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Factors Affecting Arterial Supply of Testis Under Experimental Conditions.

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The presence of well defined anastomoses between the 3 arteries of the testis at the *cauda epididymidis* has been repeatedly demonstrated by morphological studies. The testicular atrophy, however, that has followed experimental and clinical ligation of the internal spermatic vessels, indicates the need of an investigation of factors affecting the arterial supply of the testis. It has been shown that after ligation of the internal spermatic artery and vein, the testis undergoes sloughing or complete atrophy while the epididymis remains normal. This difference toward ligation became a primary consideration in the present investigation. The *tunica albuginea* covering the epididymis is thinner and less resistant than the part covering the testis. Was the congestion in the testis following ligation due to the unyielding nature of its fibrous investment?

A characteristic reaction associated with ligation of the internal spermatic vessels is a sudden appearance of firmness or so-called "stone-hardness" in the testis, and this stone-hardness is remarkably uniform in degree. Our objective was to duplicate this increased tension experimentally and test the degree of penetration of injection-media under these conditions. Hill, while injecting the human testis, observed that the organ became firm when perfused with normal salt solution under a pressure of 60-80 mm. of mercury. This increase in tension occurred with a pressure below the normal systolic pressure, and Hill believed that the phenomenon was due to an extravasation of fluid between the endothelial cells of the capillaries, induced by the rapid death of these cells.

In the present work we have been able to duplicate the "stone-hardness" of the testis by means of saline perfusions. A control condition which will here be designated as "normal tension" was maintained with saline perfusions of a duration of 4 minutes, under a pressure not exceeding 120 mm. of murcury. A degree of tension, which will here be used as the standard of "increased tension", was produced by saline perfusions under the same pressure prolonged to 20 minutes. This increased tension corresponds to the stone-hardness found in the living testis after ligation of the internal spermatic vessels.

The degree of penetration of separate injections of 1.25% solution of celloidin in acetone and 2% solution of Berlin blue in distilled water, was determined under normal and increased tension of the testis. The perfusion and injection were made into the segment of the aorta corresponding to the origin of the internal spermatic artery and during the procedure the whole animal was submerged in water. Arterial casts were made by placing the celloidin specimens in 75% hydrochloric acid for 24 hours.

In the first series of 8 dogs in which normal tension was maintained in the testis, the celloidin extended into the finest radicals of the internal spermatic artery within the testis and epididymis, passing through the arterial anastomoses into the deferential and external spermatic arteries. An extensive anastomosis was found between the 3 arteries in the spermatic cord.

In the second series of 8 dogs, in which the standard of increased tension was produced, the celloidin penetrated only the larger arterial rami of the testis, and failed to pass beyond the *tunica albuginea* into the septa in the interior of the organ: the penetration of the epididymis in several specimens was quite complete, reaching and passing beyond the spermatico-deferential and spermatico-cremasteric anastomoses.

The above results were confirmed in a third series of 4 dogs, in which the penetration of a less viscid fluid, Berlin blue in distilled water, was determined, 2 under normal and 2 under increased tension. The findings were similar to those obtained in the preceding series. Again under normal tension both testis and epididymis were equally well injected. On the other hand, under increased tension the difference in penetration of the dye in the testis and epididymis was even more striking than that of the celloidin. While the epididymis was again completely injected, the testis was penetrated to the extent of only 1 mm. from the periphery.

The present results demonstrate that definite pressure disturbances upon the vascular system of the testis occur after prolonged saline perfusions. Comparable disturbances may occur in the testis after ligation of the internal spermatic vessels. In our experimental injections this disturbance was measured by the penetration of the celloidin or Berlin blue; in experimental ligation it is determined by the degree of atrophy. The extent to which the degree of penetration in experimental injections is equivalent to the degree of atrophy following ligation, remains a problem for further investigation.

The difference in the behavior of the testis and the epididymis

toward injections under increased tension and toward ligation of the internal spermatic vessels appears to be due to the fact that the portion of the *tunica albuginea* overlying the testis is thicker and more unyielding than that covering the epididymis. If pressure within the capsule after ligation is a factor in the production of atrophy in the testis, then either an anterior longitudinal incision through the *tunica albuginea* or a division of the testis in the mid-line with a subsequent repair by suture of the *tunica vaginalis,* may relieve the pressure and thus prevent atrophy. The results of a series of experiments now being conducted with a view to testing this hypothesis will be given in a subsequent report.