Vol 19 No 2, p 165-168

CAROTID LATERALISATION FOR REPETITIVE ARTERIAL BLOOD SAMPLING IN CAMEL (*Camelus dromedarius*)

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ABSTRACT

Surgical lateralisation of the left carotid artery (LLCA) is frequently used to allow easy access to direct (invasive) arterial blood pressure and blood gas measurement in experimental settings. An experimental study was conducted in 15 dromedary camels of 2-12; average 4.9 ± 2.6 years and weighing 250-480, average 375.4 ± 74.3 kg. Animals were divided into 3 groups receiving one of 3 different surgical lateralization techniques. In group 1, the carotid was exposed over a continuous suture bed and covered with a wide skin flap. In group 2, a tunnel was made at the ventral part of skin flap to pass and cover the carotid artery. In Group 3, the carotid artery was loosely inserted subcutaneously between the sternocephalic and intertransverse muscles and held through a loop of non-absorbable suture material protruding with its free ends over the incision line to allow easier localisation and gentle grasping of the artery during experiment. Animals were observed for 7 days and any abnormalities noted. Base echocardiography was performed before collection of samples. Arterial and venous samples were collected twice from each group. Five animals died at variable period after the operations. Thrombosis in 4 animals (2 from group I and 2 from group II) was noted, and Post-mortem angiographaphy in one camel showed cerebral ischaemia.

Key words: Anatomy, camel, carotid arterial blood sampling, dromedary

Ventilation and oxygenation disturbances frequently occur in large animal patients during general anaesthesia. These can be monitored with spirometry, capnography and pulse oxymetry, but only blood gas analysis of arterial blood samples give accurate information about these 2 parameters. Arterial catheterisation may simultaneously also be used for invasive blood pressure monitoring. Arterial catheterisation and blood sampling are often done at peripheral arteries such as the femoral and the dorsal pedal artery in dogs and cats, or in the transverse facial as well as the facial artery in horses (Hall *et al*, 2001). However, that appears to be complicated in camel owing to their hard and very thick skin layers and subcutaneous fibrous connective tissue (Smuts and Bezuidenhout, 1987)

The carotid artery is commonly used as an alternative vessel due to its size and location. However lateralisation of the left carotid artery is a challenge due to the anatomic complexity in this region and presence of many vital structures (Smuts and Bezuidenhout, 1987). Various methods exist for its lateralization in many species for research purposes that require direct access to the carotid artery (Fredeen and De Peters, 1985; Graham *et al,* 1937; Schambye, 1951; Linzell, 1963). These methods are complicated and inappropriate for unrestrained patients, and do not permit frequent sampling over extended periods of time (Schambye, 1951; Hecker, 1974; Fredeen and DePeters, 1985; Peshin *et al,* 1986). Anaesthesia studies in camels like in other species also require blood gas and invasive arterial blood pressure measurement. To our knowledge there is no method mentioned in the literature which describes the lateralization of the carotid artery in this species.

The objective of this study was to evaluate and compare the use of three different surgical techniques for lateralisation of the left carotid artery and observe their complications in dromedary camels.

Materials and Methods

Fifteen camels were used in this experiment out of which 8 were males and 7 females aged 4.93 ± 2.64 years (2-12 years) and weighed 375.42 ± 74.27 kg (250-480). All animals were fasted for two days prior to surgery. These were sedated with 0.2 mg

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Kg^{-1} xylazine ((Ilium-Xylazil-20, Troy Laboratories, Australia), and followed by injection of 0.8 mg Kg^{-1} Ketamine (Ketamil, Troy Laboratories, Australia) for induction. Animals were positioned in right lateral recumbency and the proximal half of the neck was prepared for aseptic surgery. The skin of the jugular groove was longitudinally incised ventral to inter-transverse muscles at the level of the 3rd cervical vertebra. The skin was dissected from the subcutaneous tissue and the incision was deepened bluntly parallel to the external jugular vein and sternocephalic muscle (Kanan, 1970). The carotid artery was bluntly dissected from the carotid sheath and vagus nerve so that it could be relocated subcutaneously without tension.

The animals were then divided into three groups according to the technique of lateralisation as follow:

Group I (six animals)

The thin fibrous tissue dorsal to the jugular vein was reflected beneath the carotid artery and sutured in a continuous manner to the fascia of the inter-transverse muscle. The skin incision was sutured over the carotid artery in interrupted mattress fashion (Fig 1 a,b).

Group II (six animals)

The carotid artery was exposed subcutaneously as in group I. A twice transversely cut and a strip of 10.0 mm was obtained at the middle third of the ventral edge of skin wound. This skin strip was reflected beneath the carotid artery (cushion like) and sutured to the corresponding part of the dorsal edge of the skin wound. The upper and lower thirds of both dorsal and ventral edges of the skin were sutured together over the carotid artery forming a tunnel where the carotid was passed over the thin 10.0 mm flap and covered with bigger skin flap (Fig 2).

Group III (3 animals)

The carotid artery was loosened and pulled to the operated field. A silk loop was made to encircle the artery for mobilisation. The skin was closed with interrupted mattress sutures.

All animals in the groups received 20 mg Kg^{-1} oxytetracycline (Oxytetracycline 10%, United Veterinary Drugs, Jordan) as broad spectrum antibiotic repeatedly every other day for 7 days. The wound was then covered with protective bandage.

Postmortem angiogram

The head and neck of one animal (group I) which died secondary to necrotic carotid artery was disarticulated at its base. The common carotid arteries of either side were identified at the thoracic inlet. Each artery was perfused with liberal amount of barium sulphate suspention using a 50 ml syringe under manual pressure. The injection was terminated when drops of the contrast media appeared at a lingual incision. Lateral and ventrodorsal radiographs were obtained before and after injection of the contrast media (Fig 3-5).

Results

All animals showed an uneventful recovery from anaesthesia. The first arterial sampling was obtained 7 days after the operation. Two animals (one from group I and one from II) showed weak, and necrotic carotid arteries at time of sampling, and therefore the right carotid was catheterised under local analgesia for continuation of the experiment. Suture sepsis and dehiscence occurred 10 days after the operation in two animals (group I). Five animals died after variable periods of time. The cause was attributed in 4 animals (2 from group I and 2 from group II) to cerebral ischaemia secondary to thrombosis of the carotid arteries, as confirmed by a post mortem angiogram in one animal (Fig 3). While the cause was attributed in one camel (Group II) to severe haemorrhage after repeated friction of the neck on the fence.

The result of postmortem angiogram showed complete perfusion of the normal carotid artery on the right side compared to the left ones. The decrease in perfusion was more noticeable at the cranial tributaries suggesting possible ischaemia.

Discussion

The period of carotid lateralisation and cannulations could vary from a short to extended time periods. Sharma *et al* (1984) described first catheterisation of the carotid artery and jugular vein of camels and obtained samples for a period of 30-40 minutes. A few years later Peshin *et al* (1986) extended the sampling period for over 105 minutes. In other large animals, repetitive sampling could be obtained at the rate of 1-3 times a day for period of 72 consecutive days and 90 days (Orsini and Roby, 1997; Tavernor, 1969). In the small animals repetitive sampling was achieved for 2-5 months (Prassinos *et al,* 2001).

The result of the current study suggest that catheterisation in the camel was achieved only for 3 weeks. During the first week, the behavior of the camel changed drastically. Some animals

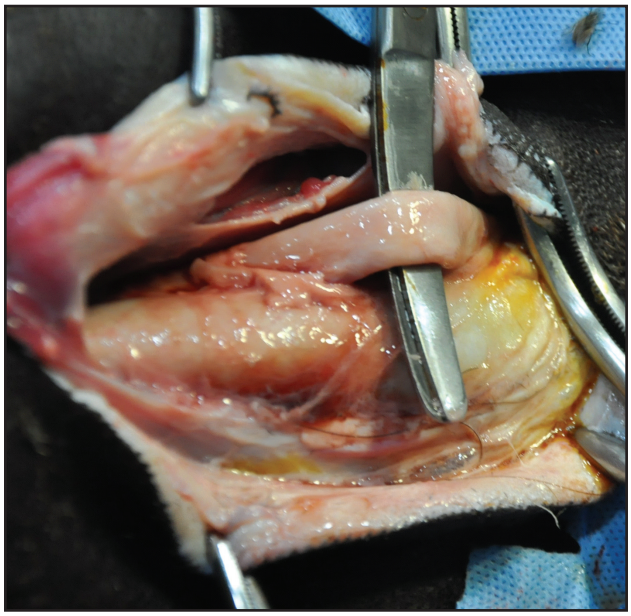

Fig 1a. The carotid artery is lifted over the jugular vein in a camel of Group I (A).

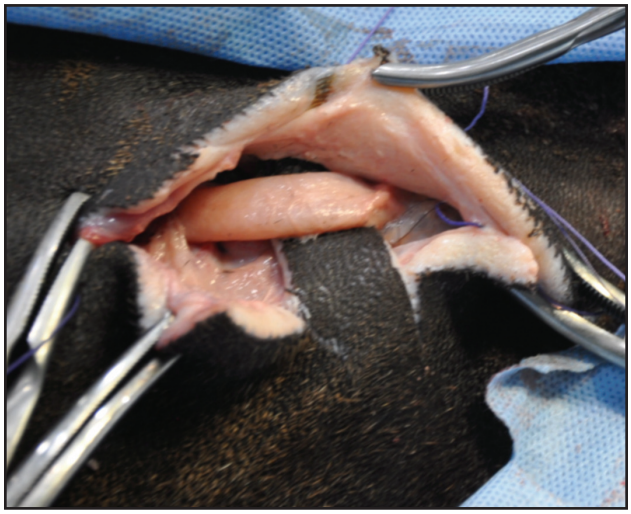

Fig 2. The carotid artery passing over a tongue of skin flap in a camel of Group II.

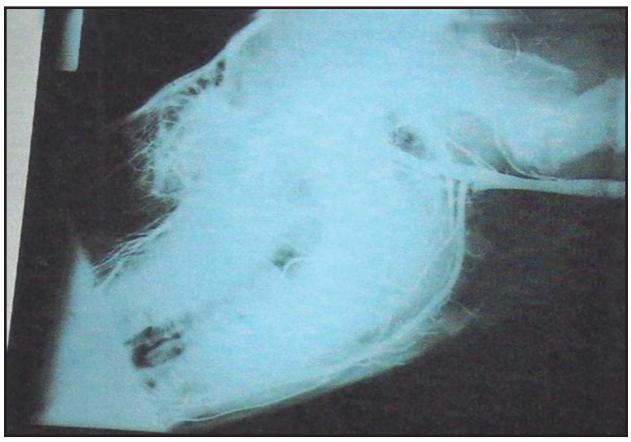

Fig 4. Lateral radiograph of head of a camel as shown in fig 3.

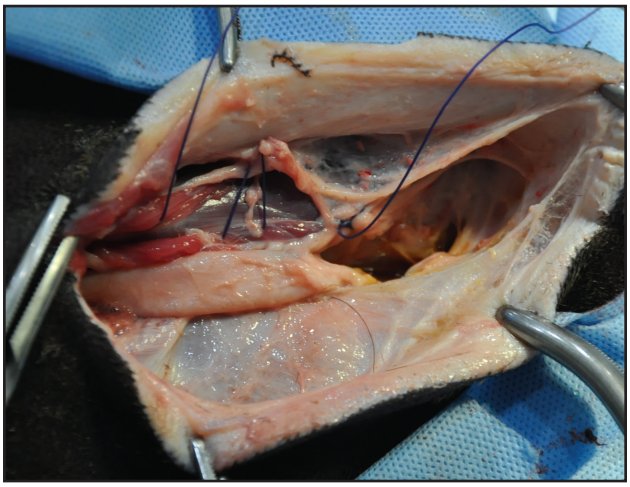

Fig 1b. Continuous suture pattern under the artery in a camel of Group I (B).

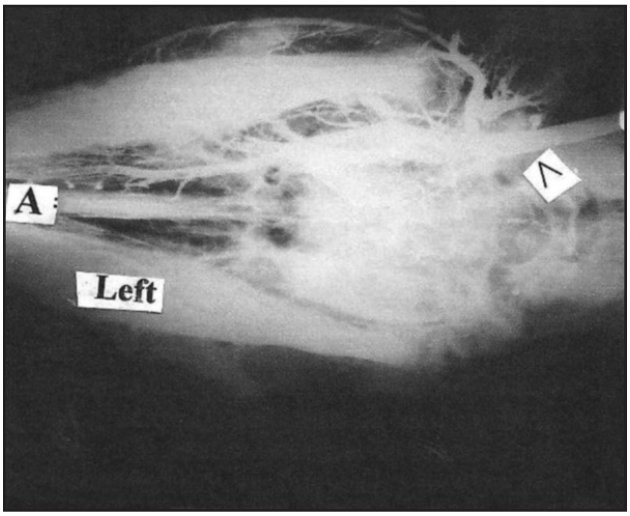

Fig 3. Ventrodoral radiograph of the head of a camel showing terminal branches of the common carotid at the mandible(>) (Note insufficient filling of the artery on the left side. (Bottom). A=Nasal septum.

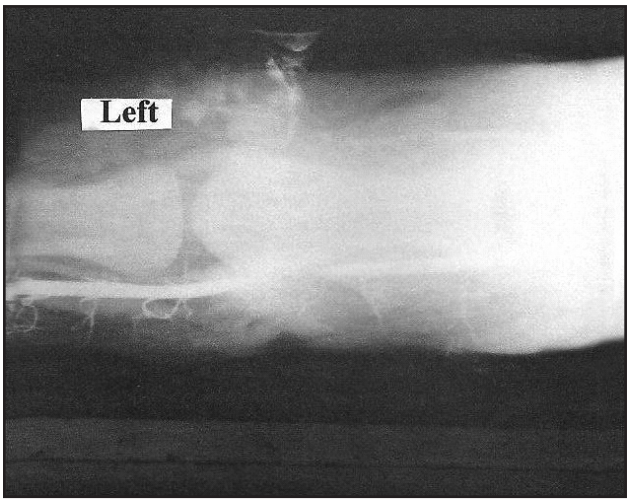

Fig 5. Ventrodorsal radiograph of neck at level of 3rd cervical vertebrae showing filling of right common carotid artery.

did not accept the injury and increased its neck swing thus subjecting the artery to thrombosis and collapse. Other animals kept scratching the neck against hard surfaces, sustaining severe laceration to the carotid with fatal consequences. Thereafter the rate of adhesion around the artery was increasing and leading to thrombosis, wound dehiscence and infection. Four animals (2 from group I and 2 from group II) developed thrombosis after commencement of experiment. Friction may lead to weakening of the carotid and thrombosis, that is similarly to what has been reported in the literature in other species (Prassinos *et al*, 2001). Although the adopted technique in this study was similar to those performed in sheep and goat, our results are inferior to those reported elsewhere. This may be attributed to differences in anatomic topography as the carotid artery in camel is more deeply situated than in other animals. It needs excessive traction to be brought to a subcutaneous location. In our study the carotid loop adopted in group III, facilitate traction before adhesion around the artery commence. When the loop remains without traction for more than two weeks adhesion occurs making the artery inaccessible. Therefore it was suggested to protect the carotid artery within a piece of polyethylene tubing in the future experiment (Tavernor, 1969).

Acknowledgement

Thanks are due to Prof Abdelhadi Ali Department of anatomy for his comments.

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