

Case Insights: Combining Surgical Video and Objective Performance Indicators for Learning and Quality Improvement in Robotic Surgery

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Objective of the Technology

Case Insights (CI), is a machine learning-enabled application that integrates video review, objective performance indicators (OPIs), trend visualization, and workflow analysis to support data-driven quality improvement for robotic surgery. We conducted a mixed-methods study to evaluate early adoption patterns, usage behaviors, and surgeon perceptions.

Description of the Technology

Case Insights combines surgical video, kinematic data, and system events to generate OPIs, which are quantitative measures reflecting console and instrument efficiency, energy use, and tissue interaction. OPIs include insights from Force Feedback, a technology which measures the push and pull forces experienced at the instrument tips on the da Vinci 5 surgical system. These metrics are presented through visual dashboards that display performance trends, procedural phases (e.g., exposure, dissection, transection, reconstruction, and extraction), and key operative steps.

Methods

A retrospective review of Case Insights usage data was conducted for procedures performed between March 2024 and November 2025. Quantitative metrics included the number of cases captured, frequency of video review, and engagement. A structured online survey was administered between October 2024 and March 2025 to Case Insights users in the United States. Survey domains assessed use patterns, perceived value, and educational applications. Descriptive statistics summarized system usage and survey responses.

Technologies

Figure 1. Mobile and web Case Insights application to review video with OPIs

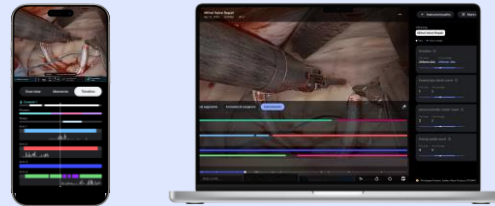
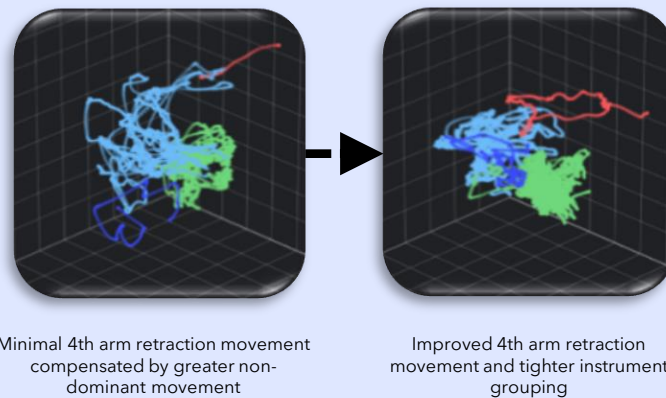


Figure 2. Path length plots before and after Case Insights mentorship and coaching



Preliminary Results

During the study period, Case Insights captured data for 95,392 robotic procedures, and video was reviewed at least once for 21,635 cases (22.6%).

Forty-three surgeons (10% response rate) across multiple specialties and practice settings completed the survey.

Respondents reported using Case Insights for self-assessment (90%), longitudinal performance tracking (53%), and resident or fellow education (45%).

Benefits cited (by % of respondents) included:

92%
Continuous
self-improvement

53%
Efficiency

50%
Peer Collaboration

50%
Presentation
preparation

An illustrative case involved a junior attending who reviewed Case Insights data monthly with a senior mentor, reducing mean console time for robotic cholecystectomy from 46.2 minutes (n = 47 cases pre-mentorship) to 30.4 minutes (n = 15 cases post-mentorship) for a 34% improvement attributed to data-informed technique refinement and workflow optimization (Figure 2).

Conclusions & Future Directions

Case Insights is a machine-learning enabled application that facilitates objective performance review, lifelong learning, and continuous improvement in robotic surgery. Retrospective usage and survey findings demonstrate its value in promoting technique refinement and workflow optimization, supporting a data-driven continuous learning and performance enhancement in robotic surgical practice.