

Using Machine Learning to Identify Patients Likely To Choose Surgery For One Level Anterior Cervical Disc Herniations

Background:

While machine learning has shown great value in medical diagnostics, its potential in assisting treatment decision making continues to be explored.

Research Question:

Can machine learning identify factors associated with the likelihood of a patient will ultimately choose surgical intervention for one level cervical disc herniation?

Design:

Retrospective study

Methods:

130 retrospective chart reviews were conducted on patients who presented with cervical disc herniations causing radiculopathy to non-operative spine care providers at an interdisciplinary clinic. 18 independent variables were collected across demographic, clinical and patient reported outcome domains.

Results:

Overall, 27.3% of the patients eventually choose surgical intervention with median time to surgery 17 weeks from intake appointment. Sex was the only demographic factor to have a significant impact on surgical intervention. 38% of males underwent surgery compared to 16% of females. Body Mass Index, smoking status and comorbidities did not significantly influence the decision to have surgery, nor did any specific non-operative treatment modality. The final optimized model yielded a test recall of 0.73. Three variables significantly impacted the odds of surgical intervention. Male sex increased the odds ratio of surgical intervention by 3.2 ($p=0.003$); left symptom laterality increased the odds ratio of surgical intervention by 3.2 ($p=0.01$); and, interestingly, an increase in baseline Oswestry Disability Index (ODI) score decreased the odds of surgical intervention marginally by 0.4 ($p=0.02$), although mean ODI scores were slightly higher in surgical patients compared to non-operative patients (30 and 28, respectively).

Conclusion:

Male gender and left symptom laterality increased the odds of surgical intervention, while increase in baseline ODI decreased the odds of surgical intervention in this data set. This may be due in part to the use of ODI, instead of the Neck Disability Index. Sample size and variability between physicians' treatment protocols for acute cervical radiculopathy are limitations of this study. A larger, prospective study would be the next step in utilizing machine learning to predict which patients are most likely to report satisfaction and a successful outcome.