



REVERDY

-Digestive system

Colic : Symptoms, causes, risk factors, and post-operative re-feeding

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A horse that rolls, kicks the ground and looks round at the flank... These symptoms, well known to riders, are closely watched for. It should be said that “colic”, a word that gathers together every type of abdominal pain, is the dread of every horse owner, and for good reason : This disease is the biggest cause of mortality in the horse¹.

The horse, possessing a unique digestive system, is of particular risk from suffering from colic. The pain can be caused by an infection, or be related directly to the horse (his age, breed...), but also may be linked to his lifestyle. It is therefore possible to minimize the risk of your horse developing colic by controlling, for example, his feeding, watering and housing.

This article aims to explain what colic is, present the environmental risk factors that you can control to optimise your horses' health. Finally, a non-exhaustive presentation of post-colic (with or without surgery) re-feeding plans is proposed.

POINTS TO REMEMBER

The word “colic” regroups every type of abdominal pain that may be confronted by the horse. There are true colics, that is to say, affecting the digestive organs, and “false colics”, caused by diseases affecting the urinogenital systems, circulatory system, muscles (azoturia/tying-up), movement (laminitis) or even the respiratory system.

In the large majority of cases, colic symptoms are related to a digestive blockage. This blockage may be caused by an obstruction of extremely fibrous foods like straw, wood chips/shavings, sand, enteroliths, lipoma, parasites, or by strangulation of a section of the gut. The symptoms of colic can also be related to a massive build up of gas in the caecum/large colon, following the ingestion of a too large quantity of fermentable sugars (starch and/or fructans). Ulcers affecting the stomach and /or small intestine can also be at the root of colic symptoms and can become chronic. Ponies are more susceptible to suffering from colics due to lipomas whilst horses have an increased risk of suffering from colics related to gut displacement. It is possible to limit the risks by respecting simple health and feeding rules :

- » Ad-lib clean water at a temperate temperature in the stable and paddock at all times. In the same manner, when travelling, stopping at regular intervals to offer water to the horse so he is able to remain hydrated can reduce the risk of travel related colics,
- » Feed a minimum of 1.5kg of good quality hay (not mouldy...) for each 100kg of live-weight (body-weight) a day,
- » Split the daily concentrate ration into as many feeds as possible, 150g of starch for 100kg of live-weight and 400g of food per 100kg of live-weight per meal must not be exceeded. It is also recommended to not exceed 5kg of concentrate feed per day for a 500kg horse,
- » When there is a change in hay and/or concentrate feed, a gradual transition over about 10 days is advised,
- » Horses who are turned out in a paddock at least 3 times a week have less risk of suffering colic than those who remain stabled,
- » Finally, teeth should be checked regularly, and animals wormed following a programme recommended by your vet.

Reintroducing feed to the horse after digestive surgery must be carefully monitored in order to limit postoperative complications and optimise the animal's recovery. As far as possible, the horse should be started with small quantities of forage as soon as is feasible. He can, when his state of health stabilises, be given a low starch concentrate feed.



COLIC : SYMPTOMS AND CAUSES

Symptoms

A grid of symptoms has been developed, which also allows the pain intensity from which the horse is suffering to be identified on a scale of 1 to 5² :

On seeing these symptoms, a vet should be contacted who will also examine:

- » The heart rate, which increases according to the pain. This is a good indicator as to the seriousness of the colic,
- » The respiration rate, which is also a good indicator of pain,
- » The colour of the mucous membranes, which are naturally pink. In cases of colic they can be a dirty bright red, or even show cyanosis,
- » Pinch test to check for dehydration,
- » Intestinal noises, which are fewer and even absent in most colics, but can be greater in the case of diarrhoeas,
- » Body temperature, which can give information on a possible inflammatory/infectious cause, or if the animal is in shock.

The vet will also carry out a rectal examination which will allow him to more precisely evaluate the cause of this pain. This complete examination (which can be associated with other tests and examinations, such as a blood count or even nasogastric intubation) will allow a diagnosis in order to treat the horse. Depending on the cause and the severity of symptoms, the horse can be treated on the spot, or must be taken to a veterinary clinic and/or undergo surgery.

THE HORSE'S DIGESTIVE SYSTEM

The horse has a unique digestive system:

- » A small stomach (about 18L, that is to say 9% of the total digestive tract), which only 2/3 fills and which must empty 6 to 8 times a day. Thus, food generally stays very little time in the stomach which has only a moderate action on digestion.

The small intestine is the major site of digestion, but its capacity to digest starch is limited and can be exceeded by the ingestion of too many cereals (in general when the quantity of starch exceeds 150g per 100kg live-weight per meal or when the amount of compound feed exceeds 400g per 100kg live-weight per meal). The large intestine, comprised of the colon and the caecum, a pocket



Stage	Pain intensity	» Symptoms
1	Absent	» None
2	Light	» Lack of appetite » Occasional pawing at the ground » Looking at the flank » Posturing as if to urinate » Laying down for longer than normal » Backs into a corner against a wall or a separation » Curling the upper lip » Playing with water without drinking
3	Moderate	» Agitation, restlessness » Gathers himself up as though about to lay down » Kicking at the abdomen with a hind leg » Laying on his side on the ground » Rolling » Adopts a "sitting dog" position » Groaning
4	Severe	» Sweating » Violent rolling » Throwing himself to the floor » Previous symptoms expressed violently
5	Depression	» Depressed state

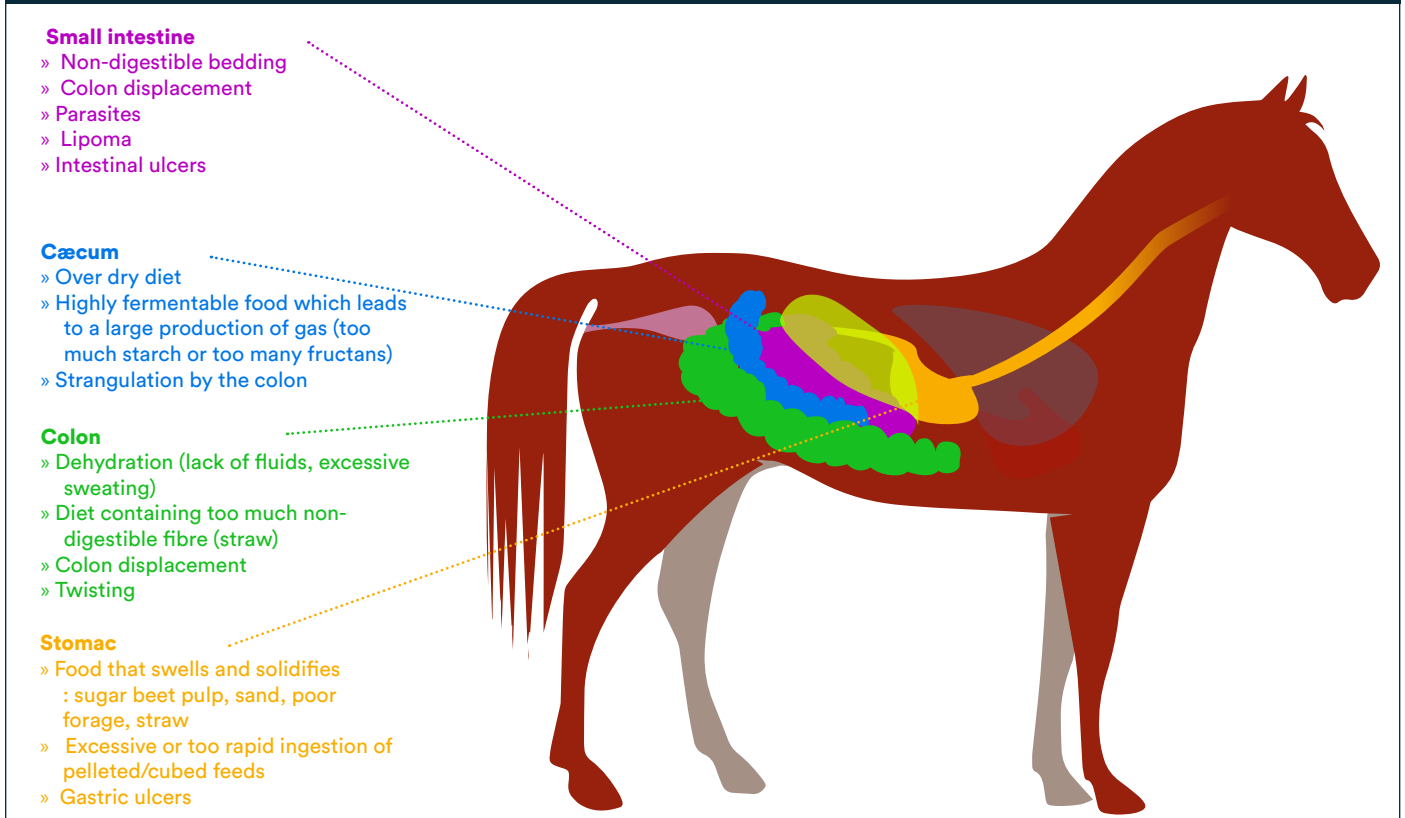
situated at the entry to the colon, is the seat of microbial digestion which breaks down fibre from forage that is non-digestible in the small intestine. If starch is not entirely digested in the small intestine, it passes into the large intestine where it will be fermented, which can disturb the intestinal microbiota (for further information, consult the article "STARCH" and the information sheet "STARCH AND COLICS")

THE PRINCIPAL CAUSES OF COLIC

The causes of colic are multiple, they can be infectious, inflammatory, parasitic, dietary or even anatomic. Every cause does not carry the same prognostic nor is as easy to treat. Certain colics will pass with anti-spasmodic drugs, whilst others require emergency surgery. Here are the principal causes, but others also do exist.
Stomach :Pains in the stomach can be linked to an impaction, which is an accumulation of dried food in the stomach which then doesn't empty. The impaction is generally related to foods **that swell-up or solidify (sugar-beet pulp, sand, poor forage, straw) or excessive or too rapid ingestion of pelleted/cubed feeds**. Gastric ulcers can also lead to colic symptoms, in general chronic but sometimes acute when the stomach fails to empty.

Small intestine : Pain in the small intestine can be caused by obstructions which prevent foods from continuing their passage through the digestive tract. This can be related to the ingestion of **difficult to digest bedding (an accumulation of fibre)** to the displacement of other organs blocking the progression of food through the digestive tract (for example the colon is poorly fixed and so subject to displacements), to **parasites**, or tumours (such as lipomas, benign fatty tumours). Ulcers in the small intestine can also slow the intestinal transit and cause an obstruction. The small intestine itself can also enter an opening in the abdomen and become trapped (at the navel for the umbilical hernia, in the scrotum for the inguinal hernia, or even in the foramen epiploic), twist on its self (volvulus) or become strangled by the colon.

Caecum : Pain in the caecum can be linked to an obstruction caused by **over dry food**, or even to distension by gas if **the food is easily fermented** and undigested by the small intestine. For example, when there is too large a quantity of starch (>150g of starch/100kg live-weight per meal), the small intestine's starch digestion ability will be exceeded, undigested starch will therefore pass into, and be fermented by, the caecum and colon. In the same manner, too many fructans (be wary of spring grass), non-digestible by the small intestine, will also be fermented in the



caecum. These fermentations will lead to a large, painful, amount of gas being produced, as well as the production of lactic acid, which will bring about a drop in the pH, detrimental to the working and survival of intestinal cells and the intestinal microbiota. The caecum can also find itself strangled by the colon.

Colon : An impacted colon is the most frequent cause of colic³ : a plug forms and the contents can no longer move. This can be connected to **dehydration** (not drinking enough, exercise that is too strenuous) or even a **food too rich in non-digestible fibre** (for example colics caused by straw). The colon, poorly fixed, can also displace itself and position itself badly (we talk about nephrosplenic entrapment, or left dorsal displacement, when the colon displaces to the left, between the spleen and abdominal wall). The colon can also twist on itself, from 180 to 720° (volvulus). The formation of enteroliths, stones composed from struvite crystals, in the colon can equally lead to colic symptoms. Enteroliths are principally observed in horses living in arid areas, as well as in horses who ingest large amounts of luzerne⁴.

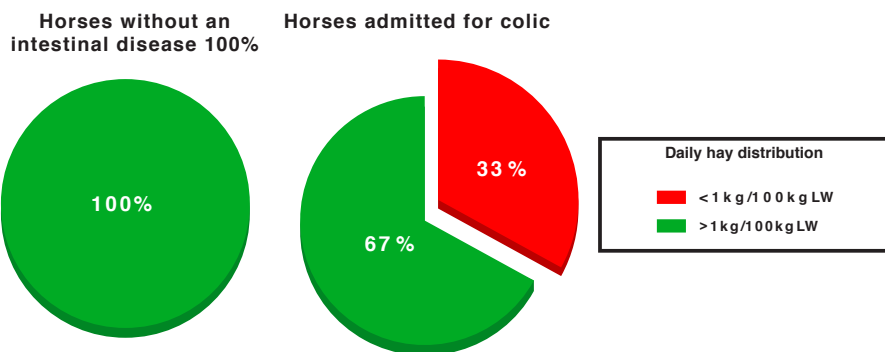
“False colics” also exist, related to diseases of the urinogenital system, circulatory system, muscles (tying-up, laminitis) or even respiratory system. These diseases can manifest the same symptoms as digestive colics.

THE SPECIAL CASE OF THE FOAL:

It can happen that the foal shows signs of colic very rapidly after birth. The most common causes of these symptoms are :

- » **Meconium impaction.** The meconium is the equivalent of the “first droppings”, it is dark brown and of a firm consistency. The meconium must normally be passed in the hours following birth. Expulsion is generally complete after 24 hours but may take up to 48 hours.
- » **Enterocolitis,** which is characterised by diarrhoeas caused by infection. Diarrhoea in the foal is classically observed in 70 to 80% of foals in the first weeks following birth (generally during the foal heat). In this case it is a short lasting and self-resolving diarrhoea. However, the diarrhoea can also be caused by infection : pain can therefore be intense and mortality high.
- » **Hernias,** which correspond to a part of the small intestine incarcerated within an abdominal opening (for example, umbilical hernia). The digestive hernia maybe external (umbilical hernia) or internal (foramen epiploic). In the second case it is therefore not visible. This can lead to pain associated with an obstruction.
- » **The presence of urine within the abdomen,** which can be caused by a ruptured bladder. The foal will have abdominal pain and swelling.
- » **Twisting of the small intestine (volvulus).** Volvulus of the small intestine is the principal cause of abdominal surgery in the foal. Pain is generally progressive and intense and not relieved by pain-killing drugs..

Other, less common problems, such as the absence of intestinal motility, obstruction of the stomach, small intestine intussusception (that is to say the intestine slides over itself, causing an obstruction), volvulus of the large colon, colon displacement or gastric ulcers can also be at the root of colic symptoms seen in the foal.



WHAT ARE THE RISK FACTORS ?

Digestive colics are multifactorial diseases. This means that a large number of risk factors can influence their development. This makes it difficult to estimate the risk factors directly related to the horses (for example, breed, age, sex) as these factors often merge with other environmental factors: for example, the breed is often associated with a discipline and living conditions. Numerous studies have examined this subject. The major findings are presented here, and take into consideration the principal limits associated with each factor, as the cause and effect relationships have not always been elucidated.

FACTORS RELATED TO THE HORSE

The breed of the horse

Study findings are contradictory. A single breed would not seem to be more at risk than another, but rather the way he is kept (lifestyle) would be the cause of a higher risk. However, the breed would seem to have an influence over the type of colic affecting the horse. Indeed, ponies would be more at risk of developing problems in the small intestine (related or not to lipoma development) as well as colitis³ (inflammation of the colon), while riding horse types would be more at risk of showing left and right colon displacements^{3,5} and draft types, of presenting colon displacements and problems in the caecum³. Hence, the metabolism, but also the size of horse, influence the causes of colic.

The age of the horse

Even if these observations are not systematic, a number of studies observed an increase in the risk of colic in older horses^{3,6-11} : from the age of 10^{6,10} or 20^{8,11} years of age, depending on the study. Furthermore, the risk of requiring surgical intervention for colic is greater in

horses over 15 years of age¹².

To conclude, the older horse would seem to be more at risk and must therefore be more closely watched.

The horse's sex

The sex of the horse does not have an affect on the risk of suffering from colic^{3,6-9,11,13,14}. Nevertheless, mares who foal are at greater risk^{13,15}. It has moreover been demonstrated that in broodmares who colic just after foaling, the intestinal microbiota (=flora) has already altered 10 days before colic occurs. Indeed, the proportion of commensal bacteria (beneficial bacteria) is reduced, while that of bacteria that can become pathological under certain conditions, is increased¹⁶.

Thus the intestinal microbiota would also seem to play a big role in the development of colic: whether it is the cause of colic symptoms or an early indicator of a future bout, it is not to be neglected.

Stereotypical behaviours (vices)

Horses who crib-bite or wind-suck are at more risk of suffering from colic^{8,17-21}. The cause and effect relationships between stereotypical behaviours and colic have not yet been elucidated. However, horses showing these behaviours would seem to have a slower intestinal transit²², which would explain this increase in cases of colic amongst these animals. In horses that wind-suck, the actual swallowing of air has not been associated with colic²³. The development of stereotypical behaviours would also be an indicator of the animal's way of life. In this respect, the fact that the horse has this behaviour can also be associated with feeding practices, housing... also shown to be in favour of colic developing, as explained below.

RISK FACTORS LINKED TO THE HORSE'S WAY OF LIFE

WATERING

Horses without access to water at all times in their stable, field or paddock are more at risk of suffering from colic^{7,10,24}. This effect is all the more important as the age of the horse increases⁷. Furthermore, the prevalence of colic increases during, or following travelling²⁵, notably if the journey lasts more than 24 hours¹⁷. This will be in part related to the fact that travelling long distances leads to horses becoming dehydrated, by the absence of, or insufficient water, the stress and sometimes the heat. **It is thus primordial to offer your horse, free easy access to clean, temperate water, no matter the season.**

FEEDING

Hay : The quantity of hay offered is essential to limiting the risk of colic. A study undertaken between 2013 and 2017 at the Centre Hospitalier Universitaire Vétérinaire at Ghent (Belgium) demonstrated that 33% of horses that were admitted for colic received less than 1kg of hay per 100 kg live-weight per day against 0% for those horses without digestive problems²⁶. Epidemiological research, carried out in Sweden in 2017, also showed that for each extra kg of hay distributed per 100kg live-weight, the risk of colic was divided by three²⁷.

Hay quality and in particular forage hygiene, for example the absence of contamination by bacteria or mould, is also primordial. Indeed, horses eating poor unhygienic hay have more risk of colic²⁴. In the same manner, horses who ate hay directly from the bale also showed a higher risk. This would seem to be related to a greater presence of "foreign bodies" (for example, nets/string left on

the bale), as well as the lesser hygienic quality of bales exposed to conditions favourable to the development of mould²⁸. **Hay quality is very important, its' storage and distribution must be carefully monitored.**

Concentrate feeds :

Concentrate feeds lead to an increase in the risk of colic when they are fed in too large a quantity and bolted (eaten too quickly)^{9,17,24,28,29} : Horses that ingest more than 2.5kg of concentrate feed daily show a 5 fold increase in the risk of suffering from colic²⁹, and this risk rises as the quantity of concentrate food increases. Indeed, horses ingesting more than 5 kg of concentrates a day are 6 times more at risk of colic²⁹. Increasing the number of meals from 2 to 3 when the horse is eating more than 5kg of concentrate feed per day does not reduce the risk of colic as the quantity of concentrate feed consumed per meal remains high²⁹. Eating oversized meals can lead to compaction, but equally swelling of the caecum as a result of excess fermentation. Indeed, starch undigested in the small intestine will enter the large intestine, where it will ferment, this can disturb the intestinal microbiota and thus equally causing gas to be produced and bloating to occur. **As a reminder, 150g of starch, and 400g of feed /100kg of live-weight per meal should not be exceeded. For horses subject to gastric ulcers, we must remember that it is advisable to not exceed 100g of starch /100kg live-weight per meal**

for further information, consult the information sheet "STARCH AND ULCERS". In addition, feeding large quantities of concentrate feeds is often associated with a lack of forage²⁷. No scientific study has examined the effects

of the quality of raw ingredients used in concentrate feeds.

To conclude, to reduce the risk of colic, it is best to give small meals of concentrate feeds, thus allowing optimum digestion. The actual type of concentrate feed will not have any real incidence on the risk of colic, and access to water, exercise and the horse's environment, also play a part in how concentrate feeds are digested.

Fruit and vegetables:

Giving your horse fruit and vegetables reduces the horse's risk of colic²¹. In this case, the carrot is more appropriate than the apple, which can ferment in the large intestine and cause digestive disorders if consumed in too large a quantity. Carrots are of interest as they have a very high water content (about 80-90%), they are also a good source of carotenes (transformed into vitamin A by the organism). Carrots are also composed of insoluble (predominantly) and soluble (between 2 et 8%) fibres as well as soluble sugars (between 2 et 8%).

Dietary transitions :

Sudden changes of feed without a period of transition is also a risk factor in the development of colic : Changing the type of concentrate feed but also the type of forage leads to a rise in the risk of colic in the 14 day period following the change, and especially within the first 7 days^{17,28}. Abrupt changes of feed can disturb the intestinal microbiota and so also the digestion in general. **When a change of food is needed a progressive transition must be programmed (about 10 days), whether it be for concentrate feeds or forage.**

HOUSING

Horses stabled for over 13 hours a day are more at risk from colic than horses who are turned out daily (field or paddock with ad-lib water) for at least 11 hours^{6,17,21,28}.

Horses who live out or who are turned out at least 3 times a week have less risk of colic than horses who never get turned out during the week, and more so if they have not had access to pasture in the 6 months preceding colic¹⁷. **To conclude, the horse needs sufficient, clean and regular water, good quality hay in sufficient quantity (a minimum of 1.5kg for 100kg live-weight), small fractioned meals of concentrate feeds (a maximum of 150g of starch and 400g of feed/100kg live-weight per meal), a well as regular turnout in order to limit boredom and permit regular and slow ingestion of fibre. It must be ensured that as to a great an extent as possible that the same foods are fed, at fixed times, and if there is a need to change, to programme a progressive transition between the old and the new food.**

RISK FACTORS RELATED TO THE CARE OF THE HORSE

DENTAL HEALTH

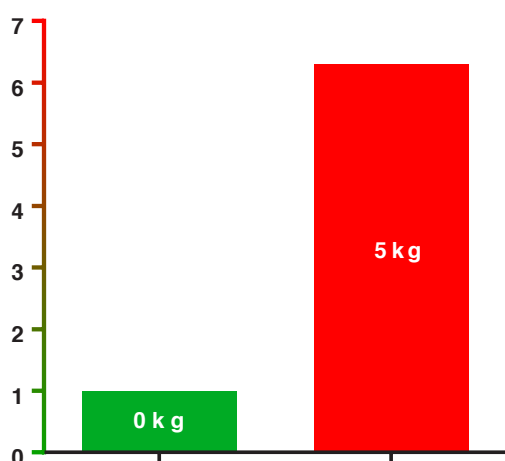
It is important ensure the horse has regular dental care. Horses with dental problems are more at risk of suffering from colic^{20,21,30}. In the same manner, the number of colic cases drop when dental care increases¹⁷. Horses that show "quidding", that is to say, dropping partially chewed food, so having trouble chewing their food are also more at risk from colic¹⁵. In the aged horse dental problems are more frequent and partly explains why this population is more at risk than others. Dental problems lead to difficulty chewing food which will therefore be swallowed unaltered, less well broken down but also less humidified by saliva, and so able to cause compaction and even excessive fermentation. **Regular dental care of the horse is paramount in order to reduce the occurrence of colic but also to permit the horse optimum digestion and assimilation of food.**

PARASITES

Regular worming is associated with a reduction in cases of colic^{7,10,17,31}. However, recent worming, possibly tied to taking into consideration signs of parasitism (weight-loss, pot belly, itching, diarrhoea...) is associated with an increase in the risk of colic^{10,17,24}. In the second case, colic can be the result of a

Distributing more than 5kg of concentrate feed a day multiplies the risk of colic by 6.

Risk of colic depending on the quantity of concentrate feed distributed daily



large number of parasites killed by the wormer being released into the intestines which can cause, for example, intestinal obstructions. **Following a regular worming programme established by a vet in order to limit colics of parasitic origin is therefore important.**

HOW TO FEED A HORSE FOLLOWING COLIC ?

RE-FEEDING THE HORSE AFTER COLIC NOT REQUIRING SURGERY

It is advised to withdraw water and food during colic, that is until the episode has finished and clinical parameters have returned to normal. For the following few days, feeding concentrate feeds is not advised in order to limit production of gases in the large intestine, especially if the colic was caused by the ingestion of too much fermentable sugars.

With the aim of rebalancing the intestinal microbiota, which may have been disturbed by the colic episode¹⁶, giving a pre-pro-postbiotic supplement after the colic is advocated.

RE-FEEDING THE HORSE AFTER DIGESTIVE SURGERY

Following digestive surgery, re-feeding must be carefully followed. Indeed, the choice of method of re-feeding can have an influence over recovery and the chances of the horse's post-operative survival. Rapidly after surgery (6-12 hours), it is common to give the horse only water and/or IV fluids and electrolytes. However, if the delay

between the surgery and re-feeding the animal is too long it can lead to increased post-operative complications, such as post-operative paralytic ileus (an arrest or slowing of the intestinal transit during an abnormal lapse of time). There is in fact a positive correlation between the parameters of serum biochemical indicators of negative energy balance and post-operative complications in the horse, in the same manner as seen in man. Thus, rapid re-feeding after surgery, in order to limit the massive use of tissue energy reserves by the animal leads to a reduction in the risks of post-operative complications.

How to feed the horse after surgery in this case?

Rapidly after surgery, feeding the horse with a ration providing slightly less energy than his requirements for maintenance is recommended (about 75% of maintenance requirements)³². This corresponds to about 2.9 UFC (Horse forage units) per 100kg of live-weight to the power of 0.75. Protein requirements are approximately 0.92g of crude protein/kg/live-weight during this period³³. Restricting energy just after surgery allows the risks associated with over-nutrition such as hyperglycaemia and septic shock to be limited. If the horse shows an absence of gastric reflux, good intestinal motility and an appetite, voluntary parenteral (oral) re-feeding is advised. **The horse must receive small amounts (between 0.1 and 0.2% of live-weight) of good quality forage 4 to 6 times a day, which will gradually increase day after day³².**

Thus in practice we recommend feeding 1.2% of the horse's live-weight (body weight) in good quality hay, over 4 to 6 meals a day.

At the end of 2 to 4 days depending on the horse's state of health, the energy value of the diet will be progressively increased to reach the horse's true maintenance requirements, approximately 3.8 UFC (Horse Forage Units) per 100kg live-weight to the power of 0.75. Protein requirements are around 1.25g of crude protein/kg/live-weight³³. **Once the state of health is stabilised, a specific concentrate feed, suited to post-operative re-feeding, low in fermentable sugar (in particular starch), containing good quality protein and rich in omega-3 fatty acids can be given in addition to forage. In practice, we recommend distributing 1.2% of the horse's live-weight in good quality hay, and 0.4L (350g) for each 100kg of live-weight of the concentrate feed Reverdy POSTOP, these quantities should be divided between 4 to 6 feeds daily, without ever exceeding 0.2L of concentrate feed for every 100kg of live-weight per meal.**

Administering probiotic supplements (*Lactobacillus plantarum*, *L. casei*, *L. acidophilus*, *Streptococcus faecium* ou *L. acidophilus*, *S. faecium*, *Bifidobacterium thermophilum* et *B. longum*) during the 7 days following digestive surgery has not been shown to have any effect on the prevalence of diarrhoea, the quantity of salmonella in the droppings, the duration of antibiotic treatment and hospitalisation³⁴. However no research has been undertaken on the use of pre or postbiotics, and data concerning the evolution of the intestinal microbiota after surgery following the quality of post-operative recovery is lacking.



CONCLUSION,

What should be done to reduce the risk of colic ?

1. Know your horse: Is your horse at risk or not from colic, certain types of colic, or will not easily support surgery (is he a big horse, cribs or wind-sucks, an aged horse, a new-born foal, a brood mare, is often colicky...) ? Knowing him means being able to take precautions in his lifestyle that will reduce the risks but equally allow quick action if the first symptoms arise.
2. In every case, give the horse the possibility of being able to drink enough clean, temperate water at every moment of the day, feed good quality clean hay, divide the concentrate ration into a number of small meals, also give him the opportunity of being turned out in order to reduce boredom and permit slow and regular ingestion of fibre (roughage). In addition, aim to avoid the ingestion of too many, or too much, little or non-digestible foods such as straw, shavings or sand.
3. Worm your horse in accordance with your vet's recommendations and organise regular dental care (of even greater importance if your your horse is aged).



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