



Use of Injection Pressure Monitoring to Guide Procedural Decision-Making During Performance of Peripheral Nerve Block

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Introduction:

Nerve trauma during regional anesthetic blocks is a rare but potentially devastating complication of regional anesthesia. Nerve damage can occur either through direct trauma from needle-nerve contact or from intrafascicular injection of medication. With the widespread adoption of ultrasound for performing peripheral nerve blocks (PNB), studies have continued to demonstrate the superiority of ultrasound guidance in achieving successful PNBs. However, evidence demonstrating that ultrasound guidance reduces postoperative neurologic symptoms (PONS) when compared to other nerve localization techniques is lacking.¹ This is quite possibly due to the extremely rare incidence of PONS, making it impossible to investigate differences in incidence with adequate power. However, other modalities are available to maximize patient safety during peripheral nerve blockade, including the use of injection pressure monitors during performance of PNB. It has been established in animal models that a high opening injection pressure (OIP) greater than 15-20 psi can result in nerve damage. Clinically, injection pressures greater than 15 psi have been associated with needle-nerve contact.²

Given the rare occurrence of postoperative nerve injury, it is unknown to what degree, if any, that quantitative pressure monitoring would alter the incidence of nerve injury. A study large enough to detect any measurable difference in incidence would be impractical.² As an alternative, we propose a study to investigate the impact of an injection pressure manometer on clinician decision-making and performance of PNB as well as reporting on overall incidence of PONS at our institution.

Materials and Methods:

After receiving an overview and demonstration of the injection pressure manometer, clinicians performed ultrasound-guided peripheral nerve blocks (PNBs) with real-time pressure monitoring. Opening injection pressure (OIP) was recorded and categorized as either >15 psi or ≤15 psi. Additional variables collected included block type, injectate composition, total injectate volume, volume injected while pressure exceeded 15 psi (if applicable), block success, presence of pain or paresthesia during injection, resident training level, and whether the block was adjusted or aborted intra-procedurally.

The primary outcome was the rate of intra-procedural management change (block adjustment or abortion). Secondary outcomes included the rate of OIP >15 psi and descriptive analysis of procedural characteristics associated with elevated injection pressure. Postoperative neurologic symptoms (PONS) were intended for evaluation but were not available in the current dataset.

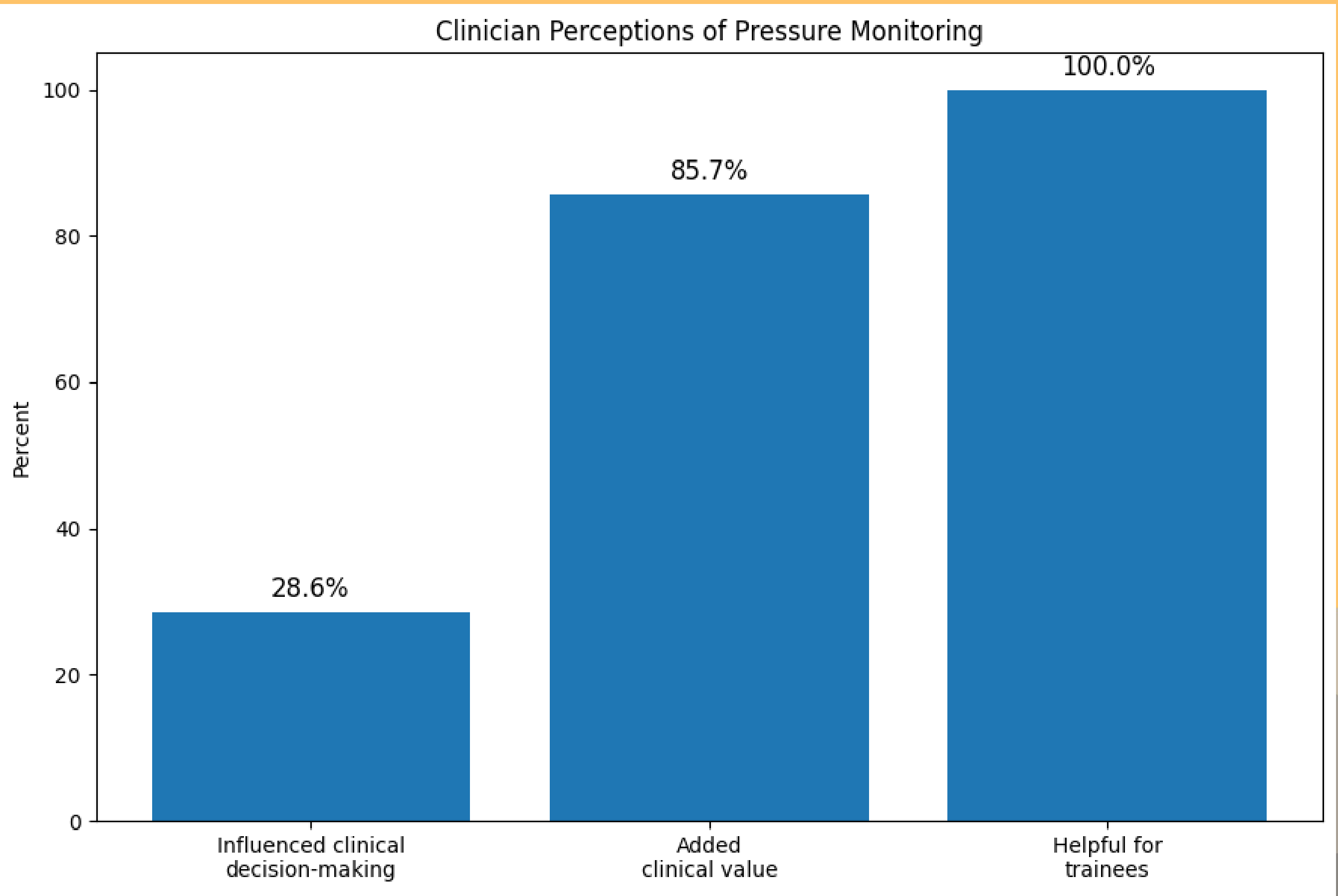
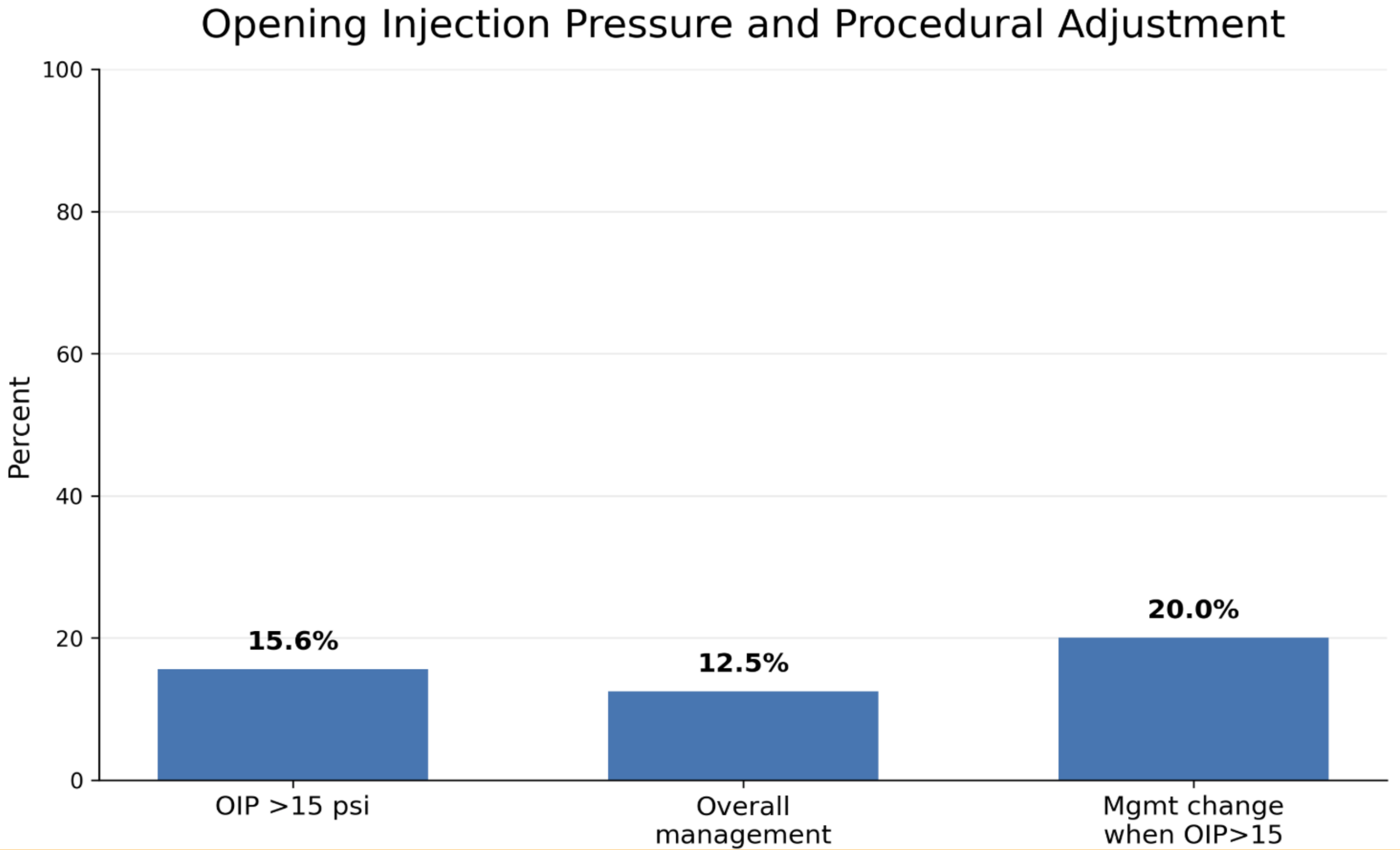
No identifiable patient information was collected; therefore, the study was considered exempt from institutional review board review per institutional policy. Data were analyzed descriptively, with proportions reported as percentages and exploratory comparisons performed between OIP >15 psi and ≤15 psi cases to assess trends in management .



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Results:



- 32 ultrasound-guided peripheral nerve blocks performed with injection pressure monitoring were included in the analysis.
- Elevated opening injection pressure (OIP >15 psi) occurred in 5/32 blocks (15.6%).
- Intra-procedural management change occurred in 4/32 blocks (12.5%)
 - All were adjustments and never aborted
- Management changes by pressure category
 - OIP >15 psi: 1/5 blocks (20.0%)
 - OIP <15 psi: 3/27 blocks (11.1%)
 - Suggests a directionally higher rate of adjustment with elevated pressure
- Volume injected during elevated pressure
 - Typically 0 cc, occasionally small volumes (1–5 cc)
 - Suggests early recognition of elevated pressure

- Pain or paresthesia during block performance:
 - 1/30 documented cases (3.3%)
- Block success
 - 25/25 documented cases (100%) (7 cases missing documentation)

Provider Survey

- 71.4% encountered elevated injection pressures
 - Responded by reducing injection pressure or repositioning the needle
- 85.7% reported added clinical value beyond ultrasound
- 28.6% reported a positive influence on clinical decision-making
- 28.6% were somewhat likely to incorporate the device into practice
- 100% indicated the device would be helpful for trainees learning safe injection pressures

Discussion:

In this cohort of 32 ultrasound-guided peripheral nerve blocks performed with injection pressure monitoring, elevated opening injection pressure (OIP >15 psi) occurred in 15.6% of cases, indicating that potentially concerning injection pressures occur in routine clinical practice. Intra-procedural management change occurred in 12.5% of blocks and was more frequent when OIP exceeded 15 psi (20.0%) compared with OIP <15 psi (11.1%), suggesting that pressure monitoring may influence clinician decision-making. Recorded volumes injected while pressure remained above 15 psi were minimal (0–5 cc), suggesting early recognition of elevated pressure and prompt modification of injection technique.

Survey responses further supported the potential utility of the device, with clinicians reporting that elevated pressures prompted adjustments such as reducing injection pressure or repositioning the needle. Respondents also reported added clinical value beyond ultrasound guidance and indicated that the device may be a useful educational tool for trainees learning safe injection pressures. Limitations of this study include the small sample size, lack of a historical comparison group, absence of postoperative neurologic follow-up data, supply chain delays that limited device availability during the study period, and the possibility that pressure measurements may be influenced by the force applied to the syringe plunger during injection.

Clinical Impact:

Elevated injection pressures were identified in a meaningful proportion of peripheral nerve blocks, and real-time pressure monitoring may prompt clinicians to modify injection technique, suggesting a potential role as a practical safety adjunct to ultrasound guidance.

References:

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