

Research Article

Perceptions of Regional Anesthesia for Pediatric Supracondylar humerus fractures – a multispecialty survey

Alfred Mansour^{1a}, Andrea Biaggi-Ondina^{2b}, Lindsay Crawford^{2c}, Shiraz Younas^{1d}, Maria Matuszczak^e, Staci Cameron^f, Ryan J. Warth^{1g}, Layla Haidar^{1h}

- a Dr. Alfred Mansour is an Associate Professor in the Department of Orthopedic Surgery at McGovern Medical School at The University of Texas Health Science Center at Houston (UTHealth). He is the Director of the UT Ortho Comprehensive Hip Preservation Program and serves as a Team Physician for the Houston Rockets NBA Organization. In addition to leading the hip preservation program, he also currently serves as Director of Pediatric Orthopedics.

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- c Dr. Lindsay Crawford is an Assistant Professor in the Department of Orthopedic Surgery at McGovern Medical School at The University of Texas Health Science Center at Houston (UTHealth).

Certified by the American Board of Orthopedic Surgery, Dr. Crawford specializes in Pediatric Orthopedics with an emphasis in Spinal Deformity and Scoliosis.

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- d An affiliated physician with Children's Memorial Hermann Hospital, Dr. Shiraz Younas joined the department of Orthopedic Surgery at UTHealth's John P. and Kathrine G. McGovern Medical School in 2009. An associate professor, he is a diplomate of the American Board of Orthopedic Surgery with special expertise in spinal deformities, scoliosis and limb deformity.

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- e Professor of Anesthesiology, Vice-Chair and Division Chief Pediatric Anesthesia University of Texas, Houston, Children's Memorial Hermann Hospital, Texas Medical Center Houston.

Research interest: Pediatric Regional Anesthesia, Pediatric Airway Management, Opioid Sparing Pain Management in Children, Peri-operative Safety.

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- f Following completion of fellowship training, Dr. Cameron became an assistant professor of pediatric anesthesiology at the UT Health Science Center in Houston, mainly practicing at the Texas Medical Center campus of Memorial Hermann Hospital. Her focus has been on pediatric anesthesia, pediatric acute pain medicine, and pediatric regional anesthesia.

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- g Dr. Ryan J. Warth is an Assistant Professor and the Director of Clinical Research Operations in the Department of Orthopedic Surgery at McGovern Medical School at the University of Texas Health Science Center at Houston (UTHealth). Dr. Warth is responsible for overseeing clinical trial operations, academic clinical studies involving medical students, residents, fellows, and faculty, and optimizing internal research processes to uphold the mission of the Department of Orthopaedic Surgery and the University as a whole.

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- h Haidar is an experienced researcher, health promotion specialist, and team management professional with a passion for medicine and healthcare. Currently, Haidar manages all pediatric orthopaedic research projects at UTHealth Orthopaedics, producing valuable research to improve patient care, and build the future of medicine. Haidar is also pursuing a doctorate in public health (DrPH)

¹ The University of Texas Health Science Center Houston, ² The University of Texas Health Science Center

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Background

The purpose of this study was to compare the prior experiences, perceived risks, benefits, complications, and practice patterns in the use of regional anesthesia for pediatric supracondylar humerus fractures between orthopaedic surgeons and anesthesiologists to better understand the attitudes and experiences governing perioperative pain management in the opioid crisis.

Methods

An online survey consisting of 22 multiple-choice questions regarding usage of regional anesthesia for perioperative pain management of supracondylar humerus fractures was approved by the Evidence-based Practice committee of the Pediatric Orthopaedic Society of North America (POSNA) and distributed to the active members. The same survey was also distributed to anesthesiologists associated with pediatric anesthesiology teaching centers between January 2019-June 2019. The results were captured anonymously using a RedCAP database, after which the data was exported for analysis.

Results

Two hundred and seventy nine physicians participated in this survey (n=249 orthopaedic surgeons [89.2%]; n=30 anesthesiologists [10.8%]). In total, 162/279 (58.1%) reported at least 10 years of practice, 236/279 (84.6%) reported practicing in an academic setting, and 185/279 (66.3%) reported a minimum volume of 20 applicable cases per year. 69.9% of Orthopaedic surgeons were moderately or highly concerned regional anesthesia would mask a compartment syndrome compared to only 10% of anesthesiologist sharing that same level of concern ($p<0.001$), although similar numbers of respondents treated patients with volkman's contracture after a supracondylar humerus fracture. 76.1% of orthopaedic surgeons did not believe the level of perioperative pain warranted regional anesthesia compared to only 6.7% of anesthesiologists ($p=0.005$).

Conclusion

This multidisciplinary survey highlights the distinct differences in perceptions of regional anesthesia for supracondylar humerus fractures. These perceptual differences frame our opinions and willingness to changes our practices. This survey suggests perceptions on pain, risks, and benefits of regional anesthesia vary greatly between two major stakeholders treating the same injury.

INTRODUCTION

Supracondylar humerus fractures are one of the most common traumatic fractures seen in children between the ages of 5-7 (Kronner Jr. et al. 2013, 131-137; Kumar and Singh 2016, RE01-RE06). This injury accounts for more than half of all elbow fractures and roughly 33% of all pediatric limb fractures (Carson et al. 2006, 41-67, v). Surgical treatment is the gold standard for displaced fractures, with the ur-

gency depending on whether the hand remains perfused or not (Zhao, Wang, and Zhang 2013, 2942-2953). Outcomes in large series are uniformly excellent, with low risk of complications including compartment syndrome and Volkman's ischemic contracture (Omid, Choi, and Skaggs 2008, 1121-1132).

Several perioperative pain management strategies have been evaluated, including narcotic and non-narcotic modalities, with some authors advocating acetaminophen and ibuprofen as a completely non-narcotic method of pain

at the University of Texas, School of Public Health- Houston to use her passion for preventative medicine to educate, encourage, and empower others to lead a healthy lifestyle.

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control (Stillwagon et al. 2020, 543-548). Another modality commonly used in elective pediatric orthopaedics is regional anesthesia (Tobias and Mencia 1998, 273-277). This type of anesthesia can offer many advantages over conventional anesthesia. Some proposed advantages include fewer side effects and a faster recovery time (Egol et al. 2014, 231). A study found that regional anesthesia decreased pain scores, the incidence of severe pain, and opioid consumption until the nerve block wore off, without increasing the time spent in the operating room (Glover et al. 2015, 178-183). Regional anesthesia provides patients with prolonged postoperative pain relief (Dudziak and Klein 1982, 331-334).

There are also some disadvantages to regional anesthesia. For instance, most pediatric patients require sedation during regional placement, requiring more time under general anesthesia (Dudziak and Klein 1982, 331-334). In addition, extra equipment is needed, as well as an additional skill set to safely perform a regional block. In fact, an anesthesia survey showed that more than half of the respondents felt that their training in regional anesthesia was inadequate (Hadžić et al. 1998, 241).

The push to minimize narcotic use has reignited the discussion on regional anesthesia even in the acute trauma setting. Concerns of missed compartment syndrome due to regional anesthesia exist, but there is little evidence in the literature to support the actual incidence of this concern. Anecdotal evidence suggests a difference in opinion on the benefit and risk of regional anesthesia between the orthopaedic surgeon and anesthesiologist. We believe these opinions form the underlying bias that greatly impacts utilization. Cognitive biases have been influencing medical thinking and decision making throughout time. Understanding these perceptions is critical in order to design meaningful studies, make better evidence-based decisions, and provide greater care for patients.

We surveyed both pediatric orthopaedic surgeons and anesthesiologists to understand and compare differences in perceived risks, benefits, complications, and current practice patterns regarding the use of regional anesthesia during the perioperative treatment of displaced, neurovascularly intact supracondylar humerus fractures. We hypothesized that these perceptions differ significantly between the two groups. A secondary objective of this study is to estimate the percentage of orthopaedic surgeons already employing regional anesthesia in their perioperative management and their experience. We intend to use this data as a baseline for discussions regarding regional anesthesia and its role in perioperative pain management for acute supracondylar humerus fractures.

METHODS

STUDY AND GENERAL SURVEY DESIGN

A novel IRB-approved survey assessing perceptions of regional anesthesia for perioperative pain management for supracondylar humerus fractures was generated. This survey was reviewed, approved, and distributed by the Pedi-

atric Orthopaedic Society of North America (POSNA) after approval from their Evidence-based medicine (EBM) Committee. A HIPAA-compliant secure online storage platform with email-based distribution, branching logic, and online-input capability (REDCap) was utilized to conduct the survey. The questions asked in the survey are provided in the appendix.

SURVEY POPULATION

The subject population includes Board Certified Pediatric Orthopaedic Surgeons and a convenience sample of Board Certified Pediatric Anesthesiologists. All POSNA members received electronic communication inviting survey completion. Pediatric anesthesiologists who were associated with pediatric anesthesiology teaching centers and who regularly care for pediatric upper-extremity trauma patients were contacted for survey completion.

STATISTICAL ANALYSIS

Statistical analyses were performed using SPSS Version 23.0 (IBM; Armonk, NY). Survey data are grouped according to orthopaedic and anesthesiology sub-specialists and reported as discrete counts and percentages of the total number of responses. Chi-square analyses were performed for comparison between groups for each of the survey questions. Parametric and non-parametric follow-up tests were performed where appropriate. Logistic regressions with Bonferroni corrections were performed to account for possible interactions among the survey responses and are reported as odds ratios with 95% confidence intervals. P-values less than 0.05 were considered statistically significant.

RESULTS

Two hundred and seventy-nine physicians participated in this survey (n=249 orthopaedic surgeons [89.2%]; n=30 anesthesiologists [10.8%]). In total, 162/279 (58.1%) reported at least 10 years of practice, 236/279 (84.6%) reported practicing in an academic setting, and 185/279 (66.3%) reported a minimum volume of 20 applicable cases per year ([Table 1](#)).

PRACTICE PATTERNS

Only 4.0% (10/249) of surgeons surveyed ever used regional anesthesia as part of their standard routine for perioperative pain management in neurovascularly intact supracondylar humerus fractures, with only 0.8% (2/249) employing it more than half of their cases. Of the surgeons that employ regional anesthesia, 90% cited the availability of pediatric regional-trained anesthesiologists, 70% cited minimizing the risk of opioid use, and 50% cited low concerns over the complications of regional anesthesia as reasons supporting regional anesthesia use.

Of the surgeons that do not utilize regional anesthesia, 76% cited lack of sufficient postoperative pain to warrant regional anesthesia and 61% cited the concern of the regional anesthesia masking surgical complications such as

Table 1. Pertinent demographic and perceptions survey data comparing orthopaedic surgeon responses with anesthesiology responses

Demographics			P-Value
Variable	Ortho, n (%)	Anesthesia, n (%)	
Total	249	30	--
Practice setting			
Private practice/solo or group	42 (16.9%)	1 (3.3%)	0.052 [†]
Academic/University affiliated	207 (83.1%)	29 (96.7%)	
Years of practice			
0-5	50 (20.1%)	10 (33.3%)	0.167 [†]
5-10	50 (20.1%)	7 (22.2%)	
10-20	149 (59.8%)	13 (43.3%)	
Treatment Involvement			
<20 SCH fracture cases/yr	75 (30.1%)	17 (56.7%)	0.004* [†]
≥20 SCH fracture cases/yr	172 (69.1%)	13 (43.3%)	
≥ 1 post-treatment CS/contracture	98 (39.5%)	8 (26.7%)	0.587 [†]
≥1 missed/delayed diagnosis of CS	38 (15.2%)	2 (6.7%)	
Pertinent Survey Results			
Taken care of a patient with compartment syndrome or Volkmann's contracture as a complication of SCH fracture	99 (39.5%)	8 (26.7%)	0.377 [‡]
Been involved in the care of a patient with a missed or delayed diagnosis of compartment syndrome or Volkmann's contracture due to regional anesthesia	37 (15.1%)	2 (6.7%)	0.130 [‡]
Perception of insufficient evidence supporting use of regional anesthesia during treatment of SCH fracture	87 (35.0%)	2 (6.7%)	0.614 [‡]
The level of perioperative pain does not warrant regional anesthesia	189 (76.0%)	2 (6.7%)	0.005* [‡]
Have no interest in changing current practice	119 (47.8%)	3 (10.0%)	0.007* [‡]
Moderate/High concern that regional anesthesia can mask a compartment syndrome	174 (69.9%)	3 (10.0%)	<0.001* [‡]

* Statistical significance (p<0.05)

[†] χ^2 test[‡] According to logistic regression coefficient (B)

compartment syndrome as reasons they do not use regional anesthesia. This contrasted sharply with anesthesiologists' reasons for not using regional anesthesia for supracondylar humerus fractures. 70% of them work with surgeons who do not allow regional anesthesia for supracondylar humerus fractures, none of them are concerned about their ability to perform an adequate physical examination, and only 20% feel intravenous or oral pain control is adequate to control postoperative pain. See [table 2](#) for the complete responses.

Regarding surgeon administered use of local anesthetic (either intra-articular injection or local infiltration) as an adjunct in perioperative pain management, 70.4% (174/247) rarely (<5% of cases) utilize, whereas only 24.3% (60/247) routinely (>50% of cases) utilize this pain control modality.

PERCEPTIONS

69.9% of Orthopaedic surgeons were moderately or highly concerned that regional anesthesia would mask a compartment syndrome compared to only 10% of anesthesiologist sharing that same level of concern (p<0.001). 76.1% of orthopaedic surgeons did not believe the level of perioperative pain warranted regional anesthesia compared to only 6.7% of anesthesiologists (p=0.005). 46.2% of orthopaedic surgeons expressed concern regarding inability to perform a complete physical examination after regional anesthesia compared to 0% anesthesiologists (p<0.001). 39.5% of orthopaedic surgeons reported taking care of at least one patient with compartment syndrome or Volkmann's contracture related to an isolated supracondylar humerus fracture compared to 26.7% of anesthesiologists.

Table 2. Orthopaedic Surgeon and Anesthesiologist responses as reasons they do not currently use regional anesthesia for acute displaced neurovascularly intact supracondylar humerus fractures

Variable	Ortho, n (%)	Anesthesia, n (%)
Total	238	20
I do not feel the level of perioperative pain warrants a regional block	189 (79.4%)	2 (10%)
Adequate pain control is achieved with oral/IV pain meds.	176 (73.9%)	4 (20%)
I am concerned about the risk of potential surgical complications masked by regional anesthesia, specifically a missed compartment syndrome	153 (64.3%)	1 (5%)
I am concerned about the inability to perform a complete physical assessment of the patient	115 (48.3%)	0 (0%)
The amount of time required to perform regional anesthesia is too long	90 (37.8%)	0 (0%)
There is insufficient evidence to support the utility of regional anesthesia in supracondylar humerus fractures	87 (36.6%)	2 (10%)
I am concerned about the risk of potential complications due to regional anesthesia such as dysesthesias, prolonged weakness, and hematoma	83 (34.9%)	2 (10%)
I currently use local anesthesia/intra-articular anesthesia for perioperative pain control and have been satisfied with the outcome.	55 (23.1%)	0 (0%)
There is insufficient evidence to support the complication rate of regional anesthesia in supracondylar humerus fractures	53 (22.2%)	1 (5%)
I have never used regional anesthesia in my practice and have not evaluated its utility	23 (9.7%)	1 (5%)
I do not trust our anesthesia provider's ability to perform regional anesthesia	19 (8.0%)	0 (0%)
The surgeons at my institution do not allow regional anesthesia for supracondylar humerus fractures.	7 (2.9%)	14 (70%)
I have had complications arise from regional anesthesia in supracondylar humerus fractures other than a compartment syndrome	2 (0.8%)	0 (0%)

DISCUSSION

This survey elucidates the current practice preferences of pediatric orthopaedic surgeons regarding regional anesthesia for the perioperative pain management of pediatric supracondylar humerus fractures. It further illuminates the distinct differences in physician perceptions between surgeons and anesthesiologists. These perceptions have an influence on the day-to-day behavior of physicians and many times represent an underappreciated barrier and driver of daily decision-making. It is often assumed that all clinical decisions are strictly made using a risk-benefit analysis or data review, however it is important to remember that physicians are not immune to the influence of biases, especially when the literature available for guidance is sparse (Avorn 2018, 689-691). What shapes these perceptions is incalculable and based on risks, rewards, and trade-offs that suit the decision maker. This study highlights the stark differences in perception between two groups of providers that treat the same clinical problem.

A greater majority of surveyed pediatric orthopaedic surgeons tended to be against the use of regional anesthesia

in the treatment of SCH fractures due to factors such as the masking of a compartment syndrome, level of perioperative pain not warranting regional block, and the inability to perform an accurate physical exam. Contrastingly, a majority of pediatric anesthesiologists preferred the use of regional anesthesia while treating these fractures and did not believe the factors influencing the perceptions of orthopaedic surgeons were significant enough to outweigh the benefits of the treatment. Although similar numbers of both anesthesiologists and pediatric orthopaedic surgeons reported treating patients with compartment syndrome or volkmann's contracture after a supracondylar humerus fracture, the two groups vary greatly in their concern that regional anesthesia can mask a compartment syndrome (69.9% vs. 10%, $p < 0.001$). Furthermore, most orthopaedic surgeons (76%) are not eager to change practices because they do not believe the level of perioperative pain warrants regional anesthesia. These stark contrasts in perceptions present a huge barrier to standardizing best practices regarding perioperative pain management. Future studies diving into perception differences among specialists overlapping care of a similar problem will be important to sup-

port generalizability of these findings. Understanding these attitudes at the core of the treating providers is critical in making progress toward maximizing perioperative pain management in the opioid crisis.

Another finding of our study is that only approximately 25% of surgeon respondents utilize local anesthetic as a routine part (>50%) of the perioperative pain management despite the prospective single-blinded randomized control trial by Georgopoulos et al. that found intra-articular 0.25% bupivacaine effective at reducing postoperative pain after supracondylar humerus fracture pinning (Georgopoulos et al. 2012, 1633-1642). This relatively low level adoption of Level 1 evidence may speak to surgeons perception of the degree of postoperative pain and evaluation of the risk/benefits of intra-articular bupivacaine.

There are several limitations in our study. Although we received a strong response rate from orthopaedic surgeons, we were only able to distribute to a relatively small number of anesthesiologists due to lack of a centralized distribution mechanism, and therefore received a disproportionate number of responses. Response rate is always a limitation in survey-based studies and our numbers are similar to prior reported. Yellin et al. looking at the surgical management of osteochondritis dissecans of the knee in the skeletally immature had a total of 129 respondents, and Halsey et al. studying patient satisfaction had a combined 229 member respondents with significant data reported (Kumar

and Singh 2016, 104-107; Yellin et al. 2017, 491-499). There was also potential for recall bias, as some of the questions had the respondents think of past events/memories. Furthermore, the survey is not formally validated in literature, however the intent of this study is for hypothesis generation.

CONCLUSION

This multidisciplinary survey reveals current perceptions of using regional anesthesia for supracondylar humerus fractures and shows currently only 0.8% of surveyed pediatric orthopaedic surgeons use regional anesthesia routinely in the perioperative pain management of supracondylar humerus fractures. This survey further suggests perceptions on pain, risks, and benefits of regional anesthesia vary greatly between two major stakeholders treating the same injury. We must understand and work through these differences as a collective unit to optimize the perioperative management of our pediatric patients in the opioid crisis. The results have provided foundational data as a baseline for discussions regarding regional anesthesia and its role in perioperative pain management for acute supracondylar humerus fractures.

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