INFRAORBITAL NERVE BLOCK WITHIN THE *PTERYGOPALATINE FOSSA* OF THE HORSE: ANATOMICAL LANDMARKS DEFINED BY COMPUTED TOMOGRAPHY.

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ABSTRACT

In order to provide anaesthesia of the equine maxillary cheek teeth, a local nerve block of the infraorbital nerve in the pterygopalatine fossa had been proposed, which is referred to as the "Palatine Bone Insertion" (PBI). As several complications with this method were reported, our study was designed to recommend a modified injection technique which avoids the risk of puncturing of relevant anatomical structures.

Five cadaver heads and two living horses were examined by contrast medium injections and subsequent computed tomography (CT). Spinal needles were inserted using two different insertion techniques: The above mentioned (PBI), and a modification called "Extraperiorbital Fat Body Insertion" (EFBI).

Both techniques (PBI and EFBI) provide a consistent distribution of contrast medium around the infraorbital nerve. However, only the EFBI technique is appropriate to minimize the risk of complications.

This study is an example for the permanent challenge of anatomists to supply a basis for clinical and surgical procedures.

KEY WORDS: horse, anaesthesia, maxillary foramen block, cheek teeth, equine dentistry

INTRODUCTION

A local block of the infraorbital nerve in the pterygopalatine fossa had been proposed to achieve sufficient anaesthesia of the maxillary cheek teeth. For this purpose, a spinal needle was inserted between the zygomatic arch and the rostral margin of the ramus of the mandible until the needle contacted the perpendicular plate of the palatine bone. Subsequently, 20 ml of an anesthetic (2% Lidocaine) were infiltrated (2, 4, 5). This procedure was well tolerated by sedated horses. However, several complications such as hematoma, exophthalmos, and blindness were observed after application of this technique.

The objective of our present study was to provide a fundamental anatomical basis in order to improve the insertion technique and to minimize the risk of complications. Therefore, the examinations were focused on two issues:

First: Re-examination of the gross anatomy of the pterygopalatine fossa, with special attention to relevant arteries, veins and nerves that might be affected by insertion of a spinal needle.

Second: Simulation of the infiltration of the anesthetic by injecting a contrast medium.

MATERIAL AND METHODS

Heads from five warm-blood horses (3 male, 2 female, 2 - 15 years old) were collected immediately after euthanasia. A simulation of an infraorbital nerve block was performed by injecting contrast medium (Solutrast 250©, non-ionic, 250 mg iodide in 1 mL water; Altana Pharma Deutschland GmbH, Konstanz, Germany) into the pterygopalatine fossa. For this purpose two different injection techniques were applied: The previously recommended

“Palatine Bone Insertion” (PBI), and the new “Extraperiorbital Fat Body Insertion” (EFBI). Subsequently, the distribution of the injected contrast medium was determined on CT images.

The same procedure was also applied to two female horses under general anaesthesia (12 and 15 years old) immediately before euthanasia for other medical reasons.

Following CT scans, the specimens were either dissected or deep frozen so as to be able to cut transversal slices (20 mm thick) out of the retrobulbar region. Relevant anatomical structures (i.e. major blood vessels, nerves, and the periorbita) were identified and their topography was determined in relation to the position of the inserted needles.

RESULTS AND DISCUSSION

Position of the spinal needle with regard to relevant anatomical structures

PBI technique:

The spinal needle was pushed forward into a triangle which was delineated by three anatomical landmarks: the zygomatic arch, the mandible, and the maxillary tuber. Within this triangle, the following relevant anatomical structures were identified:

the infraorbital nerve;
the maxillary artery and its branches;
the deep facial vein;
the periorbita.

As the spinal needle was advanced until it touched the perpendicular plate of the palatine bone, the tip of the needle came close to the infraorbital nerve, the infraorbital artery and the descending palatine artery. Furthermore, the puncture canal passed by the deep facial vein and the periorbita.

EFBI technique:

The spinal needle was not pushed forward until it contacted the perpendicular plate of the palatine bone. Instead, the needle was pushed forward through the masseter muscle until the intersection between the masseter muscle and the extraperiorbital fat body was noticeable due to a change in consistency. Then the needle was advanced 15 to 20 mm into the extraperiorbital fat body. The tip of the needle was located in the extraperiorbital fat body laterally to the deep facial vein (at a distance of 5 to 10 mm). None of the above mentioned anatomical structures were passed by or reached by the spinal needle. The infraorbital nerve, the infraorbital artery, the descending palatine artery and the periorbita were located outside a radius of about 20 mm around the tip of the needle.

Simulation of infraorbital nerve blocks evaluated by CT scan

In all simulations of the PBI and EFBI, the injected contrast medium infiltrated the infraorbital nerve. In several simulations, the contrast medium continued with the infraorbital nerve into the infraorbital canal. No contrast medium was detected inside the intraperiorbital compartment in any of the applications. In all heads, the periorbita limited the flow of the contrast medium and prevented contrast medium from penetrating into the intraperiorbital compartment. No contrast medium was present in the blood sinuses of the brain. The distribution of contrast medium recorded in cadaveric specimens was the same as in the horses under general anaesthesia.

Risks

As the deep facial vein is connected with the sinus cavernosus, an inadvertent bolus injection of lidocaine into the deep facial vein might results in central nervous stimulation causing severe ataxia, central nervous system toxicity or collapse (1, 3). The intraperiorbital compartment contains the eyeball, its associated muscles, nerves and blood vessels. The periorbita functions as a sufficient barrier preventing contrast medium (and presumably Lidocaine) from penetrating into the intraperiorbital compartment and thus anaesthetic effects on the eye and its organs are limited.

CONCLUSIONS

The EFBI technique is most appropriate for providing a sufficient nerve block with minimized risk, because:

(a) the risk of puncturing the deep facial vein, the infraorbital artery and the descending palatine artery is minimized, since the needle is not pushed close to the palatine bone and consequently stays away from these blood vessels;

(b) the injected agent spreads within the extraperiorbital fat body; it has been demonstrated that this will be sufficient to yield a consistent infiltration of the infraorbital nerve.

Clinical investigations should be performed to evaluate whether the EFBI technique has the same analgesic effect as the PBI technique.

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