14460

Experimental Technic for Measuring Mean Systolic Blood Pressures During Activity, Rest, and Natural Sleep.

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Blood pressures are conventionally determined in the dog either directly by a mercury or a Hamilton[1] manometer connected to a cannula or needle introduced into a large artery or indirectly by auscultation or palpation distal to a modified Riva-Rocci[2] blood pressure cuff about an extremity or a Van Leersum[3] arterial loop. The positioning or training required for these methods precludes blood pressure determinations during normal emotional and physical activity, rest, and sleep. Accordingly reported normal blood pressure values have varied significantly, A new technic for blood pressure determination that permits frequent readings during varying phases of activity or rest was therefore devised and tested. It has not to the knowledge of the authors been previously described.

Healthy dogs were anesthetized and placed on one side on an operating table with the upper leg externally rotated. The lower half of the upper side of the trunk and the groin and thigh were then shaved and prepared. Employing aseptic technic, the iliac and the upper femoral artery was exposed above and below the inguinal ligament through a 3-inch incision. A 1-inch square of sterile fine mesh gauze was next placed beneath each artery. A small rubber balloon fashioned from ½ inch of the tip of a small finger cot and attached over a short segment of 18-gauge needle to a 4-foot length of fine plastic tubing was then placed above and in direct contact with each artery. Each gauze was folded about the artery and the balloon to form a cuff and sutured snugly in place. Care was taken to avoid arterial injury or constriction. Each cuff was carefully filled and tested by the introduction of sterile water under pressure. The 2 plastic tubes were then guided subcutaneously around the flank and out through a stab wound located over the first lumbar spine. The inguinal wound was closed and dressed. The 2 tubes were led through a 30-inch length of flexible BX cable sheath the proximal end of which was securely attached to a canvas harness or corset. A sterile dressing was placed over the stab wound and the harness was adjusted to the dog's back by 6 straps. The animal was allowed to recover from the anesthetic and then placed in a prepared animal cage.

The BX cable was then attached to a pulley arrangement so that the flexibility of the cable and the excursion of the pulley allowed the dog free movement about his cage. Each of the two plastic tubes coming through the stab wound over the first lumbar spine and passing upward through the flexible cable was then connected to a manometer system. The tube from the femoral pressure cuff was attached to a capillary glass manometer and the entire system was filled with a tinted water solution. The manometer was placed 3 feet above the cuff. The hydrostatic pressure of this open system was sufficient to transmit a wide pulsating excursion from the femoral artery to the column of tinted water in the capillary tube. The plastic tube from the iliac cuff was then connected to a pressure bottle and a mercury manometer the zero point of which had been set to correspond with the level of the cuff. Care was taken to evacuate all air from the tube and the balloon in each system. The pulse rate was determined without disturbing the animal by counting the pulsations in the water manometer. (Fig. 1.)

Blood pressure readings were obtained by inflating the balloon in the iliac cuff. When

[1] Hamilton, W. F., Brewer, G., and Brotman, I., *Am. J. Physiol.*, 1934, **107**, 427.

[2] Riva-Rocci, *Un Nuovo Sfigmomanometro, Gazz. Med. di Torino*, 1896, **50**, 51.

[3] Van Leersum, *Arch. G. d. ges. Physiol.*, 1911, **142**, 377.

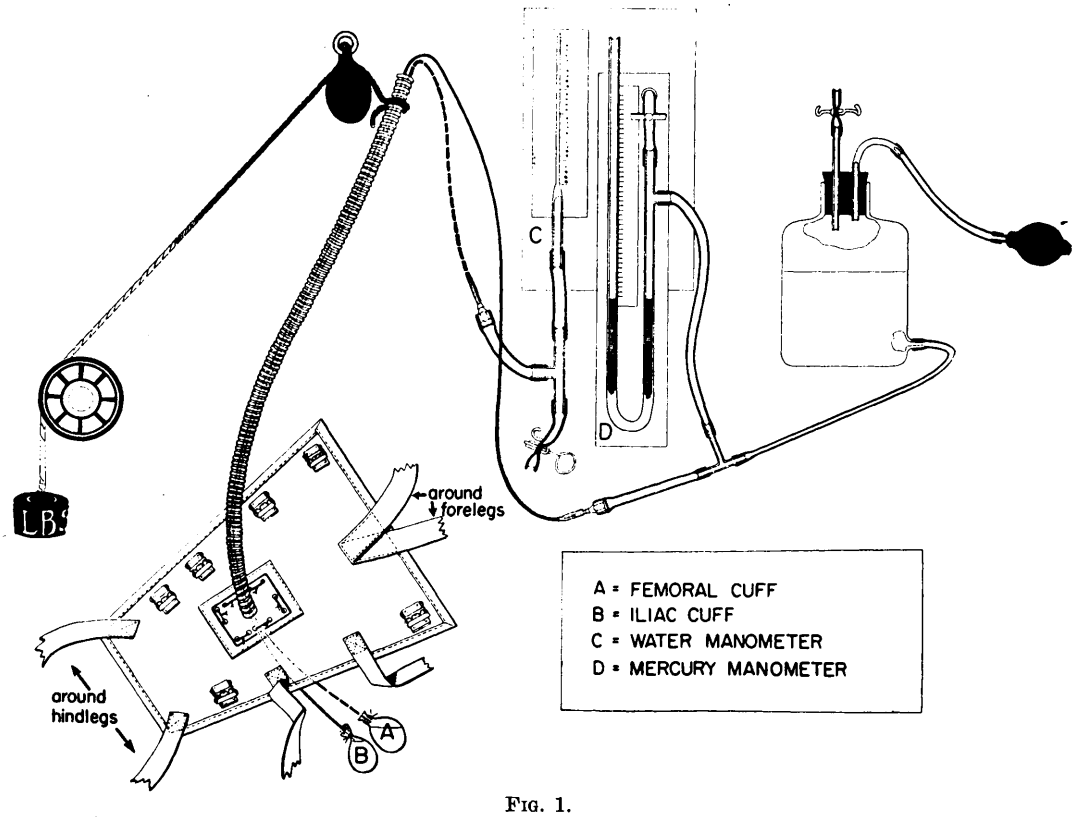

FIG. 1.

Diagram of double cuff blood pressure apparatus. Elastic sacs A and B are incorporated into cuffs about the femoral and iliac arteries. The fine plastic tubes are led subcutaneously through a stab wound to the manometers. The pulleys and flexible tubing allow free movement. Blood pressures may be recorded at will during various phases of activity and rest.

TABLE I.

Modified Double Cuff Blood Pressure Measurement in Dogs.
Each reading represents a typical determination.

	Dog 1		Dog 2		Dog 3		Dog 4	
Activity	BP	Pulse	BP	Pulse	BP	Pulse	BP	Pulse
Exercising	117	135	135	140	147	132	128	112
Standing	125	128	120	131	158	119	118	110
Voiding	—	—	119	151	150	104	—	—
Eating	129	110	126	120	161	126	100	116
Drinking	—	—	128	122	162	111	113	105
Resting	103	89	90	91	135	93	78	91
Sleeping	101	106	—	—	—	—	72	70

this pressure was sufficient to compress the iliac artery the femoral artery in the femoral cuff ceased its pulsation and decreased in size. The column in the water manometer fell and the pulse excursion disappeared. The pressure required in the iliac system to produce this phenomena was read from the mercury manometer as the mean systolic blood pressure.

This technic was employed successfully with 4 dogs and permitted repeated blood pressure determinations over periods of time varying from 3 to 6 days. Readings were taken at will without disturbing the animal or inducing symptoms of discomfort. Table I illustrates the utility of this technic by summarizing average blood pressures taken during various stages of activity, rest, and sleep.

The technic should prove useful in certain

experiments. It has the disadvantage of requiring anesthesia and surgery early and of initiating thrombosis and edema late. There is, however, a period frequently lasting several days during which the animal is bright and active and in good general condition. Observations during this period seem reasonably reliable.

Blood pressure observations employing this technic confirm the impression that there is a normal range rather than a normal blood pressure level for the dog varying with the degree and nature of activity.

14461

Streptomycin, a Substance Exhibiting Antibiotic Activity Against Gram-Positive and Gram-Negative Bacteria.*†

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With the exception of streptothricin,[1] most of the antibiotic substances known at the present time, including penicillin and other mold products as well as gramicidin and actinomycin, act largely upon gram-positive bacteria. The activity of these substances upon gram-negative organisms is highly selective, as in the case of penicillin, which affects the *Neisseria* group and has little activity upon *Escherichia coli* and other gram-negative bacteria,[2] or else much larger quantities are required to bring about the inhibition of these bacteria, as in the case of actinomycin.[3] Among the antibiotic agents that act selectively alike against both gram-positive and gram-negative bacteria, streptothricin occupies a prominent place; since this substance is water-soluble and possesses limited toxicity to animals, it is of particular interest from a chemotherapeutic point of view. Unfortunately, streptothricin has very little activity against a number of bacteria found among both the gram-negative (*Pseudomonas fluorescens, Ps. aeruginosa*) and the gram-positive (*Bacillus mycoides* and *B. cereus*) groups.

In a search for antagonistic organisms that are active against gram-negative bacteria, and from which antibiotic substances could be isolated, the actinomycetes were found[4] to offer extensive potentialities. Although most of the antibacterial agents produced by these organisms are also active against gram-positive bacteria, certain few of them exert a marked selective activity against many of the gram-negative types of bacteria. *Actinomyces lavendulæ,* which produces streptothricin, is such an organism. After detailed examination of a large number of cultures, either isolated at random from different natural and enriched soils and composts, or selected from the culture collection, another organism was found that produces an antibiotic substance which apparently combines many of the desirable antibacterial properties. This organism is similar, in most of its cultural characteristics as well as in its morphology,

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1 Waksman, S. A., and Woodruff, H. B., PROC. SOC. EXP. BIOL. AND MED., 1942, **49**, 207; *J. Bact.*, 1943, **46**, 299.

2 Abraham, E. P., Chain, E., Fletcher, C. M., Gardner, A., Heatley, D., Jennings, M. A., and Florey, H. W., *Lancet*, 1941, **241**, 177; *Nature*, 1942, **148**, 758; **149**, 356.

3 Waksman, S. A., and Woodruff, H. B., PROC. SOC. EXP. BIOL. AND MED., 1940, **45**, 609; *J. Bact.*, 1941, **42**, 231.

4 Waksman, S. A., Horning, E. S., Welsch, M., and Woodruff, H. B., *Soil Sci.*, 1942, **54**, 281; Welsch, M., *J. Bact.*, 1942, **44**, 571.