findings. The clinical features and results of treatment are also discussed.

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B.C.G. VACCINE IN THE PREVENTION OF TUBERCULOSIS

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B.C.G. (bacillus of Calmette and Guerin) vaccine consists of a one time virulent strain of bovine tubercle bacilli. After years of subculturing and experimenting with animals, Calmette and Guerin discovered that the organism gradually became innocuous for all laboratory animals. Since its first trial on humans in 1921 (by Weill-Hallé, Paris) considerable controversial articles and papers appeared in the literature. (By 1934, 1,600 papers had been written on the subject[3]). Finally, after 25 years the use of the vaccine is becoming increasingly more popular throughout the world.

Reaction of host to B.C.G. vaccine.—Rosenthal[1] demonstrated by animal inoculation (guinea pigs) that the organisms could be given intradermally, intravenously, intracardially, intraperitoneally and intratesticularly in large quantities without producing progressive tuberculosis. In another experiment he describes the development of tubercles, and finally their complete resolution, following guinea pig inoculation with 10 to 15 mgm. of the organisms intracardially.[2] All cells (due to tissue response) disappeared by the end of the third month. Fibrosis or caseation rarely occurred and restitution was complete. Kayne[3] mentions the work of K. A. Jensen (Holland) in which the protective mechanism in vaccinated guinea pigs is a delaying of the effect of virulent bacilli on this highly susceptible animal.

Harmlessness of B.C.G. for humans.—Kayne[3] again, quotes Irvine (1934),

> "If we review the whole of this chapter we see a great tragedy in Germany, (Luebeck disaster) due to a contaminated vaccine, a suspicious but inadequately investigated minor disaster in Hungary, a doubtful incident in Chile, and several suggestive but quite unproved individual cases (of tuberculosis developing following B.C.G. but not proved due to B.C.G.). When we consider that 1,343,000 infants have been given the vaccine and there is not yet one sure case of death from the B.C.G., we should indeed be cautious if we still doubted the safety of the vaccine for normal infants. Even if every case (of tuberculosis) mentioned in this chapter had been proved to be due to the B.C.G., the ratio to the total number inoculated would only have been just under 1 in every 15,000."

From 1934 and to this day, to the best of my knowledge there are no reports of any ill effects following vaccination with B.C.G. vaccine. Heimbeck of Norway, Wallgren of Sweden, Baudouin of Montreal, Ferguson of Saskatchewan, Aronson and Danenberg of Philadelphia, Kereszturi and Park, New York City, Rosenthal of Chicago make no mention of ill effects in over 30,000 infants, children and adults vaccinated since 1934.

Birkhaug of Norway stated at the N.T.A. meeting, Buffalo, N.Y., June, 1946, that tuberculin negative student nurses and applicants for medical schools are accepted for training only if rendered positive following B.C.G. vaccination. Ferguson, Saskatchewan, at the same meeting stated that tuberculin negative reactors working in a sanatorium environment, provided they are rendered positive to old tuberculin following vaccination, are now granted insurance as arranged by the Saskatchewan Tuberculosis League.

Results of vaccination in humans.—Heimbeck[4] (Norway) in a study among student nurses from 1927 to 1938 at the Ullevaal Hospital. Oslo, presented the following results. Among previously positive reacting student nurses, without history or evidence of disease on commencing training, 3.29% developed tuberculosis but there were no deaths. Among those negative reactors not receiving the vaccine 34.15% developed tuberculosis and 4.23% of the total

negative reactors died. Among the positive reactors, rendered positive following vaccination, 3.52% developed tuberculosis and there were no deaths.

R. G. Ferguson[5] in a study from 1934 to 1943 among nurses in general hospitals and sanatoria in Saskatchewan showed a definite reduction in morbidity rate to at least its fourth. Because of his results the C.T.A. has adopted the use of B.C.G. vaccine, at present, particularly for those living or working in a tuberculous environment. (C.T.A. Conference, Quebec City, May, 1947.)

Methods of vaccination.—B.C.G. vaccine was first given (1921) orally to infants on the 5th, 7th and 9th days of life. This is still being carried on today in 3 doses of 10 mgm. by weight of the organisms in 2 c.c. sterile saline. Heimbeck in 1926 introduced the subcutaneous route, while Wallgren of Sweden in 1927 the intradermal route; each using 1 to 2 mgm. in 1/10 c.c. saline. In 1939, Rosenthal introduced the multiple-puncture method, and Weill-Hallé the scarification method, both using concentrated vaccine. Ferguson, in his study, used the intradermal route, the dosage being 0.5 mgm. in 1/10 c.c. in two areas about 1" apart. The multiple-puncture method developed by Rosenthal[6] will probably become the most widely used. It consists of placing a drop of B.C.G. vaccine on the outer aspect of the alcohol-cleansed arm, through which 30 punctures are executed over an area of 2 x 2.5 cm. This method has produced tuberculinization in 99.4% of the vaccinated within a period of a month.

The writer's method of the vaccination was the intradermal injection of 1/25 mgm. as recommended by Dr. Armand Frappier in a personal communication to the late Dr. C. H. Playfair, in 1946. It would appear, however that the important factor is to obtain a definite positive tuberculin reaction to 1 mgm. O.T. in 2 to 3 weeks following vaccination. There does not appear to be any severe reaction to this higher concentration if positive results are shown. The scratch and puncture methods give a higher percentage of positive reaction in 2 weeks than the other methods, nevertheless Dr. Ferguson's method has been suggested as a standard.

Duration of allergy.—It is obviously difficult to determine duration of allergy to old tuberculin B.C.G. vaccination. However, a study was made by Debre and Cofino in France between 1922 and 1926. They reported on 132 vaccinated and 141 unvaccinated infants who were placed in a healthy environment. At the age of 4 years 88.6% of the vaccinated group were still positive reactors, whereas all of the non-vaccinated group were still negative reactors.

Reaction of vaccination.—From personal observations of approximately 75 persons vaccinated ranging from 16 to 40 years (1 girl 9 years), using intradermal and scratch method, no general reactions have occurred. Regional adenitis as yet has not been observed. Local reaction following the intradermal route ranges from a small red area of induration to an area 1 cm. in diameter of redness, induration and sero-pustular formation. The pustule is small and is seldom tender. The few on whom this occurred had no complaints, but were naturally curious. The final picture is a pin-head-sized scar. The induration may last 6 to 12 weeks, and few of the pustules lasted more than 6 to 9 weeks. The scarification method, although only about 15 have been observed by the writer, presented redness and some induration only, for 3 to 6 weeks. In the first 30 vaccinated (intradermally with 1/25 mgm.) by the writer only 92% were positive in 6 weeks. At that time the vaccinated were tested on the 3rd and 6th week following vaccination with 1/10 mgm. O.T. followed by a second test of 1 mgm. O.T. on the 6th week. Only 10% required the 1 mgm. dose of O.T.; 67% were positive to 1/10 mgm. in 3 weeks.

Selection of candidates for vaccination. — Those persons whose Mantoux test is definitely negative to 1/10 mgm. O.T. on the 48 hour reading are given 1 mgm. 1/100 O.T. immediately. If their reaction using fresh dilutions of O.T. is still negative, (particularly in the younger age group) it is considered that they have never had a tuberculous infection. In the case of infants or children recently exposed to a tuberculous infection, it is suggested that an interval of 2 to 3 months be allowed to elapse after separation from the source, for the final tests prior to vaccination.

Retesting following vaccination. — It is suggested that between 3 and 4 weeks following vaccination 1 mgm. 1/100 O.T. be given. This can be done safely and is time saving. If nega-

tive, the test could be repeated in 6 to 8 weeks and if still no reaction occurs, the vaccination can be repeated. It has often been recommended that persons planning on working in an infectious environment be rendered positive prior to commencing such work. This is considered important for the protection of the present reputation of B.C.G. as a valuable weapon in the fight against tuberculosis.

DISCUSSION

Many factors are important in considering the use of B.C.G. vaccine. Every effort should be made to avoid indiscriminate use of the vaccine, since the method of vaccination is inexpensive and would appeal to the public generally. Little would be gained, and much of the present public health prevention and control measures might be lost. The preparation of the vaccine should be limited to the well established laboratories already supplying it, for use in man. A seminar on B.C.G.[7] in June, 1947 (U.S.A.) presented many interesting facts. The following are statements of the moderator, H. C. Sweany, at the beginning and conclusion of the meeting.

"Certain facts have been learned: It has been proved beyond doubt that B.C.G. is harmless, that it is feasible to administer the vaccine to human beings, and that it offers some degree of protection against a later infection with virulent tubercle bacilli. The unfavourable features are the dangers of contamination or mixing cultures with virulent strains, the difficulty of applying it to great masses of people, the false security that may be engendered by its use, and that it does not afford the complete protection that smallpox vaccination does. It seems clear that, if rigidly supervised, B.C.G. has a place in anti-tuberculosis work."

SUMMARY AND CONCLUSIONS

1. B.C.G. vaccine is innocuous and is of definite value in the prevention of tuberculosis.

2. It is recommended for use among those negative reactors destined to live or work in a tuberculous or potentially tuberculous environment. Infants and children whose parents or other members of the family are stricken with the disease; our young women planning or already training as nurses; and any group working in a sanatorium environment, are among those recommended for vaccination.

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RÉSUMÉ

Description du B.C.G. et des réactions qui suivent son emploi, chez l'animal et chez l'homme. Discussion des résultats obtenus et exposé des diverses méthodes de vaccination. La méthode intradermique paraît la plus simple mais il semble que la méthode par scarification sera la plus employée. Le B.C.G. est inoffensif et les résultats obtenus à la suite de son emploi sont indéniables. On l'emploiera chez les individus Mantoux-négatifs qui doivent séjourner où il y a des tuberculeux, notamment chez les infirmières; chez ceux qui vivent dans les sanatoria et auprès de tuberculeux.

JEAN SAUCIER

INFECTIOUS POLYNEURITIS OF UNKNOWN ETIOLOGY (Guillain-Barré Syndrome) IN CHILDHOOD

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THE polyneuritides have for several decades been described under many headings.† In 1916, Guillain, Barré and Strohl[1] separated from the polyradicular neuritides, a group of patients who had, besides the symptoms common to polyneuritis, an increase in the cerebrospinal fluid proteins but without cellular reaction. In subsequent years more of these cases were recognized and many case reports and excellent monographs on this condition appeared in the literature, stressing the more important findings and adding new ones.[2, 3]

For more than 20 years all the cases reported were in adults; indeed it was considered a disease of adult life until Ford[4] and Hecht[5] in 1937 reported cases in children. Hecht described 7 cases of "acute infective polyneuritis" in children between the ages of 2 and 10 years, which illustrate the clinical picture. In 1941, Casamajor and Alpert[6] reviewed the English and French literature and found 38 cases reported in children under 12 years of age. They described three additional cases bringing the total to 41. Since then several reports have appeared

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† Such as infective polyneuritis, acute febrile polyneuritis, Landry's ascending paralysis, polyradiculoneuritis, polyneuritis, acute infectious neuronitis, Guillain-Barré syndrome, Guillain-Barré-Strohl syndrome, radiculoneuritis and polyneuritis of unknown etiology.