

ABSTRACTS

INTERACTION OF FREQUENCY OF CONTRACTION AND PRELOAD ON THE PERFORMANCE OF ISOMETRIC KITTEN PAPILLARY MUSCLE

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Initial fiber length and heart rate are important intrinsic determinants of cardiac muscle performance. To date the effect of their interaction has not been considered. To study the interaction of the length-tension and frequency-force relationships, peak developed tension (F), peak first derivative of tension development (dF/dt), time to peak tension (TPF), and time to decline to 1/2 of peak developed tension (T_{1/2}P) were plotted as functions of a series of increments of frequency ranging from 0.2 to 2.4 contractions/sec at several different preloads for 15 kitten papillary muscles (mean cross-sectional area 0.5±0.4 mm²). The stimulation frequencies at which the F and dF/dt curves peaked and subsequently declined and the slopes of the curves of the above 4 indices of performance over a given range of frequencies were compared for each pair of preloads in each muscle. At high preloads F and dF/dt reached peaks at significantly lower frequencies than at corresponding low preloads; similarly, dF/dt rose to its peak and TPF and T_{1/2}P declined at significantly greater rates. Once F peaked it declined at a consistently greater rate at the high preload than at the low preload. Post-control results returned toward those of the pre-control experiments. Hypoxia as the mechanism was excluded by data from 7 additional muscles at 2 levels of oxygenation which demonstrated the converse of the above hemodynamic changes. These data indicate that preload determines whether a given increment in frequency produces a positive or negative inotropic effect and define the interaction of these two intrinsic variables on performance.

HEMOLYSIS IN THE STARR-EDWARDS AORTIC PROSTHESES

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This study was to compare the degree of hemolysis in the various models of the Starr-Edwards (S.E.) aortic prostheses. Patients seen in our post-operative follow-up clinic over the last 18 months who had only aortic prostheses and no significant paravalvular leakage were studied. Hematocrits (Hmct), serum haptoglobin, lactic dehydrogenase, glutamic oxalacetic transaminase levels and reticulocyte counts were obtained. In addition the regular use of iron therapy was noted. Patients were grouped as having non cloth covered valves namely Series 1000, 1200 and 1260 - Group I. Cloth covered valves were Series 2300 - Group II and the modified valve Series 2310 and 2320 - Group III. The results are noted in the table.

Group	Mean Hmct	Mean LDH	Fe Rx	Patients
I	44	128	0	21
II	37	512	10	24
III	39	243	5	38

The differences between the groups for iron therapy is significant (P<0.01). Group I differed significantly from Groups II and III both in terms of LDH and Hmct (P<0.01); however there was insufficient evidence to detect a difference between Groups II and III either in LDH or Hmct values. Patients receiving iron therapy all have hemolytic anemia secondary to the S.E. aortic prostheses. Our known frequency of significant hemolysis in the 2300 series is 13 of 58 patients or 22%. Three patients with the 2300 series have required valve replacement with the 1260 model for intractable hemolysis. Presently the series 2320 would seem to have less hemolysis than the 2300 valve however the short follow-up makes this conclusion tentative. We can conclude however that the cloth covered S.E. aortic prostheses has greater hemolysis than the non cloth covered prostheses.

THE EFFECT OF HYPOXIA ON AUTOMATICITY AND CONTRACTILITY IN CANINE PURKINJE FIBERS

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Previous studies in vivo and in vitro have indicated that electrical properties of Purkinje (P) tissue are unaffected by low O₂ levels for long periods of time. After several hours of hypoxia, enhanced automaticity has been reported. To re-evaluate the relation between pO₂ and P cell function we used isolated P strands attached to a force transducer, under .3-.6 gms of tension, as well as preparations of the entire endocardial surface of the ventricles pinned and superfused with Tyrode's solution at 37° C. O₂ tension was varied from 600-20 mmHg while pH and pCO₂ were kept constant. Within 5 minutes after changing the gas mixture, the rate of firing and isometric contractile tension changed in direct relation to the change in O₂ tension. Over the full range of pO₂ values the range of mean firing rates was 40-8 beats/min. The full range of isometric tension was 100-30%. Changes in automaticity were most marked at pO₂ values less than 150 mmHg. No appreciable change in isometric tension was seen at low pO₂ levels (20-40 mmHg) up to 2 hours. Changes in automaticity were primarily related to changes in the slope of phase 4 depolarization. Maximum diastolic and threshold potentials were not affected. No other electrophysiological property was immediately responsive to changes in pO₂. Only after P fibers showed signs of deterioration in hypoxia such as loss of resting potential, was enhanced automaticity manifested. In conclusion, in P cells the properties of automaticity and contractility are closely linked to pO₂ tension. Such dependence may be one electrophysiological mechanism for hypoxic arrest in vivo.

CLINICAL AND ELECTROPHYSIOLOGIC SIGNIFICANCE OF BUNDLE BRANCH BLOCK (BBB) IN ACUTE MYOCARDIAL INFARCTION (AMI)

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In order to assess atrioventricular (AV) conduction in BBB occurring in AMI, Bundle of His (BH) electrograms were recorded during pacemaker insertion or withdrawal. Twelve patients (pts) with right bundle branch block (RBBB) and two with left bundle branch block (LBBB) were observed. All but 2 pts (with RBBB) had narrow QRS complexes prior to AMI. All studies were carried out during sinus rhythm.

Ten of 12 pts with RBBB and both with LBBB had abnormal His-Purkinje (HP) conduction (50 to 135 msec.). All had normal AV nodal conduction. The response to atrial pacing at rapid rates was normal in all. Five of 6 pts restudied 5 to 90 days later had abnormal HP conduction, including 3 pts who had lost their BBB.

Nine pts expired and 5 survived. Five of 6 pts who developed high degree AV block expired; four in hospital of power failure, and one suddenly following discharge. Of the 9 deaths, 6 occurred in hospital and 3 after discharge. No pt died in hospital of heart block. The late deaths were sudden and 2 of the 3 had persistent RBBB. Five pts have survived from 1 to 12 months. Four have persistent BBB, and 1 with a narrow QRS had abnormal HP conduction by BH study. Thus, all survivors have evidence of persistent abnormal HP conduction. The findings suggest that the great majority of pts with fresh BBB due to AMI have bilateral BBB. Prophylactic demand pacing is probably indicated but myocardial performance is a more important determinant of survival. Recovery from BBB does not indicate normal HP conduction and the value of permanent demand pacemakers in survivors should be investigated.