Anesthesia Procedural Guidelines for Neuro-Spine Surgeries

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ABSTRACT

BACKGROUND
Anesthesia providers are required to create anesthetic plans of care which are tailored to a multitude of specific surgical operations while also incorporating surgeon preferences and individual patient factors. Recent literature suggests that the implementation of an anesthesia procedural guideline for neuro-spine procedures may improve operating room efficiency, patient outcomes, and staff confidence.

OBJECTIVE
This quality improvement project developed and implemented an anesthesia guideline and compared retrospective data and post-intervention data to determine if the implementation of the guideline impacted a predetermined list of outcomes.

PICOT QUESTION
In patients aged 18-90 years old undergoing neuro-spine surgeries at a Midwestern hospital (P), does the development and implementation of evidence-based anesthesia guideline tools (I) reduce complication rates such as peripheral neuropathies by 5%, reduce the time from "in-room" to "incision" by 5%, reduce OR cost by 2%, decrease patient pain scores by 5%, and improve anesthesia staff confidence in performing these procedures (O) when compared to surgeries before the guidelines were created (C), as examined over a three month period (T)?

METHODS
The pre-implementation group consisted of 38 patients while the post-implementation group consisted of 34 patients. Demographic data were collected and analyzed, and no significant differences were identified between the two groups. Outcome data were statistically analyzed using paired, two-tailed *t*-tests; staff survey data were analyzed using chi-squared tests.

RESULTS
Efficiency markers (time from in-room to incision, in-room to turnover, case end to anesthesia end) showed some improvement, but there was no statistical significance in any category (p = .740; p = .841; p = .549). Mean postoperative pain scores did not show any improvement (p = .127). There was a reduction in pain scores in patients who received ketorolac, but it was not statistically significant (p = .449). The staff survey data showed no statistically significant changes in confidence when providing anesthesia for neuro-spine surgeries.

CONCLUSIONS
The "case end" to "anesthesia end" time was the only efficiency marker that did demonstrate a 5% decrease in mean time when analyzing all case types together, as was the initial goal. Although there were no statistically significant findings, the raw data of the staff survey suggests that the guideline may assist providers in caring for individuals undergoing neuro-spine procedures at the institution of study.

OBJECTIVE

To develop and implement an anesthesia guideline tool for neuro-spine procedures and compare pre- and post- intervention data to determine if there are improvements in anesthesia efficiency, post-operative pain, and anesthesia staff confidence.

METHODS

- Quality improvement initiative.
- Setting: Midsized, tertiary teaching hospital. 10 ORs. One OR dedicated to neurosurgeries.
- Sample:
  - Two groups:
    1. Patients who underwent neuro-spine surgeries in three months prior to intervention and three months after intervention.
       - Approximately 30 patients in each cohort.
    2. Staff anesthesia providers (approximately 20 individuals).
- Anesthesia guideline tool was developed with input from neurosurgery and anesthesia departments.
  - Information in the guideline included:
    - Best practice anesthetic management for neuro-spine surgeries.
    - Neurosurgeon preferences for surgeries
      - Positioning, hemodynamic parameters, anesthetic type when neuromonitoring is incorporated.
- Retrospective chart extraction of outcome data
  - Markers of OR efficiency: "in-room" to "turnover," "in-room" to "incision," "case end" to "anesthesia end."
  - Complications: Post-operative patient pain scores, incidence of peripheral neuropathies.
- Anesthesia staff survey
- Data Analysis:
  - Unpaired *t*-tests were used to analyze the means between the pre- and post-intervention groups.
  - Control and intervention groups were compared holistically.
    - Same procedure types were also analyzed individually.
  - Categorical data from of the surveys were examined and analyzed with *chi-square* tests.

RESULTS

Table 1

Patient Demographic Data

Age in years *M* (SD)		BMI *M* (SD)		Gender (%)		ASA Class (%)		Arterial Line Placed (%)		Presence of Neuromonitoring (%)		Intubation Attempts (%)	
Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
62.79 (15.07)	58.85 (16.14)	31.5 (5.42)	30.5 (4.49)	M = 55.3% F = 44.7%	M = 64.7% F = 35.3%	1 = 0% 2 = 23.7% 3 = 76.3% 4 = 0%	1 = 2.9% 2 = 41.2% 3 = 55.9% 4 = 0%	Y = 39.5% N = 60.5%	Y = 38.2% N = 61.8%	Y = 23.7% N = 76.3%	Y = 11.8% N = 88.2%	1 = 94.8% 2 = 2.6% 3 = 0% 4 = 2.6%	1 = 94.1% 2 = 5.9% 3 = 0% 4 = 0%

Note. Pre-intervention period = 38 patients. Post-intervention period = 34 patients. *M* = Mean. SD = Standard deviation. BMI = body mass index. ASA = American Society of Anesthesiologists. M = Male. F = Female. Y = Yes. N = No.

RESULTS

Table 2

Pre- Versus Post-guideline "In-Room" to "Turnover to Proceduralist" Time

	Pre-Guideline		Post-Guideline			
Neuro-spine surgery type	Number of surgeries	In-room to turnover to proceduralist time* *M* (SD)	Number of surgeries	In-room to turnover to proceduralist time* *M* (SD)	Difference	*p* value
All surgery types	38	14.71 (6.46)	34	15.03 (7.02)	+0.32	.841
Cervical	10	19 (6.34)	6	19.5 (5.32)	+0.5	.874
All posterior lumbar/thoracic surgeries	28	13.18 (5.88)	28	14.07 (7.04)	+0.89	.608
Lumbar fusions	6	17.66 (8.66)	10	16.1 (6.95)	-1.56	.696
Lumbar/thoracic discectomies and laminectomies	22	11.95 (4.39)	18	12.94 (7.45)	+0.99	.589

*Time measured in minutes. *M* = Mean. SD = Standard deviation.

Table 3

Pre- Versus Post-Guideline "In-room" to "Incision" Time

	Pre-Guideline		Post-Guideline			
Neuro-spine surgery type	Number of surgeries	In-room to incision time* *M* (SD)	Number of surgeries	In-room to incision time* *M* (SD)	Difference	*p* value
All surgery types	35	41.97 (14.85)	32	40.94 (9.82)	-1.03	.740
Cervical	7	62.57 (16.34)	5	52.2 (10.55)	-10.37	.243
All posterior lumbar/thoracic surgeries	28	36.82 (8.99)	27	38.85 (8.30)	+2.03	.388
Lumbar fusions	6	48.33 (7.43)	9	42.89 (8.78)	-5.44	.236
Lumbar/thoracic discectomies and laminectomies	22	33.68 (6.51)	18	36.83 (7.49)	+3.15	.162

*Time measured in minutes. *M* = Mean. SD = Standard deviation.

Table 4

Pre- Versus Post-Guideline "Case end" to "Anesthesia end" Time

	Pre-Guideline		Post-Guideline			
Neuro-spine surgery type	Number of surgeries	Case end to anesthesia end time* *M* (SD)	Number of surgeries	Case end to anesthesia end time* *M* (SD)	Difference	*p* value
All surgery types	36	13.44 (8.05)	33	12.42 (5.76)	-1.02	.549
Cervical	8	20.5 (10.14)	6	13.67 (5.50)	-6.83	.163
All posterior lumbar/thoracic surgeries	28	11.43 (6.19)	27	12.15 (5.89)	+0.72	.660
Lumbar fusions	6	14.33 (3.67)	10	14.6 (6.52)	+0.27	.930
Lumbar/thoracic discectomies and laminectomies	22	10.63 (6.56)	17	10.71 (5.44)	+0.08	.971

*Time measured in minutes. *M* = Mean. SD = Standard deviation.

Table 5

Pre- Versus Post-Guideline Mean Pain Score

	Pre-Guideline		Post-Guideline			
Neuro-spine surgery type	Number of surgeries	Pain Score* *M* (SD)	Number of surgeries	Pain Score* *M* (SD)	Difference	*p* value
All surgery types	38	2.21 (3.30)	32**	3.47 (3.51)	+1.26	.127
Cervical	10	3.3 (3.74)	6	5.67 (2.94)	+2.37	.209
All posterior lumbar/thoracic surgeries	28	1.82 (3.10)	26	2.96 (3.48)	+1.14	.209
Lumbar fusions	6	0.5 (1.22)	9	3.78 (3.67)	+3.28	.057
Lumbar/thoracic discectomies and laminectomies	22	2.18 (3.38)	17	2.53 (3.41)	+0.35	.753

*Pain scores were based on a 0-10 scale. Pain scores were collected from the first reported pain score assessed in the PACU.

**Two patients were not included because one went to the intensive care unit and the other did not receive a pain score until two hours after surgery. *M* = Mean. SD = Standard deviation.

Table 6

Pre- versus post-guideline staff survey

Question		1—4 (Unconfident)	5-6 (Neutral)	7-10 (Confident)	*p* value
How confident are you in providing anesthesia for patients undergoing spinal surgeries?	Pre-guideline	0	1	15	.85
	Post-guideline	0	0	5	
How efficient do you feel during induction and positioning of patients undergoing spinal surgeries?	Pre-guideline	0	3	13	.58
	Post-guideline	0	0	5	
How clear do you feel the communication is between neurosurgeons and anesthesia staff in the PREoperative period?	Pre-guideline	2	5	9	.19
	Post-guideline	0	0	5	
How clear do you feel the communication is between neurosurgeons and anesthesia staff in the INTRAoperative period?	Pre-guideline	3	3	10	.27
	Post-guideline	0	0	5	
How confident are you in the management of fluid/blood replacement during neuro-spine surgeries?	Pre-guideline	0	3	13	.58
	Post-guideline	0	0	5	
How confident are you in modifying a general anesthetic to accommodate SSEP and MEP monitoring?	Pre-guideline	0	0	16	1.0
	Post-guideline	0	0	5	

DISCUSSION

- No statistically significant changes were found after implementing the anesthesia guideline.
  - "In-room" to "turnover" time.
    - Potential subjective factors.
  - "In-room" to "incision" time.
    - Much of this time does not involve anesthesia.
  - "Case end" to "anesthesia end" time.
    - Patient factors; CRNA factors
- Cost savings
  - Not calculated due to no statistically significant change attributed to the efficiency markers.
- No complications found in either group.
  - Cannot be determined if the guideline provides any benefit in this area.
- Postoperative pain scores
  - Patients in the post-guideline group had higher pain scores but the change was not statistically significant.
  - Data could be impacted by lingering anesthesia effects in the PACU.

  Ketorolac
  - Differences in pain scores was examined with and without Ketorolac.
    37 patients without Ketorolac – average pain score = 3.08
    33 patients with Ketorolac – average pain score = 2.45
    Difference = 0.63 (p = .449)
- Staff Survey: Approximately 20 staff CRNAs.
  - 16 pre-surveys
  - Five post-surveys
  - Chi-square analysis utilized
- No statistically significant changes.
  - Trend of the pre-surveys indicated a gap in communication.
  - Post-surveys demonstrated some improvement in this measure.

CONCLUSIONS

- Although no statistically significant changes were found, the guideline provides current evidence-based practice measures and can assist CRNAs in delivering optimal care to patients undergoing neuro-spine surgery.
- A study on Ketorolac in the spinal surgery population could be beneficial for patients.
- Further development of the project and research into OR inefficiencies during neuro-spine surgeries could be beneficial as well.

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