



INFORMATION SHEET

Feeding & Management Advice

For Tying Up/Azoturia/Monday Morning Disease/Equine Rhabdomyolysis Syndrome etc.

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This has been based on an article in the proceedings of the BEVA specialist day on Nutrition and behaviour (1999) and a paper on the use of the urinary fractional electrolyte excretion test to assess electrolyte status in the horse (1992). Both by kind permission of the Equine Veterinary Journal Ltd.

Introduction to the Equine Rhabdomyolysis Syndrome

- This syndrome affects primarily the muscles of horses of apparently any age, breed or gender and results in the partial or complete inability to move (e.g. signs may range from a show pony that may fail to lengthen when asked, or a race horse that slows in the closing stages, to an animal that cannot move, or becomes recumbent). Death can result.
- Sufferers have an underlying susceptibility to the condition, which may then be triggered by one or more factors, usually including exercise, resulting in the clinical signs.
- The underlying predisposition, as well as the triggering factors are likely to differ between groups of sufferers - so the measures that may be successful in one individual may not be so successful in another sufferer.
- Two subgroups with specific and different causes have recently been discovered in the USA. One involves a disorder in muscle contractility or excitation- contraction coupling and the other involves a defect in carbohydrate storage and/or utilisation (polysaccharide storage myopathy :PSSM).
- Depending on the clinical signs, the condition can be relatively easy or difficult to diagnose. Diagnosis is usually based on the clinical history and signs together with plasma muscle enzyme activities. Diagnosis of PSSM is confirmed by means of a muscle biopsy.
- Treatment depends on the clinical severity but aims to limit further muscle damage, decrease pain and anxiety and restore fluid balance.
- There is no single procedure or set of procedures (including diet and management) that can guarantee against further episodes of Tying up or the Equine Rhabdomyolysis Syndrome (ERS). ***However, appropriate managemental procedures and nutrition of susceptible animals may help to reduce the likelihood or frequency of future episodes.***



INFORMATION SHEET

For recurrent sufferers:

The actual diet which will be the most beneficial to a sufferer will depend on the horse as an individual, and what they are being used for (as influences energy needs), as well as their history with respect to Tying up.

Diet

1. FORAGE

- The major proportion, if not all, of the daily intake of feed should be forage - either fresh (pasture) or preserved (hay or hay equivalents).
- For the majority of horses it is preferable not to feed large quantities of alfalfa or other legume rich hays. Alfalfa chaff fed in increasing amounts, in conjunction with increasing workload, may be a beneficial addition especially for those horses in hard work or those in which a calcium imbalance may be present (suggested by an urinary Fractional Electrolyte excretion test).
- If the energy needs of the individual horse can be met by forage alone - i.e. the horse maintains the desired body condition and provides the rider with the type of ride they require then they should be fed ~ 100% forage.
- An appropriate general vitamin and mineral supplement normally will be required to ensure appropriate overall nutrition.
- Remember that if the horse is being worked on a forage based diet, plus a vitamin and mineral supplement, it will still most probably require additional salt especially in hot weather or if working hard.
- Do not turn the horse out onto lush fast growing pastures but prolonged daily periods out in a sparse paddock is often beneficial.
- There have been anecdotal reports of an increased incidence of this syndrome in hard working animals following a sudden change onto haylage/silage.

2. SUPPLEMENTARY FEED

If the horse's energy needs cannot be met by forage alone then provide in addition either:-

- A. A fibre based complementary manufactured feed (i.e. high fibre, low cereal - *especially a low oat* - feed).
 - If the amount that is needed to be fed, to enable the horse's desired body condition to be maintained and the rider to have the type of ride they prefer, is less than the manufacturers recommend for that work load then an appropriate vitamin and mineral supplement should be provided (usually it is helpful to contact the Nutritional Helpline of the complementary feed being fed and inform them of the diet, workload and get direct advice appropriate for their feed).



INFORMATION SHEET

- By inference these feeds tend to be low energy feeds. If the horse requires more than the manufacturers recommend amount of the feed in order to maintain condition, the feed does not provide the type of ride required, or too much feed and too little forage is having to be fed, then consider adding additional supplementary oil. (see below).
- B. Supplementary oil fed in addition to a short chopped forage or chaff - again remember to consider vitamins, mineral and trace element intake. Significant amounts of certain chaffs may not be suitable for animals that are not in work. It may be worth contacting the Nutritional Helpline of the chaff being fed for further advice.

3. SUPPLEMENTARY FAT/OIL

- Supplementary fat or oil can be supplied in three main ways:
 - a. High fat feeds – such as rice bran (which is also high in fibre and usually low in starch). However, many of the rice brans available have the same disadvantages of wheat bran in that they have a very imbalanced Calcium to Phosphorus content which may be potentially detrimental for some sufferers.
 - b. Animal fat – many horses find most animal fats to be unpalatable and they seem often to be more likely to cause digestive upsets. Their use is not to be recommended in the UK.
 - c. Vegetable oils – such as corn oil or soya oil. Research has suggested that corn oil may be one of the most palatable oils and may have the lowest risk of causing monotony. Some horses do not like rapeseed oil for example and soy oil apparently has been shown to result in monotony in some animals. However, horses will vary in their likes and dislikes and providing the oil is fresh, not rancid, of a good quality – preferably human grade, palatable and digestible to that individual, at the present time that is acceptable. The optimal desired fatty acid composition of any supplemental oil is not yet known.
- Any supplemental oil should be introduced slowly. Horses have been shown to be able to digest and utilise up to 20% of the diet as fat although around 10% of the daily intake has been suggested in the literature to provide the maximal beneficial metabolic effects. Levels of 5 – 8 % in the total diet are more common in the competition horse and the majority of animals (500kg BW) can be fed up to 400mls/day (~370g) in divided doses without any problems – provided that it has been introduced gradually, is required and is not rancid.
- In order to obtain metabolic benefits from the feeding of oil, in addition to those associated with its high energy density and lack of starch content, the oil needs to be fed for several months.
- It is very important to note that oil does not provide any additional protein, vitamins or minerals. If the horse is not receiving sufficient, for its work load from its basal diet, then an appropriate additional mix may be needed (usually it is helpful to contact the Nutritional Helpline of the feed being fed and inform them of the diet, and workload and get direct advice appropriate for their supplement).



INFORMATION SHEET

- It is recommended that additional Vitamin E be fed in combination with supplemental fat. Exact recommendations are not known but an additional 100iu Vitamin E/100mls added supplemental oil is the author's current recommendation.

4. ELECTROLYTES

- Electrolytes are very important in neuromuscular function.
- Over the past few years the author has apparently been able to either reduce the frequency of episodes or to prevent further episodes in a number of recurrent sufferers by appropriate electrolyte (calcium, magnesium, sodium and potassium) supplementation.
- The supplementation was recommended based on the results of the urinary FE test as illustrated in Figure 1. Often, but not always, combined with appropriate managerial changes.
- This regimen will not be successful in all sufferers and in those in which there is apparent success, this may be due to either an effect of the managerial and/or dietary changes or the unpredictable nature of this syndrome.
- However, in several cases such supplementation has proved very successful and cessation of the electrolyte supplementation has resulted in the reoccurrence of episodes.

It is therefore advisable for all sufferers to try and ensure that the diet provides a sufficient intake of these electrolytes in an adequate and balanced manner.

5. SALT

- Most complementary feeds do not provide sufficient sodium and chloride intake for horses that are significantly losing these electrolytes in sweat. Salt should be provided, therefore, to many horses in work.
- For those horses in little or no work the provision of a salt block may be adequate (but ensure that it is sited so that its use by that individual horse can be monitored). Where complementary feed or a vitamin mineral supplement is being fed, any block should be a pure salt rather than a mineralised one. It is not advised that owners use blocks formulated for other species.
- For those horses in more work or who sweat noticeably the recommendation is that additional salt should be added to the feed. Advice on how much salt should be needed for a particular horse and diet may be obtained from a nutritionist but as a very practical guide : For a 500kg horse the amount should start at about 1/2oz - ~14g/day and build up to around 2oz --~56g/day depending on the time of year, work load, and sweating rate. If, when the additional salt is fed, the horse either will not eat the feed (& providing it is not a fussy feeder!) or obviously urinates more than normal it may be helpful to reduce the amount by 1/2oz, leave it at this level for a few days, monitor and reassess.



INFORMATION SHEET

6. VITAMIN E AND SELENIUM

- The selenium containing enzyme, glutathione peroxidase and Vitamin E help to protect against free radical induced cellular damage. These are therefore important nutrients for all horses regardless of whether they suffer from this condition or not.
- Evidence for the role of a Vitamin E/Selenium deficiency in the pathophysiology of ERS has been based on anecdotal reports on the apparent success of supplementation in preventing further episodes. These anecdotal findings have not been backed up by scientific studies.
- It is therefore unlikely that Vitamin E/Selenium deficiency is involved in the pathophysiology of the majority of sufferers.
- However, in certain individuals a concurrent Vitamin E/Selenium deficiency may be a contributing or a permissive factor in the syndrome.
- It is therefore advisable to ensure that all horses, but in particular those susceptible to this syndrome, are fed adequate Vitamin E and Selenium.
- The NRC recommends as a minimum for horses in work :-

Vitamin E : 80iu/kg DM intake.

The author's recommendation is at least double this figure at **160iu/kg DM** intake plus additional Vitamin E to support any supplemental oil (see above).

Selenium : 0.1mg/kg DM intake.

The author's recommendation again is twice this at **0.2mg/kg DM intake**.

7. GENERAL ADVICE

- Avoid the addition of wheat bran to the horse's diet – wherever possible but certainly avoid large amounts (unbalanced calcium to phosphorus ratio).
- Small amounts of soaked sugar beet may be fed, but the non-molassed variety is recommended.
- Do not feed in anticipation of an increase in workload - wait until additional energy is needed before the intake is increased.

Management

Figures 2 and 3 provide a simplified flow chart for the initial and later stages of management.

1. EXERCISE

- If being worked, sufferers should be kept in regular daily exercise.
- If daily exercise is not possible they should be turned out for as long as possible (avoiding lush rapidly growing pastures) on rest days and any complementary feed intake reduced (halved) from the evening before until the evening afterwards. (If a more prolonged period of rest is to be given then the type of feed fed should be evaluated and either one of a lower energy density, or forage alone, appropriately supplemented, fed).



INFORMATION SHEET

- Horses should not be allowed to get cold standing in a field but provided with appropriate shelter and rugs. They should be encouraged to move by placing feed and water devices in different sections of the field.
- Especially in the initial stages of a return to work lunging and work in tight circles, as well as hill work, should be avoided.
- For the majority of sufferers long, slow warm ups and downs seem to be the most beneficial.
- Decrease work intensity, and complementary concentrate feed intake, if there is any suspicion of a respiratory viral infection being present on the premises where the horse is being kept.

2. 'STRESS'

For some sufferers 'stress' may be a contributing triggering factor. Therefore wherever possible the level of 'stress' experienced by the sufferer should be kept to a minimum e.g.:-

- If they are quieter being ridden out in company then ride out in company or vice versa.
- If they get disturbed around feed time then feed them first.
- Keep to the established routine as far as possible.
- If certain trigger factors (such as not reducing feed on days of rest; overexertion, being in season etc.) can be linked to episodes then these trigger factors should be avoided wherever possible.

Monitoring

1. PLASMA MUSCLE ENZYME ACTIVITIES

- The muscle response to exercise can be monitored via blood samples taken before; 2 - 6hrs post exercise and if possible 20 -24hrs post.
- The exercise that is used should be similar to the most strenuous work that they have very recently undertaken and not a standardised lunge test i.e. in the initial stages of a return to work this will just involve walking.
- Plasma should be harvested as soon as possible after collection.
- Carry out approximately 3 days after a return to exercise
- If acceptable results are obtained continue to bring back into work.
- Consider repeating after being in work around 7 - 10days to monitor progress.
- It can be useful in problematical cases to monitor 3 days after any major increase in workload.



INFORMATION SHEET

- If unacceptable results are obtained, check managemental procedures. Consider a further period of rest (but maintain pasture or equivalent turnout wherever possible) and other preventative regimens including diet and FE testing.

Criteria for determining a ‘normal’ response to this sub-maximal individually tailor made exercise test include:-

- Pre exercise CK activity < 100u/L for a laboratory with a resting reference range of 0 –50u/L
- Pre exercise AST activity <300u/L for a laboratory with a resting reference range of 150 – 230u/L
- Not more than a doubling of the resting CK activity at 2-6hrs post exercise
- Return to close to baseline CK activities at 24hrs post exercise,
- Not more than a 50% increase in AST activities at any point
- No clinical signs of stiffness.

But still needs to be interpreted with care and take into consideration the history of the horse.

NOTE that due to the nature of this syndrome normal results can be obtained with such an exercise test on one day and the horse can still suffer an episode the following day.

2. FRACTIONAL ELECTROLYTE EXCRETION TESTING

Appropriate electrolyte supplementation based on the results of a paired blood and urine test may be of benefit in some cases see figure 1. Some, non exhaustive comments on the use of the FE test are provided below:-

Appropriate Collection

- The diet should have been constant for at least 2 weeks prior to the test
- The test should not be carried out within a week of an episode .
- The urine must be collected **pre-exercise and pre-feeding** or at least 8 hrs post concentrate feeding
- Plasma and urine do not need to be collected at the same time – once the owner has a freely voided urine sample then the blood sample can be collected provided that it is also pre exercise and away from forage or concentrate feeding etc.
- Urine should be Freely voided - In some horses taking them out first thing in the morning for a short pick of grass before returning to a clean well bedded stable may encourage them to urinate.



INFORMATION SHEET

- Appropriate urine harnesses may be used to collect urine or in mares urine can be collected by catheterisation providing the bloods are taken first and then the mare is given a short sharp trot before catheterisation – all the urine voided should be collected.

Appropriate Sample Preparation

- Fully mix the urine before taking an aliquot.
- Separate the plasma before sending
- Use a laboratory with experience in FE testing in horses.

Appropriate Analysis

- Should be undertaken within 4 days of collection
- Before analysis all urine samples should be checked and samples that have a pH of 6 or below, are positive for glucose, have more than 0.3g/l protein or are positive for blood or myoglobin/haemoglobin are not considered to be normal samples with respect to this test.
- Do not interpret the results if the Urinary Creatinine concentration is <9,000umol/L
- Do not interpret if the Plasma Creatinine values are elevated
- Undertake magnesium determinations at the same time as Calcium

Appropriate interpretation

- Interpret with caution – only a guide – abnormal results do not mean that electrolyte imbalances as detected by this test are involved in the patho-physiology in this individual.
- Need to use reference ranges appropriate to diet and consider results in light of the diet e.g horses on a cereal based diet tend to have higher % Phosphates – this may reflect the likely imbalance in Ca: P in such diets or an individual issue. It may not be related to the ERS *per se* but as discussed above as high cereal based diets are not advised for most ERS cases therefore may be worth considering changes anyway.
- If abnormal results are seen consider
 1. Sample collection, preparation, analysis errors
 2. Dietary variations – e.g high % K FE values expected on a high fibre based diet.
 3. Mineral interactions in the diet
 4. Individual variability in ability to absorb
 5. Individual variability in requirements/utilisation.
- Can take several weeks for changes in response to supplementation to be seen – especially with respect to calcium in adult horses.

Comments

Animals without renal disease, that have abnormal FE values while being fed a diet containing an adequate and balanced electrolyte content, may have an individual absorption/utilisation problem. Such abnormalities have been found in horses and ponies suffering from musculoskeletal problems, in particular the equine rhabdomyolysis syndrome. Restoration of the FE values to



INFORMATION SHEET

within the expected reference range for the type of diet fed may result in clinical improvement. Abnormal FE values in horses with rhabdomyolysis is complicated by the fact that many diets of horses are low or unbalanced with respect to certain electrolytes or minerals. Ideally, affected animals should be sampled while being fed their regular diet (on which they had suffered attacks) and then after a period on a diet balanced with respect to its electrolyte and vitamin content. For practical and financial reasons this may not be possible. A compromise, therefore, can be to feed the animal a high fibre diet believed to provide an adequate and balanced diet for at least 2 weeks before collection of appropriate blood and urine samples. An abnormal FE value then would more probably reflect an absorption/utilisation problem rather than a possible dietary imbalance providing the hay is not markedly imbalanced. The appropriate supplementation could then be given and the level of supplementation altered accordingly following monitoring. If an FE abnormality was not detected on this 'balanced diet' the animal could then be kept on the diet with the knowledge that the electrolyte intake would remain fairly constant and any further attacks would be unlikely to be related to electrolyte imbalances (as detected by the FE test). However, because of the increased requirements of certain electrolytes with exercise the test should be repeated when the horse is in full work on full feed.

Useful references

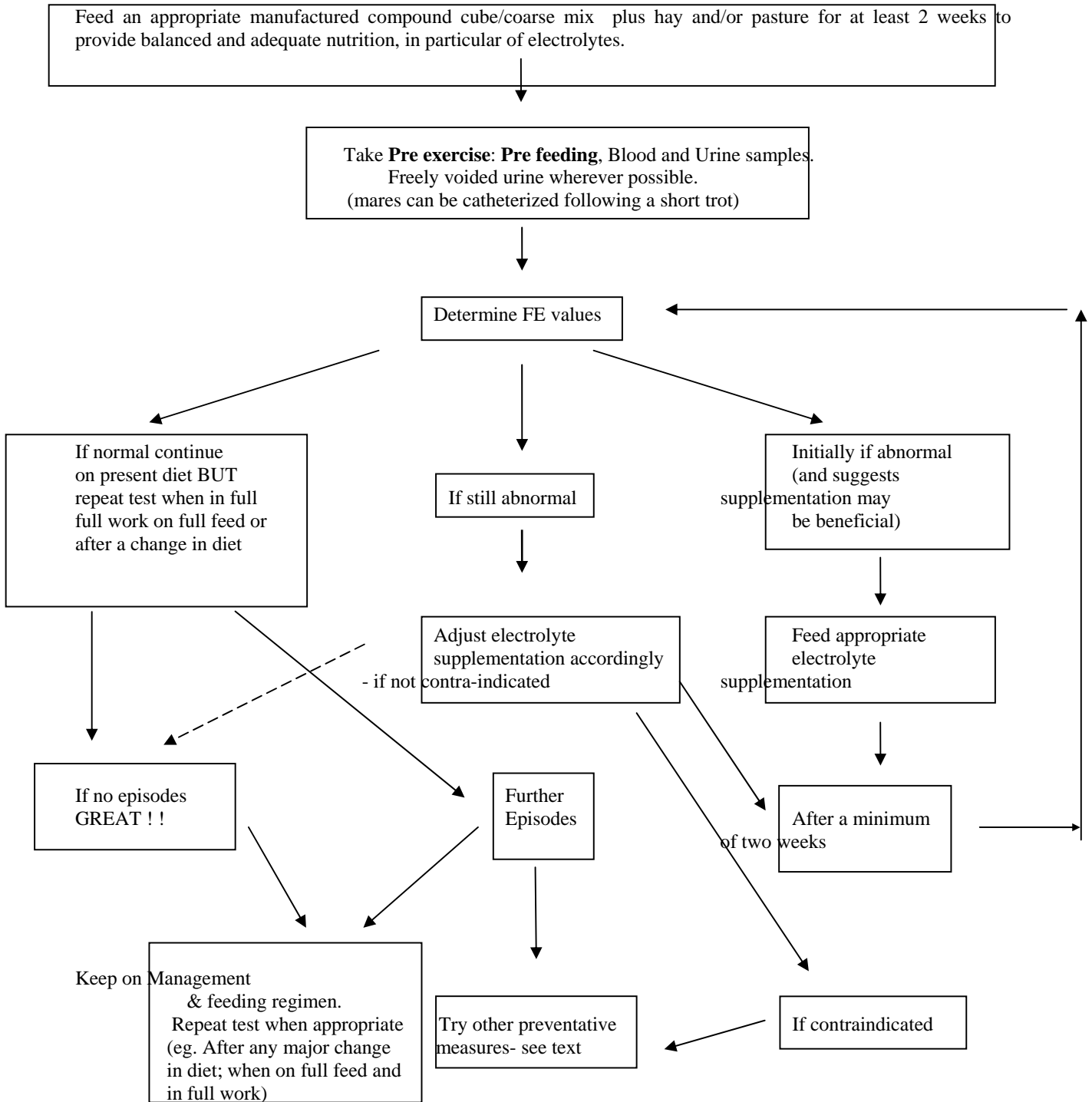
- Harris PA (1998) Equine Rhabdomyolysis syndrome. In Metabolic and endocrine problems of the horse. Watson T ed. WB Saunders. London 75 –100. ***Outlines possible treatments and other preventative regimens***
- Harris PA and Gray J (1992) The use of the urinary fractional electrolyte excretion test to assess electrolyte status in the horse. Equine Vet Ed. 4 (4) :162-166.
- Valberg SJ (1995) Exertional Rhabdomyolysis and polysaccharide storage myopathy in Quarter Horses. 41st A.A.E.P. Proc. Kentucky. 228 –230.
- Valberg et al (1996) Familial basis of polysaccharide storage myopathy and exertional rhabdomyolysis in Quarter horses and related breeds.
- Macleay et al (1999) Heritability of recurrent exertional rhabdomyolysis in thoroughbred racehorses Am J Vet Res 60 250-256
- Valberg et al (1999) Skeletal muscle metabolic response to exercise in horses with 'tying-up' due to polysaccharide storage myopathy. Equine vet. J. 31 43-47.



INFORMATION SHEET

FIGURE 1: Protocol for FE testing (taken from Harris [1997]. In Current Equine therapy 4)

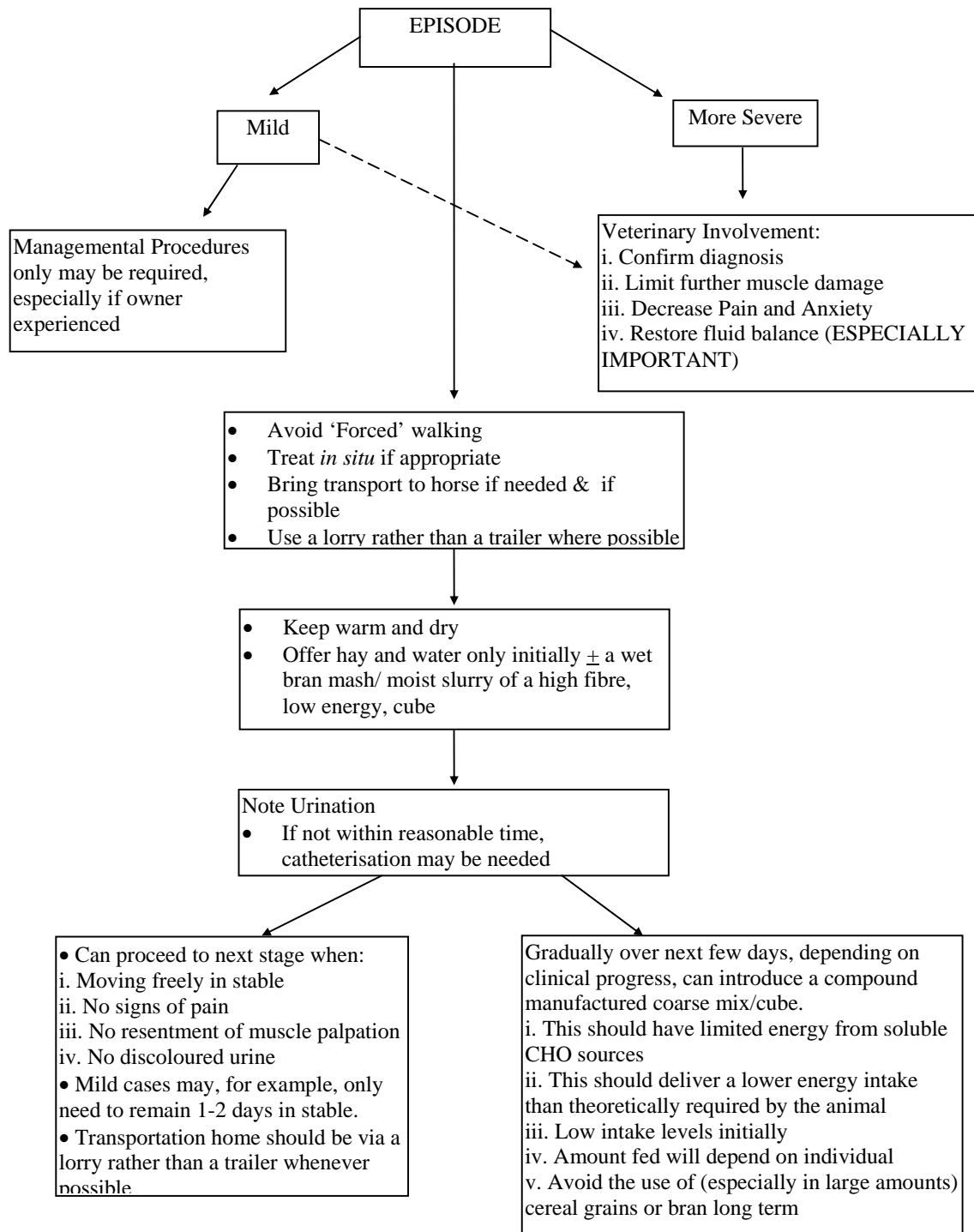
Institute appropriate managemental procedures.





INFORMATION SHEET

FIGURE 2: A suggested protocol for the management of an ERS case in the initial stages (From Harris 1998: Equine Rhabdomyolysis syndrome. In Metabolic and endocrine problems of the horse. Watson T ed.)





INFORMATION SHEET

FIGURE 3: Later stages in the management of an ERS Case - a suggested protocol (From Harris 1998: Equine Rhabdomyolysis syndrome. In Metabolic and endocrine problems of the horse. Watson T ed.)

