Two-level hybrid surgical reconstruction of the cervical spine: a kinematic study in whole cadavers

Baoge LIU M.D.

Department of Orthopedic surgery, Beijing TianTan Hospital, Capital Medical University, Beijing China
Disclosure

• None of the authors has any potential conflict of interest
Introduction and Objectives

- **ACDF:** altered kinematics — adjacent segment degeneration
- **ADR (TDR):** multilevel arthroplasty remains controversial
- **Hybrid surgery** (combine ACDF and ADR)?

- To investigate kinematic of cervical after hybrid surgery
- To compared with two-level cervical fusion and ADR(TDR)
Method

- Five fresh whole cadavers
- Radiography by C-arm fluoroscope
- Parameters
  - Instantaneous center of rotation (ICR)
  - Range of motion (ROM) at C3-4 and C6-7
  - Sagittal alignment between C2 and C7
Method

- Four consecutive surgeries on each cadaver from C4 to C6
  A two-level ADR
  B two-level ACDF
  C hybrid C4-5 ACDF and C5-6 ADR
  D hybrid C4-5 ADR and C5-6 ACDF
- Four metal markers of 1 mm in diameter were implanted
Method

- A goniometer at lateral side of head to record the range of motion (ROM)

- A gradienter at front of head to ensure motion occurred in sagittal plane

- The traction caliper to provide consistent moment of force (2 kg) during full range of flexion and extension.
• The segmental extension and flexion images were automatically superimposed according to metal landmarks

• Point-registration tool of Mimics software (Materialise; Leuven, Belgium)

• Two corresponding metal points on superior vertebra connected by lines

• ICR was determined to be intersection of perpendicular bisectors of these two lines.
Result—ROM

- Two-level ACDF resulted in increased ROM at C3-4 and C6-7 ($P<0.05$)
- There was no significant difference between two TDR reconstruction and intact spine.
No significant increase in sagittal alignment was observed for all group, although with increasing trend after operation.
Result

• Location of ICR shifted inferior and anterior at C3-C4 level after reconstruction.
• Change of ICR in groups B and D were significant, with no difference between A and C at C3-C4 level.
• At C6-C7 level, the ICR were localized more posterior and superior than in the intact condition.
• The greatest change was observed in group B, which was statistically different from all other groups.
Conclusion

• Hybrid surgery can partially restore native kinematics of cervical spine
• It can generate better biomechanical conditions than arthrodesis at adjacent levels
• It may be considered in clinical practice for multilevel cervical degenerative diseases
• The type of hybrid surgery may affect kinematic behavior of adjacent segments
Thank you for your attention!