

# Surgical Smoke Safety: Intervention of Smoke Evacuation Devices (SSEDs) and Policy Implementation

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## Clinical Question

For surgical staff in the operating room at Sanford Medical Center, Fargo (P), how does implementing an evidence-based surgical smoke algorithm (I), compared to current practice (C), impact the rate smoke evacuation devices are used during appropriate procedures (O) over a period (T)?

## Background and Significance

- Over the past decades, the role of surgical smoke as a source of occupational hazards within the intra-operative care environment has been the subject of much interest and debate.
- Patients and surgical staff remain at risk of hidden hazards associated with surgical smoke exposure each time energy-generating devices (EGDs) or lasers are used to seal vessels, destroy tissue, or cut bone.
- At Sanford Medical Center, Fargo, North Dakota, there was a significant lack of compliance with recommended best practices for a smoke-free operating room, highlighting the urgent need for change.
- This quality improvement project implemented an evidence-based algorithm for surgical smoke safety and measured its success using the surgical smoke evacuation devices utilization audit tool after 6 weeks of change implementation.

## Evidence

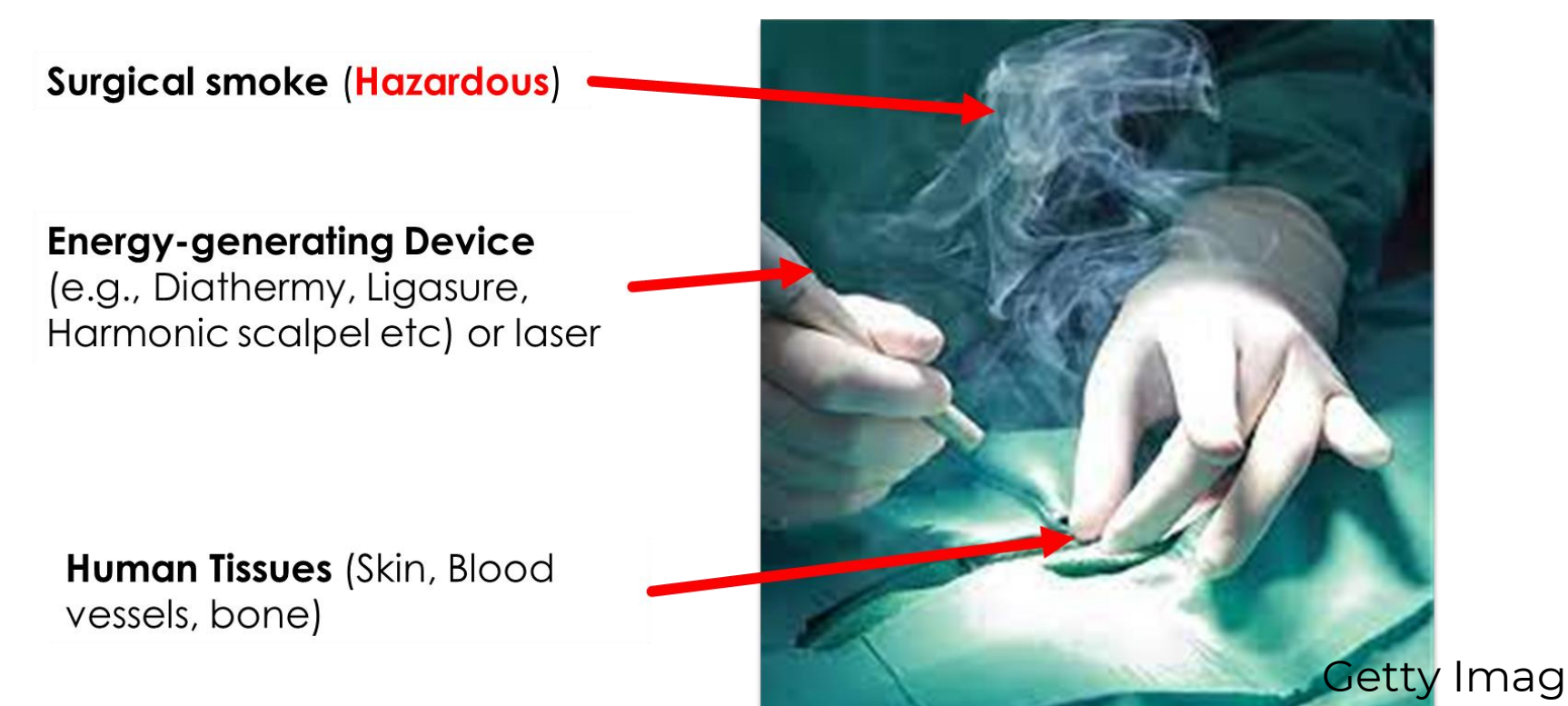
- 1-Day exposure to surgical smoke is equivalent to 27-30 unfiltered cigarettes (Fereidouni et al., 2021).
- AORN endorses legislative and regulatory approaches mandating surgical smoke evacuation for optimal patient care and safe surgery outcomes (AORN, 2021).
- Furthermore, Gioustos et al. (2022) reported that a mobile smoke evacuation device can effectively decrease the amount of carcinogenic, mutagenic, and reprotoxic volatile organic compounds in surgical smoke, improving worker safety.
- The Plan-Do-Study-Act (PDSA) model was employed as a method that provided an easy-to-understand, sequential approach to this QI project and intraoperative practice quality enhancement.

## Evidence Based Recommendation

- A smoke-free environment contributes to overall patient safety by preventing potential health risks associated with exposure to surgical smoke by-products.
- Operating room managers will establish policies and procedures for surgical smoke safety in practice areas where energy-generating devices create surgical smoke (AORN, 2023).

## Implementation

- This quality improvement project used an evidence-based surgical smoke safety algorithm, adapted with permission from AORN, to increase the use of surgical smoke evacuation devices during appropriate procedures at Sanford Medical Center Fargo.
- The evidence-based surgical smoke algorithm (Went Live 11/26/23) was implemented. The RN circulator played a crucial role in monitoring the surgeon's compliance with smoke evacuation device use for six weeks using the surgical smoke evacuation device utilization tracker.
- Following the successful implementation of the initial algorithm, we have extended the daily audit of surgical smoke evacuation device utilization to the Trauma and Acute Care Surgeons (TRACS). This expansion, which lasted for 3 months, has significantly increased our departmental coverage and involvement.



## Evaluation

- Registered nurse circulators completed surveys, and selected surgeons were observed to collect pre- and post-implementation data over three and six weeks, respectively.

### Metrics

- Total number of procedures (surgical cases) scheduled by surgeon per day/week
- Total number of times surgical smoke evacuation devices utilized during appropriate procedures
- Percentage of compliance for using surgical smoke evacuation devices by each surgeon after six weeks of algorithm implementation.

## Results-Surgical smoke Evacuation

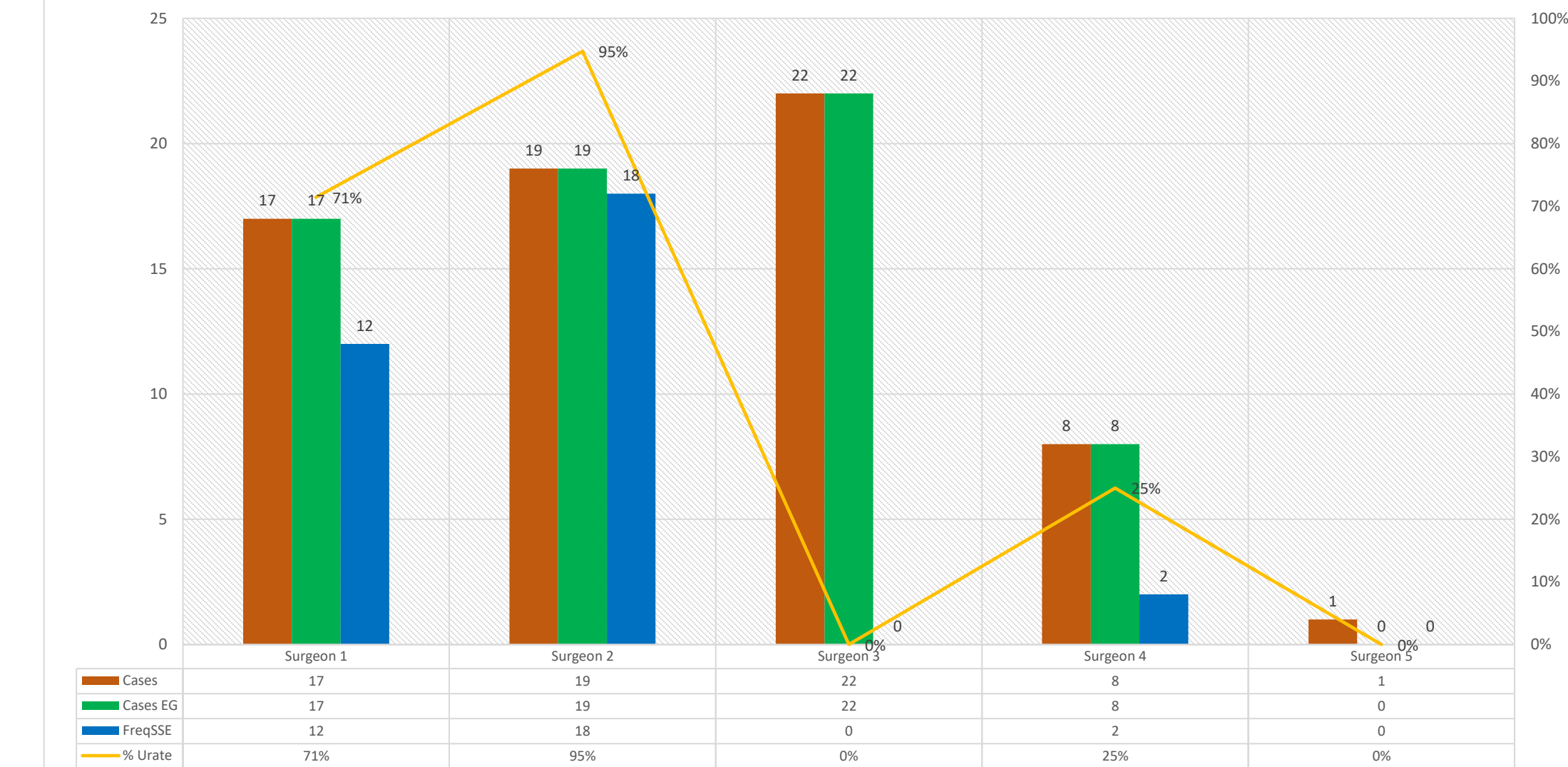
	PRE-IMPLEMENTATION				POST-IMPLEMENTATION				
	WEEKLY SSEDs UTILIZATION RATE				WEEKLY SSEDs UTILIZATION RATE				
	#CASES	#cases EGD	FreqSSE	% Urate	#CASES	#Case EGDs	FreqSSE	% Urate	
WEEK 1	8	8	0	0%	WEEK 1	4	4	4	100%
WEEK 2	10	10	0	0%	WEEK 2	12	12	12	100%
WEEK 3	4	4	0	0%	WEEK 3	6	6	6	100%
TOTAL	22	22	0	0%	TOTAL	34	34	34	100%

SSEDs (Surgical Smoke Evacuation Devices) Source: PI's Computation, 2024.

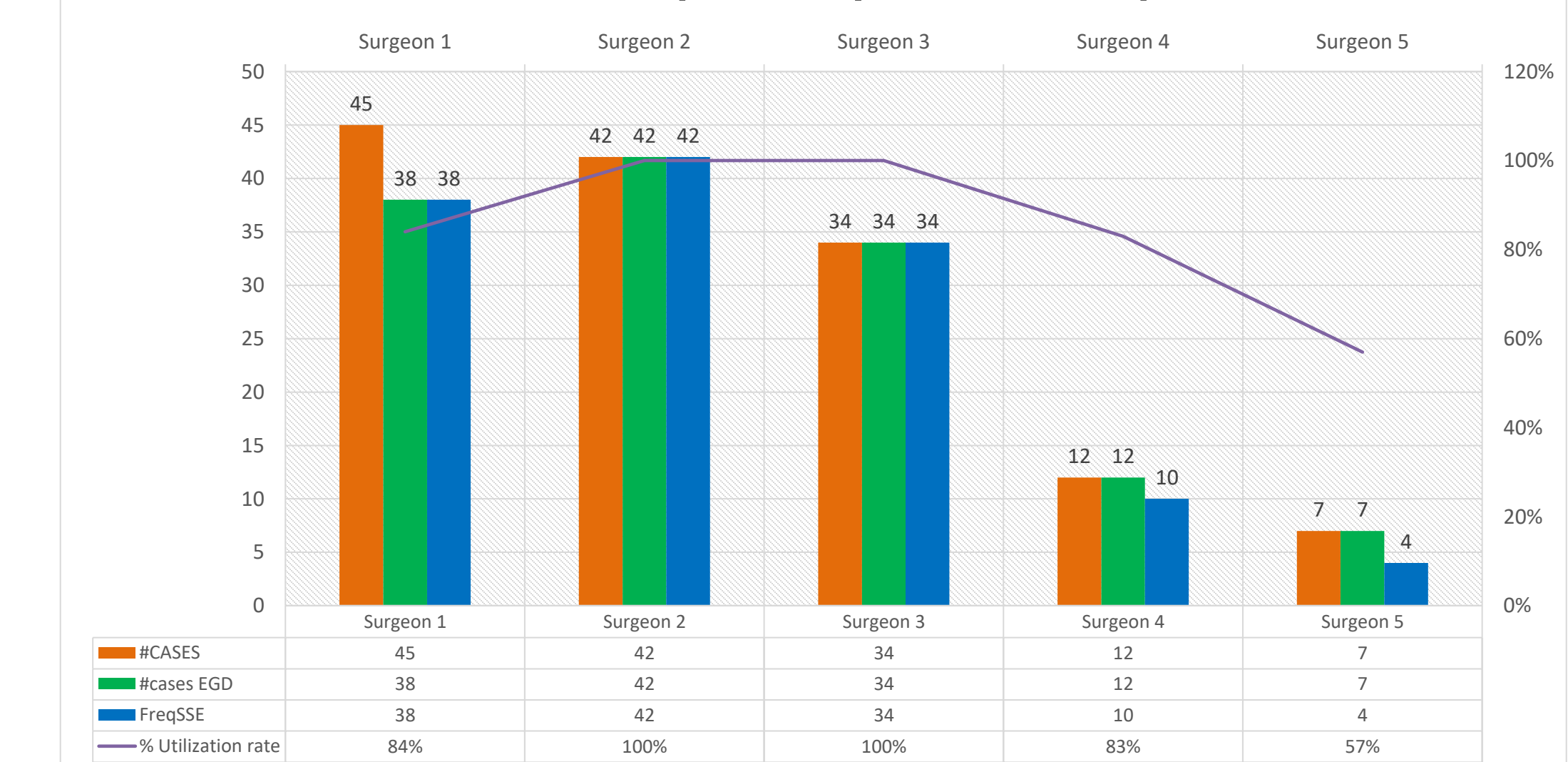
## Results

- The Wilcoxon signed-rank test revealed a statistically significant increase in SSED usage post-implementation ( $z = -2.998, p = 0.0027$ ). Post-implementation, the average SSED usage increased to 4.4 times per week (SD = 3.756), with a maximum usage of 12 times per week.
- The findings indicate a significant improvement in the use of SSEDs following the implementation of an evidence-based surgical smoke safety algorithm, aligning with the Association of Peri-Operative Registered Nurses (AORN) recommendations.

Total cases and the SSEDs utilization rate over 3 weeks (Pre-implementation)



Total cases and the SSEDs utilization rate over 6-weeks (Post-Implementation)



■ Total Number of Procedures (Cases)  
■ Total Number of Procedures (Cases) requiring Energy generating device (EGD)  
■ Total Number of Procedures (Cases) where Surgical smoke evacuation devices (SSEDs) were utilized

EGDs   SSEDs	Z	P-value
Pre-implementation & Post implementation	-2.998	0.0027

## Conclusions

- The intervention of smoke evacuation devices and the implementation of an evidence-based surgical smoke safety algorithm are emerging innovations to be considered by operating room governance and public health experts in preventing human exposure to surgical smoke hazards, especially for the surgical staff and patients in the operating room.
- Implementing a surgical smoke evacuation algorithm has proven beneficial for both healthcare providers and patients. This quality improvement initiative effectively enhanced safety practices in the operating room, demonstrating the importance of structured interventions in promoting compliance with safety standards. Policymakers and healthcare administrators must recognize and urgently prioritize these measures, as their role is vital in safeguarding health and improving surgical care quality.
- Extending this quality improvement project to other surgical specialties has been recommended. This would emphasize the potential for ongoing improvement and innovation within the intraoperative care setting and inspire confidence in a smoke-free operating room for optimal patient care and a safer surgical future.

## References

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