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Effect of Initial Length on the Work of the Cardiac Atrium.* (20325)

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Atrial contraction may insure adequate cardiac filling in patients with mitral or tricuspid stenosis. Factors that affect the work done by atrial systole became of great importance in such cases. The relationship between ventricular initial length and systolic work has been studied(1-2); apparently similar relationships for mammalian atrial muscle have not been investigated. Such information may be valuable in interpreting atrial pressures, particularly in cases of valvular dysfunction.

Method. Strips of atrial muscle 2 by 0.5 cm were removed carefully from the beating left atrium of dogs anesthetized with sodium barbital. The strips were placed in warm Tyrode's solution modified to contain 0.008% NaH_2PO_4 and 0.013% CaCl_2 . The solution was oxygenated with 95% O_2 and 5% CO_2 , and maintained at 39°C. One end of the muscle strip was fixed by a support and the other end suspended by a simple lever. Weights ranging from 0.5 to 10 g were placed on the free arm of the lever, and the resulting muscular stretch was recorded by projecting the movement of the lever onto a photokymograph. Muscular contractions were elicited

by maximal induction shocks, and the height of the contractions was recorded. All records were corrected for magnification and were expressed as the actual movement in mm of the free end of the muscle strip. The work performed by each contraction was calculated in gram-centimeters. Muscular stretch was calculated as percent of the original 2 cm length.

Results. A total of 131 observations on strips from 9 atria were satisfactory for analysis. The amount of work performed varied widely among muscular strips. However, in each case the amount of work increased with increase in initial length until a

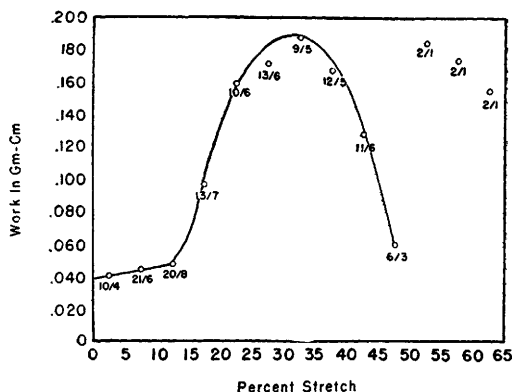


FIG. 1. Work-stretch diagram of left atrial strips. Circles are avg work performed. Upper figures are number of observations, lower figures are number of animals. The three points in upper left of plot were all from the same animal.

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maximum work response was obtained.

The degree of stretch was divided into groups; the class interval being a 5% increase. Plotting average amount of work done by the muscle for each group (Fig. 1) indicates the maximum work response occurs at 30% stretch over the original length. This agrees closely with the mean of the maximum for each individual muscle strip, the mean being 26.9% with a standard deviation of 9.7.

Discussion. The average filling volume of the left atrium of the dog is stated(3) as 3.4 cc. Assuming that the atria are spherical, this gives a surface of 10.93 square cm. To increase this surface 30%, it is necessary to increase the volume to 5.03 cc. Calculations employing previously reported(3) volume elasticity curves of the left atrium indicate that this volume will result in an intra-atrial pressure of 150 mm of H₂O.

Such a theoretical analysis of the data indicate that maximum left atrial systolic work will occur at an atrial pressure of 150 mm of H₂O. Pressures higher than this will result in atrial failure with markedly reduced work output.

Summary. Strips of left atrial muscle from the dog heart were subjected to varying degrees of stretch, and the work performed during contraction was calculated. Maximum work occurred at approximately 30% stretch. A theoretical analysis of these data indicates that maximum left atrial systolic work occurs at an intra-atrial pressure of 150 mm of water.

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Effect of Pituitary Extracts on Radiation-Induced Testicular Atrophy in Rats.* (20326)

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Treatment of both local and total-body radiation injuries in man and experimental animals has, in general, produced disappointing results. One exception to such results has been the study of Momigliano and Essenberg (1) on the effect of pituitary extract on radiation-induced testicular atrophy in rats. They have reported that gonadophysin (Searle), an extract from sheep pituitaries which contains both follicle-stimulating and luteinizing hormone, hastens regeneration of the testes of albino rats when injections are begun shortly after radiation exposure and continued for several weeks.

This finding is at variance with the usual experiences in treating radiation injuries and because of the possible practical importance of this method of treatment in human cases it was considered worth while to repeat and

extend this work.

Materials and methods. A total of 172 three-month-old and 48 thirty-day-old male Sprague-Dawley rats weighing 280 to 340 and 80 to 110 g, respectively, were used. The animals were maintained 5 or 6 to a cage and given water and Purina laboratory chow *ad libitum*. The details of the method of X-ray exposure have been given in a previous report(2). In the experiments in which body shielding was employed the animals were anesthetized with pentobarbital (40 mg/kg), their testes drawn into the scrotum, and their entire bodies, with the exception of the scrotum, shielded with 6.4 mm of lead during the X-ray exposures. Gonadophysin (Searle), containing both follicle-stimulating hormone (FSH) and luteinizing hormone (LH) which are stimulatory to the seminiferous tubules and interstitial cells of the testis, respectively, was injected subcutaneously twice a week.

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