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# How a nursing care plan can facilitate successful nursing of a pony with hyperlipaemia

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**ABSTRACT:** First reported in 1969, hyperlipaemia is now a well-known condition seen in pony breeds, donkeys and miniatures. Reported mortality rates are high, but with quick identification and appropriate nursing support the condition is potentially reversible. This case report details the pathophysiology of the condition in relation to clinical signs and describes how a nursing care plan was implemented to provide holistic patient care for successful treatment of a pony with hyperlipaemia.

**Keywords:** hyperlipaemia; pony; nursing care plan

### Patient details

The patient, an 8-year-old 14 hands Welsh Cob mare, in her third trimester of pregnancy, weighed 450 kg. The owner observed depressive, anorexic and mild colic behaviours, while the veterinary surgeon's examination revealed tachycardia, dehydration and lipaemic plasma. The patient was admitted for treatment of hyperlipaemia. During admission to the hospital it was discovered that the mare's management routine had recently changed from full pasture turnout to being fully stabled and fed hay, due to concerns over her increasing obesity potentially triggering laminitis. She was also found to have multiple sites of gingivitis caused by severe valve diastemas.

### Pathophysiology of hyperlipaemia

Durham and Thiemann (2015) stated that hyperlipaemia occurs when the rate of lipolysis from adipose tissue exceeds the removal rate of triglycerides from plasma. The body naturally utilises the triglyceride metabolism cycle (TMC) (Figure 1) to homeostatically control energy requirements, but several factors, such as breed, obesity, stress and pregnancy, disturb the body's control mechanisms (Hughes, Hodgson, & Dart, 2004). These factors predisposed the patient to insulin resistance (IR), which leads to the inability to control the TMC. McKenzie

(2011) found that fasting ponies actually induces IR, especially when obese. This pony was at great risk of IR, especially when management changes and oral pain lead to anorexia.

Liver glycogen stores quickly deplete within 24–48 h after onset of fasting (Geor, 2001) and the increased energy demands of pregnancy creates a negative energy balance that triggers hormone-sensitive lipase (HSL) to be released in response to low circulating levels of insulin (Hughes et al., 2004). HSL triggers the lipolysis of triglycerides into glycerol and non-essential free fatty acids (NEFAs), which are then converted into energy by the liver. Normally blood glucose levels rise and insulin levels increase reducing the release of HSL but, as this patient was predisposed to IR, the cycle was uncontrolled. This results in an abundant breakdown of adipose tissue leading to excessive production of NEFAs that exceeds the capacity of the liver's oxidative, glycolytic and ketogenic pathways, resulting in excessive production of triglycerides and very-low-density lipoproteins (VLDL) (Watson, 1994). Lipaemic blood serum indicates a high concentration of VLDL and triglycerides in the blood.

The clearance of VLDLs and triglycerides from the serum into adipose tissue is reduced in ponies with IR (Kersten, 2014), as lipoprotein lipase is required to complete the process, which is stimulated

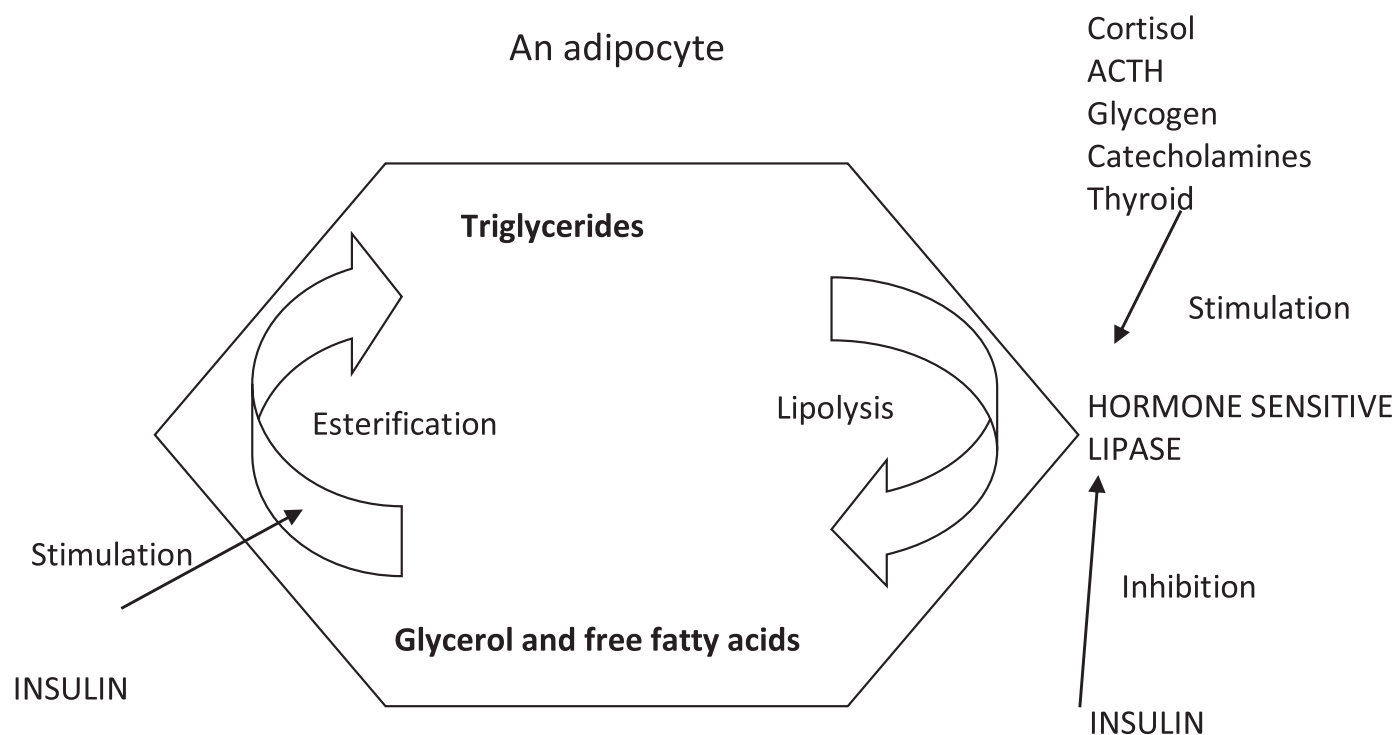


Figure 1. Normal triglyceride metabolism in equine adipocytes (adapted from Hughes et al., 2004).

by insulin. Hughes et al. (2004) reported that a prolonged build-up of triglycerides in serum could lead to impaired function of the liver, kidney, skeletal muscle, adrenal cortex and myocardium due to lipid accumulation within these tissues.

## Clinical signs

Mild abdominal pain is a common clinical sign that Hughes et al. (2004) attribute to stretching of the liver capsule. This occurs due to hepatic triglyceride synthesis exceeding the capacity for VLDL export into the serum resulting in hepatic lipodosis. Barton (2009) explained that if hyperlipaemia is not reversed, hepatic lipodosis causes disruption of hepatic functions, hepatic failure and eventually rupture. This is best supported by Watson (1994), who reported post mortem findings of swollen, fissured and ruptured livers in ponies suffering with hyperlipaemia.

Ponies with hyperlipaemia often have icteric mucous membranes due to an inability to excrete bilirubin from the body via the bile ducts (Lofstedt, 2011). Chronic build up of bilirubin in the bloodstream can lead to kernicterus if left untreated.

Watson's (1994) in-depth study described mucous-coated hard faecal balls as a clinical sign of ponies with hyperlipaemia, which was also seen in this case. Enterocyte cells found in the intestinal mucosa have an extremely high metabolic rate and are greatly affected by anorexia leading to mucosal atrophy, impaired digestion and potential for bacteria to pass into the circulation, causing septicemia

(Geor, 2001). Pyrexia may indicate a septic process or may be due to systemic inflammation due to organ lipodosis.

McKenzie (2011) described how lipid accumulation in skeletal muscle tissue interferes with pathways responsible for insulin-induced glucose uptake leading to a reduced muscle energy store, while Hughes et al. (2004) stated that lipid accumulation in the liver impairs gluconeogenesis. Anorexia reduces glucose and glycogen stores and, in response to starvation, the thyroid decreases its synthesis of triiodothyronine, which results in a lowered metabolic rate in order to reduce daily energy requirements (Miller, 2014). This would account for the dull demeanour of the patient.

Severely affected horses may show hepatic encephalopathy due to severe liver damage preventing the conversion of ammonia in the bloodstream into urea ready for excretion (Hammond, 2004). Acute renal failure due to lipodosis of kidney cells has also been reported in severe cases (Dunkel & McKenzie, 2003). If this condition is left untreated, multiple organ failure leads to recumbency, seizures and death (Hughes et al., 2004).

## The use of a nursing care plan

On arrival to the hospital a nursing care plan (NCP) (Table 1) adapted from the Ability Model (Orpet & Jeffery, 2007) was created to establish the patient's actual problems and potential problems, with nursing plans and evaluations documented during the

day to provide a means of ensuring all staff members were aware of the care the patient required. Adaptations to the NCP were made in order to make it more user-friendly, less time-consuming and simpler to interpret than current models.

The NCP enabled all staff members to quickly identify any changes in the patient's condition and the nursing interventions were clearly shown on the hospital sheets where they could be ticked off when achieved. Using the hospital sheet provided a quick overview of medical and nursing procedures that had been carried out and what other treatments and interventions were required that day, while the planning and evaluation sheet was a more in-depth written display of the patient's requirements and progress.

## Patient management – nutrition

The patient's actual problem was hypophagia, so cafeteria feeding using fresh chopped grass, chops, mixes, carrots and bread were offered every 30–60 min, making sure the patient was never overfaced. Geor (2001) considered nutritional support to be the most important factor in the treatment of hyperlipaemia in order to provide cells with sufficient energy requirements to promote the release of insulin and inhibit adipose tissue lipolysis.

On evaluation it was deemed that anorexia, initially a potential problem, became her actual problem, so the nursing intervention was to provide involuntary enteral feeding

**Table 1.** A NCP for one observation period

Activity	Problem (actual or potential)	Nursing plan	Evaluation
Feeding	AP Anorexic hyperlipaemic PP Cant get enough nutrition in	Enteral feeding of soaked high-energy cubes every hour. Inc. glucose powder	Slurry easily gets stuck. Use lots of H <sub>2</sub> O, add glucose IV
Drinking	AP Sham drinkingPP Dehydration	Monitor PCV & TPFluid therapy enterally and parentally	PCV high, TP high. Cont. with fluid therapy
Urine & faeces output	AP Hard faecal balls, infrequent faecesPP Impaction, gut stasis, obstruction	Fluid therapy, walking, enteral feeding, monitor	Passed 1 pile AM hard. Vet rectal no impaction/twist. No colic just dull
Mobility	AP DullPP Too weak	Walk round yard three times daily for 5 min	Reluctant to walk. Reduce to once daily until stronger
Temperature	AP NormalPP Infection, cold causes energy expenditure	Stable rug esp. at night and monitor temp	Not shivering. Rectal temp WNL
Demeanour	AP QARPP QDR, hepatic encephalopathy symptoms	Monitor, groom and spend time in stable. Remove NGT if get irritated	NGT removed due to agitation and multiple blockages. QAR
Notes		Depocillin IM BIDFlunixin 5 ml BID IV	Good for meds LH & through catheter

using an indwelling large-bore nasogastric tube. An indwelling tube prevented the stress and pharyngeal trauma from repeated tube placement and allowed small frequent feeds to be given, which does not overwhelm the horse's gastrointestinal tract (McKenzie, 2011). A soakable, high-fibre pellet mixed with glucose powder was used to form a gruel that was placed down the tube every hour. Unfortunately, as reported by Hallebeek and Beyen (2001), the tube was easily obstructed by the slurry and the daily energy requirements of the patient were unable to be met, so parenteral nutrition (PN) using 5% glucose saline at a rate of 400 ml per hour as suggested by McKenzie (2011) was started alongside the enteral feeding. The mare responded well to the nutritional supplements but began to show irritation to the nasogastric tube after 24 h, at which point it was removed. Cafeteria feeding was reintroduced using a selection of succulents, treats and forage in small quantities throughout the day and night. The NCP facilitated an in-depth record of what the patient consumed.

Another actual problem was reduced faecal output, which was combated using enteral feeding and fluid therapy once rectal examination had established there were no gastrointestinal abnormalities. The fluid therapy was an important factor in the patient's treatment plan as a high packed cell volume and total protein were shown during blood testing and the NCP identified that she was "sham" drinking. Alongside intravenous fluid therapy three types of flavoured water were placed in the stable to encourage drinking and the levels were monitored and recorded three times daily. The patient's packed cell volume and total protein were assessed twice daily to monitor her hydration status.

## Patient management – environment

The patient was placed in a quiet internal stable away from the busy yard where she

could be monitored closely. This allowed her to relax in her environment and reduce stress to prevent catecholamine production, which can increase the activity of HSL (McKenzie, 2011). Initially she had no actual problem for mobility and was walked out twice daily to help stimulate her appetite, as suggested by Schott (2013), but on evaluation it was deemed she was too weak to walk out and her NCP was changed to box rest. The internal stable provided a warm environment and the use of a stable rug helped to reduce her energy expenditure (Baxter, 2008).

## Patient management – identification and treatment of the primary cause

Inability to identify or treat the primary cause significantly increases patient mortality. Flushing and widening the diaphragmas to prevent food packing around the gingiva treated the dental pain that caused the anorexia when long-fibre roughage was fed. Only soft and short-fibre feed was offered to the patient, which included chopped grass and chaff.

Watson (1994) advocated abortion of a foal to reduce energy expenditure, while Hammond (2004) warns that abortion can lead to excessive stress and energy demands. It was deemed that at this late stage of pregnancy that abortion would have been contraindicated in this patient.

## Patient management – pharmacological management

Penicillin (Depocillin MSD) was administered to combat gingivitis and prevent any systemic secondary infections. Flunixin meglumine (Flunixin, Norbrook) was given at a half dose of 0.75 mg/kg in the first few days to reduce pain and inflammation associated with her condition in order to improve her demeanour and

encourage appetite. Limited NSAIDs were given due to the increased demand they cause on the liver. They were deemed to be useful in this patient to reduce pain which would encourage appetite.

Detomidine (Domidine, Dechra), an alpha-2-adrenergic agonist, was used to provide sedation during dental treatment. Durham and Thiemann (2015) reported studies that have found alpha-2-adrenergic agonists to be potent inhibitors of lipolysis and, although no studies have specifically tested their use in hyperlipaemic patients, their use may be of benefit alongside their sedative effect.

In theory, insulin has benefits in the treatment of hyperlipaemia such as antagonising lipolysis through HSL inhibition and stimulating lipogenesis to enhance peripheral tissue clearance of triglycerides. However, the marked insulin resistance of a hyperlipaemic pony deems the treatment ineffective (Hughes et al., 2004) and for that reason it was not used.

## Evaluation of nursing care

Studies suggest mortality rates of 57–80% and that aggressive treatment is required to reverse hyperlipaemia. There are many suggestions of enteral feeding preparations ranging from inexpensive high-starch and fibre pelleted gruel, home preparations using cottage cheese, alfalfa and dextrose created by Naylor, Freeman, and Kronfeld (1984), a liquid diet designed by Hallebeek and Beyen (2001) containing dextrose, casein, vitamins and minerals, up to expensive commercial enteral feeding preparations such as Osmolyte and NutriPrime. Studies have shown all preparations to have benefits to the patients, but no specific evidence-based study identifies which regime is best (Durham & Thiemann, 2015; McKenzie, 2011). The clinician must use their judgement based on economics, availability and patient tolerance and response to





▲ **Figure 2.** Mare and newborn foal.

treatment to decide the best preparation for the patient. All the studies advocate low-fat and high-starch products and indicate the importance of initial glucose supplementation to correct hypoglycemia, which improves the patient's attitude and appetite while suitable voluntary or involuntary feeding is introduced. This patient found bread to be palatable and due to its high starch content proved invaluable in treating this patient.

Limited PN was performed due to financial constraints, but was also justified by McKenzie (2011) who believed complications such as hyperglycaemia, electrolyte imbalances and bloodstream infections were contraindications of PN. The literature suggests that enteral feeding has more benefits, such as providing fibre to assist colonocyte health and nutrition in an inexpensive way, allowing normal function of the intestinal tract and reversing the hyperlipaemia (Stratton-Phelps, 2008). However, fluid therapy was important in this case to rehydrate the patient and support organ function.

## Conclusion

The NCP was carried out to a high standard with everyone involved understanding their

roles and through systematic review actual problems were identified and nursing interventions were put in place to deal with them within the constraints of limited finances. The patient remained in the hospital for 8 days and gradually her actual problems were reduced as she responded to treatment and nursing care. The patient's condition slowly improved until she was able to go home with a strict home care plan. She gave birth to a healthy foal 8 weeks later and was able to support herself and the foal (**Figure 2**).

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