

**SPINAL IMPLANTS: FROM BONE TO METAL TO
ARTIFICIAL DISC**

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Course description:

Introduction:

History of spinal implants

Define what spinal implants are and examples of each

What areas of the spine are implants utilized

Cervical, Lumbar and Thoracic Spine Surgery

Indications for implants

Techniques of insertion with video

Goals of surgical implants

Other types of spinal surgery do not involve implants

New ideas

Questions

History

Vallex 1841 Disc protrusions on autopsy

Virchow 1857, Von Luschka 1858, Kocher 1896

all confirmed Vallex's findings

Oppenheimer and Krause 1909 excised a disc herniation
for paralysis

Albee/Hibbs 1911 used bone for fusion

Dandy 1929 published two cases of disectomy for
cauda equina syndrome

Burns in 1933 (Anterior Lumbar Interbody) and Briggs
and Milligan, Cloward and Jaslow (Posterior Lumbar
Interbody Arthrodesis) added the interbody approach
1930s metallic implants were first introduced

Mixter and Barr 1934 first laminectomy/disectomy

- 1940's Disectomy with posterior arthrodesis (fusion) became accepted practice
- 1955 Hamby and Cleveland injected lumbar discs with methyl methacrylate
- 1962 Nachemson injected lumbar discs with silicone
- 1964 Fernstrom implanted ball bearings (lumbar)
- Late 1970's Roy-Camille used screw and hooks and connected them with rods or plates
- Late 1970's Bagby developed modern intervertebral cages to correct "wobbler syndrome" in horses
- 1982 Lumbar artificial disc approved
- 1989 FDA granted approval for investigational phase of titanium cage usage in humans
- 1989 Work on artificial cervical disc begun
- 1996 approval for posterior interbody and since then also anterior interbody

1996 cervical artificial discs had been implanted

2002 second generation of cervical artificial disc developed

What are implants and what are their function?

Spinal Implants- something that is inserted into the spine
bone, metal (titanium), Poly Ethyl Ethyl Ketone (PEEK)
which resembles a very tough plastic, carbon fiber or
artificial discs

Bone

Historically this is the choice and still used today

Provide stability as certain types of surgery will
destabilize spine i.e. multi level laminectomy

Placed between vertebrae or transverse processes

Many bone substitutes now available

Metal used to improve fusion rate, eliminate bracing

hold spine in place while bone fuses, improve
alignment, immediate stability, quicker rehab

Various types over the years- stainless steel

Presently titanium stronger than PEEK

but more difficult to assess fusion on
imaging for recheck

PEEK and carbon fiber allow to see

bone in them through X ray to

assess if fusion has happened.

Interbody devices developed due to poor fusion rates of
placing bone only between vertebrae.

From a spinal surgeons point of view, the spine is divided into three columns

Anterior column - made up of the anterior longitudinal ligament and the anterior one-half of the vertebral body, disc, and annulus.

Middle column - made up of the posterior one-half of the vertebral body, disc, and annulus, and the posterior longitudinal ligament.

Posterior column - made up of the facet joints, ligamentum flavum, the posterior elements and the interconnecting ligaments

Indications for various implants

Cervical spine

Anterior cervical plating

One or multi level DDD

Disc abnormalities (bulging, fragmented, herniated)

Generally C-3 to C-7 levels.

Trauma, fractures, instability

Posterior approach 360 approach

Stenosis

Lose lamina, bone graft to transverse

Artificial Disc

One level DDD, Disc abnormalities

Need posterior column including facet joints to be intact. Otherwise cannot use since artificial discs do not stabilize the spine.

Thoracic spine

- Scoliosis screws and rods

- Kyphoplasty

 - Vertebral compression fractures

- No artificial disc for this area

- X-Stop for spinal stenosis

Lumbar spine

- Interbody cages/pedicle screws and rods

 - One or multi level disc abnormalities (bulging, fragmented, herniated)

 - DDD

 - Trauma, fractures, instability

- Artificial disc Need posterior column intact

 - Disc herniations,

 - One level DDD

Can use off label

Fusion

Low back pain- most common justification. Abnormal vertebral motion -spinal surgeon point of view. Their objective is to prevent the motion at that area. Pain is eliminated

This abnormal and painful motion can be caused by DDD, spondylolisthesis, spondylolysis, which all cause facet degeneration. Also fractures, tumors, scoliosis

In order for fusion to occur

Outer layer of bone must be removed.(decortication)

Nothing must be between graft bone and vertebral bone that has been prepared.

Area must be immobilized while graft heals to segments

This is the purpose of interbody cages, rods, plates, screws

If the fusion does not happen over time the implants will loosen, break or pull out of the bone.

Metal will break.

Pseudoarthrosis lack of fusion after a spinal fusion surgery

Cervical/Lumbar disc replacement surgery would most typically be done for patients with disc herniations that have not responded to non-surgical treatment options

One big contraindication for artificial disc in lumbar or cervical is any posterior column disease i.e. the facet joints, ligamentum flavum, the posterior elements and the interconnecting ligaments

Therefore majority of these types of patients are going to be younger, not elderly.

Concern is about how long are they going to last?

Function of artificial disc

Placed between two vertebrae between which disc has been removed..

Preserve motion at the disc space.

Act as shock absorber much like a regular disc (fusion eliminates this ability)

Also reduce the incidence of degeneration of adjacent disc levels of the spine (adjacent-segment disease)
to permit more rapid return to normal activity

Eliminates the risk for a bone graft infection from cadaver, pain at donor site, fusion healing a non-issue

No post op collar

It is an alternative to the use of bone grafts, plates and screws..

Techniques of insertion of implants

Cervical implants

Anterior cervical plating ACDF

Artificial disc

Laminectomy

Lateral mass plates

Lumbar implants

Interbody cages/pedicle screws and rods

Techniques of insertion for these implants

ALIF, PLIF, TLIF

Artificial disc

Thoraic implants

Scoliosis screws and rods

Kyphoplasty

Vertebral compression fractures

X-Stop device for spinal stenosis

Each section will consist of description of OR procedure, X-ray images of implants in spine, as well as a video of the technique

New ideas

Dynamic fixation for fusion using pedicle screws and flexible rod

Disc repair using mesh

Biotechnology for nucleus/annulus repair on own

Other types of spinal surgeries do not involve implants

Discectomy, microdiscectomy

Laminectomy

Laminoplasty

Laminotomy

Foraminotomy

Video links

<http://www.spine-health.com>

<http://www.or-live.com/wfubmc/1142/>

One hour to watch.