ANTHRAX WITH SPECIAL REFERENCE

TO DIAGNOSIS, PROGNOSIS AND TREATMENT

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THESIS

PART I

INTRODUCTION WITH REVIEW OF SOME OF THE MORE IMPORTANT STATISTICAL AND EPIDEMIOLOGICAL CONSIDERATIONS

The natural habitat of Bacillus Anthracis is in the surface soil and on vegetation. From this normal abode it passes via the mouth into the intestinal tracts of the herbivora and there depending upon the resisting power or weakness of the host it is destroyed or produces an intestinal anthrax with subsequent rapid and fatal septicaemia.

Infection in man is in the majority of cases through the intermediate animal host, but this is not always so. Cases do occur where it is impossible to trace the intermediate host and where all the evidence goes to prove that the infection was from surface vegetation.

Anthrax then as a disease in grazing animals and in man has probably existed from the earliest times. It was not however until the later half of the eighteenth century that the relationship existing between human and animal anthrax was suspected. Fournier of Dijon in 1769 noticed the occurrence of anthrax in men working amongst or with hair and wool. In 1847 anthrax occurring in a horse hair factory in England was described by Lawrence, whilst Russell in 1878 related nine cases occurring in a horse-hair factory in Glasgow. In his

report he cited examples of a similar outbreak amongst Frenchmen working with Russian material. No further cases occurred in Glasgow until the years 1899 and 1900. After the experience in 1878 the factory referred to above discarded Siberian hair with the result that no further cases were reported.

Dr. Bell of Bradford, it was who, in 1879, definitely established the association of wool-sorters' disease with anthrax. With the blood of a fatal case he inoculated guinea-pigs, rabbits, and mice and from the blood of each after death he recovered the anthrax bacillus.

From a bacteriological point of view Pollender first pointed out in 1849 that the blood of anthracised animals contained rod-shaped bodies and he suggested that the disease was attributable to these. Brauell in 1857 independently made a similar discovery. In 1863 Davaine stated definitely that these bodies were bacteria. He termed the organism the bacillus anthracis. Koch in 1876 proved conclusively that they were bacteria and that they were the cause of the disease.

Anthrax in the human being occurs in three principal forms according to the position of the site of infection. In the first and most frequent variety the

point of entrance is the skin of the exposed surfaces; in the second the bronchi and bronchioles; and in the third the intestinal mucous membrane. These types are usually in this country divided into (1) the non-industrial or agricultural and (2) the industrial or notifiable.

The non-industrial cases include

(a) Those who come in contact with anthracised animals during life as farmers, shepherds, veterinary surgeons, or have taken part in their slaughter and disposal as butchers, and consumers of infected meat.

(b) Those cases of the transmission of the disease from person to person either by direct contact or by contact with carcases or bodies that have died as a result of the infection.

(c) Those cases of persons who have come in contact with workers amongst infected material who may not themselves be "active" but simply carriers of the disease.

Industrial Anthrax includes workers

(a) of wool (sheep, lamb, goats' wool or hair).

(b) of animal hair and bristles.

(c) of hides and skins.

(d) of harness, manure, rag sorting, and grain-porterage.

STATISTICS. The number of cases of agricultural anthrax depends on the number of cases occurring in susceptible animals. The greater the number in animals the greater the number in man will be, and vice versa. The industrial cases vary according to the amount of disease in the countries exporting raw material to us.

The story of the animal epidemics for the 20 years commencing 1890 and finishing 1909, is statistically told thus :-

ANTHRAX IN GT.BRITAIN DURING 20 YEARS 1890-1909 (inclusive)

Years.	No.of countries from which reported.	No.of outbreaks	No.of animals affected.	Quinquennial Figures		
				No.of countries from which reported.	No.of outbreaks	No.of animals affected.
1890	48	152	535			
1891	50	226	471			
1892	60	289	646			
1893	68	563	1300			
1894	64	494	1000	290	1724	3952
1895	66	434	934			
1896	64	488	904			
1897	67	433	882			
1898	73	556	856			
1899	67	534	986	337	2445	4562
1900	74	571	956			
1901	63	651	971			
1902	71	678	1032			
1903	78	767	1142			
1904	77	1049	1589	363	3716	5690
1905	84	970	1317			
1906	80	939	1330			
1907	83	1084	1456			
1908	80	1105	1419			
1909	79	1317	1690	406	5415	7213
TOTALS	1396	13300	21416	1396	13300	21416

These figures show marked quinquennial increases.

As human anthrax in numbers depends upon the number of anthracised animals we may expect to find increases here also. Such is the case. Industrial anthrax did not become notifiable until 1895 so that for comparison one must rely upon the deaths registered during the corresponding twenty years.

HUMAN DEATHS FROM ANTHRAX DURING 20 YEARS 1890-1909.

Year	England and Wales		Scotland
	Number of Deaths	Quinquennial Figures	
1890	4		
1891	3		
1892	6		
1893	7		
1894	10	30	
1895	13		
1896	9		1
1897	18		
1898	18		
1899	21	79	3
1900	10		5
1901	12		
1902	13		1
1903	18		
1904	20	73	3
1905	24		1
1906	26		
1907	15		1
1908	13		
1909	15	93	
	275	275	15

The small number of human deaths in Scotland is noteworthy.

Industrial anthrax became notifiable in 1895. From this source then we shall be able to obtain a more accurate table of the number of cases of anthrax in man.

Year	All cases of industrial anthrax.	Deaths.	Percentage fatal.
1899	55	14	25.4
1900	37	7	18.9
1901	39	10	25.6
1902	38	9	23.6
1903	47	12	25.5
1904	50	11	22.0
1905	51	18	30.5
1906	67	22	32.8
1907	58	11	19.0
	452	114	25.2

From 1902-1904, 58 deaths from anthrax (industrial and non-industrial) were registered. Of these 32 were due to industrial conditions. The difference 26, is therefore the number of deaths occurring in non-industrial occupations. The average mortality of anthrax being about 25% it may therefore be estimated that during the three years (1902-1904) non-industrial cases amounted to about 104. Non-industrial cases average 34 per annum whilst industrial cases average 50.

The mortality returns from the different industries

which occasion anthrax are obtainable from Dr. T. M. Legge's report to the Chief Inspector of Factories for 1904.

The following are the statistics for the six years 1899-1904.

	Cases	Fatal	Mortality
Wool	88	23	26.12
Horse-hair and bristles	70	17	24.32
Hides and skins	86	21	24.4%
Other Industries	17	6	35.3%

Completing these figures for the 3 years 1905-1907.

Wool	87	24	27.5%
Horse-hair	34	9	26.5%
Hides and skins	45	13	28.8%
Others	20	7	35.0%

From these figures a few interesting observations can be made. (1) The high mortality in the "other industries". This is probably due to the fact that a sharp look-out is not kept upon the possibilities and evidences of anthrax infection and that the cases when presented are too far advanced for successful treatment. (2) the increase in the number of cases amongst wool-workers, despite the fact that special precautions are taken when manipulating raw animal material.

This would prove that there has been a demand for Asiatic wool and that anthrax must have been prevalent

amongst the animals from whom the wool was obtained. (3) the increased mortality in every industry in spite of the introduction of better methods of treatment and (4) the small mortality in the horse-hair industry. This is the more remarkable when one considers that in the West Riding of Yorkshire practically all the horse-hair prepared for commercial purposes is obtained from the Eastern Countries - Russia, Siberia, and Persia.

The horse-hair which I have seen is less blood-stained that the wool, and in this may be the explanation of the smaller death rate.

Amongst horse-hair workers anthrax is more fatal in women than in men. The risk however is much greater for men in as much as they are employed in the earlier and more dangerous processes. The risk amongst bristle-workers is much less. Page estimates the risk amongst male horse-hair workers - .593% and for female workers .123% whilst in brushworkers the risks are .04% and .022%

The nature of the lesion varies according to industry. Thus, out of the 215 cases of industrial anthrax occurring during the years 1903-1906, 12 were

of the pulmonary type. All were fatal and all occurred in woollen workers. Inhalation of spores is therefore common amongst manipulators of wool and uncommon amongst other workers in anthrax carrying materials. Amongst hair and hide workers, the external manifestations are the rule.

External anthrax usually occurs on the exposed part of the body. In 93% of the cases, the sore is situated on the head, neck, or arms.

Amongst hair and wool workers the sore is situated on the neck in 34.2%; on the cheek in 20%; and on the forearms and hands in 11%.

In hide workers the lesion in 60% of the cases is found on the neck.

In my experience the lesions on the neck exhibit a preference for the right side as well in hair and wool as in hide workers.

These observations may be explained by the fact that the arms and hands are more frequently and thoroughly washed than the face but that the nails which harbour the infection are not so conscientiously tended with the result that scratching and inoculation of the face is more liable. In one of the cases reported later,

a child of 2½ years was inoculated thus by the father who was a worker in a horse-hair factory.

The frequency of neck infections amongst hide workers is due to the fact that the skins are usually carried on the shoulders, and in the case of right-handed workers on the right shoulder.

SITUATION OF THE LESION IN 105 CASES OF EXTERNAL ANTHRAX.

Situation of Pustule	Cases	Deaths	% Fatal	Position %
Head	3	0	0	2.8
Forehead	7	1	14.3	6.6
Eyebrow	2	1	50.0	1.9
Eyelids	2	0	0	1.9
Face	5	1	20.0	4.7
Chin	5	3	60.0	4.7
Cheek	21	2	9.5	20.0
Neck	36	12	33.3	34.2
Arm & Shoulder	4	1	25.0	3.8
Forearm	12	1	8.3	11.4
Hand	0	0	0	0
Fingers	0	0	0	0
Trunk	2	0	0	1.9
Leg	1	1	100.0	.9
Not stated	5	1	20.0	
TOTALS	105	24	22.8	

In foreign countries the lesions on the upper extremities are next in frequency to those on the head and neck.

The mortality of cases of external anthrax varies with the situation.

Dr. Legge states :-

Situation	Number of cases	Deaths	Percentage Fatal
Neck	84	26	30.9
Upper Eyelid	12	5	41.6
Cheek	31	3	9.7
Forehead	14	2	14.3
Forearm and wrist	23	1	4.3
Trunk	1	0	0
Leg	4	1	25.0

The upper eyelids and neck would appear to be a much more fatal situation than the face or other parts. The mortality diminishes from the head downwards. The French statistics correspond more or less with the English ones.

As much of the hair, bristles, wool and hides used in this country are imported, it is of importance to examine the prevalence of the disease in other countries.

Professor Monti says that in Italy human anthrax is more frequent than in any other European country. From 1890-1904, a period of 15 years 36,426 cases were reported (both industrial and non-industrial anthrax being notifiable) and of this number 7308 died. This gives a percentage mortality of 20.6. During the same

period the number of cases has steadily increased but the death rate has diminished a fact which is probably to be attributed to the introduction of serum-therapy by Sclavo. The disease in Italy is generally of agriculture origin and the lesions therefore are most frequent on the upper extremities.

In France no official statistics are available. From information received from traders the disease is rare and what cases occur are generally traced to manipulation of Russian or Chinese hair.

In Germany we find that from 1894-1903 (ten years) 901 cases of human anthrax from all causes occurred. Of these 128 were fatal, giving a percentage mortality of 13.9. Only 4.1% were industrial in origin. The agricultural form therefore prevails.

Information as to the prevalence of anthrax in China is unsatisfactory. A medical man writing from that country states that he has been on the look-out for cases during the past 6 years and that so far he personally has not seen a case.

This is rather remarkable as China heads the list of countries from which the infection is spread: The conditions too under which the animals live are

particularly conducive to the development of the organism. An animal epidemic with a mortality varying from 50 - 75% and showing symptons strongly suggestive of pulmonary anthrax occurred at Hsuchonfou. Half a million of these hides were exported. The possibility of anthrax infection has at any rate impressed itself upon the Chinese mind for although they handle raw materials freely they take certain precautions. Bristles and hair are well boiled in soda solution: wool is roughly carded and shaken by machinery to get rid of dust: whilst hides are sorted and packed with naphthaline.

The explanation of the infectivity of Chinese material lies probably in the fact that during the passage through the Indian ocean and Red Sea in the warm hold of a ship the spores are preserved, so that when the bales are opened these are liberated and infect home-workers.

A similar state of affairs to those in China appears to exist in the Argentine where it is said no human anthrax has been known though millions of hides and skins and thousands of tons of wool pass through it. Cases of anthrax have occurred in

Liverpool after working with South American hides, so that this statement must be accepted with caution.

Special conditions seem to be necessary for the germination of anthrax spores into bacilli. In most countries where the disease exists endemically or epidemically it has been found that the incidence is greatest in the hot summer months.

The number of cases increase, and reach a maximum in July, after which there is a fall until in November and December the figures reach the level of the early months of the year. According to Legge, Great Britain is an exception to this rule, there being fewer cases in the summer months. If this means anything, it means that the other necessary conditions for the development of the spores are absent. Koch after observation made in the anthrax districts of France concludes that the favourable conditions are (1) Moderately impervious layers of chalk, marl or clay (2) sand lying in impervious ground and containing decomposing animal and vegetable matter and (3) peaty soils rich in organic and mineral matter e.g. steppes, prairies, moors and marshland. Given these and a suitable temperature (12° C. - 45° C.) the bacilli will multiply.

SUMMARY.

Infection in man is usually by means of infected animals. In this country industrial cases are more numerous than agricultural and are the result of manipulations of Chinese, Russian and Persian wool and hair and South American hides.

The mortality in woollen workers is increasing, due to the larger number of internal cases.

There is a high mortality rate in the miscellaneous industries in which anthrax is not suspected.

In a given case, an early diagnosis may be facilitated by the nature of the employment giving rise to a suspicion of anthrax.

Anthrax is more fatal in women than in men though the occupational risk is greater amongst men,

The lowest mortality is amongst hair and bristle workers though the risk with hair work is greater than with wool workers.

The nature of the lesion varies with the industry.

The position of the pustule varies slightly with the occupation.

The mortality varies with the situation.

In all countries except Great Britain agricultural anthrax is the most common.

There has been a progressive increase of cases in Italy, but a decrease of the death rate.

Infection may be carried in clothes or nails to non-workers.

Anthrax spores on hair may retain their vitality for years.

There is an increased incidence amongst animals during the hot summer months.

In certain districts special conditions of the soil exist which make them permanent centres of infection.

Owing to the fact that Russian, Chinese and Persian wools are avoided by manufacturers, industrial anthrax in Scotland is a rarity. The disease when it does occur is usually agricultural in origin and even then it is infrequent.

Anthrax is formidable not only from its severity and the frequency of a fatal issue but also because of the insiduous nature of the attack.

For these reasons a study of nine cases, especially from the point of view of diagnosis, prognosis and treatment, which came under my notice during a 2½ years hospital residence in Dewsbury, one of the "woollen" towns in the West Riding of Yorkshire may be of some value especially in consideration of the

fact that the recovery rate was 100 per cent.

After a careful study of the literature I believe that this is the largest consecutive series of cases treated without a death. *

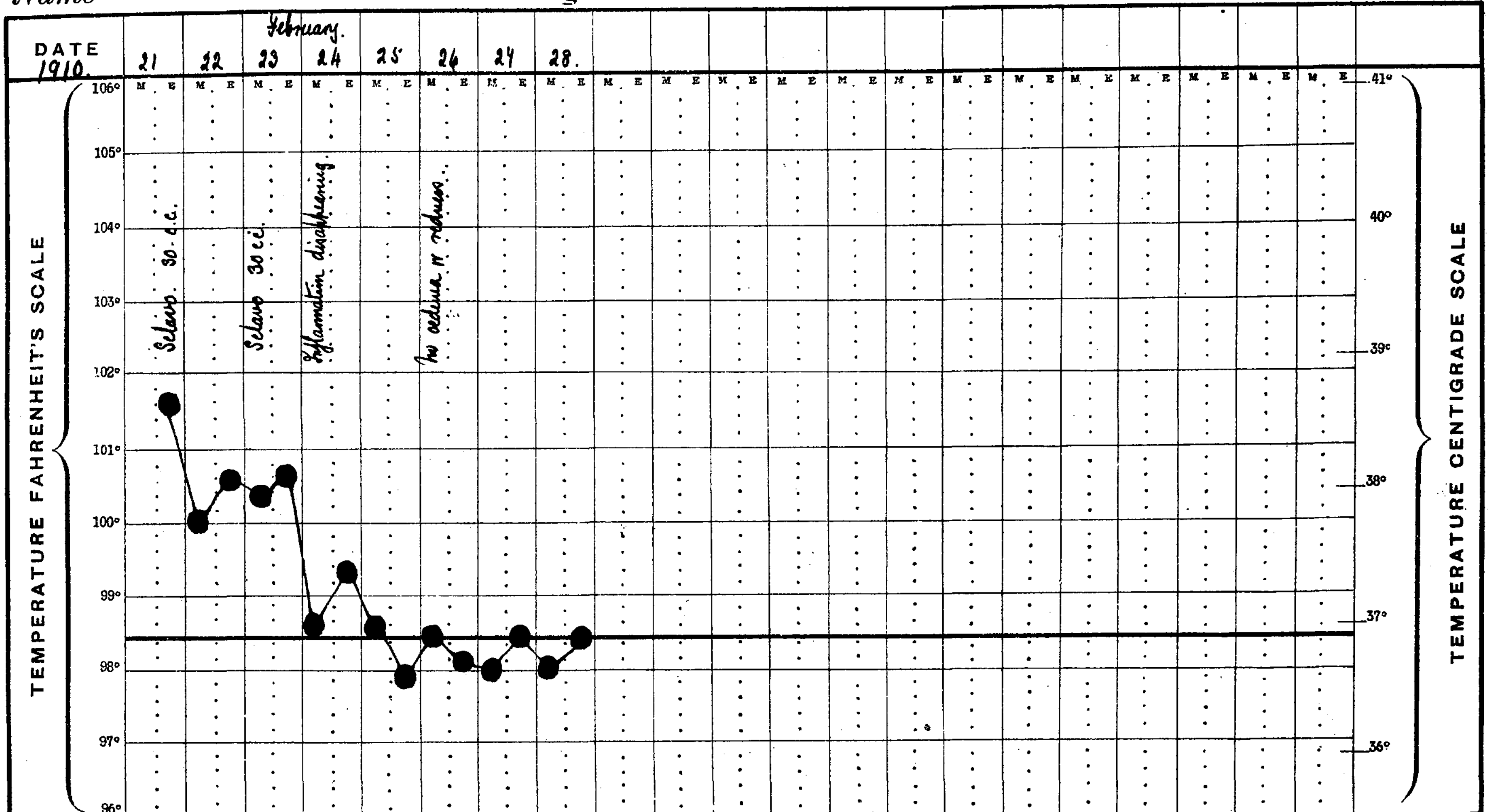
* Muskett in Lancet 1888, reports 4 of a series of 50 cases which he treated in S. Africa with Ipecacuanha, without a death. Bacteriological verification was absent in all.

PART II

CASES

CLINICAL CHART OF TEMPERATURE, &c.

Name Case. I. *Age* 12. *Disease* *Result*



		21	22	23	24	25	26	27	28	Remarks
Pulse	*m*		104	82	80	78	84	80	68	*Pulse m*
	E	116	100	104	88	82	80	72	70.	*E*
Resp.	*m*		22	36	22	22	20	24	22	*Resp. m*
	E	30	24	26	22	22	24	24	22.	*E*
Motions		-	2	-	1	1	4	3	1	*Motions*
URINE	*No. of ozs.*									*No. of ozs.*
	Sp. Gr.	1010								*Sp. Gr.*
	Reaction	acid								*Reaction*
	Chlorides									*Chlorides*
	Albumen	nil	-	-	-	-	-	-	-	*Albumen*
DAY OF DISEASE										REMARKS

(*Observations taken at.........A.M. and.........P.M.*
For Memoranda of Treatment, see back of Chart.)

CASE I. S.P. a school-boy aet 12 was admitted on the 21st February 1910 complaining of "a swelling" on the chin of four days duration. This had caused him so little discomfort that he did not see a Doctor until it was evident that the sore was spreading.

On admission the lad appeared to be in every way comfortable. The temperature was 101.6° F. the pulse 116 and the respiration 30.

The tongue was furred slightly. Examination of the abdomen was negative. The heart and lungs were normal. There was no albumen in the urine. On the tip of the chin there was the typical sore of external anthrax. The lesion consisted of a black central slough, half an inch in diameter with a single annular vesicle surrounding it. Around this there was a well marked phlegmon. The submaxillary glands were enlarged and tender.

The vesicle was punctured and its serous contents examined microscopically. A few bacilli having the morphological character and staining reactions of the Bacillus Anthracis were present. Blood films made at the same time and stained by Gram's method failed to show bacilli. The leucocytes numbered 12,600 per

c.m.m. and of these 80% were polymorphonuclear neutrophiles.

Thirty c.c. of Sclavo's serum were administered hypodermically in the interscapular region, a diaphoretic diuretic mixture was prescribed and a dry dressing applied. Four hours after the administration of the serum the temperature was 100.2° F. the pulse 100 and the respirations 28. The leucocytosis was 12,000.

Next day (22nd) the local condition remained unchanged. The temperature was 100.6° F. and the lencocytosis 10,800. Serum was withheld and the other treatment continued.

On the 23rd no further vesication had occurred, and the sore though little improved had not extended The temperature was 99.2°, pulse 104 and respirations 26. Twenty cc. of serum were injected. On the 24th the local condition showed distinct signs of improvement. The temperature was now normal (98°), the pulse 88 and the respirations 22. The lencocyte count was 9,600 and differentially normal.

Thereafter there was steady improvement. On the 26th, five days after the commencement of treatment the inflamatory oedema and adenitis had disappeared.

On the 2nd of March - nine days after admission the slough had separated and the patient was allowed up. He was discharged on the 22nd of March, the sore having healed soundly.

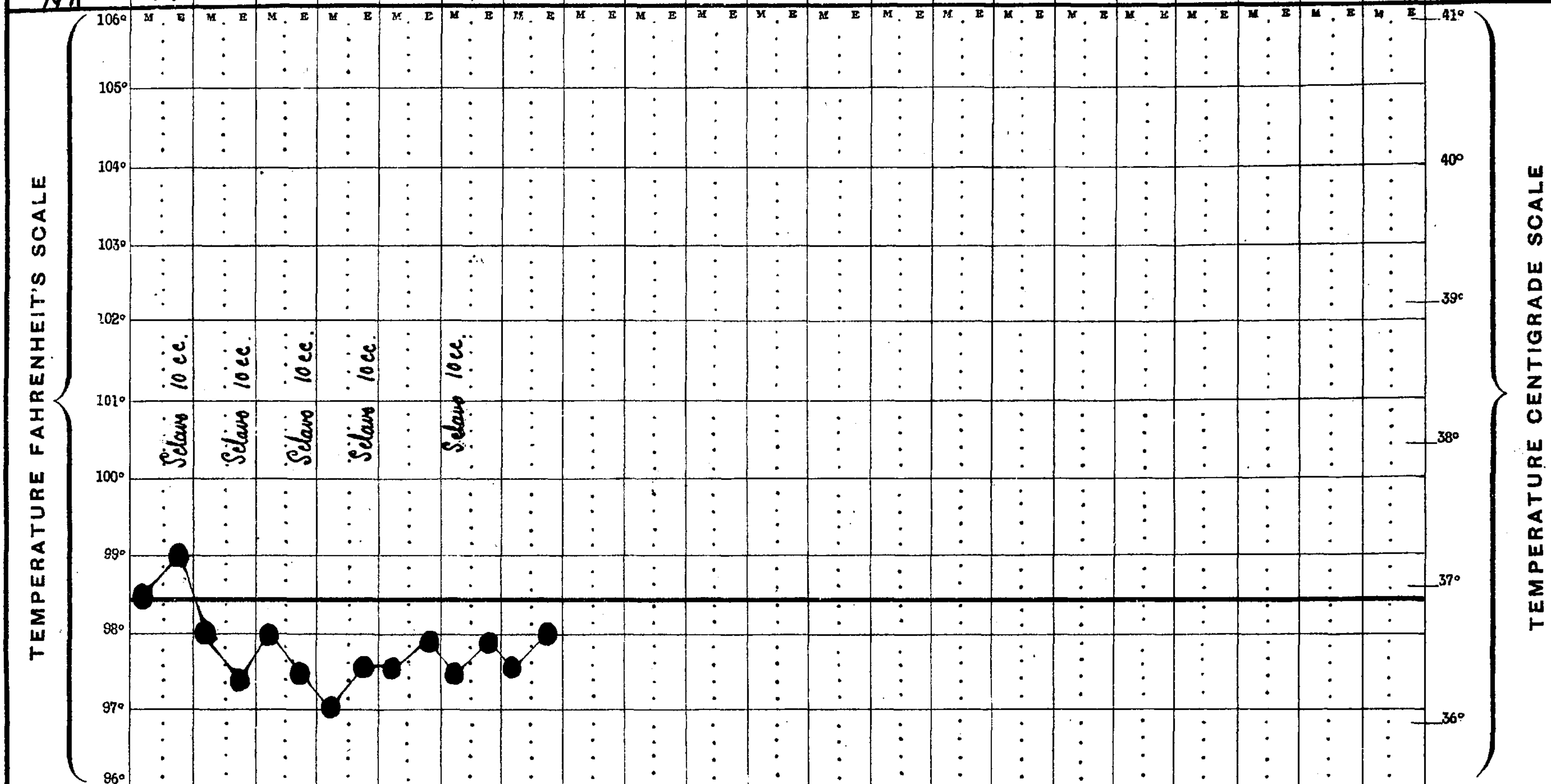
Swabs sent to the County Hall, Wakefield, were reported upon as positive after microscopic and cultural tests and animal inoculations. The identity of the organism present with B. Anthracis was definitely established.

The source of infection in this case is and will remain a mystery. None of the members of his family were engaged in the wool or hair industry and he had never entered a factory or warehouse. The probability is that he had somewhere and somehow picked up the spores of the organism; that these had harboured beneath his nails and that he had by scratching his chin, inoculated himself. An outbreak of the disease in cows in the neighbourhood of Dewsbury was attributed to the dust (infected) being carried from a winnow in a mill into the fields. A similar explanation may account for the appearance ofthis sore in a schoolboy who in no other known way was exposed to infection.

CLINICAL CHART OF TEMPERATURE, &c.

Name Case. II. *Age* *Disease* *Result*

DATE 1911	Feb. 27	28	March 1	2	3	4	5



		Feb. 27	28	March 1	2	3	4	5
Pulse	m	92	80	84	76	76	72	72
	E	96	88	84	72	72	72	72
Resp.	m	24	20	20	20	24	22	20
	E	20	20	20	22	24	20	20
Motions		1	2	-	1	2	1	1
URINE	No. OF OZS.							
	Sp. Gr.	1020						
	Reaction	acid						
	Chlorides	-						
	Albumen	nil.						
DAY OF DISEASE								

REMARKS

(*Observations taken at.........A.M. and.........P.M.*
For Memoranda of Treatment, see back of Chart.)

CASE II. E.H. aet 32, a hackler in a horse-hair factory was admitted to the Dewsbury Infirmary on the 27th February 1911 complaining of a sore on the back of his neck. Three days previous to admission he noticed a "pimple" on the right side of his neck behind and thinking that his collar was responsible, he ignored it. Next day (25th) there was a decided increased in size, so much so that he had to remove his collar and wear a muffler. The neck was stiff and painful On the 26th the condition was much the same but it was not until the 27th that he became anxious and decided to see his medical man, who at once ordered his removal to the infirmary.

On admission the patient looked haggard and ill. The tongue was coated. The temperature was 99° F. the pulse 96 and the respirations 24. His general condition was so unsatisfactory as to suggest the possibility of a rapid and fatal development of the disease.

The lungs and urine were normal. The heart sounds were feeble and distant but pure.

On the neck, behind and on the right side was a sore with a black depressed slough, the size of a

shilling, in the centre surrounded by a zone of vesicles. Outside this there was redness and inflamatory oedema. The glands were not enlarged.

Ten ccs. of Sclavo's serum were injected into the cellular tissues between the shoulders and treatment calculated to improve the general condition was pushed. A dry dressing was applied to the sore after swabs had been taken from the serum in the vesicles. Next day (28th) he was feeling decidedly better. The temperature was 98°, pulse 88 and respirations 20. Serum (10 ccs) was again administered intracellularly. The report from the County Hall, Wakefield stated that no anthrax bacilli were present in the films.

On the 1st March the general condition was maintained. Locally the oedema had disappeared but fresh vesiculation had made its appearance. Ten ccs of Sclavo were injected. A further report stated that Bacilli Anthracis had been obtained culturally but that the inoculated guinea-pig remained well. On the 2nd March, 10 ccs. of serum were again injected; on the 3rd a report was received stating that the guinea-pig had been found dead and that the post-mortem signs were typical of anthrax. The bacilli

had been recovered from the blood. The guinea pig had survived the inoculation for three days. A further dose of serum (10 ccs.) was administered on the 4th. This completed the treatment. On the 6th the patient was allowed up; on the 15th the slough separated and on the 24th he was discharged.

In the particular factory in which this man was employed, hair imported chiefly from Russia, China and Persia was used. As this is recognised as dangerous material special precautions are taken during its manipulation, but amongst the workers themselves "sorting" is the only recognised danger. The hair having been liberated from the bales is placed in the sorting room. The worker having donned his respirator and over-alls, separates the hair according to its quality and colour on a sieve which rests on a suction apparatus. The dust liberated in this process is carried by a duct through the floor to a collecting chamber outside from which it is removed and burned at intervals. The hair is then removed to the hackling room where it is immersed in tubs containing a 2% solution of cyllin. It is allowed to soak for 10 hours ere being hackled. In this process

the hairs are separated by means of a steel comb with long teeth. The handfuls of hair are carried over the right shoulder, brought down with force on the comb and drawnvigorously through the teeth. The hair is then dried and after drying is sent to the bundling department.

White hair is more expensive and delicate than the coloured and for this reason disinfection and hackling are dispensed with. The hair is washed and separated by hand instead, and for this purpose women are usually employed. It will be seen then that the dangerous processes in a hair factory are the sorting and washing manipulations.

E.H. whose case has been detailed only worked the hair after it had been soaked in cyllin, yet he developed the external sore of anthrax probably by touching his neck with infected hair, and fromthis it would appear that cases are liable to occur in practically all the processes to which hair is subjected. Predisposing factors in this case were the debility due to a lengthy period of unemployment with its associated semi-starvation; excessive drinking, and the fact that he was a beginner having been employed in this factory for three months.

CLINICAL CHART OF TEMPERATURE, &c.

Name Case III. *Age* *Disease* *Result*

DATE 1911.	June. 8	9	10	11	12	13.
Pulse M	78	72	72	68	78	80
Pulse E		72	80	72	78	80.
Resp. M	22	22	22	22	22	22
Resp. E		22	24	22	22	22
Motions	1	2		2	1	1
URINE No. OF OZS.						
URINE Sp. Gr.	1040					
URINE Reaction	acid					
URINE Chlorides	-					
URINE Albumen	nil.					
DAY OF DISEASE						

TEMPERATURE FAHRENHEIT'S SCALE: 106° 105° 104° 103° 102° 101° 100° 99° 98° 97° 96°

TEMPERATURE CENTIGRADE SCALE: 41° 40° 39° 38° 37° 36°

10 cc. Solaro — 10 cc. Solaro — no vaccine. — 10 cc. Solaro

REMARKS

(Observations taken at.....A.M. and.....P.M.
For Memoranda of Treatment, see back of Chart.)

CASE III. J.T.H. aet 41, a labourer on the L. & N.W. Railway was admitted as an in-patient on the 8th June 1911 complaining of a sore at the right angle of the mouth with pain and stiffness on opening and closing the mouth.

Whilst unloading wool in the Goods Yard four days before admission he noticed a pimple at the angle of his mouth. This increased in size and becoming anxious about it he came to the infirmary on the 8th of June to have it attended to.

Patient was well nourished and except for the pain and stiffness on opening and closing the mouth made no complaint. Temperature was 99° F. pulse 78 and respirations 22. Examination of the different organs revealed no abnormality. At the right angle of the mouth and invading the lower rather than the upper lip was a sore composed of the following parts (1) black central slough (2) zone of vesicles and (3) inflamatory oedema and slight redness. The submaxillary glands were slightly enlarged and tender. Swabs were taken and dispatched for examination. Next morning (9th) ten ccs. of Sclavo's serum were injected between the shoulders. On the 10th a positive anthrax

report was received. "Cultures from this specimen show the presence of a few colonies having the characteristic appearance of those of anthrax.

Microscopical examination of these colonies shows that they are composed of bacilli which in morphology and staining reaction are typical of B. Anthracis.

Numerous colonies composed of staphylococci are also present." A further dose of serum (20 ccs) was administered. Temperature was 98°, pulse 72 and respirations 22. On the 12th, 10 ccs of serum were administered, the temperature then being 98°, pulse 68 and respirations 22. Improvement thereafter was rapid. On the 12th the vesicles had disappeared; on the 18th the slough separated and on the 23rd the patient was discharged.

The source of infection in this case is evident. Be it noted however that as in Case II a period of unemployment had immediately preceded, and that though there was no visible deterioration there must have been a diminished resistance, and also that this was the first occasion on which he had handled wool.

With the exception of a slight degree of fever on admission there was no temperature or constitutional

CLINICAL CHART OF TEMPERATURE, &c.

Name Case IV. Age 24. Disease Result

DATE	23	24	25	July. 26	27	28	29	30	31
TEMPERATURE FAHRENHEIT'S SCALE	106° 105° 104° 103° 102° 101° 100° 99° 98° 97° 96°								
	10 c.c. Selavo	30 c.c. Selavo							
TEMPERATURE CENTIGRADE SCALE	41° 40° 39° 38° 37° 36°								
Pulse m	88	96	84	96	96	84	84	84	92
Pulse E	96	96	96	84	84	96	84	84	
Resp. m	24	24	24	24	24	24	24	24	24.
Resp. E	24	24	24	24	24	24	24	24	
Motions	-	3	2	2	-	1	1	2	4.
URINE No. OF OZS.									
URINE Sp. Gr.	1030								
URINE Reaction	acid								
URINE Chlorides	-								
URINE Albumen	nil.								
DAY OF DISEASE									

(Observations taken at.....A.M. and.....P.M.
For Memoranda of Treatment, see back of Chart.)

disturbance throughout his period of residence, and that from a bacteriological point of view the anthrax bacilli were few whilst numerous staphylococci were present. This fact had in my opinion much to do with the mildness of the infection and the speedy convalescence.

CASE IV. F.S. a weaver, aet 27 was admitted to the Dewsbury Infirmary on July 23rd 1911.

The history she gave was that on the 19th of July whilst at work in the weaving shed she fell and grazed her forehead. Two days later she noticed a sore in the centre of her forehead near the scalp and on hearing from a companion that it looked like anthrax, she decided to come to the infirmary.

On admission a sore situated on the margin of the hairy scalp on the forehead was present showing all the characteristic signs of external anthrax. There was a black depressed centre about the size of a sixpenny piece with a few small vesicles around it. There was slight inflamatory reaction around. No glands were palpable and constitutional symptoms were so entirely absent that she did not wish to remain

as an in-patient.

All the organs were healthy. Temperature was 97.2°, pulse 88 and respirations 24.

After swabs had been taken, 20 cc's of Sclavo's serum were injected into the cellular tissues between the shoulders and a wet carbolic dressing (1-40) applied to the sore. The excretory organs in this as in every case recorded were carefully attended to.

On the 24th the temperature reached 100.4°, the pulse then being 96 and the respirations 24. The bacteriologist reported that anthrax-like bacilli had been recovered from the vesicles and that guinea-pigs had been inoculated. Thirty ccs. of serum were administered.

On the 25th the local condition was much improved. The redness and oedema were disappearing and no further vesiculation had taken place.

The temperature was 99°, the pulse 84 and the respirations 24. During the remainder of her stay in hospital these phenomena never exceeded the normal limits. On the 29th it was reported that the guinea pig had died and that typical post-mortem signs of anthrax were present.

CLINICAL CHART OF TEMPERATURE, &c.

Name Case I. Age 54. Disease Result

DATE	5°	6	7	August 8	9	10	11	12
Pulse m		92	92	68	76	80	72	74
Pulse E	94	98	92	92	92	92	92	92
Resp. m			26	20	22			
Resp. E	28	24	24	24	20			
Motions		2	-	3	1	1	1	2.
URINE No. OF OZS.								
URINE Sp. Gr.								
URINE Reaction								
URINE Chlorides								
URINE Albumen								
DAY OF DISEASE								

TEMPERATURE FAHRENHEIT'S SCALE: 106° 105° 104° 103° 102° 101° 100° 99° 98° 97° 96°

TEMPERATURE CENTIGRADE SCALE: 41° 40° 39° 38° 37° 36°

Solano 10 cc. Solano. 20 cc.

REMARKS

(Observations taken at.....A.M. and.....P.M.
For Memoranda of Treatment, see back of Chart.)

The slough separated on the 83rd of August and the same day she was discharged.

Here again is an example of the disease occurring at a stage in the manufacture when the wool had passed through many hands and a few processes without producing any infection. Though chiefly infecting the workers in the earlier processes, the disease then is liable to affect anyone engaged in any of the processes.

The absence of symptons is noteworthy also in this case and had it not been for the suggestion of her companion there is no saying what might have been the ultimate result.

The disease is an insidious one, trifling in appearance at first but capable of explosion at any time with dire results.

CASE V. W.P. aet 54 a card fettler in a wool factory was admitted on August 5th 1911 suffering from external anthrax on the right side of the chin.

The history obtained from this man was that on the 1st of August he had a little pain in his chin;

on the 2nd he noticed a red pimple and on the 4th he felt decidedly out of sorts, having pains all over his body and swelling beneath the jaw. When admitted on the 5th his temperature was 102.8° F. the pulse 94 and respirations 28. The tongue was coated. Examination of the heart, lungs, abdomen and urine was negative. On the right side of the chin and involving the lower tip rather than the submaxillary region there was a sore consisting of (1) a central black slough a little larger than a threepenny piece (2) a complete ring of serum containing vesicles immediately around the slough and (3) swelling and discolouration of the skin surrounding the slough and vesicles. The submaxillary glands were enlarged and painful. There was a lencocytosis of 13,800 chiefly polymorphous on admission. Swabs were obtained from the vesicular fluid and 30 ccs. of Sclavo serum were injected into the interscapular connective tissue. A diaphoretic-diuretic mixture not containing ipecacuanha was prescribed and magnesium sulphate freely administered. Milk diet was given.

Next day (6th) patient was feeling slightly better. He did not sleep much but the pains were less

severe. The temperature in the morning was 103°, pulse 110 and respirations 28, in the evening these were 101, 78, 24 respectively. Ten ccs. of serum were administered.

On the 7th he was considerably better. The local condition had improved beyond measure, the swelling and adenitis had almost gone and no further vesiculation had occurred. The temp. was 98°, the pulse 72 and the respirations 24. The lencocyte count was a normal one - 9,200 per c.m.m.

No further serum treatment was really necessary but as positive bacteriological reports had been received from Wakefield it was decided to administer a final dose of serum. Ten ccs. were accordingly given.

The temperature remained normal for the remainder of the time; the condition of the sore steadily improved and he was discharged on the 25th day of August after 20 days residence in the infirmary.

The patient was never aware of any accident likely to cause an abrasion of the skin in the region of the chin but admitted the possibility of his scratching his chin with his fingers during working hours. The

CLINICAL CHART OF TEMPERATURE, &c.

Name Case VI. Age 49. Disease Result

DATE 1911	25	September 26	24	28	29	30	1	Oct. 2	3
Pulse m	98	68	72	72	76	74	80	80	72
Pulse E	68	70	72	72	72	72	72	71	76
Resp. m	24	20	22	22					
Resp. E	22	22	22	20					
Motions	-	1	1	1	1	1	-	1	1
URINE No. OF OZS.									
URINE Sp. Gr.	1028								
URINE Reaction	acid								
URINE Chlorides	-								
URINE Albumen	nil.								
DAY OF DISEASE									

Selano 20 c.c.

Selano 10 c.c.

TEMPERATURE FAHRENHEIT'S SCALE: 106° 105° 104° 103° 102° 101° 100° 99° 98° 97° 96°

TEMPERATURE CENTIGRADE SCALE: 41° 40° 39° 38° 37° 36°

REMARKS

(Observations taken at.....A.M. and.....P.M.
For Memoranda of Treatment, see back of Chart.)

inoculation had probably taken place in this way.

CASE VI. G.B. aet 49 a hide worker was admitted into hospital on September 25th 1911 complaining of a sore on his left arm above the elbow of a few days duration. He paid no attention to his arm until the day of admission and could not state definitely when first the sore made its appearance.

On admission no complaints of any kind were made. The man was of slight build but examination of the different systems failed to reveal any abnormality. The temperature, pulse, and respirations were normal.

On the outer side of the left arm just above the elbow was situated a sore, the whole covering an area in size equal to half a crown. In the centre was a circular black depressed slough surrounded by a ring of vesicles containing clear fluid and around this again a small amount of redness and oedema. There was no lymphangitis nor axillary adenitis.

Swabs having been made from the vesicular fluid and dispatched for bacteriological examination, twenty ccs. of Sclavo's serum were administered

intracellularily between the shoulders.

On the 26th, temperature, pulse and respirations were normal. Ten ccs. of serum were injected.

A report received from the laboratory stated that the films showed the presence of anthrax like bacilli and that cultures had been made and a guinea-pig inoculated.

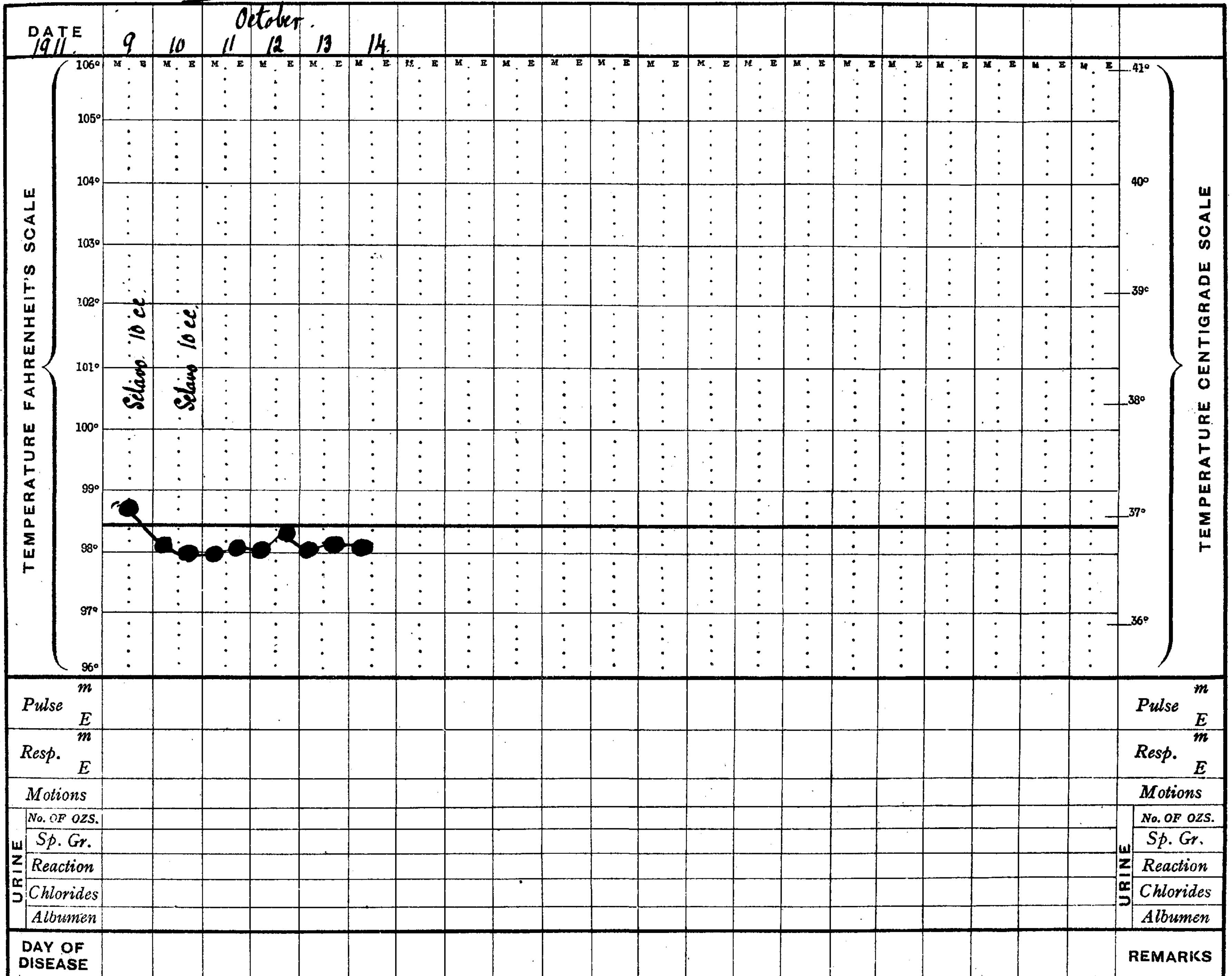
On the 27th cultures showed the presence of a few anthrax bacilli and an abundant growth of staphylococci. On the 28th the guinea-pig was found dead and on post-mortem typical signs of anthrax were present. The bacilli were recovered from the heart blood.

The patients temperature remained normal throughout and he was discharged on the 8th of October, 12 days after admission.

The firm for whom the patient worked dealt only with English hides and skins. These they purchased in large amounts and sold to fellmongers. The skins were not worked in any way but were sold in the same state as they were purchased. The soaking in lime and separation of the hair and wool from the skins were carried out by the fellmongers. This was the first case of anthrax which had occurred in the history

CLINICAL CHART OF TEMPERATURE, &c.

Name Case VII. *Age* 2½. *Disease* *Result*



(*Observations taken at..........A.M. and..........P.M.*
For Memoranda of Treatment, see back of Chart.)

of the firm. No other workmen were affected.

The bacteriological report stated that the anthrax colonies in the culture were few whilst those of the staphylococcus were abundant. The constitutional disturbance in this case was nil, the convalescence was a rapid one and healing sound with a very small amount of scar formation.

This satisfactory progress and termination I attribute to the presence of the staphylococci and I feel sure that a spontaneous and natural cure would have resulted in the absence of serum treatment.

CASE VII. This case is of unusual interest firstly because I have not in my search through the literature of anthrax discovered a case occurring in a lad of such tender years and secondly because of the clinical and bacteriological doubt as to the diagnosis which existed during the investigation of the case. Fortunately, despite the uncertainty of the diagnosis and the initial negative findings of the bacteriologist treatment with serum was commenced at once.

W.K. aet 2½ years was first seen by Dr. P. on October 9th 1911. External anthrax was diagnosed and

the child promptly conveyed to the Infirmary.

The child on admission was healthy and robust in every way. The heart, lungs and kidneys were functionating normally whilst abdominal examination was negative. The temperature, pulse and respirations were normal.

In the centre of the right cheek there was a rounded swelling about the size of a threepenny piece in appearance not unlike three quarters of a small marble adhering to the skin. In the centre of this swelling a small slightly depressed black slough was evident. There was an entire absence of vesication, inflamatory oedema or redness. No glandular enlargements were detected.

The absence of vesication, inflamatory reaction and temperature in a child so young made me doubt the accuracy of the diagnosis. Ten ccs. of Sclavo's serum were however injected into the subcutaneous tissues of the abdomen, a dressing was applied and the child's arms fixed.

Next day swabs were made and sent for examination, and a further ten ccs. of serum administered.

On the 11th it was reported that no bacilli had

been discovered on microscopic examination but that cultures had been made and a guinea-pig inoculated and a report on these experiments would be forwarded in due course.

On the 12th the cultures were reported to be negative and the guinea-pig well. Temperature, pulse and respiration normal and the child in every way quite well.

On the 13th the guinea-pig died and post-mortem typical signs of anthrax were found.

The Bacillus Anthracis was recovered from the heart blood.

The condition of the sore continued to improve, the slough separated and the child was discharged on the 26th October, 17 days after admission.

It transpired shortly after admission that the child's father was a worker in a horse-hair factory, and the probability is that he had carried the infection to the child either under his finger nails or else on his chin. Inoculation by either means would then be a simple matter.

The points of interest in this case apart from the age of the patient are (1) the atypical appearance

CLINICAL CHART OF TEMPERATURE, &c.

Name Case VIII *Age* 13 *Disease* *Result*

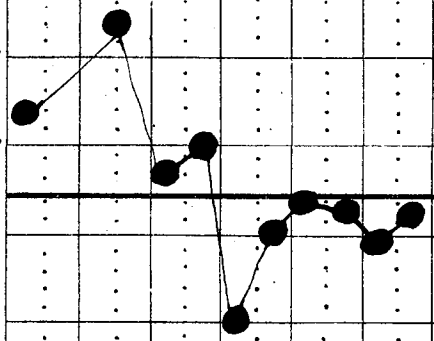
DATE 1911	24	28	October 29	30	31	1	2
Pulse M							
Pulse E							
~~Resp.~~ M	80	82	74	74	72	68	
~~Resp.~~ E	76	80	72	76	70	72	
Motions							
URINE No. OF OZS.							
URINE Sp. Gr.							
URINE Reaction							
URINE Chlorides							
URINE Albumen							
DAY OF DISEASE							

TEMPERATURE FAHRENHEIT'S SCALE: 106° 105° 104° 103° 102° 101° 100° 99° 98° 97° 96°

TEMPERATURE CENTIGRADE SCALE: 41° 40° 39° 38° 37° 36°

Solang 20 c.c.

Solang 10 c.c.



Pulse M / E

Resp. M / E

Motions

URINE No. OF OZS. / Sp. Gr. / Reaction / Chlorides / Albumen

REMARKS

(*Observations taken at.....A.M. and.....P.M.*
For Memoranda of Treatment, see back of Chart.)

of the sore (2) the entire absence of temperature and constitutional disturbance and (3) the length of time - four days - ere a positive anthrax report was received and that too after negative microscopical and cultural examination.

CASE VIII. A.S. aet 13, a hanker was admitted to hospital on October 27th 1911 complaining of a swelling on the right arm. The disease first showed itself as a small red pimple just above the elbow on the outer side of the arm and so far as she can remember she first noticed it on or about the 21st October.

The Girl looked robust and healthy. Examination of chest and abdomen was negative. Urine was normal. Temperature on admission was 99.2°, pulse 74 and respirations 20.

Just above the right elbow on the outer side of the arm a sore typical of external anthrax was visible. In the centre there was a circular depressed black slough in size rather less than a threepenny piece. As in case I, so in this only one vesicle surrounded the slough whilst outside this again there was well

marked redness and oedema of the skin.

Twenty ccs. of Sclavo's serum were injected beneath the abdominal skin. The temperature after the exhibition of the serum reached 100.4° whilst the pulse rate was unaffected.

On the 28th 10 ccs. were given. Temperature was 98.2°, pulse 70 and respirations 24. The sore had not altered much in appearance. Thereafter the temperature remained normal, the redness and oedema gradually disappeared, the slough separated and she was discharged well after a residence of ten days. The swabs sent for examination, microscopically culturally and after the death of the guinea-pig were positive for Bacillus Anthracis.

Ere reaching the hanking process the wool has passed through the following processes:-
(1) shaking (2) blending (3) willeying (4) scribbling (5) carding and condensing (6) spinning and (7) twisting. After hanking the wool is (9) scoured and (10) finished or dyed.

The wool therefore had passed through many hands ere it reached the patient yet no other employee was affected.

CLINICAL CHART OF TEMPERATURE, &c.

Name Case IX. *Age* 24 *Disease* *Result*

DATE 1911 — November — 20 21 22 23 24 25

TEMPERATURE FAHRENHEIT'S SCALE: 106° 105° 104° 103° 102° 101° 100° 99° 98° 97° 96°

TEMPERATURE CENTIGRADE SCALE: 41° 40° 39° 38° 37° 36°

Selano 20 c.c.

Selano 10 c.c.

Pulse m / E	
Resp. m / E	
Motions	
URINE — No. OF OZS.	
URINE — Sp. Gr.	
URINE — Reaction	
URINE — Chlorides	
URINE — Albumen	
DAY OF DISEASE	REMARKS

(Observations taken at.....A.M. and.....P.M.
For Memoranda of Treatment, see back of Chart.)

Anthrax occurring in hankers is unusual and from this point of view the case is an interesting one. Herley reported another such case in the Lancet December 4th 1909.

CASE IX. H.C. aet 24, a willeyer, was admitted into the Infirmary on the 20th November 1911.

He had never to his knowledge injured his arm but four days before admission he noticed a small red pimple on the back of his right forearm just above the wrist. It felt painful but he paid no attention to it even although it was increasing in size until a fellow worker suggested the possibility of anthrax to him.

On admission the temperature was 99.4°. There were no constitutional symptons and the organs were healthy.

The sore was situated on the back of the right forearm just above the wrist. It presented the black central depressed slough about the size of a florin; one solitary vesicle surrounding the central portion: and well marked oedema and erythema of the skin around.

There was no lymphangitis or adenitis.

In this case an experiment was tried. Twenty ccs. of Sclavo's serum were administered hypodermically on admission and four hours later the vesicle was snipped and a swab taken for bacteriological examination. On the 21st the temperature was 99°. The inflamatory oedema and redness were still marked. A further injection of ten ccs. was given. On the 22nd the temperature was normal and the local condition greatly improved. The slough separated on the 30th, ten days after admission and on the 2nd of December he was discharged, after twelve days residence in hospital.

The following reports were received from the County Hall, Wakefield on November 21st and 22nd "Films made direct from the swab and examined microscopically show the presence of large Gram positive bacilli which are probably B. Anthracis.

Cultures are being made and a guinea pig has been inoculated".

22nd November "Cultures from the above specimen fail to show the presence of any anthrax like organisms. Staphylococcus pyogenes aureus was present. The guinea

pig which was inoculated remains well"

Here again be it noted that the local condition was out of all proportion to the constitutional condition. There was marked inflamatory action around the sore and yet no constitutional disturbance was present. Staphylococci were again present and to the presence of this organism plus serum the short duration of the sore was probably due.

The following case is one in which I was called upon to make a post-mortem examination, but as I was not concerned with the case during life, it has not been included in the series of cases treated. For the history of the case I am indebted to the family doctor who was in attendance.

The patient a woman aet 32, and a worker in a hair factory became suddenly ill in the middle of the day. A rigor was the first sympton and following this there was a complaint of indefinite pains all over the body and general malaise. There was loss of appetite, but no sickness or vomiting. The bowels had been regular. When the Dr. was called in that evening he found the woman decidedly ill. The face

was flushed, the alae nasi were dilating and the tongue was thickly coated. The temperature was 103°, the pulse was frequent and quick and the respirations increased out of proportion to the pulse rate. There was no rusty spit nor complaint of pain in the side but on examination there was an impaired note at the right base behind.

Bubbling rales were audible over this area. The heart sounds were pure. A Urinary examination was not made. Abdominal examination was negative. The Doctor was rather puzzled with the case but gave it as his opinion that there was a commencing pneumonia. The patient had a poor night and during the day was manifestly sinking. She died early next morning two days after the onset of symptons.

The husband called for the death certificate and in the course of conversation remarked that a worker from the same factory was under treatment in the infirmary suffering from anthrax (E.H. whose case has been already recorded) and that he himself had noticed a small black spot between the eyes of the deceased. The Doctor who all along had been suspicious on hearing this, withheld the certificate and notified the coroner.

A post-mortem examination was ordered. This was carried out in deceased's house on 8th March 1912.

POST-MORTEM EXAMINATION

The body was well nourished.

On the skin over the glabella there was a small black depressed spot not quite so large as the head of an ordinary pin. There was no surrounding vesication oedema or inflamation.

The pericardium contained 10 cc. of clear fluid. The heart was of normal size and the valves were normal. The muscle was soft.

The lungs were congested and some fluid was found in the right pleural sac. There were no adhesions. The right lower lobe was practically solid. The remainder of the lung tissue was not collapsed. A careful search was made in the trachea and bronchi but nowhere was an anthrax sore discovered. The mediastinal glands were enlarged. The spleen, liver and kidneys were enlarged and congested. The large and small intestines appeared to be normal. The brain was normal.

The sore on the forehead was excised and together with a sample of right ventricle blood and portions of the right lower lobe, liver, spleen and kidney, was

sent off for bacteriological examination.

Smears made from all revealed numerous bacilli morphologically and in staining reactions resembling the bacillus anthracis. Cultures were made and guinea pigs inoculated. These confirmed the presence of the B. Anthracis.

This then was a typical case of the so-called wool-sorters disease, a disease in which somewhere in the respiratory tract there is a sore more or less resembling the cutaneous lesion described in the first nine cases and which is followed rapidly by anthracaemia, and death.

Had it not been for the presence of the black spot between the eyes this case would probably have been certified in the usual way and the true nature of the cause of death would have remained unsuspected. It is unusual to find an external and internal sore co-existing in the same person and so far as my search through the literature on the subject goes I can only find seven other cases. These were reported by Drs. Fleming and Stewart, Teacher, Scott, Mahomed, Newton Pitt, Fucar and J. H. Bell. In these cases the internal manifestations were present not in the

respiratory but in the intestinal tract.

The sore in the case just reported though not typical in appearance, bacteriologically was proved to be an anthrax sore. Smears were positive and sections of the excised portion showed the presence of the Bacillus Anthracis.

The question as to whether or not the cutaneous manifestation preceded the visceral in point of time is one which cannot be definitely settled. It may be that the infections were simultaneous or that the cutaneous preceded the visceral: and of the two the former seems to be the more probable.

P A R T III

ANALYSIS OF CASES WITH COMMENTARY

Analysis of Nine Cases in which Sclavo's Serum was Used.

Case	Age	Sex.	Date of accidental inoculation	Date of first appearance of symptoms	Date of Admission	Date of injn of Serum and amounts.	Total amount of Serum injected	Clear Days between symptoms & 1st injection	Date of discharge	Result	Position of Lesion	Occupation	
I	12	M	—	1910 Feb 17	Feb 21.	Feb 21. 30 cc Feb 23. 20 cc	50 cc	4	Mar 22	recovery	chin	School boy	No excision
II	32	M	—	1911 Feb 24	Feb 27	Feb 27. 10 cc 28. 10 cc Mar 1. 10 cc 2. 10 cc 3. 10 cc	50 cc	3	Mar 24	recovery	neck	hackler	No excision
III	41	M	—	1911 June 4	June 8	June 9. 10 cc 10. 20 cc 12 10 cc	40 cc	4	June 23	recovery	angle of mouth	railway labourer	No excision
IV	27	F	1911 July 19	1911 July 21	July 23	July 21. 20 cc 22. 30 cc	50 cc	2	Aug 23	recovery	forehead	Spinner	No excision
V	54	M	1911 Aug 1	1911 Aug 2	Aug 5	Aug 5. 20 cc 6. 10 cc 7. 10 cc	40 cc	3	Aug 25	recovery	Chin	Card fitter	No excision
VI	49	M	—	1911 Sep 22	Sep 25	Sep 25. 20 cc 26. 10 cc	30 cc	few days	Oct 8	recovery	left arm	hide worker	No excision
VII	2½	M	—	—	1911 Oct. 9	Oct. 9. 10 cc 10. 10 cc	20 cc	—	Oct 26	recovery	cheek	—	No excision
VIII	13	F	—	1911 Oct 21	Oct 27	Oct 27. 20 cc 28. 10 cc.	30 cc	6	Nov 6	recovery	arm	hawker	No excision
IX	24	M.	—	1911 Nov 16	Nov 20	Nov 20. 20 cc 21. 10 cc.	30 cc	4	Dec 2	recovery	forearm	milleyer	No excision

ANALYSIS OF FURTHER PARTICULARS

Case	No.of days in hospital	Inflamation subsided.	Slough separated	Staphylococci present.	Remarks.
I	29	5th day	9th day	yes	Temp. febrile
II	25	3rd day	16th "	-	
III	15	4th day	10th "	yes	Temp. normal
IV	31	3rd day	31st "	-	
V	20	2nd day	-	-	
VI	12	-	-	yes	Temp. normal
VII	17	"	-	-	
VIII	10	-	-	-	
IX	12	2nd day	10th "	yes	Temp.practically normal.

In five of the cases the anthrax lesion was situated on some part of the face, in three on the arm and in one only on the neck.

In the case of the hide worker the sore was situated on the arm and not on the neck as is usually the case.

The average dose of serum administered in every case intracellularily was 40 cc. and in each case there was entire absence of after-serum effects. After such a dose the inflamation disappeared in 3 or 4 days.

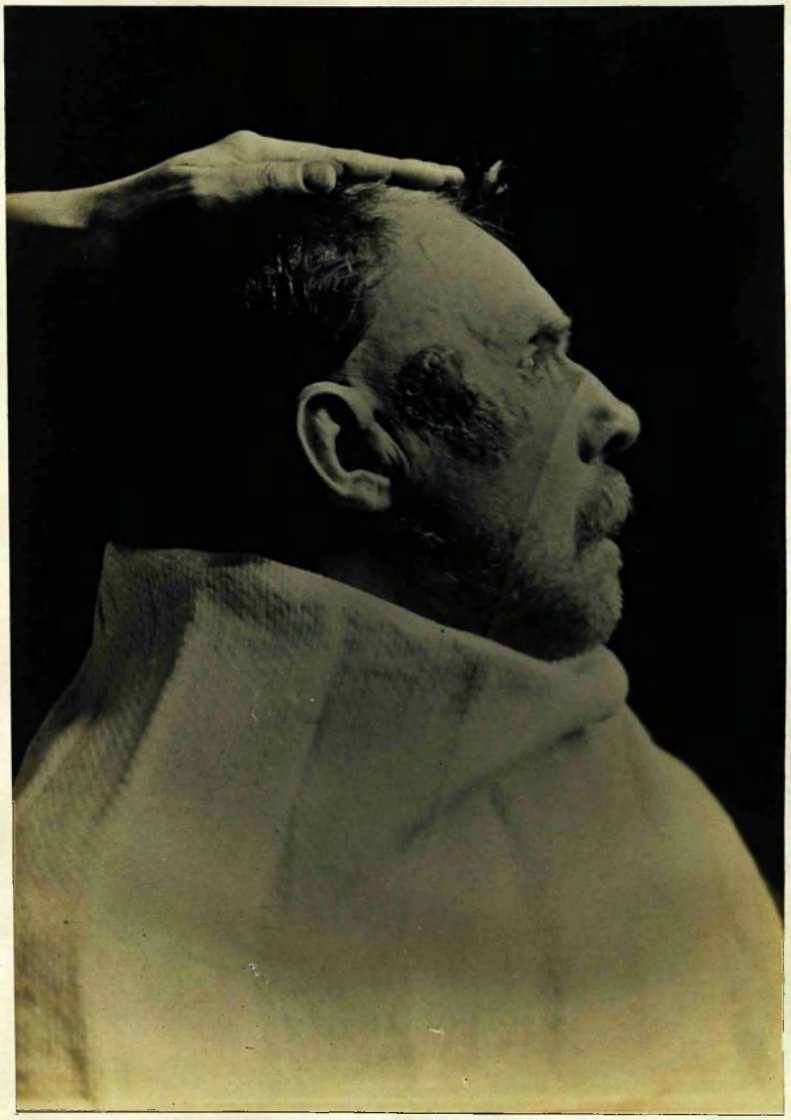
The average duration of residence in hospital, 19 days, is rather a lengthy period. I am convinced that when treatment is by serum a period of ten to twelve days is all that is required. The average is a high one because of the fact that in the earlier cases I made it the practice never to sanction discharge until the sore was quite healed. This is absolutely unnecessary and much hardship will be done away with, if the patient is allowed to go home a day or two after the separation of the slough.

The use of the term "malignant pustule" has been eschewed intentionally throughout, for the reason that it is not only a misnomer but also a misrepresentation of the facts. At no period in the development and course of the anthrax sore is pus present in the slough, in the vesicle or vesicles, or in the surrounding indurated and brawny tissues. The slough is black, dry and shrivelled in appearance; the vesicles contain a serous fluid, and the phlegmon if incised freely will fail to reveal the presence of pus. The terms external anthrax or cutaneous anthrax would be scientifically correct and at the same time less misleading.

DIAGNOSIS. As a general rule cutaneous inoculation occurs through small abrasions or scratches upon the skin in men who handle infected material. But it must be remembered that infection also takes place through the hair follicles and unbroken skin. Menschig in 1905 reported two such cases.

After an incubation period varying from one to four days the sore makes its appearance. It commences as a small red irritable pimple. After twelve to twenty-four hours a vesicle forms and bursts exposing the deeper layers of the skin. A ring of small vesicles, or it may be only one vesicle, (a ring form) forms round this and the skin in the vicinity quickly becomes swollen and assumes a dull-red hue. The central spot becomes black, depressed and shrivelled and the inflamed tissues indurated and brawny. The slough increases in size when the vesicles rupture and a fresh ring forms. The sore may at this stage undergo a natural cure and under treatment will quickly resolve. In a certain proportion of untreated cases, however, the oedema and discolouration rapidly spread, fresh vesicles form irregularly on the surface of oedematous swelling and death ensues either from the mechanical effects of the lesion, or as a result of anthracaemia.

External Anthrax showing central slough and vesicles (Herley)



External Anthrax showing black centre, vesicles and oedema (Herley)

The characteristic points in a mature cutaneous anthrax sore, then are (1) a central depressed black eschar (2) a ring of vesicles or it may be only one vesicle (as in Cases I, VIII and IX), (3) brawny induration. (4) absence of severe pain and (5) total absence of pus. An early diagnosis, that is within the first 2 or 3 days is usually impossible as in practice it is found that the patients will not present themselves until the black eschar and vesiculation are well marked. During the early days "it is just a pimple" and they will not trouble themselves to seek advice until the course and development of the sore prove to them that it is something more. In order to make an early diagnosis, it ought to be persistently impressed upon the workers that from the nature of their employment a small red pimple is highly suspicious of anthrax and should at once receive attention.

The cutaneous manifestation of anthrax does not always assume the "book picture" form and as a result of my experience I recognise four types

(1) There may be as in the fatal case described simply a minute black depressed eschar, with no

Anthrax .Oedema (Herley)

surrounding vesicle or inflamatory formation.

(2) The sore may consist of the central black slough surrounded by vesicles but by no oedema or redness as in Case 4.

(3) Central slough, vesication (single or multiple) and inflamatory reaction may be marked as in all the other cases except X and IV.

(4) The sore may be accompanied by a diffuse inflamatory process, the so-called anthrax oedema.

The only features common to each of these four types are the black eschar and the absence of pus.

Vesicle formation and inflamatory reaction are not always present, though in the majority of cases they exist.

Any sore occurring on the exposed surfaces in hide, hair and wool workers presenting this dry black slough <u>is</u> due to the Bacillus Anthracis. Bacteriological verification is desirable in every case but treatment by serum ought to be initiated right away and not withheld until the positive bacteriological report is received. In private practice or in practice in an hospital which is minus a bacteriological laboratory films may be made from the sore and examined. Cultural

and inoculation tests must be carried out ere the organism is definitely labelled B. Anthracis. It must be remembered that there are numerous non-virulent bacteria, morphologically and in staining reactions closely resembling the anthrax bacillus, but differing from it both culturally and biologically.

Hueppe and Wood described in 1889 a Gram positive bacillus which they called the B. Anthracoides. Culturally this organism grows more rapidly than the B. anthracis and causes gelatine fluidification more rapidly. It is non-pathogenic.

B. radicosus (Wurzel Bacillus) has been cultivated from city water supplies. It is larger and more irregular than the B. Anthracis. It grows at the room temperature and liquifies gelatine rapidly. It also is non-pathogenic.

The organism however which is most apt to cause confusion is the B. subtilis (Hay Bacillus). This is a shorter and narrower bacillus but is of importance because of the frequency with which it is found as a saprophyte in chronic suppurative lesions. In young cultures it is motile. Spores are formed nearer one pole than the other. It is Gram positive and liquifies gelatine. It is a saprophyte and therefore non-

Accidental vaccination.

Accidental vaccination (Herley)

pathogenic.

The appearance of cutaneous anthrax is so characteristic that it seems hardly necessary to give a differential diagnosis.

A vaccinia pustule which has become inflamed may resemble it. The black centre of anthrax is evident on the 3rd or 4th day whilst in vaccinia the brown scab does not form until the end of the second week. Primary accidental vaccination presents no diagnostic difficulties. The photographs appended show two cases of this condition which came under my notice whilst resident in Dewsbury.

Should the sore occur on the eyelid it is well to keep in mind the possibility of a diphtheritic infection.

I have twice had cases sent into hospital with a diagnosis of Anthrax where the clinical appearances were not at all suggestive of this disease.

On the 5th of December 1909 a wool-worker came to the Infirmary with a vesicular sore at the inner canthus of the eye which his Dr. had told him was anthrax. There was no black eschar and the vesicle when punctured exuded a purulent fluid which bacteriologically was proved to be due to the staphylococcus

pyogenes aurcus. Again, on the 18th of September 1911 a wool-worker with a sore on her left wrist was sent in for diagnosis and treatment, anthrax being suspected. In the absence of the black slough a negative anthrax diagnosis was given. Swabs were however taken and on examination the presence of staphylococcus pyogenes aurcus was proved.

There is one further possibility to be kept in mind and this cannot be emphasised better than by giving a synopsis of the case reported by Dr.Thomas Orr. A butcher aet 45 noticed a small pimple on the back of his left thumb. He thought nothing about it and in spite of a slow but steady increase in size he did not consult a Doctor until 14 days later.

Then the sore presented a black depressed centre about the size of a shilling. There was vesiculation around whilst the skin in the vicinity was swollen and dusky red. Five per cent carbolic injections were at first tried and later the sore was excised. Before excision the serum from the vesicles was sent off for bacteriological examination. No organisms were discovered in the stained films and the only result culturally was a growth of staphylococcus epidermatis albus.

This was probably a contamination. The excised pustule was next examined. Small Gram positive bacilli with rounded ends were noticed.

Cultures were made on agar and after 24 hours growth at 37° C two types of colonies appeared. These after further testing proved to be colonies of Proteus vulgaris and Proteus Mirabilis. The man was then interrogated and when it was found that he had been working with dirty and evil-smelling bags sent out by hide and refuse dealers the source of infection was evident.

This is the only case in the anthrax literature in which a typical anthrax sore was proved bacteriologically to be due to an organism other than the B. anthracis. Such cases are so exceedingly rare however that any sore presenting the above characteristics ought at once to be treated with anti-anthrax serum. In anthrax the necrosed centre appears in about four days whilst in this case ten to fourteen days elapsed ere it developed.

This point will help in arriving at a diagnosis. Examination of the blood might also be of service in differentiating the two conditions. In the case of anthrax the leucocytosis is a polymorph one whilst

in Orr's case the leucocytes were of the large mononuclear variety.

The main point to be remembered is that in hide, hair and wool workers the black depressed centre no matter what its size may be, is pathognomonic of anthrax.

The diagnosis of internal anthrax is a matter of greater difficulty but of the greatest importance.

The increased mortality amongst wool-workers in recent years is due entirely to the increased number of cases of pulmonary anthrax. This form of the disease is particularly formidable because of the fact that the symptons so closely resemble other acute pulmonary infections that unless the true nature of the disease is recognised and appropriate treatment carried out promptly, death in the majority of cases takes place in a few days.

Examination of the blood is of little use in arriving at a diagnosis for as was first pointed out by Greenfield no bacilli are to be found in the blood until shortly before death. Treatment then is of no avail. In order to make an early diagnosis, internal anthrax ought to be suspected from the nature of the

employment and in addition to this one is justified in making a diagnosis from the clinical symptons alone. Rigors, headache, vomiting, cyanosis, cardiac feebleness, blood-stained sputum - in which the bacilli may be found - pleural effusions, and signs of local pulmonary inflamation are the usual symptons and signs. These in the absence of pleuritic pain, tubercle, cardiac and renal disease occurring in a man engaged in a highly dangerous trade are sufficient to warrant a diagnosis of pulmonary anthrax.

Intestinal anthrax is not so fatal as the pulmonary type. The disease is a rarity and is usually due to the ingestion of infected meat. In the animal body the bacilli do not sporulate. Intestinal anthrax only arises when the bacilli in the meat contain spores. Non-sporing bacilli are destroyed by the gastric juices. This accounts for the rarity of the condition. Osterlag's statement that hundreds may partake of anthracitic animal flesh without developing the disease whilst the butchers who prepare it may, is well borne out by a case reported by Herley in which a butcher was treated for cutaneous anthrax after dealing with an infected carcase whilst a hundred who partook of the

flesh did not develop a symptom.

This variety of the disease is characterised by abdominal pain, vomiting and diarrhoea in addition to the general symptons. Blood may or may not be present in the stool. Abdominal examination may be negative and remain so throughout the course of the disease unless symptons and signs of general peritionitis supervene. Rupture of a sore has probably taken place then. Pain, vomiting and diarrhoea occurring in a worker in a highly dangerous trade in the absence of other definite causes may and probably is suffering from intestinal anthrax.

PROGNOSIS. The mere mention of the disease anthrax conveys to the lay mind impressions akin to those suggested by the disease cancer, whilst to the medical mind there is presented the picture of a virulent infection, and an uphill fight terminating perhaps in recovery but more frequently in death.

True, the disease is a formidable one from its severity and the frequency of a fatal issue but since the introduction of serum-therapy by Sclavo in 1897 the disease has lost many of its terrors.

The mortality rate is at least 25 per cent, but for cases treated under favourable conditions this is much too high.

In considering the prognosis the site of the lesion must be taken into account. It will therefore be more convenient to discuss this question as it applies (1) to the external and (2) to the internal form.

(1) EXTERNAL ANTHRAX. So long as the workers in the dangerous trades remain in ignorance of the nature of the disease, its onset, development and recognition so long will the mortality rate remain unaffected. Owing to the onsidious onset with absence of pain and constitutional disturbance, the lesion is often

Go on to page marked 64

horse-hair factory in Milan a physician attends daily to treat minor accidents. A laboratory provided with the necessary appliances for the verification and treatment of anthrax adjoins and should a suspicious case arise, serum is at once administered.

With such a co-operation on the part of the workers it is little to be wondered at that although anthrax in Italy is increasing the death rate is decreasing.

Prognosis then to a large extent depends on the promptitude or otherwise of the worker in applying for treatment and I attribute the good results achieved in my series of cases to the fact help was sought within 3 or 4 days after the onset of the disease.

If the disease is treated within that time recovery will follow in practically every case.

The longer the treatment is delayed the greater the risk.

The situation as well as the appearance of the sore influence the prognosis but little. The important point is an early recognition of the disease plus the early application of suitable treatment. If the lesion is situated near the mouth or nose it is said that there is a danger of inhalation. Nowhere in the

literature have I found a case of associated external and pulmonary anthrax reported.

The age and health of the individual have to be taken into account in giving a prognosis. They influence it slightly. It will generally be found that the younger the patient and the more robust the constitution, the more satisfactory will be the course of the disease.

The temperature chart is also of some value. No matter what the condition of the sore may be, the higher the temperature and more frequent the pulse rate, the graver the case whilst on the other hand despite a well marked phlegmon and possible adenitis the lower the temperature and less frequent the pulse rate the better the prognosis.

My experience is that a normal temperature, pulse and respiration rate in an undoubted anthrax case usually indicates the presence of the staphylococcus pyogenes-aurcus in the sore. In four of my series there was no constitutional disturbance of any kind and on bacteriological examination, in addition to the B. Anthracis, staphylococcus pyogenes aurcus was found. From this I am led to believe that the presence of

this organism is inimical to the growth of the B. Anthracis and in cases of anthrax where it is found to be present in the vesicles a much more favourable prognosis can be given. There are the cases which to my mind tend to a natural cure if left untreated. Might it not be possible that a streptococcus is responsible for those cases in which anthrax oedema is well marked?

In taking a swab for bacteriological purposes, it of course is desirable to avoid skin contamination. Such contamination, when it occurs, is usually by the Staphylococcus epidermatis albus and not by staphylococcus aurcus.

When anthrax oedema is present the case must be regarded more seriously, not so much because it indicates either a very virulent infection or a feeble resistance on the part of the individual but because of the possibility of death from the mechanical effects of the lesion. The oedema most frequently occurs when the sore is situated on the face or neck and pressure on or involvement of important structures is more liable to occur.

(2) INTERNAL ANTHRAX. The opinion of medical men to-day is that

if a patient has got internal anthrax he must surely die and that if he recovers then it is certain he never suffered from the disease. Hiss and Zinsser state that in the majority of cases, the disease terminates in death, and this probably states very accurately the attitude of the text-books.

As with external so with the internal anthrax the result depends entirely on the prompt recognition of the disease and the adoption of heroic serum treatment. If treatment is withheld until a positive bacteriological report is received, death will invariably result for it must be remembered that the bacilli do not invade the blood stream until a few hours before death.

Successful treatment depends upon a prompt diagnosis and this as has been pointed out before can only be made from the clinical symptons.

Mitchell in a very instructive paper records a case where pulmonary anthrax existed and in which recovery resulted after the administration of serum in large amounts.

My feeling is that internal anthrax is just as curable as the external variety. In this connection

unheeded and treatment neglected until too late. If it could be impressed upon the workers that anthrax in the early stages is a disease curable without operation, and that if it is neglected is apt to jeopardise life I think much will have been done to diminish the death rate. There can be no better demonstration of this fact than a study of the statistics obtained from the following hospitals, Guy's, St. Bartholomews and the Bradford Royal Infirmary. The workers in the dangerous trades in the vicinity of these institutions are so educated that they apply for treatment in the early stages of the disease. At Guy's 56 cases were treated from 1896-1904 with 4 fatalities - 7.1%; 20 were treated at St. Bartholomew's with 2 deaths - 10% and 39 at the Royal Infirmary Bradford with 6 deaths - 15.4%.

In Italy the education of the workers is so complete that the smallest pimple or boil suggesting anthrax is sufficient cause to seek medical aid.

In Santa Croce a small town on the Arno, where tanning is the staple industry the workers have no fear knowing that if in the course of their employment anthrax should develop serum is always at hand. In a

the case reported by Fleming and Stewart is of interest. Here death was not due directly to anthrax but to "septicaemia following streptococcal peritonitis, the organisms having in all probability gained entrance to the peritoneal sac by sloughing of the floor of one of the intestinal ulcers."

The prognosis of internal anthrax, then, I believe to be much less unfavourable than is generally supposed especially if the disease is diagnosed in the earliest stages and treatment by serum instituted.

TREATMENT.

Opinion is still divided as to which is the best treatment for cases of external anthrax. In the case of the internal disease there is a unanimity of opinion that serum administration is the only procedure likely to benefit the patient.

Broadly the treatment of the disease is divided into (1) active and (2) preventive.

(1) Active treatment is conducted on three lines each method having its own devotees.

(a) The expectant or conservative method is based on the fact that man is naturally possessed of a considerable degree of resistance and that cases

of spontaneous cure do occasionally occur. It is recognised that the bacilli are present locally, that they multiply slowly in the lesion and do not invade the blood stream until shortly before death, if death should occur. So long then as the tissue cells in the vicinity of the lesion remain healthy generalisation of the disease can never take place. This catastrophe is only possible when the cells become weakened in their fight with the bacilli and their toxins. Treatment is therefore directed towards the maintenance of the general health, This is done by rest fixation and elevation of the affected part; by the administration of a stimulating dietary and by the application of Grey Ointment. This treatment finds favour chiefly in Germany. Muller of Jena in 1894 reported a series of 13 cases treated in this way with one death, the fatal termination occurring in a case doing well until incisions were made into the sore. Death followed 55 hours later.

Ramstedt in 1899 reported a further series of cases from the same hospital in which the same

line of treatment was adhered to with satisfactory results whilst Schultze of Bonn in 1901 cited a severe case which recovered under this regime.

The treatment in Muller's cases extended from 3 to 45 days, the average duration being 16 days. A number of the cases attended the out-patient department afterwards for some time owing to the extensive loss of skin.

When one remembers the uncertainty of the disease with which one is dealing and that a fatal anthracaemia may occur with a lesion so insignificant as not to attract attention, then the uncertainty of this treatment will be evident. Moreover the length of time which must elapse ere a complete cure results; the possibility of extensive and ugly scarring or of surgical help being necessary in order to hasten the healing of extensive raw surfaces, whilst not affecting the statistics are of the greatest importance to the patient.

The ideal treatment is that which enables the workman to resume work in the shortest space of time, with a minimum amount of scar formation

and as little discomfort as possible during the period of treatment. Mullers treatment falls short of this ideal.

The second method of treatment yields more satisfactory results and is the line of treatment most popular to-day. Removal of the lesion containing the bacilli and cauterisation of the raw surface with the actual cautery, or strong carbolic acid is the usual procedure. Without actually excising the sore a similar result is achieved by injecting a 5 per cent carbolic solution into the tissues around it and by this means forming a barrier against the spread of the bacillus. A combination of these two methods is recommended by Da Costa in his "Modern Surgery". Davaine advises injection of the pustule and the tissues around with a solution composed of 1 part Tr. Iodine and 2 parts water.

At Guy's Hospital, Davies-Colley in addition to free excision of the sore dusted powdered Ipecacuanha on the wound and exhibited the same drug internally in ten grain doses. This practice was based on the experience of Muskett in South Africa who during 15 years treated 50 cases of

external anthrax without a fatal issue by means of Ipecacuanha applied in the form of a cream externally and administered internally in 10 grain doses. He believed that this drug was specific in its action.

As a general rule after excision and the use of the cautery or carbolic injections the oedema disappears and recovery ensues.

In a few cases however excision seems to accelerate generalisation of the disease and in this connection I would quote the following significant passage from Muir and Ritchie. "It should be noted that the greatest care ought to be taken in manipulating a pustule before excision, as the diffusion of the bacilli into the surrounding tissues may be aided and the condition greatly aggravated."

Examples of this unfortunate sequel to excision are to be found in the literature. The fatal case of Mullers already referred to is an example, whilst Legge after examination of the notes of 64 cases treated by excision at Guy's and St. Bartholomews says that in ten of these cases the oedema increased after the operation and in a small

number generalisation followed so quickly as to raise suspicion that the two events were connected. Dr. Herley after recording his series of 8 cases commenting upon the only fatal case states "that after excision of the pustule oedema increased so rapidly that I regret not having treated the case with serum alone."

If there is a danger of disseminating the mischief by manipulating the sore before excision how much greater will be the danger incurred during the process of excision ? Another great objection to excision is that in some situations e.g. the eyelids it is impracticable or if carried out is likely to lead to disfigurement.

Should the excision be successful the average duration of residence in hospital varies. The stay in St. Bartholomews Hospital averages 20 days; in Guy's Hospital 15.7 days, in the London Hospital 16.1 days and in the Bradford Royal Infirmary 22.6 days.

This method of treatment again falls short of the ideal, in as much as the risk of generalisation is real; the operation is not always practicable; the average stay in hospital is not

as short as it might be; and there is the discomfort of the operation. If the risks of anthracaemia following excision were wanting one might be tempted to regard the treatment favourably but with such a possibility I consider the "wait and see" policy of Muller as beneficial and satisfactory. As much harm is likely to ensue in the one as in the other.

The third method of treatment, that by Sclavo's serum whilst not the recognised treatment at present is the one which in a short time will supersede the others. The resultsare more nearly ideal than those of any other method,

Attempts to immunise animals against anthrax were first made by Touissaint in the year 1880.

He suggested that sheep and cattle could be protected by means of an inoculation of a culture of B. Anthracis kept at 55° C. for ten minutes.

Pasteur and Chamberland improved upon this suggestion. They found that cultures kept at 42° C. made sporulation an impossibility, and that kept thus for 24 days mice succumbed whilst guinea-pigs did not after inoculation. If kept for 12 days and then inoculated, mice and guinea

pigs died but rabbits did not. They also found that sheep inoculated with $\frac{1}{10}$ c.c. of 24 day culture and 2 weeks later with a similar dose of a 12 day culture resisted inoculation with a virulent anthrax culture. Sclavo in 1895 found that the serum of actively immunised sheep was prophylactic and curative against anthrax in rabbits. He next sought a more powerful serum and after much work with the different animals he found that the ass yielded this. With this serum he treated the first case in man in 1897.

The method of obtaining the serum is as follows. An ass having been immunised 150 c.c. of blood is withdrawn from the left jugular vein. Clotting is allowed to take place. The separated serum is then decanted and ether added to the extent of 3 per cent of the whole bulk. The efficiency of the serum is tried on rabbits and if suitable is introduced into 10 c.c. tubes and sent out.

The first case treated in England was recorded by Lockwood and Andrewes in 1904. In the nine cases recorded the treatment in every case was the same.

The sore was cleansed by swabbing with turpentine, methylated spirits and ether. The contents of the vesicles were then obtained for examination purposes and thereafter a dry dressing was applied.

The skin between the shoulders was next prepared and 20 c.c. of serum injected subcutaneously. A diaphoretic-diuretic mixture (not containing Ipecacuanha) was prescribed and the bladder and bowels attended to. Full diet was allowed.

All the cases were isolated, and dressing and discharges were thoroughly disinfected.

In the early days of serum treatment small initial doses (20-30 c.c.) were given. Now it is usual to administer 40 c.c. This may be all that is required. My own feeling in the matter is that it makes little difference whether 40 c.c be given in one day or given as 20 c.c. for two days. In my series the initial doses were small in every case but the dose was repeated daily for 3 or 4 days. The average dose for each case was 40 c.c. The effect of even a small dose of serum is almost instantaneous.

The temperature falls a degree or so within 4 hours and this drop is accompanied by a fall in the leucocyte count. The serum was given in each case daily until the temperature reached normal limits. The fall was usually by lysis. The leucocyte count also showed a fall by lysis. By the third day of treatment there is marked improvement in the general symptons and the condition of the sore. The temperature - if there has been one - is normal; the oedema and redness are disappearing and the vesicles are dry. By the 8th day there is simply the black central slough and recovery is complete when this slough separates. This varies but the average is usually from 10 - 14 days. The scarring which results is very slight. Lazzeretti and Cicognani state that in 42 of their cases there was no visible scar in 10; scar hardly visible in 5; slight scar in 10; completely recovered 15; some loss of tissue in 1; and complete loss of upper eyelid in 1.

The amount of serum to be administered varies with each case. If the temperature is normal or slightly febrile 30 or 40 cc. will be sufficient;

if the temperature is febrile and constitutional symptons marked 50 or 60 cc. may be sufficient whilst in severe cases with marked anthrax oedema 120 - 190 cc. may be necessary. The case must be carefully watched and serum administered until improvement in the local and general condition are evident. The leucocyte count might be of some use in determining the progress of the disease and the effect of serum. The leucocytoses present in the early stages will gradusally fall as improvement continues,

It is advisable in all cases to have a bacteriological examination made daily. It will generally be found that two or three days after the commencement of serum treatment no colonies will be found on cultural examination. Lazzaretti and Cicognani assert that 19 hours after the first injection examination for bacilli will be negative but this I think is rather a short period,

In cases of internal anthrax serum treatment is the only one which holds out any hope of success. The dosage in such cases must be larger. Fleming and Stewart administered 190 c.c. in six days whilst Mitchell's case received in all 230 cc.

In grave cases 10 cc. may be injected intravenously.

This treatment then in early cases is specific. There is no discomfort or after effects; the period of unemployment is short and there is little or no disfigurement.

The treatment does not depend on the nature of the disease and the position of the lesion as stated by Page.

The treatment in every case ought to be the same, namely by the early administration of serum.

The claims made by Sclavo for the serum that (1) it is innocuous even in large doses (2) it is well borne when administered intravenously (3) if used in the early stages, recovery invariably follows (4) cases are saved when the condition is critical (5) if oedema threatens death by asphyxia, intravenous administration reduces the danger (6) if used early limits the amount of tissue destruction (7) it is the only hope for internal cases, are justifiable. My experience accords with these claims, whilst the experience of others confirms the belief that serum treatment is par excellence the treatment for every

case of anthrax. The mortality of all cases treated with serum in this country is considerably higher than that of the Italian cases treated by Sclavo and Legge.

This is attributable to the fact that in this country the treatment is not commenced in the early stages of the disease. The treatment is useless if the patient is comatose or the disease well advanced and it is hardly fair to cite these as cases in which serum failed.

It must be insisted again that early recognition and treatment of the disease is essential to recovery.

PREVENTATIVE TREATMENT.

The possibilities of anthrax infection in the special industries - wool, hair and hide - have led to the introduction of certain regulations. Industrial anthrax became notifiable in 1895 and now in hair factories a list of precautions is to be found in the sorting department. Coloured plates of the disease in the different stages of development are to be found on the walls; the dust liberated in the process is drawn by suction into a chamber and

burned, the workers wear overalls and respirators and the hands are washed with carbolic soap ere the workman leaves the sorting room. After sorting, the hair - with the exception of the white - is put into tubs of 1 per cent cyllin and allowed to soak for 6 - 8 hours ere being hackled. It is then put into the drying room. Infection after this stage is a rarity. These precautions are very desirable and have no doubt done much to reduce the number of cases and minimise the severity of the disease.

Further precautions might however be taken. Disinfection by steam is more likely to effectually destroy the spores but the necessary temperature at the same time is injurious to the material. Most hope at the present time lies in the use of liquid disinfectants and of these the most efficacious is cyllin. No provision is made for the workers who open the bales and convey the material to the sorting room. These ought to observe the same rules as the sorters and when dealing with suspicious hair, overalls, and respirators ought to be worn and the hands and face thoroughly washed afterwards. The regulation by the Home Office requiring the employer to exclude

persons suffering from scratches and abrasions is useless. Most of the workers themselves cause the abrasions with their nails. The nails then ought always to be short and the application of plenty of soap and water, and the nail brush enforced. Better still gloves ought to be worn.

The workers then protect not only themselves but also those at home. The women who are employed in the washing of the white hair ought also to wear respirators and caps to cover the hair.

It is of importance to insist on the employment of healthy individuals. In two of the cases in my series the men had been unemployed for some time ere working amongst the hair and wool and feeding had been irregular and poor.

The certifying factory surgeons duties should include the examination of applicants for positions in the recognised dangerous processes. In addition as the early diagnosis of anthrax is difficult a medical man ought to be attached to each factory and so soon as a case of sickness is reported he should attend the employee. By such vigilance, remedies harmless in any case may be used with greater prospect of success.

The serum confers immunity for a year or so and as most of the workers infected by anthrax develop the disease within the first few months or years of their employment the administration of 10 c.c. might obviate the risk incurred.

Compulsion in carrying out these precautions ought to be insisted upon in the manipulation of hair and wool workers who handle the material in the early stages. Special attention must be paid to blood-stained material. Eurich after many years experience in Bradford has arrived at this conclusion. In his annual report to the Bradford Anthrax Investigation Board (Oct. 31, 1908) after examination of 435 samples of wool, hair, and dust, recovered B. anthracis from 21 samples and of these 20 were blood-stained. On January 1st 1910 he reported that during the year 1909, 878 samples of the same materials had been examined; 719 of these were blood stained and the bacilli were discovered in 23 of these samples. If in the sorting process the blood stained material were removed it would seem that the danger would be minimised. Unfortunately however in brown hair, blood clot is not easily recognisable.

The only course to pursue would be to soak the material for a longer period of time in cyllin.

According to Eurich there is only a spread from the infected blood-stained material when it is damp and then it is slight.

Efficient cyllin disinfection with strict observation of protection and personal cleanliness are the important points for the worker.

All cases of human anthrax whether industrial or agricultural should be notified. Human anthrax being associated with the animal disease greater efforts should be made to limit the spread of the disease in nature. Carcases of suspected animals ought to be disposed of without the shedding of blood either by burning or by deep burial. The susceptible animals may also be immunised.

Dust from hair factories ought in every case to be destroyed and not sold to manure manufacturers.

Effluents from the factories should be rendered inert ere being discharged.

Further all meat not slaughtered on licensed premises should be inspected and certified ere disposed of.

Cases occurring in man if admitted to a General Hospital should be placed in single wards and every precaution taken to render isolation complete. Cloaks

and gloves should be worn and all utensils and discharges disinfected. After discharge of the patient the room must be efficiently disinfected.

A case ought never to be put into a general ward. One is so dependent upon the nursing staff that bed isolation is uncertain.

SUMMARY

The diagnosis rests chiefly on the black central slough, present in a worker in a recognised dangerous trade. In internal cases a diagnosis must be made from clinical symptons alone, if hope of a recovery is to be entertained.

The prognosis in all early cases is good if serum is administered. Instruction of the worker and increased vigilance on the part of the authorities are necessary essentials.

The treatment is by the administration of Sclavo's serum. In this connection it might be mentioned that antistaphylococcic serum ought never to be administered to a case the lesion of which presents the black eschar.

Compulsory attention to details must be insisted upon amongst workers in the dangerous processes, and especially must the hands and nails receive careful treatment.

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