9:45

NORMAL SKELETAL MUSCLE METABOLISM DURING DYNAMIC EXERCISE TO CLINICAL FATIGUE AND RECOVERY: IN VIVO ASSESSMENT BY NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY

Roger Wong, Gary Lopaschuk, Norman Davies, Peter Allen, Gang Zhu, David Burton, Ruth Collins-Nakai, Terrence Montague, University of Alberta, Edmonton, Canada

Nuclear magnetic resonance spectroscopy was utilized to define the minute-to-minute spectra of high energy phosphate metabolism in the gastrocnemius muscles of 21 normal subjects, 11 males and 10 females with a mean age of 32 ± 9 years, during graded exercise to physical exhaustion and recovery. At rest, pH averaged 7.10 ± 0.04, phosphocreatine (PCr), 6972 ± 1759 units, and inorganic phosphate (Pi), 911 ± 204 units. Exercise duration averaged 11 ± 4 minutes and did not correlate with any demographic or metabolic variable. At exhaustion, pH decreased to 6.76 ± 0.17 ($p<0.05$), PCr fell to 2300 ± 1195 units ($p<0.05$) and Pi rose to 4587 ± 2032 units ($p<0.05$). By 2 minutes of recovery PCr and Pi had reverted to near-rest values; in contrast, pH had declined even further to 6.56 ± 0.24 ($p<0.05$). There were no sex differences in any variable at any study time.

Thus, intense exercise of a large skeletal muscle was principally characterized by marked changes in high energy phosphates and pH at peak exertion and rapid normalization of phosphate metabolism, but continued decrease in pH, in early recovery. These data suggest the intracellular pathophysiology of muscle fatigue is multifactorial. Moreover, the data suggest a greater contribution to high energy phosphate production from glycolysis, as opposed to oxidative metabolism, in early recovery.

## Tuesday, March 5, 1991
## 8:30AM–10:00AM, Room 364, West Concourse
## Pathophysiology

8:30

### CHRONIC COCAINE ABUSE IS ASSOCIATED WITH LEFT VENTRICULAR HYPERTROPHY IN MAN.

M. Elizabeth Brickner, M.D., John E. Willard, M.D., John Black, Ph.D., Arvella Peters, Eric J. Eichhorn, M.D., F.A.C.C., and Paul A. Grayburn, M.D., F.A.C.C. University of Texas Southwestern and Veterans Affairs Medical Centers, Dallas, Texas.

Although left ventricular hypertrophy (LVH) has been observed incidentally at autopsy in several pts dying of cocaine overdose, an association between LVH and cocaine abuse has never been established. Therefore, we performed two-dimensional echocardiography in 18 normal subjects and in 35 cocaine abusers enrolled in an in-patient drug rehabilitation program. All subjects were men under age 45 with normal resting blood pressures and no history of hypertension or any other medical condition known to cause LVH. There were no significant differences in age, race, or resting blood pressure between groups. In general, drug usage was moderate with a duration of cocaine abuse ranging from 1 month to 20 years (median 36 months). A history of intravenous cocaine abuse was present in 16 pts. Technically adequate echocardiographic images were obtained in 15 normal subjects and 33 cocaine users. Two-dimensional echocardiographic assessment of LV mass was performed using the area-length method. All studies were read in blinded fashion by an experienced echocardiographer. No clear relationship existed between LV mass indexed for body surface area and either the duration of cocaine abuse or the mode of its ingestion. However, LV mass index was significantly higher in cocaine abusers than in normals (102±23 vs 80±14 g/m$^2$, p=0.0013). Left ventricular hypertrophy defined as a mass index greater than two standard deviations from the mean value in the control group (> 108 g/m$^2$) was present in 10 cocaine subjects and no controls (p=0.011). Moreover, posterior wall thickness was ≥1.2 cm in 15 cocaine abusers as compared to 2 normals (p=0.037). Thus, chronic cocaine abuse in man is associated with left ventricular hypertrophy, an abnormality that may serve as a substrate for cocaine-related myocardial ischemia and/or arrhythmias.

8:45

IS IMPAIRED SKELETAL MUSCLE RELAXATION IN MYOTONIC DYSTROPHY ASSOCIATED WITH ALTERATIONS IN DIASTOLIC CARDIAC PROPERTIES?

Lale S. Tokgozoglu, Tetsuo Ashizawa, Antonio Pacifico, Henry Epstein, Richard Armstrong, M. Benjamin Perryman, William A. Zoghbi, Baylor College of Medicine, Houston, Texas, U.S.A.

Myotonic dystrophy, the most common muscular dystrophy affecting adults, is characterized by delayed skeletal muscle relaxation and has been associated with cardiac failure, conduction abnormality and mitral valve prolapse. Whether alteration in diastolic filling properties occur in myotonic dystrophy is not known. To address this question, we performed two dimensional echocardiographic studies, Doppler mitral inflow recordings, as well as neurologic and ophthalmologic examinations on 68 blood line members of a large kindred with myotonic dystrophy (35M, 33F; mean age 33 ± 17 yr). Twenty individuals were confirmed affected, both clinically and by haplotype analysis using closely linked DNA markers (Apo $C_2$, CKMM). Doppler filling indices in affected individuals versus unaffected age-matched family members were similar: Isovolumic relaxation time (81 ± 22 vs 81 ± 17 ms), first third filling fraction (46 ± 9 vs. 41 ± 10%), atrial filling fraction (24 ± 9 vs 25 ± 10%) and pressure half-time (47 ± 11 vs 51 ± 14 ms). Results were also similar to those of age-matched normal volunteers.
Conclusion: Although skeletal muscle relaxation is impaired in myotonic dystrophy, Doppler indices of diastolic left ventricular function are similar in affected and unaffected individuals. This suggests that myocardial relaxation is not impaired in the majority of patients with myotonic dystrophy.

9:00

### VENTRICULAR DIASTOLIC FUNCTION IN MYOTONIC DYSTROPHY

John S. Child, Joseph K. Perloff
UCLA School of Medicine, Los Angeles, CA

Myotonic dystrophy is an autosomal dominant systemic disorder characterized by delayed relaxation (myotonia) of skeletal muscle after contraction. Involvement of cardiac conduction tissues is common but myocardial dystrophy is exceptional. Left ventricular relaxation properties (myocardial myotonia) using current echo-Doppler methods have not been previously reported. We studied 20 patients with classic myotonic dystrophy (11 male, 9 female) by 2D Echo, 2D-targeted M-mode and pulsed Doppler to evaluate the maximum rate of posterior left ventricular (LV) wall relaxation (DEVM) and mitral valve inflow velocity profiles including deceleration time (DT), early (E) velocities and LV isovolumetric relaxation time (IVRT). Two groups emerged: Group A (ages 33±10 years) with normal relaxation profiles and Group B (ages 51±15 years) with abnormal relaxation patterns manifested by slow posterior wall relaxation rates (DEVM) and delayed mitral inflow deceleration times (DT).

| Gp | DEVM | DT | IVRT | E |
|---|---|---|---|---|
| A | 17±5 ms | 172±15 ms | 79±11 ms | 80±20 cm/s |
| B | 11±3 ms | 280±62 ms | 88±17 ms | 66±24 cm/s |
| *p* | <0.025 | <0.0001 | 0.145(NS) | 0.198(NS) |

Conclusions: Heretofore undescribed relaxation abnormalities of the left ventricle are found in some but not all patients with myotonic dystrophy using current echo-Doppler techniques. This is the first evidence of what appears to be myocardial myotonia in classic myotonic dystrophy.