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Application of spinal anesthesia to the dog. An Albanian experience

Prof. asoc. ERINDA LIKA
Prof. PASKAL GJINO
Department of Clinical Subjects, Faculty of Veterinary Medicine
Agricultural University of Tirana
Tirana, Albania

Abstract:

The spinal lumbar anesthesia in dogs can be a safe and simple method for realizing analgesia of the caudal abdominal region and back limbs. The technique consists in injecting analgesic solutions within the epidural or subarachnoid space in the lumbosacral region. The solution is distributed both in the cranial and caudal part. The degree and distribution depend on the volume and concentration of the solution as well as the direction of injection. The spinal column in the dog ends at the level of the sixth and seventh lumbar vertebra, but its neural fibers continue in the sacral region, with a small diameter and with little chance of damage. This data is particularly useful for laparotomy in highly toxic animals or in Caesar's incisions. The lumbosacral insertion site is located at the point joining the median line with the line that joins the two tuber coxa, caudal shifted to the spine of the seventh lumbar vertebra. Subarachnoid anesthesia has better effects but sometimes can be cause accidents. Epidural anesthesia is a very easy technique but it provides superficial anesthesia with short duration. Although there are many local anesthetics in use, the 0.75% Bupivacaine solution at concentration 1 ml/kg body weight is more appropriate for this procedure.

Key words: spinal, epidural, anesthetic, lidocaine, alfacaine, bupivacaine, dog.

INTRODUCTION

Last years. in our country there is an increase in the number of pet animals. in particular dogs and cats, who have become important members in the family environment. Although the owners' interest in these animals is good, due to their lack of knowledge of breeding conditions, many pathologies have been observed and are increasingly being observed. The treatment of them often requires specialized surgical interventions. Pathologies such as pyometra, intestinal obstruction, urinary blockage, severe fractures as a result of advanced traumatic or surgical intervention are associated with a very serious condition of the body and in particular with severe cardiovascular and respiratory disorders. In these situations it is impossible to perform general anesthesia, which in most cases is of lethal consequences.

Under these conditions, it is necessary to avoid general anesthesia, through local spinal anesthesia associated with the use of certain sedative and transient substances.

In human medicine this method has long been used and is quite effective in some surgical interventions. In veterinary medicine this technique has been used in special cases in cattle for performing some obstetric interventions. Spinal anesthesia in the dog has been successfully applied in recent years in Bari (Italy) and Berlin (Germany).

The purpose of this study is to perfect the techniques of spinal anesthesia in various pathologies and to determine its superiority and effectiveness in some pathologies compared to general anesthesia, considering in this way these indicators such as the quality of anesthesia, the ease of performing surgical interventions and achieving operator success.

MATERIAL AND METHOD

During the period December 2015-December 2016, in 36 dogs were applied spinal anesthesia. Out of this number, 30 of them were experimental and used for didactic purposes, while 6 cases underwent spinal anesthesia under realistic conditions of surgical interventions such as castration, sterilization, femoral fractures, deep wound healing in the back limbs and 1 case with a pyometra. For the realization of this study, spinal anesthesia in these dogs was performed through some anesthetic protocols. However, for study effects they were divided into 3 groups as follows:

1. Group I in total 10 dogs underwent spinal anesthesia with 2% Lidocaine at 1 ml / 10 kg body weight.
2. Group II altogether 10 dogs underwent spinal anesthesia with alphacain 2% + adrenaline at 1 ml / 10 kg body weight.
3. Group III altogether 16 dogs underwent spinal anesthesia with 0.75% bupivacaine at 1 ml / 10 kg body weight.

For all groups, were measured qualitative and quantitative indicators of spinal anesthesia. For qualitative indicators, different reflexes were evaluated as: loss of sensitivity during puncture proces in the back limb region, anal reflex, loss of ability to move, analgesia in the skrotal and perineal region, etc. Quantitative indicators have been evaluated by measuring the time of initiation of local anesthetic effects, duration of local anesthesia, pulse stroke and respiratory rate, body temperature, etc.

At the time of the initiation of surgical manipulations and after the spinal anesthetic effect appeared, in all cases, was used Xylazine at 2% in the 2 mg / kg body weight regimen for the purpose of general animal calming and muscular relaxation.

Technique. Spinal anesthesia is performed by throwing the local anesthetic into the lumbosacral space. The injection point is located on the median line, at its joinpoint with the line that joins two tubercoxes and approximately 1-3 cm caudaly displaced. For the exact determination of this injection point was done as follows: For each case was measured the distance between the two tubercoxe (Dc) weight, sex, race of animals underwent to spinal anesthesia as well as distance of displacement over median line (Dd). In a significant part of the cases (12 dogs) these distances were verified by making the real preparation of the vertebral column and lumbo-sacral space. From these manipulations it was found that there are no significant differences between the external distances (Dc) and (Dd) and those actually observed in the preparation.

Spinal anesthesia is accomplished by injecting local anesthetic into the lumbosacral space which is relatively large and easly palpable in the dog. The spinal injection process presents two important moments:

- ❖ Determining the injection point.
- ❖ Determining the spinal area in which the anesthetic solution will be thrown.

Spinal anesthesia consists in throwing anesthetics near the spinal coda. Depending on which space anesthetics is thrown, spinal anesthesia is classified as epidural and subarachnoid anesthesia. For this purpose we must clarify:

The medula spinalis is surrounded by a thin membrane which is the piamater spinalis. Above it is another thin layer witch is arachnoidea spinalis. Outside medula spinalis is wrapped by a strong layer, duramater spinalis. Between the pia mater and arachnoidea spinalis there is subarachnoid space in which circulates the cerebrospinal fluid. The outer surface of the spinal cord is supported by the periosteum of the vertebral canal and between them is epidural space. During spinal injection, the needle punch the spinal cord and penetrates into

the spinal arachnoid space (subarachnoidalis spatium) contacting with the cerebrospinal fluid. Otherwise, the insertion of needle into the epidural space (spatium epiduralis) means "not to punch the strong external spinal cord layer duramater spinalis". Epidural and subarachnoid anesthesia are two different techniques of spinal anesthesia. The common part is the anatomical path that needs to be traversed to reach the epidural space first. then subarachnoid level.

From the anatomical-topographic point of view starting from the outside of the body, during spinal injection into the lumbosacral region, the needle will penetrate into these structures: skin, subcutaneous, and three ligaments, respectively,. Supraspinat ligament, interspinat ligaments and flavum ligament. The yellow ligament that originates from the neck is the last barrier before entering the epidural space. The epidural space extends from the base of the neurocranium to the sacral extremity of the sacrum.

In the lumbar region it is relatively large, contains blood vessels, fatty tissue and nerve root which are considered the object of epidural anesthesia.

For spinal injections, an needle of 14, 16, 20, depending on the size of the animal, is required. It should be fitted with the mandrel to facilitate the crack and to avoid blockage during in-depth penetration. After the penetration into the lower basement of the vertebral canal, the needle may be blocked in the bony part of the canal and therefore it is easily withdrawn in order to position it in the lower epidural space. After removing the mandren, the exact position of the peak of the epidural space should be specified. Normally when the needle is in the epidural space it is not observed the cerebrospinal fluid output both passively and during aspiration, meantime during the push of the anesthetic in the interior there is no noticeable resistance. Further withdrawal of needle means displacement of its peak from epidural space to subarachnoid area which will be associated with the emergence of cerebrospinal fluid.

The treatment of these moments has to do with the fact that spinal anesthesia can be accomplished in two ways: epidural anesthesia and subarachnoid anesthesia. Both of these techniques are part of the local anesthesia group, but the difference lies in the degree of cessation of sensitivity, the region of involvement and the consequences that can be created.

The qualitative assessment of the two abovementioned techniques is as follows:

a-Epidural anesthesia. Technically it is easily accomplished. There are no serious consequences even in the case of overdosage. Anesthetics surrounds the medula spinalis and infiltrates through diffusion around it. This means that even when the needle top does not go exactly into the epidural space, again the anesthetic effect is achieved to a considerable extent but not 100%. The negative side of this technique is the accidental drop in anesthetic in the subarachnoid space which may be associated with undesirable side effect.

Epidural anesthesia is characterized by long time of initiation of anesthetic action, shorter period of anesthetic effect compared with subarachnoid anesthesia and minimal negative side effects.

b-Subarachnoid anesthesia. The injection of the anesthetic substance into the subarachnoid space is a relatively difficult procedure and requires experience and accuracy. The induction of anesthesia through this technique is achieved faster than in the case of epidural anesthesia while the duration is greater. The adverse side effects seen in this form of spinal anesthesia are more pronounced. This kind of anesthesia requires care in the technique of realization and replacement of the amount of cerebrospinal fluid with that of anesthetic at 50-75%.

RESULTS AND DISCUSSION

From statistical data processing results that in the geometry of spinal injection, race and sex do not have any noticeable influence over (Dd). What is noticeable is the dependence of body weight on indicators (Dc) and (Dd), as well as the strong correlation between (Dc) and (Dd). The correlation coefficient between the body weight and the displacement distance (Dd) resulted with P>0.94 whereas the correlation between the distance (Dc) and (Dd) resulted P>0.9.

The use of regression equation y = a + bx for the above results proved that:

D (d) = 0.9 + 0.054 B (w) Error ± 0.197

D (d) = 0.33 + 0.23 D (c) Error ± 0.25

D (d) → the distance of the caudal displacement over the median line

D (c) → distance between two tuber coxe

B (w) → Body weight

Knowing the body weight or the distance between the two tuber coxa, it is possible to accurately perform spinal epidural or subarachnoidal injection.

Given the qualitative indicators of spinal anesthesia, the results were classified into three groups

a. light (surface)

b. average

c. deep

These data are given in Table no. 1

Table no. 1 Qualitative valutation of spinal anaesthesia regarding groups and types of anaesthesia

Groups	Epidural anesthesia			Subarachnoidale anesthesia		
	Light	Medium	Deep	Light	Medium	Deep
I	3	2	-	1	3	1
II	1	4	1	1	1	2
III	2	4	3	7	-	-
All	6	10	4	9	4	3

For quantitative indicators of spinal anesthesia the results are reflected in Table no.2 .

Table no. 2 Quantitative valutation of spinal anaesthesia regarding groups and types of anaesthesia

Groups	Epidural anesthesia			Subarachnoidale anesthesia		
	No animals	Induction time	Duration	No.animals	Induction time	Duration
I	5	8±2min	28±4	5	5±2	48±4
II	6	7±2min	32±7	4	4±1	58±2
III	9	6±3min	41±4	7	4±2	62±5

Spinal anesthesia is part of local anesthesia and is used in those cases where surgical interventions are minor and when general anesthesia is compromised due to severe pathologies that can be created in the body (1, 3, 11). Spinal anesthesia is ideal for surgical interventions at the caudal part of the trunk or lower limbs. It is advisable in these cases:

- Surgical surgery of the back of the abdomen.
- Surgical gynecological and obstetric interventions.
- Surgical treatment of inguinal, scrotum, perineal hernias.
- Surgical surgery in the back limbs.
- Surgical interventions in the urinary tract.
- Surgical perineal and rectal surgery.

Spinal anesthesia is contraindicated in some cases as:

- Local or systemic infection
- Irreversible drop in blood pressure and volume.
- Blood clotting defects.
- Intracranial pressure increased.

Spinal anesthesia should not be considered a "transverse chemical cut" in the medula spinalis (7, 12, 15). Its realization is made possible by the blockage of the nervous system at the level of the spinal nerve root. The neural roots that emerge

from the spinal canal are directly exposed to the anesthetic inside the cerebrospinal fluid.

The results of this nerve blockade include:

- anesthesia
- analgesia
- sympathic block
- usually full muscle relaxation

Spinal anesthesia provides the possibility of a deep nerve blockade in a large area with a small amount of local anesthetic. The goal in this case is the production of sufficient anesthesia without causing disorders in the overall condition of the patient and avoiding lethal accidents. During spinal anesthesia lumbar and sacral nerve roots are always blocked. In the case of subarachnoid anesthesia, the cephalic circulation is unpredictable.

In clinical practice the most important factors to be considered during spinal anesthesia should be the dose and concentration of local anesthetic as well as the space within the spinal cord to which the anesthetic will be thrown. (Epidural and subarachnoid anesthesia). The ratio between injected anesthetic dose and spinal blocking height has never been proven (10, 20). Lower doses provide less powerful nervous blockade and shorter duration due to faster metabolism and absorption of local anesthetic.

Signs and symptoms of excessive local anesthetic prolapse can be associated with fear, distress, nausea and vomiting, hypotension, anxiety, respiratory insufficiency, coma and respiratory prohibition.

Neuronal damage is fairly rare. They may be due to trauma caused by needle, chemical contamination or local anesthetic bacterial contamination, toxic reactions to local anesthetic, subarachnoid hemorrhage, and so on.

Epidural anesthesia is perfect and with minimal side effects. It can be realized alone or combined with tranquilizants

and sedatives. Combination often gives better results and fewer complications (9, 16, 19).

The contraindications for epidural anesthesia are few. Epidural anesthesia should be avoided in absolute cases like in cases of coagulopathy and infection at the injection site. Also during epidural anesthesia care should be taken in cases of arterial hypothyroidism, sepsis conditions, and in pathologies of nervous system previously diagnosed.

The signs that you notice during intoxication are dyspnea, diaphragm paralysis, intercostal paralysis, prohibition of respiration. If local anesthetized by intrathecal pathway through foramen magnum, then "full spinal" (2, 16, 20) will occur. On the cardiovascular system, the anesthetic affects the phase of depolarization, conduction and shrinking heart rate associated with hypotension and bradycardia.

Subarachnoid injection may be associated with dyspnea (intercostal paralysis), paralysis of the diaphragm, respiratory arrest, deep hypotension, etc. Prevention of this situation is done by aspiration, avoidance of IV injection, the application of the test dose accompanied by the waiting 3-5 minutes before continuing the injection.

CONCLUSIONS

- Determining the exact point of the spinal injection is made possible by recognizing the weight or the distance between the tuber coxa.
- Spinal anesthesia can be used with great success in surgical interventions associated with dangerous patient conditions.
- Subarachnoid anesthesia gives better anesthetic results but can cause severe accidents.
- Epidural anesthesia is a very simple and easy technique to accomplish but induces short and superficial anesthesia.

- ❖ The most successful local anesthetic is 0.75% Bupivacaine at a dose of 1 ml / kg body weight.

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