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التخدير النصفى فى الجمال

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نظرا لأهمية هذا النوع من التخدير الجزئى فى جراحة الأجزاء الخلفية من الحيوان ، فقد قام الباحثون بعمل دراسة تشريحية مفصلة للمنطقة العجزية العصبية من العمود الفقرى فى الجمال وذلك لاستبيان أفضل الأماكن للحقن فى الفراغ المحيط بالأغشية المغلقة للنخاع الشوكى مع تقدير الجرعات الضرورية لحدوث التخدير وكذا تسجيل الوقت اللازم لبدأته واستمراره. هذا وقد تمت ملاحظة وتسجيل التأثيرات الاكلينيكية المختلفة وتقييم الانعكاسات مع اجراء بعض العمليات الجراحية للوقوف على كفاءة هذا النوع من التخدير.

ولهذا الغرض أجريت خمسون تجربة للتخدير ، استخدم فيها ٣٧ جملا من مختلف الأعمار والأوزان والجنس.

وأثبتت الدراسة التشريحية أن الفراغ الكائن بين الفقرة العصبية الأولى والثانية هو أنسب الأماكن لادخال ابرة الحقن بميل قدره ٤٥ درجة.

وقد أجرى التخدير باستخدام تركيزات مختلفة (١ ، ٢ ، ٣ ، ٤ ٪) من محلول هيدروكلوريد البروكايين ، ثبت فيها أن تركيز ٢ ٪ كان كافيا لاجراء العمليات الجراحية الصغيرة. على الذيل والمنطقة الشرجية ، بينما كان تركيز ٤ ٪ ضروريا لعمليات منطقة الفخذ وقناة مجرى البول والضرع.

وكانت الجرعة متناسبة مع حجم الحيوان حيث أعطيت الحيوانات صغيرة الحجم (أقل من ٢٠٠ كجم) ١٠٠ ملليمتر والحيوانات متوسطة الحجم (٢٠٠ - ٤٠٠ كجم) ١٥ ملليمتر بينما أعطيت الحيوانات كبيرة الحجم (أكثر من ٤٠٠ كجم) جرعة قدرها ٢٥ ملليمتر من محلول هيدروكلوريد البروكايين .

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EPIDURAL ANAESTHESIA IN THE CAMEL WITH SPECIAL REFERENCE TO THE TOPOGRAPHICAL
ANATOMY OF THE SACROCAUDAL REGION
(WITH 3 TABLES AND 2 FIGURES)

BY

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SUMMARY

The topographical anatomy of the sacrocaudal region of the camel was studied in detail in order to find out the best site for injection in the epidural canal. Estimation of the suitable dose for induction and reporting the time of onset as well as the duration of this type of anaesthesia were also determined.

Fifty anaesthetic trials were performed on 37 camels of different age, sex and size. The first intercoccygeal space was the most convenient site for insertion of the needle at 45° angle with the horizontal plane. The 1, 2, 3 and 4% concentrations of procaine hydrochloride were tried. A 2% concentration was sufficient for minor surgical interferences in the tail and perineal region, while the 4% concentration was necessary for operations in the thigh, urethra, udder and teats. The dose of both concentrations depended on the size of the animal. Ten, 15 and 25 ml of procaine hydrochloride were required for small, medium and large sized animals respectively.

INTRODUCTION

The Arabian one-humped camel (*Camelus dromedarius*) is an important source of meat in Egypt. It is also used for transport especially in rural and sandy districts.

Surgical affections such as wounds, fistulae, tumours, cutaneous and limb affections are met with amongst patients received in the clinic. This necessitates one form of anaesthesia or the other.

Information about anaesthesia of the camel is, still, meagre. SINGH ET AL, (1962) reported on the use of chloral hydrate alone or in combination with magnesium sulphate for the induction of narcosis in the camel. SAID (1964) described the various forms of anaesthesia in this animal and induced epidural anaesthesia through injection in the sacrococcygeal or first intercoccygeal space. This was preceded by chlorpromazine premedication. FOUAD and MORCOS (1965) injected propionylpormazine as a tranquillizer followed by 12 - 15 ml procaine hydrochloride in the sacrococcygeal as well as the first intercoccygeal space. The onset of anaesthesia appeared after 3 - 8 minutes and continued for 1 - 2 hours. HASSANEIN (1972) considered xylazine hydrochloride (Rompun-Bayer) as the best sedative for the camel. HASSANEIN (1975) recommended the use of Rompun premedication (0.25 mg/Kg-i.m.) 20 minutes before induction of anaesthesia with chloral hydrate (4 gm/50 Kg-i.v.) in cases of minor surgical interferences and with Chloral-Romun mixture (4 gm/50 Kg + 0.1 mg/Kg-i.v.) supplemented, when necessary, by variable doses of Nesdonal 10% solution (up to 5 mg/Kg-i.v.) for major surgical interferences.

Trials to induce epidural anaesthesia by injection in the sacrococcygeal space were not always easy, in some cases it was even impossible. This urged the present workers to study the topographical anatomy of the sacrocaudal region, select the suitable dose for induction of anterior and posterior epidural analgesia and to report on the time of onset as well as the duration of this type of anaesthesia.

MATERIALS AND METHODS

Fifty anaesthetic trials were performed on 37 camels of different age, sex and size. The topographical anatomy and radiological appearance of the sacrococcygeal area were studied on 5 adult camels perfused with 10% formalin solution to which 1% phenol and 1% glycerine were added. In addition, 50 sacrococcygeal vertebrae, attached to their bony pelvis, were used in studying the features and measurements of that part of the vertebral column.

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Equipments and Anaesthetics:

Sterile 16 gauge, 8 cm long needles and sterile 20 ml syringes were used. The anaesthetic was sterile solutions of 1, 2, 3 & 4% concentrations procaine hydrochloride. Fixed doses of 10, 15 and 25 ml were used, according to the size of the animal. Small sized camels (under 200 Kg) received 10 ml, the medium sized (200-400 Kg) 15 ml and the large sized (more than 400 Kg) 25 ml. Larger doses (40-60 ml) with 1 & 2% concentrations were also used in 4 cases during the preliminary trials.

According to the concentration of procaine hydrochloride used, the fifty experiments were divided into 4 groups as shown in Table 1.

Table 1: Concentrations and dosages schedule

Group	No. of animals	Concent. %	Dose / ml		
			Small	Medium	Large
I	5	1	10	15	25
II	20	2	10	15	25
III	10	3	10	15	25
IV	15	4	10	15	25

Site of Injection:

The sacrococcygeal and first intercoccygeal spaces were tried.

Technique:

The animals were controlled in the normal kneeling position. The site of injection was clipped, cleansed and disinfected. The point of a sterile needle was applied to the centre of the depression between the first and second coccygeal spines, taking care that it was exactly in the midline. The needle was inserted to its full length downwards and forwards at an angle of 45 degree with the horizontal plane (Fig. 1). The syringe was then attached to inject the anaesthetic. Sudden reduced resistance to introduction of the needle and ease of injection of the anaesthetic, indicated that the needle was in the right location for injection in the epidural space.

Duration of anaesthesia was determined at intervals by pricking the skin with a needle or by pinching the vulva with forceps and also by noting the response of the tail muscles. Good epidural analgesia was indicated by paralysis of the tail, suspension of defecation and lack of sensory reaction when the vulva was pinched.

The efficiency of the produced epidural anaesthesia was tested by performing one of the following surgical interferences: urethrotomy, suturing of wounds on the thigh, removal of a tumour under the tail, excision of a filarial nodule in the perineal region, skin biopsy from cases suffering from nodular ulcerative dermatitis in the inguinal region, as well as operation for rupture of the perineum.

RESULTS

A- Anatomical Findings:

The sacrum of the camel is composed of four fused sacral vertebrae. It is broader and shorter than that of the ox and horse, measuring 20 - 22 cm long and 23 cm wide at promontory and 7 - 8 cm at its termination. It is decidedly arched, being deviated by 35 - 40° on the horizontal plane. When seen from the side in the living animal, it inclines up to 70 - 80° on the longitudinal axis of the animal's body. The dorsal surface of the sacrum bears four short but thick spinous processes with their ends rounded and completely separated from each other, while the arch inbetween shows fine spaces except for the first which is wide reaching 1 cm long and 1.5 cm wide. These latter spaces connect the vertebral canal to the outside. In the living animals, these foramina are closed by dense fibrous tissue continuous with the thick interspinous ligament as well as the supraspinous ligament.

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The coccygeal vertebrae are large and vary in number from 14-19, their processes are greatly developed than in the ox and horse. The first coccygeal vertebra is completely developed and simulating greatly the last sacral. In the living animals, it may be mistaken for a segment of the sacrum. Moreover, its movement is restricted by the presence of a very thick supraspinous and interspinous ligaments.

The spinal cord extends from the cranial border of the atlas to the second sacral vertebra. This level of termination is subjected to variation, showing some correlation with the length of the trunk especially in the Sudanese species. The terminal end of the cord (conus medullaris) is elongated, with a diameter of 1 - 2 mm. It is manifested by the point at which the last pair of coccygeal nerves are given off and so continue caudally as a fine connective tissue filament (filum terminale) till the fourth sacral vertebra where it fuses with the dural sheath. Later on, it is continued as the extradural part of the filum terminal till the 7th or 8th coccygeal vertebra and becomes attached to the periosteum of the spinal canal. The conical end of the meninges in the camel terminates at the cranial edge of the fourth sacral vertebra, while the subarachnoid cavity ends at the level of the caudal end of the 3rd sacral vertebra.

The first intercoccygeal space is the widest and nearest space to the spinal canal, while the remaining part of the canal is filled caudally with the ensheathed coccygeal nerve trunks and the surrounding fibrous and fatty tissues. The distance between the roof of the vertebral canal and the dorsal surface of the skin is about 2.2-3.1 cm and is composed from outside of the skin, superficial fascia, a dense deep fascia which is strongly attached or adherent to the underlying supraspinous ligament. The latter is too thick reaching about 2.2-2.5 cm in front of the first coccygeal spinous process but very weak or nearly terminates at the second coccygeal spinous process where it is substituted by the interarcuate ligament with a very fine fibres of the interspinous ligament. These structures when traced caudally up to the 6th or 7th vertebral become very fine and only a weak dorsal sacrococcygeal muscle by its two parts (M. sacrococcygeus dorsalis medialis and M. sacrococcygeus lateralis) lie on the interarcuate space, while the canal itself later terminates and is occluded by fatty tissue.

B- Clinical Findings:

The onset of analgesia, interval before incoordination, interval before lying down, duration of effect and the interval before returning to normal condition were given in Table 2.

It was noticed that the standing capacity of all five animals injected with 1% procaine hydrochloride was maintained without any sign of motor incoordination. The tail and anal reflexes were lost in all animals, while the perineal reflex was maintained in one and sluggish in two animals. The croup, thigh, foot pad, flank and umbilical reflexes persisted in all cases (Table 3). The duration of effect was short (36 ± 2.29 minutes) and the animals regained their normal condition after about 50 minutes from injection.

Animals receiving 2% procaine hydrochloride maintained their standing capacity, but there was motor incoordination in ten out of the twenty animals under experimentation. The tail, anal, perineal and croup reflexes were lost in all animals of this group. The thigh reflex was absent in 13 animals, sluggish in 4 animals and present in 3 animals. The reflexes of foot pad, flank and umbilicus were present in all cases (Table 3). The effect of analgesia remained for 1 - 2 hours.

Nine out of the ten animals of group III lost their standing capacity and lay down after about 20 minutes from injection. All the animals lost their tail, anal, perineal, croup and thigh reflexes. Three animals lost the foot pad reflex, five showed sluggish and two maintained it. The flank and umbilical reflexes were present in all the animals of this group (Table 3).

The animals of group IV lost their tail, anal, perineal, croup and thigh reflexes. The foot pad and flank reflexes were sluggish while the umbilical reflex was persisted in 13 animals and abolished in 2 animals. Thirteen out of the fifteen animals lost their standing capacity after 27.8 ± 2.2 minutes (Fig. 2).

DISCUSSION

The topography of the sacrococcygeal segment of the medulla spinalis in the camel was briefly described by LESBRE (1900), NEUMANI (1911) and LEESE (1916/17). The results reported here are basically in agreement with those earlier authors.

The present study showed that in the camel, the spinal cord ends caudally at the beginning of the second sacral vertebra, but in few cases it terminates at its caudal end. In the ox and horse, it ends at the first or second sacral vertebra (HABEL, 1951 and GETTY, 1975).

The coccygeal vertebrae of the camel were found to have a complete bony arch. In dogs and horses, the first coccygeal vertebra was the only one which possesses a complete bony arch while the others were incomplete and substituted by the interarcuate ligaments (BRADLEY and GRAHAME, 1959; FLETCHER and KITCHELL, 1966; HEATH and MAYER, 1972 and GETTY, 1975).

The use of 3 and 4% concentrations of procaine hydrochloride resulted in motor incoordination of the hind limbs after 12.8 ± 0.54 and 13.26 ± 1.02 minutes respectively, then the animals lay down after 20.55 and 1.55 and 27.8 ± 2.2 minutes. This could be attributed to the motor paralysis caused by the sciatic block from the high concentrations of procaine hydrochloride. The produced analgesia was quite sufficient for performing different surgical operations on the perineal region and thigh. However, the 4% concentration was more efficient for operations of the urethra, udder and teats.

The 1% concentration of procaine hydrochloride failed to produce satisfactory analgesia even in the large doses given. The desired analgesia for performing minor surgical interferences on the tail and perineal region was obtained after 16 ± 1.12 minutes, using 2% procaine hydrochloride. This was accompanied with slight motor incoordination in half of the animals under experimentation.

The dose used in the present work was correlated with the size of the animal. The small sized ones (under 200 Kg) received 10 ml, the medium sized (200 - 400 Kg) 15 ml and the large sized (over 400 Kg) received 25 ml.

The total time of blockade seemed to depend on the concentration of anaesthetic, the rate of injection, the initial level of blockade, the age and condition of the patient. The same observations have been encountered by SOMA (1971).

The present investigation revealed that the only available site for introducing the needle for epidural anaesthesia in the camel is the first intercoccygeal space, as it is the widest and nearest space to the spinal canal. The sacrococcygeal space is covered by a thick supraspinous and interspinous ligaments, resulting in restriction of the movement of the first coccygeal vertebra, that it may be mistaken for the last sacral vertebra. Moreover, the remaining part of the canal is filled caudally by the ensheathed coccygeal nerve trunks with their surrounding fibrous and fatty tissues.

Injection in the first intercoccygeal space has the advantage that the canal inside it is more roomy and thus facilitating the flow of the anaesthetic solution cranially. In addition, the interarcuate space at the first intercoccygeal articulation is wider and measuring 3.0 - 3.4 cm, while at the sacrococcygeal articulation measuring 1.5 - 1.8 cm wide.

Insertion of the needle at 45° angle appears to be preferable for administering caudal anaesthesia in camels, due to the normal arched back and great slope of the sacrum at its junction with the coccygeal vertebrae. Thus, the anaesthetic can flow cranially more easily and the chance of the needle being inserted into the intervertebral disc is reduced. Similar results were obtained in camels by SAID (1964) and FOUAD and MORCOS (1965) and in horses by WESTHEUES and FRITSCH (1964) and HEATH and MAYER (1972).

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Table 2: The effect of epidural injection of 1, 2, 3 and 4% procaine hydrochloride on different groups of animals

Group	No of animals	Onset (min.)	Interval before incoordination (min.)	Interval before lying down (min.)	Duration of effect (min.)	Return to normal (min.)	
I	5	Range	7 - 10	-	-	30 - 45	40 - 60
		Mean	8.20	-	-	36.00	50.00
		St.E.	± 0.48	-	-	± 2.29	± 4.48
II	20	Range	3 - 8	10 - 20	-	60 - 120	90 - 163
		Mean	5.50	16.00	-	80.25	125.55
		St.E.	± 0.28	± 1.12	-	± 3.20	± 6.19
III	10	Range	3 - 6	10 - 15	15 - 30	80 - 120	100 - 160
		Mean	4.60	12.80	20.55	100.50	127.00
		St.E.	± 0.30	± 0.64	± 1.55	± 4.62	± 6.84
IV	15	Range	3 - 5	10 - 25	20 - 45	75 - 120	120 - 220
		Mean	4.26	13.26	27.80	92.33	157.66
		St.E.	± 0.21	± 1.02	± 2.20	± 3.08	± 6.91

Table 3: Reflexes following epidural injection of various concentrations of procaine Hcl

Group	Concent. %	R e f l e x e s							
		tail	anal	peri-neal	croup	thigh	foot pad	flank	umbilicus
I	1	-	-	++	+++	+++	+++	+++	+++
II	2	-	-	-	-	+	+++	+++	+++
III	3	-	-	-	-	-	++	+++	+++
IV	4	-	-	-	-	-	+	+	++

+++ Reflex normal

++ Reflex sluggish

+ Reflex very sluggish

- Reflex abolished

Fig. 1: Injection in the first
intercoccygeal space.

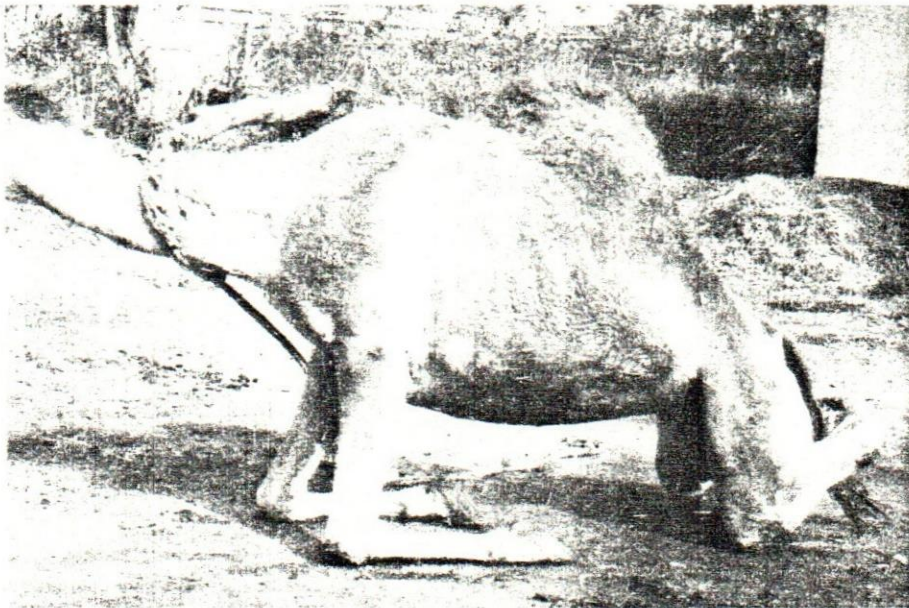


Fig. 2: Inability to stand following epidural injection of
3 and 4% procaine hydrochloride.