*The Diagnosis of the Surgical Disorders of the Bovine Abomasum

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Diseases of the abomasum comprise a most interesting group of conditions only really appreciated in comparatively recent years.

Displacement of the Abomasum to the Left

Since this disease was first reported by Ford (1950) and Begg (1950) a large number of reports have appeared in the literature, and the clinical syndrome is now too well known to merit further description. In the writer's opinion diagnosis is relatively easy, provided that the clinician always keeps the condition in mind when dealing with dairy animals under intensive management, and makes a routine of checking abomasal position and condition. Auscultation; auscultation with ballottement; and percussion, as described by Wood (1957), Pinsent, Neal and Ritchie (1961) and other writers, to demonstrate the typical resonant and splashing abomasal sounds and the absence of ruminal sound in this condition, give very satisfactory results.

It must be remembered that the clinical picture varies quite considerably from the average syndrome so often described. Mild cases are encountered showing little more than slightly reduced appetite, rumination, and milk yield; whilst at the other end of the scale occasional acute cases occur with complete inappetence, absence of rumination, loss of condition, marked weakness, scanty diarrhoea, and grunting, groaning and grinding of teeth. This type usually shows marked left flank distention, and could be confused with many acute abdominal conditions, but if ballottement and auscultation are carried out as a routine very little confusion need arise, except possibly with "vagus indigestion." The acute syndrome of abomasal displacement is more often seen in the pregnant cow.

It should also be remembered that the occasional case of displacement occurs assciated with ulceration which has provoked extensive adhesions as described by Marr and Jarrett (1955). Nevertheless, the majority of cases are unassociated with ulceration, and nutritional factors are probably the most important concern in the development of the atony which precedes the condition. It is well recognised, as indicated by Jones (1962), that the normal abomasum varies in position, and it seems likely that the primary etiological factors in displacement on the one hand, and in dilatation and torsion on the other, are those which in producing atony, allow the accumulation within the abomasum of excessive amounts of food and gas.

The writer accepts that the differential diagnosis of displacement of the abomasum theoretically includes parasitism, Johne's disease, and tuberculosis in longstanding cases; ketosis and traumatic reticulitis in many average cases, and abomasal dilatation and ulceration, and even acute peritonitis, or "vagus indigestion" in the occasional acute cases. Nevertheless he believes that discussion along these lines is nearly always of academic interest only in view of the ease of diagnosis by the demonstration of typical abomasal sounds. When then, does this method fail? It must be admitted that, even using the most reliable method, i.e., auscultation with ballottement, the sounds are not necessarily present in mild and moderate cases throughout the whole of the twenty-four hours, and a chance examination may miss them. The intensity of the sounds depends on the position of the organ and the volume of its content of gas and liquid, and in intermittent clinical cases it will be found that the clarity of the sound is roughly proportional to the intensity of the clinical picture. Nevertheless it is highly unlikely that sounds will still be absent if a further examination is made a day later, and in the atypical acute cases previously mentioned the characteristic sounds are always present.

Is it possible to confuse the sounds with anything else? The writer believes that once they have been heard on several occasions such confusion is unlikely to arise, but very similar sounds do occur in some cases of actinobacillosis of the rumen and reticulum, and in the condition of "vagus indigestion" previously described, where the rumen content is largely liquid with a little gas. The writer has on more than one occasion diagnosed "vagus indigestion" as the acute form of abomasal displacement, only to discover the error during laparotomy. Somewhat similar sounds do occur in the rare case of a large subperitoneal abscess following left flank surgery.

The blood picture in abomasal displacement tends to show a lowered total white cell count and sometimes a lowered neutrophil percentage, but this

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is not sufficiently constant to be reliable in diagnosis.

It seems probable that the high concentrate, high fat, low roughage diet fed in early lactation is important in the production of abomasal atony, as is ulceration of the abomasum; but the post-parturient diseases of milk fever, ketosis, and in particular metritis may also predispose to atony, and at the same time reduce food intake sufficiently to produce a shrunken rumen beneath which the abomasum may easily pass. Very many cases of displacement have, in fact, a history of recent post-parturient disease of the types mentioned, and it behooves the clinician to ensure that such a disease apparently not responding satisfactorily to treatment has not, in fact, been superseded by abomasal displacement. This is perhaps particularly important where acetonaemia is concerned, as many cases of displacement show a positive Rothera's reaction.

Dilatation and Torsion of the Abomasum in the Right Flank

It is interesting that, in spite of the frequency with which these conditions have been described in Denmark, they have rarely been discussed in British literature until very recent years. Begg (1950) referred to dilatation and Richardson (1956) described a case of torsion but little more was heard until Neal & Pinsent (1960) described and reviewed these conditions. Espersen (1964), as mentioned earlier, described the conditions in detail, and it should be noted that Espersen (1961) had already produced an extensive piece of work on the subject, which although not written in English is well worth careful study for the photographs and diagrams are self-explanatory and excellently produced.

It seems possible that concurrent disease, abomasal ulceration, or the presence of sand, gravel, or impacted food material in the abomasum may be predisposing causes leading to atony of the organ. Dilatation then develops, which may resolve spontaneously, but more usually leads to torsion with fatal consequences.

Dilatation usually occurs in adult cows in the first few weeks after parturition. The onset is insidious with inappetence, reduction of milk yield, and variable degrees of ketosis. Rumination does not occur and rumen movement is weak and irregular. The amount of faeces is greatly reduced, and the faeces are usually, but not always, diarrhoeic, foul smelling, and contain changed blood. Temperature is within normal range but pulse is between 90 and 100 per minute. Abdominal pain is shown by occasional lifting of the hind legs, and looking around at the right flank. Differential diagnosis in the early stages includes ketosis, and later, traumatic reticulitis, abomasal ulceration, acute cases of abomasal displacement and other subacute abdominal disturbances must be considered. Nevertheless diagnosis should present little or no difficulty to the clinician aware of the disease as the greatly dilated abomasum, filled with gas and foul-smelling coffee-coloured fluid usually produces noticeable distention of the right flank, and is frequently palpable on rectal examination. In all cases auscultation of the right flank produces high-pitched fluid sounds; ballottement produces loud resonant splashing sounds; whilst percussion over the last rib produces a very resonant sound. All these sounds are identical to, but louder than, those heard in the left flank in displacement cases.

Once torsion has supervened the animal's condition deteriorates rapidly, and death soon occurs. A subnormal temperature, pulse rate of 120-160 per minute, cold extremities, and extreme dullness and weakness, indicate the presence of shock, while grunting, groaning, grinding of teeth, frequent standing up, lying down, and kicking at the belly indicate acute pain. Appetite is non-existent, but there may be thirst. No defaecation occurs, and the rectum is empty save for a little tarry mucus.

Differential diagnosis obviously includes all the causes of abdominal catastrophe, e.g., intussusception and perforated abomasal ulcer, as well as the causes of abdominal distention, but diagnosis is simplified by the very obvious distention of the right flank, and the ease with which the distended abomasum can be felt on rectal examination. The characteristic sounds are also very clear.

The question of whether the torsion has occurred in a clockwise or anticlockwise direction is of purely academic importance during the diagnostic procedure, although it becomes vitally important once corrective surgery is contemplated. Nevertheless it seems highly unlikely that the direction of torsion can be foretold before laparotomy is performed.

Impaction of the Abomasum

This condition has already been described in the differential diagnosis of pain in the anterior abdomen, for reasons previously discussed.

Ulceration of the Abomasum

Multiple erosions of the mucous surface of the abomasum occur in a number of systemic diseases of cattle, their presence being masked by the overall signs of the systemic disease. The condition under consideration here is that known as peptic ulceration in adult cattle and described as such by Marr & Jarrett (1955). It was mentioned by Begg (1950); one case was described by Pinsent & Ritchie (1955) and the condition in general by Pinsent (1968). Three cases of perforation of abomasal ulcers were described by Tutt & Tull (1955), while Jones (1959) reviewed the condition.

The ulcers occur singly or sometimes in twos and threes, usually of florin or half-crown size and involving the greater curvature of the abomasum. Fungal hyphae invade the depths of most such ulcers, which tend to extend more and more deeply into the submucous layers with considerable development of fibrous and granulation tissue until in some cases per-

foration occurs. If this happens at a point lateral to the omental covering a fatal termination ensues unless adhesion to the abdominal wall can occur, but if perforation occurs at a point covered by or attached to the greater omentum the ulcer may be sealed by omental adhesions, the sides and base of the lesion then consisting of omental fat with strands of fibrous tissue.

It is probable that many cows live for considerable periods with little or no clinical ill-effect from abomasal ulcers, which may eventually heal. More severe ulceration with or without omental adhesions will produce a clinical syndrome which tends to appear insidiously during the immediate post-parturient period, with impaired appetite, ruminal function, and milk yield, as well as loss of condition. Some cows eat dung, straw, and even rock salt with interest. Temperature is usually in normal range, but febrile periods may occur. Pulse rate is usually unaffected. Diarrhoea, often intermittent, is frequently but not constantly seen. Ketosis often occurs, while some degree of pain is always present, manifested by grinding of the teeth and possibly by vague discomfort when pressure is applied low in the abdomen behind the last rib on the right-hand side.

Anaemia and submaxillary oedema may occur, as the animal becomes steadily more weak, harsh-coated, unkept and emaciated, until recumbency ensues.

The condition is difficult to diagnose and falls into the category of wasting diseases, differential diagnoses including tuberculosis, Johne's disease, parasitism, particularly liver-fluke infestation, ketosis, and of course some cases of displacement of the abomasum, particularly those complicated by ulceration.

The clinical picture is vague and the blood picture variable and of no diagnostic value. A faecal blood test may help, but it must be realised that these tests are very sensitive, and "false positives" will occur in cases which have recently been subjected to rectal examination. A right flank laparotomy in the sub-lumbar fossa may allow palpation of the thickened area of the abomasal wall, or of abomasal adhesions, but rarely can the affected area be brought into this laparotomy wound.

Perforation of an abomasal ulcer may occur, not only in a cow showing the vague syndrome outlined above, but also in an apparently healthy animal in which the presence of a disease lesion has not been suspected (Tutt & Tull, 1955). The early signs of perforation have been discussed amongst conditions causing pain in the anterior abdomen, but within twenty-four hours of the onset of symptoms the cow will be recumbent, with cold extremities, sub-normal temperature and rapidly rising pulse rate, continually groaning and very dejected, with shallow rapid respirations and possibly a degree of peritoneal tympany. Death quickly supervenes from shock and diffuse peritonitis.

In cases of displacement to the left associated with ulceration, it is much easier to diagnose displacement than to determine preoperatively that an ulcer is also present. Frequently the first indication appears at laparotomy when adhesions between the abomasum and the left flank are detected. It is wise to bear in mind that any cow showing signs of displacement, and also abdominal discomfort with a raised or intermittent temperature, may have an associated ulcer with adhesions, although the occasional acute uncomplicated abomasal displacement has already been discussed, and of course there is no reason why uncomplicated abomasal displacement and any other painful abdominal condition, e.g., acute liver abscessation, should not occur coincidentally. In such cases the clinician may operate expecting to find abomasal adhesions and be surprised at their absence.

A further complication of the abomasal ulcer syndrome occurs when such an ulcer erodes into a blood vessel producing severe and even fatal haemorrhage within a few hours. The clinical picture includes a weak fast pulse, rapidly increasing in rate; a subnormal temperature, pale mucous membranes, rapid respirations, weakness and collapse, usually accompanied by signs of mocerate abdominal pain. If recovery occurs, black tarry faeces appear in 24-36 hours, scanty at first, and then profuse. Diagnosis is made on signs of internal haemorrhage accompanied by abdominal pain, but is by no means easy even to the clinician familiar with the syndrome. It should be remembered that the packed cell volume of a blood sample may be determined very rapidly and be of great help in assessing this type of case.

The Diagnosis of Intestinal Obstruction

(A) Acute Intestinal Obstruction. Dilatation and torsion of the abomasum, some cases of perforation of an abomasal ulcer, very acute cases of displacement of the abomasum, "vagus indigestion" and even acute peritonitis, must be differentiated from acute obstructive conditions of the gut, of which the most familiar is intussusception, although scrotal hernia, torsion of the caecum and other forms of intestinal strangulation do occur.

Differentiation is, up to a point, not difficult. Dilatation, torsion, and acute displacement of the abomasum are readily diagnosed on abdominal distention and characteristic sounds, whilst "vagus indigestion" causes ruminal distention and obvious discomfort, but not "colic" type pain. Nor do perforated ulcers or acute peritonitis cause a "colic" syndrome. The acute intestinal obstructions, on the other hand present a definite "colic" picture as, for example, intussusception where the early signs include marked restlessness with lifting of the hind legs, kicking at the belly, looking around at the flanks, and frequent getting up and lying down. A peculiar "trestle" attitude with dipping of the back is frequently seen in this condition. Temperature is at first normal or slightly raised, tending to become subnormal later in the course of the disease, whilst the pulse rate tends

to become faster and weaker as the disease progresses, reaching 100-120 per minute or even higher in the terminal stages. Intussusception can affect any age of bovine animal, but is probably more common in the relatively young. Faeces are passed at first, but in 24 hours only a trace of tarry material will be seen. After the transient colicky phase, usually lasting less than 24 hours, the animal will show progressively less pain, but will become dull and obviously very ill as the result of necrosis of the strangulated gut with resultant peritonitis, toxaemia, and shock.

Pearson (1971a) has recently produced a paper of excellence on intussusception, covering in detail all aspects of the subject. There is therefore no need for further discussion, except to stress that some cases of intussusception, including those in which the ileum has passed into the caecum, may show a less acute and more slowly progressive picture, in which the initial signs of abdominal pain are much less marked. The same is true in cases of prolapse of gut through tears in the mesentery. When the hernial aperture is small and strangulation develops rapidly there may be initial acute pain, but where the hernial aperture is larger and less restrictive, a much less clear-cut syndrome may be presented.

Scrotal hernia occasionally occurs in the bull, but the clinician will always have this condition in mind when investigating acute abdominal pain in an entire animal, and so is unlikely to overlook it. The condition traditionally called "gut-tie" still occurs in bullocks, usually in animals castrated by traction at an age older than is advisable. The condition, in the writer's limited experience, is due to prolapse of gut through small torn loops of peritoneum still attached at their ends which occur at the edge of the internal inguinal ring during fierce traction on the testicle. The clinical picture follows the general pattern described for acute intestinal obstruction with the additional factor that the patient tends to walk stiffly backwards in a crouched position and may even press backwards against a wall or post. Rectal examination will always give a satisfactory confirmation of this condition.

Pearson (1971a) describes two cases of acute colic in milking heifers with complete bowel obstruction due to a single taut thread-like fibrous strand, probably congenital in origin, connecting two loops of intestine.

Rectal examination is always indicated when acute intestinal obstructions are suspected, although, except in "gut-tie," it does not follow that the affected portion of gut, tense and painful at first, but doughy and insensitive later, will be within reach. The presence of tense gas-filled loops of intestine cranial to the obstruction may be more easily recognised and should be regarded with suspicion, but frequently right flank laparotomy will be necessary to confirm the diagnosis of this group of conditions.

Torsion of the caecum, with or without involvement of the colon and ileum, also suspended by the common mesentery, does occur and merits especial mention. The condition was described by Jones, Johnson & Moore (1957) but Pearson (1963), Espersen (1964) and Pearson (1964) have added greatly to our knowledge of this syndrome, which is much less common than abomasal disease. Pearson suggested that the condition probably originates as a form of dietary ileus, producing gaseous distention of the colon, ileum, or caecum, or all three together, with resultant disturbance in the equilibrium of these organs, all suspended by the same sheet of mesentery. He described four degrees of illness: 1) dilatation of the caecum alone; 2) torsion of the caecum which is not a true torsion but involves a kinking forward of the free and distended end from the point of reflection of the common mesentery. It must be remembered that the organ is some thirty inches long, its base lying medial to the lower extremity of the last rib while its apex reaches the right side of the pelvic inlet. The distal third projects from the common mesentery and is thus the obvious portion to deviate; 3) distention of the whole of the intestine suspended by the mesentery; and 4) torsion at the root of the mesentery with rapidly developing ischaemia. The prognosis of this degree of the condition is serious indeed.

The condition affects dairy cattle of a wide range of breed and age, producing a transient but very acute episode of acute colicky pain. Faeces often cease completely and there is no desire to eat or drink. Very rapidly this phase gives way to progressive dullness, as circulatory obstruction leads to necrosis and toxaemia, temperature becomes sub-normal, and pulse rate, already high, becomes faster and weaker. Specific diagnosis depends upon the demonstration of a distended right flank, particularly prominent just beneath the lumbar transverse processes where if the caecum alone is involved, it may give the impression that a distended, horizontally placed tubular organ lies beneath.

If, however, the whole of the gut suspended by the common mesentery is involved in a torsion at its root, the right flank is likely to be more uniformly, although not necessarily greatly, distended. Ballottement of the distention produces a fluid splash and when the caecum alone is involved it can always be detected by rectal examination, which may, however, not be so clear an aid in cases of torsion about the root of the mesentery. These cases are not easily diagnosed, and one may not be certain until exploratory laparotomy is carried out. The writer would hasten to add that in a limited experience of this lesion he was by no means certain of the diagnosis even after laparotomy. Pearson (1964) said that in all his cases of caecal dilatation the rectum of the patient felt relaxed, rather dry, and suggestive of the cow under epidural anaesthesia, and he believed this to be a useful diagnostic aid.

The clinician must not be misled into an erroneous diagnosis of acute intestinal obstruction by one of the

following conditions.

(1) The very early stages of some types of acute enteritis may produce severe abdominal pain, rapid pulse rate, absence of faeces, and even tenesmus, a syndrome superficially similar to the acute obstructions, but signs of "colic" are rare in enteritis, and in any case profuse diarrhoea within 24 hours will generally simplify the diagnosis. Such cases may present a noticeable right flank splash on ballottement.

(2) Cattle occasionally suffer from tympanitic intestinal colic very similar in its clinical signs to the syndrome well known in the horse. These cases are, in the first instance, readily diagnosed as acute obstructive conditions, but within 12-24 hours all pain will have ceased, and in contra-distinction to the acute obstructions, the animal will be bright, eating, and normal in every way, though often exhibiting quite profuse diarrhoea. This syndrome has already been discussed in the differentiation of abdominal distention.

(3) The writer has on three occasons been misled by a very painful condition of the teats of Guernsey and Ayrshire cows occurring in the early stages of photosensitisation. It affects non-pigmented teats causing reddening to a purple end point, heat, and intense pain. The cow is extremely restless, lifts its hind legs, and kicks at its belly quite energetically, but pulse rate remains in normal range and faeces remain normal. Demeanour is usually quite bright. If the vulva is non-pigmented and also becomes affected, swishing of the tail may also occur. There will be violent reaction to handling of the teats, and although the pain will disappear within the next few days, cracking of the damaged epithelium in a mosaic pattern with exudation may occur. In cattle with areas of white skin and hair the characteristic skin lesions of photosensitisation may soon appear.

(4) Passage of a renal calculus through the ureter may, on occasion, produce transient acute colic-like pain, whilst occasional cases occur in which more permanent ureteral obstruction due to adhesions, or granulation tissue, may cause marked pain during the development of hydronephrosis.

(5) Pearson (1971b) in reviewing 168 cases of uterine torsion in cattle, points out that in one case where torsion had occurred before parturition became imminent, colic, with kicking at the abdomen and paddling with the hind legs, was the main symptom. There was also inappetence and constipation with a raised pulse and a noticeable dipping of the lumbar spine. Such a case could very easily be mistaken for an acute intestinal obstruction such as intussusception.

(B) Subacute and Chronic Intestinal Obstruction. In this connection it suffices to say that obstructions of gut due to fat necrosis in Jersey cattle, to the leukosis complex, or even as the result of adhesions resulting from trauma, may occasionally occur, with slow onset and development, loss of condition, and increasing signs of obstruction to the passage of ingesta through the intestine. The details of the clinical picture vary in almost every case according to the position and size of the lesion or lesions, and a complete diagnosis is unlikely without the aid of laparotomy.

On one occasion a penetrating portion of wire was found in an area of massive adhesion involving the ileum.

It is important, when considering the possibility of subacute intestinal obstruction in the heavily pregnant cow, to remember (Pearson 1971b) that symptoms of subacute or chronic abdominal pain with progressive inappetence and constipation are features of the longstanding case of uterine torsion in which, of course, superficial evidence of parturition may be slight only.

Exploratory Laparotomy as a Diagnostic Aid

It is the writer's opinion that an increasing awareness of the value of exploratory laparotomy as a diagnostic procedure, as opposed to its use solely as a surgical treatment, is of vital importance if progress is to be made in our knowledge of bovine abdominal disorders. Laparotomy in cattle is a straightforward and relatively simple procedure which rarely, if ever, adversely affects the subject, and which can be carried out with the simplest of equipment and facilities. It may be said that the procedure is time-consuming and expensive, and that clients object to its use unless spectacular results are forthcoming. Nevertheless there are many cases where the diagnostic and prognostic information obtained at laparotomy saves a great deal of time, expense, and worry in the long run, whilst the modern farmer with his higher standard of education and training is, by and large, becoming increasingly amenable to its use. It is also worth reminding ourselves that judicious choice of the laparotomy site renders every abdominal organ available to manual, if not to visual examination, at least to a limited extent.

Abdominal Disease in Calves

It is not the writer's intention to attempt any full discussion on surgical abdominal disease in calves, but the problem of ruminal tympany in the calf is of such importance today that a brief consideration is quite necessary.

There are a number of causes of tympany in this animal. Tympany in the housed calf, either suckling or bucket fed, due to greedy drinking allowing escape of milk into the rumen, and tympany due to congenital or acquired anatomical deviations of the stomachs are occasionally seen. The important form of tympany seen today, however, is that associated with modern systems of rearing and feeding. Allowing calves to eat concentrates, particularly barley, before they have learnt to eat hay, the provision of poor quality coarse and mouldy hay and straw, the high fat content of many milk substitutes, the frequent lack of hygiene in modern nursery units, associated with a high level of coincidental illness, all predispose to atony of the stomachs with ulceration and partial im-

paction of the abomasum, continual accumulation of gas in the slowly distending rumen, and intermittent diarrhoea.

Provided that abomasal ulceration is not too far advanced, and that the owner is able and willing to consider the health of an individual calf, much can be done by putting the calf back on to full milk for a few days, preferably with a wide-spectrum antibiotic included, and then weaning it again in a gradual and sensible manner first to good hay, and then to concentrates. The main stumbling block in such a procedure is the necessity for very frequent stomach tubing of the patient to allow release of gas, for although sufficient eructation occurs to prevent fatal results from tympany, the continual distention interferes with the restoration of proper function and motility and renders the calf uncomfortable and miserable. Some form of permanent or semi-permanent escape mechanism for ruminal gas is very necessary in most cases if recovery is to be complete.

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