CEH HORSE REPORT

July 2013 A publication of the Center for Equine Health • School of Veterinary Medicine • University of California, Davis

Transporting Horses by Road and Air

Recommendations for Reducing the Stress

Horses have been transported across continents for centuries for many of the same reasons that they are transported today: competition, breeding and commerce. They have traveled in ships, horse-drawn vehicles, trains, planes and trailers and vans. Motorized conveyances were developed in the mid-1900s, and trailers or vans hauling pleasure, show and race horses became essential in the horse industry.

The first known air transport of a horse reportedly was in the 1920s, and by the 1950s, horses were flying regularly between Ireland, England and France. The 1960s brought the "jet age," with the first carriage of horses in a Boeing 707. Later, wide-bodied jets like the Boeing 747 could hold greater numbers of horses (up to 112) on charter flights. Throughout history, the management practices and other considerations in transporting horses have changed very little from ships to jets.

This horse appears calm and comfortable in an open stall aboard an airplane. Photo courtesy H. E. Sutton Forwarding Company.

For horses that breed, show or compete in athletic events, transport may be a necessary and frequent part of life. Air transport of horses is an obvious necessity for horses with international aspirations, but also is a viable modality for those going long distances within the United States. A 6-hour flight from New York to California can be a lot less stressful than a 72-hour van ride (5 days). While some horses adapt well to transport, others do not, and being moved from one place to another can be highly stressful for them, whether they travel by air or by road.

Dr. Desmond Leadon of the Irish Equine Centre in County Kildare, Ireland, is a leading authority on transport stress in horses. He has written extensively on the subject and includes a definition of stress in the context of transport: Stress occurs when a horse is required to make abnormal or extreme adjustments in its behavior or internal management

—Continued on page 3

INSIDE THIS ISSUE...

UCDAVIS VETERINARY MEDICINE
Center for Equine Health

DIRECTOR'S MESSAGE

Dr. Claudia Sonder

I remember the first shipping fever I ever treated. It was a brisk October evening and I was serving as the show veterinarian in Sacramento. A highly successful trainer called me to look at her jumper who was not eating. He was a gorgeous, bay gelding who had recently been imported from Europe and hauled up from Los Angeles quarantine to compete. When I placed my stethoscope upon his chest, I knew we were in trouble. The creaking and crackling in my ear was indicative of pneumonia and inflammation of the tissues surrounding the lungs, known as pleuritis. He had a fever and was moderately dehydrated. I began IV fluid therapy as I prepared him for the short trip to UC Davis. Luckily, he responded well to supportive therapy and IV antibiotics, but it was months before he entered the ring again.

Horses are the most frequent flyers second to humans, and the travel demands on our sport horse population are on the rise. In the past few years, the number of international equine competitions grew by 30%. Equine travel is big business and important to equine industry. There are organizations that oversee equine travel and guide best practices to minimize transport stress. The World Organization for Animal Health (OIE) and the International Association of Airline Travel (IAAT) carefully monitor the equine transport situation. These agencies work to balance ease and accessibility of travel with maintaining biosecurity and safety, and they must back these recommendations with scientifically defensible research.

The Center for Equine Health (CEH) has funded several studies to identify indicators of equine stress and predisposing factors to travel-associated diseases such as shipping fever, but there is much remaining to learn. Human models of effect of travel on athleticism have some implications for horses but a number of the variables we measure in human performance are not repeatable in equines.

Many of you have imported horses from great distances and were shocked at their physical appearance upon arrival at your barn. That shiny, well-muscled specimen you fell in love with overseas can arrive as a shadow of its former self. We see many of these horses at our Contagious Equine Metritis (CEM) Quarantine facility at the CEH and we watch them closely after travel. Most of these horses lose 5% of their body weight on their journey, and studies show that the longer these horses travel by plane or road, the greater the threat to their well-being. We know that factors such as temperature, humidity, turbulence, air quality, and health prior to travel all play a role in successful travel. We understand there is a great amount of variability in equine response to the stress of travel. There are seasoned traveler sport horses that don't blink an eye when loaded and there are young newbies who fail to eat or drink along the way. Outcomes for these horses are often different despite similar travel conditions.

We have recently updated our CEM quarantine program to meet the needs of these equine athletes and to improve the customer experience. Our quarantine is designed to minimize stress and maximize care with the goal in mind of delivering your horse in the best possible condition after import. We monitor weight and health closely, and the horses tend to regain weight almost immediately when allowed to rest and forage on high quality hay. We manage these horses with the support and expertise of the world renowned equine faculty at UC Davis.

There are seasoned traveler sport horses that don't blink an eye when loaded and there are young newbies who fail to eat or drink along the way. Outcomes for these horses are often different despite similar travel conditions.

This issue of the *Horse Report* will update you on the latest research findings regarding transport stress in horses and arm you with the knowledge you need to prepare for your own equine transport experience. We wish you success in competition and safe travel. ❄

Transporting Horses
— From page 1

(physiology) in order to cope with adverse aspects of its environment and management. While some adaptations to travel are normal, a measure of these adaptive responses can provide a better understanding of how stressful the circumstances are to the horse as well as its probable rate and duration of recovery.

The Irish Equine Centre has had an ongoing interest in transport research for the last 30 years. According to Dr. Leadon, "We have looked at stall design with air transport companies, aircraft manufacturers, and with aero engineers. We have studied airflow, temperature gradients, and environmental contamination within road transport vehicles and in aircraft carrying horses. It makes surprisingly little difference whether the vehicle has wings or wheels." Rather, he proposes that managing the transit environment and a horse's general health are key elements to delivering a horse to its destination in as good a condition as possible.

Factors involved in transport that contribute to stress include physical factors, psychological factors and environmental factors, as shown below.

— Continued on page 4

Transport Stress: A Complex Response Involving Multiple Components

Physical Stressors	Psychological Stressors	Environmental Stressors
Loading and unloading	Separation from the herd and familiar environment	Fluctuations of temperature and humidity
Constant vibration and noise	Exposure to strange environments and animals	Altered and possibly inadequate ventilation
Noise	Confinement	Exposure to gases and particles from exhaust, urine and feces
Loss of balance from accelerations and decelerations	Lack of exercise or movement (particularly for older horses)	Road or flight conditions
Deprivation of feed and water	Schedule changes	Intensity and/or fluctuations in light levels
Orientation to direction of travel		Dust
Head posture		Bedding
Decreased function of the immune system		Footing materials, traction
Lack of exercise or movement (particularly for older horses)		Disease or pathogens
Socialization with other traveling mates or isolation if traveling alone		
Length of journey		

Transporting Horses
— From page 3

Why is transport stress important? Horses stressed by transport are more susceptible to a variety of diseases, including pneumonia, colic, diarrhea and laminitis. Additionally, transport stress may alter energy metabolism, which can affect the horse's ability to perform or compete soon after transport. For these reasons, it is important for the horse's welfare to minimize the stress of transport in every way possible by optimizing the transport environment. Take control of what can be controlled in order to reduce the chance of illness or injury in your horses.

Few studies on the effects of long-distance transportation of horses have been done. Yet, there have been numerous research studies reported on post-transit respiratory diseases in horses. To gain more insight into the physical responses of horses during transport, Dr. Carolyn Stull of UC Davis and Dr. Anne Rodiek, Emeritus Professor at California State University-Fresno, teamed up to study the physiology of horses both during transport and recovery. The study was conducted using a commercial equine van that traveled the interstate highways of central California under typical hot and dry summer conditions.

The study subjects were 15 mature, healthy horses that were experienced travelers. Their physiological responses were documented during 24 hours of road transport, followed by a 24-hour recovery period during which horses rested in their individual stalls. It was important to study the recovery period to obtain information on how quickly the physiological responses return to pretransit or baseline values. Here are some of the findings.

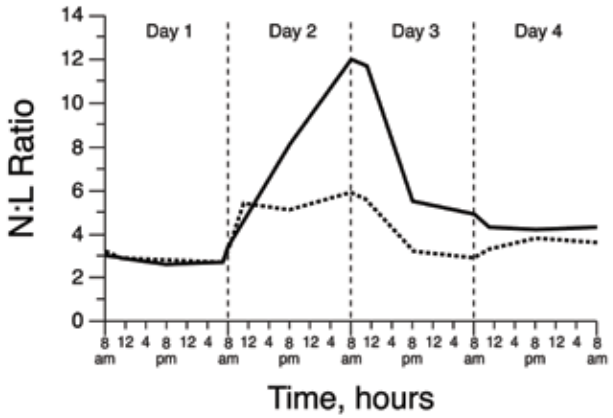
General health. Body weight, rectal temperature, and white blood cell count were measured as general indicators of health and the ability of the horses to handle the heat of the summer during transport. The horses generally lost about 6% of body weight, possibly due to heat dissipation, sweat loss, and decreased gut fill during transit, but they recovered half of their weight loss 24 hours after transit. This may support the notion that horses respond to heat stress during transit using their thermoregulatory mechanisms of sweating and increased respiration rate.

Dehydration. Hematocrit and total protein concentration are blood tests that are often used as indicators of dehydration in horses. These measurements increased during the duration of transport but returned to baseline values during the post-transit period. This indicated that dehydration was progressing with the duration of transport. Interestingly, during the last 12 hours of transport when the hematocrit levels peaked, the horses had consumed 91% of the water offered.

Muscle fatigue. Minimal muscular fatigue was found in the horses during the transit period. However, two serum enzymes with high activity in skeletal muscle and evaluated clinically in horses with muscular diseases are CPK and AST. In this study, CPK was slightly elevated after transport, and AST rose in response to transport and returned to baseline within 24 hours after transport. This indicates that there was muscle activity during transport probably due to maintaining balance.

Stress. During stressful situations such as exercise or transport, activation of the part of the brain that controls metabolic state (hypothalamic-pituitary-adrenal axis) results in an increased concentration of the hormone cortisol in blood circulation. The concentration of cortisol in these horses increased during loading and continued to rise throughout the 24-hour transit period, peaking at the termination of transit. After unloading, the stress of transportation ceased and cortisol concentration dramatically decreased.

The large increase of cortisol during transport influences the immune system, and its influence can be measured by the ratio of two types of white blood cells: the neutrophil:lymphocyte (N:L) ratio. This ratio also increased during transit and did not return to baseline



The above graph shows the neutrophil:lymphocyte (N:L) ratio. This ratio increased during transit and did not return to baseline within the 24-hour recovery period. Continued elevation in the N:L ratio may contribute to disease susceptibility following long-term transport.

within the 24-hour recovery period. This elevated N:L ratio contributes to disease susceptibility, such as pleuropneumonia, following long-term transport.

In other research conducted at UC Davis, Dr. Jim Jones has been studying transport stress in horses for the past 25 years. He has worked closely with international teams to identify factors that predispose horses to transport-associated respiratory disease (shipping fever) and to investigate biological indicators of stress in horses. Recently, he found that Heart Rate Variability (HRV) may be a more sensitive indicator of physiologic stress than heart rate alone.

Heart Rate Variability is the variation in time between heartbeats. Some intervals are a little longer, some a little shorter. The lengthening and shortening of these intervals occurs regularly over intervals ranging from a few seconds to several minutes. These frequencies cannot be determined by looking at a recording but are identified using mathematical techniques (fast Fourier transform). The frequencies reflect how strongly different parts of the autonomic (unconscious) nervous system are activated—a balance between sympathetic (fight or flight) versus parasympathetic (rest and digest). HRV values can provide an idea of how strongly each part of the autonomic nervous system is stimulated and where the balance is.

Dr. Jones and his colleagues measured marked differences in the HRV responses of horses that were being transported compared with the same horses resting in their stalls. In a previous study, they noted that there was a modest occurrence of transport stress related to respiratory disease in horses traveling up to 12 hours. After that, the occurrence of shipping fever rises dramatically and in proportion to the duration of transport. So HRV, or the intervals between heartbeats, appears to be more suggestive of horses' hormonal response to stressors, and this research tool will enhance future studies of how horses react to changes in their environment.

Meals are served on most flights. Photo courtesy H. E. Sutton Forwarding Company.

Shipping Fever and Other Illness

Shipping fever is the most common illness found in horses subjected to transport. It is a respiratory infection characterized by signs of depression, loss of appetite, fever, increased respiratory rate, nasal discharge, and coughing and can rapidly progress to pleurisy and pneumonia.

Shipping fever can occur in as little as 4 to 6 hours after departure in all journeys. Initial signs of this condition may be seen relatively soon after takeoff in air journeys, which have been preceded by long road journeys or by long delays spent in a road vehicle while awaiting loading onto aircraft.
The incidence of shipping fever in long journeys may be 6% or higher. In any shipment of 16 or more horses, it is reasonable to anticipate and provide for one or more instances of this disease. Not all cases of shipping fever are apparent during the journey or immediately after arrival. A substantial number of cases will be not be apparent until the morning after arrival or thereafter.

When the clinical signs of shipping fever are observed during road journeys, veterinary help should be sought immediately or, if not possible, immediately after arrival. During air transport, if there is a veterinarian on board, treatment should begin immediately. It has been shown that prompt intervention significantly reduces the duration of therapy and severity of illness.

Colic and other unpredictable conditions that occur with horses can also occur in transit on the road or in the air. The handling of these conditions should be approached with the same urgency as shipping fever. ❄

Reducing Transport Stress

BEFORE TRANSPORT

- Teach or train the horse to load, unload and haul quietly. This will drastically reduce the stress levels right from the start of travel. Loading is by far the most stressful single aspect of transport (other than ultra-long duration hauling).
- Make sure your preventative health program, particularly vaccinations, is up to date. Vaccinations take 2 to 3 weeks to provide protection.
- Make sure you have the proper health records for any regulatory requirements, especially if crossing state lines or country borders.
- Select a van or trailer that suits your horse's size and temperament, preferably one that allows the horse to lower its head as this can make a significant difference. Make a safety check of the trailer (see page 7).
- Inspect the transport vehicle for cleanliness and sanitize if necessary.
- If hiring a commercial transport company, make sure the grooms and other caretakers are experienced in handling horses and their care.
- Plan the route to minimize duration, along with any extremes in weather or environmental temperatures.
- Ensure that the flooring remains nonslip for the entire trip. Provide absorbent bedding to help soak up any urine and manure excreted.
- Ensure adequate ventilation in the transport vehicle.
- Avoid prolonged stationary periods in traffic or at refueling stops. A trailer in the sun can be more than 20 degrees warmer inside than outside. Traffic delays during the summer, with associated fumes, can be disastrous to the horse. Unload if safe to do so if a prolonged delay is apparent.
- Provide a well-fitting halter; leather is ideal.
- Bring sufficient feed and water.
- Have an effective means of restraint.
- Plan for rest or recovery periods. Offer water every 4 to 6 hours, or every 3 to 4 hours in hot weather. If possible, pick up manure and urine at the same time intervals.
- Check that veterinary help is available if required.
- Notify the point of arrival of the journey plan and any special requirements.

Tranquilization and Familiarization

Many horses have been familiarized with transport from a young age. And, even many that have never been transported before will often readily allow themselves to be loaded and confined in a transport vehicle. A small minority of horses may be difficult to handle during transport. Tranquilization by a veterinarian may facilitate loading and assist with the safe handling of the horse during transport. However, the medication can interfere with temperature regulation, so should be done with caution.

Water and Electrolytes

Unless a horse has a history of dehydration, excessive or uncontrolled administration of electrolytes may actually have adverse effects on water and electrolyte balance in the horse. Check that a horse that is to be transported has been drinking normally in the days leading up to transport, and especially immediately before transport. The pretravel administration of oral or intravenous fluids is not usually recommended unless the horse has a history of developing dehydration during travel.

Body Weight

It is normal for a horse to lose weight during transport. The amount of weight lost can range from 0.45 to 0.55% of total body weight (about 5 to 6 lbs in a normal mature Thoroughbred) per hour of transport. This weight loss may reflect reduced dietary intake during travel, dehydration, manure and urine excretion, and sweating. Horses can lose 45 lbs (20 kg) on international flights, and horses with shipping fever may lose 75 lbs or more en route. Horses traveling greater than 12 hours have been found to lose up to 5% of their body weight. Weight loss in transit tends to be regained over the following 3 to 7 days in healthy horses, and possibly over longer periods in horses with shipping fever.

It is recommended that horses be weighed before travel to establish a baseline for comparison with weight status on arrival and in the recovery period. Since scales are likely to vary, weigh two large sacks of feed and record their weights. Keep the sacks intact to weigh on the scale at your destination. You will then be able to compare departure with arrival weights, compensating for differences in scale accuracy. Weight tapes, when applied correctly, tend to be accurate within 40 pounds.

Respiratory Health and Disease

One of the fundamental rules of transport is: *Sick horse on, sicker horse when getting off.* The importance of avoiding the shipment of horses that are even slightly sick (other than for transport to a hospital or clinic) cannot be overemphasized. This is especially true for horses with respiratory illness. Horses with fever or nasal discharge, those with a history of exposure to other horses with infectious respiratory disease (such as strangles or viral respiratory infections) should not be transported.

Medication

Unnecessary medication should be avoided, especially before travel. Adverse reactions are always a possibility with any therapeutic substance. Tranquilizers should be administered only by a veterinarian and are not recommended unless necesssary.

Transport Vehicle (Trailer/Van) Inspection

Prior to departure, the transport vehicle should be carefully inspected to be sure that it is safe and road-worthy. Special attention to competency of flooring should be paid in all trailers.

- All lights are in working order.
- Brakes are fully operational.
- Doors fully open and close and can be locked properly.
- Vents fully open and close.
- The trailer floor and any loading ramps have been thoroughly checked.
- If rubber mats are used, make sure these are flush with floor to avoid any tripping during loading and traveling.
- Emergency trailer brake box has been tested and is in working order.
- Tire pressure is adjusted according to the manufacturer's suggested levels.
- The spare tire is accessible and properly inflated.
- The vehicle is stocked with an appropriate trailer and truck jack as well as tire chocks (a wedge placed behind a vehicle's wheels to prevent accidental movement).
- The hitch is functional for the trailer and the vehicle.

Route Plan

The route for road transport should be carefully considered. Plan the time of day for transport to avoid extremes of heat or cold. Night travel may be advantageous because ambient temperatures will be lower during hot weather, traffic is likely to be lighter so as to avoid stops and starts, refueling may be faster, and horses may be more relaxed during the evening.

Plan the route so that it is possible to stop regularly to check horses and offer them water every 4 to 6 hours. Locate veterinarians along the way in case of a medical emergency during transit.

— Continued on page 8

Reducing Stress
— From page 7

Flight Plan for Air Transport

The duration of confinement to the air should be minimized as much as possible. Loading and unloading of planes should be facilitated in every way possible. The shortest route to reach a distant destination is always preferred. The duration of ground stops should be minimized and auxiliary ventilation systems should be used to maintain excellent air quality. Typically, the worst air quality occurs during ground times. Planes are much better ventilated when aloft. Relative humidity and temperature rise quickly in a stationary closed vehicle, especially in warm climates and sunny conditions.

Emergency Preparedness

Consult your veterinarian for his/her recommendation for what to include in a first aid kit prior to travel. Some essential items should include sterile bandage material, adhesive wrap and tape, leg wraps, scissors, rectal thermometer, antiseptic solution, latex gloves, and PVC tubing cut into lengths of 1.5 to 2 feet (for emergency splinting).

Blankets and Bandages

Bandages and bell boots for leg and coronary band protection can be useful if horses are accustomed to wearing them. If not (i.e., foals or yearlings), shipping boots or bandages may be a liability instead of an asset. Train the horse to wear protective bandages if you plan to use them. If the horse is blanketed (not advised unless it is cold), select a blanket that will not overheat the horse and cause sweating. Remember the horse will be using his muscles to balance and there may be limited ventilation once the vehicle is fully loaded with horses.

Recovery Period

Despite every effort at preventing shipping fever or other transport-related disease, some horses will become ill during or within the first 3 days following transport. It is advisable to plan for a convalescent period of at least 3 days after shipping to allow for treatment of horses that may be ill. Contact a veterinarian if the horse exhibits nasal discharge, refuses feed, or has an elevated rectal temperature.

DURING TRANSPORT

Duration of Journey

Journeys of 3 hours or less than 500 miles are unlikely to be associated with transport-related diseases, dehydration or fatigue due to energy expenditure and reduced feed intake.

Road transport time per day should not exceed 12 hours from the time the first horse is loaded on the vehicle. After 12 hours of transport, horses should be removed from the vehicle and comfortably stabled for at least 8 hours. This time period is necessary for tracheal clearance and rehydration.

Behavior and Injury

Horse behavior should be monitored regularly throughout any transport. Additional skillful help may be required if a horse becomes extremely agitated. Any depression or injury in horses should be noted and appropriate first aid action taken wherever possible.

Feed and Water

Clean water should be offered regularly—approximately every 3 to 6 hours—during prolonged ground or air transport. If possible, it may be advisable to bring water from home as some horses are reluctant to drink water that is not from the home sources. In warmer conditions, high humidity, or when horses are sweating, water should be offered more frequently.

It is important that horses eat during long journeys. However, it is also imperative that the environment on the transport vehicle have as little contamination of the air with respirable particles as possible. In particular, the breathing zone around the horse's muzzle should not be heavily contaminated with particulate matter. Because hay nets must be placed very close to (or within) the breathing zone, it is essential that hay be as dust-free as possible. It is therefore recommended that hay be thoroughly soaked in water before being loaded on the vehicle or fed in a net to horses.

Head Posture

Horses should be given as much freedom of movement of their heads as is safe. Restraint in the head up posture for prolonged intervals may severely compromise lung clearance mechanisms and predispose a horse to shipping fever. Hay nets should be placed as low as possible while still assuring that horses cannot entangle their feet in the nets. Alternatively, horses travel well in small box stalls in which they can extend their heads to the floor to consume hay. Please see article on *How Cross-Tying Affects Horses During Transport* (page 11).

Orientation During Transport

Orientation of the horse within a transport vehicle has been identified as a potential source of stress. Several studies have examined horses facing toward or away from the direction of road travel. With some variation,

When providing feed for horses during transport, make sure it is quality hay, free of mold and with minimal dust.

the studies suggest that horses facing away from travel experience less stress and better ability to clear their airways and adjust posture. While most horses seem to prefer this, there is evidence that some individuals prefer head forward and may show greater signs of stress if forced to ride backward. It is not known whether the horses respond this way because they have become accustomed to it or for other reasons. Decisions regarding restraint and orientation during travel should be made on a case-by-case basis. Greater caution is required when opening the doors of a trailer with an unrestrained horse inside.

Ventilation and the Environment

There are a number of factors about air quality that impact the respiratory system. The properly designed trailer or van will allow for adequate ventilation without a gale force draft directly on the horse or a total drenching if it rains. That said, it is almost impossible not to have the airflow in a trailer recirculate rear to front along the floor, bringing noxious fumes up for the horses to breathe. The pressure profiles along a moving trailer largely dictate that there will be lots of rebreathing. More open-stock trailers potentially offer significant advantages for ventilation and reduced heat load during the summer.

Ensure that potential factors that can negatively impact air quality within the trailer/van are minimized. The exhaust system of the vehicle should be inspected yearly. If the truck has a vertical exhaust similar to that on a tractor-trailer, it should be taller than the ceiling of the van or trailer and not be flowing in the immediate vicinity of an intake vent. Note that diesel exhaust can be more harmful than gasoline exhaust, and keeping either engine in proper maintenance can decrease its emissions. (Health concerns about diesel exhaust relate not only to cancer, but also to other health problems such as lung and heart diseases.) Breathing of exhaust fumes can be an irritant to the respiratory system and excessive fumes in an enclosed compartment can cause death due to carbon monoxide poisoning. Deaths of horses in trailers have been reported when the wind currents during transit directed the exhaust directly into closed trailers.

Urine-soaked bedding or poor drainage from the trailer can also have a negative impact on air quality. When urine breaks down, a substantial amount of ammonia fumes can be generated. Excessive inhalation of ammonia fumes can cause respiratory irritation that predisposes the horse to respiratory problems. Recent research suggests that in the case of long road journeys there is benefit in removing feces and urine-soaked material during periodic stops.

— Continued on page 10

Reducing Stress
— From page 9

AFTER ARRIVAL

Horses that travel well will be bright and alert with a normal rectal temperature upon arrival at their destination. Unload horses as soon as possible to avoid additional confinement and other stress factors. They should voluntarily drink and be keenly interested in eating within 1 or 2 hours of arrival. Hand walking or turnout in a small paddock for an hour or so upon arrival after a long journey is recommended.

Photo courtesy H. E. Sutton Forwarding Company.

Ideally, dietary adjustments are made over 7 to 10 days to decrease the likelihood of digestive upsets. A normal horse passes approximately one pile of manure every 3 to 4 hours. Any decrease in manure output should be reported to a veterinarian.

Monitoring

Rectal temperature should be recorded morning and evening. When possible, weigh horses upon arrival and then daily at the same time for the next 3 to 7 days. Comparison with a pre-transport weight is useful to quantify actual weight losses and to assess the effects of shipping.

Horses with signs of shipping fever (see section above) will be readily identified by this monitoring system. Some horses will not show signs of shipping fever until 2 to 3 days after transport. Occasionally, horses may have colic or diarrhea after shipping. Seek veterinary assistance immediately if transport-associated disease is suspected.

Recovery Times

A specified recovery interval should be part of the pre-shipment plan for horses making long journeys.

For road journeys of 6 to 12 hours, a one-day rest period is likely to be sufficient. When horses travel longer than 12 hours by road or are transported by plane, a recovery period of 2 to 3 days should be planned. Research at UC Davis in horses transported 24 hours by road in a commercial van has shown that physiological parameters, especially white blood cells, take 24 hours to return to normal levels for horses transported in box stalls and an additional day for horses cross-tied during the trip.

Horses traveling long distances for performance events should arrive 5 to 6 days prior to the competition date to comply with medication withdrawal rules in the event of travel-associated illness. Horses with shipping fever may need 3 to 4 weeks to resume athletic activity. ❄

Acknowledgments

Dr. Carolyn Stull of UC Davis is a Cooperative Extension Specialist and lecturer at UC Davis. She has authored numerous articles on the welfare of horses and livestock and was a major contributor to this Horse Report. Dr. Anne Rodiek has recently retired as a professor in equine studies and has performed research in horse transport, breeding and nutrition for over 30 years. Dr. Jim Jones, a specialist in equine exercise physiology and sports medicine, has been researching transport stress for many years with colleagues at the Japan Racing Association. His most recent work focuses on heart rate variability as a sensitive indicator of stress in traveling horses. Dr. Desmond Leadon is Head of Clinical Pathology at the Irish Equine Center and formerly International Director of the American Association of Equine Practitioners. He has a long-standing interest in the long-distance transport of horses. Dr. Michael Ball runs his own practice at Early Winter Equine Medicine & Surgery in Ithaca, NY. We thank these individuals for their contributions.

How Cross-Tying During Transport Affects Horses

Transport stress has long been thought to predispose horses to respiratory disease. The stress response during transport causes changes in serum cortisol concentrations, heart rate, immune parameters, and serum muscle enzyme activities. Another variable in the transport of horses—cross-tying—has been the subject of concern to UC Davis Center for Equine Health researchers. While cross-tying horses individually in stalls is common practice for transporting show and race horses, horses also travel in small groups or individually without being restricted by tying.

Dr. Carolyn Stull and Dr. Anne Rodiek recently conducted a study to examine the specific physiological responses of horses during transport to either cross-tying or traveling loose. They found that the cross-tied horses had larger increases of selected stress parameters 24 hours following transport than did horses traveling loose without being tied. In particular, they found that levels of serum cortisol, which is secreted during stressful situations, were greater in the cross-tied horses, although the levels returned to normal following transport.

Cortisol also affects other physiological responses, such as the neutrophil:lymphocyte (N:L) ratio, which may be a more reliable indicator of chronic stress than cortisol. A substantial increase in N:L ratio was seen in the cross-tied horses compared with the loose horses. Neutrophilia, indicated by an increased N:L ratio, has been associated with respiratory disease in horses following long-term road transport.

Other studies have found that elevation of the horse's head, which restricts the range of neck movements, compromises the immune system and increases the number of bacteria in transtracheal aspirates. The increase in bacteria is thought to be the result of a decrease in clearance rate of the bacteria from the tracheobronchial secretions in horses that are confined and unable to lower their heads. This information suggests that the practice of cross-tying may, along with other factors, predispose horses to respiratory disorders following transport. It also leads to further questions on the athletic potential and disease susceptibility of the horse during the recovery period and post-transit complications from other stressors such as social stress, thermal stress, and housing or pathogen challenges.

In view of these findings, Dr. Stull and Dr. Rodiek recommend that a small box stall is preferable to cross-tying during long-distance road transport. "If you have to use cross ties or a trailer design that keeps horses' heads elevated, unload every 6 to 8 hours to let them move around, graze and rest," advises Dr. Stull. And if you use a commercial carrier to ship a horse across the country, "pay the extra amount to get a box stall. It will be worth it when your horse arrives less stressed and ready to compete."

For air transport, cross-tied restraint is still largely used to prevent the horse from damaging the integrity of the pressurized cabin. In this case, the benefits of restraint outweigh the risks. ❄

If cross-ties must be used in the transport of horses, unload the horses every 6 to 8 hours to let them move around, graze and rest.

CEM Quarantine at the UC Davis Center for Equine Health

For horses imported into the United States from regions affected with Contagious Equine Metritis (CEM), a highly contagious venereal disease in animals, the long and arduous journey does not end at their point of entry in New York, Los Angeles or Miami. These horses are subjected to testing for specific diseases by the U.S. Department of Agriculture at each point of entry into the United States, where the horses remain in quarantine until test results are returned and the horse is certified as free from clinical evidence of disease. The quarantine period is a minimum of 42 hours.

Approximately 10% of all horses arriving in Los Angeles will have a transient fever, and that percentage increases in Friesians and in horses under the age of four. Any pre-existing respiratory disease would predispose a horse to shipping fever. The import quarantine staff in Los Angeles takes great care to ensure that the horses have had a chance to replenish water intake and are in good health prior to loading for road travel. Horses demonstrating evidence of shipping fever or other medical compromise are held in Los Angeles until they are fit to travel under the supervision of an experienced veterinary team.

When the initial import quarantine and testing requirements have been satisfied, stallions and mares 731 days of age or less which have been bred, and all stallions and mares over 731 days of age, must be consigned to a CEM testing facility to undergo the prescribed treatment and testing requirements.

From the Los Angeles import station, horses travel 8 to 10 hours (300 miles) by van to Davis. Prior to that, a typical travel history for these horses includes road transport to the airport of origination, 4 hours in a box stall prior to takeoff, 6 to 8 hours of air travel, and a minimum of 42 hours of quarantine at the import station.

Arrival Protocol at the Testing Facility

Upon arrival, each horse is inspected and its temperature, pulse rate and respiratory rate are documented. Any injuries or evidence of illness are reported to the staff. The horse is escorted to a private stall area by the transport personnel and offered hay and water. Most horses correct dehydration within hours of exposure to clean water. The stall lights are left on during the first evening to facilitate acclimation to their new environment. Night staff monitor the horse overnight.

Common initial observations include thin body condition, stocked up limbs from lack of exercise, or occasionally a missing shoe or abrasion from the trip. The first weekday after arrival, the horse is examined by a veterinarian, checked for any signs of overt lameness and videotaped to document its condition. The horse's body condition score and weight are recorded. The CEH staff contacts the horse owner or trainer to report any abnormal findings and to discuss observations and requests. Any vaccination or farrier services are scheduled. A communication schedule tailored to the owner's needs is established.

Since 1989, a total of 3,664 horses have come through quarantine at UC Davis. There have been 8 injuries, which equates to a 0.22% injury rate.

A large outdoor arena and round pen are available for horse owners or their delegates to exercise horses in quarantine.

CEM Quarantine
— From page 12

How does the CEH work to support these horses?

Approximately 6% of horses arriving from Los Angeles quarantine experience some form of illness associated with transport stress. UC Davis's state-of-the-art Veterinary Medical Teaching Hospital is located just 2.5 miles from the quarantine facility. Their world-class veterinary faculty and staff are on hand to ensure the well being of the import horses. Because the CEM program is federally controlled, the care and culture procedures are performed by CEH-trained technicians and veterinarian and are not part of the teaching program at UC Davis. Should a horse need medical care outside of the CEM testing, a faculty veterinarian from the Veterinary Medical Teaching Hospital is called to evaluate the patient.

Who is handling my horse?

The Center for Equine Health employs animal health technicians with extensive horse handling experience. They work as a team to maximize safety and minimize stress and they are knowledgeable regarding all testing protocols. The CEM organism requires specialized handling and transport media and strict adherence to protocol is essential to a successful quarantine. Horses arriving late at night are checked in by nontechnical staff who are instructed to contact the veterinarian on call with any concerns. Our facility is the only quarantine facility in the United States that has never released a CEM-positive horse.

Can my horse be exercised?

Exercise and grooming programs are available at the CEH. An Equinesizer is onsite, and a large outdoor arena and round pen are available for horse owners or their delegates. Riding time can be scheduled to help maintain fitness. An initial rest period of 3 to 6 days is advised.

What if my horse gets hurt?

Since 1989, a total of 3,664 horses have come through quarantine at UC Davis. There have been 8 injuries, which equates to a 0.22% injury rate. Horses do occasionally get themselves into trouble in a new environment and the CEH works to ensure timely, cutting-edge care should an injury occur. The horses are treated as individuals and decisions regarding their day-to-day care are carefully considered with safety in mind.

Please call or visit our website for current pricing and booking information or to view photographs of our quarantine facility: **www.vetmed.ucdavis.edu/ceh/quarantine.cfm**

Future Plans for Quarantine

The CEH has plans to install cameras in the individual stalls with online password-protected access. This will give owners and trainers the added comfort of round-the-clock visual access.

A quarantine horse is exercised in the Equinesizer.

Shipping Fever: Prevention is Key

By Nancy S. Loving, DVM

Imagine the scenario: You've been training for the big competition all year. Your horse has never looked better, he's stayed healthy, and he's performing to the best of his abilities. You load him in the trailer for the cross-country commute in hopes of bringing home the blue ribbon and set off on your journey. When you unload your horse at your destination, however, something is seriously wrong. The show veterinarian tells you that your horse is suffering from a pulmonary disorder called shipping fever, and just like that, your competition season is over.

A primary risk factor for the development of broncho or pleuropneumonia (pulmonary disorders commonly known as shipping fever) in horses is long-distance transport. At the 2011 American College of Veterinary Internal Medicine Forum, held June 15-18 in Denver, Colo., Rose Nolen-Walston, DVM, Dipl. ACVIM, assistant professor in the department of clinical sciences at the University of Pennsylvania's College of Veterinary Medicine, described the risk factors associated with transport-associated respiratory disease and what preventive methods owners can take.

Nolen-Walston explained that specific travel-associated factors amplify the horse's disease risk including a continuously raised head position, which causes profound and adverse changes in the respiratory tract's ability to effectively clear debris and microorganisms. Trailer design and standard restraint methods (ties) prevent the horse from fully lowering his head.

Nolen-Walston discussed one study in which researchers evaluated the effects of keeping a horse's head raised for prolonged periods of time—similar to their position when being transported. Within six to 12 hours, microbes increased exponentially in tracheal fluid and abnormal lung sounds (heard through a stethoscope) developed. Additionally, the researchers discovered that allowing the horses to lower their heads for 30 minutes every six hours was not effective in eliminating debris and microorganisms from the airways: "At least 8-12 hours is necessary to clear airway contamination," she added.

To compound this problem, some horses with pre-existing airway disease (such as influenza, heaves, or inflammatory airway disease) are at much greater risk for developing pneumonia. In these cases, the mucociliary clearance mechanism (which removes debris from the lungs) is already compromised before the horse even loads on the trailer. Simply, the horse will have an even harder time clearing debris from his lungs during transportation.

Stress has a negative impact on a horse's immune system, and hauling is considered one of the most common stressors for horses. Nolen-Walston noted that researchers have learned that the immune functions of horses transported loose in the trailer stall were significantly improved compared to those tied in the stalls.

Nolen-Walston also emphasized that ambient (environmental) trailer conditions along with air "quality" can amplify disease risk. Airborne dust, ammonia, and pathogens all increase substantially in trailers, she noted, particularly when feeding from a hay bag (which might increase the amount of inhaled particles in a horse's breathing zone) and when manure and urine accumulate in the trailer.

"In most trailers, the air exchange rate (the rate at which outdoor air replaces indoor air) is less than half the acceptable rate for a normal horse environment," she said. Agricultural engineers often recommend four to eight air exchanges per hour; however, some equine researchers and barn builders recommend 10 air exchanges per hour.

Nolen-Walston said researchers have found that horses allowed regular rest period along with frequent trailer cleaning (i.e., removing manure and urine-soaked bedding) had no mucopurulent (containing pus and mucus) material in their airways upon arriving at their destination.

"Respirable particulates and volatile gases are rampant in horse trailers," noted Nolen-Walston. "These features , along with the inability to lower the head, markedly increase a horse's risk of developing shipping fever pneumonia."

Although the risk of shipping fever can't be definitively eliminated, she recommended horse owners implement practices to improve the shipping environment and lessen disease risk. Such preventive measures include:

- Improve air quality by maximizing ventilation;
- Soak hay thoroughly if feeding en route to reduce the amount of dust present in the feed and thus inhaled by horses;
- Take longer, more frequent rest stops to reduce stress;
- Allow the horse to be loose in the box if and when possible; and
- Clean the trailer regularly along the travel route to reduce the amount of mucopurulent material the horse could inhale.

*Reprinted with permission of The Horse; visit **www.thehorse.com** for more horse health information.*

CEH
HORSEREPORT
Mail ID#1415
Center for Equine Health
School of Veterinary Medicine
University of California
One Shields Avenue
Davis, CA 95616-8589

RETURN SERVICE REQUESTED

Presorted
First Class Mail
US Postage
PAID
Davis, CA
Permit #3

View the videos in our award-winning online Horse Report!

The Horse Report **is now brought to you in an online format that allows us to include videos. If you can access *The Horse Report* from our website, you can read it sooner and save us the postage. Send your e-mail address to *ljchristison@ucdavis.edu* and receive an e-mail notice whenever a new publication is posted!**

www.vetmed.ucdavis.edu/ceh

The Center for Equine Health is supported with funds provided by the State of California Pari-Mutuel Fund and contributions by private donors.

CEH
HORSEREPORT

Center for Equine Health
(530) 752-6433
www.vetmed.ucdavis.edu/ceh
www.facebook.com/ucdavis.ceh

Director: Dr. Claudia Sonder
csonder@ucdavis.edu

Director Emeritus: Dr. Gregory Ferraro
glferraro@ucdavis.edu

Senior Editor: Barbara Meierhenry
cehwriter@ucdavis.edu

Management Services Officer: Katie Glide
kaglide@ucdavis.edu

Dean, School of Veterinary Medicine:
Dr. Michael D. Lairmore