Frequency of occurrence of mamillo-accessory foramen in lumbar vertebrae

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The medial branch of the posterior ramus of spinal nerves passing between the mamillary process and the accessory process may be subjected to irritation and compression as a result of conversion of these formations into a foramen. As a result, pain due to spasm may occur in muscles which are innervated by this nerve. However, as this branch also provides the sensitive innervation of zygapophysial joint, there maybe a pain arising from the joint. At present no clinical study is available on this subject.

In this study which is carried out on 273 adult lumbar vertebrae, the mamillo-accespry foramen was not observed at LI and L2, whereas it was most frequently found at L4. Most of the mamillo-accessory foramina found were on the vertebrae with osteoarthiritic findings and distributed more or less equally on the right and left sides.
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Key Wods: Lumbar spine, Low back pain, Spinal cord

Each vertebra consists of two main parts, the vertebral body and the vertebral arch. As bodies are placed on each other through intervertebral discs, vertebral canal is formed when the holes surrounded by bodies and arches come one on another. This canal protects the spinal cord and its membranes (1-3).

The initial appearance of the vertebra is in the 4th week of the embryonic period. Sclerotomes developing from the mesenchymal cells on the medial parts of the somites have an excessive tendency to migrate. Of these mesenchymal cells, those parts which completely surround the notochord form the vertebral body and those which migrate to the surroundings of neural tube form the vertebral arch and those settle on the vertebral bodies form the costal process (2-4).

As of the eight week, chondrification centers appear in mesenchymal vertebrae. At the beginning, each vertebral body posseses to seperate chondrification centres. Towards the end of the embryonic period these two centres fuse together to form a single centre. Additionally, each vertebral arch posseses a pair of chondrification centres initially. These centres gradually fuse with each other and the bodies. These chondrification centres extend to the sides and fuse at the back of the vertebra to form the transverse and spinous processes respectively. The length of these procesess vary with different vertebrae (3,4).

In pedicle section where arches fuse with bodies, there is a notch both on the superior and inferior parts. Of these the superior one is called the superior vertebral notch, the inferior one is called the inferior vertebral notch. The foramen, formed as a result of fusion of the superior and inferior vertebral notches of the vertebrae placed on each other through intervertebral disc to form the vertebral column is called the intervertebral foramen, from where spinal nerves emerge (1,3).

Immediately distal to the spinal ganglia, ventral and dorsal roots coming out of the spinal cord unite to form the spinal nerves, which emerge through intervertebral foramina and give off recurrent meningeal branches, and divide immediately into dorsal and ventral rami. Since the last two of the three coccygeal segments remain rudimentary, there are 31 pairs of spinal nerves distributed as 8C, 12 TH, 5L, 5S and 1 coccygeal. Posterior and anterior roots fuse right over the distal ends of the spinal ganglia. The spinal nerve leaves the vertebral canal through intervertebral foramen. Only the first cervical spinal nerve leaves the vertebral canal between the occipital bone and the atlas. The posterior branch of this is called the suboccipital nerve (3).

Posterior ramus divides into a medial and a lateral branch. In the lumbar region, medial branches extend towards joint processes and end up in mm.

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rpultifidi. On the other hand, lateral branches innerve ₀₀th m.sacrospinalis and the skin of this region (5).

Over the transverse processes of lumbar vertebrae there are two little processes called mamillary process and accessory process. The mamillary processes which are superior lie on the posterior parts of the superior articular process. On the other hand, accessory processes which are inferior lie on the base of the transvers process about the posterior part (3,6).

Mamillo-accessory ligament between the mamillary process and the accessory process in lumbar vertebrae may be subjected to ossification especially both in old osteoarthritic patients and cause the formation of a foramen called mamillo-accessory foramen. Medial branches of dorsal ramus of lumbar spinal nerves pass through the groove between the mamillary process and the accessory process. Therefore, through closing up of this groove to become mamillo-accessory foramen, this branch remains within the foramen (6,7).

Allthough it is considered that medial branch of posterior ramus may be subjected to irritation and compression thus causing lumbalgia while passing through the mamillo-accessory foraman; a clinical study related to this subject is not available (6).

This study has been carried out on lumbar vertebrae in order to determine the frequency of occurence and distribution of mamillo-accesory foramen in lumbar vertebrae.

MATERIALS AND METHODS

This study has been carried out on 273 various lumbar vertebrae available at the Department of Anatomy, Medical School of Ankara University.

Out of these vertebrae, 51 were 1st, 61 were 2nd, 62 were 4th and 39 vere 5th lumbar vertebrae. At all levels of lumbar vertebrae, notches which have a formation level of 3/4 and 1/2 as well as fully formed mamillo-accessory foramen were examined.

As we do not have information about the sex and age distribution of the available lumbar vertebrae, these are not included in the evaluation.

RESULTS

During our study, at L1, no notch or foramen was observed. At l_2, these formations were rarely found. At L3, notches and foramina were found, although rarely, especially at inferior levels (Table 3).

A total of 56 1/2 notch being 28 on the right and 28 on the left (Figure 1) and a total of 34 3/4 notches being 16 on the right and 18 on the left (Figure 2) and a total of 16 mamillo-accessory foramina being 9 on the left and 7 on the right were found (Figure 3).

It was observed that mamillo-accessory foramina occurred only on one side of the vertebrae. However, while there was a foramen on one side, there might be a 3/4 or 1/2 notch on the other side.

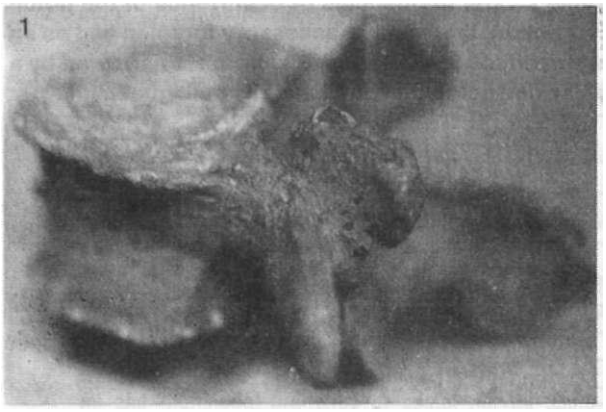

Figure 1. View of vertebrae L5 with 1/2 notch on the left side (arrows).

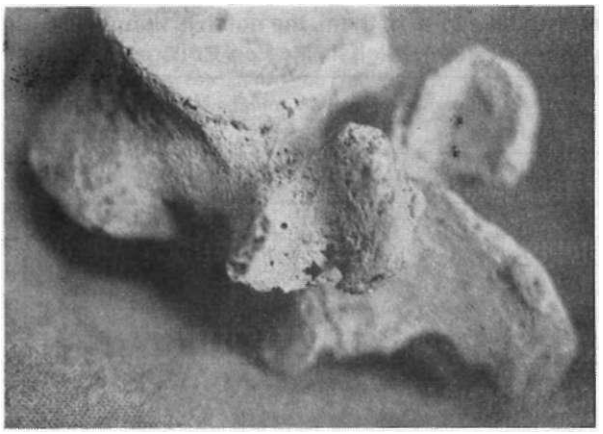

Figure 2. View of vertebrae L5 with 3/4 notch on the left side (arrows).

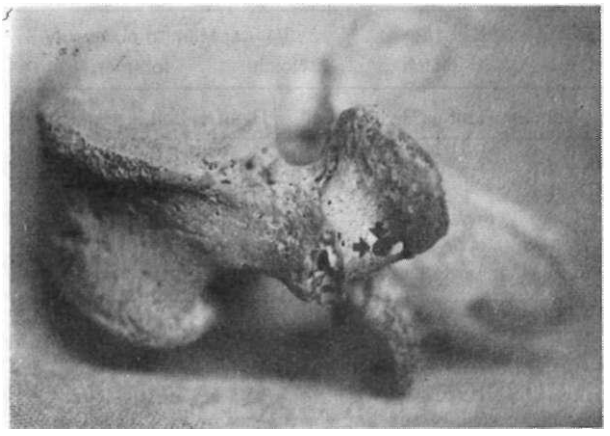

Figure 3. View of vertebrae L4 with mamillo-accesory foramen on the left side (arrows)

Table 1. The frequencies of occurrence of the notch (1/2 notch), the mamillo-accessory foramen and as an intermediate form of them, the notch is narrowed by a spine (3/4 notch). (Maigne and his collagues).

	1/2 Notch		3/4 Notch		Mamillo-accessory foramen	
	Left	Right	Left	Right	Left	Right
L1						
L2	1	1			2	
L3	6	1	5	2	5	3
L4	21	6	6	4	10	11
L5	20	12	12	11	51	26

Table 2. The frequencies of occurrence of the notch (1/2 notch), the mamillo-accessory foramen and as an intermediate form of them, the notch is narrowed by a spine (3/4 notch). (Nighsia Medical Collage).

	1/2 Notch		3/4 Notch		Mamillo-accessory foramen	
	Left	Right	Left	Right	Left	Right
L1	100	100				
L2	92	89	8	10	—	—
L3	51	48	46	48	3	4
L4	25	22	64	68	11	10
L5	23	20	50	52	27	28

Table 3. The frequencies of occurrence of the notch (1/2 notch), the mamillo-accessory foramen and as an intermediate form of them, the notch is narrowed by a spine (3/4 notch). (Our study).

		1/2 Notch		3/4 Notch		Mamillo-accessory foramen	
	Number	Left	Right	Left	Right	Left	Right
L1	51						
L2	61	1	3	2	1	—	—
L3	62	9	6	2	3	—	1
L4	60	11	13	11	8	5	5
L5	39	7	6	3	4	2	3

DISCUSSION

Mamillo-accessory foramen was first defined in a study carried out on 100 lumbar vertebrae. It was observed that mamillo-accessory foramen did not occur at L1, and that it occured more often at L4 and most frequently at L5. In this study, mamillo-accessory foramine were found to be equally distributed on the left and right. As researchers could not find, in classical books and literature, any information to compare with the results of their study, they concluded that such a formation is a peculiarity to the Chinese race (Table 1) (8).

Bogduk and his colleagues (9), stated that in their study about denervation of posterior ramus of the spinal nerve which innervates superior articular process in the treatment of low back pain, they rarely found mamillo-accessory foramen.

In their study, carried out on 10 fresh cadavers about innervation of zygapophysial joint in lumbar vertebrae, they also rarely found mamillo-accessory foramen (10).

Maigne and his colleagues (6), in a study, carried out on 193 vertebrae, stated that mamillo-accessory foramen never occurred at L1 and rarely seen at L3. In their study, mamillo-accessory foramen was more often found at L4 and most frequently at L5 (26.4% on the left and 13.5% on the right). In the same study, during the examination of lumbar vertebrae of 10 infants who did not have osteoarthritic semptoms, no mamillo-accessory foramen was found (Table 2).

Researchers indicated that mamillo-accessory foramen can easily be shown by computed tomography, while they are conducting denervation of nerve in order to treat low back pain. They took this foramen as a reference point at it is where nerves which innervate zygapophysial joint pass (6).

The fact that mamillo-accessory foramen is found in the elderly and especially with osteoarthritic patients explains that this foramen occurs by ossification of the mamillo-accessory ligament (6).

In our study, no notch or mamillo-accessory foramen was observed at L1. These formations were rarely observed at L2. These formations were, although seldom, found especially at inferior lumbar vertebrae at L3. However, in our study, notches and mamillo-accessory foramen were more frequently found at L4. These formations were seen to be almost equally distributed on the right and left side.

The fact that in other studies the frequency of occurrence of mamillo-accessory foramen on the right and left sides vary may be explained by the fact that in our study we had less vertebrae at L5 compared to other levels.

We belive that when investigating done on lumbalgia etiology, the anatomical statues of mamillo-accessory foramen should be taken into consideration and clinical studies chould also be evaluated in this respect.

Lumbal vertebralarda for. mamilloaccessorius'un görülme sıklığı

Proc.mamillaris ve proc.accessorius arasından geçen r.posterior nervi spinalis'in medial dalı, bu yapıların delik haline dönüşmesi sonucu irritasyon ve kompresyona uğrayabilmektedir. Bunun sonucunda bu sinirin innerve ettiği kaslarda spasma bağlı ağrılar ortaya çıkabilmektedir. Bununla birlikte art. zygapophysialos'lerin sensitif innervasyonu da bu sinir dalınca sağlandığından bu eklem bölgesinden kaynaklanan ağrılarda söz konusu olabilir.

Toplam 273 erişkin insan lumbal vertebrasında yapılan çalışmada, for. mamillo-accesorius L1 ve L2 seviyesinde hiç gözlenmezken, en sık olarak L4'de tesbit edilmiştir. Tesbit edilen for. mamillo-accesorius'un büyük bir çoğunluğu osteoartrit bulguları olan vertebralarda, sağ ve sol tarafta aşağı yukarı eşit oranda bulunmuştur.
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