Effect of Fever on Serum Polysaccharide Level. (20270)

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Previous work has shown that the serum polysaccharide level of dogs becomes elevated in experimental inflammation caused by infection with bacteria, intrapleural or intramuscular injection of turpentine, intraperitoneal injection of a talc suspension, or surgical operation(1) and after epidermal thermal injury(2). It was noted that this elevation occurred both in the presence and absence of fever. This observation raised the question as to whether fever had any direct connection with the elevation of serum polysaccharide. In order to answer this question, experimental fever was induced in normal dogs by various means and the serum polysaccharides determined serially. As it appeared feasible that the polysaccharide content of one serum protein fraction might increase relative to the others, studies of these fractions were also made serially.

Methods. In this study nonglucosamine polysaccharide was determined by the tryptophan method(3) and serum was fractionated as previously described(4) by precipitation with 21.6% and 26.0% sodium sulfate. The fraction not precipitated by 26.0% sodium sulfate was assumed to be largely albumin and is designated in this paper as the albumin fraction, while that not precipitated by 21.6% was assumed to be combined albumin and pseudoglobin (α-globulin). Mucoprotein polysaccharide was determined by the tryptophan method after isolation of the mucoprotein fraction by the method of Winzler and Smyth(5). Fever was induced in one set of seven dogs (group 1) by muzzling the animals

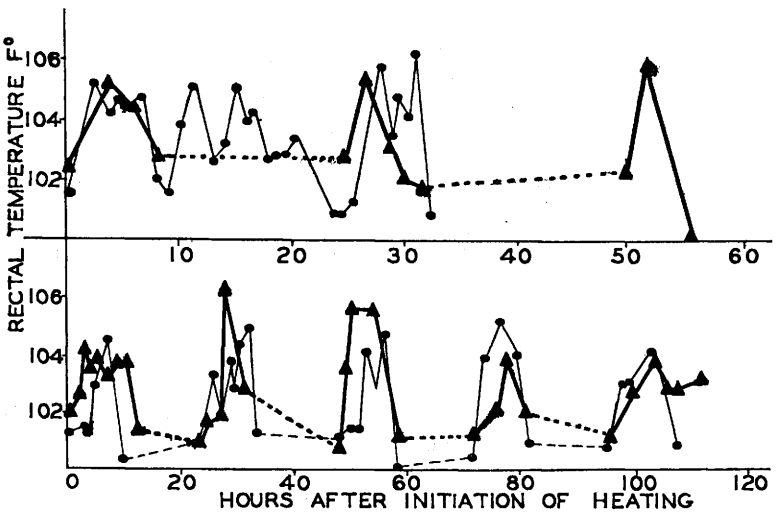

FIG. 1. Typical temperature curves of dogs in which fever was induced by various means. Upper curves: ●——● group 1, heated by external means; ▲——▲, group 3 given pyromen inj. Lower curves: ●——● group 2, heated by external means, ▲——▲ group 4 given pyromen inj.

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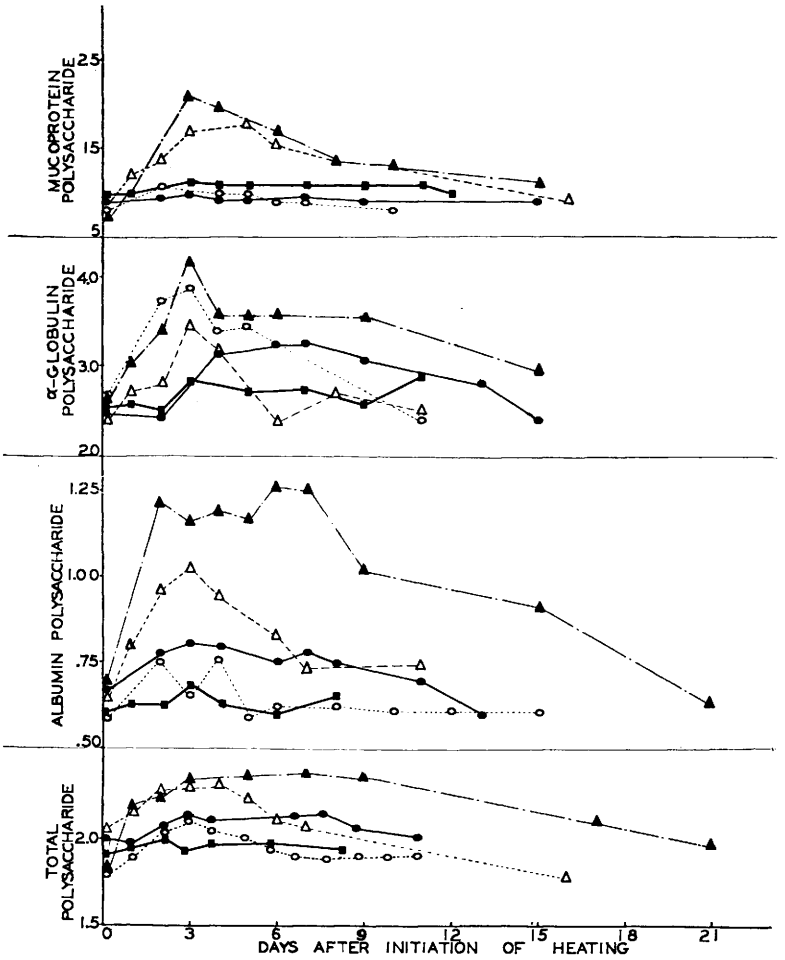

FIG. 2. Effect of fever on the nonglucosamine polysaccharides of serum protein. The different groups are denoted graphically: (1) ○-----○ heated externally 32-48 hr, (2) ●——● heated externally for 8 hr intervals for 5 days, (3) △-----△ given pyromen inj. for 8 hr intervals for 3 days, (4) ▲——▲ given pyromen inj. for 8 hr intervals for 5 days, and (5) ■——■ control group. Total polysaccharide is denoted as % of the serum protein, "albumin" polysaccharide as % of the albumin protein, "α-globulin" polysaccharide as % of α-globulin, and mucoprotein polysaccharide as mg of hexose per 100 ml of serum.

and wrapping them in a blanket containing a heat pad. Considerable elevations of temperature were induced and maintained by this method as shown in Fig. 1. At 3-4-hour intervals the animals were unmuzzled and allowed to drink. This heating process was continued for 24 to 48 hours. Rectal temperatures were taken every two hours. A second set of four dogs (group 2) were heated by the same procedure for periods of 8 hours daily for 5 days. Six dogs (group 3) were subjected to repeated intravenous injections of the pyrogenic substance pyromen† in order to maintain a fever. Injections were continued for a period of 2 days. Rectal temperatures were taken at two-hour intervals. A fourth set of dogs (group 4) was subjected to pyromen injections in order to maintain elevated temperatures for 8-hour intervals over a period of 5 days.

Results. The average data for each set of dogs are summarized in Fig. 2. The data for each day following heating were compared statistically with the data obtained before

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TABLE I. Summary of Statistical Comparisons.

Group*	No. of animals	Days on which significant elevations occurred in polysaccharide of: Total protein	Albumin	Pseudo-globulin	Mucoprotein
1	7	4†	0	0	0
2	4	3†	0	3†	0
3	6	2†	2,§ 3,§ 5†	2§	5§
4	3	1,† 2,‡ 3,§ 15§	1,‡ 2,‡ 5,‡ 7†	2,† 3,† 5§	1,‡ 2,‡ 3,§ 7,§ 9‡

* Groups 1 and 2 were heated by external means, Group 1 for 2-3 days, Group 2 in 8 hr periods each day for 5 days. Group 3 and 4 heated by inj. of pyromen, Group 3 for 2-3 days, Group 4 in 8 hr periods each day for 5 days.

† Significant at 5% level. ‡ Significant at 2% level. § Significant at 1% level.

treatment. The averages were compared by the conventional "t" test, with results as given in Table I.

An elevation in total nonglucosamine polysaccharide was obtained in all groups of animals after heating. Response of individual animals of group 1 and 2, in which fever was induced by external heating, however, was variable, some individuals experiencing little elevation. Response of animals given pyromen was much more consistent. Noticeable elevations of total polysaccharide occurred within 24 hours, but significant elevations did not occur, except in group 4, until the second, third or fourth day. An elevation of the polysaccharide content of the pseudoglobulin usually occurred whenever an elevation of the total polysaccharide occurred. Due to variations between dogs, no significant increase of this factor was noted in group 1, although a considerable average increase was found as shown in Fig. 1. The maximum elevation of pseudoglobulin polysaccharide occurred on about the third or fourth day after initiation of treatment. A significant elevation of albumin polysaccharide was noted in both groups of dogs given pyromen injections. This elevation occurred somewhat before the elevation of the polysaccharide of the pseudoglobulin fraction, being significantly elevated on the first day after the first injection in group 4 and the second day in group 3. This elevation of albumin polysaccharide was found to be due in every instance to an increase of mucoprotein polysaccharide. In contrast to group 3 and 4 in which fever was induced by injections of pyromen, no significant increase in albumin or mucoprotein polysaccharide was noted in the animals in which fever was induced by external means.

Discussion. The elevations of total, pseudoglobulin, and mucoprotein polysaccharide levels of animals subjected to other stress, *i.e.*, epidermal thermal injury(2), were considerably greater and more consistent than those found in this study. Fever caused by bacterial pyrogens in the animal body may be expected to affect both the mucoprotein and pseudoglobulin fraction. In contrast to cancer patients(4) or pregnant women(6), the polysaccharide of the albumin fraction, after correction for the mucoprotein, is not significantly elevated following fever.

Summary and conclusions. Experimental fever in dogs caused by external heating or by injection of a pyrogenic substance resulted in a significant elevation of total serum nonglucosamine polysaccharide. An elevation of the polysaccharide content of the pseudoglobulin was noted in all animals, while an elevation of mucoprotein was noted only in the animals subjected to the injections of the pyrogenic substance, pyromen.

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