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Digital Blood Flow and Distensibility During Immersion in Cold Water.* (29507)

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The decreased distensibility of fingers immersed in ice water has been ascribed to increased venomotor tone(1). However, Edwards and Burton(2) found that there is an increase in volume of fingers immersed in ice water and have suggested that reduction in distensibility may be due to increased venous filling. In an attempt to determine the interrelationships between finger volume, digital distensibility, blood flow and venous pressure, studies have been made at different local and environmental temperatures.

Methods. The experiments were performed on 2 subjects with bath temperatures (T_w) at 5, 9.5, 20 and 38.5°C and room temperature (T_r) of 12, 20 and 28°C. The subjects lay on a cot with the right hand placed in a 27 l water tank. The tank was raised so that when the hand was in position the tips of the fingers were about 15 cm above heart level.

Changes in finger volume were determined by a mercury-in-rubber strain gauge(3,4) compensated for temperature changes(5). The strain gauge was applied to the tip of the middle finger and changes in circumference recorded on a Sanborn polygraph. A cuff wrapped around the root of the finger was intermittently inflated and the final increase in volume at each of 7 cuff pressures observed. Regression equations of change in volume on cuff pressures between 20-50 mm Hg were calculated by the method of least squares. The slopes of the regression lines were taken as indices of distensibility and the calculated cuff pressures at which no changes in finger volume would take place were taken as venous pressure. Blood flow was estimated by observing the rate of change in finger volume immediately after inflation of the cuff to 70 mm Hg.

Results. Distensibility was positively related to both T_w and T_r. However, distensibility appeared to be limited to a maximum at T_w 40°C and a minimum at T_w 5°C so that the effects of changes in T_r were greatest at intermediate bath temperatures (Fig. 1A). Blood flow through the fingertips was minimum at T_w 10 to 20°C and was reduced at all bath temperatures by a reduction in T_r (Fig. 1B). Below T_w 10°C flow increased. Thus an increase in blood flow was associated with an increase in distensibility when T_w was 20 and 40°C but below 20°C an increase in flow was associated with a decrease in distensibility.

Finger volume after 20 minutes' immersion varied inversely with T_w (Fig. 2). The relationship between distensibility, T_r and finger volume is shown in Fig. 3. While distensibility was lower at larger finger volumes, reducing the room temperature resulted in a reduction in distensibility.

Distensibility was inversely related to the calculated venous pressure (Fig. 4). The correlation coefficient was —.88 ($n = 12$) and the relationship between the two did not appear to be altered by changes in T_r.

Discussion and summary. The increased blood flow through the finger during immer-

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sion in water above 20°C is accompanied by increased distensibility and decreased finger volume. At temperatures below 20°C the increase in blood flow (cold-induced vasodilatation, CIVD) is accompanied by decreased distensibility and increased finger volume. It is clear that the mechanism for increased blood flow during CIVD is quite different from that during exposure to heat. The major cause of changes in the finger volume may be alterations in amounts of interstitial fluid and not filling of the capacity vessels. It is possible that arteriolar dilatation during CIVD is not accompanied by a dilatation on the venous side. This would lead to increased capillary pressure and accumulation of tissue

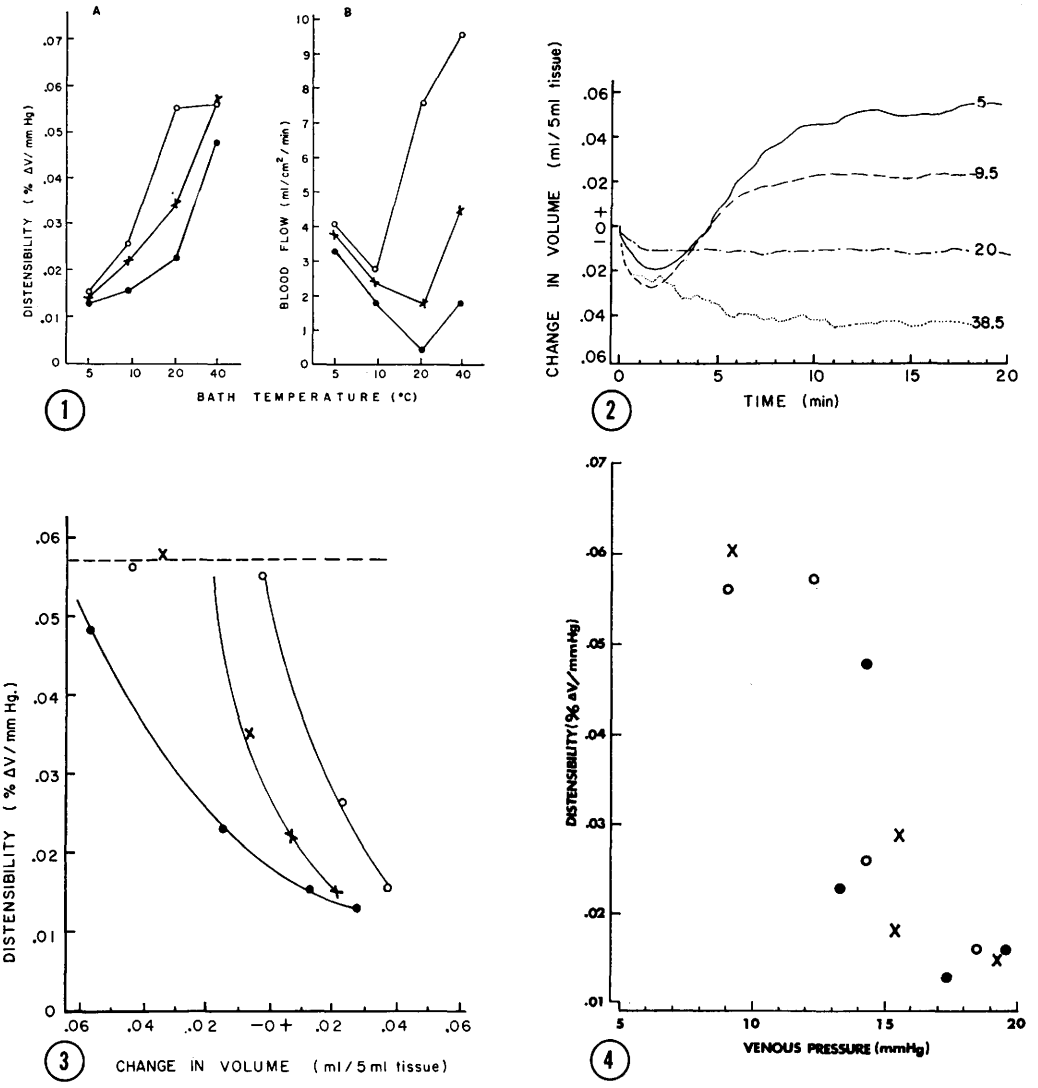

FIG. 1. Average distensibility (A) and blood flow (B) of middle finger of 2 subjects during immersion of the finger in water at various temperatures. O, Room temp 28°C; X, room temp 20°C; ●, room temp 12°C.

FIG. 2. Change in finger volume during immersion in water at 5, 9.5, 20 and 38.5°C. Room temp 28°C.

FIG. 3. Distensibility of middle finger plotted against change in volume. Symbols as in Fig. 1.

FIG. 4. Distensibility of middle finger plotted against calculated venous pressure. Symbols as in Fig. 1.

fluid. Venoconstriction associated with increased perfusion pressure would lead to increased venous pressure. The close negative correlation between finger distensibility and venous pressure lend support to the above view. The experiments support the hypothesis that increased venomotor tone is the cause of decreased distensibility of fingers immersed in cold water.

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Effect of Glucan on Mouse Sarcoma 37.* (29508)

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Our earlier studies dealt with oncolytic effects of various fungi, including yeasts and yeast-like organisms, and their carbohydrate derivatives(1,3,4,6). Of these agents, the most effective in anti-tumor activity was hydroglucan(2), the active component of which was considered to be glucan, from which it was prepared by Nickerson(5). Glucan has been shown by Riggi and DiLuzio(8) to be a powerful stimulator of the reticulo-endothelial system. The supply of hydroglucan, which was available to us in experimental quantities only, is now exhausted. Before going ahead with the preparation of a fresh supply, it seemed advisable to test the source material, glucan, for possible oncolytic activity.

Material and methods. Samples of purified glucan were kindly supplied us by Standard Brands, Inc., New York City. Glucan, like hydroglucan and zymosan, is insoluble in water, physiological saline, or alcohol, and must be injected into animals in the form of a suspension, as proposed by Pillemer *et al* (7) for zymosan. Glucan (100 mg in 100 volumes of water) is maintained at boiling temperature in a water bath for one hour and then centrifuged at 4000 rpm for 30 minutes. The supernatant is discarded and replaced by an equal volume of distilled water in which the residue is resuspended. To avoid contamination, we autoclave the preparations for 30 minutes at 15 lb pressure in small lots just before using.

The tumor-destructive capacity of glucan was tested against Sarcoma 37 in solid and ascites form transplanted into ICR/albino mice (both males and females, avg wt 25-30 g); against mammary tumors arising spontaneously in C3HNIcr mice; and against a transplantable form of the mammary tumor derived in our laboratory and maintained in the same mouse stock. Treatment of subcutaneous implants of Sarcoma 37 was begun one week after implantation, when the vascular system was well established. In the case of ascites tumors, treatment was initiated as soon as abdominal swelling was discernible. Both spontaneous and transplanted mammary tumors were allowed to grow until they were approximately one centimeter at the base before starting treatment.

Tissues of responsive and resistant tumors and of host organs were preserved in a picro-formol-acetic mixture, sectioned in paraffin, and stained in hematoxylin and eosin. These preparations were examined by our staff pathologist.

Results. Activity against established tumors. The ability of glucan to induce regression of subcutaneously implanted Sarcoma 37 in comparison with hydroglucan is indicated

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