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Review Article

Ultrasound-Guided Pudendal Nerve Block in Male Donkeys

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Abstract

The objective of this study was to develop a color flow doppler ultrasound-guided technique for the pudendal nerve block in male donkeys. A detailed anatomical dissection was performed in five donkey cadavers to obtain the precise details of pudendal nerve and its relations and ramifications, detect the pudendal nerve blood vessels and to determine the optimal point for local anesthetic injection. The pudendal nerve in six male native breed donkeys was blocked successfully with local anesthetic solution. The injection site was located with the aid of ultrasound. Ten milliliters of local analgesic solution were injected via 20cm, 18-gauge needle. Anesthetic effect was evaluated after bilateral pudendal nerve blocks. A feasible, applicable and highly accurate technique to locate the pudendal nerve was developed. Satisfactory anesthesia of the anus, perineum, penis, prepuce and glans penis was achieved while the animal in a steady standing position.

INTRODUCTION

Several surgical procedures in the equine male genital organs, often done under effect of epidural anesthesia or general anesthesia. Epidural anesthesia is not always an easy procedure in donkeys rather than horses, due to, anatomical variation. Moreover, epidural anesthesia has many drawbacks including; impairment of locomotor function, ataxia and recumbency during the procedure [1-3].

General anesthesia has the disadvantage that it requires advanced tools and associated with high mortalities [4]. Regional anesthetic techniques were developed and reported to have a reliable anesthetic effect, a better pain relief and easily performed. Pudendal nerve block is introduced as an efficient method to anesthetize anus, perineum and penis in male horses,in a steady standing position without impairment of locomotion function [5,6].

Standard pudenda nerve block technique in horses was achieved by blind insertion of a long needle to the level of the nerve at the sacroisheatic ligament [5]. An alternative recent technique was introduced in horses by using a nerve-locating device to offer more accuracy for the procedure [6,7]. Topographic anatomy of the pudendal nerve makes it hard to reach. The pudendal nerve originates as a common branch with the caudal rectal nerve at the level of the second to third sacral vertebrae. It gives a superficial branch, ends at the caudal portion of sacrotubiral ligament and a deep branch, extended distally as nerve of the penis. Few centimeters cranial to the pudendal nerve, ischiatic nerve lies. The pudendal nerve is closely related to internal pudendal artery and vein [8,9]. Faulty introduction to the anesthetic needle may cause severe damage to the ischiatic nerve or bleeding from associated blood vessels. The purpose of this study was to develop a technique for ultrasound-guided pudendal nerve block in the male donkey. Also, the onset, duration and quality of anesthesia were recorded and evaluated.

MATERIALS AND METHODS

The institutional animal welfare committee of Assiut University (Ref. 01/ 3-2017) approved the present study. The study performed at the department of surgery, faculty of veterinary medicine, New Valley, Egypt.

Topographical anatomy of the pudendal nerve

A preliminary cadaveric study was performed on five native breed male donkeys. The pudendal nerve was determined among its related structures; the sacroischiatic ligament, sacrotuboral ligament, ischiatic nerve and internal pudendal blood vessels. The distance between the point of needle insertion at the most dorsal portion of the ischiorectal fossa and the superficial and deep branches of the nerve was recorded via a graded CHIBA needle. Ultrasound rectal probe was introduced via the rectum in order to obtain the proper distance and position to image the nerve and its associated blood vessels (Figure 1).

Figure 1 Dissection of the pelvic showing the pudendal nerve and its relations. Sacroischiatic ligament (1) Ischial tuberosity (2) Ischiocavernosus M. (3) Retractor ani M. (4) Root of tail (5) Deep branch of Pudendal N. branches (6, 6', 6'', 6'''), Pudendal N. (7) Caudal rectal N. (8) internal pudendal blood vessels (9).

Ultrasound-guided technique of the pudendal nerve block

Clinical bilateral pudendal nerve block was performed on six native breed adult male donkeys. Candidate donkeys aged between 8-15 years-old and weighted from 170-210kg body weight. All animals were kept on soft food for a week prior to the experiment.

The rectum was emptied manually at the time of the procedure and the perineal area and area around the anus was washed, scrubbed and disinfected. A 0.5ml of 2% lidocaine HCL (Depocaine 2%, El-Depiky Pharm., Egypt) was injected subcutaneously at both sides of the rectum, at the most dorsal portion of ischiorectal fossa to desensitize the point of needle insertion.

The operator introduced his left hand with the rectal probe with its transducer directed ventrolateral. Ultrasound machine (Exago, France, 5-10 MHz rectal probe) was used to locate the internal pudendal blood vessels with the aid of color coded doppler ultrasound. The operator used his right hand to insert and introduce a 20-cm, 18-gauge CHIBA needle (Gallini, S.R.L, Italy) at the most dorsal portion of the ischiorectal fossa. The needle shaft could be imaged on the ultrasound screen. The needle is advanced slowly to above the level of the internal pudendal blood vessels under direct vision. The rectal probe was rotated slowly up and down to configure the both; the site of the blood vessels and the needle. Amixture of 5ml of lidocaine HCL and 1ml of methylene blue solution was injected (Figure 2).

Clinical and necropsy evaluation of the pudendal nerve block (Figure 3).

Evaluation process was performed on two levels. The first was to assess the successfulness of the nerve block, and the second was to locate the dye at the injection site. Loss of sensation onset was detected by applying needle pricks to the anus, perineum and downward to the penis and glans penis every five minutes (Figure 4 A,B,C). The onset of anesthesia that lies between the time of injection and desensitization was recorded. The duration of anesthesia was recorded for each donkey.

All participated animals were euthanized for educational purposes at the same day of the experiment. Dissection of the pelvic region was performed to assess the accuracy of the injection by locating the stained segment of the nerve with the methylene blue solution. A stained segment of 2cm or more of the pudendal nerve considered as an evidence of proper blockade [10] (Figure 4D).

RESULTS

The present study revealed that the pudendal nerve fibers at the gluteal region descend caudoventrally on the medial face of the sacroischiatic ligament. The nerve is bounded laterally by the middle gluteus and biceps femoris muscles. The nerve passes nearly parallel to the ischiatic nerve for about 5-6cm, where it appears superficially and uncovered by the sacroischiatic ligament and bifurcates into superficial and deep branches. At this point, the nerve is closely related to the internal pudendal blood vessels. The deep branch divides into superficial perineal that enervates the perineal region and deep genital that ends at the penis. The deep branch is closely associated with the blood vessels of the penis.

The insertion point of the anesthetic needle was determined. The proper insertion point was the most dorsal aspect of the

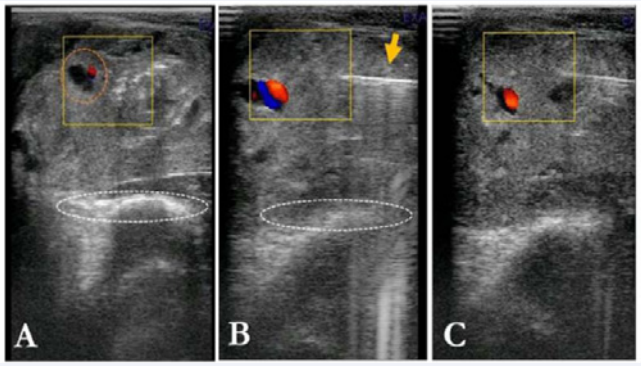

Figure 2 Color flow doppler guided pudendal nerve block.
[A] Identification of gluteal blood vessels (orange dotted circle), ischium (white dotted circle),
[B] advancing the needle above the level of internal pudendal blood vessels (yellow arrow),
[C] injection of 10ml lidocaine solution at the level of gluteal blood vessels.

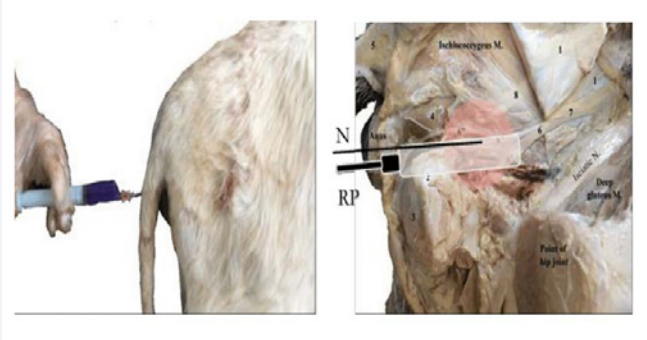

Figure 3 Injection process. (N) Needle of injection, (RP) Rectal Probe, site of injection (the faint red circle).

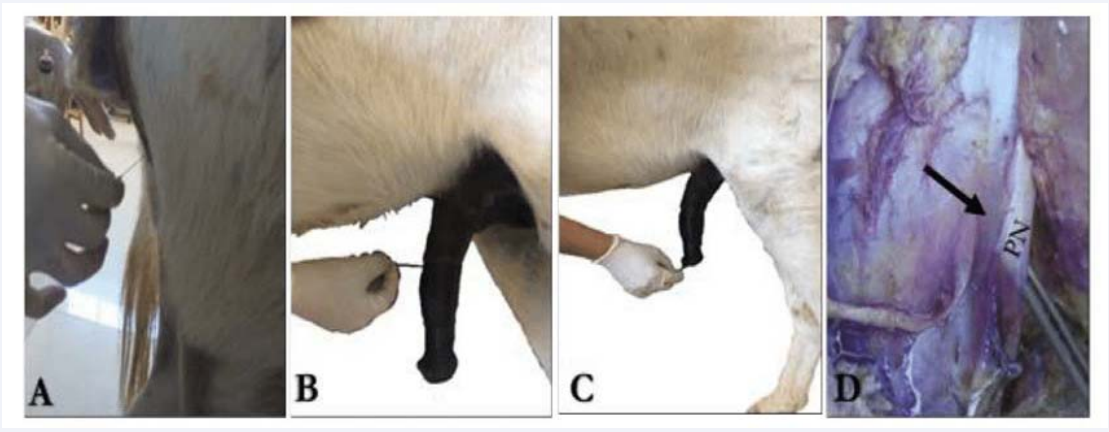

Figure 4 Assessment process. Desensitization of perineum [A] Penile body [B] Glans penis [C] The pudendal nerve (PN) is stained with the dye on dissection.

ischiorectal fossa, so as to the needle can directed cranially and slightly ventral to reach the injection site about 8cm deep to the insertion point. Pudendal nerve block was performed successfully in all six participated male donkeys and resulted in the desired clinical anesthetic effect. After (5.8 minutes - mean average) of bilateral injection of the local anesthetic, the perineal region was totally desensitized. After (8 minutes -mean average) the penis relaxed within 30 to 60 seconds and totally desensitized within about five minutes. Pin prick of the penile body and glans penis revealed complete desensitization and loss of pain reflexes. The glans penis and penis were examined and evaluated for presence of lesions while the animals were in a steady standing position. Lidocaine local anesthetic agent was used for standard effect. Ten ml of lidocaine solution for each side was sufficient and resulted in a successful block.

Several tempts were made in each animal to rotate the rectal probe slowly with the transducers plastic nose directed lateral and ventrolateral to capture the internal pudendal blood vessels. Rectal transducer with a frequency ranging from 5-8.5MHz was adequate to reveal the blood flow within the internal pudendal blood vessels. The time needed to perform unilateral block was (4 minutes - mean average).

The mean average time to produce clinical anesthesia was 5.25 minutes. The man average clinical anesthesia duration was 47.1 minutes. Penis protrusion time was 1.5 hour (mean average) and all animals gained normal penile position.

One donkey showed sever straining and blowing from the rectum during ultrasound rectal probe introduction.

DISCUSSION

To our knowledge, this is the first description of a technique for blocking the pudendal nerve in donkeys using color flow doppler ultrasound. A blind pudendal nerve block technique in horses was described by [6]. This technique reported [6] depends on locating the pudendal nerve through identification of the foremen of the caudal gluteal blood vessels via manual rectal palpation. This technique was difficult to achieve in donkeys because of its much less sized anus than in horses which makes rectal palpation absolutely difficult. Blind insertion of the needle without guidance may lead to sever intra and postoperative complications. A recent technique reported by [5], uses electro-locating device that detect anal and perineal twitches to identify the accurate site of the pudendal nerve. The present technique uses ultrasound to detect the blood vessels accompanying the pudendal nerve. Although the experimental trials presented here required variable time to identify the internal pudendal blood vessels, but further training and gaining experience will decrease the bilateral pudendal nerve blockade time [6]. inserted the anesthesia needle at the dorsolateral aspect of the ischiorectal fossa and advanced the needle to the rectally palpable foremen and the local anesthetic deposited to desensitize the pudendal nerve midway of its course. [6] changed the point of needle insertion to the ventrolateral portion of the ischiorectal fossa in order to desensitize the main trunk of the pudendal nerve. In the present study, it was most appropriate to insert the anesthetic needle at the dorsolateral aspect of the ischiorectal fossa. The main target to identify was the internal pudendal blood vessels, the pudendal nerve lies about 1 cm dorsal to the pudendal vessels, so, it was more convenient to advance the needle from the dorsolateral aspect not to miss the anatomical landmarks and to avoid accidental injury of pudendal vessels. The results of the former study revealed that the pudendal nerve trunk is too small to be identified by ultrasound [11]. In our limited (*n=6*) experimental study, color flow doppler ultrasound machine with transrectal transducer was used to locate the internal pudendal blood vessels. First attempts were hard and required more time to introduce operator hand with the rectal probe into the small diameter anus of experimental donkeys. Further attempts were successful and required less time. The direction of the transducers' nose was recognized. Some of the potential complications during the procedure of pudendal nerve block are puncture of the rectum or, puncture of vessels with possible hematoma formation. There were no complications during or after the anesthesia procedure except for one animal. Straining and discomfort during the first attempts to introduce operators hand into the rectum. This, reduced after introduction of the lubricated hand. Further repeated attempts should be avoided to reduce post-operative complications. No post-anesthesia complications recorded except for one animal that showed pneumo-rectum and rectal plowing

which may be due to the anesthetic effect of anal sphincter and its relaxation. Regarding the possibility of monitoring needle advancement through the tissues, and observing the vessels and other anatomical structures, ultrasonographical guidance is likely to greatly decrease the risk of complications compared with the blind technique, and also offers the advantage of a more accurate and specific nerve block. Further studies might be beneficial to investigate the use of using ultrasound guidance to monitor the pudendal nerve block in female donkeys and horses either experimentally or in clinical cases.

CONCLUSIONS

This study suggests that pudendal nerve block under ultrasonographical guidance in standing male donkeys is feasible, effective and could reduce the complications associated with the blind technique. Administration of 10ml of lidocaine anesthetic solution for each side was readily effective and produced the desired anesthetic effect. Pudendal nerve block under ultrasound guidance is a valuable choice rather than epidural or general anesthesia for standing examination and operative procedures. Future trials will be needed to assess the usefulness and the applicability of this technique in the clinical cases [12-19].

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