collagen area ($41 \pm 37-\mu g$-$10^{-4}$ mm$^2$, $p < 0.05$). The amount of perivascular
collagen correlated directly with medial thickness ($r = 0.57$, $p < 0.05$) and
increase of volume of medial collagen ($r = 0.57$, $p < 0.05$). Thus, IMCAS in HCM are en-
cased in perivascular collagen and also show greatly thickened media due in part
to increase in perivascular and subintimal collagen potentially impair vasoactivity,
in turn resulting in diminished coronary blood flow and cell death. The findings provide an morphologic explanation for myocardial ischemia, mediated by "small vessel disease," in pts with HCM.

**932-87 Non-Mechanical Energy Expenditure is Preserved During the Transition from Compensatory Hypertrophy to Failure of the Left Ventricle in Dahl Salt-Sensitive Rats**

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Dahl salt-sensitive rats fed with a high-salt diet (8% NaCl) progressively de-
dvelop concentric LV hypertrophy (LVH, 11 weeks), which is followed by LV
dilation with pulmonary congestion (CHF, 18 weeks). To clarify modulation in
cardiac energetics during the transition from LVH to CHF, we measured LV
pressure-volume area (PVA) and myocardial oxygen consumption (MVO$_2$) in
ischemic isolated, isovolumically contracting hearts from this animal model. Hearts
were coronary-perfused with Tyrode’s solution at 37°C and were paced at
3.33 Hz (perfusion Ca$^{2+}: 1$ mM or 2 mM). The perfusion pressure was kept
constant at 140 mmHg throughout the experiment. PO$_2$ in the perfuse and
and in the coronary effluent were continuously monitored with oxygen elec-
trodes. The end-systolic pressure-volume relation (ESPVR) determined during
the stepwise changes of the LV volume were fit by a binomial regression
analysis, which provided a slope (Ees) and a volume intercept (Vo). Linear
analysis of the MVO$_2$-PVA relation determined a slope (A) and a MVO$_2$
intercept (B).

<table>
<thead>
<tr>
<th>Ca$_{2+}$</th>
<th>Ees</th>
<th>nM</th>
<th>mmHg.g(ml)</th>
<th>Vo</th>
<th>mL x 10$^{-2}$</th>
<th>A</th>
<th>mLO$_2$.mg$^{-1}$.min$^{-1}$</th>
<th>B</th>
<th>mLO$_2$.beat$^{-1}$.g$^{-1}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>LVH</td>
<td>1</td>
<td>30.2 ± 1.25</td>
<td>1.97 ± 1.23</td>
<td>3.27 ± 1.45</td>
<td>1.86 ± 0.14</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>n = 5</td>
<td>2</td>
<td>18.6 ± 1.59</td>
<td>1.59 ± 1.01</td>
<td>3.27 ± 1.89</td>
<td>2.27 ± 0.20</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>CHF</td>
<td>1</td>
<td>48.5 ± 9.8</td>
<td>7.33 ± 2.01</td>
<td>4.05 ± 1.15</td>
<td>1.19 ± 0.06</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n = 4</td>
<td>2</td>
<td>64.9 ± 14.9</td>
<td>5.60 ± 1.58</td>
<td>3.47 ± 0.85</td>
<td>1.52 ± 0.15</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

mean ± SEM. *p < 0.05 vs. Ca$^{2+}$, #p < 0.05 vs. LVH, unpaired t-test

During the transition from LVH to CHF, Ees was decreased and Vo was in-
creased. These changes in inotropic state and in ventricular shape were asso-
ciated with a decrease in the MVO$_2$, while the slope of MVO$_2$-PVA relation was not altered. In conclusion, we confirm that the myocardial
contractility and the ventricular remodeling occur during the transition from
LVH to CHF in this animal model. Despite these changes, the oxygen cost
of contractility does not change and the total energy cost of the remodeling
myocardium might be preserved by reducing the expenditure for the non-
mechanical process which includes the E-C coupling.

**932-88 Tumor Necrosis Factor-a Impairs ß-Adrenergic Responsiveness in Conscious Dogs**

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Tumor necrosis factor-a (TNF-a) plays a role in the pathophysiology of my-
ocardial depression observed in septic shock and myocarditis. Limited re-
sponsiveness to inotropic therapy in these pathological states may be related
to cytokine-mediated down regulation of ß-adrenergic signal transduction. In
cultured myocytes, TNF-a reversibly inhibits sotrastrol mediated increases in
both contractility and intracellular Ca$^{2+}$ accumulation via interference with ß-
adrenergic receptor coupling to adenylate cyclase. Whether TNF-a alters
myocardial responsiveness to exogenous ß-adrenergic stimulation in the in-
tact animal has yet to be determined. Accordingly, we evaluated the effects of
dobutamine (Dob) in 9 conscious dogs, chronically instrumented with 3 sets of
3 diameter gauges and LV manometers, treated with a 1 hour infusion of TNF-a (40 µg/kg). Mw, the slope of the relation between stroke-work and end-
diastolic volume, was determined before and after brief infusions of Dob (4 µg/kg/min) at multiple times after TNF-a. TNF-a produced a reduction in base-
lne contractile performance beginning 4 hours and extending to 25 hours after
initiation of infusion. The percentage increase of Mw induced by Dob dropped from 34 ± 7% pre-TNF-a to a nadir of 15 ± 5% 3 hours post-TNF-a, an
effect which persisted but then dissipated. Similar results were found when end-systolic elastance and dP/dt max were evaluated. We conclude that TNF-a
impairs myocardial responsiveness to ß-adrenergic stimulation in the intact
animal, an effect separate from its primary myocardial depressant properties.

**932-89 Prevention of Reoxygenation Injury in Hypoxic Immature Hearts by Treatment with Antioxidants**

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Introduction: Abrupt reoxygenation of cyanotic immature hearts when start-
ing cardiopulmonary bypass (CPB) produces an "unintended reoxygenation
injury" that is avoidable by treatment with antioxidants. Methods: Nineteen
immature piglets (2-3 weeks) underwent 30 minutes of blood cardiopulmonary
arrest. Five piglets remained normoxic (Control). Fourteen piglets were
made hypoxic (pO$_2$: 20-30 mmHg) for 2 hours before undergoing reoxygen-
genation on CPB. In 5, the pump prime was not supplemented with antioxi-
dants (noRx), whereas MPG (80 mg/kg) and catalase (150 U/kg) were added
to the pump prime in the 6 others (Rx). Myocardial function (Ex, conduc-
tance catheter), oxygen damage (myocardial conjugated dienes (CD) produc-
tion) and antioxidant reserve capacity (AORC, determined by incubating
myocardium in the oxygen, t-butyl hydroperoxide, with subsequent measure-
ment of MDA production) were evaluated. Results: Blood cardiopulmonary arrest
cased no functional and biochemical change in normoxic control immature
piglets. In contrast, hypoxia with subsequent reoxygenation on CPB resulted
in marked conjugated diene production (42 ± 4% vs. 3 ± 1 A$_{255}$nm/min/100
ml, reduced antioxidant reserve capacity (MDA at 4.0 mM of t-BHP: 1342 ± 59
vs. 958 ± 50 nm/mg protein), and caused profound myocardial dysfunc-
tion; Ees recovered only 21 ± 26%. Conversely, adding MPG and catalase to
the pump prime reduced lipid peroxidation (CD production was only 22 ± 7
A$_{255}$nm/min/100 g($^*$), restored antioxidant reserve capacity (MDA at 4.0 mM of
of t-BHP: 975 ± 139 nm/mg protein($^*$)) and allowed functional recovery (80 ± 8%).
Conclusion: R eoxxygenation of the hypoxic immature heart by initi-
ating CPB causes oxidative damage and functional depression that nullifies the
anti-cardioprotective effects of cardioplegia. Antioxidant supplementation of
the CPB prime limits these detrimental effects, and may be useful in surgi-
cal treatment of cyanotic heart disease. *p < 0.05 vs. Control, **p < 0.05
vs. no Rx (ANOVA)

**932-90 Transient Adenosine Infusion and Washout Before Ischemia Protects the Heart Against Metabolic Damage During Ischemia and Reperfusion, but Does Not Attenuate Stunning in Pigs — Comparison with Ischemic Preconditioning**

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Recent studies indicate that ischemic preconditioning (IP) may be mediated by adenosine (ADO) receptor stimulation. This study compared the effects of
adenosine preconditioning on myocardial metabolism and function with those of
IP Control (C) underwent 15 min LAD occlusion (occl) followed by 120 min reperfusion (R). ADO (200 µg/kg/min) was infused into left atrium for 15
min starting at 20 min before LAD occl. IP was elicited by two cycles of 5 min
occl & 5 min R. Tissue levels of ATP, creatine phosphate (CP) and pH in the
area at risk were measured as $^{13}$P-MRS, and %segment shortening ($^{13}$S) by
sonomicrometry (Results) ADO infusion decreased blood pressure ($-$26%) and
heart rate ($-$13%), and increased three times regional myocar-
dial blood flow (rMBF). However, within 5 min after stopping ADO infusion, hemodynamic parameters returned to baseline. During sustained ischemia