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Malignant Pustule or Anthrax, its Symptoms, Pathology and Treatment

Thesis for degree of M. D.
by Wm G. Dun M. B.
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The term Malignant Pustule is that by which a disease, not very often observed in this country, but nevertheless occurring more frequently, perhaps, than many are inclined to think, is most familiarly known to us. On the Continent, where it is of more frequent occurrence, it has received quite a number of names, "feu persique", "charbon", "pure malin", "anthrax", "milzbrand" &c. A disease essentially the same has been observed among some of the lower animals, such is the "black quarter", "evil quarter", "blood" &c.

In discussing this subject I cannot confine myself merely to a consideration of the external manifestation of the disease, but am forced to take into account another group of cases, which more recent investigation has identified with the hitherto better known malignant pustule. I refer to the class of cases known as Intestinal or Internal Anthrax, and Mycosis Intestinalis. It appears also that cases may present themselves, where

from the appearance of the disease, the course of the symptoms, and the results of post mortem examination, we may conclude that both forms of the affection are simultaneously present, or if not so, that the local infection has disseminated itself more rapidly than usual throughout the whole system.

It is a pity that the nomenclature of this disease should be so confused, and it appears to me it would be much better to abandon the use of all other terms, and to adopt that of anthrax alone, restricting it to the very malegnant disease in which the bacteremia, known as Bacillus Anthracis, is present, either in the local lesion, or in the blood and serous exudations. Adopting the general term of Anthrax, the affection would be divided into Internal and External Anthrax.

My attention has been directed to the subject of Malegnant Pustule (to retain the

familiar term), from having seen three cases of the disease. These have all been in hospital practice. The first case I saw was while I was a resident in the Royal Infirmary. I had not then ever heard of this affection, and the rapidly fatal course of what, to one who had not seen much of the practice of his profession, seemed by no means a formidable case, was sufficiently striking. The patient a young woman, aged 19, employed as a spinner in a hair factory, was admitted into the Royal Infirmary under Dr. H. C. Cameron's care on 10th Oct. 1876, and died two days after. The case is reported, as follows, by Dr. J. B. Russell,* from notes supplied by Dr. Cameron:— "On 6th Oct. 1876 a pimple appeared on left angle of lower jaw. It was black in the centre, with a yellow ring outside the black, like a "shilf cow", or flea bite. She made no complaint until 8 p.m. on the 7th, having gone to work that day. She then felt "out of sorts", and took

1st Case.

* Eighth Annual Report of the Local Govt Board. 1878-79. Suppl.

some laxative medicine. The lip swelled up, in the words of her mother, "as fast as a loaf in an oven". She was out of bed on the 8th, but on the 9th felt very weak, and was very restless. On the 10th about mid-day, she entered the hospital, pulse 120, and the local appearances entirely typified of malegnant pustule. Passed a very restless night, constantly endeavouring to get out of bed. On the 11th her pulse was 140, temp. 104·4° F., her respiration rapid and laboured; much moaning and restlessness. A plentiful crop of small vesicles and pustules had appeared over trunk and limbs, interspersed with numerous minute haemorrhagic spots, permanent on pressure. On the 12th the patient was evidently sinking, pulse 140, respirations 50 per minute, and temp. 105° F. in the morning; passed everything in bed. The minute vesicles were more numerous. Died at 9·30 p.m., the temp. being 106° F. an hour before death. On that day a sample of

4th Case.

urine, removed by catheter, was examined. It was very red, and turbid with amorphous urates; reaction highly acid; a precipitate of albumen was obtained amounting, after subsidence for twelve hours, to two thirds or more of the bulk operated upon. The blood had been examined, it should be stated, during the life of the patient, and was found to contain the Bacillus Anthracis, thereby confirming the view as to the true nature of the case.

Post mortem Exam^n of 1^st Case.

A post mortem examination was made by Dr. Foulis twelve hours after death. Rigor mortis was established, and the external appearances were as already noted. There were evidences of a recent pleurisy, and a large effusion of soft fibrine on both pleurae. The left lung was congested and soled, the right also congested but crepitant. Several haemorrhagic infarctions were observed, both in lungs and kidneys. The spleen was pulpy, and of a light ~~plum~~

plum colour. In the cellular tissue behind the gullet, there was a haemorrhagic effusion; the minute lymphatics in the gullet were injected in small beaded lines. Intestines normal, except that near the ileo-cæcal valve, numerous, minute, round, clear dots, like enlarged solitary glands were observed. The lip on being cut into creaked under the knife, and the whole of the veins in the tissue of the lips and chin were full of pus.

The other cases I have seen were patients of Dr. M'Call Anderson in the Western Infirmary, and are reported by me in the Glasgow Medical Journal of September 1879. — The patients were sisters, and were employed in a hair factory. Their employment consisted in teasing hair, and picking straw and other impurities out of it. They had been engaged at this occupation only for a few weeks. During the process much dust is raised,

2nd Case

the expectoration of the cleaners, while engaged in it, is quite black.

The younger sister, aged 14, was first attacked. She was admitted to the hospital on 12th July. The history of her case is as follows:— On Saturday, 5th July, she was at her work as usual. On returning from it, and while washing her face, she noticed a small pimple on the left side of her neck, below and a little in front of the angle of the jaw. Next day, her neck was somewhat swollen, though not painful, but otherwise she was quite well. On the following day (Monday) the swelling had increased, and she did not go to work, but called on a medical man, who gave her an ointment to apply to the part. During the next three days the pimple increased in size, and the swelling became much greater. On Thursday the pimple broke, but there was no discharge, and on that day the swelling of the face and neck reached its maximum,

2nd Case.

being so great as to cause closure of both eyes, and to render it a difficult matter to feed her, from her inability to open her mouth. She was admitted to the hospital on the following Saturday. On her admission, the face and neck were still much swollen, the swelling being hard and tense, but not tender to the touch; occupying the site of the pimple also, there was a black, circular patch, about one inch in diameter. Around this, for a radius of three inches, the skin was of a purplish red hue, and erysipelatous looking, with darker purplish streaks here and there. The boundary of the reddened portion was quite well defined, and it did not shade off into the surrounding skin. On 17th July the swelling had decreased to some extent, but otherwise the appearances were much the same. There was noticeable, however, surrounding the black spot above spoken of, a distinct inflammatory zone or line of demarcation, dividing the

blackened portion from the surrounding red skin. During this time the patient had little or no constitutional disturbance. She was not at all sick, had no shiverings, and took her food fairly well. The temperatures noted throughout the illness were, on an average, but very slightly above normal. The area of dulness over the spleen was enlarged, but this organ could not be felt projecting from beneath the ribs. The urine was of rather high specific gravity at first, but otherwise was quite normal.

On admission the treatment adopted
2nd Com was salicylic acid in 15 gr. doses, twice daily, and the assiduous application of poultices to the neck. Milk diet and soup were ordered, and the patient was fed hourly. An improvement took place in her condition from the time of admission. The swelling gradually subsided, ulceration took place round the blackened portion before mentioned, and on 31st July the

slough was removed, and the part washed out every morning with carbolised water, the application of poultices being still continued. The salicylic acid was now stopped, a tonic mixture of iron and quinine being substituted, with 4 oz. of port wine. The favourable condition of patient continued, but some burrowing having taken place in the neck, it was found necessary on 7th August to make a counter opening to allow of the escape of pus. Practically, however, the patient may be said at that date to have recovered from the effects of her serious complaint.

The second case was much slighter, and need not be so fully related. The patient was aged 17, and was as already stated, a sister of the former patient. The pustule had the same situation. The swelling of the face and neck was never so great. The

pimple broke spontaneously two days after it was first observed; a considerable fall in the swelling then took place, and a small open sore was left. When admitted to hospital on 18th July there was still some swelling of the face and neck. The treatment was quite the same as in the former case, and the patient was dismissed well on 6th Augt.

A specimen of the blood was obtained and preserved by Dr. Joseph Coats. At first nothing abnormal was observed on microscopical examination, but in the course of a day or two numerous motionless rod-like bodies were found in the preserved specimens. In the second case nothing was discovered either when the blood was nearly drawn, or four days after.

I might easily give accounts of

other, and even more characteristic and striking cases of malignant pustule, but those I have already related, and which are the only instances of the affection I have seen, are sufficient to give a fairly good idea of this exceedingly dangerous, but to the medical practitioner highly interesting and important disease. In the British Medical Journal for 1863 Budd of Bristol has a series of papers on Malignant Pustule, in which he relates his own experience, and details in addition a number of cases communicated to him by professional friends. There is a very extensive continental literature on this subject, and some contributions have been made to it by Americans. The latest addition to the English literature, I know of, is a report by the Medical Officer of Health for Glasgow, Dr. J. B. Russell, in the Eighth Annual Report of the Local Government Board 1878-79. Supplement.

Malignant Pustule is to be classed in the group of acute infectious diseases. Primarily the disease occurs amongst the lower animals, sheep, horses, swine &c., and from them is transferred to man. This happens in a variety of ways; by direct inoculation; through the medium of insects; by eating the flesh of diseased animals; by the inhalation of air laden with particles separated from the bodies of diseased animals, and composed, it may be, of the dried blood or other exudations or secretions of such animals; and finally by inoculation from man to man.

The disease is most often seen amongst shepherds, farriers, tanners, and workers in hair and wool. In the cases I have seen, and, so far as I know, in all the cases observed in Glasgow, the medium of infection has been horse hair. In these cases the hair was imported from Russia, a country where the disease rages with peculiar virulence. The occurrence of malignant pustule among

hair workers, although but little noticed in this country, has been particularly observed in France by Trousseau and Rayer, the former being aware of twenty fatal cases in the course of ten years, and Rayer having treated eight cases in three years. Dr Russell has been able to trace no fewer than fifteen cases of anthrax, mostly, however, of the internal form, all happening within about two and a half years, and as these are the only cases ever observed in Glasgow to my knowledge, the likelihood is that many other cases have occurred which have not been recognised.

Budd up till the date at which he wrote was cognisant of twenty four cases of malegnant pustule, in the majority of which no connection between the employment of the persons affected, and the disease could be traced. In some, however, this was tolerably obvious. In five cases the individuals had to do with cattle, in another the patient was a plasterer, an occupation where there is frequent handling of

bullocks hair, another was a butcher and two worked amongst hides.

These facts serve to show the wide area over which the disease may be distributed, and the very varied character of the occupations with which it is connected. In many cases, no doubt, the nature of the occupation sheds no light whatever on them, but, certainly, regard to the occupation ought not to be overlooked, and we may even find that where animal infection is not suspected, or cannot at first be traced, a closer consideration of the trade of the patient may reveal it.

I have already referred to the production of this disease by the bite of insects. This view is strongly supported by Budd, who says, "on the whole I incline to the supposition, that in the case of persons whose calling does not bring them into direct contact with the virus, the inoculation is generally effected by flies." The popular

French term "Puce maligne" gives expression to this view, and Reydellet* in 1820 said, "it is to be remarked that the contact of insects, which have alighted on the body of an animal suffering from charbon, may give rise to the development of malegnant pustule." It is to be expected that most instances of this kind will occur in districts where anthrax prevails amongst animals, the insects, settling on these animals, carry the poison on their wings and feet, and convey it to the unfortunate individuals on whom they may happen to alight. Budd thinks he has seen this mode of infection in this county at least twice.

As to the spread of the disease by eating the flesh of diseased animals, or by the inhalation of air laden with anthrax particles, the consideration of these facts need not detain us long. It is very obvious that the form of disease which

*Dictionnaire des Sciences Medicales. Paris 1820. Article, Pustule Maligne.

is most likely to arise here, is not that of external anthrax or malegnant pustule, with which we are at present dealing, but the internal form, to which we shall refer further on. It is, however, quite proper to recognise them as possible modes of external infection, and this is more readily seen in the eating of diseased flesh, than in the inspiring of poisoned air, for while Ballinger* holds that "meat after being properly boiled or roasted is harmless", Budd on the other hand asserts that he has ascertained "by careful and repeated experiments, that the temperature to which meat is generally subjected in the operations of roasting and boiling, in no case, except perhaps at exposed surfaces, impairs the powers of animal poisons." It can readily be seen then that persons partaking of such food, and who happen to have any crack or abrasion about the lips, run great risks of contracting the disease, and

* Cyclopaedia of the Practice of Medicine. Ziemssen. Article Anthrax. Vol III.

the frequency with which it is seen upon the lips may be, in some degree, thus accounted for. In hair factories it seems to be the custom for the workers to eat their food in a dust laden atmosphere, anthrax particles may settle on the food, and the disease originate about the lips in the same way as when diseased flesh is partaken of.

The last mode of propagating anthrax to which I refer is that from man to man. Keydellet quotes the case reported by Thomassin, where a woman, whose husband was affected with malignant pustule, having wiped her cheeks with her fingers, moist with the serum which exuded from the vesicles, perceived, two hours after, the presence of a tumour on her cheek, which made very rapid progress. Others have made confirmatory observations.

Having very fully related the cases which have come under my own

observation, it will be unnecessary to enter into any long account of the course and symptoms of malegnant pustule, and the more so, as the cases illustrate both of the ponible terminations of the affection, namely death and recovery. I shall merely make mention of two symptoms generally observed, but wanting in these cases. The first is a slight stinging, itchy sensation, which no doubt, often gives rise to the idea of the person having been bitten by an insect, this itching becomes more acute, and when the vesicle is fairly formed may cause the patient to tear it. The other indication usually present is the formation of secondary vesicles around the raised areola of the primary pustule. These I do not remember having seen, although in the case of Dr. Cameron's patient I recollect well the crop of pustules scattered over the body, and referred to in the report of the

case. The general symptoms are sufficiently illustrated in my cases, and particularly so in that of C.H., which terminated fatally.

One most important and indeed pathognomonic feature in the disease is the detection of the Bacillus Anthracis, the bacteremia characteristic of the affection, in the pustule and blood of the person affected. The discovery of this minute organism is of comparatively recent date. Pollender in 1849 first detected it in the blood of cattle suffering from anthrax, and Brauell, later and independently, discovered it, both in the blood of men and animals. The bacilli have very much the appearance of the familiar bacteria of decomposition, so often seen in putrid urine, they consist of short, unbranched filaments, measuring from $\frac{1}{3500}$ to $\frac{1}{2000}$ of an inch in length, and are of scarcely appreciable breadth. With a high magnifying power they are seen to be composed of minute spherules joined

together, like rows of beads. In addition, there are also to be seen a few isolated round bodies. The chief distinction between the bacilli and other bacteria is that they are devoid of motion. —— Decomposition or exposure to a temperature of 140° F. destroys them, but they resist the action of cold, not being destroyed at so low a temperature as 1° F., even after hours of exposure, and the intensity of their vitality is testified by the fact that they retain their infective properties for a seemingly indefinite period, so that hair, hides &c., may be collected, exported and stored, and yet long after give rise to epidemics of anthrax. This fact, and the knowledge that they so readily perish from decomposition, to which they are so much exposed, is a little puzzling, but has been explained by the theory that bacteria possess two forms of existence, one in which they quickly perish, and

another in which they remain active for long periods. To this form the name "Dauerspores" has been given by Cohn, and it is in this state the bacilli are conjectured to retain their vitality.

As to the specific character of the bacilli in the production of anthrax, this seems, in the minds of some, to be still a moot point. Brauell appears, at least, to have doubted it, and Sanderson so late as 1875 in his* "Report on Recent Researches on the Pathology of Infective Processes," speaks very guardedly as to their specific nature, he says "their significance is still matter of dispute, there being great difference of opinion, even among those who admit that they are characteristic of the disease, as to the part they play in the morbid process." Bollinger however is more decided in his opinion for he says, "the infectious material consists of a vegetable parasite, which is produced

* Reports of the Medical Officer of the Privy Council, and Local Govt. Board. New Series No III.

in the diseased animals." His conclusions are based upon the results of experiments which he thinks confute those of Brauell, who found he was able to produce anthrax by inoculation with blood which did not contain bacilli. Bollinger, however, has satisfied himself, and his experiments are not unsupported, that the blood of infected animals, not containing bacilli, does not produce anthrax. Further support is given in favour of their specific nature by the experiments of Klebs and Tiegel.* These investigators succeeded in separating bacteria from their fluids; and on treating a virulent fluid, from a diseased animal, by filtration under pressure through porous porcelain, the fluid was found incapable of producing anthrax. The observation of the disease in pregnant animals agrees with this result, for it

* Referred to by Sanderson.

has been found that the blood of the embryo of an animal suffering from anthrax is not contagious, the placenta seemingly acting as a filter. Dr. Carpenter* so recently as 1879, in his Address to the Sanitary Institute of Great Britain gives expression to the latest opinion, I know of, on the subject. His attitude is one of uncertainty, he says, "whether the rod is the absolute cause of the disease or not, it is always present, and the disease cannot be propagated without it." No doubt further research will put this matter on a firmer basis, one thing, however, remains, the diagnostic value of the bacilli is of the greatest practical importance.

In the early stage of the disease, the bacilli are found in isolated masses in the pustule, and the rationale of the treatment recommended depends upon this fact; gradually, however, unless arrested by treatment, they make their way through

* Brit. Med. Journal, Oct. 25th 1879.

the skin, and are distributed by the blood vessels, throughout the entire system.

Malignant pustule being produced in most cases by direct inoculation, it is not to be wondered at that it is seen most frequently on those parts of the body habitually uncovered, as the hand, the arm, the neck, the face. In two of the cases I have related the pustule was seated on the neck, in the other on the lip. This last situation seems, somehow, a very favourite one. Budd's cases illustrate this in a remarkable manner. Out of twenty nine cases, in seven the pustule was seated on the upper lip, and in other sixteen cases it occurred on the face, lip or neighbourhood of the mouth. In four it was on the hand, in three of these the occupations of the patients were such that they were likely to be handling infective material, and the situation of the pustule is thus readily

explained. In labourers engaged in carrying hides upon their shoulders the occurrence of malegnant pustule on the neck is easily understood. Any pustule, therefore, seated on an ordinarily uncovered part of the body, and giving rise to constitutional symptoms more severe than the local appearances would seem to justify, should be viewed with suspicion.

One attack of the disease does not protect the individual from subsequent attacks. It has been observed also, that while age and sex have no influence on the disease, nevertheless it attacks by preference those in good condition, just as in parasitic affections in the vegetable kingdom, it is the healthy plants which suffer. Although age does not influence the disease, yet as good health is usually the privilege of youth, we should therefore expect to find

anthrax occur most frequently among the young. The cases noted in Glasgow bear this out to a certain extent, for the average age in fourteen of these is twenty six, and if two are excluded, where the ages were forty seven and forty nine, the average is reduced to a little under twenty three years.

Before referring to the treatment of malegnant pustule, I ought to make mention of another external form of the disease, which has received the name of malegnant anthrax oedema. In this form there is no pustule, but a pale yellowish or greenish swelling is observed. This is considered a variety of external anthrax. I am not, however, of this opinion, but would rather class it with internal anthrax, regarding the external swelling not as a pustule, but as an exudation similar to what takes place into

the abdominal and thoracic cavities. Guipow* seems to be also of this opinion for he "classes it etiologically with symptomatic and secondary carbuncles." The only case I know of approaching this form of the disease is one in the Glasgow series of cases, which may be regarded either as a case of internal anthrax with external ōdema, or one where both the internal and external forms of the affection were simultaneously present. The true nature of the disease was recognised by Dr. Meighan who certified the cause of death as "Malignant Vesicle." The patient, a young woman aged 20, was seized on 29th March 1878 with slight shivering and colicky pains; a pimple was observed on the following day on the forehead, and soon after considerable ōdematous swelling of the neck took place, which rapidly increased; vomiting and purging came on, the breathing became oppressed and laborious, the

* Referred to by Bollinger.

breath fœtid, and death took place on 1st April, the whole duration of the case being about three days. At the post mortem examination, the swelling in the neck was seen to be very œdematous, and œdematous collections were found in the thorax and abdomen. The fluid of the œdema contained crowds of bacilli, and they were also observed in the blood.

In the treatment of malignant pustule nothing is of more importance than early diagnosis. Once the medical attendant makes up his mind as to what he has to deal with, he is then in a position to urge the necessity of what to ignorant bystanders may seem too energetic treatment. This consists in the application of strong caustics to the pustule, such as concentrated carbolic acid, caustic potash, nitric acid &c. It may even be advisable to excise the part and then cauterise, or incisions may be made and cauterants applied. The

part should afterward be diligently poulticed, and some antiseptic used. Internally quinine in considerable doses is recommended, and the use of carbolic acid is advised. Salicylic acid and the salicylates also suggest themselves. The constitution is to be upheld by a tonic and stimulant regimen. In this way cases which may even have shown constitutional symptoms may recover.

When infection is suspected, and even before the pustule is developed, caustics should be applied.

Having now concluded the subject of malignant pustule, I shall briefly refer to that of internal or intestinal anthrax. It can readily be imagined how easily the system may be affected when an atmosphere charged with the specific germs of a disease is inhaled, or flesh partaken of in which these are present. And such virtually, we may say, are the conditions which frequently exist with respect to anthrax. In hair combs

for instance, the air seems at times to be crowded with the germs of this disease, and in anthrax districts, and even in our own county to a larger extent seemingly than many suspect, flesh abounding with the same noxious organisms is eaten. In anthrax districts too, the air and the soil may be contaminated by the imbruied bodies of animals which have died of anthrax, and during the prevalence of dry weather the poisoned soil, as can easily be imagined, may get carried far and wide, as fine dust.

The recognition of the identity of internal anthrax with malignant pustule is of comparatively recent date. Cases of this kind went formerly under the name of Intestinal Mycosis. A cases of anthrax intestinales is published in the British Med. Journal of 27th Sept. 1879. "A girl aged 17, a seamstress, presented the following symptoms when received into the hospital. Her skin was livid; she was very restless and threw herself about; the

heart sounds were very loud; the throat and lower jaw were oedematous, the glands could be felt with difficulty both here and in the groin; the abdomen was meteoristic and painful; the bladder empty. On being spoken to in a loud voice she answered slowly and sensibly. There was an excoriated patch on her forehead, and a similar one on the inner condyle of the right femur, where the patient said she had a pustule before. She had been ill three days before with dysphagia. On the second and third days she had felt comparatively well. On entering the hospital she vomited once, and died three hours later. At the post mortem examination, the subcutaneous cellular tissue in the abdominal walls was found to be haemorhagically infiltrated; the abdominal cavity contained a serous liquid. The mesenteric and inguinal glands also presented a bloody infiltration. The whole of the intestinal tract was

injected. In the duodenum several semi-globular swellings were found, which became fewer in number in the small intestine. The spleen was soft, little enlarged; the liver was not enlarged, and was soft. Punctiform extravasations were found in the pelvis of one of the kidneys. Several bloody punctules, partly degenerated, were found on the aryepiglottic ligaments. In the apex of the right lung was a fresh infarct of the size of a walnut. The longitudinal sinus of the dura mater was filled with fluid blood. Minute extravasations of blood were on the external lamella of the sinus. The blood itself contained numerous bacteria." In reading Dr. Russell's paper, one is struck with the almost invariable mention in every case, of hæmorrhagic effusion, and also with the very rapid manner in which decomposition sets in. The cause of this tendency to extravasation seems to lie in the altered condition of the blood; the number of colorless

corpuscles is increased, the blood does not coagulate, and there appears to be a tendency for both the corpuscles and the liquor sanguinis to soak or squeeze through the walls of the blood vessels.

After the very full account of the case above quoted it is quite unnecessary to refer at length to any further cases, or indeed to say much more upon the subject. The desirability of a more extended knowledge of this affection is brought home to us very forcibly by the fact, that none of the medical men, who saw some of the cases of internal anthrax reported upon by Dr. Russell, recognised them; the causes of death assigned being such as "delirium tremens", "pneumonia", "sudden, supposed heart disease", and the like. I do not mention this in any fault finding spirit, indeed it would be strange if the cases had been recognised. Bollinger writing of such cases says, "our knowledge is still far from complete concerning this form of the disease, which

is, perhaps, more common than has been hitherto supposed, — and this we say in spite of certain recent very valuable observations which lead to a different conclusion".

Prognosis in these cases is very bad, recovery being rare. The treatment is the same as in malignant pustule, with the exception that, of course, no local treatment is possible.

In conclusion, I ought, perhaps, to say that in this disease, as in all infectious diseases, the duty is laid upon us not only of treating cases when they do arise, but of doing what we can to prevent their occurrence. To do this effectually legislative interference is, I am convinced, necessary. In a trading community like ours, however, enactments which hamper trade are not easily obtained, and are only with difficulty put into execution. Something might be done by representations to foreign governments to put a stop to the exportation of diseased

annual products, and it may even be necessary, as suggested by Dr Russell, to prevent the importation of certain specially dangerous materials, as Russian and Siberian hair. Apart from the dangers abroad, we have our own flesh markets to watch, and to see that diseased meat is not disposed of.

With regard to workers, who, from the nature of their occupations, are particularly exposed to the dangers of infection, instructions should be issued, which would secure cleanliness on their part, at least while engaged at work, or while partaking of their food. The masters certainly should know something of the dangers which their servants run, so that when cases of illness arise among them, particular attention may be paid to them. Some changes in the manufacturing processes in hair and wool works may be necessary, and while at present it seems that any process which will render hair quite

free from all risk of infection, cannot be devised without depreciating its value too much, yet no doubt some perfectly harmless yet efficient method will in the end be discovered.

These precautions, and a more general knowledge amongst the profession of anthrax in all its varieties, might do much to prevent the occurrence, or at least to minimise the dangers of what, were it more closely investigated in our industrial centres, might be found to be an affection of much greater frequency than has hitherto been imagined.