of it, and on being restored to soundness the necessity of taking them into work very gradually.

There are other changes taking place in joints, due to the deposition in the articular cartilage of salts of lime, giving rise to white nodules which may or may not cause lameness. In the pages of this Journal I have dealt with the clinical aspect of calcareous degeneration, and any further mention of the subject would be needless repetition.

Granular degeneration of the articular cartilage is a curious affection which is comparatively common, yet I cannot make up my mind that its practical significance is of any importance; it is common in the shoulder (a seat of lameness which is distinctly rare), it is not uncommon in the knee, and it is fairly common in the fetlock.

The joint affected with granular degeneration has its cartilage here and there eroded, the cartilage surrounding the eroded patch, which may be no larger than a pin's head, being opaque, loose, ragged, and fringey; the fringes can readily be raised, and the bone beneath is found bare. Microscopically the fringes are found to be granular, and to have lost their normal cartilage cells. Beyond this description we find nothing more; there is no caries, no inflammation, and so far as I am aware no lameness, and yet we cannot regard the alterations as normal. A systematic *post-mortem* inspection of the joints of healthy horses will reveal the comparative frequency with which this change may be observed.

I have observed that loose pieces of cartilage may commonly be found on the anterior edge of the suffraginis at the fetlock articulation. The cartilage or nodule is not absolutely loose, but is very freely movable. I know nothing of the significance of this change.

(*To be continued.*)

MALLEIN AS AN AID TO THE DIAGNOSIS OF GLANDERS.

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AND

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MALLEIN is a liquid obtained by extracting cultures of the glanders bacillus with glycerine. Its preparation was suggested to the Russian veterinary surgeon Kalning by the analogous solution first introduced by Koch under the name tuberculin, the latter being a glycerine extract obtained from cultures of the bacillus tuberculosis. Kalning's experiments showed that, just as tuberculin when subcutaneously injected is capable of exciting a febrile reaction in tuberculous patients, so mallein determines a rise of temperature and other symptoms of fever in horses that are the subject of glanders. Moreover, as with tuberculin, this effect is specific, the mallein being without appreciable effect on healthy or non-glandered horses..

Kalning's observations soon attracted attention, and during the past eighteen months experiments with mallein on a very large scale have been carried out in Germany, France, and elsewhere. The results have been so uniformly favourable as to leave little doubt regarding its high diagnostic value.

The matter may thus be said to have passed the experimental stage, and, as there is probably no place in the world where glanders is more prevalent at the present time than in London, it appeared highly desirable to bring the value of mallein home to veterinary surgeons here. That is our object in publishing the following observations, for it is probable that even a small number of experiments made at our own doors are more likely to attract attention than the summary of a much larger series of cases from foreign literature.

For the mallein used in the following cases we are indebted to Dr Roux of the Pasteur Institute, Paris, and we desire to express here our gratitude for the promptness and liberality with which he acceded to our request to be supplied with a quantity of the material. We are also under obligation to fellow members of the profession in London who have aided us by placing at our disposal horses under their charge suspected of glanders.[1]

Mallein is sent out from the Pasteur Institute in two forms. The first of these, or diluted mallein, is a transparent straw-coloured liquid, despatched ready for use in Pasteur tubes. This diluted mallein retains its activity for about a fortnight if the tubes are kept in the dark and unopened. The second form is the concentrated mallein; this is a thicker, deeper-coloured liquid, and it retains its activity for some months. Before use it must be reduced to the condition of the diluted mallein by adding to it nine times its volume of a $\frac{1}{2}$ per cent. solution of carbolic acid in water. The prescribed dose of the diluted mallein for a horse is $2\frac{1}{2}$ cc., and the best seat for the injection is the middle of the side of the neck.

It is advisable to ascertain the temperature of the animal once or twice during the day preceding the inoculation, and in every case it must be noted at the time of inoculation, and several times during the course of the next 18 hours. Were it not for the trouble involved, one would recommend that the temperature should be taken every two hours during the 24 after inoculation, but in every-day-practice many would doubtless find this very irksome or even impossible. Fortunately a smaller number of observations may be made without much risk of missing any rise of temperature, for experience has shown that the febrile reaction seldom sets in during the first 2 or 3 hours, and that when once the temperature has become febrile it remains so for several hours. The practitioner may therefore content himself with taking the temperature once on the day prior to inoculation, at the hour of inoculation, and then at the 6th, 10th, 14th, and 18th hours afterwards. At each observation after inoculation not only the temperature but also the local reaction (at the seat of inoculation), and any evidence of general disturbance should be noted.

[1] Mr Hobday, M.R.C.V.S., and Messrs Hunting and Calestremé, veterinary students, rendered valuable assistance in the taking of temperatures.

CASE I.—Donkey, aged; apparently healthy; dissection subject.

Day.	*Hour.*	*Temp.*	*Remarks.*
Mon.	12 midnight.	98·5	Received 2 cc. mallein.
Tues.	6.0 a.m.	98·5	Firm swelling at seat of inoculation about size of walnut.
„	9.0 a.m.	98·8	
„	12.0 p.m.	99·6	
„	3.0 p.m.	100·0	Appetite good, general appearance normal.
„	6.0 p.m.	101·0	
„	9.0 p.m.	100·0	
Wed.	9.0 a.m.	98·5	Local swelling scarcely perceptible.

A few days later the donkey was killed, and its subsequent dissection showed it to be free from glanders lesions.

CASE II.—Chestnut pony, aged; very emaciated, but apparently healthy; purchased for dissection.

Day.	*Hour.*	*Temp.*	*Remarks.*
Mon.	11.45 p.m.	99·8	Received 2 cc. mallein.
Tues.	6.0 a.m.	98·5	Swelling at seat of inoculation about size of walnut—tender to the touch.
„	9.0 a.m.	99·6	Appetite good.
„	12.0 p.m.	99·8	
„	3.0 p.m.	100·2	
„	6.0 p.m.	100·8	Appetite maintained. Swelling about same.
„	9.0 p.m.	99·0	
Wed.	9.0 a.m.	100·0	Swelling smaller but very sensitive. Killed for dissection.

No glanders lesions were discovered during the dissection of this subject.

CASE III.—Bay cart gelding, aged; submaxillary glands tumefied. Slight erosion in left nostril; bad grunter. General appearance unthrifty. Off hind leg thickened; has a number of discharging buds on inside of limb between hock and stifle.

Day.	*Hour.*	*Resp.*	*Pulse.*	*Temp.*	*Remarks.*
Sun.	12.0 noon.	12	56	100·0	Received 2½ cc. mallein.
„	6.0 p.m.	18	60	102·8	Pulse intermittent. Feeding well. Swelling at seat of inoculation 6 in. × 3 in.
„	10.0 p.m.	11	62	103·5	Swelling tender on pressure.
Mon.	2.0 a.m.	11	66	103·5	Feeding well. Swelling still larger, very tender.
„	6.0 a.m.	12	56	103·0	Swelling has extended downwards over jugular furrow.
„	10.0 a.m.	12	80	103·0	Left part of last feed. Pulse very intermittent; swelling tender, and somewhat fluctuating.

The swelling at the seat of inoculation gradually decreased, and no noteworthy alteration in the animal's general condition took place until the ninth day after the last observation.

At about 11 P.M. on that date he was noticed to be in very acute pain, sweating profusely, and gasping for breath. Death took place the following morning at 3 A.M.

Post-mortem revealed glanders nodules in the lungs. The septum nasi was not examined.

CASE IV.—Roan cart gelding; apparently healthy.

Day.	*Hour.*	*Pulse.*	*Temp.*	*Remarks.*
Sun.	12.0 noon	45	100·4	Received 2½ cc. mallein.
„	6.0 p.m.	50	100·8	Appetite good; swollen at seat of inoculation.
„	10.0 p.m.	50	100·0	
Mon.	1.30 a.m.	...	101·0	
„	4.30 a.m.	...	101·0	
„	7.30 a.m.	48	100·6	
„	10.30 a.m.	46	100·4	Swelling disappearing. Feeding well.

This animal is still alive, and apparently healthy.

CASE V.—Chestnut cart gelding; discharge from both nostrils. Tumefaction of submaxillary lymphatic glands on both sides; glanders ulcer visible in left nostril.

Day.	*Hour.*	*Pulse.*	*Temp.*	*Remarks.*
Sun.	12.0 noon	60	102·2	Received 2½ cc. mallein.
„	6.0 p.m.	60	103·6	Slightly off feed.
„	10.30 p.m.	60	103·6	Swelling at seat of inoculation.
Mon.	1.30 a.m.	...	103·6	
„	4.30 a.m.	...	103·6	
„	7.30 a.m.	60	103·0	
„	10.30 a.m.	60	103·0	Not feeding well. Slaughtered.

Post-mortem.—Right lung contains numerous glanders nodules. Left lung, no perceptible glanders nodules. Septum nasi on left side much eroded and ulcerated. Ulcer on right vocal cord.

CASE VI.—Black aged pony, purchased for dissection; apparently healthy, appetite good.

Day.	*Hour.*	*Resp.*	*Pulse.*	*Temp.*	*Remarks.*
Sun.	2.0 p.m.	12	52	100·0	
„	11.0 p.m.	16	40	100·6	Received 2½ cc. mallein.
Mon.	5.0 a.m.	16	44	100·6	Flat swelling at seat of inoculation, 5 inches in diameter, intensely painful.
„	8.0 a.m	12	48	102·8	
„	11.0 a.m.	12	48	103·0	
„	2.0 p.m.	24	42	102·2	Swelling decreasing.
„	5.0 p.m.	24	52	100·8	Swelling less sensitive, and smaller.
„	8.0 p.m.	20	40	99·8	Swelling painless.
„	11.0 p.m.	18	40	99·2	Slaughtered.

No glanders lesions were discovered in the course of dissection.

CASE VII.—Chestnut cart mare; subject of nasal gleet. Admitted into the college infirmary.

Day.	*Hour.*	*Temp.*	*Remarks.*
Tues.	10.0 a.m.	101·0	Nostrils fumigated with Tuson's disinfectant and ol. tereb. āā.
Wed.	10.0 a.m.	100·0	
Thur.	10.0 a.m.	99·8	
Fri.	12.0 midnight	100·8	Received 2½ cc. mallein.
„	6.0 a.m.	100·8	Swelling at seat of inoculation about size of walnut. Feeding well.
„	9.0 a.m.	100·6	
„	12.0 noon	101·2	Swelling perceptibly less.
„	3.0 p.m.	101·8	
„	6.0 p.m.	101·0	
„	9.0 p.m.	100·8	
Sat.	9.0 a.m.	100·0	Swelling quite disappeared. No nasal discharge. Discharged cured.

CASE VIII.—The history of the following case is peculiarly interesting. The animal, a bay cart-gelding, was purchased to serve as a subject in the class of elementary clinique, in which junior students practise, among other things, the administration of balls. The horse was specially chosen as being one without any suspicion of glanders, but his history was not obtainable. After he had stood in the college for a day or two it was noticed that he had a slight discharge from the right nostril, and it was therefore determined to test him with mallein.

Day.	*Hour.*	*Resp.*	*Pulse.*	*Temp.*	*Remarks.*
Fri.	9.0 p.m.	16	40	101·4	Pulse very irregular and intermittent. Received 2½ cc. mallein subcutaneously on near side of neck.
Sat.	3.0 a.m.	16	40	101·0	Swelling at seat of inoculation about 3 inches in diameter; not very sensitive.
„	8.0 a.m.	16	36	101·8	Appetite good. Aspect lively. Pulse very intermittent. Swelling about same size but more sensitive.
„	9.0 a.m.	13	36	103·0	
„	12 noon	12	48	104·8	
„	3.0 p.m.	12	48	105·0	Swelling very painful.
„	6.0 p.m.	15	48	104·6	
„	9.0 p.m.	18	44	104·6	Breathing laboured.
„	midnight	24	48	104·4	Breathing still laboured; horse standing constantly in one position. Pulse very intermittent.
Sun.	3.0 a.m.	18	42	102·8	
„	6.0 a.m.	18	36	102·6	
„	10.30 p.m.	...	...	103·0	Swelling more diffused and very painful.
Mon.	9.0 a.m.	16	36	102·0	Feeding well. Whitish discharge from both nostrils.
Tues.	9.0 a.m.	30	44	99·5	Animal down and unable to get up. Appetite retained. Slaughtered.

Post-mortem.—Numerous glanders nodules varying in size from a hazel nut to a walnut in both lungs. One recent nodule in septum.

CASE IX.—Roan cart gelding, 8 years old. Near hind leg thickened, with discharging farcy bud on inside of hock. Appetite good.

Day.	*Hour.*	*Pulse.*	*Temp.*	*Remarks.*
Tues.	3.30 p.m.	70	102·4	
Wed.	11.0 a.m.	70	101·4	Received 2½ cc. mallein.
„	5.0 p.m.	...	103·8	Rigors. Seat of inoculation swollen. Off feed.
„	8.0 p.m.	88	105·6	
„	11.0 p.m.	96	105·8	Seat of inoculation intensely painful. Swelling 3 or 4 inches in diameter.
Thur.	2.0 a.m.	...	105·8	
„	5.0 a.m.	94	105·6	
Fri.	3.0 p.m.	80	105·0	Appetite better. Swelling slightly decreased.
Sat.	10.0 a.m.	68	103·2	Swelling remaining about same size ; intensely painful.
„	2.0 p.m.	...	104·0	
Mon.	10.30 a.m.	64	101·6	Appetite suppressed. Near fore leg swollen ; brachial lymphatic glands appear enlarged.

Three weeks later this animal was injected for the second time. At this date the following notes were made regarding his condition :

Appetite good. On both inner and outer aspects of near fore leg in the region of the knee, there are numerous farcy sores. Near hind hock shows an old healing ulcer, and behind that several recent sores. On the back of the hock there is a quite recent bud. Animal grunts badly when threatened.

SECOND INJECTION.

Day.	*Hour.*	*Resp.*	*Pulse.*	*Temp.*	*Remarks.*
Sun.	12 noon.	12	62	100·5	Injected with 2½ cc. mallein.
„	6.0 p.m.	12	68	103·0	Pulse very weak. Animal off feed. Swelling at seat of inoculation well defined, 4 in. × 3 in.—very tender.
„	10.0 p.m.	12	78	105·1	Swelling larger ; pits on strong pressure.
Mon.	2.0 a.m.	12	76	104·4	Has eaten part of a feed.
„	6.0 a.m.	10	72	104·8	
„	10.0 a.m.	10	72	103·2	Animal off feed ; swelling very painful.

This animal was killed a week after the last observation.

Post-mortem.—Lungs contained a few small glanders nodules. Typical farcy buds under skin of knee of near fore limb and hock of near hind limb. Several typical glanders ulcers on left side of septum nasi ; these evidently of very recent formation.

CASE X.—Aged chestnut pony purchased for dissection. Very emaciated, but apparently healthy.

Day.	*Hour.*	*Temp.*	*Remarks.*
Mon.	11.45 p.m.	100·6	Received 2½ cc. mallein.
Tues.	6.0 a.m.	99·8	Firm swelling size of walnut at seat of inoculation.
„	9.0 a.m.	99·0	Eating well.
„	12 noon.	100·4	
„	3.0 p.m.	101·0	Appetite good.
„	6.0 p.m.	102·5	Appetite good, swelling as before.
„	9.0 p.m.	102·0	
Wed.	9.0 a.m.	101·4	Swelling diminished in size, but more painful.
„	4.0 p.m.	101·6	Swelling almost disappeared.
Thur.	10.0 a.m.	102·4	Feeding well.

This animal was killed a few days later, and no glanders lesions were discovered during its dissection.

CASE XI.—Black pony mare brought to free clinique. Detained on account of a discharge from the right nostril. Submaxillary gland of same side as large as a walnut and adherent to the jaw. Did not grunt when threatened.

Day.	*Hour.*	*Resp.*	*Pulse.*	*Temp.*	*Remarks.*
Mon.	6.0 p.m.	12	60	103·1	Received 2½ cc. mallein.
Tues.	12.0 midnight	16	56	102·8	Flat swelling at seat of inoculation, 3 in. × 2 in.
„	4.0 a.m.	12	64	102·6	Appetite good.
„	8.0 a.m.	12	60	102·8	Appetite maintained. Swelling smaller; not painful.

The pony was slaughtered at 11 A.M. on the 22nd November.

Post-mortem.—A large erosion high up on the septum nasi. The lungs contained numerous glanders nodules.

Since in this case there was no general reaction and only an unimportant local one, it appeared very desirable to obtain positive evidence regarding the nature of the lung lesions, although their appearance left little room for doubt that they were glanderous. A guinea-pig was therefore subcutaneously inoculated on the abdomen with matter from one of the lung nodules, and it died 24 days afterwards with

glanders lesions in the left testicle, left inguinal lymphatic gland, and nose. Pure cultures of the glanders bacillus were obtained from the lymphatic gland.

CASE XII. — Brown pony, aged, brought to free clinique. The animal was detained on account of suspicious unhealthy looking sores on the external skin of the left nostril. Both submaxillary glands were enlarged to the size of a walnut and adherent to the jaw. No visible lesions in nose.

Day.	*Hour.*	*Resp.*	*Pulse.*	*Temp.*	*Remarks.*
Wed.	12.0 midnight	12	40	99·6	Received 2½ cc. mallein.
Thur.	6.0 a.m.	12	60	103·0	Firm swelling, 3 in. × 2 in. at seat of inoculation.
„	1.0 p.m.	16	56	105·0	Not feeding ; very dull ; head held down ; swelling very tense and painful.
„	5.0 p.m.	16	52	104·8	Swelling somewhat increased in size. Pony slaughtered.

Post-mortem.—Septum nasi shows on left side 8 or 9 recent glanders ulcers ; on right side some small ecchymoses but no ulcers. Right lung contains numerous glanders nodules, and its pleural covering shows several patches of thickening. Left lung contains some nodules of cartilaginous consistence.

CASE XIII. — Chestnut mare, aged, brought to the free clinique. Detained as suspected of glanders. The animal appeared very weak and ill. There was a white flaky discharge from the right nostril, and a similar discharge from the inner canthus of right eye. The left mammary gland was swollen and firm, about as large as the closed fist ; a few inches in front of this, near the umbilicus, there was a swelling of about the same size but more oblong in shape. In the backward direction this was continuous by means of a subcutaneous cord with the enlarged mammary gland.

Day.	*Hour.*	*Resp.*	*Pulse.*	*Temp.*	*Remarks.*
Sun.	10.0 a.m.	...	66	103·4	
Mon.	4.0 p.m.	18	90	103·0	Received 2½ cc. mallein.
Tues.	12.0 midnight	16	64	102·6	Swelling at seat of inoculation about size of a walnut.
„	4.0 a.m.	30	56	100·0	Animal down and unable to get up.
„	9.0 a.m.	28	56	100·0	Animal *in extremis*. Slaughtered.

Post-mortem.—Mammary gland contains numerous small purulent

centres. The swelling in region of umbilicus proved to be due to inflammatory thickening of the subcutaneous tissue, without any suppuration. Recent pleurisy with adhesion of left lung to chest wall by means of a creamy fibrinous layer. Both lungs crammed with glanders nodules.

CASE XIV.—This is in some respects the most interesting and instructive case in the series. After the horse purchased for use in the class of elementary clinique had unexpectedly proved to be glandered (*see* Case VIII.), it became apparent that great care would have to be exercised in providing for this purpose any animal whose previous history could not be ascertained. After some trouble there was obtained a mare whose history appeared to give a guarantee that she was free from glanders. This animal was an aged bay draught mare, which had been in possession of its last owner for seven years. At no part of that time had the mare shown the least suspicion of glanders or farcy, but she had become broken-winded, and for that reason was placed on the cast list. There was no nasal discharge, the submaxillary glands were normal, and the skin was clean, but the general appearance somewhat unthrifty. The respiratory movements were characteristic of broken wind, and she grunted badly when threatened with a stick. She was a rather poor feeder. Prior to the injection of mallein it was observed that the pulse was frequent and weak, and that the temperature was abnormally high. Notwithstanding these symptoms, no suspicion of glanders was entertained.

Day.	*Hour.*	*Resp.*	*Pulse.*	*Temp.*	*Remarks.*
Mon.	6.0 p.m.	20	88	103·0	Received 2½ cc. mallein.
„	12 midnight.	20	88	102·8	Swelling at seat of inoculation 3 in. × 4 in., slightly sensitive.
Tues.	4.0 a.m.	20	84	104·4	Feeding well.
„	8.0 a.m.	20	88	104·4	Swelling nearly gone ; not feeding.
„	12.0 noon.	22	88	105·0	
„	5.0 p.m.	20	86	104·6	Appetite fair.
„	11.0 p.m.	20	88	104·4	Not feeding well, swelling painful ; a [illegible]
Wed.	9.0 a.m.	20	90	104·0	Swelling at seat of inoculation larger, 6 in. × 4 in. ; flat and not well defined. Coat staring, and general appearance very unthrifty.
„	10.0 p.m.	24	88	103·4	Swelling still larger, pits on pressure, painful.
Thur.	4.0 p.m.	18	84	104·0	
„	9.0 p.m.	...	...	104·0	

From this time onwards the temperature fluctuated between 101·2° and 104·0°. The respirations remained as before, but the pulse was scarcely so frequent. Two days after the last observation an abscess the size of a mandarin orange appeared high up on the inside of the left thigh. This was lanced, and microscopic examination of the pus after staining with methyl-blue, revealed a few bacilli resembling those of glanders. Cultures from this pus were made on sterilised potato and placed in the incubator. After three or four days an amber yellow growth made its appearance, and this subsequently underwent the deepening of colour characteristic of cultures of the bacillus mallei.

The swellings in the neck gradually disappeared, but left the skin somewhat thickened.

Subsequently the near hind leg became swollen; the abscess on the inner aspect of the thigh continued to discharge, and farcy buds discharging a dirty yellowish purulent fluid made their appearance above and below the hock on the inside of the same limb. The appetite became very poor, the general appearance of the animal very unhealthy, and a fluctuating swelling appeared underneath the sternum.

At no time was there the least nasal discharge, nor were the submaxillary lymphatic glands in any way affected.

The mare was slaughtered on the 17th day after the inoculation.

Post-mortem.—Both lungs crammed with characteristic glanders nodules, many as large as a hazel nut. Considerable emphysema towards the apices and edges of the lungs. Liver cirrhotic and showing an early stage of nutmeg lesion. Spleen swollen, pulp firm, no visible lesions. No glanders lesions in nostrils. Farcy lesions (see above) on near hind leg.

CASE XV.—Grey gelding, aged. Suspected for three months; been in contact with diseased animals. Stellate scar on nasal membrane.

Date.	*Hour.*	*Temp.*	*Remarks.*
Nov. 2	11.0 a.m.	100·3	Received 2½ cc. mallein.
„	6.0 p.m.	104·2	
„	10.0 p.m.	104·5	Off feed, and blowing.
Nov. 3	2.0 a.m.	104·0	Swelling at seat of injection.
„	11.0 a.m.	103·6	Very lame. Off food, neck swollen.

14th Nov.—Slaughtered. Nasal scar broken up and ulcerating. Lungs contain chronic glanders lesions.

CASE XVI.—Grey gelding, aged. Suspicious for some weeks; maxillary gland enlarged; has had slight intermittent nasal discharge.

Date.	*Hour.*	*Temp.*	*Remarks.*
Nov. 2	11.0 a.m.	99·2	Received 2½ cc. mallein.
„	6.0 p.m.	104·4	
„	10.0 p.m.	105·8	Off feed and very dull.
Nov. 3	2.0 a.m.	105·4	Inoculation spot swollen.
„	11.0 a.m.	105·2	Lame; excessive staling.

Remains alive; no visible signs of disease. Excessive action of kidneys lasted for a week.

CASE XVII.—Roan gelding, aged. Been under suspicion for 14 days on account of slight nasal discharge, which had now ceased. Maxillary glands slightly enlarged.

Date.	*Hour.*	*Temp.*	*Remarks.*
Nov. 2	11.0 a.m.	100·8	Received 2½ cc. mallein.
„	6.0 p.m.	103·2	Off feed and dull.
„	10.0 p.m.	105·2	Blowing, and discharge from nose.
Nov. 3	2.0 a.m.	105·2	
„	11.0 a.m.	104·0	Inoculation spot swollen; very lame.

5th Nov.—Slaughtered. *Post-mortem*—Chronic glandered lungs; extensive ulceration of septum nasi.

CASE XVIII.—Brown mare, aged. Under suspicion for nasal discharge which ceased four months ago; also thickened off fore leg, but no "cords" or "buds."

Date.	*Hour.*	*Temp.*	*Remarks.*
Nov. 2	11.0 a.m.	100·8	Received 2½ cc. mallein.
„	6.0 p.m.	103·2	
„	10.0 p.m.	105·0	Dull and off feed.
Nov. 3	2.0 a.m.	105·4	
„	11.0 a.m.	104·2	Feeding well, pulse 44.

Remains alive; inoculation spot never was swollen.

CASE XIX.—Grey mare, aged. Been suspected for some weeks; thickened off hind leg; no other sign of disease.

Date.	*Hour.*	*Temp.*	*Remarks.*
Nov. 2	11.0 a.m.	101·8	Received 2½ cc. mallein.
„	6.0 p.m.	105·4	
„	10.0 p.m.	105·4	Blowing and very dull.
Nov. 3	2.0 a.m.	105·6	Off feed; inoculation spot swollen.
„	11.0 a.m.	105·5	Off hind leg much swollen; pulse 60.

9th Dec.—Slaughtered. No nasal disease; chronic lung lesions of glanders.

CASE XX.—Grey gelding, aged. Under suspicion. Has had occasional intermittent nasal discharge; no other sign of disease.

Date.	*Hour.*	*Temp.*	*Remarks.*
Nov. 2	11.0 a.m.	99·2	Received 2½ cc. mallein.
„	6.0 p.m.	104·3	Off feed and dull.
„	10.0 p.m.	105·0	Dull and blowing.
Nov. 3	2.0 a.m.	104·2	Inoculation spot much swollen; still blowing.
„	11.0 a.m.	104·0	Excessive staling; pulse 62.

Remains alive; no sign of disease.

CASE XXI.—Brown mare, aged. No sign of disease; lame from picked up nail. Had enlarged gland and nasal discharge six years previously. Was then considered infected and ever since been watched as suspicious.

Date.	*Hour.*	*Temp.*	*Remarks.*
Nov. 2	11.0 a.m.	100·8	Received 2½ cc. mallein.
„	6.0 p.m.	102·4	Off feed and dull.
„	10.0 p.m.	103·6	Blowing.
Nov. 3	2.0 a.m.	104·6	Dull; excessive staling.
„	11.0 a.m.	103·6	Great depression; continued staling.

Remains alive. Loss of appetite and great loss of condition were noticeable for a fortnight. No sign of disease developed; resumed work.

CASE XXII.—Chestnut mare, aged 6 years. Suspicious sore on off shoulder; been doing badly for some few weeks.

Date.	*Hour.*	*Temp.*	*Remarks.*
Nov. 2	11.0 a.m.	101·0	Received 2½ cc. mallein.
„	6.0 p.m.	104·2	
„	10.0 p.m.	105·0	Off feed and blowing.
Nov. 3	2.0 a.m.	104·6	Inoculation spot swollen.
„	11.0 a.m.	104·0	Dull, stiff, and much swollen.

The constitutional disturbance remained marked for some days.

6th Dec.—Slaughtered. Wound on shoulder, which had been cicatrised, again ulcerated and corded. Lungs studded with glanderous nodules.

CASE XXIII.—Brown gelding, 5 years old. Enlarged maxillary gland and nasal discharge; been working with a known glandered horse.

Date.	*Hour.*	*Temp.*	*Remarks.*
Nov. 5	2.0 p.m.	102·8	Received 2½ cc. mallein.
„	12.0 p.m.	106·0	Off food.
Nov. 6	6.0 a.m.	105·0	Feeding slightly.
„	11.30 a.m.	104·0	Not much disturbance; inoculation spot considerably swollen.

7th Nov.—Slaughtered. Ulcerated nasal membrane, and glanderous nodules in both lungs.

CASE XXIV.—Brown mare, aged. Slightly enlarged gland; poor in condition and slight nasal discharge; isolated as very suspicious.

Date.	*Hour.*	*Temp.*	*Remarks.*
Nov. 5	2.0 p.m.	102·0	Received 2½ cc. mallein.
„	12.0 p.m.	103·0	
Nov. 6	6.0 a.m.	102·8	
„	11.30 a.m.	101·8	No constitutional disturbance and never off feed or blowing.

12th Nov.—Slaughtered. Ulcerated nasal membrane; glanderous nodules in both lungs, some caseous, others calcareous.

CASE XXV.—Brown mare, aged. Apparently healthy.

Date.	*Hour.*	*Temp.*	*Remarks.*
Nov. 5	12 noon	99·4	Received 2½ cc. mallein.
„	6.0 p.m.	101·4	Remained lively, feeding and undisturbed; no swelling at seat of inoculation.
„	10.0 p.m.	103·6	
Nov. 6	2.0 a.m.	103·6	
„	11.0 a.m.	102·6	

Remains alive and at work.

CASE XXVI.—Chestnut mare, aged. Apparently healthy.

Date.	*Hour.*	*Temp.*	*Remarks.*
Nov. 5	12 noon	100·2	Received 2½ cc. mallein.
„	6.0 p.m.	101·2	Remained lively, continued feeding, inoculation spot not swollen.
„	10.0 p.m.	102·4	
Nov. 6	2.0 a.m.	102·8	
„	11.0 a.m.	101·8	

Remains alive and at work.

CASE XXVII.—Black gelding. Apparently healthy; wearing a tracheotomy tube.

Date.	*Hour.*	*Temp.*	*Remarks.*
Nov. 5	12 noon	100·4	Received 2½ cc. mallein.
„	6.0 p.m.	101·6	Remained lively, continued feeding, inoculation spot not swollen.
„	10.0 p.m.	101·5	
Nov. 6	2.0 a.m.	101·2	
„	11.0 a.m.	100·0	

Remains alive and healthy.

CASE XXVIII.—Bay gelding, aged. Apparently healthy, except for a thickening of hind leg resulting from accident.

Date.	*Hour.*	*Temp.*	*Remarks.*
Nov. 5	12 noon	100·0	Received 2½ cc. mallein.
,,	6.0 p.m.	101·0	Remained lively, continued feeding, inoculation spot not swollen.
,,	10.0 p.m.	101·2	
Nov. 6	2.0 a.m.	101·0	
,,	11.0 a.m.	100·0	

Remains alive and healthy.

CASE XXIX.—Bay gelding, aged. Looked unthrifty; had been turned out to grass for being weak and out of condition.

Date.	*Hour.*	*Temp.*	*Remarks.*
Nov. 5	12.0 p.m.	101·5	Received 2½ cc. mallein.
,,	6.0 p.m.	105·6	Dull and blowing.
,,	10.0 p.m.	105·2	Inoculation spot swollen.
Nov. 6	2.0 a.m.	104·6	Remained dull and disturbed.
,,	11.0 a.m.	104·0	Remained dull and disturbed, and excessive staling.

9th Nov.—Slaughtered. Enlarged nutmeg liver; no glanderous changes in lung; nasal membrane congested but not ulcerated.

CASE XXX.—Black mare, aged. Poor and unthrifty; no definite sign of disease.

Date.	*Hour.*	*Temp.*	*Remarks.*
Nov. 5	1.0 p.m.	101·2	Received 2½ cc. mallein.
,,	7.0 p.m.	104·4	
,,	11.0 p.m.	104·8	Off feed, blowing, and dull.
Nov. 6	3.0 a.m.	104·6	Dull and blowing.
,,	11.0 a.m.	104·0	Inoculation spot much swollen.

7th Nov.—Slaughtered. Chronic glanderous lesions in lungs.

CASE XXXI.—Black gelding, aged. Slightly enlarged maxillary gland; no other sign of disease.

Date.	*Hour.*	*Temp.*	*Remarks.*
Nov. 5	1.0 p.m.	99·8	Received 2½ cc. mallein.
„	7.0 p.m.	101·0	No swelling at inoculation spot, and very slight constitutional disturbance.
„	11.0 p.m.	103·8	
Nov. 6	3.0 a.m.	104·8	
„	11.0 a.m.	103·8	

7th Nov.—Slaughtered. Lung changes due to a previous pneumonic attack; no definite glanders lesions detected.

CASE XXXII.—Chestnut gelding, aged. Apparently healthy.

Date.	*Hour.*	*Temp.*	*Remarks.*
Nov. 5	1.0 p.m.	100·2	Received 2½ cc. mallein.
„	7.0 p.m.	101·2	Remained lively, continued feeding, inoculation spot not swollen.
„	11.0 p.m.	101·2	
Nov. 6	3.0 a.m.	101·1	
„	11.0 a.m.	100·0	

Remains alive and healthy.

CASE XXXIII.—Black mare, 5 years old. Apparently healthy.

Date.	*Hour.*	*Temp.*	*Remarks.*
Nov. 5	1.0 p.m.	100·2	Received 2½ cc. mallein.
„	7.0 p.m.	101·2	Remained lively, continued feeding, inoculation spot not swollen.
„	11.0 p.m.	100·6	
Nov. 6	3.0 a.m.	100·6	
„	11.0 a.m.	100·4	

Remains alive and healthy.

CASE XXXIV.—Chestnut gelding, aged. Fœtid nasal discharge; slightly enlarged glands. Diagnosed as a local disease.

Date.	*Hour.*	*Temp.*	*Remarks.*
Dec. 10	11.0 a.m.	100·2	Received 2½ cc. mallein.
„	7.0 p.m.	102·3	Remained lively, continued feeding, inoculation spot not swollen.
Dec. 11	1.0 a.m.	101·4	
„	6.0 a.m.	100·6	

Remains alive; symptoms unaltered.

CASE XXXV.—Bay gelding, aged 6 years. Swollen off hind leg. Farcy buds and "corded" swelling on near side of neck.

Date.	*Hour.*	*Temp.*	*Remarks.*
Dec. 10	11.0 a.m.	102·0	Received 2½ cc. mallein.
„	7.0 p.m.	104·6	Dull, blowing, and off feed.
Dec. 11	1.0 a.m.	105·0	
„	6.0 a.m.	105·0	Hind leg much swollen, and the inoculation spot ditto.

12*th Dec.*—Slaughtered. Ulceration of nasal membrane, and glanderous nodules in lung.

CASE XXXVI.—Brown gelding. Suspected on account of chronic cough and general unthrifty appearance. Had two attacks of pneumonia during the last six months.

Date.	*Hour.*	*Temp.*	*Remarks.*
Nov. 30	11.30 a.m.	101·2	Received 2½ cc. mallein.
„	3.30 p.m.	101·2	No evidence of general disturbance at any time, and very little swelling at seat of injection.
„	7.30 p.m.	101·2	
„	11.30 p.m.	101·2	
Dec. 1	3.30 a.m.	101·2	

This horse is still alive, and his condition has improved since he was treated with mallein.

CASE XXXVII.—Bay gelding. About a month prior to inoculation farcy buds had formed along the abdomen in front of the prepuce. The animal seemed stiff in his hind legs.

Date.	*Hour.*	*Temp.*	*Remarks.*
Nov. 30	11.30 a.m.	102·0	Received 2½ cc. mallein.
„	3.30 p.m.	103·0	A large painful swelling formed at the seat of inoculation, and the animal fed badly.
„	7.30 p.m.	105·0	
„	11.30 p.m.	105·0	
Dec. 1	3.30 a.m.	104·3	

7th Dec.—Slaughtered. Lung full of glanders nodules; liver cirrhotic.

CASE XXXVIII.—Brown gelding, with slight discharge from right nostril and slight enlargement of submaxillary glands. An accidental wound inflicted on chest-wall two months previously had taken on an unhealthy action, and had absolutely refused to heal. Of late the horse had been very unthrifty.

Date.	*Hour.*	*Temp.*	*Remarks.*
Nov. 30	11.30 a.m.	101·0	Received 2½ cc. mallein.
„	3.30 p.m.	102·4	
„	7.30 p.m.	105·1	
„	11.30 p.m.	106·0	Seat of inoculation much swollen.
„	3.30 a.m.	105·3	

7th Dec.—Slaughtered. Glanders nodules in lungs.

CASE XXXIX.—Bay gelding. Object of suspicion from sore on hock.

Date.	*Hour.*	*Temp.*	*Remarks.*
Oct. 30	11.30 a.m.	101·0	Received 2½ cc. mallein.
„	3.30 p.m.	101·0	
„	7.30 p.m.	101·2	
„	11.30 p.m.	101·3	

This horse was a vicious kicker and it became impossible to take

his temperature after the 4th observation. The sore on the hock has healed, and it has since been learned that it was due to the application of an irritant. A few days after the injection with mallein an abscess burst on the inner aspect of one thigh, and that has healed up.

It now remains to make a brief analysis of the results obtained in these 39 cases. Fifteen of the horses are still alive, and the remaining 24 have been killed and submitted to a *post-mortem* examination. In 18 of these 24 distinct glanderous lesions were discovered, and in the other 6 the *post-mortem* did not reveal any such lesions. The following table refers to the 18 glandered horses.

No. in Series.	*Initial Temperature.*	*Maximum Temperature during the 18 hours after injection.*	*Hour at which Temp. reached its maximum.*
3	100·0	103·5	10th
5	102·2	103·6	6th
8	101·4	105·0	18th
9	101·4	105·8	12th
11	103·1	102·8	14th
12	99·6	105·0	13th
13	103·0	102·6	8th
14	103·0	105·0	18th
15	100·3	104·5	11th
17	100·8	105·2	11th
19	101·8	105·6	14th
22	101·0	105·0	11th
23	102·8	106·0	10th
24	102·0	103·0	10th
30	101·2	104·8	10th
35	102·0	105·0	13th
37	102·0	105·0	8th
38	101·0	106·0	12th

A glance at the above table will show that except in two instances (Nos. XI. and XIII.) the temperature after the injection of mallein went up to 103° at least; in 3 cases it reached 103-104°, in 2 cases 104-105°, and in 11 cases 105-106.°

In the two cases in which no rise of temperature followed, the latter was febrile (103°) before the injection of the mallein, and in one of these (No. XIII.) the animal was almost in a dying state at the time of injection.

Turning next to the 6 cases in which the *post-mortem* did not reveal any glanderous lesions, it will be observed from the following figures that in 3 of them the temperature after injection remained under 103°, while in the other 3 it rose to that point or above it.

No. in Series.	*Maximum Temperature.*
1	101·0
2	100·8
6	103·0
10	102·5
29	105·6
31	104·8

Finally, there remain for notice the 15 cases in which the animals are still alive. The following table refers to them. The mark + denotes a clinical suspicion of glanders, — that the animal was believed to be healthy or non-glandered.

No. in Series.	*History.*	*Initial Temperature.*	*Maximum Temperature after Injection.*
4	—	100·4	100·8
7	—	100·8	101·8
16	+	99·2	105·8
18	+	100·8	105·4
20	+	99·2	105·0
21	—	100·8	104·6
25	—	99·4	103·6
26	—	100·2	102·8
27	—	100·4	101·6
28	—	100·0	101·2
32	—	100·2	101·2
33	—	100·2	100·6
34	—	100·2	102·3
36	—	101·2	101·2
39	—	101·0	101·3

We do not intend to appraise the precise value of mallein from the results obtained in these experiments, but prefer to wait until we can base our estimate on a larger series of observations. The readers of this article will probably form their own conclusions on the matter, but in doing so two points should be kept in mind. The first is that the majority of the horses discovered to be glandered on *post-mortem* did not present during life any symptom from which the most experienced practitioner could have certainly diagnosed the disease. The second point is that the non-discovery of glanders lesions in certain of the cases is not absolute proof of their non-existence. In most of the cases the *post-mortem* examination had to be carried out at a knacker's, and it had sometimes to be of a rough-and-ready character.

A FREQUENT BUT UNSUSPECTED CAUSE OF INTESTINAL CALCULI.

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AS our literature on the above subject is by no means so complete as it might be, I am induced to record the following experience, in the hope that it may prove of some interest.

Between the years 1884 and 1889 I was somewhat puzzled to account for the formation of the calculi to which were due an extraordinary number of fatal cases in the stud under my care. During that period no less than sixteen deaths from this cause occurred in a stud of about a thousand horses. With a view to discovering the cause for these formations, I had the calculi, which were carefully preserved from each case, ground down so as to reveal the nuclei; and in the majority of instances I found them to consist of a small piece of metal, which, I conjectured, must have gained access to the alimentary canal mingled with the food. It was also deemed advisable to submit several of the concretions to an analytical chemist, with a view to ascertaining their composition and thus perhaps the origin of their formation. The opinion of the chemist was, from the preponderance of ammonia which was in them, that they were in some way due to the ammonia gas in the stable, but I did not feel justified in accepting this as feasible, especially as in every case there seemed a more palpable and probable cause.

I subsequently made inquiries of other practitioners who had large studs under their care, and was informed that their percentage of deaths from this malady was much less than mine. What to my mind seemed an important point was the fact that a similar proportion of cases were reported from our provincial depôts; and as all our stables were supplied with provender from one centre, this confirmed me in the conclusion which I had previously come to, viz., that I must confine my attention either to the corn supply or the fittings of the mangers for a solution of the problem. As regards the construction of the mangers, none of the nuclei were of such a character as to indicate definitely that they were derived from that source. I therefore concentrated my attention on the food, and being desirous of ascertaining what precaution was in existence for