Proceedings of the Third Annual Meeting for Animal Production Under Arid Conditions, Vol. 2: 145-153

New Technique for Soft Palatectomy in One-humped Male Racing Camels

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ABSTRACT

In adult male camels the presence of an extremely large soft palate coupled with a palatine diverticulum known as the "DULAA" impedes with airflow in upper respiratory tract. This potentially reduces the maximum oxygen uptake and therefore, lowers performance results. Surgical resection of the dulaa is reviewed and the technique used at the center is described with results discussed and comments on its effect on racing performance noted.

Key words: Soft palate, Palatine diverticulum, Oxygen uptake, Racing, Camels.

INTRODUCTION

Camel being an integral part of the desert ecosystem is extremely well adapted to survival in hot dry conditions of the world deserts. However, under optimal management and feeding, it is also capable of admirable feats of endurance and speed. Camel racing is a well- organized sport in the Middle East with a large number of camels trained to compete for lucrative prizes during racing season. The racing season in UAE is from October to April every year.

The camel is an obligatory nose breather (Cooks, 1992). It has the longest soft palate of the domesticated animals, which lies in an extraordinarily long and narrow pharynx (Smuts and Bezuidenhout, 1987). A sexually active male will use soft palate (dulaa) as an accessory sex organ when checking receptivity of females or in territorial disputes with other males (Dorges *et al.* 1992). During racing, attempts to inspire through the mouth are associated with fatigue and naso-pharyngeal restriction. In such camels, mouth

breathing is accompanied by lip frothing, dysponea and utmost poor racing performance (Cooks, 1992).

Exercise induced dysponea in racing camels is associated with naso-pharyngeal restrictions on airflow. Naso-pharyngeal obstruction can be associated with the presence of the palatine diverticulum (dulaa) in males, nasal bots (nasal myiasis), exercise induced pulmonary hemorrhage and occasional growths like hematomas and tumors (Manefield and Tinson, 1996).

The frequent exteriorization of palatine diverticulum is one of the most distinguishing anatomical specialties of the adult male (Hegazi, 1994). It is not seen in any other mammal, even close relatives like the Bactrian camel or South American Llama (Tibary and Anouassi, 1997). The dulaa is described as a loose extension of tissue which when extended, can reach a length of 25-35 cm (Leese, 1927). It hangs from the oroventral aspect of soft palate the Vesica buccalis (Dorandi, 1936) and Vesica palatine (Arnautovic and Magid, 1986). This diverticulum is present in both sexes but is far better developed in males (Rathore, 1986 and Manefield and Tinson, 1996). The soft palate is dorsally attached and a free ventral aspect with surface folds when not distended. In camels, the palatine muscles are well-developed (Tibary and Anouassi, 1997). Both sides of the diverticular wall consist of stratified epithelium which is separated by a thick layer of alveolar tissue with few mucous glands (Hegazi, 1994).

The exact method of distention is not well understood but may occur when air is forced from the lungs into the oral pharynx against the closed naso-pharyngeal opening (Posterior nares), to inflate and balloon the soft palate. Most male camels display their dulaa to the right commissure (Manefield and Tinson, 1996). The reason for this predisposition is still unknown, (Singh and Prakash, 1964; Khan and kohli, 1972 and 1973).

In the case of racing camels, female run faster than male camles. The presence of the well developed palatine diverticulum in males as well as the heavier body frame allow the female of the species to record the fastest times. Males, on average, tend to be 20-30 seconds slower at 8 and 10-km distances. The restriction of air-flow through naso and oro-pharynx restrict the potential maximum oxygen uptake (VO_2 max) under strenuous workload. In human athletes failure of oxygen transport during strenuous exercise is

associated with muscular weakness. Oxygen deficiency at the mitochondrial level will result in intracellular lactate accumulation. The camel with the best endurance will be those that have relatively high maximum oxygen consumption. (Evans *et al.*, 1992).

Surgical resection of the dulaa in the adult male dromedary is practical to improve air movements in the upper respiratory tract, which enables them to compete more effectively. Our aim was to develop a technique that was both simple to perform but maximized the amount of tissue resected thus optimizing the airway passage

Fig. 1: A sexually active dromedary male with dulaa.

MATERIALS AND METHODS

In a two-year period from 1996-98 over 50 camels were selected for dulaa resection. Camels selected for surgery are generally four and six years old with the procedure performed before the camels started serious racing or at the end of a season of poor performance. Food was withheld for 12 hours prior to surgery being done. When surgery was done at the end of the racing seasons the cases were always attended very early morning to avoid high ambient temperature.

The technique involved couching the camel in sternal recumbency with the animals front and back legs restrained with rope or straps (Manefield and Tinson, 1996). Tranquilization was administrated using a combination of Rompun (xylazine 100 mg/ml) and Ketamine (Ketamine hydrochloride 100 mg/ml) I.V. at a dose of 0.25 mg/Kg of each). The oral cavity was flushed with 2% solution of potassium permanganate after allowing the tranquilizers time to work (5-10 min.). The mouth was held open with a Housmann or a T-shaped Varnells gag (Fig 2) and the tongue held out to the side. One camel attendant held up the head while another attendant ensured thew camel stayed upright in sternal recumbency throughout the procedure.

Long grasping forceps are used to reach to the back of the pharynx to grasp the dulaa. It was then drawn out of the mouth to its maximum possible extent anteriorly and spread horizontally with the aid of an assistant to visualize the vessels. Two long curved angiotribes were then introduced deep into the pharynx from either side of the flattened dulaa. The clamps are then closed as close as to the base of the dulaa as possible in a V-like pattern, at 45 degree to the lateral edges of the dulaa. If there are any major vessels present (esp with large dulaa) they are cauterized and the extended dulaa is cut of anterior to the line of cauterized vessels. The clamped tissue is returned back deep in the pharynx with the clamp still present and was removed after one minute. In the younger (4.5 years old) camels where the dulaa can only be exteriorized to the level between the mouth commissure, a single clamp with no cautery is often sufficient. The oral cavity was flushed with the antiseptic solution again with head in lowered position to wash out excess saliva and blood. Camel was kept in sternal recumbency throughout procedure.

The sedation is reversed with Xylex (4-anminopyridine 24 mg/ml Parnell, Australia) and Reverzine (Yohimbine Hydrochloride 10 mg/ml, Parnell, Australia) in combination as an I.V. injection at 1 ml of each 100 Kg body weight. Post operatively the camel receives one shot of long acting terramycine. Camels were kept off feed for 24 hours and then introuduced to finely chopped fresh Lucerne for the next couple of days.

Fig. 2: Maximum possible exteriorization of dulaa to visualize the major vessels.

RESULTS

The technique has proved to be quick and complication free provided the tranquilization dose was sufficient. It allowed for optimal visualization of surgery site. Total time for the procedure was between 15 and 25 minutes depending on the age of the camel, the size of the dulaa or weather it had been tranquilized for any previous procedures involving the use of Rompun and ketamine. In all camels there was minimum postoperative infection and within 3-5 days all camels were eating normally.

By maximizing the exteriorization and resecting the dulaa deep in the pharynx, a maximum amount of tissue (Fig. 3) is resected and post surgically one can visualize a hole in the soft palate with ventral border intact. In young camels where the teeth that only just erupted the resected tissue was approximately half that show in (Fig 3). Camels that were endoscoped a few weeks after surgery showed that the hole had closed over and flattening of the profile of the soft palate in the pharynx had occurred. This significantly improved the potential for more rapid air movements in the upper respiratory tract. With regards to performance there has been a positive effect on the

camels that received the surgery. All camels monitored showed improvement in their performance particularly when time comparisons were done over 8-km pre and post surgery. In 30% of the cases the 8-km improvement was of the order of 20 seconds.

Fig. 3: Maximum amount of dulaa tissue resected.

DISCUSSION

Racing camels have got a high capacity for both endurance and high intensity exercise. Camels can make certain changes in their respiratory rate to meet high demands during races. Being a natural pacer they can often pace and gallop at similar speeds especially towards the end of the races. Camels, like horses, do exhibit locomotor respiratory coupling at both gaits (1:1) (Cooks, 1992). Rose *et al*., (1992) observed a linear increase in maximum oxygen uptake (VO_2 max) at speeds from 2-8 meter/sec. Maximum VO_2 max (55-65 ml/Kg BW) is achieved at the relatively high speed of 9-10 meter/sec (Rose *et al.*, 1994). Whilst one would assume a lower value for an adult male, but it would be interesting in the future to be able to compare oxygen uptake on a treadmill pre- and post-surgery in a male camel. This could be done using similar methods to the rose experiment at our center in 1992 to quantify the improvement in maximum oxygen uptake.

Experimental surgeries done on racing horses over the last few years have centered on removal of small folds of tissue in the pharynx either by surgery or laser treatment. This has resulted in smoothing of pharyngeal mucosa, improved air movement and improved track performances. If small folds can make a difference in horse racing performance, there is no doubt that resection of the large diverticulum will make difference in the performance of racing camels.

At maximal exercise, an attempt to breathe orally to meet with VO_2 max demand results in dorsal displacement of soft palate against the epiglottis (Cooks, 1992). This will act as an obstruction in the upper respiratory airway and impedes VO_2 max values. This will also interfere with the potential for Locomotor Respiratory Coupling and ultimately gives poor performance.

Dulaa surgery has been described by Ramadan, 1966; and Tibary and Anouassi, 1997). However, these authors have advocated a technique of suturing the resected edges, which is probably fine for non-racing stock, but in race camels this would lead to a number of problems. Firstly, the amount of tissue resected is not optimal, since one has to limit the resection position to be able to suture successfully. Secondly the suture acts as a foreign body and often causes a large thickened area in the soft palate. This further interferes with airflow and does not take advantage of the potential scarring and flattering of the soft palate. Suturing is also a time consuming procedure. Gahlot and Chouhan (1992) reporetd the death in one camel due to bleeding stump of tissue causing asphyxiation.

The effect of suppression of testicular functions (Dowsett. *et al.*, 1996) using a reversible gonadotrophin releasing hormone (GnRH) vaccine (Peptide Technology N.S.W. Aust.) on a soft palate development in young bulls is currently in progress at our center. As well as a method of reversible reproductive control which may offer an alternative to surgery in the future. However at present surgical intervention is the only method used to influence potential airway obstruction caused by the dulaa.

CONCLUSION

The surgical resection of the dulaa provided better air movements in the upper respiratory tract during strenuous exercise.

The improvement is yet to be accurately quantified but pre and post surgical results indicate a positive effect on the performance of male camels in the race track. The technique is quick to perform, gives good results and has minimal complications.

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