Surgical intelligence in action: Harnessing computer vision to define and monitor data-driven best practices

Monica Ortenzi,[1,2] Ariel Wimpfheimer,[1] Sari Maril,[1] Dotan Asselmann,[1] Tamir Wolf [1]

[1] Theator Inc., Palo Alto, CA, USA [2] Department of General and Emergency Surgery, Polytechnic University of Marche, Ancona, Italy

theator

SAGES 2024 Annual Meeting

Introduction:

- Variability in surgical practices contributes to variability in surgical outcomes
- Validated best practices can improve uniformity and quality of outcomes
- Surgical intelligence harnesses AI to facilitate routine, automated video capture and analysis, and connects resulting intraoperative data with patient and outcome data
- To produce validated best practices from this knowledge, we must:

Define relevant practices

↓

Examine existing support for their utility

↓

Accurately monitor their routine, real-world adoption

↓

Evaluate associations between adoption and surgical outcomes

Objectives:

- To describe a novel method, enabled by an advanced surgical intelligence platform, for identifying surgical best practices
- To demonstrate the method through its initial application in bariatrics

Methods:

1. Practice identification *(Figure 1)*:
   - Identify potential best practice based on extensive literature review and expert inputs
   - For each practice: assess clinical utility, adoption variability, and feasibility of AI-based detection
   - Train and integrate computer vision model in a Surgical Intelligence platform [Theator Inc., Palo Alto, CA]
   - Enable automated monitoring of endoscopic videos for practice adoption
   - Use collected data to guide quality initiatives
2. Initial application in bariatrics:
   - Reviewed and selected potential best practices in sleeve gastrectomy and gastric bypass
   - Assessed adoption percentages from January to December 2023 at 3 medical centers

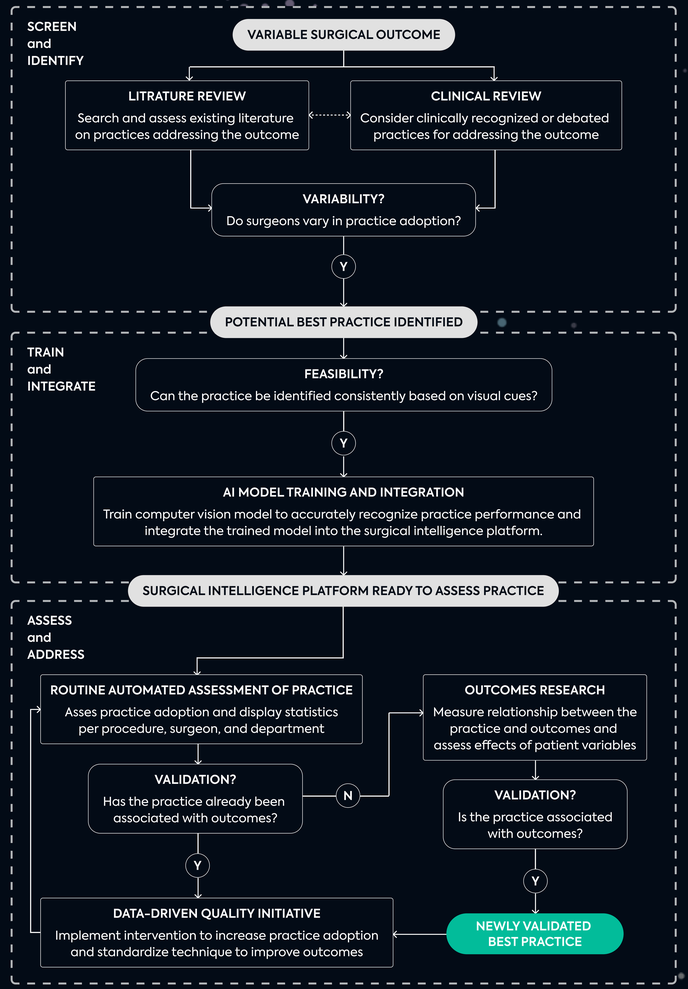


Figure 1.
Flowchart: Incorporating a new practice into a surgical intelligence platform.

Results:

- Identified 5 potential best practices, evaluated them and integrated them into the platform.
  - **Sleeve gastrectomy:** end gastric transection at least 1 cm from angle of His; reinforce the staple line
  - **Gastric bypass:** view the ligament of Treitz, perform leak test (dry or wet), close mesenteric defects

Procedure and Surgical Practice	Center 1	Center 2	Center 3	Comparison (χ^2)
Sleeve Gastrectomy	*N = 163*	*N = 163*	*N = 17*	
Ended gastric transection at least 1 cm from angle of His	80.4%	89.2%	52.9%	$p = .002$
Reinforced the staple line	90.8%	58.1%	64.7%	$p < .001$
Gastric Bypass	*N = 54*	*N = 354*	*N = 40*	
Viewed the ligament of Treitz	94.4%	94.4%	77.5%	$p < .001$
Performed leak test	96.3%	96.6%	92.5%	ns
• Dry	5.8%	91.8%	100%	$p < .001$
• Wet	94.2%	94.2%	0%	
Closed mesenteric defects	100%	33.6%	15.0%	$p < .001$

Table 1. Adoption percentages throughout 2023

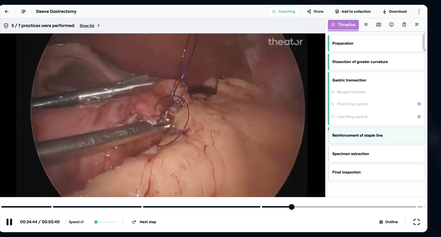


Figure 2. Staple line reinforcement in sleeve gastrectomy as seen in a video captured on the surgical intelligence platform.

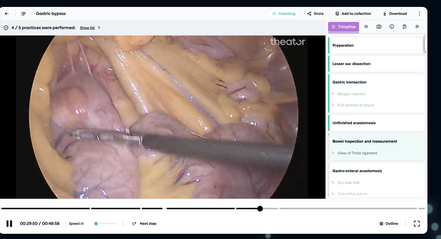


Figure 3. View of the ligament of Treitz in gastric bypass as seen in a video captured on the surgical intelligence platform.

Conclusions:

- Utilizing a novel methodology, we showed dramatic variability between and within medical centers in the adoption of surgical practices
- Enabled by AI-based video analysis, this data-driven process:
  - Facilitates multicenter studies connecting best practices to better postoperative outcomes
  - Enables assessment of practice adoption in daily surgeon workflow
- This methodology lays the foundation for large-scale, proactive quality initiatives at multiple levels, from individual surgeon to hospital administration