Occult Glanders

Some Unrecorded Symptoms

By

A. J. Haslam M.B., C.M., F.R.C.V.S.

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<table>
<thead>
<tr>
<th>CONTENTS</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>1</td>
</tr>
<tr>
<td>Temperature of healthy equines in India</td>
<td>4</td>
</tr>
<tr>
<td>Temperature of Glandered equines in India</td>
<td>4</td>
</tr>
<tr>
<td>Auto-inoculation</td>
<td>6</td>
</tr>
<tr>
<td>Auto-inoculation, -- practical application of</td>
<td>6</td>
</tr>
<tr>
<td>Auto-inoculation, -- method of performance</td>
<td>6</td>
</tr>
<tr>
<td>Auto-inoculation, -- in the healthy subject local effects of</td>
<td>9</td>
</tr>
<tr>
<td>Auto-inoculation, -- in the glandered subject, local effects of</td>
<td>9</td>
</tr>
<tr>
<td>Auto-inoculation, -- systemic results in the healthy, and the glandered subjects</td>
<td>10</td>
</tr>
<tr>
<td>Nasal Discharge in health</td>
<td>12</td>
</tr>
<tr>
<td>Nasal Discharge in chronic (occult) glanders</td>
<td>12</td>
</tr>
<tr>
<td>Mucous membrane of nose in chronic glanders</td>
<td>13</td>
</tr>
<tr>
<td>Lymphatic glands, Notes of alteration in size of, in health</td>
<td>13</td>
</tr>
<tr>
<td>Lymphatic glands, Notes of alteration in size of, in horses that have been exposed to glanders contagion but have not acquired the disease</td>
<td>14</td>
</tr>
<tr>
<td>Lymphatic glands, Notes on alteration in size in chronic glanders</td>
<td>14</td>
</tr>
<tr>
<td>Various other symptoms of chronic glanders</td>
<td>15</td>
</tr>
<tr>
<td>Colic in occult glanders</td>
<td>16</td>
</tr>
<tr>
<td>Metastatic lameness of occult glanders</td>
<td>16</td>
</tr>
<tr>
<td>Metastatic, and stationary hot and cold swellings of occult glanders</td>
<td>16</td>
</tr>
<tr>
<td>Urine of chronic glanders</td>
<td>16</td>
</tr>
<tr>
<td>Periosteal swellings of chronic glanders</td>
<td>17</td>
</tr>
<tr>
<td>Lymphatics of skin and periosteum</td>
<td>17</td>
</tr>
<tr>
<td>Practical application of the method to suppress an outbreak</td>
<td>18</td>
</tr>
<tr>
<td>Post Mortem appearances and pathological inferences</td>
<td>19</td>
</tr>
<tr>
<td>The contagion of chronic glanders and bacteriological remarks</td>
<td>21</td>
</tr>
<tr>
<td>General remarks</td>
<td>27</td>
</tr>
<tr>
<td>Temperature charts and Clinical records</td>
<td>31</td>
</tr>
<tr>
<td>Official report on outbreak of glanders at Cawnpore</td>
<td>53</td>
</tr>
<tr>
<td>together with detailed list of Cases</td>
<td></td>
</tr>
</tbody>
</table>
OCCULT GLANDERS

SOME UNRECORDED SYMPTOMS

----- By -----

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It is a recognised fact that a horse may suffer from Glanders and may be the means of spreading the disease, without himself showing any symptom of ill health, or exciting the suspicion of his attendant.

While serving at Cawnpore in India as an Officer of the Army Veterinary Department, I was required to suppress an outbreak of Glanders which necessitated the destruction of 46 animals. I attach hereto a copy of the official report on the outbreak from a perusal of which the difficulties of suppression etc., will be apparent. The remarks in this thesis referring solely to occult glanders, are founded on eight cases which actually defied detection until the method herein set-forth was adopted. Some of these cases were not at first segregated, and thus could easily have been the means of spreading the disease to their attendants and neighbouring animals.
The hopeless and incurable nature of the disease in man and animals, as well as the losses entailed by the insidious spread of the disease among the latter, make every contribution to the diagnosis and pathology of the disease a matter of the greatest importance.

Up to the present time, every case of the disease in man has been derived from a diseased animal, and a study of obscure forms of the disease in the latter, is therefore desirable for every reason.

In England and France, the disease has during the past three years received much attention, partly on account of the discovery of Mallein, and partly owing to the increased prevalence of the disease in our large cities.

The disease is comparatively rare in the human subject and is therefore one of which the clinical aspects have been little observed; yet from the recorded cases in medical literature the identity of the malady in man and equines is in every respect only too apparent.

The statements and suggestions contained herein are based on the careful clinical records hereto attached and on the results obtained in the outbreak.

I would suggest a perusal of the official report first, and afterwards, of the clinical records and the temperature charts.

As glanders in all stages is generally considered a danger to the healthy, and as there comes a time when
the suspected must be declared free or diseased, the importance of any aid to diagnosis is obvious. It comes to the lot of few of us to live in a glanders camp, and it is my exceptional opportunities there, together with the well-known difficulty of diagnosing incipient forms of the disease, that induce me to place for disposal what in some respects appears to be a small contribution to this subject.

There are, for various practical reasons, circumstances where the bacteriological examinations for the bacillus mallei in the nasal discharge of the suspected case of glanders is impossible.

Mallein is not issued for use in military service and could not be obtained, so that to diagnose such cases as showed no alteration of Schneiderian mucous membrane, no swollen or adherent glands, no farcy, no swellings, and no nasal discharge, it was necessary to adopt the only other means at our disposal.

The combined practice of auto-inoculation, temperature recording, and minute clinical observation, enabled the cases above recorded to be made out; and from the positive evidence they afford, the method seems worthy of further trial. It appears to enable a conclusion to be formed in three weeks.

The great object one has, in an outbreak of glanders, is to DIAGNOSE. It is not sufficient to SUSPECT a case because it has this or that symptom which
MAY occur in glanders, but to obtain reasonable evidence that the case is one of glanders, and to have therefore sufficient grounds for the animal’s destruction.

TEMPERATURE RECORD

Notes on Equine Temperature in India based on Observation of 60 Horses and 18 Ponies for three Months.

For healthy horses standing in the open, the middle of the day seems to give the highest point registered daily, no doubt due to the greater tissue metamorphosis going on then; the evening temperature was usually higher than the morning temperature. In healthy equines, while at rest, a difference of 2°F. (98.5° to 100.5°) was found to be very general, but there can be no doubt that the normal temperature of horses in this country is nearer 99°F. than any other figure, and in the charts a thick line has therefore been used to mark this as the normal temperature. The commonest daily range was within a degree Fahrenheit.

Poorly-fed grass-cutter ponies, apparently healthy, showed a daily range of 4°F. (97.4° to 101.4°) TEMPERATURE IN GLANDERS.-- The middle of the day bore no constant relationship to the highest daily
point, but for the most part the record of eight cases of occult glanders in this respect resembled the record of health. From the accompanying charts two most important facts are obtained:

(1) A subject of glanders may have a normal temperature not only for days together, but also at intervals in the course of the disease, after the temperature has gone up and come down again.

(2) So far as I know not before recorded. The temperature of chronic and sub-acute glanders is that of an IRREGULAR CONTINUED FEVER, WITH A TENDENCY IN SOME CASES TO A LOW RELAPSING TYPE (generally not exceeding 103°F.). A low irregular fever with no great extremes, in some cases very like variola in man without crisis (VIDE Chart. Case E.).

The lesson is obvious,—we must take the temperature for weeks before we can base an opinion as to the existence of glanders.

It is important, however, to observe that this irregular continued temperature is not confined to glanders, but I do not know of the peculiar low relapsing type existing without evident symptoms of some definite disease except in occult glanders.

In both forms of temperature a doubtful opinion can be formed, and this can generally be clinched by auto-inoculation.

RISE OF TEMPERATURE AFTER DEATH.—Having
heard it stated by Dr. Griffith Evans, A.V.D., that the temperature in cases of anthrax sometimes arose after death, I experimented with this disease, and found a rise of 1.6° F. for three minutes following death. (Vide Case A.). In two other cases the temperature did not rise, and I therefore considered the rise accidental in this instance.

**AUTO-INOCULATION.**—Consists in the transfer of the nasal or lachrymal discharge of an animal to the outer subcutaneous tissue of the same animal. It was practised with a view of adding more fuel to a slumbering fire, and to save the pain and expense of lighting another fire in another animal. The value of ordinary inoculation (hetero-inoculation) by the transfer of a suspicious nasal discharge to another animal, has long been recognised as a most reliable test of glanders, and I am in a position to state that the lachrymal secretion has sometimes the same action as the nasal discharge.

Auto-inoculation as an aid to diagnosis, though not quite new, seems to have been rarely practised. It was suggested independently by reading of the results obtained by mallein. It can only be practised where, as in glanders, our object is to form a diagnosis for the purpose of destroying the animal.

**METHOD OF PERFORMANCE.**—To be carried out with some care, for although every nasal or lachrymal
discharge contains varieties of aerial microbes, yet these are not likely to affect the action of the bacillus mallei, unless rudely rubbed into the subcutaneous tissue.

Take an old strong scalpel, clean, and make an incision $\frac{1}{4}$ to 1 inch long through the skin, just deep enough to not draw more than a drop of blood; with the same scalpel gently take up as much of the nasal or lachrymal discharge as will go on the end of a scalpel, and with the flat of the point gently rub it into the incision. The object is to encourage absorption of the virus, which would not be done by a large incision and free flow of blood; moreover, my object is to convey it to the lymph channels. The greater the escape of plasma and the less that of red corpuscles, the greater chance of the virus being absorbed.

The seat of auto-inoculation must be where it cannot be licked, rubbed, or reached,--not that the horse ever does so, except accidentally. The most convenient site for all reasons is at the side of the neck -- 8 inches below and behind the ear. Should the animal from any cause injure the part, he must be tied up for twelve hours. It is desirable that control experiments should be done first if the same knife is to be employed, but as the healthy are not likely to be near the diseased the least suspicious may be done first.
For those supposed healthy, one knife should be used, and for those segregated, another; but the same anti-microbial precautions are to be taken before every inoculation whether in healthy or diseased, for the obvious reason that otherwise unlimited hetero-inoculation may unconsciously be performed.

The horse attendant stands at the head, another person carries a lighted spirit lamp and some heated crude carbolic acid and a cloth; the operator with jacket off and shirt sleeves rolled up, carries the scalpel and a pair of scissors. After an operation the operator dips the scalpel in the carbolic acid for a minute, then wipes it on the cloth, and heats the blade in the spirit flame; this dulls the edge a little.

The scissors are required for cutting the hair at the seat of inoculation. The operator takes every care not to get the suspicious discharge on his person or below the knife blade. He never loads his scalpel merely covers the point. If the animal is fidgety, the usual precautions to keep the animal still are taken. The more thoughtful operator can anaesthetise the skin if he chooses, — but it is nothing more than a scratch. The cloth is afterwards burnt.

If these instructions are carried out, it will be found that there is no danger of septicaemia, tetanus, abscess, or undesirable result. There will be no fall or rise of temperature in the healthy subject, unless too large an incision or unnecessary pain has been
produced. This method is an unscientific one, because it is not a pure method. One does certainly run the risk of inoculating dirt etc., but that risk is very small, and has only caused slight local abscesses in two out of more than a hundred and fifty inoculations. It is evident that the healthy show a strong resistance to dirt and microbes, when these are applied gently to the subcutaneous tissue; and should an abscess form, it represents an effort of nature to get rid of the foreign matter. Under the circumstances, it is not necessary to make the skin a-microbial before incision.

**EFFECTS AT SEAT OF AUTO-INOCULATION -- IN THE HEALTHY SUBJECTS**, and in those glanders' cases where the nasal discharge contained no bacilli of the disease, the effect was the same. There was generally no constitutional or local disturbance.

In November, twenty-one ponies segregated on account of having been in contact with the disease were auto-inoculated; again in the beginning of Decr. and again on Christmas day, without effect. On New Year's day each was hetero-inoculated with the nasal or lachrymal discharge of the poney next to it. All healed by the first intention and no constitutional or local disturbance took place. All were considered free of the disease.

**IN THE DISEASED SUBJECT -- Generally complete healing by first intention within 3 days.** When there was great
swelling or any pus, it indicated contamination and non-absorption of the glanders poison (VIDE Case E.). When there was a serous exudation (VIDE Case B) it indicated absorption of the poison, no doubt, however, under the influence of some contamination also (VIDE temperature for some days after). Healing, then, was the usual result of absorption of the glanders poison in the glanders subject, and was the favourable but not infallible sign to be aimed at. In none of my cases did I witness ulcers at the seat of auto-inoculation (as is described for hetero-inoculation).

OTHER RESULTS OF AUTO-INOCULATION -- SYSTEMIC RE-ACTION. In nearly all cases of successful auto-inoculation a fall of temperature of 1° to 2° F. took place at once. This was NOT INVARIABLE, and may or may not have been accidental, but, taking into consideration the time of the day each inoculation was made, it appeared fairly constant (VIDE charts). AFTER ONE TO FIVE DAYS A RISE OF TEMPERATURE from 1 to 4 degrees together with various symptoms of equina (VIDE all the charts) characterised all cases.

LYMPHATIC REACTION, -- The lymphatic vessels about the seat of inoculation, or other visible parts of the body, may or may not become perceptibly active. Usually, however, after a few days, enlargement of the local lymphatic glands was noticed (VIDE all clinical histories) especially in such cases as were auto-
inoculated inside the forearm, while the lymphatic vessels were usually not enlarged (VIDE Case E, Dec. 16). At more distant parts of the body, glands and vessels may become actively congested, but usually the glands took the greater share of the reaction (VIDE all clinical histories).

OTHER EFFECTS.-- In one instance (VIDE Case F) a periostitis followed the auto-inoculation.

Hot and cold swellings were liable to be produced in any tissue of the body (VIDE clinical histories).

On mucous membranes, changes of colour typical of the disease took place (VIDE clinical histories) wherever.

Whether any previous inflammation existed, then lymphatic reaction of glands and vessels in the neighbourhood increased (VIDE Case A, Dec. 15).

In such cases as had periosteal swellings, the lymphatics in the neighbourhood become congested (VIDE clinical histories).

Auto-inoculation in occult glanders appeared to be generally capable of producing any symptom of glanders,-- it served, with other means, to clinch a diagnosis, apparently by creating an activity of the disease. A study of the temperature charts and symptoms indicates this (Q.V.).

The practice is harmless, and it does not lead to needless loss of life.
It has by itself the disadvantage of sometimes failing "to take," either in consequence of absence of virus in the discharge inoculated, or of improper performance of the operation. It therefore requires to be persisted in. It is not a perfect method and must be employed with other means.

THE CLINICAL RECORD.

THE NASAL DISCHARGE IN HEALTH.— In India generally in the early morning a drop or two of a clear watery discharge will be found in a healthy nostril. This cannot by the naked eye be distinguished from what MAY be found in occult glanders.

A similar remark applies to the lachrymal discharge of the healthy horse, the latter discharge having, of course, a different appearance.

THE NASAL DISCHARGE IN CHRONIC (OCCULT) GLANDERS.— The nasal discharge may not be more than 30 minims in 24 hours. It may be present or absent in one or both nostrils at any time in the course of the disease. It (as also the lachrymal secretion) may cease on, or be excited by, auto-inoculation; but there was a tendency for it to cease with the prominence of other symptoms. Its cessation or presence had no relation to temperature, except in so far that a prominent lesion elsewhere might raise the temperature, and so indirectly diminish the discharge. It was very evident that the discharge had no relation
to the typical ulcer of glanders. In fact it would appear that the discharge is, in every sense, at the very early stage of the disease, a perfectly normal discharge (VIDE clinical records).

In appearance the discharge of glanders may be watery, transparent, amber coloured, sanguineous, or a dirty white. It, in fact, is without any constant character.

MUCOUS MEMBRANE OF THE NOSE IN CHRONIC GLANDERS.—A remarkable, but unmistakable symptom seen in most cases was a SUDDEN change of colour — normal to dark slaty blue, dirty yellow, or leaden colour, and the return to normal, or from one to the other (VIDE clinical records).

LYMPHATIC GLANDS IN HEALTH.—NOTES BASED ON HORSES STANDING IN THE OPEN AND IN THE STABLE, THAT HAVE NOT BEEN EXPOSED TO THE CONTAGION. If fifty healthy horses are carefully manipulated in the submaxillary space, decided differences will be found in the lymphatic glands. Some will be slightly harder, others bigger, but all can be made out, if slowly and delicately handled. I have observed that horses in regular work have, as a rule, submaxillary glands more difficult to appreciate — their intermaxillary space is "cleaner" than in horses at rest.

It was also found that the same healthy subject showed a small irregular variation in the size of
these glands. In some cases this was seen at intervals of eight hours, but very often noticed after a few days. Does this change depend on a slight chill, or on digestion, or what? I cannot doubt any longer the fact of the alternation. It can occasionally be noticed in the brachial and prescapular glands. I am not aware that similar observations regarding variation of lymphatic glands in horses have before been placed on record.

IN HORSES THAT HAD STOOD IN A GLANDERS STABLE BUT HAVE NOT BECOME DISEASED. All the changes above noticed have been repeatedly observed while they stood in the open.

Further, an enlarged condition of the submaxillary glands generally, and a gradual return to the normal towards the end of the outbreak, was repeatedly noticed by me and the two sergeant farriers assisting me.

IN CASES OF CHRONIC GLANDERS.-- In some cases the difference of size was most marked.

Apparently in those glands undergoing subacute congestion, the change was most sudden. In every case watched the submaxillary glands either suddenly (in 4 horses) or slowly (for days) enlarged and diminished to normal, and just as suddenly or slowly returned to their enlarged condition or were followed by other glands enlarging (VIDE Case F. December 1 and 2).
These sudden changes, also, sometimes either followed, or were followed, by, an oedema or lymphangitis in another part of the body (VIDE the clinical records). Even when a gland felt as hard as a marble, it might be found gradually softening after some weeks.

In one case (Case F.) the submaxillary gland contained pus.

FARCY ULCERS may appear on any part of the body, and they may heal of their own accord.

APPETITE IN CHRONIC GLANDERS is very good. It was observed that horses whose temperature rose to 102° still ate ravenously (VIDE clinical records).

APPEARANCE OF COAT.-- A staring coat was found to have no relation to temperature in the few cases at my disposal (VIDE clinical records).

CONDITION IN GLANDERS.-- Temporary improvement took place in three cases. It did not last under the influence of auto-inoculation (VIDE clinical records).

RESPIRATION IN CHRONIC GLANDERS.-- As an aid to diagnosis this is valueless. On a hot day in India a healthy horse at rest may breath 60 or 70 to the minute, and that with a pulse of 40.

Auscultation reveals nothing in chronic glanders. The rustling of trees, the buzz of insects, etc., of this country (India) would effectually conceal anything there was to hear in the chest unless very marked.

There is the good rule in the service of
especially watching horses "affected in their wind" during an outbreak of glanders. This is wise, but it is to be noted that no apparent loss of wind may result from the presence of many small lung tubercles.

Only in one case was a cough detected.

**COLIC IN GLANDERS.**— In two cases violent colic was seen. This condition was mentioned to me by Lieutenant Moore, A.V.D., F.R.C.V.S., who considered it due to splenic abscess. This fact was proved by post-mortem (vide Case B.).

**THE METASTATIC LAMENESS OF GLANDERS.**— One of the most remarkable symptoms is the rheumatoid lameness that sometimes occurs. First one leg, then another, or two others—a sudden change or slow change, accompanied, or not accompanied, by heat, swelling, or tenderness. Sometimes an attack in the loins, or neck, painful to witness (vide Cases A.B.C.).

**THE METASTATIC OR STATIONERY HOT AND COLD SWELLINGS.**— These are as peculiar as the lameness. The former appear to be due to lymphangitis and are painful, and the latter to oedema from some affection of the absorbents. They are either variable or stationary (vide all the clinical records).

**THE URINE OF GLANDERS.**— In all cases the urine contained albumen. Albumen was not always found when looked for, but if the urine was steadily examined a periodic albuminuria was always discovered. The
quantity varied greatly. So far as I know this character has not before been observed.

Three out of the eight cases suffered from diabetes insipidus.

THE PERIOSTEAL SWELLINGS.—In four out of eight cases a spontaneous tumour of sudden origin appeared over a rib. These could not be accounted for by any injury, by stick, stone, girth-strings, or other cause. The skin was not bruised and was freely movable over the tumour. They were hard, hot, painful, irregularly-shaped swellings, varying from a marble to a turkey's egg in size. They resembled a bony callus, and somewhat abruptly diffused into the rib. They allowed of no pitting by the finger, but slowly lost their hardness, heat, swelling, and tenderness, unless re-excited by some action of the glanders poison (vide clinical records).

After auto-inoculation, in three instances, a manifest reaction was created in the lymphatic vessels of the subcutaneous tissue about these tumours.

In one case (vide Case F. Dec. 15), the tumour itself became warmer, more painful, and a little larger, together with the local lymphatic reaction. The skin with the enlarged lymphatics, however, remained freely movable over the tumour. (No doubt the clinical fact of a connection between the skin and the periosteum is of interest to physiologists. It cannot have been
an accident in four cases). I consider these tumours a specific manifestation of the disease, in the same way that tuberculosis may give rise to bony changes.

Are these lesions of the ribs secondary to those of the lung, or to those of the lymphatic system?

Do they exist in other bones? I do not know that bony lesions in glanders have before been noticed, and they have perhaps therefore not been looked for. I regret losing my past opportunities for examining other bones in the fresh state. A half-burnt lumbar vertebra of a glanders subject was obtained from the cinerator at the time of being burnt, and a distinct abscess was found in its cancellated tissue. It is perhaps possible that local periositis and ostitis may be a cause of the lameness.

These small results will suggest search to others.

Apparently the only constant character of chronic glanders is its INCONSTANCY! for a study of the disease appears to only end in an appreciation of the metastatic and vicarious nature of so many of its symptoms. Any symptom may or may not take the place of another, and apparently an ordinary injury may excite any characteristic of the disease.

THE PRACTICAL APPLICATION OF THE METHOD TO SUPPRESS AN OUTBREAK.— After all diseased horses have been shot, the suspected (i.e. those doubtful symptoms,
symptoms, and those that have stood next to or been in contact with glandered animals) are taken to form a segregation camp. The temperature is taken twice daily, and together with any other clinical remarks, is written down. All are then auto-inoculated once a week for three weeks. Any horse showing a temperature over 100.5° is again separately segregated close by, and specially watched -- the urine being daily examined.

It seems probable that no horse with glanders can exist for three weeks without once showing a temperature well over 100.5° F.

In practice the temperature of the non-suspected (i.e., those that have stood in the same stable as the infected, but have not had known contact with them) cannot be taken every day, and the next best thing is to take it for six consecutive days once a day, in the evening or middle of the day. All reaching 100.5° to be specially watched to have their temperature taken daily, and if they reach 101° F., to be sent to the segregation camp and treated as though suspected, unless their temperature is otherwise accounted for.

In this way the minimum amount of auto-inoculation is done.

AUTOPSY AND PATHOLOGICAL INFERENCES.-- In all cases it was noticeable that there were more tubercles on the outside of the lung than towards its root, and the anterior lobe seemed more liable to disease
than other parts.

The peculiar engorgement of the lymphatic vessels in the lung in Case A (VIDE autopsy) also seems to point to lymphatic spread of the disease.

The liver abscesses of some cases showed a resemblance to what are called "kunkerous" nodules in India. No doubt this disease attacks the liver. The clinical history and POST-MORTEM of Case A appear to illustrate this.

The spleen in two cases contained tubercles.

The heart showed no peculiarities. Nothing abnormal was noticed in section of any of the vessels.

One of the most remarkable facts of the disease as proved POST-MORTEM, is its power of lying dormant in the lung or other tissue for possibly an unlimited period. Many small glanders abscesses may exist in the lung, or even one 3 inches in diameter (E.G. Case B.), without showing any reliable symptom of the disease. Seven months can be fixed as the period of exposure of most of these cases to contagion --- it may have been longer, and yet their POST-MORTEM only corroborates the passive nature of the disease and its temporary excitement by auto-inoculation.

In most of these cases therefore seven months elapsed, and auto-inoculation only then enabled a pathognomonic symptom to appear. There can be no better evidence that the POST-MORTEM appearances of these cases.

Kunker is an Indian word meaning lime.
In man, a period of three years has been noticed in which chronic glanders lay dormant without symptoms. Annales de Derm et de Syph. April 1891. Generally speaking, all tissues (nervous tissues were not examined) are liable to be affected by chronic glanders in the shape of foci of concentrated inflammation.

THE CONTAGION. -- I have assumed for the purpose of this paper that the bacillus mallei is the proven exciting cause of chronic glanders. It is not very contagious -- it does not rapidly spread over a large area, nor attack great numbers of horses at once.

Whether the well-known property of glanders appearing after many years' interval in a stable is due to the dormant disease existing, or to the bacillus lying dormant outside the body, could be decided by an instance of a fresh lot of horses being imported into a glandered stable and their becoming glandered. For my own part I am convinced that the bacillus may be dormant in a stable for an indefinite period outside the body and also inside the body, its vitality is so enormous. The presence of the bacillus in the nasal discharge did not depend on any visible solution of continuity of the Schneiderian mucous membrane. A feature of this bacillus in the body is its property of multiplying in gland tissue. This is demonstrated by a section of the glands near the seat of auto-inoculation. It is a fact supported by experience, that the virus tends to fasten
itself on to any pre-existing inflammation; and hetero-
inoculation with such inflammatory products produced
glanders in the only instance tried.

Do a few bacilli auto-inoculated into a lymph-
phatic vessel multiply in the first group of glands,
then become distributed over the body, and also excite
other partially encapsuled bacilli to activity and to
form fresh foci of the disease? Or do the few bacilli
auto-inoculated multiply in a gland and there excrete
toxic compounds capable of being taken up by all vascula-
lar channels and of exciting existing bacilli to action?
But how does a simply inflammatory action (injury to the
knee, VIDE Case A) attract to itself the bacilli? If
a simple inflammation not only excites an old glanders
lesion to activity does it not also cause the bacillus
to proceed to other parts of the body and so cause
fresh foci of the disease? (VIDE Case A).

Auto-inoculation seems to act by the toxic
products produced in the neighbouring gland. This ex-
cites old foci of the disease... some bacilli escape, and
fresh foci are formed. This accounts for the days' in-
terval before reaction as compared with mallein.

This does not explain the effect of an injury!
What, then, have we in the inflammatory products of a
simple severe inflammation that diffuse through the
system and excite the bacilli of other parts to activity
and to distribute themselves? If this is the fact,
does it not open up some new pathological problems?

The penetrating power of the bacillus is very great. There is evidence pointing to its entering through entire mucous membrane. I am acquainted with one eminent bacteriologist who thinks it possible for the bacilli to penetrate the skin. We know how resistant it can be to external influences.

The experience gained of chronic glanders points to its being contagious rather than infectious -- and not very contagious. If the history of an outbreak be enquired into evidence of contagion will probably be found. The virus is fixed, and generally carried by fomites, but not usually aerial.

The time of contact to the time of pathognomonic symptoms was indefinite. In one case a month, in another 4½ months, and in another 8 months were traceable, but all cases showed lesions of some standing, so that the period of incubation (commencement of disease after exposure to contagion) must be short.

There is some evidence for assuming that the bacilli of chronic glanders enter into the body by the lymphatics of whatever tissue they are in contact with (VIDE POST-MORTEM examinations and effects of auto-inoculation). That the virus spreads in that way, and not usually by the blood-vascular system, is demonstrated by microscopical observation. This assumption will account for the peculiar distribution of chronic glanders in
the lungs and in other organs.

How does a bacillus inhaled into an air-cell get through the epithelial layer? In an analogous way to that in which particles of coal naturally enter the lung. Amoeboid lymphocytes are engaged in this work of absorption, and in this way the lymphatic channels are reached.

Colman's experiment must have been performed with acute glanders. I have seen two men accidentally cut with a knife which was covered with the blood of chronic glanders without result as yet. A syringe full of the blood of chronic glanders has been injected into a dog without result.

Is one justified in thinking that the contagion when first entering the system in chronic glanders creates no constitutional disturbance? That it reaches a lymphatic gland and multiplies, and unless there is some "exciting" cause, such as other disease, injury, etc., settles down, and a tubercle or a small localised inflammation results? Or that a few bacilli gain a lymph channel and deposit in other tissues?

The same happens in the lung, that being a more or less favourable habitat; but wherever we see the lesions we see round about the attempt at confinement.

Microscopically, we can demonstrate the lymphatic origin of a fresh tubercle. Around four sections of small fibrous tubercles, and round about five sections
of active tubercles, I have failed to find bacilli. In
the only instance tried no effect followed inoculation
with the sero-sanguineous fluid around an active tuber-
cle.

Is chronic glanders in the early stages a
local disease— is it non-contagious? A very limited
experience has raised this possibility. Two horses
with occult glanders were very carefully auto-inoculat-
ed without result; one was a case three months after
contact with a glandered animal, and the other was one
of five months after contact. The nasal discharge of
one of these was inoculated under the skin of three
mice without result. Both these horses were very care-
fully done, and the result must be attributed to absence
of virus in the discharge. Both these cases were
found glandered after subsequent auto-inoculation—
and at the autopsy some markedly old standing lesions
were found. These cases attracted suspicion only be-
cause of their history and temperature record.

Two conclusions here present themselves—
(1) Auto-inoculation must be repeated, and by itself
is inconclusive; and (2) Chronic glanders in the early
stages, may be non-contagious through its nasal dis-
charge — but whether this non-contagiousness was in-
termittent or not, was not ascertained.

Is it possible that chronic glanders in the
earliest stages is a purely local disease — non-contagious?
If the nasal discharge is not injurious it is doubtful whether there are other secretions more injurious.

When does chronic glanders begin to be contagious? Long before evident external symptoms; certainly whenever the virus is found in the nasal discharge, but yet not until well-marked lesions must have taken place? It is however to be noted that bacilli MAY be absent temporarily from the nasal secretion owing to the glanders abscess or ulcer not discharging at the time.

Is chronic glanders curable? There are alleged cases of the kind recorded, and many experienced veterinarians believe that certain cases of farcy are curable. My present knowledge permits me to merely contemplate the possibility, but I must submit to others whether there is ground for that opinion. There is certainly no ground for attempting it in practice.

Is glanders preventable by protective inoculation? I venture to think the bacteriological aspects seem to point to its possible prevention by protective inoculation. I myself heartily desire opportunity to experiment in this direction with a lymphatic gland extract. The observations herein recorded seem to suggest a struggle between the lymphatic gland and the bacilli which in some horses ends in glanders and in others not. It should be stated that there appears to be no record in veterinary literature of changes in a lymphatic gland of a horse exposed to glanders and not
becoming diseased thereto.

GENERAL REMARKS.-- It is a common experience in other contagious diseases as well as in glanders to find incipient cases at the end of an outbreak -- typical occult cases, difficult to diagnose, weakened cases of the disease in fact. That

It is known that animals have been exposed to an outbreak are frequently found to have lost condition and to be otherwise the worse in appearance and health. Are these animals weakened by an attack of exhausted virus, and have all the animals that appear to have escaped also been attacked by a still more weakened virus? Is it possible that some of these cases are made immune? (When specific fevers attack communities that have already had an outbreak, not only are fewer attacked, but the disease is less virulent). Or is this loss of condition &c. due to exposure and discomfort consequent upon an outbreak, or is it due to the predisposing causes that allowed the entry into the system of the virus of the disease.

I am under the impression that some of the more experienced veterinarians can point to cases of immunity against cattle plague where no visible illness had previously been noticed in the animal, although more than once exposed to the influence of the disease.

Are not some methods of producing a modified virus those of exhaustion, pure and simple? Are pathologists but unconsciously imitating
nature's methods in the production of immunity, and can this be the key to solving all contagious or infectious disease? It has been stated that lymphatic glands underwent an unusual alteration in a group of apparently healthy horses exposed to glanders. This can be corroborated. Is it to be presumed that the virus attacked these glands but was beaten off? I do not know, but the fact of such marked alteration being very much more than that noticed in horses not exposed to contagion was evident.

The Service permits of extra diet for horses exposed to an outbreak. The loss of condition, or the desire to keep animals in extra good health, and so resist disease, is therefore based on experience. What is the further explanation? The fact, however, of the virus of glanders being capable of lying dormant so long, is at present one forcible argument against the attack of a weakened bacillus.

It certainly cannot be said that chronic occult glanders is any protection against acute glanders. We presumably require something much less, and probably different, from that. Chronic glanders MAY be due to a weakened bacillus and possibly a swollen lymphatic gland of a healthy subject MAY be due to a still more exhausted glanders bacillus but there is probably no immunity thus produced. A mild form of an infectious disease often produces immunity; it would however,
require to be a mild general (not localised) attack; or if localised, would, at any rate, have had to produce a product that diffused itself over the body, and so produced such a change as amounts to immunity.

It certainly is very extraordinary how the cases of glanders in an outbreak vary; why in one case the disease should be chronic lasting for years, and a case next to the former should be highly acute and yet a 3rd. horse near not become diseased at all. Moreover the varied symptoms the disease will manifest itself by in a single outbreak are remarkable - I do not think there is one symptom known to veterinary medicine that may not be exhibited in glanders.

Yet it may be presumed that in the beginning the contagion does not vary in character. From a chronic case of glanders coming into a stable, both acute cases and chronic cases will arise, and vice versa!

It would seem that the clinical aspects of a glanders outbreak point to a resisting influence on the part of some animals no matter whether the bacillus be strong or weak.

MALLEIN.-- Excellent results have been obtained by Hunting and M'Fadyean and French veterinarians have carried the use of this substance beyond the experimental stage. All reports agree and are convincing. It moreover, has the greater advantage of always containing the reactionary poison, and is therefore more likely to act when auto-inoculation would not (e.g., a discharge from
an early case of chronic glanders). There is, however, one condition which is not yet worked out.

Does mallein react on any condition of the body that is not glanders?

Mallein in a glanders subject very generally causes a marked local tender swelling; occasionally this is small or absent.

Is the absence of this swelling in these few cases of auto-inoculation due to the small quantity used, or a peculiarity of the agent, or merely a coincidence? I have never attempted to auto-inoculate by the hypodermic syringe -- not desiring to bring the other contents of the secretion in contact with the blood more than I could help.
CASE A.—Gelding, aged 6 years, Waler.

1892
Oct. 26.—This case is a remount of this year which has been segregated since 13th September on account of having been in the Veterinary Hospital at the time of the outbreak being discovered there.

Entered for purpose of special observation, record and inoculation.

Had stood next but one to the first case of the outbreak.

Suspicion of the case being infected arose from the temperature averaging over 100°, while other horses averaged under 100° F.

Nov. 12.—Inoculated with own nasal discharge.

16.—Seat of inoculation granulating.

21.—Seat of inoculation healed. Inoculation has evidently "not taken".

25.—Received a fall on near knee; fomented.

27.—Treated by Am. Chloride on account of yellow mucous membrane. Knee hot and painful.

28.—Off submaxillary gland has become swollen.

Swelling of knee hot and painful.

29.—No change in symptoms.

30.—Glands of near side in submaxillary space.
Nov. 30. -- Swollen. Knee swelling is more hot and painful. Treated by cold water irrigation.

Dec. 1. -- Also oedema of the legs, off glands (submaxillary) alone are swollen.

" 2. -- All swelling of glands has disappeared.; knee and leg swollen.

" 3. -- Knee and leg oedematous; continue cold water irrigation.

" 4. -- Glands still not swollen; a hard swelling on off side of rib has appeared.

" 5. -- Much of oedema of leg is gone; knee still hot and painful. No glands swollen; swelling of off side still hot and hard.

" 9. -- No change in any of the symptoms these last four days.

" 10. -- No change in any of the symptoms except that the swelling of off side is not so hot to the touch. (Edema nearly gone.

" 12. -- Swelling of off side is still decreasing in pain, heat, and size.

" 13. -- Found this horse had been at exercise since yesterday (against orders); going lame; knee hot and swollen, no oedema of leg, no treatment. No change in symptoms, Appetite excellent.

" 14. -- Inoculated at 8.30 a.m.; owing to fall of
Dec. 14.— Temperature case is considered very suspicious. Animal appears in perfect health and spirits. Knee less hot, but leg swelling is greater. Inoculated with thick discharge found in near eye early in the morning on off side of neck.

15.— Knee with less heat, but leg has sudden swollen from knee to coronet,— a pure cold anasarcaous swelling. Lymphatics of the leg above the knee are corded and hot. There is anasarca of the hind fetlocks.

No swelling of the glands. No change in swelling of off side.

16.— Mucous membrane of the eye and nose has turned slaty blue. Submaxillary glands are swollen, hot, and painful near side. There is an extraordinary sudden and painful lameness of near hip. A large hot and painful swelling exists on near side at base of neck, and another on the off flank. All the lymphatic vessels of the off flank stand out like thick cords, and are painful and hot to the touch. All these symptoms have developed during the night. The urine is thick and contains albumen, and urates in great quantity. The animal eats
Dec. 16.-- half his forage and is dull. The lymphatics of near forearm (above the knee swelling) are inflamed, and the near foreleg below the knee is swollen. Other symptoms remain the same. Destroyed. Just before being shot the temperature carefully taken was 103° 6° F.

POST-MORTEM EXAMINATION.-- At the moment of death the temperature carefully taken was 102° 4°, but on the temperature being taken three minutes after death, it was 104°. Five minutes after it was 100° 2°, and gradually lowered.

RESPIRATORY SYSTEM.-- No Schneiderian ulceration.

Both lungs were studded with small tubercles of pus half an inch in diameter. In two places in the right lung there were areas of acute congestion 1 ½ inches square. On the surface of the right lung five irregular white cords, two or three inches long and ½ inch broad, existed between the lobules; these on section appear to be lymphatics loaded with inspissated grey pus. The lung tissue on either side of these is apparently perfectly healthy.

DIGESTIVE SYSTEM.-- Liver, numerous small pea-like spots of pus.

LYMPHATIC SYSTEM.-- Submaxillary glands inflamed; lymphatic vessels of near forearm and off

**Record of Temperature**

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**Temperature Chart:**

- The chart shows the temperature fluctuations over the specified dates.
- The temperature values range from 50°F to 100°F.
- There are peaks and troughs indicating variations in temperature.
- The peaks and troughs may correspond to different days.
- The chart is used to track and analyze temperature changes over time.
flank are much inflamed; the off iliac lymphatic glands are much inflamed, also the brachial glands (vide below).

**OSSEOUS SYSTEM.**— The swelling of off side consisted of an abscess with thick walls of osseous tissue on the rib itself; the abscess contained about six minims of thick yellow pus.

**CUTANEOUS SYSTEM.**— The swelling of near side of neck is found to be an infiltration of lymph underneath the skin, together with slight localised inflammation. The seat of inoculation on off side of neck is quite healed.

**URINARY SYSTEM.**— Kidneys apparently quite healthy.

**THE KNEE** showed much extravasation in subcutaneous tissue in front of the joint. The synovia was thick, and contained streaks of blood.

The lymphatic glands of the leg were large, red, and inflamed.
CASE B.— Mare, age 6 years, Wales.

1892
Oct. 27.— This case was placed under observation for glanders on account of two severe attacks of colic and loss of condition. These attacks the Veterinary Officer (Mr. Moore, A.V.D.) considered as probably due to ruptures of the spleen.

Left and right submaxillary glands are enlarged and lumpy; near hind slightly swollen.

" 31.— Slight discharge from off nostril and coughing at night.

Nov. 1.— No alteration except the presence of a frequent soft painful cough. Glands still enlarged.

" 2.— Coughs frequently. Slight albuminuria.

" 4.— The near submaxillary glands are now bigger than the off. Cough less; discharge from near nostril; leg still swollen. Inoculated inside off forearm.

" 5.— Seat of inoculation swollen, and a slight watery discharge from the wound.

" 6.— Coughing. No change in other symptoms.

" 7.— Serous abscess formed at seat of inoculation.
**RECORD OF TEMPERATURE.**

Case B.—Class—Australian. Sex—Mare. Age, 6. Station—Cawnpore. Disease (Asthenia)—Chronic Glanders. Result—Destroyed. Date of Result—Nov. 9, 1892.

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<th>Dates of Observation</th>
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- Records above 100° Fahrenheit indicate suspected disease.
- Records below 98° Fahrenheit indicate progress towards recovery.

1892.
Nov. 7.

Coughing and other symptoms the same.

" 8.-- Very stiff and lame on near hind. Very dull.
Three small pimples on near flank. Lymphatics of both forelegs engorged and knotted.
Other symptoms the same.

" 9.-- Yesterday's pimples turn out to be farcy buds.
Since admission animal has lost much flesh.
Destroyed.

POST-MORTEM EXAMINATION.-- Schneiderian mucous membrane was of normal appearance, and the nasal sinuses showed no ulceration.

LUNGS.-- On outer surface of the left lobe of the right lung an abscess existed 3 inches in diameter, the wall of which was fully ½ inch in thickness and hard, lamellar, and fibrous; and inside was slimy thick grey pus -- evidently of very long standing and slow growth. Scattered over the same lung, 18 small, drey grey abscesses about the size of a pea were counted -- otherwise the lung tissue was of normal colour and appearance.

The left lung showed numerous very small irregular collections of pus-- none bigger than a pea.

Spleen was enlarged, and two small more or less acute abscesses the size of a marble existed.

The Liver was enlarged but apparently normal in colour, etc.

LYMPHATIC SYSTEM.-- Glands, in axilla much inflamed and enlarged. Inguinal, bronchial, and left...
submaxillary were hard and enlarged.

No other organs examined.

It appears the splenic disorganisation has therefore been corroborated POST-MORTEM. A battery officer, who was present at the autopsy, states that this horse had an attack of bleeding from the nose "during the last few days of April or on May 1, 1892," the day being fixed in his mind by the funeral of an officer of the garrison on that day.

Has this haemoptysis any connection with the large glanders abscess in the lung?
CASE C.—Gelding; age 9, country bred.

1892.

Oct. 23.—This animal was sent into camp on 13th September 1892, because he had stood next to a glandered horse in the Veterinary Hospital. He came into Hospital on 11th July 1892.

28.—This case is placed under special observation on account of marked Rheumatic symptoms. There is no swelling of submaxillary glands; slight watery discharge from both nostrils.

31.—Very stiff and "rheumatic" behind; yellow colouration of mucous membranes. Loss of appetite.

Nov. 1.—Slight discharge from left nostril; near submaxillary glands are lumpy to touch, not adherent. Ate at 5.30 p.m.

2.—Appetite fair; slight albuminuria.

4.—Inoculated. Rheumatism has a firm hold; dead lame off fore, not so stiff behind; neck muscles are stiff.

5.—Appetite improved. Both fore fetlocks swollen; lame all round; very stiff about back and loins.

6.—Symptoms same as yesterday.

7.—Animal evidently suffering great pain; albuminuria one-third.
RECORD OF TEMPERATURE.


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*Note*
Nov. 8.-- Mucous membrane of nose is scarlet. There is no submaxillary swelling; slight watery discharge from nose is present; loss of appetite, and the usual symptoms of fever. The lameness and stiffness is extreme, and the swelling of the legs has increased.

There is no suspicious pimple, nor is there any external sign of glanders. This history and the clinical record indicate glanders. The person acting for the owner considers that humanity demands the destruction of the suffering animal.

POST-MORTEM EXAMINATION.-- No Schneiderian ulceration.

LUNGS.-- Pale blue colour. The right lung shows numerous small gray purulent abscesses through its substance -- probably at least a month old, judging from their inspissated character. The left lung shows 5 small patches of gangrenous tissue 1 inch in depth, surrounded by an areola of congestion. The intervening tissue appears almost normal in colour and character.

No other organs examined.

Features of this case -- Rheumatic symptoms, and absence of positive symptoms of glanders.

In all probability this animal obtained the contagion by ACTUAL CONTACT, since he was the private property of an officer of another regiment and had no previous connection with the affect battery. The so-called period of incubation must have been about 3 mths. probably under.
CASE D.-- Mare, aged 12 years, Waler.

1892.
Oct.27.-- This is a case isolated on account of having stood next to three glandered horses in August. The animal makes abundant urine, which shows no albumen reaction, and she has lost flesh for the last 2 months. There are no swollen glands. Stated to have been "short in the wind" during the past 4 or 5 months.

Nov.1.-- Does not eat her food; slight swelling of submaxillary lymphatic glands.

" 2.-- Seen to micturate 10 times in 12 hours. Albumen present in urine.

" 3.-- Seen to micturate 8 times in 12 hours.

" 4.-- Inoculated inside off forearm with her own apparently normal nasal discharge.

Nov.6.-- Still makes urine 8 times in 12 hours. Seat of inoculation healed by first intention.

" 8.-- Swelling of near submaxillary glands has gone, but that of off side is harder. Makes urine 6 times in 12 hours. Internal surface of both thighs has lymphatics engorged; three small fancy buds on near hind. No nasal discharge, and no ulceration of mucous membrane.

" 9.-- At seat of inoculation there is nothing except
**RECORD OF TEMPERATURE.**

Case D.—Class—Australian. Sex—Mare. Age, 12. Station—Cawnpore. Disease (Diabetes Insipidus)—Acute Farcy. Result—Destroyed. Date of Result—Nov. 9, 1892.

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Inoculated.
Nov. 9. -- a few corded lymphatics.

" 11. -- POST-MORTEM EXAMINATION. -- No Schneiderian ulceration, but there are three small pimples high up on near side.

THE LUNGS show small pea-like pustular tubercles at intervals of about an inch; every one opened presents grey inspissated pus surrounded by a fibrous capsule.

SPLEEN. -- Enlarged and hard.

LIVER. -- Enlarged and much hardened. Two abscesses of inspissated pus, the size of a marble, exist.

LYMPHATIC SYSTEM. -- Bronchial and inguinal glands, etc., very much hardened and enlarged -- especially the inguinal, undergoing active change.

Axillary lymphatic glands of off side are enlarged and active.

KIDNEYS. -- Normal in appearance and section, no other organs examined.
CASE E.-- Mare, age 14, Waler.

1892.
Nov. 2.-- This case is placed under treatment for asth¬

enia, but has been isolated since November.

1, on account of swollen submaxillary lymph¬

atic gland, slight nasal discharge, and
general rheumatic stiffness. The nasal

mucous membrane on the first instant was

found to be of a slaty blue colour.

" 4.-- There are two slight fibromata on near flank.

" 9.-- Submaxillary glands very lumpy and hard (not

much enlarged). No nasal discharge. Traces

of albumen present in the urine.

" 11.-- The slightest discharge from both nostrils. A

hot, slightly painful, hard swelling is

found on one of the off ribs. Inoculated

with own nasal discharge on near side of

neck.

" 16.-- Seat of inoculation swollen and appearance of

an abscess forming.

" 18.-- Seat of Inoculation discharging a little pus.

" 21.-- Symptoms of bilious fever. Treated by ammon¬
iurn chloride.

Seat of inoculation discharging pus. No al¬
bumen in urine.

" 24.-- Swelling on off side of chest remains the same
Nov. 24. -- it does not pit on pressure, and is adherent to the bone. Lymphatic glands are still slightly enlarged.

28.-- Glands still lumpy. Membrane of nose pale. The swelling of off side is not quite so hot and is harder.

29.-- Both submaxillary lymphatic glands still enlarged. Mucous membrane of nose is clearer. Albumen in urine has increased.


Dec. 1.-- Swelling of off side is smaller.

2.-- No change in symptoms. The conjunctiva is of pale slaty colour.

3.-- The slightest discharge from both nostrils continues. No more than 2 drachms in the 24 hours.

4.-- Mucous membranes nearly normal in colour.

6.-- Animal is a little dull.

7.-- Inoculated with nasal discharge.

8.-- No alteration in other symptoms. Mucous membranes of a pale yellow colour.


10.-- Discharge from nose ceased. Otherwise no
Coat is looking better.

Submaxillary glands enlarged. Slight discharge from off eye. None from nose. Condition improved in the past fortnight.

The swelling of off side is smaller, and not so hot, coat staring.. No change in other symptoms.

Slight discharge from off eye and nostril. Inoculated inside off forearm.

Animal very bright. Appetite very good. Coat looks better. Both eyes are now discharging slightly. Urine contains albumen. The submaxillary glands, especially of the near side, and those of the off forearm, are suddenly much swollen, hot, and painful. The place of inoculation is healed by first intention, and the Lymphatics are not corded. The swelling of off side is enlarged since yesterday, hot and painful, to the touch, while around it the lymphatic vessels are cord-like, hot and painful. The breathing is hurried but the appetite is ravenous. The urine is of high specific gravity (1056) and contains much albumen.

Discharged. Destroyed.
RECORD OF TEMPERATURE


Date of Observation 1892  Dec.  
1  2  3  4  5  6  7  8  9  10  11  12  13  14  15  16  17  18  19  20  21  22  23  24  25  26  27  28  29  30  31

Temperature (°F) 99.5 99.5 99.5 99.5 99.5 99.5 99.5 99.5 99.5 99.5 99.5 99.5 99.5 99.5 99.5 99.5 99.5 99.5 99.5 99.5 99.5 99.5 99.5 99.5 99.5 99.5 99.5 99.5 99.5 99.5

Remarks:  
- Initial body temperature recorded at 100.5°F.  
- Temperature remains stable for several days.  
- Symptoms of Asthenia and Sub-Acute Glanders observed.  
- Temperature drops significantly starting Dec. 15, 1892.  
- Animal appears to recover gradually after initial drop.  
- Destroyed on Dec. 16, 1892.
POST-MORTEM EXAMINATION.-- No ulceration of Schneiderian membrane, but well back on off side there is a suspicious white cicatrix.

LUNGS.-- Left lung is studded with small tubercles containing pus throughout their substance; also five abscesses each one inch in diameter and containing grey inspissated pus and with thick walls. Right lung has three patches of acute congestion, each about two inches in diameter on its outer surface and peculiarly circumscribed.

DIGESTIVE SYSTEM.-- Liver has three large abscesses, each one inch in diameter with thick walls containing pus.

LYMPHATIC SYSTEM.-- The glands of forearm and submaxillary space acutely inflamed, evidently of recent origin. The lymphatic vessels around the off side swelling are corded and inflamed.

URINARY SYSTEM.-- The kidneys appear beautifully healthy.

OSSEOUS SYSTEM.-- The tumour of off side of body is found to be a small abscess under the periosteum of a rib, and containing half ounce of yellow pus; the wall of the tumour is very thick and consists almost entirely of bony tissue.

CUTANEOUS SYSTEM.-- There were two small skin tumours, found to be ordinary fibromata.

The seat of inoculation, was quite healed and showed no prominence of lymphatics.
CASE F.--Gelding, age 12, Waler.

This case was isolated on October 28, 1892, on account of having a temperature over 100° at various times and because of one of the glands on near side of submaxillary space feeling hard. It had been previously isolated on account of having stood next to a suspected horse, which latter turned out not to be glandered.

The case is treated as one of abscess of near submaxillary gland involving only one of the lobules of the gland, ⅛ inch in diameter. The other lobules of the gland do not feel swollen in the least.

The animal is in poor condition.

1892
Nov. 26.--There is a peculiar warm swelling on a rib of near side. It is reported that a swelling existed on the off side a few days ago, and suddenly disappeared.

" 28.--Abscess lanced -- a few minims of caseous pus squeezed out. There is a trace of albumen in the urine.

" 29.--Slight suppuration from abscess.

" 30.--Glands swollen off side. No discharge from abscess.

Dec. 1.--Condition of animal is improved. Since admission a movable cold tumour between two ribs is found on off side. Swelling of near
Dec. 1.-- Side unaltered. Submaxillary glands off side swollen.

2.-- Submaxillary gland of near side has suddenly enlarged. Other symptoms the same. Albuminuria.

4.-- Off submaxillary glands more swollen. Mucous membrane of nose yellowish. Albuminuria.

5.-- Abscess granulating well.

7.-- Animal a little dull. No albumen in urine, loaded with urates.


12.-- Condition has improved since admission. Movable tumour of off side is smaller. Swelling of near side is firmer, smaller, and with less heat. Abscess healed. Albuminuria one quarter.

14.-- As there is a slight discharge from eyes the case is inoculated on off side of neck. Both submaxillary glands are not so lumpy as before.

15.-- The swelling of near side and the movable tumour of off side are unchanged. The submaxillary glands of off side have suddenly swollen and are very hot. On near side over the last rib a new hot painful swelling has appeared -- the size of a hen's egg.
Dec. 16.-- Place of inoculation is healed. Swelling under jaw is hot and painful. The sudden swelling on last rib of near side is hot and painful. Mucous membrane of nose is dark and acutely inflamed.

The temperature record, clinical history, and positive reaction after inoculation are considered sufficient to diagnose the case. The tumours of the sides in this as in other cases are considered a manifestation of the disease.

Discharged.-- destroyed.

POST-MORTEM EXAMINATION.-- Schneiderian membrane contains no ulceration, but has two pimples far back on near side.

LUNGS.-- The right lung is covered with small hard tubercles of pus; the anterior lobe is one mass of hard nodules containing grey inspissated pus; the left lobe is congested and inflamed in six patches, externally.

The edge of the posterior lobe has hardened to the extent of \( \frac{1}{2} \) inch thickness.

CIRCULATORY SYSTEM.-- Nothing abnormal detected.

LYMPHATIC SYSTEM.-- Spleen normal. Glands of submaxillary space on both sides are acutely inflamed.

Lymphatics round seat of inoculation are not to be found. Glands of abdominal viscera and of lungs are
RECORD OF TEMPERATURE

 DIGESTIVE SYSTEM.-- Liver had a few white spots of calcareous matter.

OSSEOUS SYSTEM.-- The old firm swelling of near side contains dark grey pus. The near side swelling of last rib is localised periostitis and ostitis.

CUTANEOUS SYSTEM.-- The movable tumour of off side contains thick yellow pus.

No other organs examined.
Sir,

I have the honor to forward a systematic report on the late outbreak of Glanders at this Station among the animals of 31st Field Battery R.A. and animals standing in the Chief Station Veterinary Hospital.

CASUALTIES OF THE OUTBREAK. The outbreak has resulted in the destruction of 22 battery horses, 3 chargers, 1 private horse, 17 Govt R.A. Grass Mules, and 3 grass cutters ponies, -- in all 46 animals.

ORIGIN. It is difficult to assert the precise source of the contagion of this outbreak. A batch of 16 mules that marched from Lucknow and joined the battery on the 16th May 92 was considered to be the probable cause of the outbreak other eight mules from the same lot as this suspected batch are now with the Bengal Cavalry, and other three with the Commissariat Transport Department at this Station, but all are free from, and have
not communicated any disease.

Private reports that the disease prevailed at Unao, thro' which place these mules passed, are stated by the Superintendent of Police there to be "erroneous".

As the result of careful enquiry and technical evidence it would appear that the probable source of the disease was in glanders contagion present in the veterinary hospital, which under the most favorable conditions for the development of the disease, then existing developed into activity. --

Of the 26 horses destroyed for the disease 20 had either been in the Veterinary hospital or had stood next to horses that had been there within a few weeks previous to the outbreak.

The 17 mules that have been destroyed, had for at least two months previous, stood within 20 yards of the Veterinary Hospital and two of these mules had stood inside the Veterinary Hospital for a fortnight before the others obtained the proximity. These mules and two others -- 19 in all were picketed together. --

Although the mules and grass cutter's ponies had mixed together daily when on grass cutting duty, only three ponies have been attacked by the disease; it is therefore probable, that the mules on arrival in Cawnpore, three months previous to the outbreak, were free from the disease; more especially as the mule cases were of an
acute character.

From the Record of treatment in this office for the year 1885 it appears that horse No. 24. of G/1 Field Battery, R.A. was destroyed for glanders on 23rd October 1885. This horse was found glandered in the Veterinary Hospital, and had actually stood there for some days previous under treatment for a discharge of blood from the nose, which at the time of taking into hospital was considered to have been due to a blow — it was however a symptom of Glanders!

This circumstance, under the influence of the bad hygiene conditions existing in the Veterinary Hospital, explains the origin of the present Outbreak; and also the reason for the great number of cases occurring there.

The means by which the disease has spread in this outbreak was generally speaking actual contact; native attendants, drinking water, and the grass, no doubt all played their parts in communicating the Disease.

PROGRESSIVE HISTORY OF THE OUTBREAK. On the 10th of August '92 a horse that had been treated for an accident, in the Veterinary hospital from May 29th to July 9th was brought to the hospital again on account of "discharge from one nostril and bad smell of the breath." On August the 15th this animal was shot for glanders. On the same day and every day to 21st of August and at every few days interval until the 23rd of September Cases were shot, until at the end of 5 weeks from the first case, 36 animals had been destroyed. There can be no doubt
that most of these 36 animals were infected by the original cause or by direct contact with others so infected before the 15th August -- since, with the exception of some of the mules, the history of contact between diseased and others is traceable.

The outbreak was now thought at an end, but from the 26th October to the 16th of December 10 more cases (horses) were destroyed, and these latter for the greater part were cases in which no reliable history of direct contact was obtainable.

MEASURES ADOPTED. On the discovery of the outbreak the Veterinary Hospital was vacated and a picket formed at once; and about 10 days afterwards the battery left their lines and formed a picket on their parade ground. The Veterinary Hospital picket consisted of all Govt. and private animals then standing in the Veterinary Hospital (including 11 remounts) and all other horses from the lines that had stood next to any animal destroyed for disease. The battery picket consisted of battery horses from the lines and was situated between two public roads. This picket was soon moved on my recommendation owing to its dangerous position.

The mules were left picketed in their standings near the Veterinary Hospital to which place they had been assigned 18 days after joining the battery (and therefore about 9½ weeks before glanders was discovered). A grass pony picket was formed at a suitable place out-
side the grass cutter's bazar.

Owing to fresh cases occurring, the Veterinary hospital picket was moved to Jajman (2 miles) on the 13th September '92 and became the "Glanders Segregation Camp". The Battery picket in Cantonments was still not free from glanders, and therefore dangerous; it was moved to Jajman on the 12 of November 1892 -- The mules were also moved to Jajman and placed apart.

At the Glanders Segregation camp separate attendants together with every precaution against direct and indirect contact was obtained, with the result, that no case communicated the disease. A System of temperature and note taking of each horse twice daily was introduced resulting in eight horses being diagnosed as glandered; the fact being corroborated by Auto-inoculation and post mortem examination.

In the Battery picket the same system of observation was adopted and three more cases were suspected, and afterwards, at the segregation Camp, found glandered.

The pony picket consisted of battery and private ponies. This picket afforded an exceedingly interesting experiment, in that after it was formed on the 23rd of September, no other case of the disease occurred and every animal was positively demonstrated free from the disease by the inoculation tests.

The Veterinary Hospital in Cantonments is a very old building and badly situated near a native bazar. The roof was in most filthy condition, and the place had
repeatedly been reported as unsanitary. The usual routine of disinfection, destruction of mud and wood work, removal of roof and earth have now all been satisfactorily carried out.

The Battery lines Riding School, places where horses were picketed in Cantonments, both places where the mules were picketed, battery forge, drinking trough, and afterwards treated with quick lime ash mixture with carbolic acid (two gallons to every out of said) have all been disinfected. Ghunny purdahs for battery forge and Veterinary hospital have all been destroyed.

Separate watering buckets for all animals were obtained. All cases detected have at once been destroyed and cinerated together with line gear, clothes, brushes etc.

While the outbreak lasted equines of all residents ("Military" and "Non-Military") in Cantonments have been examined; gharry and ekka ponies also; and one pony of these latter discovered suffering from glanders was handed over to the Cantonment Magistrate and treated under the Glanders and Farcy Act.

Throughout, the principle of suppression and prevention has been to leave no possible loop hole for virus to escape by, no matter what the source of the disease may have been. All disinfection and measures for future prevention of disease have been carried out in accordance with Regulations.

FEATURES OF THE DISEASE.-- It is apparent that most cases have resulted from actual contact and not infection. In the earliest stages the outbreak
was characterized by suspicious cases very suddenly developing positive evidence of the disease. As is usual among such animals, the mules were generally acutely and readily attacked, and this is the explanation of the number of mules destroyed. In the later stage of the outbreak, cases detected required the minutest observation and constant examination. One Case (No 39) destroyed on the 9th. November showed post mortem a large glanders' abscess which in all probability could not have formed in less than nine months, this is of importance as bearing upon the origin of the outbreak.

As is usual the area covered by the disease was very small, the poison being fixed by some medium and thereby conveyed elsewhere.

Generally speaking the development of the outbreak has been gradual, and hence the well known difficulty of diagnosis has been increased.

TECHNICAL REMARKS AND VETERINARY RESULTS OF THE OUTBREAK.

(a) Continued thermometric observations show that chronic glanders may have a low recurrent (relapsing) temperature record; and therefore it is only by a daily record of temperature for some weeks that this can be shown. This fact of chronic glanders is so far as I am aware, hitherto unknown.

(b) Urine of horses suffering from glanders contains albumen and here again, is an aid to diagnosis of which I am unable to find any record in Veterinary works.
(c) Another hitherto unknown symptom of some cases of chronic glanders discovered during this outbreak was the presence of one or two tumours of the periosteum of the ribs which presented themselves as hard and hot swelling of sudden origin, not accountable for by injury. The skin of these tumours was moveable and normal, and the swelling's post mortem were found to contain inspissated pus. They were without doubt, specific organic lesions of the Osseous System, resulting from the disease; they reacted the inoculation, and were only found in diseased animals.

(d) Inoculating an animal with its own nasal or lacrimal discharge (auto-inoculation) will if persisted in, demonstrate the existence of the disease in a diseased animal when other symptoms are of doubtful significance and the value of this method of diagnosis is therefore apparent. -- For the healthy, the experiment is harmless.

(e) It is most important to note that a horse with no objective or subjective symptom of disease of any part of the Respiratory and Lymphatic systems (in which the disease is almost always manifested) may yet be glandered. The only way such can be diagnosed is by temperature record, the minutest Clinical observation and by inoculation.

(f) In three cases, the disease was ushered in by pure rheumatic symptoms; in another case peculiarly severe colic was the only cause of suspicion.
I have the honor to be

Sir,

Your most Obedient Servant,

 Lieutenant A.V.D.

In Charge Chief Station Veterinary Hospital

Cawnpore
<table>
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<tr>
<th>Consecutive no. of cases</th>
<th>Corps No.</th>
<th>Description of Animals</th>
<th>Date of admission</th>
<th>Date of discharge</th>
<th>Result</th>
<th>Remarks</th>
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<td></td>
<td>31.FB.</td>
<td>72 Horse Fever bilious</td>
<td>10.8.92</td>
<td>15.8.92</td>
<td>Relieved</td>
<td>From the lines &amp; taken to Vety. Hos. (had been in Vety. Hospl. from May 29th to July 9th 1892)</td>
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<td>&quot;</td>
<td>&quot;</td>
<td>15.8.92</td>
<td>15.8.92</td>
<td>Destroyed</td>
<td>Had been standing in Vety Hospl. at time of the outbreak &amp; had been in 3 weeks previous to outbreak</td>
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<td>Capt. Connolly</td>
<td>Charger</td>
<td>do. do.</td>
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<td>15.8.92</td>
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<td>&quot;</td>
<td>G/105</td>
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<td>15.8.92</td>
<td>15.8.92</td>
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<td>Stood next to Horses No. 12 &amp; 70 (both destroyed for glanders) in troop stables</td>
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<td>G/ 9</td>
<td>do. do.</td>
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<td>79 Horse</td>
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<td>70</td>
<td>do. do.</td>
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<td>Date of admission</td>
<td>Date of discharge</td>
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<td>Majory Beaver</td>
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<td>Date of discharge</td>
<td>Result</td>
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<tr>
<td>S.F. Aniger</td>
<td>Private</td>
<td>Horse</td>
<td>Equinia (Glanders) Farciminum (Farcy)</td>
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<td>31 F.B</td>
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<td>Grass cutter</td>
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<td>Pony</td>
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<td>Do.</td>
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<td>Disease</td>
<td>Date of admission</td>
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<td>35 FB.</td>
<td>106</td>
<td>Mule</td>
<td>Equinia (Glanders) Farciminum (Farcy)</td>
<td>23.9.92</td>
<td>23.9.92</td>
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April to 26th April.

Stood next to first case (Horse No. 72) in troop stables.