Dissection Gesture Sequence of Nerve-Spare to Predict Erectile Function Recovery after Robot-Assisted Radical Prostatectomy

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Introduction and Objective

Delicate dissection maneuvers during nerve-spare (NS) of robot-assisted radical prostatectomy (RARP) are essential to the preservation of erectile function (EF). Our prior study established a classification system of all basic gestures during robotic dissection (**Fig 1a**). Herein, we utilized the classification system to identify the exact sequence of dissection gestures during NS and to subsequently predict EF recovery.

Methods

RARPs from 2016 to 2019 with preoperative EF and ≥1 year postoperative follow up were included in this study. Non-nerve-sparing cases were excluded. EF was defined as *erections sufficient for intercourse* greater than half the time (corresponding to a 4 or 5 on the third question of the International Index of Erectile Function). After standardized training, 4 annotators independently labeled gesture sequences of 3 initial NS videos. Gesture classification agreement rate was evaluated and subsequent videos were split amongst annotators.

80% and 20% of cases were used to train the machine learning model. 2 subnetworks were utilized: 1) Interpretable recurrent network (IMV-LSTM) for gesture sequences and 2) Tabular network (TabNet) for 12 patient features (eg, age, comorbidities). To illustrate important sequences for EF prediction, we extracted attention scores for each gesture within a sequence. Occlusion techniques further extracted directionality to indicate gesture patterns that correlated positively or negatively with EF recovery.

Results

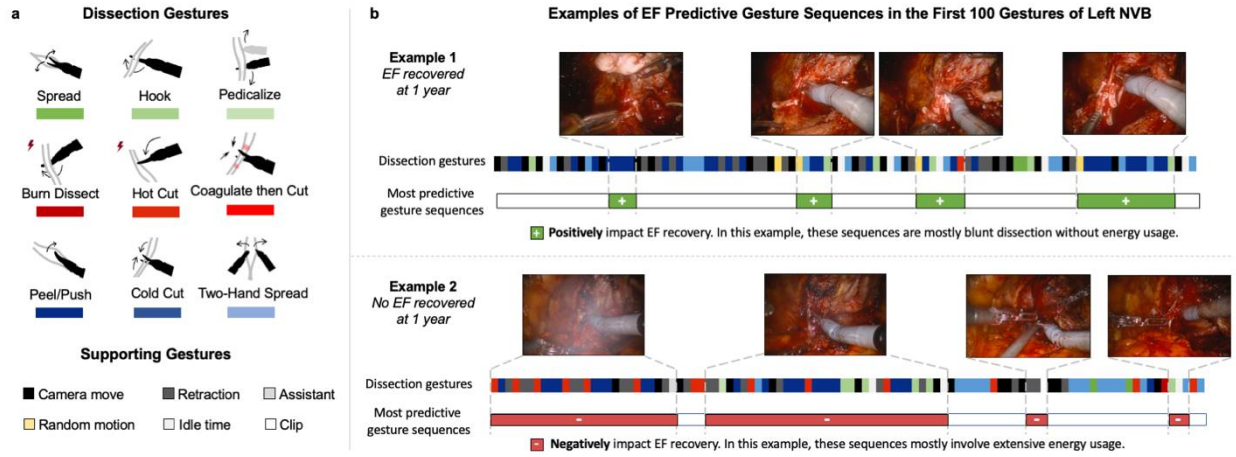
50 cases were included in this study. 1-yr postoperative EF recovery rate was 46%. A median of 526 gestures (IQR 337-638) were identified during each NS video. The gesture classification

agreement rate among annotators was 90.4%. During *testing*, area under the curve (AUC) of the model predicting 1-year EF recovery was 0.64 (±SD 0.08) and 0.66 (±SD 0.09) using clinical features and gesture sequences alone, respectively. Combining both inputs, model achieved AUC of 0.70 (±SD 0.11). The model further outputted important gesture sequences that associated with EF recovery positively or negatively (**Fig 1b)**.

Conclusions

The dissection gesture sequence of NS is predictive of EF recovery after RARP. This implicates the importance of surgical training down to the granularity of gestures.

Fig 1. Dissection gesture classification and examples of most predictive gesture sequences of erectile function recovery at 1 year.



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