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GASTRIC RUPTURE AND INTESTINAL TORSION IN
HORSES.¹

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NO matter how hackneyed or commonplace the subject may be, while so many valuable equine lives are lost annually from gastro-enteric lesions, so long will they prove a never-failing and ever-green source for discussion. That there is a heavy mortality from this cause, no one, I imagine, will gainsay. Personally, I believe that gastro-intestinal affections are responsible for as great a percentage of fatal cases among hard worked, highly fed, urban cart horses in the prime of life as are all other causes put together. On this point Friedberger and Fröhner, in their "Pathology and Therapeutics of the Domestic Animals," provide some corroborative data, and prove that alimentary diseases are no less prevalent on the Continent than here. These authors give the mortality among horses from the various conditions they designate under the head of colic as 40 per cent. of the total death-rate from all causes. Now, if this is true, and there seems no reason to question it, there is little doubt that, on the Continent at least, 50 per cent. of the fatal cases in middle life are of a gastro-enteric character, for it is well known that deaths from other causes are relatively fewer in the prime of life than in old and young animals.

On the present occasion I don't intend to make any attempt to survey the whole field of gastro-enteric lesions. The most cursory review of so wide a subject would necessitate much more time and

¹ A paper read before the North of England Veterinary Medical Association on 15th Feb. 1895.

space than are at my disposal. I purpose, therefore, limiting my remarks to gastric rupture and intestinal torsion, and I take these two conditions together because, although the causes which give rise to the one sometimes differ from those which originate the other, there is nevertheless in many cases an undoubted etiological connection between them, and in practice it is a matter of common observation that where the one is prevalent the other is of frequent occurrence. In some studs so markedly is this the case that we are irresistibly led to look for a common originating factor. It is, however, much easier to recognise the operation of some common cause than to demonstrate what that cause is, and it has to be admitted that after the most careful and painstaking investigation failure often rewards all attempts at elucidation. Even when a complete change of régime has been followed by an abatement or cessation of the cases it may be impossible to establish the operating cause, and we have to remain content with a more or less hypothetical explanation, which may vary according to the individual idiosyncrasy of the investigator, or his inductive or deductive capacity.

In many cases, however, it is possible to demonstrate the connection between cause and effect, and in the majority of cases where such a connection is established the cause is nearly always traceable to some defect in the dietetic régime.

Most authorities have recognised the not infrequent occurrence of gastric rupture, but many have failed to realise the relatively equal, and in some studs much greater, frequency of intestinal torsion. The late Professor Walley was, I believe, one of the first to call public attention to the great prevalence of volvulus of the intestines in horses, and his surmise that many cases looked upon as enteritis were in reality cases of twist has received ample confirmation whenever careful and systematic *post-mortem* examinations have been made. He was, further, finally of opinion, and regularly taught, that these intestinal lesions were almost exclusively of dietetic origin.

More recently we are indebted to Captain Smith for his able articles and lecture on gastro-enteric diseases, but while he seems to have no doubt as to the usual cause of gastric rupture, he expresses no decided opinion upon those of intestinal torsion. Speaking at the Southern Counties Veterinary meeting the other day, he said he wished he could throw some light upon the cause of twist. He could see no other explanation than "erratic or perverse peristalsis," but he offered no opinion on the cause of the perverted action.

Professor Williams, writing as to the cause of diseases of the digestive organs generally, says, "with very rare exceptions they are the result of errors in feeding," and, when specifically referring to the prevalence of volvulus or intestinal torsion, he observes, "several cases are reported of such occurrences in the various Veterinary Journals. They, as well as strangulation from the entanglement of the intestines by pedunculated tumours, are very rare." Many practitioners, I need scarcely say, who cannot acquiesce in the latter, will accept the former statement without reserve; for example, Mr Rutherford of Edinburgh says, "twist of the bowels is a cause of heavy mortality." Mr Peter Taylor of Manchester, when advocating the reading of a paper on this subject, said, "if there is one thing more than another we are anxious to know the cause of, and how to prevent, it is twisted bowels. Twist

is the source of much trouble and a cause of great loss. Any one who will tell us how to prevent it will do real service."

The late Professor Robertson detailed several changes in the position of the bowels, but did not indicate their relative or aggregate frequency. I have canvassed the question of twist with many practitioners who attend upon large studs of cart horses, and in the main their opinion as to its frequency agrees with that expressed by Messrs Rutherford and Taylor. On the relative frequency of twist Friedberger and Fröhner cite the statistics of Böllinger, who records that of all fatal gastro-enteric conditions 50 per cent. to 60 per cent. are the result of some change in the position of the bowels or some obstruction in their interior, but no differentiation is made between these two conditions.

These authors, however, evidently look upon twist as of common occurrence, and they mention the experience of Shütze, who from 1886 to 1888 records sixty-two fatal cases from volvulus, the majority of which involved the colon. I think we may take it that volvulus or twist is no rare condition, but is on the contrary exceedingly common. Whether it was always so common is not clear. Personal observation inclines me to the belief that it is much more prevalent now than in times gone by, and a perusal of the veterinary literature within my reach serves to corroborate and confirm that view. This increase in frequency I attribute largely to the changes which have taken place in our methods of feeding. Probably some who have had a longer and more extensive experience than myself may throw some light on the matter. Although all observers concur that dietetic errors are chiefly responsible for the production of these lesions, it is nevertheless true that isolated cases appear under the most favourable régime, and some of these are very difficult to account for. No doubt a number depend upon some intrinsic cause, such as disease of stomach or bowels, verminous aneurism, etc., and others may be produced by external violence, such as falls, or by rolling, etc., but after due allowance is made for all this a number of cases remain unexplained. It is well known that horses are more subject to these gastro-enteric lesions than other animals, a fact probably due to the anatomical disposition and physiological function of the digestive organs in the equine species, together with the difference in food and feeding. It is not so generally known, however, that some classes of horses are more subject than others. In my experience heavy horses are more liable than light ones, and incidental to this I may here record the fact that in a stud of forty light horses which I have charge of there has only been one fatal gastro-enteric case in fourteen years. The exact cause of this difference is not clear. It may be connected with the greater size of the digestive organs in large horses, but there is little direct evidence to establish this. All we can say positively is that these cases usually occur in large horses. Before proceeding to consider the circumstances under which the lesions we are discussing occur, it may be of service to refer in the first place to one or two anatomical and physiological points which seem to have some bearing on their production.

Commencing with the stomach, the first point to be noticed is the relatively small size of that organ in the equine species as compared with that of our other domestic animals. Colin estimates its average capacity in an ordinary-sized horse at 3 to 3½ gallons, but he tells us

that normally, even after a full meal, its contents rarely exceed two-thirds of this amount. It is very evident therefore that under ordinary circumstances a horse's stomach cannot contain a large bulk of food, and should there be any obstruction to the onward passage of the gastric contents engorgement must soon follow, unless coincidentally the appetite be in total abeyance.

It is well known to every one that a horse, unlike animals which vomit, cannot relieve a surcharged stomach by vomition.

This inability to vomit is explainable by the position of the stomach, which, not being in contact with the abdominal walls, is not subjected to direct pressure by the abdominal muscles; by the thick wall and firmly contracted condition of the cardiac end of the œsophagus; by the cuticular folds which guard its orifice; and by the nonsensibility of the vomiting nerve centre to ordinary nauseating stimuli, owing to which the horse can be given without perceptible inconvenience doses of emetic which if administered in relative proportion to other animals would induce in them marked nausea and emesis. These conditions effectually prevent regurgitation of the gastric contents, and even after death the normal stomach can be distended with gas or water through the pylorus without any escape taking place through the œsophagus, and the process of distension can be continued until the gastric walls give way. In conducting experiments on this line Captain Smith has been able to ascertain the actual pressure a normal stomach will bear. He finds the stomach will rupture if subjected to a pressure of 1 lb. to the square inch, whereas the small intestines similarly tested can sustain $2\frac{1}{2}$ lbs. to the square inch. From this it is evident that the more frequent rupture of the stomach than of the bowels is explainable not only by their contents but also by the difference in the resisting power of the organs.

Our physiologists tell us, and our own *post-mortem* examinations bear out their statement, that the stomach is never absolutely empty except after a considerable fast; neither, on the other hand, as has already been indicated, is it normally ever full. It seems that as soon as feeding commences the food which enters the cardia immediately begins to pass out at the pylorus, but not so rapidly as it enters. Consequently, as feeding continues the gastric contents gradually increase. As the contents increase the rapidity of their passage through the pylorus increases, so that usually by the time the stomach is two-thirds full the amount passing out is said to equal the amount entering. If this arrangement for regulating the exit of the gastric contents by the amount of food entering the stomach were an invariable condition gastric engorgement and gastric rupture would be unknown, unless when due to tympany or violence. But although this regulating arrangement is no doubt a physiological fact, a greedy feeder with unlimited supply of food before him will speedily upset it, and under such circumstances the amount passing out of the stomach is not regulated by, nor equal to, the amount entering, and the result is gastric engorgement.

With irregular work and insufficient food or irregular feeding, many horses become voracious feeders, and whenever such are allowed an unlimited supply of rich, easily masticated, or highly fermentible food, the same result—gastric engorgement—takes place. Now the usual sequel of gastric engorgement is gastric paralysis, and

whenever the stomach is paralysed its contents cease to pass through the pylorus. Under such circumstances even normal fermentation renders the imminence of rupture evident, but if there be increased fermentation, or simultaneous violence through the patient rolling or knocking about, the occurrence of rupture is almost inevitable.

Before turning our attention from the stomach, another physiological fact of much interest, though perhaps only slightly connected with our present subject, may receive a moment's notice here. When dry food is taken into the stomach it does not mix there indiscriminately, but passes through the pylorus in the order in which it entered the cardia. Thus, if oats are eaten first, and then hay, the oats pass out of the stomach before the hay, but, as the time required for the gastric digestion of oats is greater than for hay, it is claimed that less digestive derangement would be induced and better nutritive effects secured if the order in which they are usually given were reversed. Ellenberger suggests that the hay should be given first, the water next, and the oats last, in order that the oats may not be carried through the pylorus in a partially digested state before the hay, but be left in the stomach and subjected to a longer period of digestion; but whether such a method of feeding could lessen gastro-enteric diseases, I have no data to show.

We will now turn for a few moments to some points of interest in connection with the intestines. The points I wish to refer to are the course and shape of the duodenum, the length of the mesentery, and the size and disposition of the large bowels. With reference to the duodenum, beyond the pylorus it takes a course somewhat like the letter **U**, which is probably for the purpose of regulating the amount of ingesta passing from the stomach to the bowels. It has recently been pointed out that this course which the bowel takes is very probably a predisposing factor in many cases of gastric rupture. When the large bowels are excessively distended from any cause they naturally press upon this bend in the duodenum, and thereby, by paralysing that viscus or lessening its lumen, prevent the onward passage of the gastric contents. In this connection it may be of interest to remember that those somewhat unique cases of duodenal impaction occasionally met with may occur through paralysis of the terminal portion of the involved bowel by pressure in the way here indicated.

We have next to notice the mesentery, and in reference thereto it is highly probable that its length and tenuity predispose to those cases of twist and mesenteric hernia, with intestinal strangulation, which especially involve the ileum. So far as my own experience goes, these lesions occur equally in small and large horses, and in this respect they differ from twist of the large bowels, which is much more common in large than small animals. Twist of the ileum may occur either from rolling or other alteration in the normal position, or from some interference with normal peristalsis, an aberrant condition of which may be induced either by disease, by the irritant action of the enteric contents, or by a perverted neurotic or vascular supply. The influence of verminous aneurism of the anterior mesenteric artery, with resulting thrombosis and embolism of the small mesenteric blood-vessels, is well known in this connection, and incidental to this I may mention that the last *post-mortem* I made was a case of this kind. In

strangulation of the ileum the bowel passes through the mesentery or omentum, and the subsequent knotting and interlacing of the bowel which takes place is sometimes most remarkable, and defies all efforts at disentanglement. Naturally the extent of the strangulation and the rapidity with which it takes place vary according to the extent of the bowel involved, and the degree of tension exercised by the mesentery or omentum or the bowels themselves in the knotting process. To this difference in the degree of the strangulation we may ascribe the complex variety of the symptoms by which these cases are marked. However much in degree one case may vary from another, they are, of course, from their nature, all necessarily fatal. Though they affect all classes of horses indiscriminately, and are by no means rare in occurrence, yet I have never known what could be called an outbreak or series of cases in any particular stud. On the contrary, all have been isolated cases, and, so far as could be ascertained, occurred quite independently of any particular régime.

In connection with the large bowels, the first point which strikes us is the relatively enormous size of the large intestines, especially of the double colon and cæcum; the next is the unique arrangement of the double colon, which is in the form of a U-shaped double tube, attached at one end, but absolutely free at the other, and through its whole extent. These facts are well known to every one, and need not be further dwelt upon, except to acknowledge that such an arrangement must facilitate intestinal displacement. The enormous size of the colon permits of the collection in it of a great mass of ingesta, which either from its special character, its excessive fermentation, or its simple impaction, may readily interfere with normal peristalsis, and induce, instead, a partial, irregular, and perverted spasmodic action. We know that excessive distension either of the stomach or bowels, whether due to the impaction of solid material or to dilatation with gas, paralyses the parts involved. We also know that owing to such paralysis impacted material may remain in the part impacted without any movement, either on the part of the viscus involved or its contents, whereas anteriorly or posteriorly to this there may be no paralysis, but, instead, a very irregular erratic and spasmodic peristalsis. To these and such like allied conditions the causes of intestinal torsion may very probably be traceable.

The size or calibre of the cæcum has already been mentioned, but its free position has also to be noticed. It will be remembered that its sole attachment is at its base; there is therefore no real obstacle to its displacement, which indeed is a not uncommon event. Displacement of this organ, however, so far as my experience goes, more frequently complicates torsion of the colon than occurs to any material extent as an uncomplicated condition. In the mass of ingesta which collects in the cæcum irregular fermentation occasionally takes place, and that this may induce erratic peristalsis, and, from its free position, occasional displacement of the bowel need be a matter of no surprise. The actual character of the displacements of the colon and cæcum may vary considerably, *e.g.*, there may be simple displacement of the colon, or there may be partial or complete torsion, or even double torsion, and each of these again may vary in position and direction.

The exact conditions under which each occurs is uncertain, and

whether all forms can take place independently of rolling, falling, etc., is not known, but I am firmly convinced that some of the simpler conditions may arise solely from irregular spasmodic action of the viscus involved, and quite independently of rolling. At the same time, it can be imagined how much more easily they may occur, as in all probability many of them do occur, under the combined simultaneous action of intestinal spasm and rolling. As with twist and strangulation of the ileum, as already indicated, so with torsion of the colon, the symptoms will vary with and depend upon the extent of the torsion. No one could expect the same train of symptoms in a case of simple displacement of the bowel, where, although the onward passage of the intestinal contents is interrupted, there is no marked interference, for sometime at least, with the vascular supply, as in a case where there is complete strangulation of the blood-vessels.

I have already expressed the opinion that gastric rupture and intestinal torsion are more prevalent than they used to be. This conviction is inevitable if reliance is placed on our veterinary literature, for it is obvious from the somewhat perfunctory and cursory consideration of these lesions, particularly of torsion, met with in our text-books, that the authors have not considered them of such importance as their prevalence nowadays invests them with. With reference to my own observations, I can record that during a considerable experience among agricultural horses in my early years cases of rupture or twist were practically unknown. This immunity was no doubt chiefly owing to the influence of light work and light and regular feeding, but partly also to the plan of feeding with oats and long hay. This was the universal custom then in vogue, except that during the winter months a feed of boiled food was substituted in place of the ordinary evening meal. It has always appeared to me that since the inauguration of the plan of mixing chaff and corn, and substituting corn for a considerable portion of hay, many more cases of twist are seen, and reasons for this are not difficult to find. Not only has corn replaced hay, but a variety of grains have largely replaced oats. Of these substitutes it is well known that maize and peas and even beans, when their condition is imperfect, give rise to considerably greater fermentative changes than oats, and as a consequence produce more flatulence and other digestive derangements.

Then, it must be remembered that mixed food is usually a highly concentrated nitrogenous food, and, containing more grain and less hay than unmixed food, it requires a longer period for gastric digestion. This is quite sufficient to increase the liability to gastric engorgement, and very probably, in consequence of a greater proportion of nitrogenous material passing to the bowels undigested, it may also enhance the liability to intestinal derangement. Furthermore, we must not forget that mixed food is more rapidly eaten than was the case with unmixed. This is an established fact, and the explanation of it is quite simple, and is a natural consequence of the usual composition of mixed food, and quite irrespective of any influence cutting the hay may have. In the old system of unmixed feeding twice as much hay as grain was used. In mixed feeding a common proportion is three of grain to two of hay. Now, as it takes a horse as long to eat 1 lb. of hay as 2 lbs. of corn, the reason why he eats mixed food more rapidly is evident. To obtain the best results with mixed food, so far

as digestive derangements are concerned, necessitates great care in feeding.

From what I have just said it may have been assumed that I am not in favour of mixed food, but any such conclusion would be a mistake. I have simply been stating and endeavouring to explain the chief defects in the system, in order that we may anticipate its detrimental effects by preventing them. A clear recognition of the defects of the system does not necessarily lessen, and is quite consistent with, a full appreciation of its undoubted and overwhelming advantages. No one more thoroughly realises the enormous economic superiority of mixed food, and I have been able to prove that its introduction in the stud of which I have charge has resulted in a saving sufficient to pay for all the new horses required for all purposes. Whatever the defects of mixed food may be, if all its constituents be sound and good and a proper albuminoid digestive ratio maintained, they can under an efficient régime be practically nullified. In illustration of this, I may refer to the results obtained in our Gas Commissioners stud of some thirty horses used for coal cart work. These horses have very heavy work, and are very highly fed, yet in fourteen years there has only been once a case of twist and no case of rupture, and it is over ten years since the solitary case of twist occurred. Though these horses have hard work it is regular, and their feeding and watering takes place entirely in the stable and by the stableman. It is to the regularity of work, the regularity in the times of feeding, the amount of food given, and the provision of a regular and abundant supply of pure water that I ascribe this highly satisfactory result. Whatever trouble I have had from rupture and twist in other sections of our stud has been the result of some defect in one or more of these essentials, and I am personally convinced that to some defect in these may be ascribed 90 per cent. at least of all cases of rupture and twist occurring in studs fed with mixed food.

As it bears on this, it may perhaps not be inappropriate if I refer to a conversation I had quite recently with the Horse Superintendent of one of our largest Railway Companies. He told me of the trouble he had to contend with from the frequency with which cases of rupture and twist occurred in the stud, and he enquired my opinion as to the cause. I told him the conclusion I had arrived at, *viz.*, that the majority of cases depended upon the manner in which the horses were fed and watered. He replied, "That is quite another view to that held by our own veterinary surgeon. He says they are entirely due to the maize." I naturally enquired whether there was any defect in the quality of the maize, but was assured it was good corn. I then enquired whether the horses all over the system were equally subject. "Oh, no," was the reply, "we have no trouble elsewhere; it is only here at headquarters these cases are occurring." Here we have the same mixture and weight of food allowed each cart horse all over the system. Case after case of twist or rupture occurs at one centre and nowhere else, and yet we have the veterinary attendant gravely, though very illogically, incriminating maize as the cause. It is possible the maize may have been a predisposing factor, but there seems no escape from the conclusion that the actual cause was of a local character.

I will now briefly refer to some cases which have occurred in our

own stud. During the fourteen years I have had supervision of it, there have been three outbreaks, as they may be termed, of rupture and torsion. The first and third in sequence occurred at one stable, though under different circumstances, and at ten years interval. For convenience I will term this stable (A). The second occurred at another stable which I will term (B). This outbreak was at a considerable interval in time from either of the other two.

At stable (A) we have eighty horses, thirty-six of which are in two stables, each containing eighteen loose-boxes, each of which has a continuous supply of water. The remaining forty-four are in a row of smaller stables which are fitted with stalls and have no water supply laid on.

The first outbreak was entirely amongst the horses in the smaller stables, and while case after case occurred there, there were no concurrent cases in any other section of the stud. The food was the same all over, the same conditions of watering existed in several other stables, the work was the same as in other sections, and our stableman seemed all one could wish. I was naturally much exercised how to account for the cases, and repeatedly impressed upon the stableman the necessity for great care in feeding, watering, etc., but all to no purpose. At last I changed the stableman. The result was an absolute cessation of the cases. Whether the old stableman allowed too much food at one time, or fed and watered irregularly, or allowed insufficient water, I never accurately ascertained, but from the dry state of the ingesta usually found on *post-mortem* I formed the opinion there had been an insufficient allowance of water.

At stable (B), where the second outbreak occurred, twenty-three horses are stabled. This outbreak took place during the spring of 1893. In a comparatively short period we lost five of the twenty-three horses. Two of these were from gastric rupture, and three from intestinal torsion. My feelings, I need scarcely say, were beyond description. Our stableman had been in the service many years and was a good man. He was so annoyed and distressed that he gave notice to leave our employment. As we had no trouble elsewhere I was convinced of its local character, and deputed a reliable stableman to carefully observe all that took place and report. He saw the horses fed and watered in the morning, followed them at work all day, and saw them fed and watered at night. After a week he reported that several drivers did not water their horses from the time they went to work in the morning until they returned in the evening. I sent a report to the foreman on the matter, and as a result there was great indignation and denial on the part of the drivers. No fatal case has occurred at stable (B) from that day to this. It will be remembered that the spring and early summer of 1893 was an exceedingly hot and dry period, and one can well imagine the disastrous effects on horses working hard and perspiring freely in such weather when fed on concentrated dry food and no water given during the day.

The third outbreak, as already stated, occurred at stable (A), but this time the horses in the loose-boxes were not exempt. The majority of the horses at these stables work at night, and it was noticed that all the four fatal cases which occurred at this time were attacked early on a Monday morning.

On account of the night work a night stableman was stationed at

stable (A) in addition to the day men. As a result of this, with the view of shortening the hours of labour, two men were in the custom of feeding the same horses. Realising the defect of such divided responsibility, this arrangement has been put a stop to, and each man has a number of horses for the feeding of which he alone is held responsible. So far the result of this is eminently satisfactory, in that there has been no case of colic at stable (A) since October. Of the four cases one was rupture and three were twist, and in the latter on *post-mortem* examination the stomach and bowels were found surcharged with ingesta, and the conclusion arrived at was that the horses had been overfed when at rest during the Sunday.

I believe it is beneficial where mixed food is used to feed twice at the morning and evening meals, giving two-thirds of the allowance first, and after this is consumed permitting an interval to elapse before giving the remaining one-third. Under such an arrangement the tendency to gastric impaction is materially lessened.

With reference to the water and watering, it is, of course, essential that where concentrated dry food is used an abundant supply of pure water should be provided.

Some may consider that in narrating these outbreaks I have gone into needless detail. My answer is that the outbreaks arose through defects in details.

Although so much time has been spent in considering the production of rupture and twist in connection with mixed food, it is not for a moment contended that other systems of feeding are exempt.

The injurious effects of wheat, and the many cases of gastric engorgement and rupture which have followed its use, are known to every one. Yet we know that when properly used it is a most excellent food. Many farmers in the Midlands and no doubt all over the country now use it largely in consequence of its cheapness. Their usual plan is to have it ground and then damp it, and, before feeding with it, to let it stand for a time so that a certain amount of fermentation and swelling may take place in it before it is given to the horses. This is the plan the old Scottish farmers used to employ and with equally good results when using bran and pease meal.

Boiled food again has been incriminated by many authors as being prolific in the production of gastric rupture, and no doubt when used without discretion much injury may be caused by it; nevertheless, I know many people who have used it regularly as long as I can remember without the least untoward result.

HURRIED BREATHING, OR "BLOWING."

A NEUROSIS OF THE THERMOTAXIC NERVOUS MECHANISM.

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IT is now about five years since Mr H. Gray, M.R.C.V.S., London, Veterinary-Major J. C. Berne, Army Veterinary Department, and others, pointed out that cases of so-called asthma of the horse were not identical with "broken wind." *Vide* "Veterinary Journal"