ICA Injury in Endoscopic Endonasal Surgery: An Interprofessional Team Simulation Model

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Introduction

Endoscopic endonasal surgery (EES) has revolutionized the treatment of tumors and inflammatory diseases of the anterior skull base with minimally invasive technique. However, it carries the life-threatening risk of internal carotid artery (ICA) injury. A survey of experienced skull base surgeons revealed that more than 20% have encountered this complication at least once in their career.[1] Effective interprofessional teamwork among surgeons, anesthesiologists, nurses, surgical technologists, and neurophysiologists in the operating room is essential for successful management of this feared complication. In other medical specialties, interprofessional education (IPE) programs with simulation components have been shown to improve collaborative attitudes, role delineation, and patient outcomes in medical crises.[2,3] However, interprofessional education and team simulation training for ICA injury in EES remains unexplored.

Methods and Materials

Literature Review & Methodology Development

- Conducted a comprehensive review of peer-reviewed healthcare teaching tools aimed at enhancing teamwork and patient safety in medical crisis management.
- Evaluated peer-reviewed team simulation scoring methods to identify best practices for evaluating team performance during ICA injury management scenarios.

Curriculum Design & Simulation Planning

- Designed a high-fidelity curriculum and plan the use of advanced OR simulation facilities for realistic surgical training.
- Filmed surgeon performance during a perfused cadaveric ICA injury simulation at the UPMC course on Complex Endoscopic Endonasal Surgery of the Skull Base to inform educational content on communication, management, and stress-induced errors.

Population Interaction & Insights

- Interviewed OR personnel during EES to gather insights on role-specific responsibilities and priorities during an ICA injury incident. (TEAM-ICA Protocol)

Results

TEAM-ICA: Targeted Education and Advanced Management for ICA Injury

Pre-Course Material

- Didactic reading on ICA injury management
- Interactive quiz (designed with WISER Institute)
- Current standard of education

Simulation 1: ICA Injury Scenario

- Scoring: Mayo High Performance Teamwork Scale and TEAM-ICA Scoring Checklist
- Debriefing: Error identification, prevention strategies

TEAM-ICA Curriculum

- Didactic: Expert consensus articles
- Videos: Correct & incorrect management
- Interactive quizzing and error discussion

Simulation 2: ICA Injury Scenario

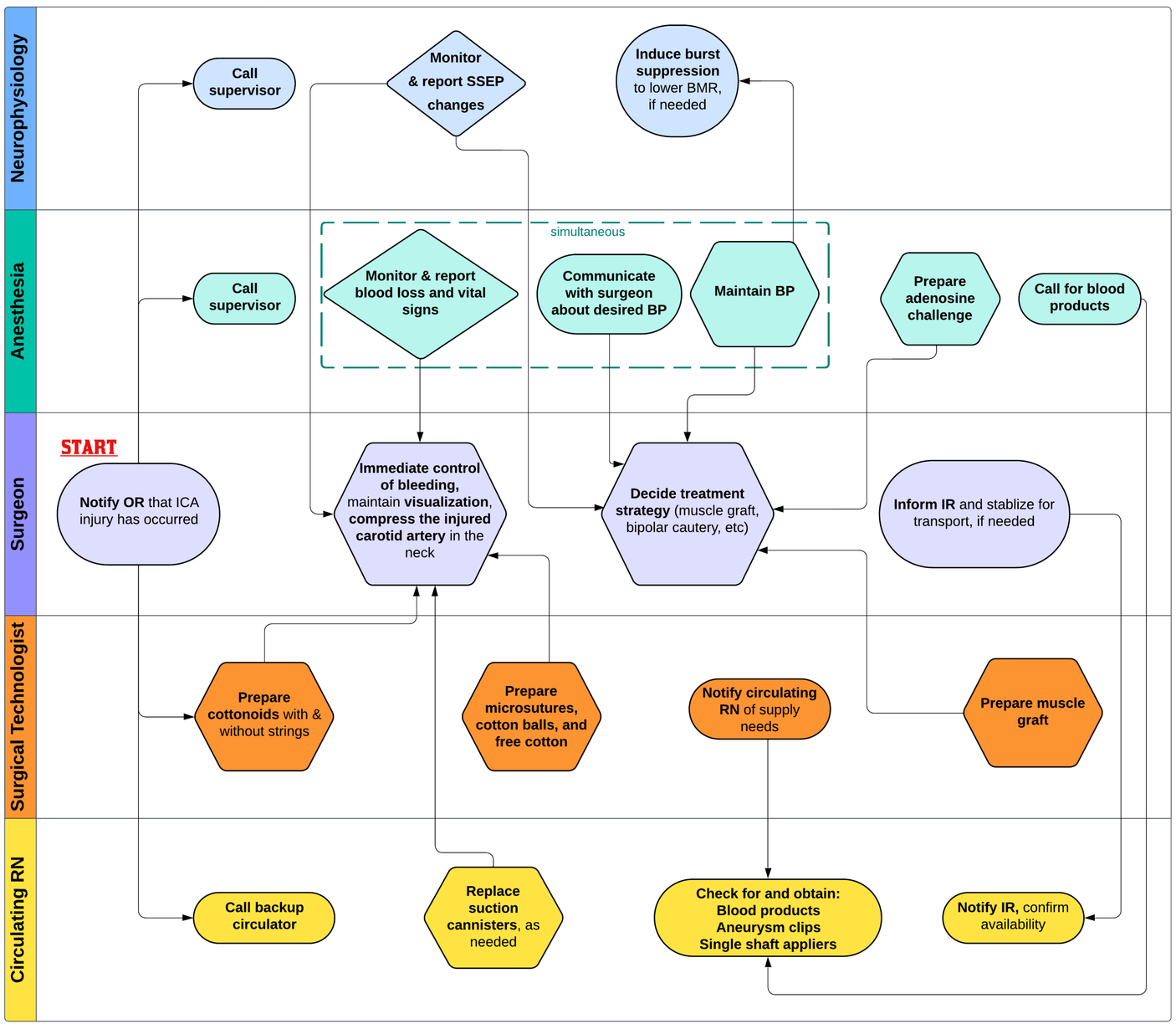
- Scoring: Mayo High Performance Teamwork Scale and TEAM-ICA Scoring Checklist
- Debriefing: Error identification, prevention strategies

Conclusions

Interviewing the OR personnel revealed a common fear associated with ICA injuries, and highlighted the necessity of robust, hands-on training. Our TEAM-ICA curriculum, combining a collaborative didactic education with a high-fidelity interprofessional simulation, is expected to enhance team performance in ICA injury management during EES.

TEAM-ICA Protocol

Targeted Education and Advanced Management for ICA Injury



TEAM-ICA Simulation Scoring Criteria

Role	Criteria	Points
Surgeons	Notify the operating room (OR) that an ICA injury has occurred	2
	Apply neck compression to the injured carotid artery	1
	Maintain regular communication with staff about blood pressure management	1
	Communicate treatment strategy and needs (muscle graft, bipolar cautery, etc.)	1
	Requests necessary supplies (cottonoids, cotton balls, free cotton, microsutures, etc.)	1
	Obtain muscle graft	1
	Regularly respond to team members' clarifications and questions	1
	Instruct a specific staff member to call Interventional Radiology	1
Anesthesia	Call for attending physician (if applicable)	1
	Provide regular updates on blood pressure and vitals	2
	Report current blood loss	1
	Report blood availability	1
	Call for blood products	1
	Communicate with surgeons regarding target blood pressure	1
	Prepares adenosine challenge	1
Neurophysiology	Call for attending physician (if applicable)	1
	Monitors and reports somatosensory evoked potential (SSEP) changes	2
Surgical Technologist	Prepare necessary surgical supplies: a. Microsutures b. Cottonoids/cotton balls/free cotton	2
	Notify circulating RN of supply needs	1
	Prepare muscle graft	1
Circulating RN	Notify front desk and call for backup circulator	1
	Check for and obtain: a. Blood products b. Aneurysm clips and single shaft appliers	2
	Check suction canisters and replace as needed	1
	Calls Interventional Radiology for urgent angiography	2

Score: __ / 30

Contact

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References

1. Rowan NR, Turner MT, Valappil B, et al. Injury of the carotid artery during endoscopic endonasal surgery: surveys of skull base surgeons. J Neurol Surg B Skull Base. 2018;79(3):302-308.
2. Klipfel JM, Carolan BJ, Brytowski N, Mitchell CA, Gettman MT, Jacobson TM. Patient safety improvement through in situ simulation interdisciplinary team training. Urol Nurs. 2014;34(1):39-46.
3. Welsch LA, Hoch J, Poston RD, Parodi VA, Akpinar-Elci M. Interprofessional education involving didactic TeamSTEPPS® and interactive healthcare simulation: A systematic review. J Interprof Care. 2018;32(6):657-665.
4. Definition of transsphenoidal surgery - NCI Dictionary of Cancer Terms - NCI. Accessed September 5, 2024. https://www.cancer.gov/publications/dictionaries/cancer-terms/def/transsphenoidal-surgery