SciMedCentral

JSM Neurosurgery and Spine

Short Communication

Chondrosis, Herniation, and Nodes: The Contributions of Christian Georg Schmorl (1861-1932) to the Intervertebral Disc Pathology

Cosamalón-Gan I[1], Villar Vega V[2], Cosamalón-Gan T[1], Cobo R[1], Mattos-Piaggio G[3], García-Cosamalón J[2,3], and Vega JA[1,4]*

[1]Department of Morphology and Cell Biology, University of Oviedo, Spain
[2]Institute of Biomedicine, University of León, Spain
[3]Neurosurgery Service, University Assistance Complex of León, Spain

*Corresponding author
Vega JA, Department of Morphology and Cell Biology, Anatomy and Human Embryology Area, Avd. Julián Clavería, 6, Planta 9ª, 33006 Oviedo, Spain, Email: javega@uniovi.es

Submitted: 02 September 2017

Accepted: 28 September 2017

Published: 30 September 2017

Keywords
- Intervertebral disc
- Degeneration
- Chondrosis
- Herniation
- Schmorl's nodes

Abstract

The German pathologist C.G. Schmorl was the first to systematically describe the normal structure and the degenerative changes of the human intervertebral disc, considering the age-related changes as primary degeneration. He established the terms of chondrosis, osteochondrosis, disc prolapse or herniation and intraosseus node. This paper briefly summarized the contribution of Schmorl to the knowledge of the intervertebral disc.

INTRODUCTION

Until the beginning of the 20th century the studies on the pathology of the spine, especially of the intervertebral disc, were almost inexistent and restricted to some description carried out by Wenzel in 1824, Rokitanski in 1855, Virchow in 1957, and Luschka in 1858 [1]. This panorama dramatically changed during the second decade of the pass century. At this time, the German pathologist Christian Georg Schmorl [2] described the normal structure and degeneration of the intervertebral disc (IVD) based on anatomical, radiological, and histological studies on nearly 10,000 necropsy specimens. Unfortunately, his work was entirely written in German and did not obtain wide-word recognition until the publication in 1959, together with Junghanns, of the English translation of his work [3]. Nevertheless, Schmorl believed that the degenerative finding he found were too common to be clinically important. Although actually the association between low back pain and sciatic pain with pathologies of the intervertebral disc is out of any doubt, a century ago this was not so clear.

CHONDROSIS OF THE INTERVERTEBRAL DISC

Within the extensive and meticulous research conducted by Schmorl on the age-dependent degenerative changes of IVD, he distinguished an initial phase, as primary degeneration, that denominates chondrosis. It is characterized by dehydration of the nucleus pulposus (NP), occurrence of fissures in the annulus fibrosus (AF) and prolapsed NP [3]. According to Schmorl, the AF perpendicular fissures (radial fissures) predispose to subsequent overflows of the NP that due to mechanical stress produce internal translations of the disc tissue and give rise to protrusions with prominence at the posterior wall of the IVD (Figure 1 a,b). When the tears of the AF are extensive, and involves all the lamellae, the true protrusion or prolapsed of the NP occurs, mainly towards dorsal or the dorso-lateral sectors (Figure 1a). These retrograde prolapsed NP were observed so often, that Schmorl called them accessory nucleus pulposus, dystopy of the NP, or nodes of the NP, and he did not give clinical importance [1]. These prolapsed NP were interpreted as disease due to wear of the IVD tissues and thus as an integral part of the chondrosis. The subsequent stage to the chondrosis was characterized by height reduction of the intervertebral space, calcification and subsequent sclerosis of the cartilaginous end plates (CP); he denominated it as osteochondrosis.

DISC HERNIATION

But when Schmorl analyzed the structure of the extruded tissue obtained from surgical pieces, observed that all the IVD components were present. He found only parts of the NP but also segments of the AF and of PC. He proposed the denomination of disc prolapsed instead of NP prolapsed, since all the elements of the IVD were present, although Schmorl himself affirms that was Geipel who introduced this term. Furthermore, during the study of long series of postmortem IVD Schmorl described and classified for the first time the different forms of IVD prolapsed: pendulans, fixatus, incarceratus and liber (sequestration) (Figure 1c) [4].

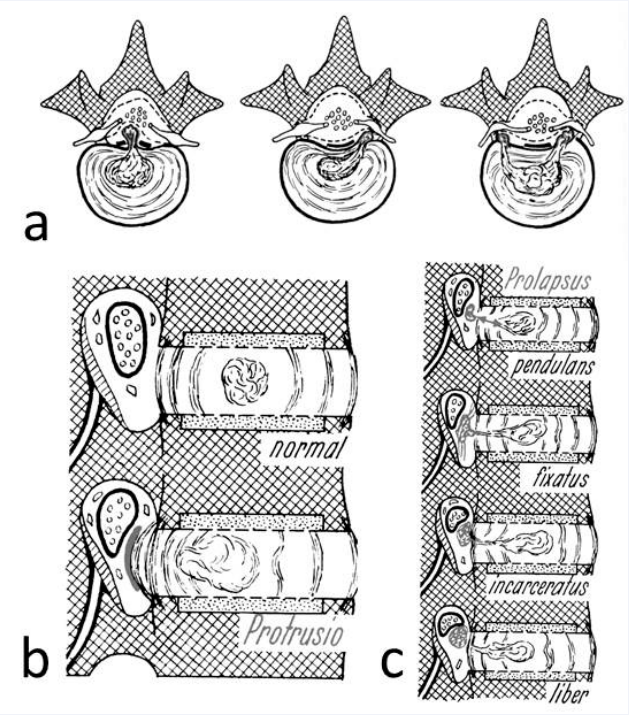

Figure 1 Electrospun nanofibers membrane of poly-ε-caprolactone visualization after 21 days of human Osteoblasts culture (Cells visualization in blue (nucleus /DAPI) and PLL^{FITC} labelled nanofibers in green): colonization and proliferation of osteoblasts into the nanofibers membrane.

THE INTRAOSSEOUS NODES (SCHMORL'S NODES)

In spite of the capital contributions of Schmorl to the knowledge of IVD pathology, his name remains historically linked to the so-called Schmorl's nodes [5,6]. Schmorl described the intraosseous nodes as accumulation of disc tissues, mainly NP, within the vertebral somata. The origin of those nodes was related to movements of the NP into the vertebral bodies due to the expansive force of the NP through points of reduced resistance in e PC of embryological origin (expansions in the passage of the notochord, vascular scarring, or ossification defects). The intraosseous nodes were found in 38% of the examined spines, more frequently in males (39.9%) than in females (34.3%), presumably due to the higher overhead of the male spine [7].

Prior to the Schmorl's research, the compressive pathologies in the spinal canal had been described and treated as enchondroma, chordoma and fibrocondroma, or osteochondritis dissecans [8,9], and not as IVD hernias. Before Schmorl, the IVD was not subject of an exhaustive study it was a neglected and ignored structure by clinicians, pathologists and radiologists [2]. Few years after the Schmorl's research was published, Mixter and Barr carried out the first operation diagnosed of ruptured intervertebral disc, and then presented the direct relationship between disc herniation and the sciatic associated with the resulting nerve compression, and related preexisting degeneration as an etiologic factor in herniations [10]. Baar discovered in the of Schmorl's book that he was operating as enchondromas were not anything more that DIV herniations.

ACKNOWLEDGEMENT

Study supported by Fundacion Leonesa Pro-Neurociencias.

REFERENCES

1. Waddell G. Back pain through history. In: The Back Pain Revolution. Churchill Livinstone. 2010; 47-69.
2. Vernon-Roberts B. Christian Georg Schmorl. Pioneer of spinal pathology and radiology. Spine. 1994; 19: 2724-2727.
3. Schmorl G, Junghanns H. The Human Spine in Health and Disease: Anatomicopathologic Studies. 1st American Edn. USA.1959.
4. Truumees E. A history of lumbar disc herniation from Hippocrates to the 1990s. Clin Orthop Relat Res. 2015; 473: 1885-1895.
5. Kyere KA, Than KD, Wang AC, Rahman SU, Valdivia–Valdivia JM, La Marca F, et al. Schmorl's nodes. Eur Spine J. 2012; 21: 2115-2121.
6. Schapiro IM, Risbud MV. Introduction to the structure, function, and comparative anatomy of the vertebrae and the intervertebral disc. In: The Intervertebral Disc. Schapiro IM, Risbud MV. Springer-Verlag. 2014; 3-15.
7. Schmorl G. The changes occurring in the sword-disks, and the excitability and excitability of the swirl-disks, and the changes caused by them and the vertebral spongiosa. Verh Dtsch Path Ges. 1927; 22: 250.
8. Wiltse LL. History of lumbar spine surgery. Lumbar Spine Surgery Techniques & Complications White AH, Rothman RH, Ray CD (Eds). The Mosby Company UK: Blackwell Scientific. 1987; 5- 23.
9. Maroon J C, Abla AA. Microlumbar discectomy. Clin Neurosurg. 1986; 33: 407-417.
10. Mixter WJ, Baar JS. Rupture of the intervertebral disk with involvement of the spinal canal. N Eng J Medn 1934; 211: 385-395.

Cite this article

Cosamalón-Gan I, Villar VV, Cosamalón-Gan T, Cobo R, Mattos-Piaggio G, et al. (2017) Chondrosis, Herniation, and Nodes: The Contributions of Christian Georg Schmorl (1861-1932) to the Intervertebral Disc Pathology. JSM Neurosurg Spine 5(4): 1092.