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A Scoring System for Learners to Stratify and Match Bleeding Risk of Peripheral Nerve Blocks to Expert Consensus

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Introduction

As the field of regional anesthesiology develops new techniques, there exists a need for a reliable and simple approach to assessing bleeding risk for providers of all skill levels. Currently there is no established framework for accurately determining this risk; prevailing methods rely on an individual's understanding of key anatomy, existing literature, and experience. A survey of expert regional anesthesiologists [1] reveals that a consensus exists regarding the bleeding risk of various nerve blocks, despite no systematic evidence-based approach to sharing this knowledge. The Critical, Intervention, Assess (CIA) scoring system has the potential to help bridge this gap. It is used to determine if the block is in a Critical location, if Intervention beyond compression is required should bleeding occur, and if this bleeding would be difficult to Assess? The purpose of this prospective observational study is to evaluate the effectiveness of the CIA score [2] as a tool for trainees to perform accurate assessments of bleeding risk of various nerve blocks when compared to their more experienced attendings.

Materials and Methods

Institutional Review Board (Stanford Health Care) approval and patient consent were obtained. The study was registered with ClinicalTrials.gov (NCT05153265). Stanford anesthesiology residents and regional anesthesiology attendings were enrolled for the study. Exclusion criteria included attendings who were not on the regional anesthesiology team.

Eighteen peripheral nerve and fascial plane blocks were selected. Three approaches to the quadratus lumborum block were included, for a total of 20 questions. Two surveys, one for residents and one for attendings, were created and distributed in a single institution. The resident survey began with, "Have you completed your regional anesthesiology rotation?" Those who answered "no" will be referred to as 'regional naïve residents.' The survey included an explanation of the CIA score and asked the residents to apply the score to each nerve block. CIA uses binary scoring in the form of three yes/no questions, where one point is assigned when the answer is "yes" for a maximum score of three points. Nerve blocks are then designated low-risk (0 points), intermediate-risk (1 point), or high-risk (≥2 points). A diagram of the relevant anatomy was also provided for each procedure (figure 1). The attending survey included the same 20 nerve blocks and asked them to classify them as low, intermediate, or high-risk

based on published definitions [1] and their own clinical experience, rather than using the CIA score.

To examine the effectiveness of the CIA score as a teaching tool, only nerve blocks scored “low” or “high” bleeding risk by more than 50% of respondents were included for comparison; otherwise, they were defined as “indeterminate.” Blocks that did not reach a common risk designation by more than 50% were also defined as “indeterminate.” Blocks deemed “intermediate” bleeding risk by more than 50% of attendings were excluded from analysis. The regional naïve residents were analyzed together with, and then separately from, the residents who had completed their regional anesthesia rotation.

Using a six-cell decision matrix [3](Table 1) to interpret “indeterminate” results, we calculated the positive and negative yield of the CIA score as a test to detect “disease”, defined as “bleeding risk as determined by attendings.” When over 50% of the residents scored a block as high-risk, the test was considered positive. When over 50% of the residents scored a block as low-risk, the test was considered negative. Overall accuracy and effectiveness were also calculated. [3][4]

Results/Case Report

A total of 50 anesthesiology residents and 19 regional anesthesiology attendings were enrolled. The residents’ training levels ranged from clinical anesthesia year one (n = 16), to year two (n = 20), to year three (n = 14). 28 were regional naïve residents and 22 had completed their regional anesthesia rotation. The attendings’ years of experience practicing regional anesthesia spanned from less than five years (n = 6), between five and 10 years (n = 5), to more than ten years (n = 8).

Figure 2 summarizes the comparison of responses from attendings (19) and regional naïve residents (28). Highlighted in red are blocks where at least 50% of participants agreed. When compared to attendings, the trainees as a group correctly identified all three high-risk blocks (100%) and six of nine low-risk blocks (67%). Overall, trainees correctly matched their attendings for nine out of twelve high or low-risk blocks (75%). Table 1 illustrates the overall effectiveness of novice residents using the CIA score when compared to experienced attendings.

Discussion

As peripheral nerve blocks have low incidence of bleeding-related complications, identifying evidence-based assessments of bleeding risk is challenging. Based on this single institutional survey, the CIA scoring system provides a framework for trainees without prior regional anesthesia experience to appropriately determine if a peripheral nerve block is high or low bleeding risk, when true risk is determined by the consensus of their attendings. Without prior ultrasound and hands-on experience, new learners may not have enough knowledge to score accurately, despite an understanding of basic principles. Therefore, the CIA scoring was analyzed based on group consensus to limit interindividual variability amongst study participants.

Importantly, there was no peripheral nerve block that was labelled high risk by the attendings that did not have the same designation by the residents. Among the nerve blocks with discrepancies between residents and attendings, all were deemed low risk by the attendings but did not achieve a majority vote within the residents. Together, these results are encouraging that the CIA score is unlikely to cause a trainee or any unfamiliar practitioner to proceed with a high risk nerve block, thinking it is low risk for bleeding.

As we depend increasingly on teleconferencing and distance learning, the CIA score is an easily shareable

teaching tool with exciting potential to help learners accurately assess bleeding risk of various peripheral nerve blocks. New regional techniques continue to be discovered, and a validated scoring system allows providers a way to risk stratify despite unfamiliarity. As this study was conducted at a single institution, further research is needed to determine whether the CIA score has cross-institutional efficacy for trainees elsewhere to utilize.

References

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Disclosures

No

Tables / Images

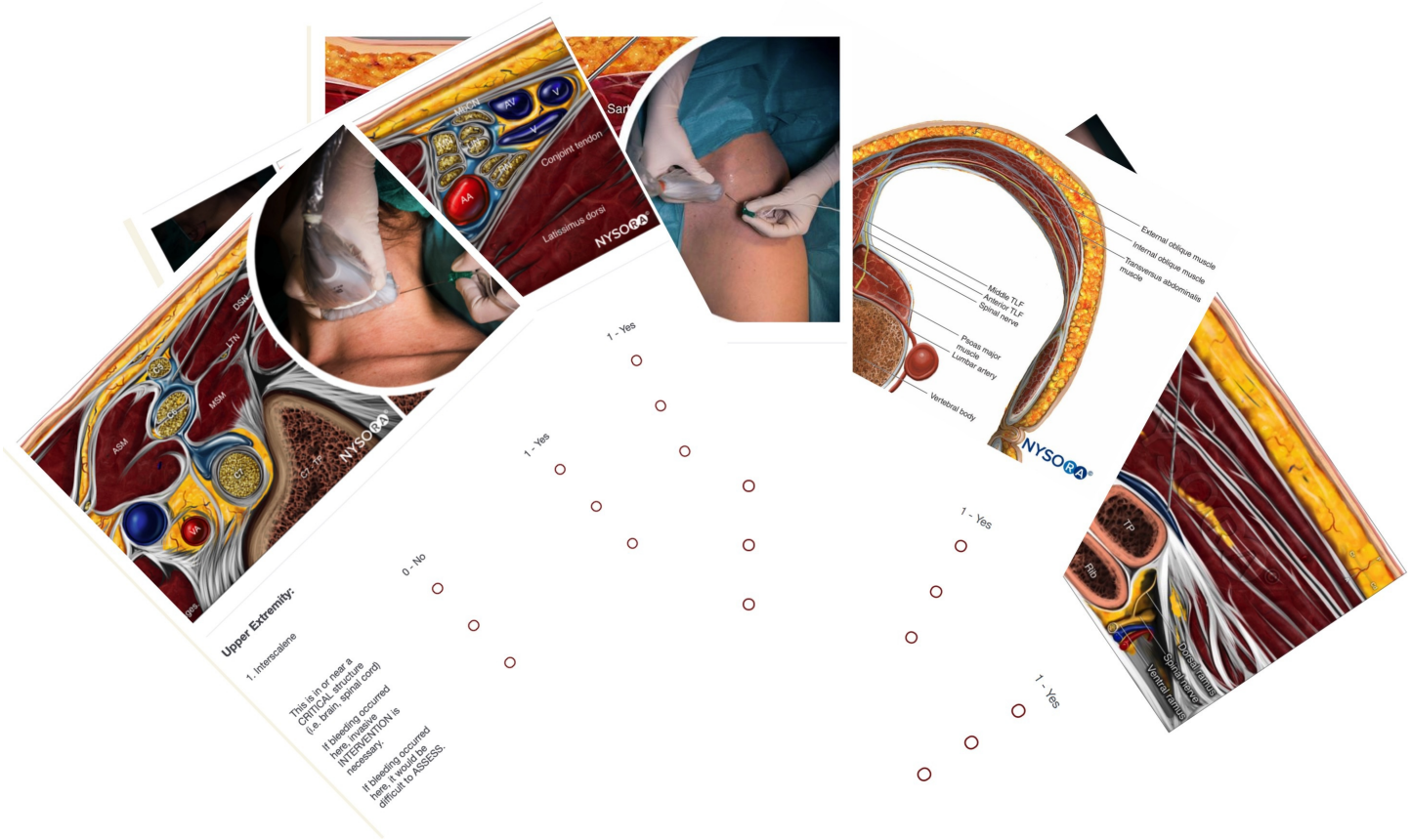

Figure 1. Sample of Online Survey Questions Using CIA to Risk Stratify 20 common peripheral Nerve and fascial Plane Blocks.

(Acknowledgement : all materials were adapted from in open educational resources on the internet)

	Attending Anesthesiologists (n = 19)					Regional Naïve Residents (n = 28)			
	Risk Level (based on clinical experience):					Risk Level (based on CIA score):			
Block Name	Low	Intermediate	High	Consensus		Low	Intermediate	High	Consensus
Interscalene	68.4%	31.6%	0.0%	Low		35.7%	42.9%	21.4%	Indeterminate
Supraclavicular	36.8%	63.2%	0.0%	Indeterminate		35.7%	17.9%	46.4%	Indeterminate
Infraclavicular	0.0%	68.4%	31.6%	Indeterminate		25.0%	28.6%	46.4%	Indeterminate
Axillary	84.2%	15.8%	0.0%	Low		50.0%	28.6%	21.4%	Low
Fascia Iliaca	57.9%	36.8%	5.3%	Low		71.4%	28.6%	0.0%	Low
Lumbar Plexus	0.0%	10.5%	89.5%	High		0.0%	7.1%	92.9%	High
Adductor Canal	42.1%	57.9%	0.0%	Indeterminate		64.3%	35.7%	0.0%	Low
Subgluteal Sciatic	21.1%	68.4%	10.5%	Indeterminate		25.0%	53.6%	21.4%	Indeterminate
Popliteal Sciatic	42.1%	57.9%	0.0%	Indeterminate		78.6%	21.4%	0.0%	Low
Ankle	94.7%	5.3%	0.0%	Low		96.4%	3.6%	0.0%	Low
Paravertebral	0.0%	15.8%	84.2%	High		3.6%	10.7%	85.7%	High
Erector Spinae Plane	63.2%	31.6%	5.3%	Low		17.9%	39.3%	42.9%	Indeterminate
Serratus Anterior	47.4%	52.6%	0.0%	Indeterminate		67.9%	28.6%	3.6%	Low
Pectoralis	52.6%	47.4%	0.0%	Low		39.3%	28.6%	32.1%	Indeterminate
Quadratus Lumborum (lateral)	5.3%	73.7%	21.1%	Indeterminate		39.3%	25.0%	35.7%	Indeterminate
Quadratus Lumborum (posterior)	10.5%	63.2%	26.3%	Indeterminate		39.3%	28.6%	32.1%	Indeterminate
Quadratus Lumborum (anterior)	0.0%	47.4%	52.6%	High		28.6%	21.4%	50.0%	High
Transversus Abdominis Plane	73.7%	26.3%	0.0%	Low		57.1%	25.0%	17.9%	Low
Rectus Sheath	73.7%	26.3%	0.0%	Low		67.9%	21.4%	10.7%	Low
Ilioinguinal/Iliohypogastric	57.9%	36.8%	5.3%	Low		64.3%	32.1%	3.6%	Low

Figure 2 : Comparison of Peripheral Nerve Block Risk Level Stratification Between Regional Anesthesiologist Attendings and Regional Naïve Residents. Red highlights indicate when ≥50% of participants in that group agreed on the risk level. Nerve blocks that reached ≥50% agreement for either high-risk or low-risk amongst attendings are highlighted in yellow and used for subsequent analysis when comparing resident responses.

		Bleeding Risk by Regional Anesthesiology Attendings	
		High-Risk	**Low-Risk**
CIA Score by Regional Naïve Residents	**≥2**	A (n = 3)	B (n = 0)
	1	E (n = 0)	F (n = 3)
	0	C (n = 0)	D (n = 6)
Effectiveness		(A+D)/(A+B+C+D+E+F) = 75%	

Table 1: Six-Cell Matrix Showing Calculation of Effectiveness of CIA Score Usage by Residents Compared to Attendings. Three nerve blocks deemed high-risk by attendings were correctly identified by ≥50% of residents. Six nerve blocks deemed low-risk by attendings were correctly identified by ≥ 50% of residents. Three nerve blocks deemed low-risk by attendings were not correctly identified as low-risk by residents; these were considered to be indeterminate tests. Effectiveness was calculated as the sum of true positives (A) and true negatives (D) over total results [true positives (A) + false positives (B) + false negatives (C) + true positives (D) + indeterminate results (E + F)].