

ear was so severe that continued administration of opiates was necessary for relief. The day following admission (September 13) he had a chill lasting ten minutes with an abrupt rise of temperature. The cough became more annoying, and signs of bronchitis were present. Anorexia and vomiting were pronounced. The temperature varied from 99 to 103 F., but the pulse rate consistently remained below 90 per minute. Physical and mental exhaustion progressed.

As the cellulitis of the ear gradually subsided, the discharge became more copious and fetid. When it became possible to visualize the tympanic membrane, a pinpoint perforation of the superior posterior quadrant was seen. However, there was no bulging, and the discharge appeared to originate entirely from the canal wall. At this time the anterior cervical nodes became palpable and tender. The patient's serum agglutinated Morgan's bacilli in a 1:160 dilution.

September 17 he had another severe chill and began complaining of soreness of the left side of the mouth. A localizing inflammation around the first upper left premolar was found. September 20 he had a chill about fifteen minutes in duration. The eyegrounds revealed the same blurring of the nerve heads found previously, with a hemorrhagic area above the disk on the right side. Spinal fluid examination was again entirely negative.

The patient became increasingly stuporous. The skin and scleras were jaundiced. He complained of generalized aching with severe sweats.

The cough increased. September 24, twelve days after admission, he complained of severe pain in the right side of the chest. Physical examination revealed diminished breath sounds in the right lower lobe. That evening he had a shaking chill and the temperature rose to 105.3 F. The cough became more constant, and productive. Sputum examination on three occasions revealed the presence of many pus cells, staphylococci, streptococci, pneumococci (nontypable) and gram-negative bacilli. Blood culture gave an abundant growth of Morgan's bacilli. The blood serum agglutinated *Bacterium morgani* antigen to a titer of 1:320. Roentgen examination of the chest revealed pneumonia of the right lower lobe. The leukocytes numbered 28,000 and the erythrocytes 3,200,000. An indirect blood transfusion (500 cc.) was given. The next few days he had several shaking chills. Sulfapyridine was given, without apparent benefit. The jaundice deepened. The sweating was more profuse and the mental confusion was worse.

September 30, eighteen days after admission, pain developed in the left side of the chest, and physical signs indicative of pneumonia in the left lower lobe were found. The left ear began to discharge the same foul material. The patient became more toxic and irrational. The blood serum agglutination with *Bacterium morgani* was only 1:40 on October 1. October 2 he complained of pain in the neck along the anterior border of the sternocleidomastoid muscle, which was tender to palpation. A swelling appeared, and four days later 6 ounces of thin grayish foul-smelling pus was removed from the abscess. This material yielded a pure culture of *Bacterium morgani*. At the same time, a small abscess around the upper left first molar was opened. Only *Staphylococcus aureus* was obtained on culture of the pus. The neck continued to drain freely. Expectoration of foul-smelling sputum was constant. He became progressively worse and died October 23. *Bacterium morgani* was never isolated from any of the samples of stools or urine examined.

On postmortem examination, the changes of interest were chiefly in the head and chest. The brain was edematous and congested, but no evidence of an inflammatory process was found in the meninges. The lateral sinuses were explored from the torcular Herophili to the jugular bulb, and there was no evidence of thrombi nor of thrombophlebitis. Cultures remained sterile. The left mastoid cells, when opened, contained some exudate which when cultured showed the presence of an anaerobic nonhemolytic streptococcus but no Morgan's bacilli. On opening the chest, both pleural cavities contained large quantities of foul-smelling mucopus. Both lungs were riddled with abscesses of various sizes both on the exterior and on the interior of the lungs. One large abscess had ruptured into

the left pleural cavity. Both lungs showed dense adhesions to the chest wall. The pus yielded a pure culture of *Bacterium morgani*. The heart was soft and flabby. Culture from the heart blood also yielded Morgan's bacilli. The intestine showed no inflammation, and the peritoneal cavity was grossly normal. The kidneys were swollen, flabby and edematous and suggested toxic nephrosis.

BACTERIOLOGY

The organism is a gram-negative aerobic nonsporing rod from 1 to 3 microns long, motile when freshly isolated. On frequent subculture at 37 C. motility is greatly diminished, but the organisms remain actively motile if grown at 20 C. They are easily cultivated on ordinary laboratory mediums. When freshly isolated, colonies show a tendency to swarm and in this respect resemble *Bacillus proteus*. There is a characteristic strong fecal odor, which is lost after subculture. Later generations form colonies not unlike *Bacillus coli*. Dextrose, fructose and galactose were fermented with the production of acid and gas as was trehalose. There was no action after thirty days on arabinose, rhamnose and xylose, lactose, sucrose and maltose, mannitol, sorbitol, dulcitol, inositol and salicin. Indole and hydrogen sulfide were formed abundantly. Nitrates were not reduced. Litmus milk was turned slightly alkaline. Gelatin was not liquefied. The organism acts on sheep red cells with the production of methemoglobin.

These observations are essentially the same as reported by Jordan, Crawford and McBroom in a study of many strains of *Bacterium morgani*.

SUMMARY

1. A fatal case of sepsis was apparently due to Morgan's bacillus, with the external auditory canal as the probable port of entry. Specific agglutinins were demonstrated in the blood stream. Morgan's bacillus was isolated post mortem from the heart blood and the abscesses in the lungs.
2. Sulfanilamide and sulfapyridine therapy were of no benefit.
3. A review of the literature denotes the extent of the infectiousness of the organism.

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MENINGITIS EPIDEMIC AMONG NAVAJO INDIANS

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Although many¹ claim that meningococcic meningitis usually strikes only one member of a family, this did not hold true during a recent epidemic on the Navajo Reservation. Of twenty-eight patients seen at the Chin Lee General Hospital, in twenty-four instances there was a close family relationship to another patient or patients while in only four instances were the patients the only members of the family to contract meningococcic meningitis.

Since we saw multiple cases in the family early in the epidemic, whenever a Navajo contracted meningitis we urged that the younger members of the family be brought to the hospital for fourteen days' observation and prophylactic treatment; nineteen persons from families in which meningococcic meningitis had recently occurred were admitted to the Chin Lee General Hospital and 174 to the Northern Navajo Hospital, Shiprock, N. M., for this reason. Two thirds of these persons were under 10 years of age. At the Chin Lee Hospital, those weighing less than 80 pounds (36 Kg.) received a daily total dosage of sulfanilamide of one-half grain per pound (0.032 Gm. per 450 Gm.) body weight. Those weighing more than 80 pounds received a daily total dosage of 40 grains (2.6 Gm.). At the Shiprock hospital, Dr. R. K. Setzler (who gave permission to report those cases) and Dr. Jacob Seigel gave all their patients a daily total dosage of one-half grain per pound of body weight. At both hospitals this drug was continued for fourteen days. Fourteen days was chosen because most observ-

From the U. S. Indian Service.
1. Griffith, J. P. C., and Mitchell, A. G.: *Diseases of Infants and Children*, Philadelphia, W. B. Saunders Company, 1937, p. 319.
Schamberg, J. F., and Kolmer, J. A.: *Acute Infectious Diseases*, Philadelphia, Lea & Febiger, 1928, p. 830.

ers agree that the incubation period of meningococcal meningitis is less than fourteen days.

None of the 193 persons who received sulfanilamide as a prophylactic developed meningococcal meningitis while taking the drug. Two of the 193 developed meningococcal meningitis approximately one month after discontinuing the drug. The remaining 191 did not develop the disease.

We can only estimate the rate of incidence in this epidemic because we know that not all cases that occurred were brought to our attention. The most accurate count that has been made for the areas concerned in the epidemic showed a population of 11,000. The physicians in the area know of ninety-two cases. This gives an approximate incidence of one case to 120 of population. This is a very high rate of incidence, since one case to 800 population is considered epidemic.²

One of the patients who received prophylactic treatment was a nursing aged 1½ months whose mother had meningococcal meningitis. The infant suckled at her mother's breast up to the second day of illness and thereafter was in intimate contact with her mother and in less intimate contact with other patients with the disease. That the infant did not become ill may have been because (a) the child was actively immune, (b) the child was passively immune, (c) the child escaped contagion, or (d) sulfanilamide protected the child.

At 1½ months of age it is possible, but unlikely, that the child had developed an active immunity. It seems unlikely too that the child was passively immune, because it is generally agreed that the passive immunity displayed by infants is derived from the mother³ and in this instance the mother demonstrated her lack of immunity by contracting the disease. However, instances of mothers who were susceptible to diphtheria or scarlet fever while the nursing was immune have been reported.⁴ As to the child escaping contact with meningococci, any one observing the intimate contact between mother and child before and after the diagnosis was made would dismiss that possibility. If one reasons by exclusion, the possibility of sulfanilamide having protected the child grows more likely as the other possibilities seem less likely, and especially so since it has been demonstrated that sulfanilamide has curative value in cases of meningococcal meningitis.⁵

It is possible that in a group of 193 persons selected at random none of them might contract meningitis in any epidemic during a fourteen day period, although I feel strongly that this particular group of persons had far more possibility of contracting the disease than is usual because of their concentrated exposure and the higher rate of susceptibility in the residents of the Navajo Reservation at this time. This would seem especially true since the epidemic showed a strong tendency to affect successive members of the same family in a short period of time.

SUMMARY

In an outbreak of meningococcal meningitis on the Navajo Reservation the disease tended to affect several members of the same family.

This was a very severe epidemic.

Nothing in this study would indicate that sulfanilamide in moderate doses is valueless as a prophylactic for meningococcal meningitis during the time it is being administered.

2. Schamberg and Kolmer: *Acute Infectious Diseases*, p. 829. Griffith and Mitchell.¹

3. McKhann, C. F., and Kapnick, Israel: *J. Pediat.* **13**: 907 (Dec.) 1938.

4. Wadsworth, Augustus, and Hoppe, Ella N.: *J. Exper. Med.* **53**: 821 (June) 1931.

5. Schwentker, F. F.: *J. Pediat.* **11**: 874 (Dec.) 1937.

Qualifications Necessary for a Flight Surgeon.—The qualifications necessary for a properly trained and successful flight surgeon are many and exacting. As in any other specialty, aviation medicine should be built on a solid foundation of general medical knowledge. An intense interest in any one specialty of general medicine is not desirable, owing to the narrow outlook which usually accompanies such an interest. A well rounded, many-sided man is much to be preferred.—Armstrong, Harry G.: *Principles and Practice of Aviation Medicine*, Baltimore, Williams & Wilkins Company, 1939.

Special Clinical Article

USE OF SULFANILAMIDE AND RELATED COMPOUNDS IN DISEASES OF INFANCY AND CHILDHOOD

CLINICAL LECTURE AT NEW YORK SESSION

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DETROIT

The advent of the sulfonamide compounds has probably had a more favorable effect on the course of many infectious diseases in pediatrics than in any other field of medicine. This paper will present as briefly as possible the indications for the use of the various drugs, the results of treatment, dosage and methods of administration of the sulfonamide compounds, contraindications to chemotherapy, and toxic manifestations of the drugs in infants and children.

BETA HEMOLYTIC STREPTOCOCCUS INFECTIONS

Erysipelas.—Response to therapy has been dramatically favorable in this type of infection. A reduction in the mortality of patients under 2 years of age from approximately 35 per cent to 5 per cent has occurred in most hospitals in which erysipelas is treated. The majority of deaths has occurred in cases of overwhelming infection in less than twenty-four hours after admission to the hospital. More experience has been gained with sulfanilamide, but favorable results have been observed with sulfapyridine and sulfathiazole. Sulfanilamide is probably the drug of choice because of its rapid absorption and its ease of administration.

Respiratory Infections.—Response to chemotherapy in infections of the upper respiratory tract due to the beta hemolytic streptococcus such as rhinitis, pharyngitis, tonsillitis, sinusitis and otitis media has been unpredictable in many instances. However, if the infection is suspected or proved to be due to the beta hemolytic streptococcus, routine administration of sulfanilamide is desirable. Complications may be averted, especially mastoiditis, which may be prevented or aborted with prompt and effective administration of the drug. Present experience suggests that sulfapyridine or sulfathiazole is as effective as sulfanilamide in this group of infections.

Bronchitis, Pneumonia and Empyema.—Experience has been somewhat limited in this group of infections, but good results with chemotherapy have been observed. It is doubtful whether the incidence of surgical procedures has been materially reduced in cases of empyema by chemotherapy, but the course of the process may be shortened in certain instances and a spread of the pneumonia to the opposite lung may be prevented. Sulfathiazole is probably the drug of choice in this group because of the possibility of a mixed infection with the pneumococcus or the staphylococcus.

Septicemia.—Prompt sterilization of the blood stream and improvement in the lesion responsible for the septicemia has occurred in the majority of cases following chemotherapy. Other therapeutic measures such

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The antipneumococcus rabbit serum used in cases of pneumococcal infection was furnished by the Lederle Laboratories, Inc., Pearl River, N. Y., and the sulfathiazole was supplied for clinical trial by the Squibb Institute for Medical Research, Dr. George A. Harrop, director, New Brunswick, N. J.