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CME

Is Ultrasound Guidance Advantageous for Interventional Pain Management? A Review of Acute Pain Outcomes

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BACKGROUND: Ultrasound (US) guidance for peripheral nerve blockade has gained popularity worldwide. The reported benefits of real-time sonographic visualization compared with traditional nerve localization techniques generally apply to procedural and technical block-related outcomes whereas acute pain–related outcomes are featured less prominently. In this review, we evaluated the effect of US guidance compared with traditional nerve localization techniques for interventional management of acute pain and acute pain–related outcomes.

METHODS: We performed a systematic search of MEDLINE, EMBASE, and the Cochrane Central Register of Controlled Clinical Trials (from January 1990 to January 2011) to identify randomized controlled trials evaluating the effects of US guidance on acute pain and related outcomes compared with traditional nerve localization techniques. Studies were excluded if they did not report at least one of the following acute pain outcomes: pain severity, opioid consumption, sensory block duration, and time to first analgesic request. Related outcomes were classified as follows: patient related (opioid-related adverse effects, patient satisfaction, postoperative cognitive deficit); anesthesia related (unwanted motor block, perineural catheter failure, morbidity, development of chronic pain); surgery related (hospital readmission, ability to ambulate); and hospital related (length of stay, cost). Promising novel applications of US guidance for acute pain management were also sought for discussion purposes.

RESULTS: We identified 23 randomized controlled trials, including 1674 patients, that compared US guidance with and without peripheral nerve stimulation with peripheral nerve stimulation alone or anatomical landmark techniques. Of the 16 studies that evaluated pain severity, 8 reported improvement with US guidance; however, only 1 study reported a difference between US guidance and the comparator of >1 interval on the numeric rating pain scale. Eight studies evaluated sensory block duration and 3 of these reported prolonged block duration with US guidance. Seven studies evaluated opioid consumption, of which 3 reported a reduction with US guidance. Three studies evaluated time to first analgesic request, of which 2 favored US guidance. We uncovered no significant differences between US guidance and traditional nerve localization techniques for any other related outcome. US guidance was not found to be inferior compared with traditional nerve localization techniques for any outcome. Nonrandomized data suggest that US-guided transversus abdominis plane blocks may offer analgesic benefit over standard analgesic therapy, but has not been compared with an anatomical landmark technique.

CONCLUSIONS: At present, there is insufficient evidence in the contemporary literature to define the effect of US guidance on acute pain and related outcomes compared with traditional nerve localization techniques for interventional acute pain management. (Anesth Analg 2011;113:596–604)

Ultrasound (US) guidance for nerve localization during peripheral nerve blockade has gained considerable popularity worldwide. Much of this popularity is attributable to several important advantages of real-time sonographic visualization compared with traditional nerve localization techniques. The benefits largely apply to procedural and technical block-related outcomes and stem from comparative studies focusing primarily on the impact of US guidance on "block success" in the immediate operative setting.[1,2] Although peripheral nerve blocks are often inserted for the purposes of postoperative analgesia and not necessarily surgical anesthesia, acute pain–related outcomes are featured far less prominently in the regional anesthesia and pain literature. The use of nerve blocks specifically for the treatment of acute pain is intrinsic to the practice of regional anesthesia and increasingly emphasized in subspecialty training.[3,4] The importance of interventional acute pain management is underscored by the popularity of perineural catheters, which have become the cornerstone of inpatient, and even outpatient, surgical and nonsurgical multimodal analgesic protocols in many leading centers. The goal of this review was

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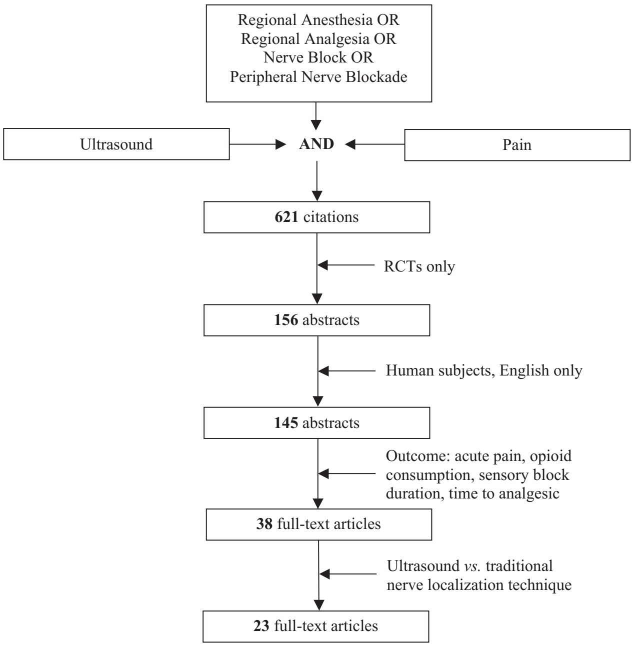

Figure 1. Flow chart of screened, excluded, and analyzed studies. RCTs = randomized controlled trials.

to evaluate the effect of US guidance compared with traditional nerve localization techniques for interventional management of acute pain and acute pain–related outcomes. Additionally, emerging trends and novel applications of US guidance for acute pain management are discussed.

METHODS

The authors (SC and RB) systematically searched the electronic databases MEDLINE, EMBASE, and the Cochrane Central Register of Controlled Clinical Trials (from January 1990 to January 2011) using the following medical subject heading (MeSH) words: "regional anesthesia" OR "regional analgesia" OR "peripheral nerve block" OR "nerve block." These search results were combined with "ultrasound" AND "pain" using the Boolean search operator AND.

The study inclusion criteria were limited to randomized controlled trials (RCTs), English language, and humans. Each abstract was screened to identify studies that had randomized patients to compare US guidance with other nerve localization techniques such as mechanical elicitation of paresthesias, peripheral nerve stimulation (PNS), and surface anatomical landmarks. Studies were excluded if they did not specifically compare US guidance with another nerve localization technique and did not report at least one of the following acute pain outcomes: pain severity, opioid consumption, sensory block duration, and time to first analgesic request. The references of the retrieved articles were manually searched for any relevant articles not captured in the original search.

Data were extracted for comparison into an independently created template including author, year of publication, peripheral nerve block procedure performed, placement of perineural catheter, patient disposition, comparative nerve localization technique, number of subjects in each group, and primary outcome measured. The specific outcomes

Table 1. Study Characteristics

	Quantity (*n*)	Percentage
Jadad score		
5 (good quality)	1	4
4	0	0
3 (intermediate quality)	18	78
2	4	18
1 (poor quality)	0	0
Comparator		
US versus PNS	15	65
US + PNS versus PNS alone	2	9
US versus LM	6	26
Country of publication		
Australia	3	13
Belgium	1	4
Canada	1	4
Denmark	1	4
United Kingdom	6	26
United States	11	49
Type of institution		
Academic center	22	96
Private practice	1	4
Provider expertise with US[a]		
Expert	14	61
Trainee supervised by expert	5	22
Novice	1	4
Unspecified	7	30
Study population age		
Adult (≥18 y)	16	70
Pediatric (≤18 y)	6	26
Unspecified	1	4
Study population sex		
Male	1	4
Female	2	9
Both	17	74
Unspecified	3	13
No. of subjects		
<50	11	48
51–100	10	44
101–150	0	0
151–200	1	4
>200	1	4
Type of surgery		
Orthopedic	16	70
Obstetric	2	9
Other	5	21
Disposition		
Inpatient	4	17
Outpatient	2	9
Both	2	9
Unspecified	15	65

LM = anatomical landmark technique; PNS = peripheral nerve stimulation; US = ultrasound (guidance).

[a] Expert defined as self-identified or ≥50 block procedures. Because of instances whereby provider expertise with US was variable, some studies were counted more than once.

sought in each article were based on the American Society of Regional Anesthesia and Pain Medicine's acute postoperative pain (AcutePOP) database initiative.[5] Acute pain outcomes sought were: (i) pain severity, (ii) sensory block duration, (iii) opioid consumption, and (iv) time to first analgesic request. Pain severity was further divided into early (<24 hours) versus late (>24 hours) and categorized into rest versus dynamic. If not otherwise stated, it was assumed that pain severity was assessed at rest. Additional related outcomes were broadly classified along patient-related outcomes, anesthesia-related outcomes, surgery-related outcomes, and hospital-related outcomes. The patient-related outcomes sought were: (i) opioid-related adverse

Table 2. Data Summary of Randomized Controlled Trials Comparing US Guidance with Other Nerve Localization Techniques and Acute Pain–Related Outcomes

Author/year	Jadad score	*N*	Block type	Cath	Groups (*n*)	Primary outcome	Pain	Sensory block duration	Opioid consumption
Aveline et al.,[8] 2010	3	92	FNB	Y	1. US (46) 2. PNS (46)	48-h LA consumption	•	•	•
Domingo-Triado et al.,[9] 2007	3	61	SCI	N	1. US + PNS (30) 2. PNS (31)	No. of needle passes	•	•	
Dufour et al.,[10] 2008	3	51	POP	N	1. US + PNS (26) 2. PNS (25)	Block performance time		•	
Faraoni et al.,[11] 2010	3	40	PEN	N	1. US (20) 2. LM (20)	Sensory block duration	•	•	
Fredrickson et al.,[12] 2009	3	82	ISB	Y	1. US (43) 2. PNS (40)	Daily LA consumption	•		•
Fredrickson and Danesh-Clough,[14] 2009	3	45	FNB	Y	1. US (21) 2. PNS (24)	NRPS at 24 h	•		•
Fredrickson et al.,[13] 2009	3	81	ISB	Y	1. US (41) 2. PNS (40)	NRPS at 24 h	•		•
Grau et al.,[16] 2002	3	300	EPI	Y	1. US (150) 2. LM (150)	No. of needle passes	•		
Grau et al.,[15] 2001	3	72	EPI	Y	1. US (36) 2. LM (36)	No. of needle passes	•		
Kapral et al.,[17] 2008	3	160	ISB	N	1. US (80) 2. PNS (80)	Sensory block duration		•	
Marhofer et al.,[18] 2004	3	40	INF	N	1. US (20) 2. PNS (20)	Onset time for surgical block		•	
Mariano et al.,[22] 2010	3	80	POP	Y	1. US (40) 2. PNS (40)	NRPS at 24 h	•		•
Mariano et al.,[21] 2009	3	40	FNB	Y	1. US (20) 2. PNS (20)	Block performance time	•		
Mariano et al.,[19] 2009	3	40	POP	Y	1. US (20) 2. PNS (20)	Block performance time	•		
Mariano et al.,[20] 2009	3	40	INF	Y	1. US (20) 2. PNS (20)	Block performance time	•		
McNaught et al.,[23] 2011	3	40	ISB	N	1. US (20) 2. PNS (20)	NRPS of 0 in PACU	•		
Oberndorfer et al.,[24] 2007	3	46	FNB/SCI	N	1. US (23) 2. PNS (23)	Sensory block duration		•	
Ponde and Diwan,[7] 2009	5	50	INF	N	1. US (25) 2. PNS (25)	Frequency surgical block	•		•
Soeding et al.,[26] 2005	2	40	ISB/AXB	N	1. US (20) 2. LM (20)	Onset time for surgical block	•	•	
Taboada et al.,[25] 2009	3	70	INF	N	1. US (35) 2. PNS (35)	Onset time for surgical block		•	
van Geffen et al.,[27] 2009	2	40	POP	N	1. US (20) 2. PNS (20)	LA volume to achieve surgical block		•	
Willschke et al.,[29] 2006	2	64	EPI	1	1. US (30) 2. LM (34)	Block performance time	•		•
Willschke et al.,[28] 2005	2	100	ING	N	1. US (50) 2. LM (50)	LA volume to achieve analgesia	•		

Amb = ambulation; AXB = axillary brachial plexus block; Cath = perineural catheter; EPI = epidural block; fail = failure; FNB = femoral nerve block; INF = infraclavicular brachial plexus block; ING = ilioinguinal/iliohypogastric nerve block; ISB = interscalene brachial plexus block; LA = local anesthetic; LM = anatomical landmark technique; LOS = length of stay; Morbid = morbidity; N = no; *N* = number of patients in study; *n* = number of patients in group; N/A = not applicable; NRPS = numeric rating pain scale; PACU = postanesthesia care unit; PEN = penile nerve block; PNS = peripheral nerve stimulation; POP = popliteal sciatic nerve block; SCI = sciatic nerve block; US = ultrasound (guidance).

events (nausea, emesis, pruritus, sedation, urinary retention, and respiratory depression), (ii) patient satisfaction with block procedure, and (iii) incidence of cognitive deficit. The anesthesia-related outcomes were: (i) incidence of undesirable motor block, (ii) perineural catheter failure (defined as dislodgement or ineffective analgesia requiring replacement), (iii) morbidity (nerve damage, vascular puncture, local anesthetic toxicity, pneumothorax, infection at block site, and hematoma), and (iv) development of chronic pain. The surgery-related outcomes were: (i) unplanned hospital readmission rate, and (ii) ability to ambulate (defined as ambulating sufficient distance as determined by the surgical team). The hospital-related outcomes were: (i) length of stay, and (ii) cost. The methodological quality of each trial was assessed using the Jadad score.[6] We independently extracted data and reviewed and scored each RCT using this methodology. Differences in extracted data or scoring were resolved through discussion. Finally, several promising studies that were excluded from the initial analysis for lack of a comparator (i.e., traditional nerve localization technique) were identified for the present discussion in the context of emerging trends and future directions for investigation.

Table 2. (*Continued*)

Opioid side effects	Patient satisfaction	Cognitive deficit	Unwanted motor block	Cath fail	Morbid	Chronic pain	Hospital readmit	Amb	LOS	Cost
•				•	•				•	
				N/A	•					
	•			N/A	•					
				N/A	•				•	
	•			•	•					
				•	•					
				•	•					
	•			•	•					
	•			•	•					
				N/A	•					
				N/A	•					
				•	•					
				•	•					
				•	•					
				•	•					
				N/A	•					
				N/A	•					
				N/A	•					
	•			N/A	•					
				N/A	•					
				N/A	•					
				•	•					
				N/A	•				•	

RESULTS

In total, 23 RCTs were identified that compared US guidance with another nerve localization technique for interventional pain management (Fig. 1). The 23 RCTs included a total of 1674 patients and all in the perioperative setting. Only 1 study[7] qualified for a high-quality Jadad score of 5; 18 studies[8–25] had an intermediate-quality score of 3; and 4 studies[26–29] had a poor-quality score of 2. Table 1 presents the characteristics of the studies included herein whereas Table 2 summarizes the specific outcomes sought for the purposes of this review.

Acute Pain Outcomes

Sixteen studies evaluated differences in early postoperative pain (<24 hours) at rest.[7–9,11–16,19–23,26,28] Of these, 8 reported improved analgesia associated with US guidance compared with PNS,[7,8,12,23] or anatomical landmarks,[11,15,16,28] whereas 8 reported no difference (Table 3).[9,13,14,19–22,26] Among the 8 studies that reported improved analgesia at rest with US guidance, only a single study demonstrated a decrease in numeric rating pain scale of >1 interval.[12] Of the 4 studies that evaluated dynamic pain,[8,12–14] only one[8] demonstrated improvement with US guidance whereas 3 did not.[12–14]

Table 3. Data Summary of Acute Pain Outcomes

Author/year	Block type	Cath	Groups (*n*)	Early pain (<24 h) Rest	Early pain (<24 h) Dynamic	Late pain (>24 h) Rest	Late pain (>24 h) Dynamic	Sensory block duration	Opioid consumption	Time to first analgesic request	Remarks
Aveline et al.,[8] 2010	FNB	Y	1. US (46) 2. PNS (46)	US	US	US	US		US	US	● US decreases rest VAS ≤10 mm at 12 h, 24 h, 48 h ($P = 0.04$) ● US decreases dynamic VAS 14 mm at 48 h (US 28.5, PNS 12.5 mm; $P < 0.0001$) ● US decreases 48-h cumulative morphine consumption (US 20, PNS 40 mg; $P = 0.0065$) ● US prolongs time to first analgesic request (US 11, PNS 8.1 h; $P = 0.0197$)
Domingo-Triado et al.,[9] 2007	SCI	N	1. US + PNS (30) 2. PNS (31)	↔				↔			
Dufour et al.,[10] 2008	POP	N	1. US + PNS (26) 2. PNS (25)					↔		↔	
Faraoni et al.,[11] 2010	PEN	N	1. US (20) 2. LM (20)	US						US	● US reduces frequency of pain on PACU arrival (US 0, LM 3 patients; $P < 0.01$) ● US prolongs time to first analgesic request (US 570, LM 60 min; $P = 0.00004$)
Fredrickson et al.,[12] 2009	ISB	Y	1. US (43) 2. PNS (40)	US	↔	↔	↔		US		● US reduces early (<24 h) rest NRPS (US 0, PNS 2; $P = 0.03$) ● US reduces frequency of oral analgesic requirements POD 1(US 2, PNS 7 patients; $P = 0.04$)
Fredrickson and Danesh-Clough,[14] 2009	FNB	Y	1. US (21) 2. PNS (24)	↔	↔	↔	↔		↔		
Fredrickson et al.,[13] 2009	ISB	Y	1. US (41) 2. PNS (40)	↔	↔	↔	↔		↔		
Grau et al.,[16] 2002	EPI	Y	1. US (150) 2. LM (150)	US							● US reduces maximum VAS (US 0.9, LM 1.9; $P = 0.02$)
Grau et al.,[15] 2001	EPI	Y	1. US (36) 2. LM (36)	US							● US reduces maximum VAS (US 0.8, LM 1.8; $P < 0.035$)
Kapral et al.,[17] 2008	ISB	N	1. US (80) 2. PNS (80)					US			● US prolongs sensory block duration (US 899, PNS 679 min; $P < 0.05$)
Marhofer et al.,[18] 2004	INF	N	1. US (20) 2. PNS (20)					US			● US prolongs sensory block duration (US 384, PNS 310 min; $P < 0.001$)
Mariano et al.,[22] 2010	POP	Y	1. US (40) 2. PNS (40)	↔					↔		
Mariano et al.,[21] 2009	FNB	Y	1. US (20) 2. PNS (20)	↔							
Mariano et al.,[19] 2009	POP	Y	1. US (20) 2. PNS (20)	↔							
Mariano et al.,[20] 2009	INF	Y	1. US (20) 2. PNS (20)	↔							
McNaught et al.,[23] 2011	ISB	N	1. US (20) 2. PNS (20)	US							● US reduces frequency of postoperative pain in PACU (US 1, PNS 5 patients; $P = 0.03$)
Oberndorfer et al.,[24] 2007	FNB/SCI	N	1. US (23) 2. PNS (23)					US			● US prolongs sensory block duration (US 508, PNS 336 min; $P < 0.001$)

(*Continued*)

Table 3. (*Continued*)

Author/year	Block type	Cath	Groups (*n*)	Early pain (<24 h) Rest	Early pain (<24 h) Dynamic	Late pain (>24 h) Rest	Late pain (>24 h) Dynamic	Sensory block duration	Opioid consumption	Time to first analgesic request	Remarks
Ponde and Diwan,[7] 2009	INF	N	1. US (25) 2. PNS (25)	US					US		• US reduces frequency of moderate pain (US 1, PNS 9 patients; $P = 0.0053$)
Soeding et al.,[26] 2005	ISB/AXB	N	1. US (20) 2. LM (20)	↔				↔			
Taboada et al.,[25] 2009	INF	N	1. US (35) 2. PNS (35)					↔			
van Geffen et al.,[27] 2009	POP	N	1. US (20) 2. PNS (20)					↔			
Willschke et al.,[29] 2006	EPI	Y	1. US (30) 2. LOR (34)						↔		
Willschke et al.,[28] 2005	ING	N	1. US (50) 2. LM (50)	US							• US reduces number of oral analgesic requirements in PACU (US 3, LM 20; $P < 0.0001$)

Data presented as ultrasound (US) (favors US guidance); ↔ (no difference to comparator).

Nota bene: only included if pain quantified on Verbal Rating Scale for pain or Objective Pain Scale for children.

AXB = axillary brachial plexus block; Cath = perineural catheter; EPI = epidural block; FNB = femoral nerve block; INF = infraclavicular brachial plexus block; ING = ilioinguinal/iliohypogastric nerve block; ISB = interscalene brachial plexus block; LM = anatomical landmark technique; LOR = loss of resistance; N = no; *n* = number of patients in group; NRPS = numeric rating pain scale; PACU = postanesthesia care unit; PEN = penile nerve block; PNS = peripheral nerve stimulation; POD = postoperative day; POP = popliteal sciatic nerve block; SCI = sciatic nerve block; US = ultrasound (guidance); VAS = visual analog scale; Y = yes.

Eight studies reported sensory nerve block duration.[9,10,17,18,24–27] Among these, 3 demonstrated prolonged sensory block duration with US guidance compared with PNS,[17,18,24] whereas 4 did not demonstrate a significant difference compared with PNS,[9,10,25,27] and 1 did not demonstrate a significant difference compared with anatomical landmarks.[26]

Seven studies reported differences in opioid consumption between US guidance and comparative nerve localization techniques.[7,8,12–14,22,29] Among these, 3 demonstrated reduced opioid consumption with the use of US guidance compared with PNS,[7,8,12] whereas 4 did not.[13,14,22,29]

There were 3 studies that reported time to first analgesic request.[8,10,11] Of these, 1 study each reported a prolongation associated with US guidance compared with PNS[8] and anatomical landmarks,[11] respectively. Dufour et al.[10] did not demonstrate a difference in time to first analgesic request when US guidance was combined with PNS compared with PNS alone.

Patient-Related Outcomes

Only 1 study reported opioid-related side effects (postoperative nausea and vomiting) and did not demonstrate any benefit for US guidance over PNS.[8] Five studies assessed patient satisfaction during the block procedure,[10,12,15,16,26] of which 2 favored US guidance compared with landmark techniques,[15,16] 2 found no difference between US guidance and PNS,[10,12] and 1 found no difference between US guidance and landmark techniques.[26] None of the studies assessed for differences in postoperative cognitive deficits.

Anesthesia-Related Outcomes

No study reported the incidence and/or duration of undesired motor block. The 11 studies in which indwelling catheters were placed did not demonstrate a difference in the incidence of catheter failure between US guidance and traditional nerve localization techniques.[8,12–16,19–22,29] Three studies demonstrated statistically significant differences in the incidence of complications in favor of US guidance by reducing vascular punctures[19,21] and postepidural headaches.[15] The remaining 20 studies did not show statistical significance or did not apply statistical analysis to the incidence of complications between US guidance and other nerve localization techniques. Finally and importantly, no study investigated the onset of previously undiagnosed chronic pain.

Surgery-Related Outcomes

No study assessed for the ability to ambulate postoperatively or the incidence of unplanned hospital readmission.

Hospital-Related Outcomes

Two studies compared the differences in length of stay in hospital between US guidance and PNS and did not find any difference.[8,11] None of the studies reported any cost differential between nerve localization techniques.

DISCUSSION

Our review of the contemporary literature produced insufficient evidence to qualitatively or quantitatively define the effect of US guidance compared with traditional nerve localization techniques on acute pain and acute pain–related outcomes for interventional acute pain management. There are, however, no data to suggest that US guidance is inferior to traditional nerve localization techniques. Previously documented procedural and technical block-related advantages associated with US guidance, such as onset time, performance time, and "success,"[1,2] do not seem to translate into superior acute pain outcomes. Although we found 8 studies that demonstrated a statistically significant difference in pain severity in favor of US guidance,[7,8,11,12,15,16,23,28] the difference was of clinical significance[30] in only one.[12]

The inability to demonstrate a clinically significant difference in acute pain outcomes between US guidance and traditional nerve localization techniques is likely attributable to several factors. First, the predominant comparator and "gold standard" nerve localization technique, PNS, is associated with a very high initial block success rate.[31] Indeed, there is often no measurable difference in block success between US guidance and PNS when performed by skilled providers.[31,32] It is therefore unlikely that clinically significant differences in acute pain outcomes would stem from such equally high block success rates. Moreover, many of the other important outcomes reported herein such as length of stay, cost, and hospital readmission are inherently multifactorial and beyond the control of even the most stringent study design. Last, because serious block-related complications and morbidity are so infrequent, prohibitively large numbers of patients would be required for study to reliably detect a difference between nerve localization techniques.[33,34]

Study Limitations

There are several limitations inherent to this comprehensive literature review. Gross heterogeneity among studies relating to surgical procedure, block technique, anatomical location, and needle approach, as well as the type, concentration, volume, and frequency of local anesthetic administered prohibits statistical meta-analysis. Importantly, our results are presented in "vote counting" format primarily to facilitate descriptive presentation of the literature rather than offer any quantitative data analysis. Furthermore, pain severity, sensory block duration, opioid consumption, or time to first analgesic request was the designated primary outcome measure (with corresponding statistical power) in only 6 of the 23 studies reviewed herein.[11,13,14,17,22,23] Furthermore, only 2 included studies that assessed pain severity before the intervention.[15,16] Meaningful differences in pain severity are difficult to interpret without the context of the preinterventional state. In addition, the time to first analgesic request, arguably the most faithful measure of acute pain because it is most intimate to the patient and least dependent on assessment schedule or protocol, was only captured by 3 studies.[8,10,11] Finally, modern multimodal analgesic regimens and accelerated clinical pathways designed to promote early mobilization and hospital discharge may have masked any material advantages of US guidance over traditional nerve localization techniques.

Future Directions

In the course of our systematic search, it was apparent that several novel and important descriptions of US guidance for the purpose of acute pain management have recently populated the literature. Although the available literature regarding these US-guided applications is primarily limited to feasibility and observational studies that did not meet our inclusion criteria for qualitative review, we fully expect that randomized data of acute pain outcomes will be forthcoming. Among the most promising of these emerging trends is US-guided transversus abdominis plane (TAP) blocks for analgesia in lower abdominal procedures including obstetric, gynecologic, and general surgery procedures. A number of studies have already demonstrated a significant reduction in acute pain in favor of TAP blocks compared with systemic or neuraxial opioids after cesarean delivery, open appendectomy, and laparoscopic cholecystectomy.[35–37] However, no study has compared real-time US-guided infiltration of the transversus abdominis fascial plane to the traditional blind landmark approach.[38]

In the wake of cautiously optimistic retrospective data signaling that thoracic paravertebral blocks (PVBs) for postoperative analgesia may reduce the recurrence of adenocarcinoma of the breast after mastectomy,[39] reports and demand for US-guided approaches to facilitate PVB placement abound.[40–43] Whereas US-guided thoracic PVB has been shown to provide superior analgesia and reduce opioid consumption compared with systemic analgesia for both breast[44,45] and thoracic surgery,[46] US guidance has yet to be directly compared with traditional landmark techniques.[47]

Additional novel applications of US guidance for interventional acute pain management include that for the lumbar plexus,[48–50] obturator nerve,[51,52] superficial cervical plexus,[53] intercostal nerve block,[54–56] and proximal sciatic nerve.[57–59] Beyond the TAP block, US guidance has enabled the identification and infiltration of other fascial planes rather than the target nerve itself, with promising results for acute pain,[58] and potentially even nerve injury.[60]

In summary, there is insufficient evidence at this time to define the effects of US guidance compared with traditional nerve localization techniques on acute pain and related outcomes for interventional acute pain management. Further study is required to determine whether the procedural and technical efficiencies afforded by US guidance will ever translate into measurable improvements in acute pain outcomes. Although there is no single, definitive, and comprehensive measure of acute pain that is equally meaningful to the patient, the anesthesiologist, the surgeon, and the hospital manager, future studies must endeavor to capture all important outcomes so that all readers are equipped to make informed choices regarding nerve localization techniques.

DISCLOSURES

Name: Stephen Choi, MD, FRCPC.
Contribution: This author helped analyze data and write the manuscript.
Attestation: Stephen Choi approved the final manuscript.
Name: Richard Brull, MD, FRCPC.
Contribution: This author helped analyze data and write the manuscript.
Attestation: Richard Brull approved the final manuscript.

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