

MP34-11: Distinguishing surgical expertise using machine learning and automated performance metrics during sub-stitches of vesico-urethral anastomosis

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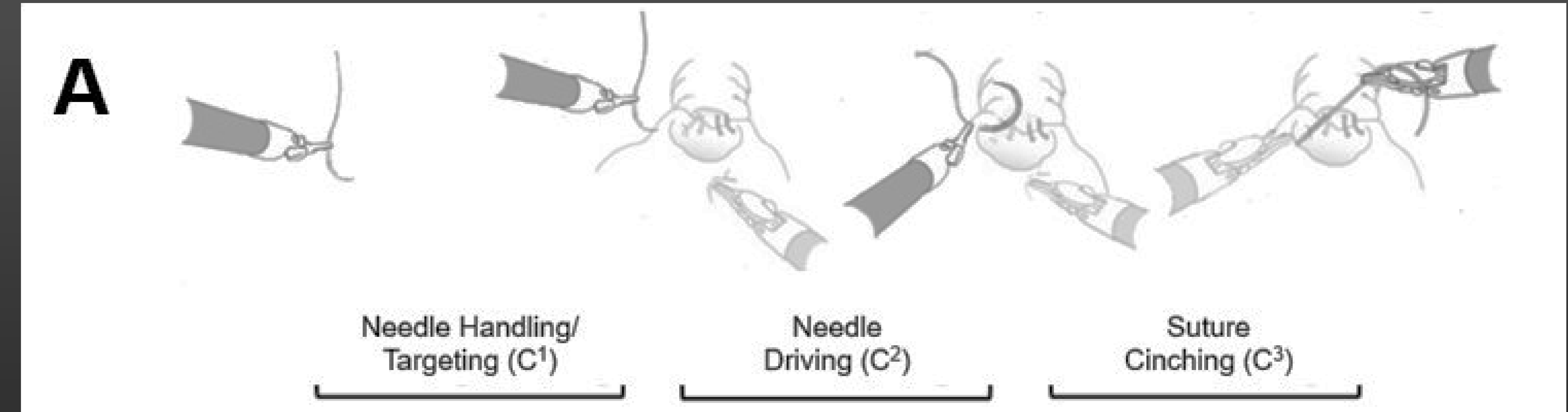
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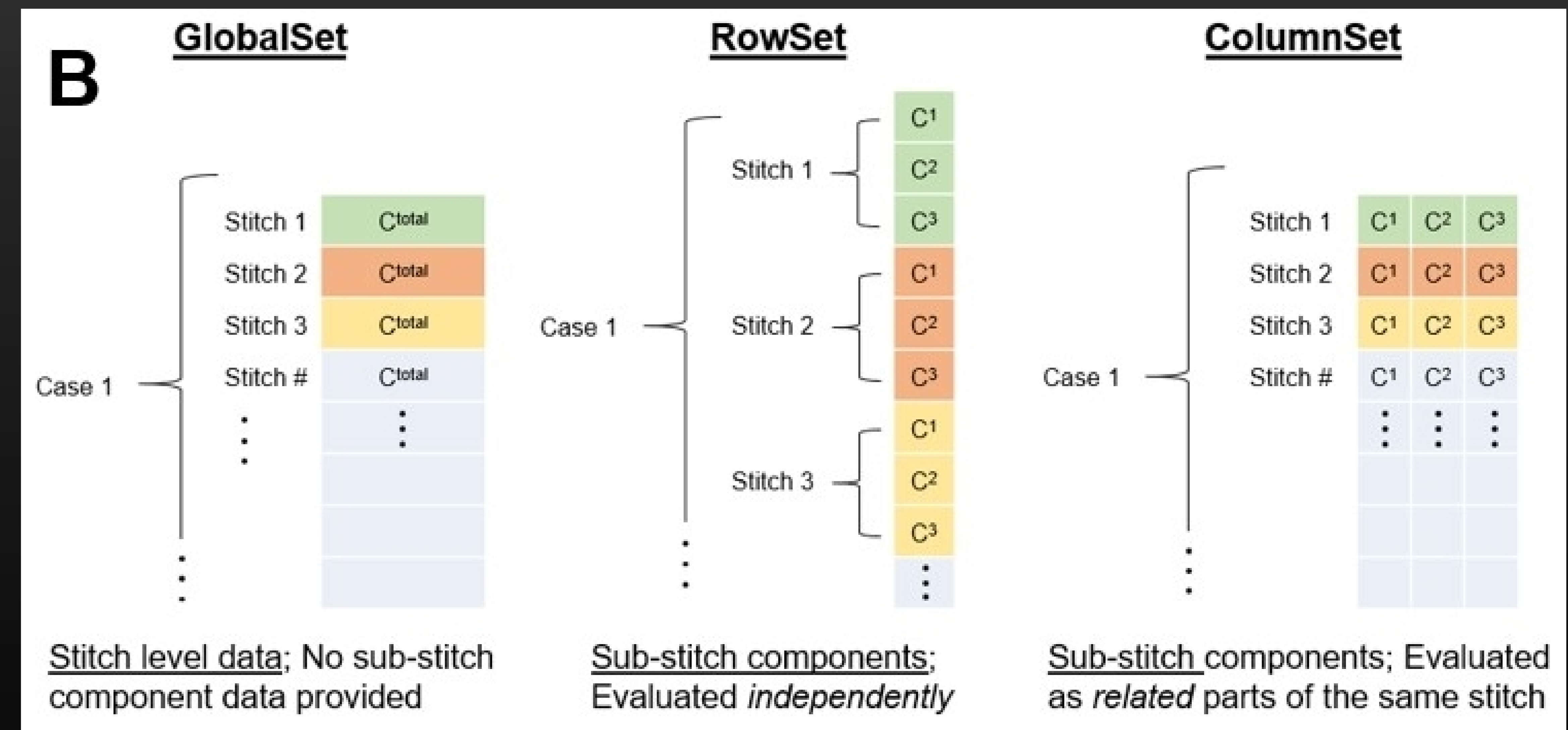
Background

- Automated performance metrics (APMs) – validated & objective measure of surgeon performance
 - Includes instrument motion tracking, Endowrist manipulation, and systems events data



Materials and Methods

- APMs were reported on the *stitch and sub-stitch level* during the vesico-urethral anastomosis (Figure A)
- Metrics were organized into 3 different datasets to analyze the different levels of granularity (Figure B)
- Datasets applied to 3 ML models (AdaBoost, Gradient Boosting, and Random Forest) to classify expertise



Results

Expert - Novice	ColumnSet	RowSet	GlobalSet
AdaBoost	0.724 +/- 0.016	0.712 +/- 0.009	0.699 +/- 0.018
Random Forest	0.732 +/- 0.005	0.716 +/- 0.003	0.728 +/- 0.009
Gradient Boosting	0.727 +/- 0.010	0.721 +/- 0.006	0.672 +/- 0.001
Ordinary Expert - Super Expert	ColumnSet	RowSet	GlobalSet
AdaBoost	0.801 +/- 0.014	0.772 +/- 0.009	0.774 +/- 0.010
Random Forest	0.761 +/- 0.007	0.761 +/- 0.004	0.769 +/- 0.009
Gradient Boosting	0.770 +/- 0.006	0.784 +/- 0.006	0.759 +/- 0.002

- Metrics arranged in the **ColumnSet** produced the highest accuracy when distinguishing expertise
- Feature selection highlighted **Endowrist® articulation** and **needle handling/targeting (C¹)** for classification

Conclusions

- Surgeon performance measured by APMs on a *granular sub-stitch level* more accurately distinguishes expertise when compared to summary APMs over whole stitches

