Endoscopic Lumber Disc Surgery

Essay

Submitted in Partial Fulfillment of the Master Degree

in General surgery

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2013

استئصال الغضروف القطني بواسطة المنظار الجراحي

رسالة

توطئه للحصول على درجة الماجستير في الجراحة العامة

مقدمة من

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بسم الله الرحمن الرحيم

(قالوا سبحانك لا علم لنا الا ما
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صدق الله العظيم

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INTRODUCTION

Virchow first described traumatic lumbar intervertebral disc disease in 1857. Contributions from physicians striving to understand back pain and sciatica have encouraged the development of new surgical interventions, as well as conservative modalities, for the treatment of spinal disorders. In 1955, Malis began using a binocular microscope, in conjunction with bipolar coagulation, to aid his surgical approach. After the introduction of the intraoperative use of an operating microscope for discectomies, Yasargil and Caspar introduced the minimally invasive concept of microdiscectomy. In 1975, Hijikata described the first percutaneous endoscopic discectomy. In 1983, Kambin and Gellman performed a discectomy by inserting a Craig cannula and a small forceps into the disc space, after an open laminectomy, evacuate the nucleus pulposus ***(Guiot BH et al., 2002)***.

There are many applications of endoscopy in spine surgery including; endoscopic discectomy for lumbar disc herniation, microendoscopic decompression for treatment of lumbar stenosis, laparoscopic anterior lumbar interbody fusion, minimally invasive percutaneous posterior lumbar interbody fusion ***(Kafadar et al., 2006).***

Minimal invasive endoscopic spinal surgery has numerous advantages including ; reduced operative time; less soft tissue damage; reduced muscle splitting and retraction; less postoperative

pain; reduced blood loss; faster recovery; and shorter hospital stay ***(Choi G et al., 2007).***

Complications of endoscopic spinal surgery can be related to anesthesia, patient positioning, and surgical technique ***(Yeung et al., 2006)***.

Complications related to surgical technique include; dural tear with a delayed pseudomeningocele formation, discitis, due to scraping of the end plates by the automated nucleotome during disc removal, and cauda equina injury. However, once mastered, endoscopic spinal procedures can result in a significant reduction of complications and postoperative pain and discomfort and return patients to their daily life activities sooner than standard open, more conventional procedures ***(Brayda-Bruno et al., 2006).***

The performance of successful minimally invasive endoscopic spinal surgery is beset with several technical challenges, including the limited tactile feedback, two-dimensional video image quality of three-dimensional anatomy, and the manual dexterity needed to manipulate instruments through small working channels ***(Yeung et al., 2006)***.

The success of endoscopic spine surgery hinges on the proper patient selection, for example the inclusion criteria for endoscopic lumbar discectomy are similar to the well-known indications for open laminectomy and discectomy; Failure to respond to nonoperative conservative measures, presence of positive tension signs, correlative

dermatomal distribution of sciatic pain, and correlative positive imaging studies ***(Ruetten et al., 2005).***

Exclusion criteria for endoscopic disc surgery include low back pain due to degenerative disc process, also cauda equina syndrome as it is usually associated with some degree of bony and ligamentous abnormality.Individuals with a global bulging disc and sciatica are usually suffering from spinal stenosis; they are best treated by open procedures. A sequestered disc, which has migrated in a cephalad or caudal direction in the spinal canal, will require laminectomy for the retrieval of herniated fragments ***(Gupta et al., 2007).***

AIM OF THE WORK

The aim of this work is to review the current concepts in endoscopic lumbar spine surgery regarding; endoscopic anatomy of the spine, applications, advantages, inclusion criteria, exclusion criteria, types of endoscopes & instruments used, surgical techniques, complications and lastly the future of minimal invasive endoscopic lumbar spine surgery.

DEVELOPMENTAL SPINAL ANATOMY

The preembryonic period (weeks 0 To 3)

The preembryonic period. Which begins at fertilization and continues for approximately 3 weeks, is characterized by the development of the bilaminar germ disc (Fig. I. 1). The bilaminar germ disc is converted to the trilaminar germ disc during the next stage, the embryonic period. ***(Sadler T.W. 2000)***

The embryonic period (weeks 3 to 8)

The third week of gestation is characterized by the processes of gastrulation and neurulation. Gstrulation is the process of the formation of all three embryonic germ layers : ectoderm , mesoderm , and endoderm.

Neurulation, which is initiated in the latter half of the third week. Is a process of folding that converts the neural plate, a thickening of the ectoderm overlying the notochored, to the neural tube (Fig I. 2) ***(Larsen W.J. 2001)***

Notochord

From the primitive pit, a rod-like process of cells called the notochordal process moves cranially up to the prechordal plate by day 20. The notochordal process, which is the precursor of the skeletal axis, becomes canalized and caudally breaks through the ectodermal surface at the primitive node. The tube then opens ventrally starting at the level of the pit and proceeds cephalad. The yolk sac therefore transiently communicates with the amniotic cavity through the opening at the pit called the neurenteric canal (Fig. I. 3). After the tube opens, it is converted to a central ventral bar of mesoderm called the notochordal plate, which detaches from the endoderm by day 22 to 24 and becomes entirely contained within the mesoderm. It then forms a solid cylinder of cells to form the definitive notochord ***(Sadler T. W. 2000).***

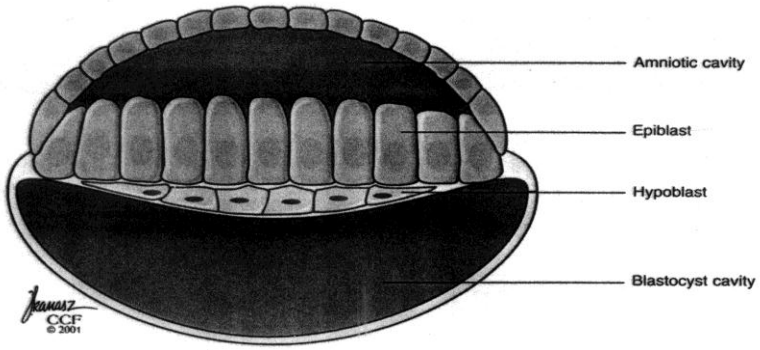

Figure (I-1): Formation of bilaminar germ disc from the embryoblast. The epiblast is adjacent to the amniotic cavity, and the hypoblast is adjacent to the blastocyst cavity. **(Courtesy *Cleveland Clinic, Division of Education, © 2001.)***

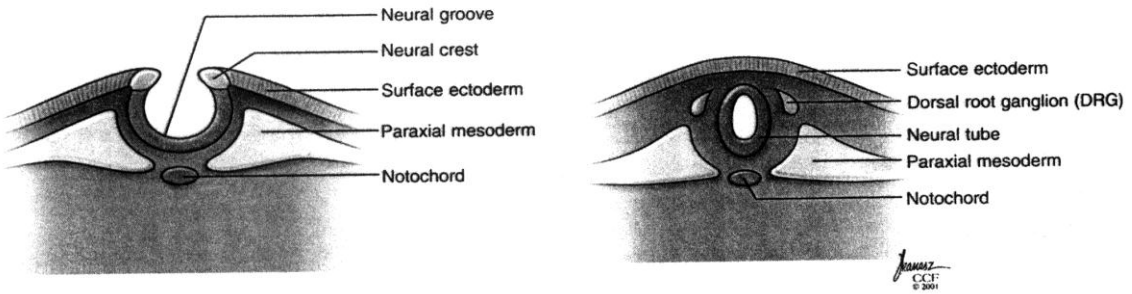

Figure (I.2): Formation of neural tube and dorsal root ganglion (axial view). A, Elevation of ectoderm creates neural folds that invaginate and ultimately fuse to form a neural tube. B, Neural crest cells form from lateral edges of these neuroectodermal cells, migrate toward the underlying mesoderm, and give rise to cranial nerve ganglia, spinal ganglia, and dorsal root ganglia (DRG). ***(Courtesy Cleveland Clinic, Division of Education, ©2001.)***

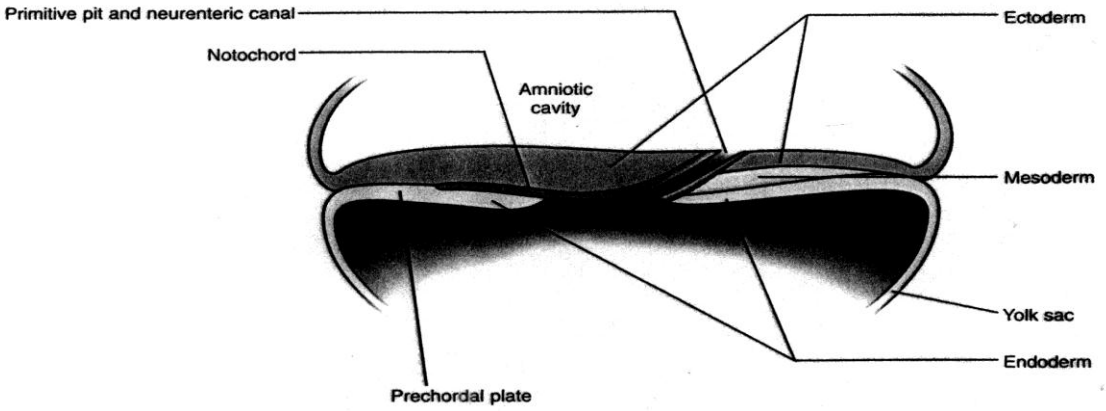

Figure (I-3): Sagittal representation showing initial stages of formation of notochord. The notochordal process becomes canalized and breaks through the caudal aspect of the ectoderm. This allows transient communication between the yolk sac and the amniotic cavity through the neurenteric canal. ***(Courtesy Cleveland Clinic, Division of Education, ©2001.)***

Neurulation

At the initiation of neurulation, the notochord and prechordal mesoderm cause the overlying ectoderm to thicken and to form the neural plate. This tongue-shaped structure elongates gradually toward the primitive streak, and by the end of the third week, the lateral edges of this plate become elevated to form the neural folds. which surround the neural groove. The neural folds fuse in the midline in the region of the embryo's future neck. The fusion gradually proceeds cephalad and caudal. thereby forming the neural tube. The two ends of the neural tube communicate with the amniotic cavity through openings called neuropores. The cranial neuropore closes by approximately day 25, and the caudal neuropore closes by approximately day 27. Neurulation is then completed. The closed neural tube has a narrow caudal portion representing the future spinal cord and a broad cephalic portion, with a number of dilatations called brain vesicles, representing the future brain. ***(Moore K.L. et al, 2002)***

Paraxial mesoderm

Along the length of the notochord, the mesenchyme becomes organized into three zones: the medial paraxial mesoderm, a narrower intermediate mesoderm, and the flattened lateral plate mesoderm. By the beginning of the third week, the paraxial mesoderm is organized into segments called somitomeres. The segmentation proceeds cephalocaudally. In the cephalic region, the somitomeres in association with neural plate segmentation, form neuromeres, which contribute most of the head mesenchyme. By day 20, somitomeres organize into somites, starting in the cervical region and proceeding at a rate of three pairs per day. By the end of week 5, there are 42