3348

Tonus Measurements on Quadriceps Femoris Muscles in Man Before and After Lumbar Sympathectomy.

ALBERT KUNTZ.

From the St. Louis University School of Medicine, St. Louis, Mo.

Through the courtesy of Drs. G. E. Brown and A. W. Adson, and the Mayo clinic, the writer was privileged to study the tonus of the muscles of the lower extremities of 4 patients who underwent bilateral extirpation of the lumbar sympathetic trunks, including the second, third, and fourth lumbar ganglia. This operation effectively eliminates the sympathetic innervation of the muscles of the lower limbs.

Tonus measurements, *i. e.,* measurements of the resistance offered by the muscle to passive extension, were carried out, according to Spiegel's method,[1] on the quadriceps femoris muscles. The results of these measurements are expressed in tonus curves. Two of the patients were available for study both before and after operation. In these cases tonus curves of both quadriceps muscles were obtained both before and after sympathectomy. The other patients were available for study only after operation. One of the latter was subjected to the tonus measurements 6 days after operation. The other had undergone the operation 1 year previously.

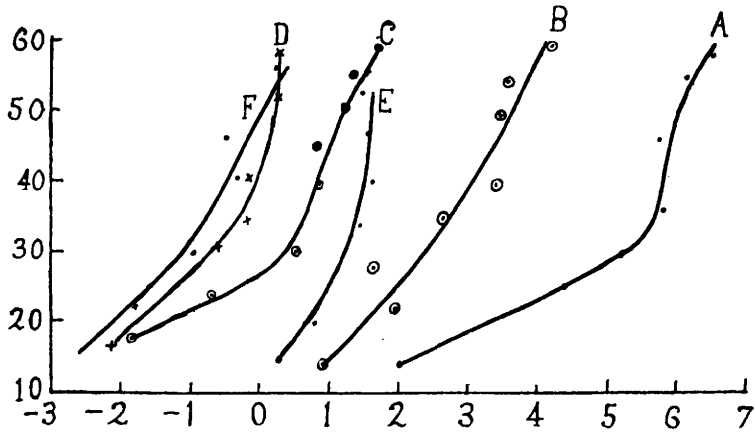
The patient studied a year after sympathectomy is a young woman who underwent the operation for the relief of Raynaud's disease. The other three patients are men afflicted with *thromboangiitis obliterans* in both lower extremities. The studies carried out on these patients revealed no appreciable changes in muscle tonus referable to the disease process. The tonus curves obtained before sympathectomy lie well within the range of normal variation.

Tonus curves of normal extensor muscles, under normal innervation, obtained by the method employed, rise slowly at the beginning and then more rapidly as the length of the muscle is increased by passive extension. The slow rise of the curve at the beginning (Fig. 1, A and C) illustrates the "brake phenomenon" which is characteristic of extensor muscles, while in a postural attitude in which they are near their minimum normal length. In the present study the measurements were initiated when the angle of the leg with the horizontal was less than 20°. The thigh remained in the horizontal position throughout the procedure. The curves obtained before sympathectomy, in the cases of both patients studied before opera-

tion, rise slowly until the angle of the leg with the horizontal approaches 30°, after which they rise more rapidly. These curves, two of which are illustrated in Fig. 1, A and C, are essentially normal tonus curves.

The tonus curves obtained after sympathectomy, in all the patients studied, rise rapidly from the beginning. Curves A and B, Fig. 1, are the tonus curves of the right quadriceps of one of the male patients, obtained before and after operation, respectively. Curves C and D are the corresponding curves respectively of the right quadriceps of another male patient. These curves indicate not only that the tonus of the muscle is materially diminished, following elimination of its sympathetic innervation, but also that it no longer exhibits the brake phenomenon, except possibly in a very slight degree. Curve E is the tonus curve of the left quadriceps of the third male patient, based on measurements carried out 6 days after operation. Curve F is the tonus curve of the left quadriceps of the female patient, based on measurements carried out 1 year after operation. These curves, like the tonus curves obtained immediately after sympathectomy, rise rapidly from the beginning, indicating that the muscles no longer exhibit the brake phenomenon,

FIG. 1.



A. Tonus curve of right quadriceps femoris obtained just before lumbar sympathectomy.

B. Tonus curve of the same muscle obtained just after lumbar sympathectomy.

C. Tonus curve of right quadriceps femoris obtained just before lumbar sympathectomy (another patient).

D. Tonus curve of the same muscle obtained just after lumbar sympathectomy.

E. Tonus curve of left quadriceps femoris (another patient) obtained six days after lumbar sympathectomy.

F. Tonus curve of left quadriceps femoris (another patient) obtained one year after lumbar sympathectomy.

except possibly in a very slight degreee. They also indicate diminution of muscle tonus; however, in the absence of tonus curves based on measurements carried out before the operation, the exact diminution of tonus referable to sympathectomy, in these cases, cannot be ascertained.

The possible rôle of increased circulation through the limb, following sympathectomy, in the diminution of muscle tonus, will be considered in another paper. The data available at present do not warrant the conclusion that circulatory changes referable to sympathectomy play more than a minor rôle in the measurable changes in muscle tonus following this operation.

The results of the tonus measurements on the quadriceps femoris in man here reported in general corroborate the results of our studies[2] involving tonus measurements on extensor muscles of the extremities, before and after sympathectomy, in experimental animals.

[1] Spiegel, E. A., *Z. ges. neurol. u. Psych.*, 1923, lxxxi, 246.

[2] Kuntz, A., and Kerper, A. H., *Am. J. Physiol.*, 1925, lxxvi, 121. PROC. SOC. EXP. BIOL. AND MED., 1925, xxiii, 77; 1926, xxiii, 367; 1926, xxiv, 103.

3349

Studies on the Enzyme-Action of Yeast.

MICHAEL SOMOGYI. (Introduced by G. H. Bishop.)

From the Laboratory of the Jewish Hospital of St. Louis, St. Louis, Mo.

If a suspension of yeast is brought together with a solution of glucose in adequately chosen proportions, then some protein admixed, and precipitated by a suitable protein precipitant, the glucose is carried down with the protein and yeast, and no trace of glucose can be recovered in the filtrate.

If, for example, 50 cc. of a 0.2 to 0.4 per cent solution of glucose and 10 g. of yeast, suspended in 50 cc. of diluted egg white or neutral casein solution, are poured together and mixed, subsequent precipitation by tungstic acid will remove all the glucose from solution. And this reaction takes place, even though fermentation be prevented by chilling both the yeast and the glucose to 0° C. before they are united, and kept at that temperature throughout the entire operation. Evidently *an adsorption-like combination takes place between yeast and glucose as soon as they come into contact.*

If the yeast is separated from a yeast-glucose solution by centrifugation or filtration, the glucose is recovered in the solution. On