



IDENTIFICATION OF BIOCHEMICAL CHANGES OCCURRING IN THE BLOOD DURING COLIC IN HORSES

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ABSTRACT

Currently, equestrian sport is developing at a rapid pace in our country and attention to this field is increasing. This, in turn, demands high-quality veterinary services for valuable horses with superior genetic traits. There are many problems significantly impeding the development of horse breeding in our country, the foremost of which are infectious and non-infectious diseases occurring in horses. This article discusses colic, which is one of the most frequently encountered conditions in horses and can lead to the animal's death if timely treatment measures are not taken. It is no secret that colic is very common among horses and causes serious harm to horse-breeding farms. Therefore, in the present study we have attempted to elucidate the diagnosis of colic and the measures for its treatment and prevention in accordance with practical needs.

Introduction

Colic is a general term denoting a syndrome of abdominal pain in horses, predominantly arising from various pathological conditions of the gastrointestinal tract. Colic is not a single disease, but rather a collection of clinical signs resulting from dozens of different causes such as intestinal gas accumulation, blockage (obstruction), or intestinal strangulation. The unique anatomy of the equine gastrointestinal system (a long duodenum, large-capacity segments of the colon, and a freely movable "floating" colon) predisposes horses to the development of colic. Colic can present in acute form (sudden onset, rapid course) or chronic form (recurrent over a period of time).

Colic is one of the most common disorders in horses, representing an emergency condition with a high incidence and a significant risk of mortality. According to a large epidemiological study in the United States, colic episodes occur in 4–5 out of every 100 horses annually, and mortality associated with colic is about 10–11%. In some populations, colic has been reported as the leading cause of death in horses (for example, a NAHMS 1998 report indicated that 26% of horse deaths were attributed to colic). The economic impact of colic is also very high: in the U.S., the annual cost of treating colic and the value of horses lost to colic is estimated in the hundreds of millions of dollars.

In the conditions of Uzbekistan, although equine colic has been less studied compared to other branches of animal husbandry, in practice it is encountered quite frequently. In particular, factors such as improper feeding in farms and equestrian clubs, lack of effective antiparasitic measures, and abrupt changes in feed composition can all lead to colic. During a colic episode, the most important task for horse owners and veterinarians is to promptly diagnose and effectively treat the condition in order to relieve the animal's pain and save its life. To achieve this, it is necessary to have a good understanding of the causes of colic, the factors in its development, and the physiological changes occurring in the body.

Analyzing the biochemical changes that occur in a horse's body during colic can provide important diagnostic information. The levels of certain substances in the blood indicate the type of colic and its severity. For example, an increase in hematocrit and total protein levels indicates dehydration and hemoconcentration in the horse, which is observed in severe colic. An elevated blood glucose level during colic occurs under the influence of stress and pain, and in serious cases it indicates a poor prognosis. Similarly, a rise in blood lactate level signifies inadequate tissue perfusion – studies have shown that high lactate concentrations correlate with severe colic and an increased likelihood of death. Therefore, measuring blood biochemical parameters during colic helps determine the severity of the condition and aids in choosing the correct treatment strategy.

Influence of Breed, Age, and Sex on Colic Occurrence

Colic can occur in horses of any breed; however, as noted above, Arabian and English Thoroughbred horses have been found to experience colic somewhat more often. The horse's age is also an important factor. Foals under 2 years old and older horses over 10 years have a relatively lower likelihood of experiencing simple (mild) colic; that is, colic is observed more frequently in middle-aged horses (3–10 years old). However, when colic does occur in older horses, a higher need for surgical intervention has been observed. Certain specific types of colic are seen in particular age groups – for example, suckling foals and yearlings more commonly experience intestinal invagination (intussusception, i.e. one section of intestine telescoping into another), whereas in older horses above 12 years, there is a higher probability of strangulation colic due to mesenteric lipomas (fatty tumors that entrap the intestine). The sex of the horse is also significant. Stallions appear somewhat more prone to small intestinal incarceration in the epiploic foramen (epiploic foramen hernia). In pregnant or newly foaled mares, colic types such as large colon displacement or torsion are encountered quite often around the time of parturition. In particular, during late pregnancy and the first weeks after foaling, the risk of large colon displacement or volvulus in mares increases markedly. Thus, breed, age, and sex are factors that influence the likelihood of colic and should be taken into account in preventive strategies.

Feeding and Management Regimen

The type of feed and the feeding management play a very important role in the development of colic. The quality and form of feed are critical: low-quality, coarse-fiber hay or straw is poorly broken down in the horse's digestive system and often leads to large-colon impaction (blockage of intestinal contents). For example, studies have shown that feeding poor-quality rough hay can precipitate large colon impaction. Abruptly switching feed types can also disrupt the intestinal microflora: if a large quantity of easily fermentable, starchy feed is given suddenly, the balance of normal gut bacteria is upset, producing an excess of lactic

acid. As a result, the pH in the stomach and intestines drops and peristalsis is disturbed. An excessive amount of grain-based feed (such as rice, oats, barley) increases the risk of colic – for instance, providing more than 5 kg of concentrated feed per day to a horse has been associated with a significantly higher incidence of colic. By contrast, green forage (pasture grass and good-quality hay) improves intestinal motility and water retention capacity, helping to prevent colic. However, an overly lush pasture can sometimes cause tympanic (gas) colic in horses. Bermuda grass hay, due to its fine fibers and high lignin content, has been reported in the literature to increase the risk of impaction of the ileum (small intestine).

Diagnosis of Colic

Clinical Signs and History (Anamnesis)

Horse owners usually recognize colic from their horse's behavior. The classic signs of colic include: restlessness, constant pawing at the ground or kicking, looking back at the abdomen or attempting to bite at it, repeatedly lying down and rolling (thrashing), passing small, hard fecal balls (indicative of constipation), loss of appetite, sweating, etc.. Each horse is individual—some are very sensitive to pain and show pronounced reactions, while others are more stoic. Thus, a mild colic can produce dramatic symptoms in some horses, whereas other horses may “hide” significant pain. Knowing a horse's normal behavior and vital signs is helpful for early detection of colic.

If colic is suspected, the veterinarian first gathers a thorough history from the owner or caretaker. Important anamnesis information includes the animal's age, sex, and breed; whether the horse has had colic before; the type and amount of feed consumed in the last 24–48 hours; water intake; defecation and urination frequency (and, if possible, the appearance of the manure — for example, whether it has been dry or absent); the date of the last deworming; any recent long-distance transport or intense exercise; and when the colic signs began and how they have changed over time. Often, the history provides an initial clue to the likely cause of colic (for instance, a sudden switch to a new batch of grain feed suggests a gas/spasmodic colic, whereas a long lapse in deworming suggests a parasitic colic).

Physical Examination

On clinical examination, the veterinarian evaluates the horse's key vital signs during the colic episode: body temperature, heart rate (pulse), respiratory rate, and also the condition of the mucous membranes (color and moisture of the gums and conjunctiva) and capillary refill time (CRT). In most colic cases, body temperature is normal or slightly below normal (fever is only typically seen if colic is due to enteritis or colitis). Heart rate (normal resting HR is ~28–40 beats per minute) often increases to 60–80 beats/min under the stress of colic pain, and in severe cases can exceed 100 beats/min – which is considered a sign of a poor prognosis. The respiratory rate likewise rises in response to pain.

The mucous membranes provide an important indication of colic severity: in mild cases they remain pale pink and moist, whereas in severe strangulating colic they become injected (bright red) and later take on a purplish-blue, cyanotic color – reflecting progressive circulatory compromise. Capillary refill time, measured by pressing a finger on the gum and noting how quickly the color returns, is normally about 1–2 seconds. In hypovolemia or shock, CRT is prolonged to 3–4 seconds or more, which is another sign of severe colic.

During the exam, to assess intestinal motility (gut sounds), the abdominal sides are auscultated with a stethoscope. Intestinal sounds vary depending on the type of colic: in

spasmodic colic, hyperactive gut sounds may be heard, whereas in impaction or strangulating colic, peristaltic sounds are diminished or absent. Sometimes, in extreme gas distension, one can hear the rumbling of gas in the gut even by pressing an ear against the abdominal wall.

Rectal examination is a critically important diagnostic tool in colic. With proper lubrication and a sleeve, the veterinarian carefully inserts an arm into the rectum to palpate the accessible internal abdominal organs. An experienced clinician can often detect issues such as a colon impaction, displacement of the large colon (for example, a left dorsal displacement of the colon), or gas distension of the cecum via rectal palpation. During rectal exam, the tone of the intestinal walls and any signs of inflammation (e.g. blood or mucus on the rectal sleeve) are also noted. It must be kept in mind that rectal examination carries significant risk (primarily the danger of causing a rectal tear); therefore it is performed with great caution and only by a qualified individual.

Nasogastric Intubation

Nasogastric intubation – the passage of a stomach tube through the nose into the stomach – is employed in colic both for diagnostic and therapeutic purposes. The presence of reflux fluid coming out of the stomach via the tube is a critical diagnostic sign. If a large volume of fluid or gas gushes out through the tube, this indicates either a small-intestinal obstruction or a proximal enteritis, since under normal conditions fluid should not accumulate in the stomach. When an obstruction exists in the upper small intestine or if the small intestine is acutely inflamed, fluid backs up into the stomach and fills it. In such cases, placing a nasogastric tube is life-saving – it relieves the stomach pressure and prevents gastric rupture. Draining the stomach in this way also typically provides the horse temporary relief.

If an abundant amount of reflux is obtained (for example, 5–10 liters of fluid), a small-intestinal obstruction is very likely and surgical intervention should be considered in that scenario. (Note that proximal enteritis can also produce significant gastric reflux; however, in that disease medical management – decompression and intensive fluid therapy – can often suffice to save the horse.) In summary, nasogastric intubation provides diagnostic information during colic while at the same time decompressing the stomach; it is one of the first and most essential steps in the acute management of colic.

Abdominal Fluid Analysis (Abdominocentesis)

If the colic is severe and the above diagnostic steps have not yielded a definitive answer, analysis of peritoneal (abdominal) fluid via abdominocentesis can be very informative. In this procedure, a specialized long thin needle or trocar is inserted through the abdominal wall to collect a sample of the peritoneal fluid. The color, transparency, and laboratory parameters (protein level, cell count, etc.) of this fluid are then analyzed.

Normal equine peritoneal fluid is clear, light yellow (straw-colored) in appearance, with a total protein ≤ 25 g/L and a nucleated cell count $\leq 5 \times 10^9$ /L. In simple obstructive colic (e.g. a non-strangulating impaction or distension), peritoneal fluid often shows an elevated protein level, while the cell count remains within normal limits – a profile indicative of a simple obstruction. By contrast, in a strangulating colic (such as an intestinal torsion or entrapment), the peritoneal fluid typically becomes turbid and blood-tinged to dark in color (often described as serosanguineous, i.e. reddish-brown), the protein level rises sharply (above ~ 30 – 40 g/L), and there is a marked leukocytosis with neutrophils predominating. For example, finding that more than 70% of the cells in the peritoneal fluid are neutrophils is a

strong indication that ischemia and necrosis are occurring in the intestinal wall. A high red blood cell presence in the peritoneal fluid is also a grave sign – it suggests that blood is leaking into the abdomen due to strangulation of intestinal veins (venous congestion) or the onset of hemorrhagic necrosis of the intestine.

Abdominal fluid can also be analyzed for metabolic indicators: measuring the lactate level in peritoneal fluid over time is very useful. If the peritoneal fluid lactate concentration is rising and especially if it exceeds the blood lactate level, it is a clear indicator of intestinal strangulation damage that likely necessitates surgery. Research shows that when peritoneal lactate is higher than blood lactate, there is almost always intestinal compromise requiring surgical intervention. Additionally, the appearance of free bacteria (or neutrophils containing bacteria) in the peritoneal fluid indicates a loss of intestinal wall integrity with bacteria translocating into the abdomen – a finding that signals developing peritonitis and carries a very poor prognosis. In sum, abdominocentesis is a valuable procedure for identifying the most severe forms of colic (strangulating lesions). The results of peritoneal fluid analysis guide the decision on whether surgical intervention is needed.

Additional Diagnostic Techniques

In addition to the core diagnostic methods above, modern veterinary practice can employ imaging techniques such as ultrasonography and radiography to help determine the cause of colic. **Ultrasound examination** of the abdomen is useful for detecting intestinal distention and displacement. For example, in a nephrosplenic entrapment (when the large colon becomes entrapped over the renosplenic ligament), ultrasound may reveal the left kidney obscured by the displaced spleen. In general, ultrasonography can provide information on intestinal wall thickness and the presence of excessive fluid or gas in intestinal loops. Distended loops of small intestine (as seen in strangulating obstructions) are often readily visible on ultrasound, while an inflammatory condition like enteritis might be evidenced by diffusely thickened intestinal walls.

Abdominal radiography (X-ray) is of limited use in adult horses due to their size, but it can be applied to certain regions (typically the lower abdomen) to detect specific issues. Radiographs are especially helpful in cases of sand colic (to confirm sand accumulation in the intestines) and to identify enteroliths (intestinal stones), particularly in smaller breeds or ponies. X-rays can also help visualize some types of foreign bodies if present. Because of the horse's large size, radiographic imaging usually focuses on smaller areas such as the cecum and colon in the lower abdomen.

Endoscopy, specifically gastroscopy, can be used to examine the interior of the stomach and the proximal small intestine, allowing diagnosis of gastric ulcers and other lesions. However, ultrasonography, radiography, and endoscopy are generally considered auxiliary diagnostic methods in colic. In practice, the clinical examination findings combined with laboratory results (e.g. bloodwork and peritoneal fluid analysis) and the veterinarian's overall experience are the most important factors in diagnosing colic and formulating a treatment plan.

Differential Diagnosis of Colic

Colic is a symptom complex, and it is important to differentiate true gastrointestinal colic from other conditions that can mimic abdominal pain. The veterinarian must consider and rule out other causes of colic-like signs in horses. Examples of such conditions include

uterine torsion in a pregnant mare, organ torsions or ruptures (such as a uterine, stomach, or bladder rupture), kidney pain (e.g. due to kidney stones), or orthopedic injuries to the hindlimbs or back – all of which can cause the horse to exhibit restlessness and signs that may resemble colic pain. A thorough clinical exam, appropriate lab tests, and diagnostic imaging as needed will help confirm the diagnosis of true gastrointestinal colic. Once colic is diagnosed, the veterinarian proceeds to the next phase, which is devising a treatment plan.

Treatment Methods for Colic

Treatment of colic should begin as quickly as possible. The primary goals of therapy are to resolve the pathological process in the intestines (e.g. remove the obstruction, relieve gas buildup, correct any displacement of intestines) while alleviating the horse's pain and preventing serious complications such as toxemia and shock. In general, colic treatment modalities can be divided into **conservative (medical) management** and **surgical intervention**. Conservative therapy is successful in the majority of colic cases, whereas surgery is reserved for cases that do not respond to medical treatment or that have clear indications for surgical correction. Conservative treatment typically involves implementing a series of therapeutic measures in sequence, as outlined below.

Conservative (Non-Surgical) Treatment

1. **Pain Relief (Analgesic therapy):** The first priority in managing colic is to reduce the horse's pain and discomfort. This is initially achieved with medication, often using non-steroidal anti-inflammatory drugs (NSAIDs) and/or sedative-analgesics. The most commonly used analgesic in equine colic is **flunixin meglumine** (tradename Finadyne/"Banamine"), which is highly effective for visceral pain relief. Flunixin not only provides potent pain relief but also helps mitigate the effects of endotoxemia (toxins entering the bloodstream due to intestinal wall compromise) and can modestly improve cardiovascular parameters. It is typically administered intravenously at 1.1 mg/kg (approximately 10 mL of a 50 mg/mL solution for a 500 kg horse), and can be given up to twice a day if needed. Another NSAID frequently used is **phenylbutazone** (4–6 mg/kg IV or orally), although its visceral analgesic effect is somewhat less than that of flunixin. Phenylbutazone does have the beneficial property of reducing prostaglandin E₂ production in the gut wall, which can decrease the likelihood of intestinal paralysis (atony) during endotoxemia. In some cases, veterinarians may alternate flunixin and phenylbutazone every 6 hours (flunixin for one dose, phenylbutazone the next) to achieve better pain control. This practice must be done cautiously and only short-term, as combining high doses of NSAIDs can lead to kidney damage or gastric ulcers. Other NSAIDs such as **ketoprofen** and **metamizole (dipyrone/Analgin)** are sometimes used as well, though their effect is considered weaker. (Selective COX-2 inhibitor NSAIDs like meloxicam are still under trial in horses and are not yet widely used.)

In addition to NSAIDs, **α₂-adrenergic agonist sedatives** are widely employed, especially in cases of severe colic pain. Drugs such as **xylazine**, **detomidine**, and **romifidine** have sedative, muscle-relaxant, and strong analgesic effects, which help calm the horse and relieve pain. Xylazine has a rapid onset (within a few minutes) but a relatively short duration of action (the effect wanes after ~20–30 minutes). Detomidine is more potent and lasts longer (providing about 45–60 minutes of relief). These sedatives also have side effects: they cause a slowed heart rate, increased blood pressure, and temporarily reduce intestinal motility.

Therefore, they are used judiciously and for short periods in colic cases. Typical dosing is 0.5–1.1 mg/kg IV for xylazine and 0.01–0.02 mg/kg IV for detomidine. Sedatives often provide very effective pain relief; however, in some severe strangulating colics, even xylazine's effect may be brief, with pain quickly returning as the drug wears off. In such situations, combining a sedative with an opioid can greatly enhance analgesia. A common combination is **xylazine plus butorphanol**: butorphanol is an opioid analgesic, and when given together with xylazine, it both increases the degree of pain relief and prolongs the duration. For example, administering xylazine (~1 mg/kg IV) along with butorphanol (~0.02 mg/kg IV) will keep a horse calm and relatively pain-free for about 30–40 minutes, facilitating other therapeutic and diagnostic procedures during that time. In general, a practical protocol is to give flunixin meglumine (1.1 mg/kg IV) as an initial treatment; if significant pain persists after 15–20 minutes or if the pain is extremely severe from the outset, xylazine (0.5 mg/kg IV) combined with butorphanol (0.02 mg/kg IV) is administered. If even this does not control the pain, it is an indication that a very serious problem is present and a prompt decision for surgical intervention is warranted.

2. **Gastric and Intestinal Decompression:** As described earlier, the passage of a nasogastric tube to empty the stomach is a critical step in colic treatment whenever reflux is present. Removing accumulated fluid and gas from the stomach (and proximal small intestine) via the tube relieves pressure and pain, and helps prevent gastric rupture. In practice, a nasogastric tube is passed in **every** case of colic upon initial examination. If significant gastric reflux is obtained, the stomach is fully drained. The tube is then left in place or reinserted at intervals (usually every 2 hours) to monitor ongoing reflux production and to continually relieve the stomach as needed. In addition to gastric decompression, other targeted decompression techniques can be used for specific situations. For example, in severe cecal gas distension (cecal tympany), a trochar or large-bore needle can be carefully inserted through the right flank into the cecum to release the gas. (This percutaneous cecal decompression must be done with strict aseptic precautions to prevent introducing infection into the abdomen.) Effective decompression often leads to noticeable improvement in the horse's condition – arterial blood pressure rises, heart rate decreases, and the overall status stabilizes after the excess gas/fluid pressure is relieved.

3. **Laxatives and Restoration of Bowel Motility:** If the colic has been diagnosed as an impaction (blockage of the intestines by feed material or a sand obstruction), a key therapeutic goal is to rehydrate and soften the impaction and stimulate the intestines to resume motility, thereby clearing the blockage. To achieve this, **laxatives and cathartic agents** are administered. The most commonly used laxatives in equine colic include: **mineral oil** (liquid paraffin), **dioctyl sodium sulfosuccinate (DSS)**, and **magnesium sulfate** (Epsom salt). Mineral oil is typically given in a volume of 2–4 liters via the nasogastric tube directly into the stomach. It then passes through the intestines, coating and lubricating the fecal mass and softening it, which helps it break up and pass. An additional benefit of mineral oil is that it serves as a marker of intestinal transit: one can monitor the horse's manure for the appearance of the oil to verify whether the impaction has started to clear. Magnesium sulfate acts as an osmotic laxative – it draws water into the intestines, softening the stool and increasing the volume of fluid in the gut, which stimulates peristalsis. DSS is a powerful surfactant that helps to emulsify and soften the impacted feed material, making it more

slippery and easier to move; however, DSS must be used in strict accordance with recommended doses, as an overdose can damage the intestinal mucosa. Laxatives are usually given once and then repeated 12 hours later if needed (no more than twice a day). It is **crucial** to note that if an obstruction of the upper small intestine is suspected or if the horse has ongoing gastric reflux, **laxatives should not** be administered. In those scenarios, the blockage prevents the laxative from reaching the site and the fluid will instead remain in the stomach, worsening distension and increasing the risk of gastric rupture.

4. **Fluid Therapy (Infusion therapy):** Because horses with colic often become dehydrated, rehydrating the animal is an important component of treatment. Dehydration in colic results from multiple factors: pain and stress cause sweating, fluid sequesters into the obstructed intestines, and reflux or reduced intake leads to fluid loss. The degree of dehydration is assessed clinically (e.g. by mucous membrane dryness, skin turgor, PCV, etc.), and then appropriate fluids are administered, primarily by intravenous infusion. If the horse is not drinking or if there is an intestinal obstruction impeding fluid absorption, **IV crystalloids** such as normal (isotonic) saline or lactated Ringer's solution are given via a jugular catheter. In mild cases, a volume of about 10–20 liters can be delivered over 2–3 hours. In more severe cases where the horse's blood is markedly concentrated (high PCV) and there are signs of low blood pressure (hypotension), **colloid solutions** (e.g. gelatin-based plasma volume expanders or hetastarch) may be indicated to more rapidly restore vascular volume. If the horse is capable of drinking and no gastric reflux is present, fluids can also be provided enterally via nasogastric tube: for instance, after giving laxatives, one can administer 4–5 liters of warm water through the tube every 1–2 hours to help push the laxative into the intestines and hydrate the impaction. The overarching goals of fluid therapy are to restore circulating volume (preventing shock) and to rehydrate the intestinal contents, thereby making it easier to resolve an impaction.

5. **Motility Stimulants (Prokinetic drugs):** In certain cases, especially in the later stages of colic management, it may be necessary to pharmacologically stimulate intestinal peristalsis. This is particularly true if an impaction has been cleared but the gut has not yet regained normal motility, or in some ileus (lack of motility) situations. One commonly used prokinetic in horses is **neostigmine methylsulfate**, at 0.01–0.02 mg/kg given subcutaneously. Neostigmine is a parasympathomimetic that stimulates the parasympathetic nervous system, thereby encouraging motility in the cecum and large colon; it is often used, for example, in cases of cecal or large-colon atony after an impaction is relieved. Another prokinetic approach is **IV lidocaine infusion**. Administered at low dose (approximately 0.05 mg/kg/min intravenously), lidocaine has been shown to enhance small intestinal motility and may also help suppress inflammatory mediators in the gut. Continuous lidocaine infusion is widely used to treat postoperative ileus in horses, and it can also be beneficial in some nonsurgical colics that have motility problems. Other prokinetic agents recommended in the literature include **metoclopramide** and **domperidone** (which act via dopamine antagonism), as well as low-dose **erythromycin** (an antibiotic that, at low doses, agonizes motilin receptors to stimulate small-intestinal motility). Prokinetic drugs must be used with great caution – if a mechanical obstruction is still present in the bowel, forcing intestinal contractions can increase the risk of rupture or injury. Therefore, prokinetics are only employed when the veterinarian has a high degree of confidence that there is no physical blockage remaining (for

instance, after an impaction has been resolved, or if the lack of motility is due to a spasmodic/functional ileus).

If the above conservative measures do not lead to improvement in the horse's condition, or if at any point the clinical signs worsen, then **surgical intervention** must be considered as the next step. Certain situations clearly mandate surgery without delay – for example, if the pain is uncontrollable (persistently severe even after analgesics), the heart rate remains very high (80–100+ bpm), the mucous membranes become dark/cyanotic, the peritoneal fluid analysis shows severe abnormalities, and/or reflux from the stomach continues unabated, these are all strong indicators for surgical exploration.

Surgical Treatment

When indicated, colic surgery is performed under general anesthesia and requires appropriate facilities and expertise. Because horses are large animals, specialized equipment (such as a large-animal surgery table or a heavily padded area for induction and recovery) and a skilled equine surgeon are needed. Surgical correction of colic is done via **ventral midline celiotomy** (a laparotomy through the linea alba). During the operation, the surgeon systematically examines the abdominal cavity and all segments of the intestines to locate the problem and correct it. This may involve decompression of gas-distended bowels, repositioning displaced intestines to their normal location, releasing trapped intestine (for example, freeing a strangulation by cutting a strangulating lipoma stalk or breaking down adhesions), and relieving obstructions. An obstructive impaction might be gently massaged out of the colon or enterotomy (surgical opening of the intestine) may be performed to remove it, if necessary. If any portion of intestine is found to be nonviable (necrotic), that segment is resected (surgically removed) and the healthy ends are sutured back together (anastomosis). After addressing the cause of the colic, the surgeon returns the intestines to their normal alignment, lavages (flushes) the abdominal cavity with sterile fluids, and then closes the incision.

Postoperative care for a colic surgery patient is intensive and critical. The horse requires several days of hospitalization (often 7–10 days) and a regimen of therapies including continued IV fluids, antibiotics to prevent infection, analgesics and anti-inflammatory drugs for pain and swelling, very gradual refeeding, and careful monitoring and nursing care. Surgery can be life-saving in severe colic cases; however, it also carries risks and potential complications. Post-surgical complications such as peritonitis (abdominal infection), postoperative ileus (prolonged gut paralysis), or adhesions (scar tissue forming and potentially causing future obstructions) can occur and may result in the horse's condition deteriorating even after surgery. On average, the survival rate for horses that undergo colic surgery is around 80–90%, meaning post-operative mortality is roughly 10–20%. The outcome depends largely on how severe the colic was and how quickly surgical intervention was performed; early intervention before significant intestinal damage occurs greatly improves the prognosis.

Euthanasia

Unfortunately, there are cases in which a horse with colic cannot be saved. If veterinary help is significantly delayed or if the pathological changes are too severe (for example, extensive intestinal necrosis or a ruptured stomach), the chances of recovery become negligible. Additionally, some owners may elect not to pursue surgery due to financial or

other considerations. In situations where a horse is suffering unrelieving pain and recovery is unlikely, **euthanasia** is a humane option to prevent further suffering. Euthanasia in horses is performed by administering a lethal overdose of a fast-acting barbiturate or anesthetic drug intravenously, resulting in a quick and painless death. The decision to euthanize is never taken lightly and is typically made with the agreement of the owner after thorough discussion, and on the recommendation of the attending veterinarian when all other options are exhausted.

Prevention of Colic (Prophylaxis)

Reviews of colic cases and literature indicate that many colic episodes are associated with management and feeding errors. Therefore, the basis of colic prevention is **proper husbandry and feeding management**. Key preventive practices include making any changes to the horse's diet gradually (to allow the gut flora to adapt), avoiding excessive feeding of concentrates (grain) and never suddenly overloading the horse with grain, always providing ample high-quality roughage (good hay) and fresh clean water, ensuring the horse gets regular exercise or turnout (daily movement helps gut motility), implementing a consistent deworming (antiparasitic) program, and monitoring the horse's dental health to ensure it can chew feed effectively. Experience shows that farms which do not perform routine deworming have a higher incidence of colic, and that the risk of colic spikes when a horse's feed is changed abruptly or feeding schedules are irregular. An important component of prevention is education: horse owners and caretakers should be taught to recognize the early signs of colic and to seek veterinary assistance without delay. Early intervention at the first sign of colic greatly improves the chance of a positive outcome.

Conclusion

The scientific information presented above highlights various broad aspects of the colic syndrome in horses. In the present article, we have also investigated through practical examples how the blood parameters change during colic in horses in the Tashkent region, particularly the degree of changes in key biochemical indicators such as proteins, lactate, glucose, etc. The following sections (below) will detail the materials and methods of our research and present the results obtained.

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