL/min
 - Coronary flow > 10 mL/min
- Hearts arrested with:
 - **Standard cardioplegia** (n=8) or
 - **Del Nido cardioplegia** (n=8)

Spontaneous Activity during Arrest

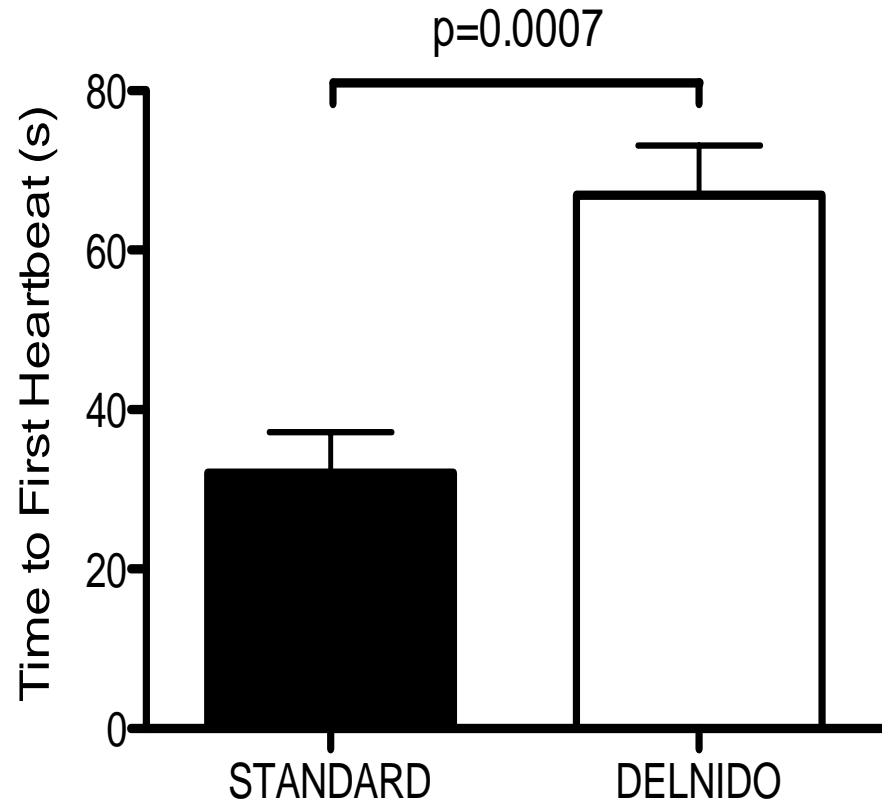
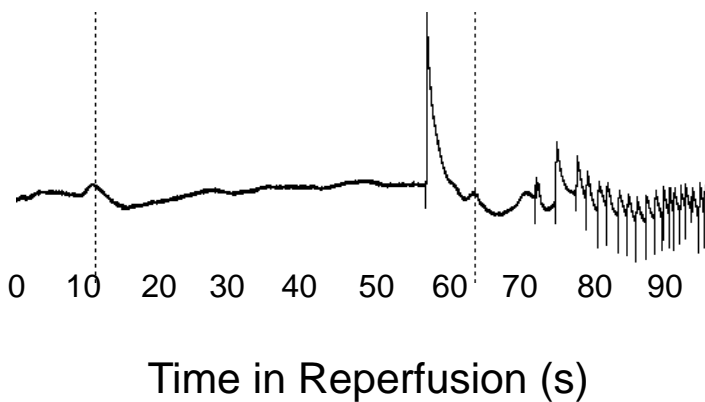


Return of Rhythm at Reperfusion

Standard

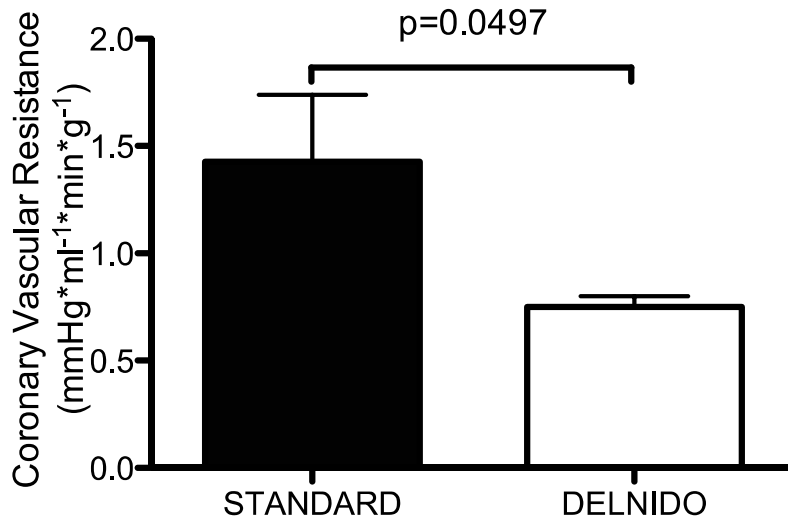


Del Nido

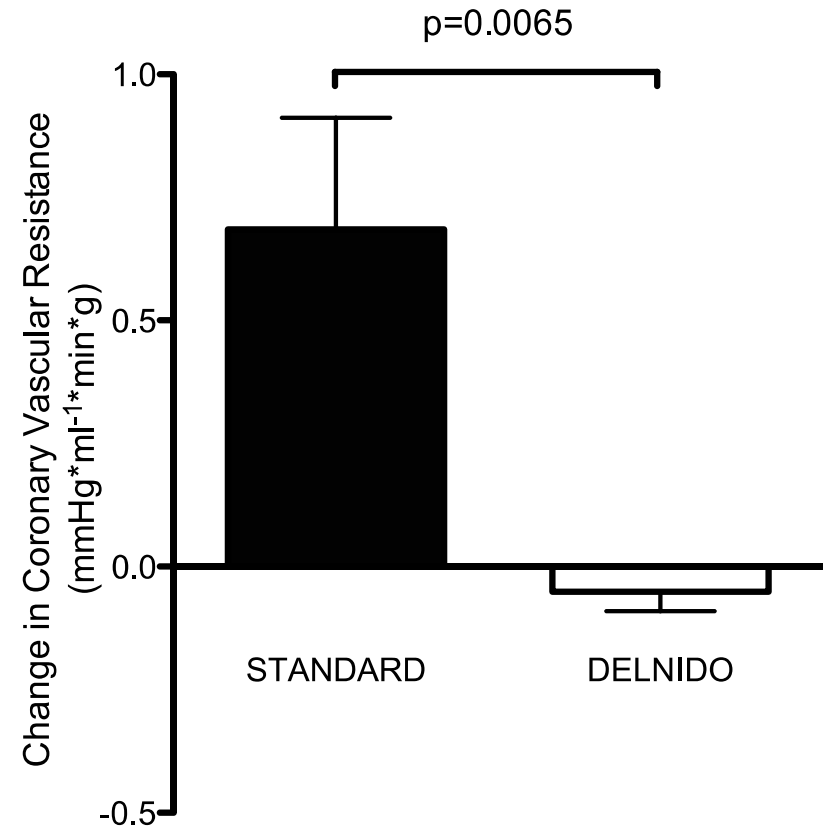


Coronary Vascular Resistance

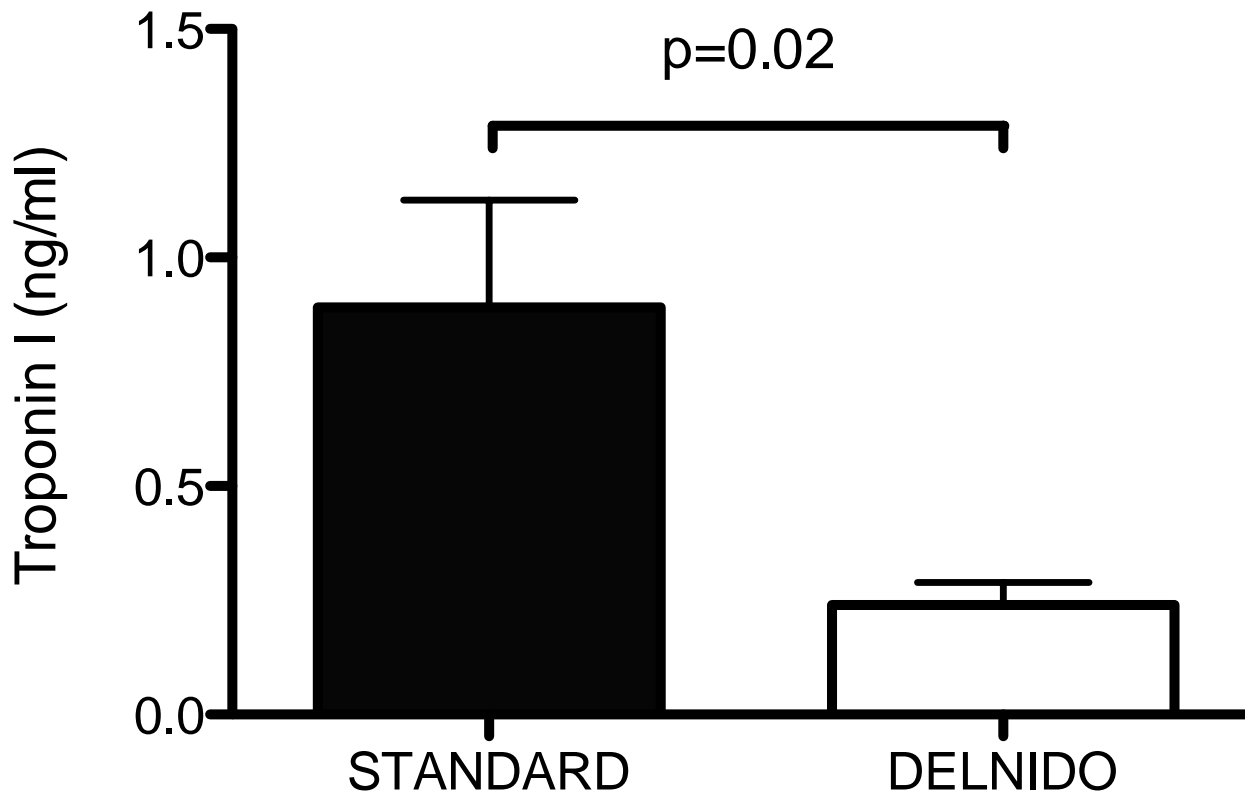
CVR during reperfusion



ΔCVR



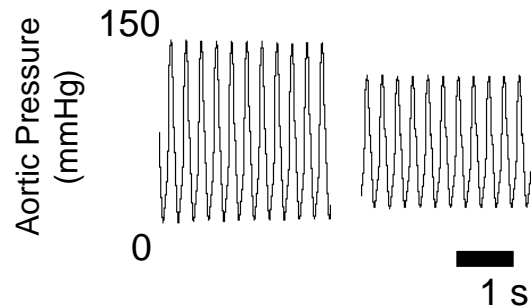
Troponin-I Release During Reperfusion



Left Ventricular Developed Pressure

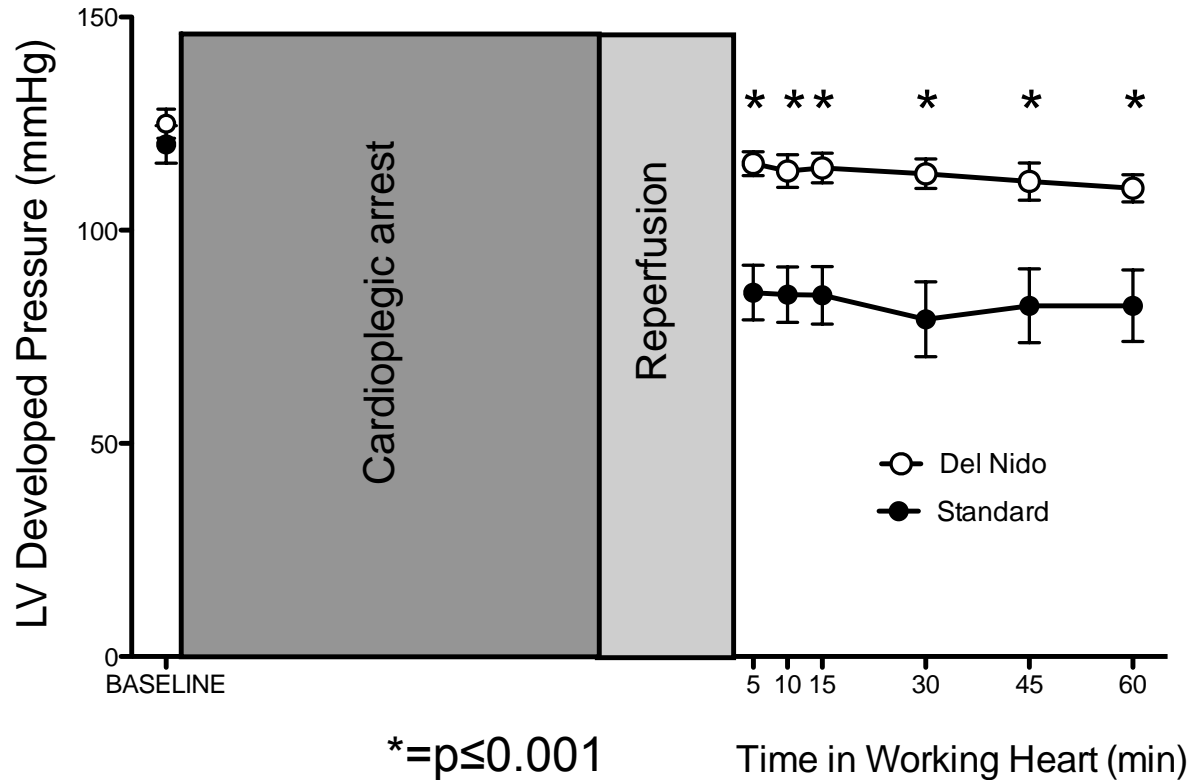
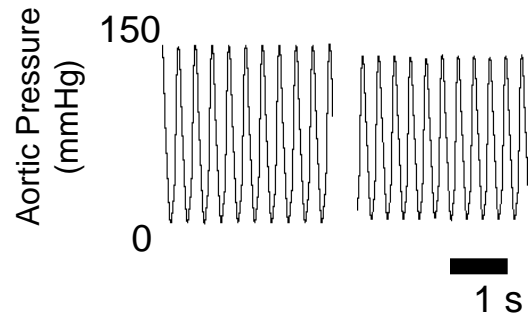
Standard

POST
BASELINE REPERFUSION



Del Nido

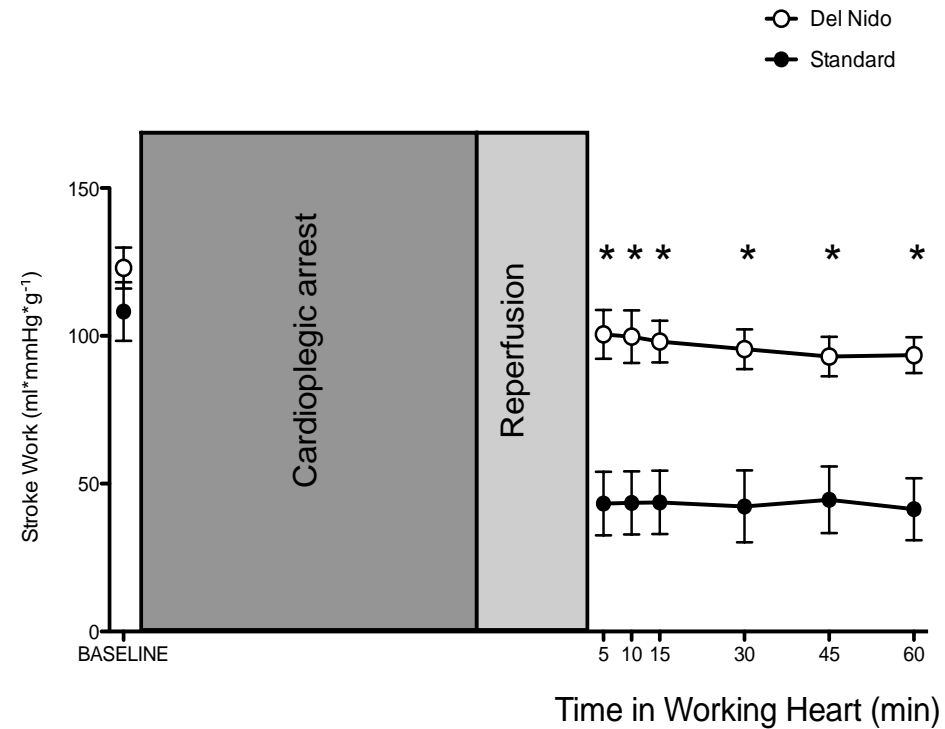
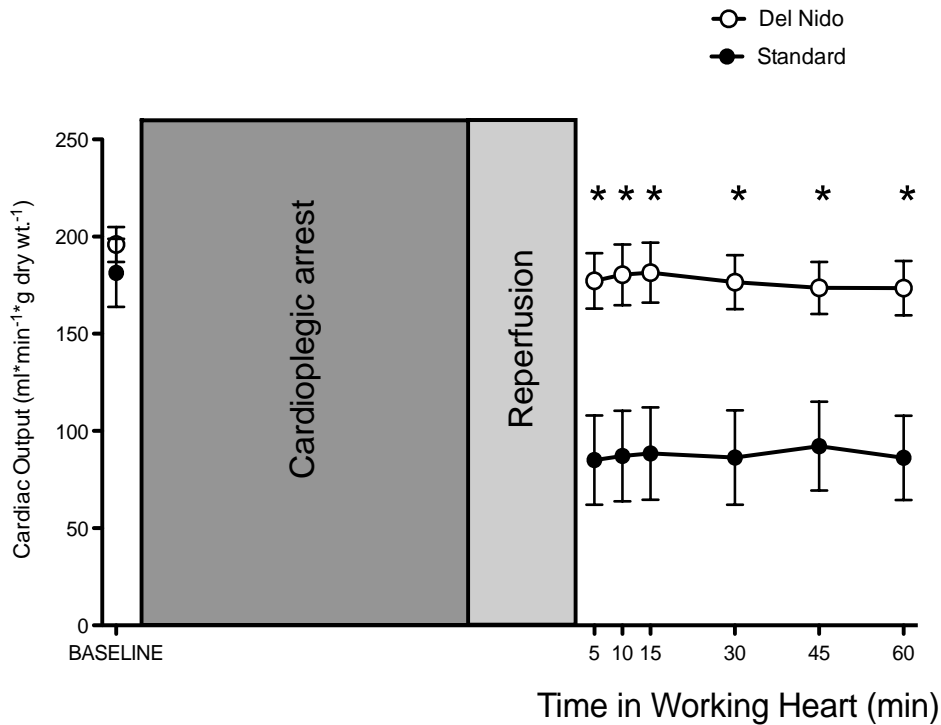
POST
BASELINE REPERFUSION



Time in Working Heart (min)

Cardiac Output

Stroke Work





Conclusion

- Del Nido cardioplegia prevents spontaneous activity during cardioplegic arrest, reduces myocardial injury, and results in superior myocardial function after reperfusion in aged hearts.
- Del Nido cardioplegia has the potential to provide superior myocardial protection for older patients undergoing cardiac surgery.



Future Directions

- Single vs. multi-dose
- Whole animal model
- Phase 1 clinical trial with elderly patients undergoing cardiac surgery

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CVRG
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