A careful dissection was carried out and an arteriovenous fistula was found. The brachial artery was exposed and a tape ligature was placed around the artery above the site of the lesion. The brachial artery was completely occluded, and 5 c.c. of thorium dioxide sol was injected into the artery distal to the tape ligature and roentgenograms of the region of the elbow were made. The first roentgenogram revealed an overabundance of thorium dioxide sol in the angiomatous tumors and veins. The presence of the roentgen opaque medium in the angiomatous masses, in the first film, with the technic employed indicated conclusively the presence of an arteriovenous fistula. The masses were removed. They were reported by the pathologist as being angiomatous lesions. In dissecting out one anomalous mass, the ulnar nerve was exposed for approximately 2 inches (5.08 cm.) above and below the elbow joint, and we found that the mass was directly compressing the ulnar nerve (fig. 1). After removal of the masses the patient's symptoms and signs rapidly improved. His convalescence was uneventful.

SPECIFIC STREPTOCOCCAL ANTIBODY-ANTIGEN REACTIONS IN POLIOMYELITIS: PRELIMINARY REPORT

E. C. Rosenow, M. D., Division of Experimental Bacteriology: Antibody-antigen reactions were studied in a series of 128 cases of acute epidemic poliomyelitis that occurred during October and November, 1943, as well as in groups of poliomyelitis contacts and noncontacts during the same period, by means of intracutaneous, precipitation and agglutination tests.

The intracutaneous test consisted of the injection, as superficially as possible into the skin of the anterior aspect of the forearm, of 0.03 c.c. of (1) 10 per cent solutions in physiologic saline solution (plus 0.2 per cent phenol) of the euglobulin fraction of poliomyelitis or arthritis antistreptococcic serums, (2) freshly prepared solutions containing the specific polysaccharide, obtained by the Lancefield method, from streptococci isolated in studies of epidemic poliomyelitis and remote from epidemic poliomyelitis, and (3) the 1:10 dilutions in saline solution of bacteria-free supernatant of suspensions in saline solution of 100,000,000,000 streptococci per cubic centimeter which were isolated in studies of poliomyelitis or arthritis. The dense suspensions of streptococci had been autoclaved for ninety-six hours. The maximal erythema which occurred, usually in from three to five minutes after the injection, was outlined with pen and ink and the size of the area was determined in square centimeters by superimposing over the marked areas circles of different and predetermined size on a transparent film.

At the time of making the intracutaneous tests the nasopharynx was swabbed and 6 c.c. of blood was drawn from a vein of the arm. Cultures of the nasopharyngeal swabbings were made on blood-agar plates and in dextrose-brain broth. After removing the serum from the blood which had been allowed to clot, the partially macerated clot

was planted in dextrose-brain broth. The serum was used in precipitation and agglutination tests. Animals were inoculated intracerebrally with highly diluted dextrose-brain broth cultures of streptococci from nasopharynx and blood.

Interphase precipitation tests were made in small precipitation tubes by superimposing over the poliomyelitis antistreptococcic serums, control (encephalitis, arthritis and influenza) antistreptococcic serums or poliomyelitis convalescent serum from persons or monkeys (1) and (2) serums and extracts of nasopharyngeal swabbings, respectively, obtained from patients during different stages of poliomyelitis, during convalescence and from well persons within zones of epidemic poliomyelitis and remote from poliomyelitis, and (3) freshly prepared filtrates of solutions of specific polysaccharide of streptococci isolated in studies of poliomyelitis or of control streptococci isolated in studies other than of poliomyelitis. The filtrates of specific polysaccharide solutions also were superimposed over the serum obtained from persons and monkeys during and following attacks of poliomyelitis and from well persons and monkeys. The setups were kept at 35° C. for one and a half hours and in the refrigerator over night when readings were made under a strong light in a dark room against a nonreflecting black velvet background.

The streptococci used in agglutination tests were freshly isolated in dextrose-brain broth from nasopharynx, cerebrospinal fluid and spinal cord of persons and from cerebrospinal fluid and spinal cord of monkeys, ill with poliomyelitis. Some were used as soon as isolated, but more often they had been preserved for varying periods in dense suspensions (1,000,000,000,000 per cubic centimeter) in glycerin (2 parts) and 25 per cent solution of sodium chloride (1 part).

Agglutination tests were made in Wassermann tubes by mixing 0.2 c.c. of suspensions of streptococci in saline solution plus 0.2 per cent phenol (4,000,000,000 streptococci per cubic centimeter) with 0.2 c.c. of the respective dilutions of poliomyelitis, encephalitis, arthritis and cold-influenza antistreptococcic serums, normal horse serum, poliomyelitis convalescent and normal serums from persons and monkeys, serums from poliomyelitis contacts and the supernatants of the respective autoclaved suspensions of streptococci. The antistreptococcic serums and normal horse serum were diluted 1:10, 1:100 and 1:1,000 and the convalescent and normal serums from persons and monkeys and the supernatants were diluted 1:5, 1:25, 1:125 and 1:625. The setups were incubated at 50° C. for eighteen to twenty-four hours and then read.

Washed streptococci isolated in studies of epidemic and experimental poliomyelitis and in studies of arthritis were used in agglutination-absorption experiments. Undiluted poliomyelitis and arthritis

antistreptococcic serums and poliomyelitis convalescent serums from persons and monkeys and the supernatants of suspensions of autoclaved streptococci were added to, and mixed with, the centrifuged, washed streptococci from poliomyelitis and arthritis, respectively, so that 4,000,000,000 streptococci were suspended in each cubic centimeter of serum. These suspensions were placed in the refrigerator over night and then centrifuged. The resultant absorbed serums and supernatants then were added to a second batch of centrifuged, washed streptococci, mixed, placed at 35° C. for one and a half hours and centrifuged again. The centrifugated, twice absorbed antiserums and supernatants, together with the unabsorbed serums and supernatants, were used in parallel agglutination experiments.

RESULTS

All of forty-two nasopharyngeal swabbings and the blood of fourteen (19 per cent) of seventy-two patients ill with acute poliomyelitis yielded the poliomyelitis type of streptococcus in dextrose-brain broth cultures. Rabbits inoculated intracerebrally in the usual manner with the highly diluted cultures of streptococci from nasopharynx and blood succumbed to flaccid paralysis.

Cutaneous reactions.—The cutaneous reactions to intradermal injection of the poliomyelitis euglobulin and the supernatants of the autoclaved suspensions of streptococci isolated in studies of epidemic and experimental poliomyelitis ran closely parallel and may be considered as measuring the specific type of antigen in skin or blood. They were largest during the early stages of acute epidemic poliomyelitis and on retesting during convalescence they gradually diminished. In sharp contrast, the cutaneous reaction to intradermal injection of the specific polysaccharide of the streptococci from epidemic and experimental poliomyelitis was minimal during the early stage of the disease, maximal during early convalescence (eleven to twenty days) and then gradually diminished. Reactions to injection of the polysaccharide may be considered as measuring the specific antibody in skin or blood.

Therapeutic injection of the poliomyelitis antistreptococcic serum and of the supernatant material from autoclaved suspensions of streptococci from poliomyelitis caused a greater diminution in the cutaneous reaction on retesting with the poliomyelitis euglobulin and poliomyelitis supernatant, and a greater increase in reaction on retesting with the specific polysaccharide, within eight to twenty-four hours than occurred in eleven days during convalescence in untreated cases.

Precipitation tests.—Extracts of nasopharyngeal swabbings and the poliomyelitis antistreptococcic serum yielded clouding at the interphase in 82 per cent of fifty-one precipitation tests. The incidence

of precipitation reactions between the poliomyelitis antistreptococcic serum and the serum from persons ill with poliomyelitis for one to five days was 100 per cent; from persons ill six to ten days, 92 per cent; from persons ill eleven to fifteen days, 82 per cent, and from persons ill sixteen to twenty days, 50 per cent. The incidence of clouding at the interphase between the poliomyelitis antistreptococcic serum and extracts of nasopharyngeal swabbings from poliomyelitis contacts and between the former and the serum of poliomyelitis contacts was 86 and 29 per cent, respectively. The incidence of positive precipitation reactions between the poliomyelitis antistreptococcic serum and extracts of nasopharyngeal swabbings from control persons and between the former and the serum of control persons remote from poliomyelitis was much lower or wholly absent. This was true also in the case of precipitation tests with material from poliomyelitis and the control encephalitis, arthritis or influenza antistreptococcic serums.

Clouding at the interphase in precipitation tests between filtrates of freshly prepared solutions of specific polysaccharide of the streptococci from poliomyelitis and the poliomyelitis antistreptococcic and convalescent serums, indicating antibody in the serums, occurred as follows: with the poliomyelitis antistreptococcic serum in 65 per cent of thirty-six tests; with the poliomyelitis convalescent serum from human beings in 46 per cent of thirty-two tests, and with the poliomyelitis convalescent serum from monkeys in 30 per cent of thirty-two tests. There was no clouding at the interphase with the serums from well persons. The incidence of clouding at the interphase with the encephalitis antistreptococcic serum was 44 per cent of thirty-one tests; with the arthritis antistreptococcic serum, 16 per cent of thirty-two tests, and with the influenza antistreptococcic serum, 8 per cent of thirty-two tests.

Agglutination tests.—Agglutination of the streptococci isolated in studies of epidemic and experimental poliomyelitis occurred in 92, 82 and 53 per cent, respectively, of a total of thirty-one tests made with poliomyelitis antistreptococcic serum at dilutions of 1:20, 1:200 and 1:2,000. The incidence of agglutination of streptococci from poliomyelitis by parallel dilutions of the encephalitis, arthritis or influenza antistreptococcic serums and by normal horse serum and of agglutination by the poliomyelitis antistreptococcic serum of streptococci isolated from persons remote from poliomyelitis was far less, or wholly absent.

During convalescence the serum of persons was found to contain a progressive increase in agglutinins for streptococci from epidemic and experimental poliomyelitis, agglutination being maximal with serums obtained sixteen to twenty-five days after onset of the disease. Poliomyelitis convalescent serum agglutinated the streptococci from

the nasopharynges of well persons who were in contact with poliomyelitis more often than streptococci from well persons remote from poliomyelitis. The serum from contacts agglutinated to a greater degree and in higher dilution the streptococci from poliomyelitis than did the serum from persons who had not been exposed to poliomyelitis.

The serum from monkeys during and after convalescence from paralytic poliomyelitis which had developed after inoculation of virus uniformly agglutinated to a higher degree or in higher dilution of the serum the streptococci isolated in studies of both epidemic and experimental poliomyelitis than did the serum of normal monkeys or of monkeys in the acute stage of poliomyelitis. There was no difference in the incidence of agglutination of streptococci from sources other than poliomyelitis by poliomyelitis convalescent serum from monkeys, serum from normal monkeys or serum from monkeys in the acute stage of poliomyelitis.

The streptococci from poliomyelitis absorbed specifically the agglutinins from the poliomyelitis antistreptococcic serum and the poliomyelitis convalescent serums from human beings and monkeys. The incidence of agglutination of streptococci isolated in studies of poliomyelitis by the three types of serum absorbed with the streptococci from poliomyelitis was 30, 21 and 19 per cent, respectively. In contrast, agglutination by the same types of serum unabsorbed was 80, 58 and 62 per cent, respectively. After absorption of these serums with streptococci from arthritis, the incidence of agglutination of streptococci isolated in studies of poliomyelitis was only slightly less than that by the unabsorbed serum; namely, 70, 58 and 50 per cent, respectively.

The supernatant of autoclaved suspensions of the streptococci from poliomyelitis agglutinated specifically the washed streptococci from poliomyelitis in degree and at dilutions comparable to the poliomyelitis antistreptococcic serums and the streptococci from poliomyelitis absorbed the agglutinins from the supernatant whereas the streptococci from arthritis did not.

COMMENT

From the results of this study which corroborate and extend those obtained previously, it seems logical to conclude that the streptococcus which has been isolated by others and by myself in studies of poliomyelitis is not a harmless invader but is antigenic and is an integral part of the infectious process in poliomyelitis now attributed to virus. Studies on the suggested nature of the relation of the streptococcus to virus will be published elsewhere.