

Quality Improvement Project on the Success Rate of Thoracic Epidurals in a Major Academic Hospital

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BACKGROUND: Continuous thoracic epidural analgesia (TEA) is considered the gold standard in the management of perioperative pain for a diverse array of major open surgeries. Although appropriate placement is not always straightforward, a partially working TEA or failed TEA is a cause of significant failure in patient postoperative pain management and satisfaction¹. Patient factors, reliance on traditional landmark-based and loss of resistance (LOR) techniques, and reduced learning opportunities for trainees have been highlighted as contributing to failure rates. Given these multiple factors, studies examining TEA failures have reported failure rates ranging from as low as 2.1% to as high as 50%^{2,3}. Examining failure rates is the first step in identifying issues that have the potential to be corrected or identifying risk factors for TEA failure. As a first step in quality improvement, we undertook a retrospective analysis of our electronic medical record (EMR) to determine the rate of thoracic epidural failures at our institution over a 6-month period.

METHODS

- Thoracic epidural procedure data were collected from the EMR review of patients who received TEA intended for postoperative analgesia between 1/1/2023 and 6/29/2023 in a major academic medical center with more than 45,000 surgeries per year. TEA is provided with a mixture of local anesthetics (Typically bupivacaine) and narcotics (typically either fentanyl or hydromorphone). The epidurals are typically placed blindly with the loss of resistance (LOR) method.
- Since systemic opioids are not administered to a patient with TEA unless the TEA is not adequately providing analgesia, we considered adding systemic opioids to the patient's analgesic regime and removal of opioids from the epidural mixture (splitting) of the epidural as a surrogate for TEA failure.
- We reviewed all the TEAs for "splitting" of narcotics and investigated documented causes of "splitting".

Data analysis demonstrated a thoracic epidural failure rate of 18% - which prompted the next steps in the improvement on the success of TEA

Table 1: Basic Patient Characteristics					
Epidural Analgesia	Age at Encounter (years ± SD)	ASA Score (score ± SD)	Patient BMI (BMI ± SD)	Gender Identity (%)	Patient Ethnicity (%)
Inadequate (n=60)	58.4 ± 15.1	2.8 ± 0.6	28.5 ± 6.2	Male 43% Female 57%	Caucasian - 75% Asian – 13.3% African American – 11.7%
Adequate (n=242)	46.94 ± 23.9	2.5 ± 0.7	25.6 ± 10.2	Male - 51% Female – 49%	Caucasian – 73% Asian – 5.2% African American – 5.8% Other/unavailable – 14%

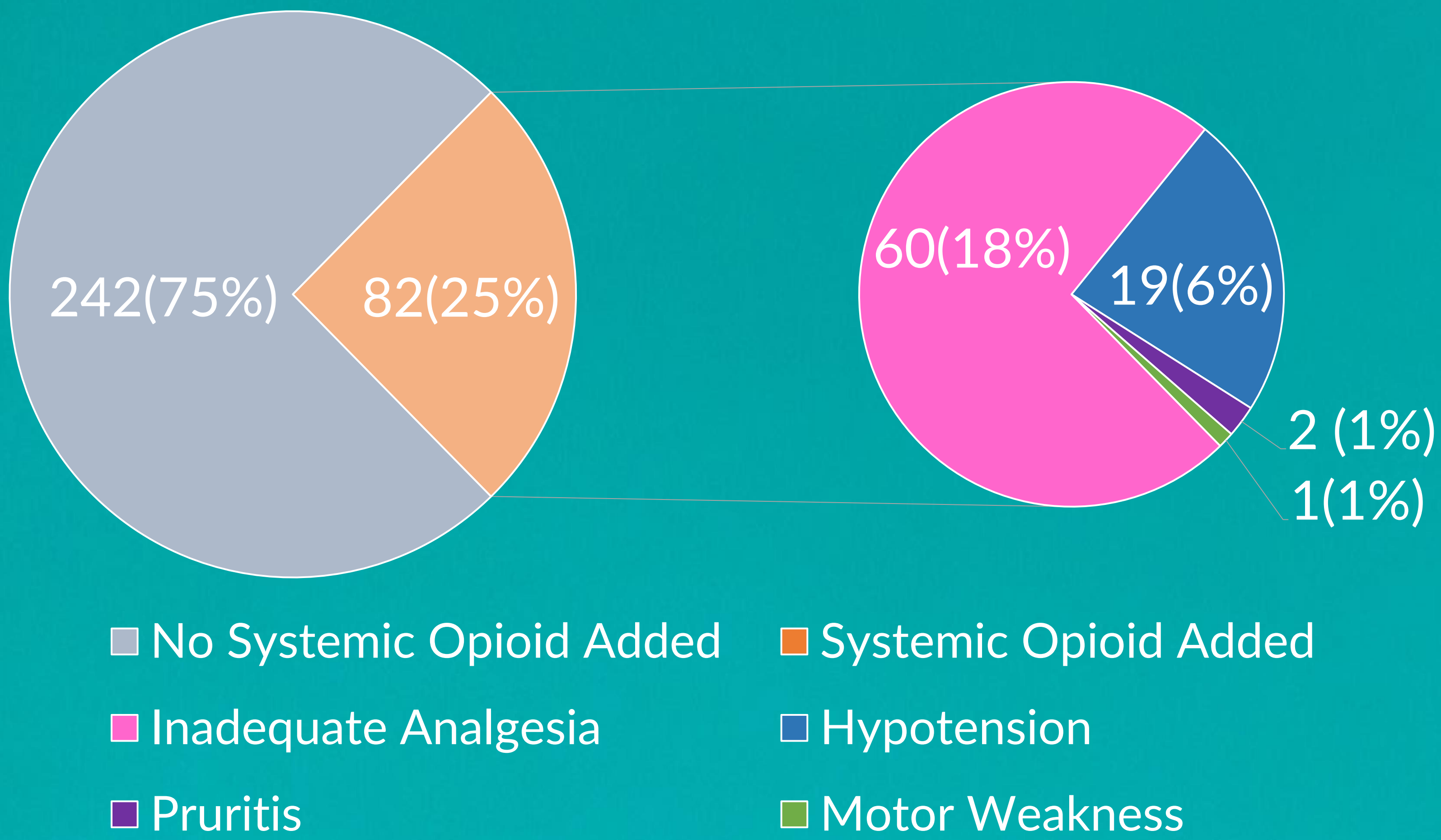
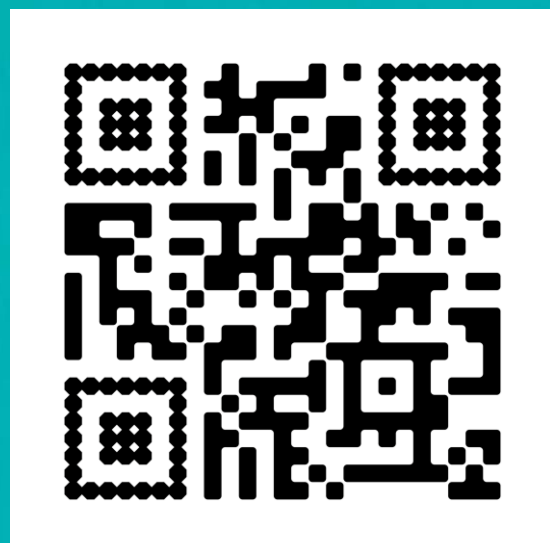


Figure 1: Pie-in-Pie chart displaying proportion of thoracic epidurals which had systemic opioids added while in place, and the documented rational for addition of systemic opioid (n, %).



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Table 2: TEA Placement Data			
		TOTAL TEA (n)	“Split” TEA (n, %)
Total number		324	82 (25)
Level of TEA			
	T9-T10 or higher	80	25 (31)
	T8-T9 or lower	241	64 (26)
Approach			
	Midline	236	67 (28)
	Paramedian R, L	60, 18	16 (26), 6 (33)
Position			
	Sitting	308	83 (26)
	Lateral	15	5 (33)
	Prone	3	1 (33)
Number of Attempts			
	1	171	48 (28)
	2	107	24 (22)
	3 or more	46	16 (34)
LOR depth (cm)			
	<5cm	118	17 (5)
	>5cm	207	71 (22)
Complications (YES)		13	4 (1)
Catheter introduction cm (%)			
	</= 12cm	270	47 (14)
	> 12cm	56	12 (3)

RESULTS

- There were 324 thoracic epidurals placed in a 6-month period, 82 (26%) of which were “split” with systemic opioid.
- Basic patient demographic data is presented in Table 1
- TEA data obtained from procedure notes is depicted in Table 2
- 21 patients (8%) had systemic opioids added due to concerns over the epidural causing hypotension, refractory pruritis, and lower extremity motor weakness
- The remaining 60 (18%) epidurals had systemic opioids added due to patchy or inadequate epidural pain coverage. Within these 60 thoracic epidurals, 8 had documentation suggesting that the epidural had migrated as a cause for inadequate epidural analgesia, and one had documentation of a kink in the epidural tubing. The remaining 51 did not attribute the failure of epidural analgesia to a specific cause.

DISCUSSION

The epidural failure rate due to inadequate analgesia reported here of 18% is consistent with the range of failure rates reported in previous studies². This high failure rate carries with it patient safety, and financial consequences. To improve the success rate of TEA in our institute the following steps have been started;

- In the short term, we will present the following data and our analysis as part of a faculty workshop with more fusing on the methods to improve the accuracy of the LOR method, including the use of **neuraxial ultrasound** to guide correct placement.
- Extend our data extraction to 5 years (May 2017 to May 2024) with an expected inclusion of ~3000 TEA and initiate a root cause analysis.
- Perform length of stay and cost analysis of the failed TEA.
- Initiate use of **fluoroscopy** in a subset of the high-risk patient requiring TEA and perform cost analysis of employing this technique.

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