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Equine Maternal Behavior and its Aberrations (6-Aug-2000)

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Normal Maternal Behavior

Maternal behavior has two phases: 1) general motivation to approach and nurse a neonate and 2) specific identification of the neonate as one's own. General maternal behavior is triggered by the events of parturition especially the fall in estrogen and progesterone and the appearance of a foal - like creature - small, wet, uncoordinated, with a foreshortened face and a high pitched neigh. The cervical stimulation which occurs as the foal is delivered triggers the second phase - specific identification. Cervical stimulation stimulates the release of oxytocin not only from the pituitary, but also into the olfactory bulb where, at least in sheep, nitric oxide and cyclic GMP potential glutamate release at the mitral to granular cell synapse, thus signaling a critical period during which the odor of the neonate encountered will be learned [1,3]. Subsequently all other neonates will be rejected. The sense she uses is probably not from the main olfactory system, but from the vomeronasal organ. In sheep, blockage of the entrance to the vomeronasal organ results in promiscuous ewes who will allow lambs other than their own to suckle [4]. The same is probably true of horses as well.

Maternal Recognition - maternal behavior in horses begins as soon as the foal is delivered. It may begin with nostril to nostril exchange of exhalations as occurs when any two horses meet for the first time. This is most likely to occur if the foal is positioned so that it is head to head with the mare. Licking of the foal usually begins when the mare stands and the licking is first concentrated on the fetal membranes around the foal's head. It is unclear whether this could serve to prevent a foal from being smothered by the membranes. Next, the mare concentrates on licking the foal's head. Later she will lick the hindquarters and perianal area and, only later, lick the center of the foal. The rate of licking decreases rapidly with time so that mares seldom lick their foals for more than two hours postpartum. There are exceptions - mares that lick their foals for much longer periods; but unlike many ungulates licking of the perianal area is not necessary to stimulate defecation. Although many species consume the placenta, horses rarely do. A survey of owners indicated that only 1% of mares eat the placenta [5]. Nevertheless, those few mares that do may suffer from colic if the placenta obstructs the gastrointestinal tract, usually at the ileocecal valve.

Following and Recumbency Response - ungulates are usually divided into followers and hidiers. Examples of hidiers are cattle and goats. The neonate remains at the birth site and the dam leaves to graze, returning to nurse her offspring. After a few days the kid or calf leaves "hiding" and follows its mother, but is generally more independent than lambs or foals who, as followers, leave the birth site within hours. Although foals are followers they can't follow all of the time because, like most neonates, they sleep much longer than adults do. They sleep most often in lateral recumbency indicating that they are in Rapid Eye Movement (REM) sleep which is associated with inhibition of all motor tone. The mare's behavior changes when the foal lies down. She does not continue walking, but instead stands over the foal. She may graze but does so within a few meters of the foal, usually in a circular path around him rather than in the straight path she pursues when the foal is upright. The closer she is to the foal the younger the foal is. Mares vary in their attachment to their foals, but are consistent across foals. Some mares stay within 5 meters of their foals for months; others spend less and less time close to the foal as it matures. This does not vary with the sex of the foal [6,7].

Nursing - foals suckle very frequently - three to four times an hour during the first week of life. This is true of New Forest and Welsh ponies, Thoroughbreds, Arabians, Belgians (nursing Belgian or mule foals) [8,12].

The time spent nursing does not vary much as the foal matures. The normal foal suckles for a minute or two. Although the frequency of nursing decreases to once an hour by the time the foal is five months old, nursing bout length does not change [13].

Aberrant Maternal Behavior

Aggression to Humans and Horses - it is normal for mares to be aggressive to any animal approaching their foals. Presumably, this aggression has evolved to keep the foal from following another horse during the sensitive period in which it learns to identify its mother. This also is probably a response to mares that try to steal the foal or stallions that try to kill it. Duncan [14] has reported infanticide by stallions; the foal's attacker is usually male. Infanticide by newly introduced stallions has also been reported in Przewalski's horses [15] and zebras [16]. Geldings may show this behavior so it is not wise to pasture geldings with mares and their young foals. Geldings that show other signs of stallion-like behavior (mounting, flehmen, aggression to other males) are those most likely to attack a foal.

Mares usually are not aggressive to their familiar caretaker, but may be aggressive to other humans. Veterinarians, in particular, may be attacked by mares shortly after parturition. Mares should be properly restrained, but able to see their foals so that they do not become agitated.

A case of extreme post - partum aggression was that of a warmblood thoroughbred cross mare who bit off her owner's finger. She had been aggressive to others but not the owner before she foaled. The mare was particularly aggressive to dogs. This is not surprising as wolves were serious threats to foals and still kill the neonatal foals of Przewalski's horses released in Mongolia [17]. The mare gradually became less aggressive over the next few weeks.

Foal Rejection - foal rejection can take several forms. In the mildest form, the mare accepts and licks the foal, but will not allow it to nurse. In another form, the mare will have nothing to do with the foal and may kick it if it approaches too closely. The most severe form is the mare who attacks the foal, attempts to bite its neck and throws it. The behavior is similar to that of an infanticidal stallion. All of these forms of rejection are most likely to occur in primiparous mares, an indication that maternal experience is important. Apparently, there is a learning component even to this innate behavior. Nevertheless, some mares will reject one foal after another. Two findings led us to investigate the genetic aspects of this behavior. Mohammed Matook noted in his Ph.D. thesis, "Maternal behavior in Arabian Mares", that 9 mares of 107 Arabian mares at the Egyptian Agricultural Organization (EAO) rejected or partially rejected their foals. The mares that rejected were all from one of several families kept at the EAO.

The other finding was the result of a request for information from owners of foal-rejecting mares. The request and a sample history form were published in a variety of equine magazines (Equus, Compendium of Continuing Education, Horse and Rider, the Bloodhorse, Equine Practice, etc.). Of the 135 cases of foal rejection reported, 70 (52%) were Arabian, 24 were Quarterhorses, and 14 were Thoroughbreds. Most (101) of the mares were primiparous. Rejection occurred immediately after parturition by 95 mares, 12 hours after parturition by 11, and 24 hours after parturition by 14. Ten foals were killed or died as a result of rejection [18].

To address the question of breed predisposition more accurately, the cooperation of the Arabian Horse Registry of America and The American Paint Horse Association was obtained. Letters were sent to 800 owners of foals of each breed born in 1993. Responses were obtained from 720 Arabian owners (90 %) and 657 Paint horse owners (82 %). Five percent of Arabian foals had been rejected, but only 2 % of Paint foals. Twenty-one Thoroughbred farms were surveyed in 1992 and 1993 in Japan. The incidence of foal rejection was 0 of 371 foaling in 1993 and 0.5 (1 of 411) in 1994 [19].

In order to determine if either estrogen or progesterone were involved, blood samples were taken from Arabian mares at the EAO 30 min before foaling and 15, 30, 60 and 90 minutes after foaling. The levels of both hormones were lower in the four mares who rejected. The pre-foaling progesterone levels were significantly lower. Whether hormone therapy would prevent aggression is unknown, but is worth considering. Progesterone is used post - partum in combination with acepromazine to treat rejecting mares. In addition to being a tranquilizer, acepromazine - a dopamine blocker - should stimulate prolactin release from the pituitary. Prolactin itself may not regulate maternal behavior in mammals, but it does stimulate milk production. Neonatal foals normally suckle several times an hour. If the mare must be restrained for nursing, owners usually do so only every few hours. The mare is apt to "dry up", that is cease lactating, if the stimulus of suckling is not applied frequently enough. The sympathetic nervous system stimulation in the aggressive mare and the failure of frequent suckling often combine to inhibit milk production. Therefore, an increase in

prolactin levels should be helpful. Oxytocin injections are also used to insure milk let down.

The other problem with separating the foal for hours at a time is that the mare will not have visual contact with the foal. The foal can suckle at will if the mare is restrained behind a pole that allows access to her udder by the foal, but does not allow her to move sideways. Her head should be tied so she cannot bite the foal. The foal should not be able to get behind or in front of the mare. Some mares cow-kick and/or squat to prevent the foal from nursing. A bale of hay or bag of shavings between her fore and hind limbs will prevent those activities. A bag of shavings is safer because there is no baling twine to entangle the mare.

The mare can be rewarded with food or rubbing when she allows the foal to nurse. If she does aggress, she can be punished with a loud noise - like that produced by a plastic bat struck on the stall. Most mares and foals learn that the mare cannot object to suckling. Gradually, most mares will accept the foal, but in extreme cases hobbles may be necessary. After several weeks, it will be safe to allow the mare some freedom but she should be observed closely. Although forcing acceptance is labor saving and better for the foal's eventual behavior than hand rearing, the danger that the mare will seriously injure the foal still persists. Owners who can afford it, can buy a nurse mare, a mare whose own foal has just been removed.

Foal rejection can be prevented - for example, well designed neonatal foal facilities have transparent partitions between the mare and foal so that the mare does not "forget" the foal. Mares who have previously rejected a foal should not be bred to prevent spread of the genetic tendency. Alternatively, a mare who has rejected before can be taught to stand in the narrow restraints before foaling so that they will habituate to it. Their udders should be palpated and the mares should be rewarded for allowing manipulation of the teats pre-partum. The foaling mare should not have visual contact with other horses or she might redirect aggression against those horses to her foal.

Example of Foal Rejection - the horses involved were a 4 year old primiparous 470 - kg registered Appaloosa mare, and her newborn, a 34 - kg foal. The mare foaled between 7 and 9 AM, while in a 1 - hectare pasture where 2 geldings also were kept. The horses had been together for several years. There were no other livestock on the property or nearby. When the owner discovered the mare, the mare and 1 of the geldings, an 18 - year-old Appaloosa, were both lunging at the foal, who was still damp and attempting to stand. The foal was lying near the electric fence. The other gelding was standing some distance away. The mare had not passed the placenta.

The mare may have begun to bite the foal, then was joined by the gelding, or the mare may have attacked the gelding when he threatened the foal, then re-directed aggression to the foal. Causes of abnormal maternal behavior in horses are unknown. Lack of experience, hormonal imbalance, stress during parturition or lack of contact with the foal during the sensitive period for bond formation may be factors.

The importance of the retained placenta in this case is unclear. Many mares with retained placentas accept their foal and mares that do not retain the placenta reject foals. Nevertheless, pain and stress can interfere with maternal behavior.

After the mare and foal were placed in a stall, minor abrasions on the foal were treated with wound glue. Four hours later, the mare had not passed the placenta. Administration of 40 IU im of oxytocin was ineffective, so the placenta was manually removed, including one small piece that had torn loose. The mare was treated with tripelethamine hydrochloride, procaine penicillin G and phenylbutazone. The afternoon of the second day after parturition, 40 mg of acepromazine was given im, with minimal effect on the mare's behavior in that she did not accept the foal. Treatment with promazine granules was equally ineffective. The mare appeared to have uterine contractions which were visible on the external abdominal wall whenever the foal nursed. If she aggressed toward the foal, the owner would further restrain the mare by twisting the mare's upper lip (hand twitching). Because endogenous opiate concentrations are believed to be increased by twitching, the mare would be calmed [20]. However, this may not be the best approach because opiates can block maternal behavior.

The mare continued to initiate aggression toward the foal whether or not the foal was approaching her. The mare was first restrained by tying, then by cross - tying. This prevented her from chasing or biting the foal, but she could still swing her hindquarters and kick. Boards were placed across the stall so that she could not move laterally; she was effectively in a stock. In this arrangement the foal could reach the udder and suckle because the mare could not reach the foal, except by cow kicking. Furthermore, the owners did not have to supervise nursing around the clock.

The owners observed that the mare's aggression toward the foal decreased in frequency. After 10 days, the mare appeared to let down milk more readily and allowed the foal to empty the udder. After approximately 20 days of restraint, the mare's behavior seemed normal.

When first turned out, the mare kept the foal away, but eventually, after several weeks, she began to nudge the foal to nurse and aggressed against the gelding and the owner, while protecting the foal. This phenomenon, stimulation of maternal behavior by forced proximity, is called concaveation or sensitization.

Fostering - it is best to have a mare raise a foal rather than bottle feed it. Not only will the foal be healthier because of the maternal antibodies that are present in the foal's gastrointestinal tract if he is drinking mare' milk rather than a formula, but also he will be much better socialized to other horses. Hand raised foals, especially colts, often become difficult to handle because they are not afraid of people. Fear of humans is the basis of much of the negative reinforcement used in horse training from round pen work to dressage. Foals may need to be fostered onto other mares because their mother died or rejected him or because the mare has to travel to be re-bred and the foal would be vulnerable to the stress and pathogens in a new environment. Nurse mares can be purchased. These are usually mares that show very good maternal behavior, but they still will be able to recognize that the foal is not their own. Therefore, the mare should not be allowed to sniff the foal until it has been suckling from her for at least 24 hours. Meanwhile, the mare should be tied so that she cannot turn and a barricade such as screening placed between her and the foal to prevent all contact except suckling. Rubbing the foal with the mare's milk or feces has been suggested, but is usually not necessary if the foster mare is adequately restrained. If sniffing under the foal's tail occurs as he begins to suckle and the mare continues to allow suckling, she has accepted him. It is hypothesized that the mare recognizes the smell of her own digested milk, but this has not been proven. After 36 hours, more contact should be allowed.

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