

The spinal nerves that constitute the plexus lumbosacrales of porcupines (*Hystrix cristata*)

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ABSTRACT: In this study, the spinal nerves that constitute the plexus lumbosacrales of porcupines (*Hystrix cristata*) were investigated. Four porcupines (two males and two females) were used in this work. Animals were appropriately dissected and the spinal nerves that constitute the plexus lumbosacrales were examined. It was found that the plexus lumbosacrales of the porcupines was formed by whole rami ventralis of L1, L2, L3, L4, S1 and a fine branch from T15 and S2. The rami ventralis of T15 and S2 were divided into two branches. The caudal branch of T15 and cranial branch of S2 contributed to the plexus lumbosacrales. At the last part of the plexus lumbosacrales, a thick branch was formed by contributions from the whole of L4 and S1, and a branch from each of L3 and S2. This root gives rise to the nerve branches which are disseminated to the posterior legs (caudal gluteal nerve, caudal cutaneous femoral nerve, ischiadic nerve). Thus, the origins of spinal nerves that constitute the plexus lumbosacrales of porcupine differ from rodentia and other mammals.

Keywords: lumbosacral plexus; nerves; posterior legs; porcupines (*Hystrix cristata*)

List of abbreviations

M = musculus, T = thoracal, L = lumbal, S = sacral, Ca = caudal

The porcupine is a member of the Hystricidae family, a small group of rodentia (Karol, 1963; Weichert, 1970; Kuru, 1987; Demirsoy, 1992). The spinal origins of the plexus lumbosacrales that spread to the posterior legs has been studied in a variety of mammals including the dog (Miller et al., 1964; Getty, 1975), rabbit (Barone et al., 1973; McLaughlin and Chiasson, 1987), mouse (Cook, 1965), and rat (Green, 1968; Chiasson, 1980; Schmalbruch, 1986; Asato et al., 2000). The spinal origins of the brachial plexus of porcupines was studied by Aydin (2003). However, to the author's knowledge this is the first study on the spinal origins of the plexus lumbosacrales of the porcupines (*Hystrix cristata*). The purpose of this study was to document the spinal nerves that constitute the lumbosacral plexus of the porcupines (*Hystrix cristata*).

MATERIAL AND METHODS

Four porcupines (two males and two females) caught by hunters were used. Abdominal cavities

were opened by an incision made along the linea alba and a dissection of the muscles. The symphysis pelvis of os coxae was cut with a costatom, and the pelvic cavity was opened. The organs of the cavum abdominis and pelvis were removed without the spinal nerves constituting the plexus lumbosacrales. The quadratus lumborum muscle, psoas minor and major muscles were dissected carefully. Subsequently, the ventral part of the corpus of lumbal and sacral vertebra from the last thoracal vertebra to the end of sacrum was cleared completely. The origins of spinal nerves that constitute the plexus lumbosacrales in both the posterior legs were examined and pictured were taken of them.

For terminology, the Nomina Anatomica Veterinaria was used (World Association of Veterinary Anatomists, 1994).

RESULTS

It was observed that the ventral rami of T15, L1, L2, L3, L4, S1 and a thin branch of S2 spinal

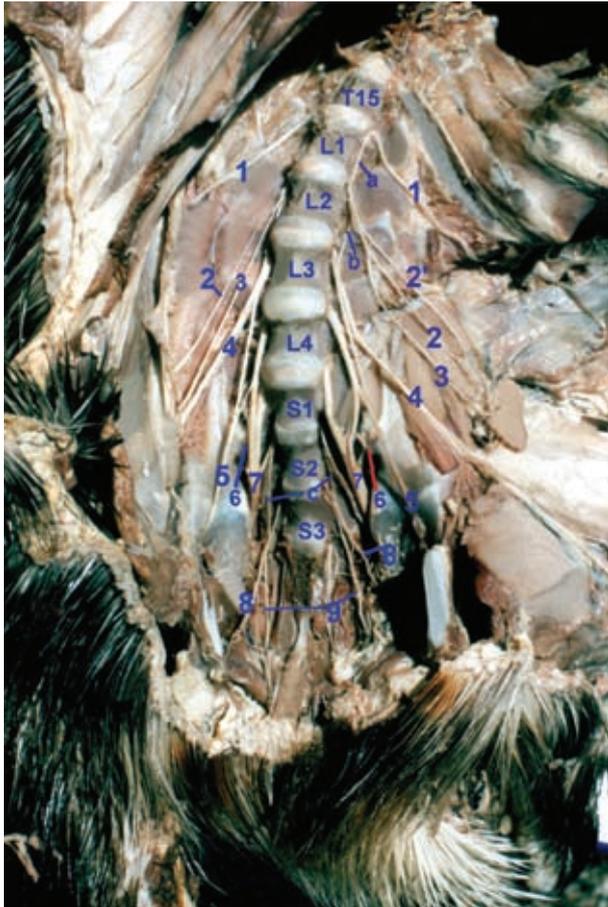


Figure 1. View from the cavum abdominal and pelvic of the plexus lumbosacralis in the female porcupines

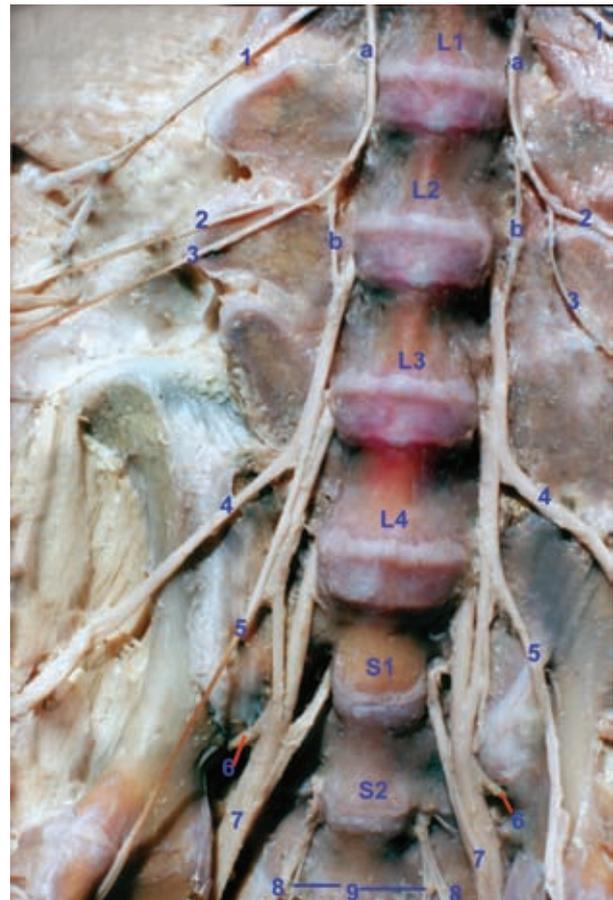


Figure 2. View from the cavum abdominal and pelvic of the plexus lumbosacralis in the male porcupines

a = branch knocking from T15 to L1; b = branch knocking from L1 to L2; c = branch knocking from S1 to S2; 1 = iliohypogastric nerve; 2 = lateral cutaneous femoral nerve; 2' = ilioinguinal nerve; 3 = genitofemoral nerve; 4 = femoral nerve; 5 = obturator nerve; 6 = cranial gluteal nerve; 7 = the common root which was forming by union of the entire L4 and S1 with a slender branch which came from S2 and L3; 8 = pudental nerve; 9 = caudal rectal nerve

nerves formed the lumbosacral plexus in porcupines (*Hystrix cristata*). The rami ventralis of T15 and S2 were divided into two branches. The ramus ventralis of T15 was divided into two branches, one of which joined to L1 the other forming the iliohypogastric nerve. A common root was formed at the distal part of the lumbosacral plexus by the union of a branch from L3, the entire L4 and S1 and a slender branch from S2. This root gave rise to the nerve (caudal gluteal nerve, caudal cutaneous femoral nerve, ischiadic nerve) branches which were scattered through the posterior leg.

After receiving a thin branch from T15, L1 gave a branch to L2 and was then divided into two branches on right and left sides of three animals and into two branches on the right side and three

branches on the left side in one female animal. Two branches diverging from L1 formed the genitofemoral and lateral femoral cutaneous nerves, whereas the third one on the left side of the one female animal was the ilioinguinal nerve. This nerve was absent in the other three animals (Figure 1).

After joining with the branch coming from L1, L2 was divided into the medial and lateral branches. The lateral branch was merged with the first branch of L3 to form the femoral nerve, while the medial branch was merged with its second branch to form the obturator nerve.

After giving the first and second branches to form the femoral and obturator nerves respectively, L3 was merged with L4. This branch forms the cranial gluteal nerve before uniting with L4 in females and

after uniting with L4 in males. Hence, the cranial gluteal nerve originated from L3 and L4 in males, but only from L3 in females (Figures 1 and 2).

In three out of four examined animals, the common root, which constitutes the distal end of the lumbosacral plexus and gives rise to the nerves scattering through the posterior leg, was formed by the union of a branch from L3, the entire L4 and S1 and a slender branch from S2. The other branch of S2 formed the pudendal and caudal rectal nerves. In the other female animal, however, S2 did not join this root. Instead, one of the two branches of S1 joined this root while the other united with S2 and formed the pudendal and caudal rectal nerves. This thick root which innervates the posterior leg left the pelvic cavity by passing between the major and minor sciatic foramina over the ischial spine, and giving rise to the caudal gluteal, caudal femoral cutaneous and sciatic nerves on the external part of the pelvis.

DISCUSSION AND CONCLUSION

It has been reported that the lumbosacral plexus was formed by the union of the ventral rami of the last five lumbar (L2, L3, L4, L5, L6) and the first four sacral (S1, S2, S3, S4) nerves in cattle, the last two lumbar (L5, L6) and the first two sacral (S1, S2) nerves in sheep, the last four lumbar (L3, L4, L5, L6) and the first two sacral (S1, S2) nerves in goats (Getty, 1975; Tecirlioglu, 1983; Dursun, 2000), the last five lumbar (L3, L4, L5, L6, L7) and the first three sacral (S1, S2, S3) nerves in dogs (Miller, 1964; Getty, 1975), the last thoracic (T13), all the lumbar (L1, L2, L3, L4, L5, L6) and the first two sacral (S1, S2) nerves in rats (Green, 1968), the last four lumbar (L4, L5, L6, L7) and the first three sacral (S1, S2, S3) nerves in cats (Getty, 1975), the last four lumbar (L3, L4, L5, L6) and the first three sacral (S1, S2, S3) nerves in guinea pigs (Cooper and Schiller, 1975), the last four lumbar (L4, L5, L6, L7) and the first three sacral (S1, S2, S3) nerves in rabbits (McLaughlin and Chiasson, 1987). In the present study, we found that the lumbosacral plexus was formed by the union of the ventral rami of the last thoracic (T15), all the lumbar (L1, L2, L3, L4) and the first two sacral (S1, S2) nerves in porcupines which has a vertebral formula of (C:7, T:15, L:4, S:4, Ca:4) as reported by Yilmaz (1998). This structure is close to that of rats (Green, 1968) in terms of rami that contributed to formation of the lumbosacral

plexus. However, the number of the spinal nerves was not same because of the different number of vertebrae in these two species. The findings of the present study were also different from those reported for ruminants (Getty, 1975; Tecirlioglu, 1983; Dursun, 2000), dogs (Miller, 1964; Getty, 1975), cats (Getty, 1975), guinea pigs (Cooper and Schiller, 1975) and rabbits (McLaughlin and Chiasson, 1987).

The common root which gives rise to the nerves innervating the posterior legs was reported to be formed by the union of L6, S1 and S2 in goats, L5, L6, S1 and S2 in sheep, L4, L5, L6, S1 and S2 in cattle (Getty, 1975), L6, L7, S1 and S2 in dogs (Miller, 1964; Getty, 1975), the last two lumbar (L4, L5) and the first three sacral (S1, S2, S3) in human (Ebraheim et al., 1997), the last four lumbar (L4, L5, L6, L7) and the first two sacral (S1, S2) in cats (Getty, 1975), the last lumbar (L6) and the first two sacral (S1, S2) in guinea pigs (Cooper and Schiller, 1975), the last three lumbar (L5, L6, L7) and the first three sacral (S1, S2, S3) in rabbits (McLaughlin and Chiasson, 1987), the last lumbar (L7), the entire first sacral (S1) and slender branches from L6 and S2 in dogs (Miller, 1964; Tecirlioglu, 1983). Getty (1975) claimed the L6, L7, S1 and S2 spinal nerves contribute to formation of this common root in dogs. There are many reports giving the data about the formation of this common root in rats. Among those: Asato et al. (2000) reported that L4 and L5 always, and L6 rarely, contribute to formation of the common root, while Vesjada and Hink (1980), Schmalbruch (1986) and Green (1968) declared that L4, L5, L6, S1 and S2 are contributing nerves. In porcupines, finding that the entire L4 and S1 and a slender branch from S2 and L3 constitutes the common root which is consistent with the formation in dogs (Miller, 1964; Tecirlioglu, 1983) but not with those of the ruminants (Getty, 1975), humans (Ebraheim, 2000), cats (Getty, 1975), guinea pigs (Cooper and Schiller, 1975), rabbits (McLaughlin and Chiasson, 1987) and rats (Green, 1968; Vesjada and Hink, 1980; Schmalbruch, 1986; Asato et al., 2000).

As a result, the formation of the lumbosacral plexus in porcupines is partly consistent only with the rat from within rodents, and differs from all others. Regarding the formation of the common root of the nerves which innervate the posterior leg, there is a slight similarity with dogs (Miller, 1964; Tecirlioglu, 1983) while it is significantly different from rodents or the other mammals mentioned above.

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