Preoperative Nomograms Predicting Patient-Specific Cervical Spine Surgery Clinical and Quality of Life Outcomes

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**No Relevant Disclosures**
• Equipoise exists among surgeons regarding the optimal approach used to treat various cervical spine pathologies

• Clinical and quality of life outcomes vary depending on the patient’s demographic characteristics, co-morbidities, combination of presenting symptoms, pathology, and surgical treatment

• Studies have identified individual predictors of outcomes, but no comprehensive method incorporates a patient’s complex clinical presentation to predict an individual’s post-operative outcome

• In an era of value based surgery, creating this type of model to identify optimal surgical candidates is imperative.
Methods

- Regression analyses using clinical data from 952 patients at the Cleveland Clinic that underwent anterior or posterior cervical decompression and/or fusion between 2007 and 2013.

- Modeled data:
  - Patient demographics, co-morbidities, presenting symptoms and duration or symptoms, indication for surgery, type and levels of surgery, as well as whether the patient had previous surgery.

- Outcomes:
  - Postop ED visit / Readmission within 30 days
  - Reoperation within 90 days
  - >MCID improvement in EuroQOL (EQ-5D), Patient Health Questionnaire-9 (PHQ-9), Pain/Disability Questionnaire (PDQ)
Results

• Nomograms for clinical outcomes had higher concordance indices (C-index) compared to those predicting QOL outcomes
  • C-index for ED visits, readmission, and reoperation were 0.639, 0.774, and 0.915, respectively; for EQ-5D: 0.619, for PHQ9: 0.584, and for PDQ: 0.655.

• Predictors of clinical outcome included:
  • Race, median income, BMI, co-morbidities, presenting symptoms, indication for surgery, surgery type and levels

• Predictors of QOL outcomes:
  • Preoperative QOL had the most significant effect
NOMOGRAM: Readmission within 30 days

Points

Race
- Black
- Non-Black

BMI

herniation
- No
- Yes

myelopathy
- No
- Yes

Surgery
- Post Decomp
- ACF
- PCF

Levels
- 2
- 3
- 4
- 5
- 6

Terminal Level
- No
- Yes

Cancer
- Yes
- No

Total Points

Predicted Probability of Readmission within 30 Days

0.01 0.02 0.03 0.05 0.07 0.1 0.15 0.2 0.3 0.4 0.5 0.6
Reoperation within 90 days

How to Use:

- 65 y/o man with diabetes and a BMI of 40, presents with neck pain and upper extremity weakness; found to have a disc herniation and undergoes ACDF.

- 0 pts for neck pain, herniation, ACDF

- ~20 pts for UE weakness, 20 pts for DM, and 45 pts for BMI

- TOTAL of 85 pts is equivalent correlates to a low risk of >2% for reoperation within 90 days

**despite having several risk factors**
Conclusion

- Statistical models provide superior prediction of outcomes as compared to both individual clinician predictions and averaged predictions of groups of clinicians.

- Nomograms presented herein enable both referring physicians and spine surgeons to determine postoperative clinical and QOL outcomes following cervical spine surgery.

- This tool enables the clinician to combine the variables of an individual to provide a personalized assessment of what the patient can expect postoperatively.
Conclusion

• Future prospective studies can validate these nomograms in external cohorts and further refine the tools in larger patient databases

• Using patient specific prediction tools, such as these nomograms, will lead to superior spine surgery outcomes and more cost effective care.