

**A PILOT STUDY ON THE LUMBOSACRAL REGION
OF THE SPINAL CORD IN RABBITS
(With 5 Figures)**

By

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دراسة إسترشادية للمنطقة القطنية والعجزية للنخاع الشوكي في الأرانب

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أجري هذا البحث على 15 أرنب لدراسة بعض الجوانب التشريحية والإشعاعية التي تسهل إجراء التبينج الجزئي للقطني بالحقن حول الأم الجافية في الأرانب . وقد أظهرت الدراسة أن الفتحة بين قوسي آخر فقرة قطنية وأول فقرة عجزية هي أوسع فتحة يمكن الدخول منها إلى الفراغ الموجود حول الأم الجافية ، حيث تبلغ 7 مم في الطول و 6.5 مم في العرض ، وهذه الفتحة مسدودة برباط قوي ، وتبعد عن الجلد مسافة 1.2 - 1.6 سم وهي مسافة دخول الإبرة من أعلى لتصل إلى الفراغ فوق الأم الجافية . كذلك وجد أن هذه الفتحة تقع في مقابل أول قطعة عجزية من النخاع الشوكي . وقد أوضحت الدراسة أيضا أن حقن كمية من معلق كبريتات الباريوم مقدارها 0.5 مليلتر لكل عشرين سنتيمتر من طول الحيوان في الحيوانات الميتة يكون كافيا للإنتشار في الفراغ الموجود حول الأم الجافية حتى آخر فقرتين صدريتين وإذا زادت الجرعة إلى 1 مليلتر / 20 سم من طول الحيوان فإنها ستصل إلى المنطقة العنقية بسبب الميل الموجود في العمود الفقري ناحية الأمام مما يعرض الحيوانات الحية للموت بسبب تبنيج جذور الأعصاب المخالية لعشرات التنفس في جدار الصدر وكذلك جذور المصب المخلي للحجاب الحاجز . لذلك يجب التأكيد على عدم إستخدام جرعات أكثر من 0.5 مللي لكل 20 سم من طول الحيوان عند التبينج الجزئي للقطني بالحقن حول الأم الجافية في الأرانب .

SUMMARY

The present work was carried out on 15 rabbits. The study clarified that the lumbosacral interarcual space shaped nearly the heart on a playing card and is 7 x 6.5 mm (average) in diameter. It is closed by a relatively strong interarcual ligament which is 1.2 to 1.6 cm far from the skin. The lumbosacral interarcual space lies against the first sacral spinal cord segment. The lumbosacral injection of barium sulphate (0.5 ml/20 cm from the animal length) as radio-opaque material into the epidural space of the dead animals was sufficient to diffuse till the

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level of the last two thoracic vertebral. The radio-opaque material extended till the cervical region when 0.7 ml/20 cm from the animal length was used. The cranial extension of the epidurally injected material is increased by the ventral inclination of the vertebral canal in front of the lumbar region when the rabbit is in the normal stance. Therefore, it has to be emphasized not to use local analgesic more than 0.5 ml/20 cm from the animal length while dealing with epidural analgesia in rabbits.

INTRODUCTION

The rabbit is frequently considered to be perhaps the most difficult research animal to anaesthetize safely (SHORT, 1987). The significance of the lumbosacral epidural analgesia in rabbits was discussed (YOUSSEF, 1992).

The fundamental informations on the topographical anatomy of the spinal cord at that region are meagre. Therefore, it was aimed to record some anatomical points those might facilitate the lumbosacral epidural analgesia in rabbits.

MATERIAL and METHODS

The study was carried out on 15 rabbits; 9 for the anatomical and 6 for the radiographical investigations. Six of these animals were bled and injected with 10% formaline through the common carotid artery. Dorsal exposure of the spinal cord was carried out by removal of the arches of the vertebrae using a pointed scissor. According to THIEL (1941) the spinal cord segment was determined between the middle of every two successive inter-root distance. The same specimens, before removal of the vertebral arches were used for description of the lumbosacral space. Three animals were bled, frozen and cut transversely at the level of the lumbosacral space to measure the distance between the skin and the epidural space.

Lateral radiographic exposure was performed for 3 animals in normal stance. The 6 animals were then bled. A 0.5 ml/20 cm from the animal length barium sulphate was injected epidurally through the lumbosacral space in 3 animals. In the other 3 animals 0.7 ml/20 cm from the animal length was used. Within 1 to 3 minutes from injection of the barium sulphate, the animals were radiographed (dorso-ventral and lateral exposures).

RESULTS

Exposure of the lumbar and sacral region of the spinal cord showed caudal displacement (*Descensus medullare spinalis*) in the lumbar region, and cranial displacement (*Ascensus medullare spinalis*) in the sacral region (Fig. 1). The first lumbar segment occupies the caudal half of first lumbar vertebra and the cranial half of the second one. The second lumbar segment occupies the caudal half of the second and the cranial half of the third lumbar vertebra. A gradual progressive displacement cranially was

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shown from the third lumbar segment caudalward. Two thirds of the third lumbar segment lies on the third lumbar vertebra and only one third on the fourth lumbar vertebra. The first sacral segment is situated entirely on the caudal half of the last lumbar vertebra. The rest of the sacral segments lie on the first sacral vertebra and the caudal spinal segments on the second sacral vertebra. The spinal cord of rabbit terminates at the second sacral segment.

The lumbosacral interarcual space in rabbit lies opposite to the first sacral spinal cord segment. Therefore, the first sacral nerve is the first one to be affected by injection of the analgesic drug in this area. the amount of the drug, and accordingly its cranial and caudal extension will determine the desensitized area.

The lumbosacral interarcual space is wide in rabbit (Fig. 2). It nearly resembles the heart of the playing card in shape and is 7 x 6.5 mm in diameter (average). Its distance from the skin is 1.2 to 1.6 cm and is closed by a relatively strong interarcual ligament, which its perforation to gain the epidural space is clearly detectable.

Fig.(1)

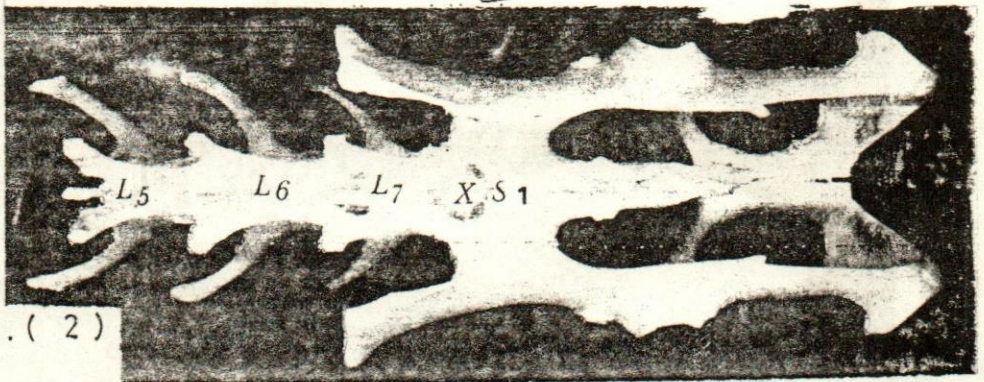
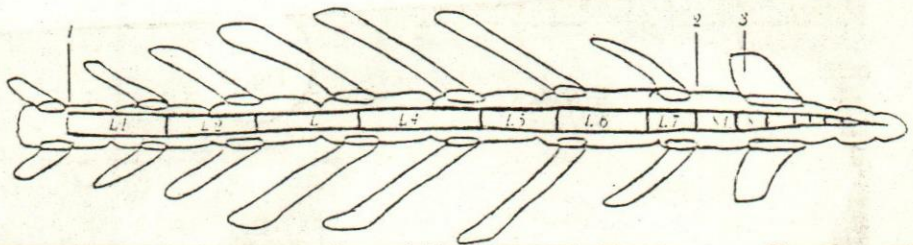


Fig. (2)

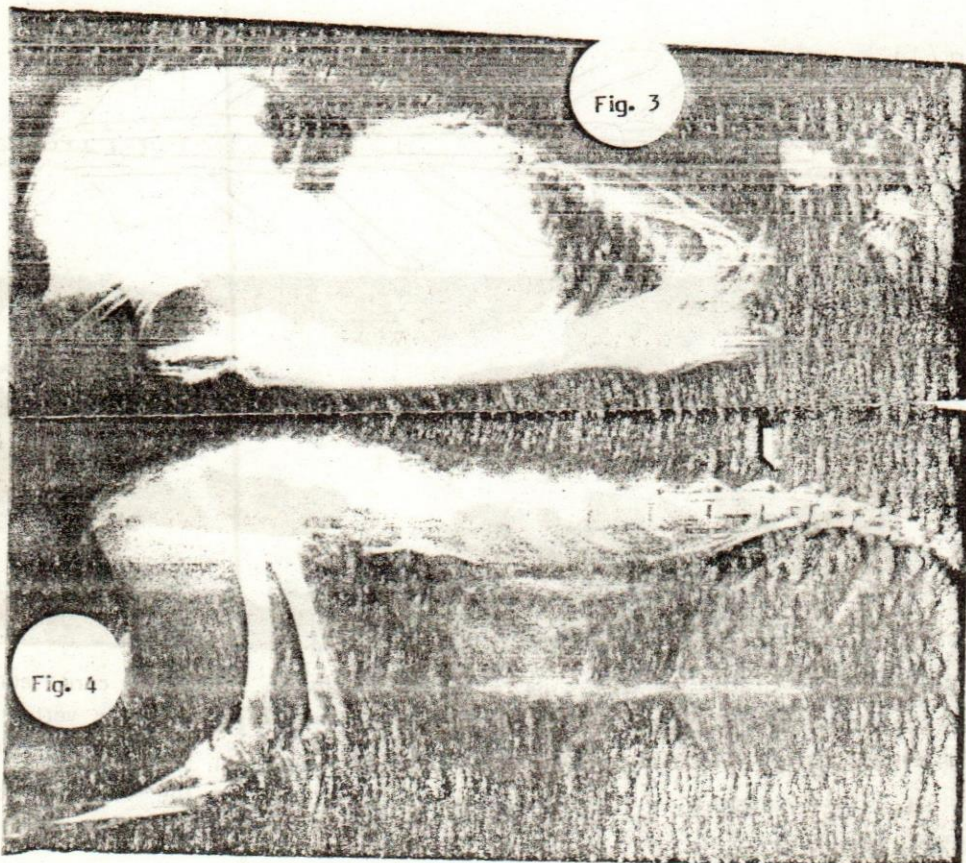
Fig. 1: A diagram showing the relationship between the spinal cord segments and its corresponding vertebrae (1: first lumbar vertebra; 2: 7th. lumbar vertebra; 3: first sacral vertebra; L_1 - L_7 : first to last lumbar segments; S_1 : first sacral segment).

Fig. 2: Photograph of the lumbar and sacral regions of the vertebral column showing the lumbosacral space (X), 5th. to 7th. lumbar vertebra (L_5 to L_7) and first sacral vertebra (S_1).

X-ray picture of the rabbit in the normal stance shows that the level of the epidural space is low in the cranial part of the thorax and in the cervical region in comparison to the lumbar region (Fig. 3). When barium sulphate (0.5 ml/20 cm from animal length) was injected epidurally through the lumbosacral space in the dead animals, it extended till the level of the last thoracic vertebrae (Fig. 4). Extension of the radioopaque material reached the level of the cervical vertebrae, when 0.7 ml/20 cm from the animal length was used (Fig. 5).

Fig. 3: A radiograph of the rabbit in the normal stance showing the ventral inclination of the vertebral canal in front of the lumbar region.

Fig. 4: A radiograph of the epidural space of a dead rabbit injected with barium sulphate (0.5 ml/20 cm from the animal length). The radioopaque material extended cranially to the level of the last two thoracic vertebrae (arrow).



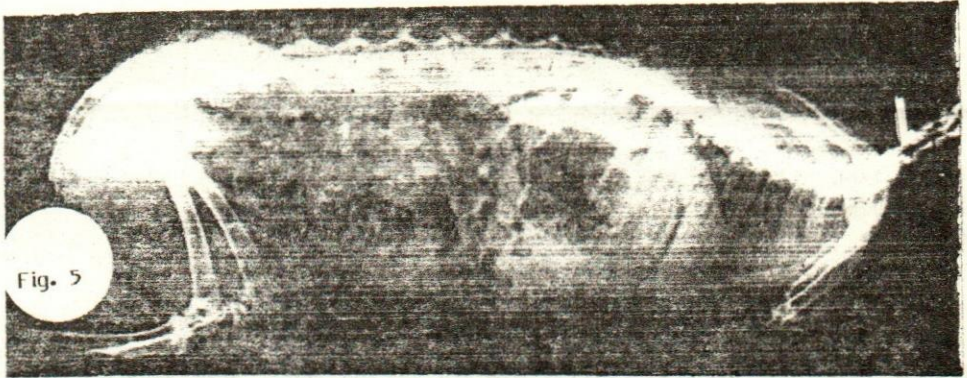


Fig. 5: A radiograph of the epidural space of a dead rabbit after injection of (0.7 ml/ 20 cm from the animal length) barium sulphate. The radio-opaque material extended to the cervical region (arrow).

DISCUSSION

The general manner of displacement of the lumbar and sacral segments described in the present study resembles to some extent that in dog, horse and cattle as given by THIEL (1941); MULLER; CHRISENSEN and EVANS (1964); HABEL (1951) and DELLMANN & McCLURE (1975) respectively.

DYCE; SACK and WENSING (1987) recorded that the spinal cord terminates between L₆ and S₁ in cat and L₆ or L₇ in dog. GABER (1982) mentioned that the spinal cord in rabbit terminates at the cranial border of the second sacral vertebra. However, in the present work, it was found like most ruminant animals such as cattle (McLEAD, 1958 and RAGAHAVAN & KACHROO, 1964), buffalo (SHARMA and RAO, 1971), and camel (MANSOUR, 1983), the spinal cord of rabbit terminated at the middle piece of the sacrum.

YOUSSEF (1992) recorded no deaths after epidural analgesia in rabbits by the lumbosacral injection of the analgesic drugs in a dose rate of 0.5 ml/20 cm from the animal length. The present radiographic study revealed that this dose must not be exceeded, otherwise the drug will extend cranially and paralyse the thoracic and diaphragmatic nerves. The cranial extension of the epidurally injected material may be enhanced by the steep inclination of the vertebral canal of rabbit in the normal stance.

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