Correction of Chin-on-Chest/Rigid Neck Drop
- Cervical Pedicle Subtraction Osteotomy -
Sang-Hun Lee MD, PhD
Professor, Department of Orthopedic Surgery
Kyung Hee University, School of Medicine, Seoul, Korea

CERVICAL KYPHOSIS; CLINICAL FINDINGS
Limit activities of daily living
Eating & drinking, hygiene, respiration
Horizontal gaze & social activity
Disabling mechanical pain
Secondary myelopathy; stretching, ischemia

COMPLICATIONS OF CERVICAL SPINE OSTEOTOMY IN THE LITERATURE
Overall Cx. rate 26.9 ~ 87.5%
Neurological Sx. 8.9~62.5 (permanent 4.3%);
; Radiculopathy, paraplegia, hemiplegia, quadriplegia
Mortality rate 2.6%

ISSUES ON CERVICAL DEFORMITY CORRECTION
Degree of correction
Fixation methods
Osteotomy techniques
Reduction maneuver

DEGREE OF CORRECTION
Sagittal balance of the cervical spine
Cervicothoracic
Thoracic inlet angle (TIA), T1 slope, Neck tilting

Thoracolumbar: Lumbar lordosis, thoracic kyphosis

Spinopelvic: Pelvic incidence, pelvic tilting, sacral slope

Chin-brow vertical angle (CBVA)

Compromised ability of horizontal gaze in ankylosed spine

\[ \approx 10° \text{ CBVA} \]

: better function for downstairs, reading & writing, eating

**FIXATION METHODS**

**Types of fixation**

External fixation: Halo vest

Internal fixation: Wiring, plate with screw, lateral mass screw, cervical pedicle screw

**Extent of fixation**

O-C, C-T, or O-C-T

Variable with fixation strength, level of ankyloses etc.

**Rod**

Diameter: 3.2mm, 3.5mm, > 4.0mm, transitional rod

Material: Ti (main), CoCr.

**TYPES OF CERVICAL OSTETOMY**

**Extension osteotomy**

**History**

- Urist, 1958
  - In sitting position, local anesthesia
- Simmons osteotomy or Smith-Petersen type osteotomy (SPO)

**Advantages**
• Technically simple
• Applicable in multilevel & mid-axial cervical spine (C2-7)

Disadvantages
• Not applicable to complete ankylosed anterior column (Fx. or subluxation risk)
• Unstable – high incidence of delayed translation → requires additional external fixation

Anterior osteotomy (will be dealt in previous topic)

Pedicle subtraction osteotomy
Tokala et al. (2007)

Advantages
• Initial stability ↑: Delayed translation ↓
• Wider contact surface: better healing of osteotomy

Disadvantages
• Technical difficulty for complete release of 3-column
• Safe reduction/correction of deformity – challenging procedure

Main indications
• Complete 3–column ankylosis
• C-T junctional deformity
• Need one-stage, large angle correction

Combination of the above

REDUCTION MANEUVER

Why reduction is critical?
Complete instability after osteotomy
→ Sudden, uncontrolled fracture
→ Overcorrection, translation or subluxation of spinal column
→ Impingement of spinal cord &/or nerve root

History
Turnbuckle (Urist, 1958)
Prebent rod loop with gradual wire tightening (Shimizu, 1996)
Malleable rod (Mehdian, 1999)
Ilizarov distraction (Bouchard, 2002)
Hinged rod (Khoueir, 2008)
Sterile Freehand (Lee, 2012)

**SURGICAL TECHNIQUES OF CERVICAL PSO**

**Positioning**
Prone position on Jackson operating table – mostly preferred

Sitting position – in severe case

**Neuromonitoring**

MEP (± SSEP), EMG

**Decision of the osteotomy level**

C7: m/c osteotomy site

- Get more correction with small amount osteotomy
- Wide spinal canal → Favorably placed spinal cord & nerve root
- C8 root: More mobile
- Maximal preservation of U/ext function in case of spinal cord/root injury
- Vertebral artery; 95% enters into C6 → Risk of VA kinking or delayed obstruction ↓
C6

- Extensive ossification of C7 & below
- More cranial location of the apex of the deformity

T1

- Associated proximal thoracic deformity
- High T1 slope

**The extent of fixation**

Generally; above 3 + below 3 vertebrae fixation with 3.5mm Ti rod

Considering,

- Osteoporosis
- Screw fixation strength
- Ossification of the adjacent segment

**Release of the deformity**

Laminectomy + ½ above and ½ below

Lateral mass and facet complete resection

→ Locate the cervical nerve roots above and below

Pedicle resection

; easier after thinning of the pedicle wall by high-speed burr

Decancellation; vertebral body and posterior wall

Placement of temporary rod after one side decancellation

C6 PSO
Require release of the vertebral arteries by resection of both ant. tubercles

T1 PSO

Resection of the proximal 1st ribs (~ post. Tubercle) to avoid impingement of the C8 and T1 root

Correction & fixation

Scrub-descrub method - conventional

Sterile freehand reduction technique

REFERENCES


