MORPHOLOGICAL CHANGES IN THE INTERNAL ORGANS
IN CHRONIC STREPTOCOCCAL INFECTION


A histological and histochemical study was made of the internal organs of albino mice at various times (from 24 h to 27 weeks) after a single intraperitoneal injection of L-forms of \( \beta \)-hemolytic group A streptococci. A progressive pathological process (myocarditis, hepatitis, glomerulonephritis) against a marked allergic background and leading to systemic lesions of the tissues was discovered.

KEY WORDS: L-forms of \( \beta \)-hemolytic streptococcus; infection; morphological changes.

Facts indicating that L-forms of streptococci can persist for a long time in an infected organism have recently been obtained [3]. There are some reports to indicate that L-forms of streptococci may have a harmful action on the tissues of the host [2, 6, 8, 9].

The object of this investigation was to study the dynamics of morphological changes in the internal organs of infected animals during prolonged (27 weeks) persistence of L-forms of streptococci.

EXPERIMENTAL METHOD

Histological (staining with hematoxylin-eosin and azure II-eosin) and histochemical (Brachet's and Feulgen's reactions, PAS) investigations were made of the heart, liver, spleen, and kidneys of 40 noninbred albino mice, weighing 16-20 g and infected intraperitoneally with L-forms of group A \( \beta \)-hemolytic streptococci (strain L-406) in a dose of 2 \( \cdot \) 10^6 colony-forming units (CFUs). The method of preparing the antigen of the L-forms was described previously [1]. The animals were killed at various times after infection: 24 h, 1, 2, 3, 13, and 27 weeks. The control group consisted of 12 mice which were not infected but were inoculated with the culture medium of the L-forms of streptococci. Detection of the L-forms in the histological sections of the organs was carried out by the indirect immunofluorescence method [7] after staining with azure II-eosin.

EXPERIMENTAL RESULTS

A single injection of L-forms of group A hemolytic streptococci into the experimental animals caused morphological changes in their internal organs which reached maximal intensity by the end of the period of observation (27 weeks).

Histological investigation of the heart of the infected mice showed mucoid swelling of the cusps of the valves, edema and lymphohistiocytic (mainly perivascular) infiltration of the interstitial tissue, swelling, amounting sometimes to fibrinoid, of the walls of the blood vessels, circulatory disturbances sometimes producing discrete hemorrhages, and degenerative changes in the muscle fibers. The latter were expressed as swelling and vacuolation of the cytoplasm of the muscle cells, fragmentation of the fibers, and the formation of foci of necrobiosis. The nuclei of the muscle cells were weakly stained in some places, and completely lysed in others. These changes appeared for the first time 2 weeks after infection, after which they

Institute of Human Morphology, Academy of Medical Sciences of the USSR. N. F. Gamaleya Institute of Epidemiology and Microbiology, Academy of Medical Sciences of the USSR, Moscow. (Presented by Academician of the Academy of Medical Sciences of the USSR A. P. Avtsyn.) Translated from Byulleten' Eksperimental'noi Biologii i Meditsiny, Vol. 80, No. 9, pp. 111-115, September, 1975. Original article submitted December 25, 1974.

©1976 Plenum Publishing Corporation, 227 West 17th Street, New York, N.Y. 10011. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, microfilming, recording or otherwise, without written permission of the publisher. A copy of this article is available from the publisher for $15.00.
Fig. 1. Changes in heart of mice infected with L-form of streptococcus: a) perivascular edema and lymphohistiocytic infiltration of interstitial tissue 13 weeks after infection (hematoxylin-eosin, 360×); b) foci of necrobiosis of muscle fibers, perinuclear edema 27 weeks after infection (hematoxylin-eosin, 560×); c) L-forms of streptococcus in myocardium (azure II-eosin, 500×).

Fig. 2. Kidney 27 weeks after infection of mice with L-form of streptococcus: a) perivascular plasma cell infiltration (Brachet's reaction, 590×); b) L-forms of streptococcus in malpighian glomerulus (azure II-eosin, 590×).

increased in intensity, so that by 13 weeks changes in the interstitial tissue were the most conspicuous (Fig. 1a) whereas later in the experiment (27 weeks) the most severe changes were found in the myocardium (Fig. 1b). L-Forms of streptococci were discovered in the interstitial tissue, in the myofibrils, and beneath the epicardium and endocardium; they increased in number during the experiment (Fig. 1c). A clearly defined cellular reaction, mainly histiocytic, could be observed around the foci of persistence of the L-forms.

In the kidney, degenerative changes in the epithelium of the tubules and glomeruli and slight circulatory disturbances appeared 1 week after infection, progressed gradually, and in the 3rd week they were joined by a proliferative reaction of the mesangial cells. By the 13th week degenerative changes were predominant and a picture of membranous glomerulonephritis could be observed. In the last stage of the investigation the most conspicuous feature was disturbances of permeability, especially of the microcirculation. The walls of the blood vessels were severely altered, with fibrinoid swelling in some cases. A plasma-cell reaction was found in the later stages of the experiment (13-27 weeks, Fig. 2a). The L-forms were found in the kidney tissues at all times of observation, more often in the immediate vicinity of the blood vessels (Fig. 2b).