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Regional Anaesthesia in the Field Hospital During Armed Conflict and Disasters: A Practice-Oriented Narrative Review

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Abstract

Regional anaesthesia (RA) has become a core component of anaesthetic care for casualties of war and natural disasters, because extremity injuries predominate; oxygen, ventilators, and recovery beds are scarce; and evacuation chains are long. Several recent reviews have mapped the evidence or advocated wider use of RA on the battlefield, but practical guidance aimed at the deployed or disaster field hospital remains scattered. This narrative review synthesises clinical and operational literature on RA delivered in field hospitals (NATO Role 2 and Role 3 equivalents, disaster field hospitals, and makeshift conflict-zone facilities), drawing on recent experience from Ukraine, Gaza, Lebanon, and Türkiye. Contemporary series report that RA, alone or combined with general anaesthesia, is used in roughly one-fifth to three-quarters of anaesthetics, depending on the level of care, the injury mix, and the availability of ultrasound and trained staff. Neuraxial techniques remain the workhorse for lower-limb and lower-abdominal surgery when haemodynamics allow; ultrasound-guided peripheral and fascial plane blocks dominate for upper-limb surgery, for unstable patients, and for analgesia during evacuation; continuous catheters extend analgesia across transfers but add infection, dislodgement, and anticoagulation issues. Field-specific safety concerns include shock, anticoagulation, compartment syndrome, toxicity, and loss of follow-up after transfer. Evidence remains dominated by retrospective series, single-centre reports, and expert opinion, with very few controlled studies. We propose a pragmatic framework covering technique selection, minimum equipment and drug stock, monitoring and handover, and training of non-anaesthetist personnel, and we identify priorities for prospective registries and trials in field settings.

Categories: Emergency Medicine, Orthopedics, Anesthesiology
Keywords: acute pain, disaster medicine, field hospital, military medicine, nerve block, regional anaesthesia, spinal anaesthesia, war casualties

Introduction And Background

Limb injuries account for the majority of surgical workload in modern armed conflict and in earthquake-related trauma. In Ukrainian soldiers wounded between 2014 and 2021, the lower and upper limbs were the most frequently injured regions, and 62.5% of patients received regional anaesthesia (RA) [1]. A similar predominance of extremity injury, and of RA, was reported from an Indian zonal hospital in an operational area, where RA was used in 78% of 371 combat casualties [2]. After major earthquakes, lower-limb trauma and crush injuries dominate, and all anaesthetic modalities have been used, with RA repeatedly described as particularly suited to field conditions [3-6].

The rationale is as much logistical as clinical. In principle, RA reduces dependence on oxygen, anaesthetic machines, ventilators, and post-anaesthesia or intensive care beds, all of which are scarce in a field hospital; it preserves airway reflexes and consciousness in patients with uncertain fasting status; and, when a catheter is used, it can provide analgesia that continues through evacuation [5,7,8]. These advantages rest mainly on operational experience and expert opinion: we found no study comparing resource use between RA and general anaesthesia in a field hospital, and the only indirect data are the greater use of RA by the same team when deployed than at home [9] and faster operating theatre turnover when blocks were performed outside the theatre [5]. The modern military experience began with the use of continuous peripheral nerve block (CPNB) to evacuate a casualty from Iraq to the United States [10,11], followed by large series at Walter Reed and Landstuhl [12,13] and by cohort data suggesting that early RA after combat extremity injury is associated with lower pain scores over the following months [14].

The literature has grown quickly since 2022. A scoping review of anaesthesia in the war in Ukraine [15], a scoping review of out-of-hospital RA in austere environments [16], a position paper from military physicians advocating RA training for non-specialists [7], and several narrative reviews on anaesthesia in conflict and low-resource settings [8,17-19] have been published. However, most of these documents either map the evidence, focus on the prehospital phase, or address anaesthesia in conflict broadly. Practical guidance aimed at the anaesthetist working in a deployed military or disaster field hospital, where most RA is actually performed, remains fragmented. For readers unfamiliar with military medicine, a few terms need defining.

In this review, a field hospital is any temporary or deployable facility that provides surgery and anaesthesia outside a permanent hospital, whether military, humanitarian, or improvised in a conflict or disaster zone. Military medical support is organised in successive levels of care, called roles in North Atlantic Treaty Organization (NATO) doctrine: Role 1 provides first aid, triage, and resuscitation without surgery; Role 2 provides damage control surgery and resuscitation close to the front; Role 3 is a deployed hospital with specialist surgery, imaging, and intensive care; and Role 4 provides definitive treatment and rehabilitation, usually in the home country. Casualties move between these levels along an evacuation chain, often over hours or days. Regional anaesthesia covers neuraxial techniques (spinal and epidural anaesthesia), peripheral nerve blocks of a nerve or plexus, and fascial plane blocks, in which local anaesthetic is injected between muscle layers to reach the nerves running in that plane; a block may be given as a single injection or extended for days through a catheter (continuous peripheral nerve block).

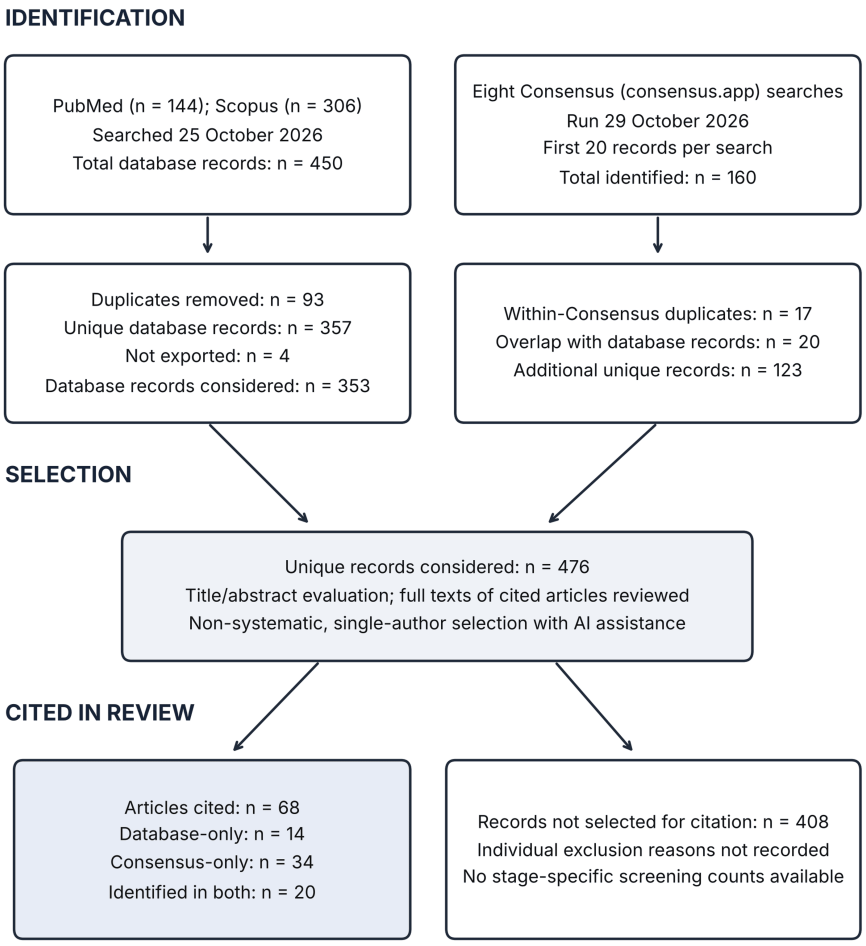
The aim of this narrative review is therefore practice-oriented: to summarise what RA techniques are used in field hospitals during armed conflict and disasters, what logistical and safety constraints shape their use, and what minimum conditions and training are required, in order to propose a pragmatic framework for field anaesthetists and planners. This review does not aim to map the literature exhaustively; a systematic scoping review on RA in war and disaster settings published from 2022 onwards has been registered separately by our group (Open Science Framework, osf.io/h9nxs) and will report a reproducible evidence map.

Review

Methods

This is a narrative review; it was not designed or conducted as a systematic review, and the methods below are reported for transparency. PRISMA reporting is not required for a narrative review, but we followed the principles of the PRISMA extension for scoping reviews (PRISMA-ScR) for reporting how literature was identified and selected, namely, information sources and dates, search queries, eligibility criteria, the selection process, and a flow diagram [20]. Two sources of records were used. First, we used the records retrieved by searches of PubMed (144 records) and Scopus (306 records) run on 25 October 2026 for a separate, ongoing scoping review on regional anaesthesia in war and disaster settings; these searches combined terms for regional anaesthesia (regional anaesthesia, nerve block, spinal and epidural anaesthesia, continuous peripheral nerve block) with terms for the setting (war, armed conflict, military, combat casualties, field hospital, earthquake, disaster, mass casualty), were limited to publications from 2022 onwards, and are reported in full in the Appendices. After removal of 93 duplicates in a reference manager, 357 records remained, of which 353 were exported for screening. Second, on 29 October 2026, we ran eight searches of Consensus (consensus.app), an artificial intelligence-based academic search engine that indexes Semantic Scholar, OpenAlex, and PubMed records and returns results ranked by relevance. The eight queries are listed verbatim in the Appendices. The first 20 results of each search were screened (160 records, 143 unique, of which 20 were already among the database records). No date limit was applied to the Consensus searches, which were the main source of publications before 2022. Because Consensus ranks results algorithmically, these searches may not be exactly reproducible.

Articles were eligible if they reported clinical data, operational experience, safety data, or training data on regional anaesthesia in field hospitals, deployed military units, or disaster and conflict settings, in any language with an English abstract. Older publications were retained when they remain the main source for a given technique or complication, and civilian data were included only to address safety questions (compartment syndrome, toxicity, training) for which field data are lacking. Records were assessed on the basis of titles and abstracts by one author (A.F.), with the assistance of a generative artificial intelligence (AI) tool (see Disclosures), and the full texts of all cited articles were read by the same author; selection was not performed in duplicate, and reasons for exclusion were not recorded individually. Reference lists were not systematically screened. In total, 68 articles were cited: 14 identified only in the database searches, 34 identified only through Consensus, and 20 found in both sources (Figure *1*). The counts describe bibliographic consideration and citation selection, not a formal systematic-review screening process. For each clinical study, we recorded the design, setting, population, technique, and main outcome (Table *1*). The strength of evidence was judged from study design, and no formal risk-of-bias scoring was performed. Two further references, a practice checklist on LAST and a reporting guideline, were added during peer review. Every reference was checked against its DOI and bibliographic record.



Note: this descriptive selection diagram is not a PRISMA systematic-review flowchart.

FIGURE 1: Descriptive flow of literature identification and selection for citation in this narrative review.

Database records come from PubMed and Scopus searches run on 25 October 2026; Consensus records come from eight searches run on 29 October 2026 (first 20 results each; queries in the Appendix). This is not a PRISMA systematic-review flowchart. Stage-specific screening counts and individual reasons for not selecting records were not recorded; selection was performed by one author with AI assistance.

Study	Setting	Design/population	Regional technique	Main finding
Stojadinovic et al. (2006) [12]	Iraq; US tertiary military centre	Prospective cohort; 287 combat casualties	Single-shot blocks and catheters (361 CPNB)	Mean infusion 9 days; catheter complications 11.9%, infection 1.9%; pain decreased
Buckenmaier et al. (2009) [13]	Iraq/Afghanistan; Landstuhl	Survey; 110 evacuated casualties	CPNB	Pain relief 45% during transport; less pain with CPNB
Gallagher et al. (2019) [14]	Iraq/Afghanistan	Prospective cohort; 358 service members	Early RA (within 7 days)	Lower average pain over 6 and up to 24 months
Mathais et al. (2019) [9]	French forward surgical unit, low-income countries	Register; 1547 anaesthetics	All RA	RA alone 43.5%; combined with GA 21%
Nambiar et al. (2020) [2]	Indian zonal hospital, operational area	Retrospective; 371 casualties	PNB and spinal	RA used in 78%
Kuchyn et al.	Ukraine, 2014-2021	Retrospective; 280	All RA	RA used in 62.5%; limbs most injured

(2025) [1]		casualties		
Tsygankov et al. (2024) [21]	Russian military units, levels 1-3, 2023-2024	Retrospective	All RA	RA 25.4%-34.5% depending on level of care
Lakhin et al. (2024) [22]	Armed conflict, qualified care stage	Retrospective cohort; 146 casualties in haemorrhagic shock	RA, mostly combined with GA	New or increased vasopressor: 3.7% after RA vs 17.8% after GA induction
Tymchyshyn et al. (2026) [23]	Ukrainian frontline hospitals and transport	Comparative; 100 limb-injured casualties (50 vs 50)	Ultrasound-guided blocks	Lower pain and more stable haemodynamics up to end of transport
Vakhnovska et al. (2026) [24]	Ukraine	Comparative; 50 wounded	Ultrasound-guided sciatic block, 4 techniques	Interbranchial injection: fastest onset, longest analgesia
Al Hseinat et al. (2026) [25]	Jordanian field hospital, Gaza	Retrospective; 362 orthopaedic patients	Spinal	Spinal 29.8%; GA 32.3%
Boye et al. (2025) [26]	French ship hospital, Gaza civilians	Retrospective; 94 war-injured (42% children)	GA combined with RA	GA 80%; GA + RA 19%; severe pain in 39%
Lehavi et al. (2016) [5]	Israeli field hospital, Nepal earthquake	Field report; 84 orthopaedic/plastic procedures	Ultrasound-guided PNB	96% under nerve blocks; no immediate complications
Jiang et al. (2010) [27]	Field hospital, Wenchuan earthquake	Retrospective; 111 patients	Spinal; brachial plexus block	Spinal 40, brachial plexus 11, GA 19, MAC 41
Taygurt et al. (2026) [28]	Referral centre, 2023 Turkiye earthquakes	Retrospective; 64 crush/compartment syndrome patients	-	93.8% required GA because of instability
Aissaoui et al. (2024) [29]	Humanitarian military field hospital	Prospective; 61 elective cholecystectomies	Thoracic spinal (T9-T10)	Feasible and stable; no post-dural puncture headache
Ariyo et al. (2016) [30]	MSF facilities	Retrospective; 75,536 adult anaesthetics	Spinal and other RA	Spinal 45.6%; lower adjusted mortality than GA with intubation (confounded)
Mohamed et al. (2025) [31]	Conflict-affected Sudan	Cross-sectional audit; 1559 cases	Spinal by non-physician providers	91% of spinals by NPAPs; adverse events 2.8x more frequent without supervision

TABLE 1: Main clinical studies of regional anaesthesia in field, conflict, and disaster settings

CPNB: continuous peripheral nerve block, GA: general anaesthesia, MAC: monitored anaesthesia care, MSF: Médecins Sans Frontières, NPAPs: non-physician anaesthesia providers, PNB: peripheral nerve block, RA: regional anaesthesia, US: United States.

Settings and levels of care

The term field hospital covers heterogeneous facilities: forward surgical teams and NATO Role 2 units performing damage control surgery close to the front, Role 3 deployed hospitals, disaster field hospitals deployed after earthquakes, humanitarian military hospitals supporting refugee populations, ship-based surgical platforms, and makeshift civilian facilities in besieged areas. The proportion of RA varies with this context. In Russian military medical units during 2023-2024, RA, including as part of combined anaesthesia, accounted for 34.5% of anaesthetics at the stage of emergency specialised surgical care and 25.4% at the stage of qualified surgical care, with the lowest use at level 1 and at level 2 facilities receiving only primary casualties [21]. A French forward surgical unit deployed in low-income countries used RA alone in 43.5% and combined with general anaesthesia in 21% of 1547 anaesthetics, significantly more than the same team used for comparable procedures at home [9]. In contrast, aboard a French amphibious ship receiving civilians from Gaza, where many patients were children and most had already undergone damage control surgery, general anaesthesia was used in 80% of procedures and combined general and RA in 19% [26].

After disasters, the mix depends on the stage of the response and the patient's systemic condition. In the Israeli field hospital deployed after the 2015 Nepal earthquake, 96% of orthopaedic and plastic procedures in non-ventilated patients were performed under ultrasound-guided nerve blocks [5]. In the Wenchuan earthquake field hospital, intrathecal anaesthesia, monitored anaesthesia care, and brachial plexus block together accounted for most of the 111 anaesthetics [27]. Conversely, in a referral centre treating crush and

compartment syndrome after the 2023 Kahramanmaraş earthquakes, 93.8% of patients required general anaesthesia because of systemic instability [28], and in 375 transferred earthquake victims, general anaesthesia was used in 352, spinal anaesthesia in 19, and a peripheral nerve block in 33 [32]. Large humanitarian datasets confirm that neuraxial and other regional techniques form a substantial share of anaesthesia in resource-limited and conflict settings [30,33].

Neuraxial anaesthesia

Spinal anaesthesia is the most widely used regional technique in humanitarian surgery. In 75,536 adult anaesthetics provided in Médecins Sans Frontières facilities, spinal anaesthesia was the most common technique (45.6%) and was associated with lower perioperative mortality than general anaesthesia with intubation, although this comparison is confounded by case selection [30]. Its expected advantages in the field, which have not been formally compared with general anaesthesia in field hospitals, are simplicity, low drug and equipment cost, no need for an anaesthetic machine, and rapid turnover; neuraxial and other regional techniques, together with ketamine, are considered among the safest options in low-resource settings [34]. At a Jordanian military field hospital in southern Gaza, spinal anaesthesia was used in 29.8% of 362 orthopaedic trauma patients [25]. The use of high-volume spinal anaesthesia as an alternative to general anaesthesia when general anaesthesia drugs and equipment were lacking has been reported from Gaza and has generated debate [35,36].

Extending indications is possible in selected patients. In a prospective study in a humanitarian military field hospital, thoracic spinal anaesthesia at T9-T10 allowed elective open cholecystectomy in 61 patients with stable haemodynamic and respiratory parameters, low intraoperative pain, and no post-dural puncture headache [29]. The anaesthetic activity of the Moroccan field medical-surgical hospital at the Zaatari camp for Syrian refugees has also been reported [37]. These data concern elective surgery in stable civilian patients and should not be extrapolated to haemorrhaging casualties.

In the acutely injured casualty, neuraxial block carries the risks of sympathectomy-induced hypotension in unrecognised hypovolaemia and of spinal haematoma in coagulopathy or after anticoagulation, and an epidural catheter in a contaminated patient raises infection concerns. Ukrainian authors argue on this basis for a preference for peripheral blocks in combat lower-limb injuries [24]. Where epidural catheters are used for prolonged analgesia in wounded servicemen, catheter dislodgement is a practical problem; in 71 casualties treated in Lviv, a double-tunnelling technique in the dermal plane was compared with conventional fixation, and dislodgement was 3.2 times more frequent in the control group [38]. In our opinion, neuraxial anaesthesia in casualties should be reserved for patients who have been resuscitated, with documented coagulation status or a clear anticoagulation history, and in a facility able to treat hypotension and convert to general anaesthesia; this recommendation is based on the risks summarised above [24] rather than on comparative data.

Peripheral nerve and fascial plane blocks

Ultrasound-guided peripheral nerve blocks are the technique of choice for upper-limb surgery and an alternative to neuraxial block for the lower limb when haemodynamics, coagulation, or positioning make spinal anaesthesia unattractive. In the Nepal field hospital, interscalene or supraclavicular blocks were used for the upper limb and femoral or saphenous blocks combined with high or low sciatic blocks for the lower limb, using a portable ultrasound machine, with operations performed awake or under light ketamine-midazolam sedation [5]. In Ukraine, ultrasound-guided sciatic block technique influences onset and duration, with interbranchial injection at the bifurcation providing the fastest onset and longest analgesia in a comparative study of 50 wounded [24]. Surgery for combat limb injury under RA with optional sedation has been evaluated in an observational cohort [39]. Blast injury is associated with specific causes of block failure, and ultrasound predictors of failure have been studied prospectively [40].

Novel and combined approaches have been described for weapon-wounded patients in low-resource settings, including combined supra-inguinal fascia iliaca, sciatic and posterior femoral cutaneous nerve blocks in haemodynamically unstable patients with vascular injuries [41], and a single-entry selective trunk block for complete upper-limb anaesthesia [42]. Fascial plane blocks such as the erector spinae plane block are attractive for thoracic trauma, as illustrated by continuous erector spinae analgesia after penetrating chest trauma from an explosion [43]. These reports describe feasibility; they do not establish superiority or safety at scale.

Better haemodynamic tolerance is often put forward as an argument for peripheral blocks in shocked patients, but the supporting data are observational. In a retrospective cohort of 146 combat casualties with haemorrhagic shock, RA (mainly as part of combined anaesthesia) was used in 73.3%, and initiation or escalation of vasopressor support was recorded after RA in 3.7% of patients versus 17.8% after induction of general anaesthesia [22]; because the technique was chosen by the clinicians, this difference may reflect patient selection rather than an effect of RA. In a comparative study of 100 casualties with limb injuries treated in frontline hospitals, patients receiving ultrasound-guided blocks were reported to have lower pain scores and more stable mean arterial pressure and heart rate at the end of surgery, at the start, and at the end of inter-hospital transport [23]. Both studies are non-randomised and exposed to confounding by

indication; neither shows that RA is safe in uncorrected haemorrhagic shock, and in our view, RA should not delay or replace haemorrhage control and resuscitation.

Table 2 summarizes the main peripheral nerve and fascial plane blocks, their usual clinical indications, and considerations for their use in field and combat settings.

Region	Block	Usual indications	Field considerations
Upper limb	Interscalene brachial plexus	Shoulder and proximal humerus	Ipsilateral phrenic nerve block is expected: avoid in respiratory compromise; used in a disaster field hospital [5]
Upper limb	Supraclavicular brachial plexus	Arm, elbow, forearm, and hand	Risk of phrenic nerve block and pneumothorax; used in a disaster field hospital [5]
Upper limb	Infraclavicular brachial plexus	Elbow, forearm, and hand	Deeper target; stable site for a catheter
Upper limb	Axillary brachial plexus	Forearm and hand	Low risk of phrenic nerve block or pneumothorax; requires arm abduction
Upper limb	Single-entry selective trunk block	Whole upper limb, from shoulder to hand	Described in weapon-wounded patients in low-resource settings [42]
Lower limb	Femoral nerve	Anterior thigh, femoral shaft, patella, and knee	Combined with a sciatic block for surgery below the knee[5]
Lower limb	Fascia iliaca (supra-inguinal)	Hip and femoral fractures (analgesia); anterior and lateral thigh	Simple, superficial technique; combined with sciatic and posterior femoral cutaneous blocks in unstable patients with vascular injuries [41]
Lower limb	Proximal (subgluteal) sciatic	Posterior thigh, knee, leg and foot, with a femoral or saphenous block	Suitable for catheters during staged surgery; technique influences onset and duration [24]
Lower limb	Popliteal sciatic	Leg below the knee, ankle and foot, with a saphenous block	Distal site, easy positioning; used in a disaster field hospital[5]
Lower limb	Saphenous (adductor canal)	Medial leg and ankle, as a complement to a popliteal block	Mainly sensory; preserves quadriceps strength
Trunk	Erector spinae plane	Rib fractures, chest wall trauma, thoracotomy, spine surgery	Superficial target away from the neuraxis; continuous use after explosion-related chest trauma [43]
Trunk	Serratus anterior plane	Anterolateral chest wall, rib fractures, chest drains	Superficial and simple technique
Trunk	Paravertebral	Unilateral chest and upper abdominal wall	Close to the neuraxis; risk of pneumothorax
Trunk	Transversus abdominis plane and rectus sheath	Abdominal wall incisions, including laparotomy	Somatic analgesia only (no visceral analgesia); part of multimodal analgesia

TABLE 2: Main peripheral nerve and fascial plane blocks and their usual indications

Indications are the usual clinical indications of each block and are given as a guide; the cited references illustrate use in field, conflict, or weapon-injury settings. The choice of block also depends on the risk of acute compartment syndrome, coagulation status, and the evacuation plan (see text).

Continuous catheters and analgesia across evacuation

The defining contribution of RA to military medicine has been continuity of analgesia along the evacuation chain. At Walter Reed, 287 of 500 casualties with extremity injuries received RA, including 361 CPNB catheters with a mean infusion time of 9 days; catheter-related complications occurred in 11.9% of casualties and were technical or minor, and infection occurred in 1.9% [12]. Among 110 casualties evacuated to Landstuhl, pain relief during transport averaged 45%, and patients with CPNB catheters reported less pain and better relief [13]. Early RA within 7 days of injury was associated with lower average pain over 6 months and up to 24 months [14], although residual confounding by injury severity and care pathway cannot be excluded. Today, Ukrainian teams use tunnelled sciatic catheters to provide continuous analgesia over

many weeks of staged surgery [44]. Continuous catheters have also been used for earthquake victims, with assessment of quality of recovery [45].

Catheters introduce specific problems in the field: the need for infusion devices or elastomeric pumps and their supply, dislodgement during transfers, infection of catheters placed near contaminated war wounds [46], systemic accumulation of local anaesthetic during prolonged infusion [47], and interaction with thromboprophylaxis, since combat casualties often receive low-molecular-weight heparin [48,49]. A general evidence base for CPNB exists [50], but its transposition to multi-week use in contaminated, anticoagulated casualties relies on case series.

Rebound pain after resolution of single-shot blocks is increasingly recognised in military patients. Ukrainian groups have studied the relationship between opioid dose and rebound pain after limb surgery [51] and the use of adjuvants to prevent it [52]. Regional analgesia was compared with systemic analgesia after mine-explosion and shrapnel limb injuries in a prospective controlled study [53], and, in 322 patients with combat extremity injury, of whom 30.4% developed chronic pain, RA in the acute phase was associated with a lower risk of chronic pain (odds ratio 0.66, 95% confidence interval 0.43-0.99) [54]. These are observational associations, with confidence intervals close to no effect, and do not establish that early RA prevents chronic pain. A planned transition from block to oral multimodal analgesia, documented on the evacuation record, is essential.

Multimodal analgesia and sedation

RA is one element of a multimodal strategy whose other components are frequently constrained by supply. In Gaza hospitals, none of 100 war-wounded patients received a formal pain assessment, two-thirds had no pain documentation, and opioid use was severely limited [55]. Severe pain affected 39% of Gazan casualties treated aboard a French ship [26]. Ketamine is central to field anaesthesia: after the Beirut pager explosions, switching to ketamine as primary anaesthetic for hand surgery was associated with lower pain scores and fewer respiratory complications than an opioid-based approach [56], and low-dose ketamine is the usual sedative adjunct to blocks in field reports [5]. RA has been described as an analgesic force multiplier on the battlefield, although it has not been studied in palliative care of expectant casualties [57].

Safety issues specific to the field

Acute compartment syndrome (ACS) is the most debated risk. High-energy ballistic and blast limb injuries are at high risk of ACS, and military authors raised early the concern that dense blocks could delay its diagnosis [58]. A systematic review identified only six case reports linking peripheral nerve blocks and ACS after limb trauma; delayed diagnosis was reported in one, and breakthrough pain despite the block revealed ACS in five [59]. Consensus guidance from the United Kingdom supports the use of RA in lower-leg trauma provided that low-concentration local anaesthetic is used, patients at risk are identified, and compartment monitoring is organised and communicated to the surgical team [60,61]. The association between perioperative RA and missed ACS has also been examined in tibial fractures [62]. In a field hospital, where clinical reassessment may be interrupted by evacuation, the decision to block a limb at risk should be shared with the surgeon and recorded on the transfer documentation. In practice, we suggest the following sequence, which combines published consensus with our own opinion. Before the block, a baseline neurovascular examination of the limb (pain, sensation and motor function in the territory of each compartment, pulses, and capillary refill) should be documented, the decision shared between surgeon and anaesthetist, and, where possible, the patient's verbal consent to the analgesic technique recorded [60]. The block should use a low concentration of local anaesthetic without adjuncts, avoiding dense blocks that last well beyond surgery [60]. After the block, observations should be made at set frequencies by staff trained to recognise ACS, preferably on an objective scoring chart [60]; pain out of proportion to the injury and breakthrough pain despite a working block should be treated as warning signs [59,61]. When clinical assessment is unreliable, for example, in sedated or obtunded patients or under a dense block, intracompartmental pressure should be measured where the equipment and expertise exist; this is our opinion, and we identified no field data on pressure monitoring. Finally, the handover to the evacuation team should state that the limb is at risk, the block type, time, drug, concentration and expected regression, the time of the last neurovascular check, and the action to take if warning signs appear.

Local anaesthetic systemic toxicity (LAST) is a particular risk when several blocks are performed in a polytraumatised casualty or when catheters run for days; a scoping review of emergency physician-performed ultrasound-guided nerve blocks reported complications in 0.89% of blocks and LAST in 0.03% [63]. In practice, the maximum dose should be calculated from body weight before the first injection, and all local anaesthetic given to the patient should be added up, including every block, catheter boluses and infusions, and surgical infiltration. When several blocks are needed, lower concentrations, ultrasound guidance to reduce volumes, incremental injection with aspiration, and spacing of injections are advisable (our opinion). Prolonged infusions can accumulate: among combat casualties with long-term catheters, two patients had isolated free ropivacaine concentrations in a previously identified toxic range about 24 hours after a 300-mg bolus, without clinically evident toxicity [47]. Lipid emulsion 20% should be stocked in every field RA kit together with a LAST cognitive aid such as the American Society of Regional Anesthesia and Pain Medicine (ASRA) checklist [64]. Blocks should be performed only where monitoring, airway equipment,

oxygen, and resuscitation drugs are immediately available, and every team member who performs or monitors blocks should be trained to recognise and treat LAST, ideally through pre-deployment simulation (our opinion). Field conditions add further risks: limited asepsis, multi-resistant organisms in war wounds [15], language barriers that complicate consent and assessment [5], and the absence of follow-up after transfer.

Equipment, drugs and logistics

Field reports converge on a small set of requirements: a portable ultrasound machine with a high-frequency linear probe, short-bevel block needles of several lengths, long-acting local anaesthetics in different concentrations, catheter kits and infusion devices, and standard monitoring with electrocardiography, non-invasive blood pressure and pulse oximetry [5,8]. When appropriate block needles were unavailable in Nepal, standard 21-G needles were used, which was feasible in thin patients [5]. Performing blocks in the preoperative area before entering the operating room improved operating theatre turnover [5]. Ultrasound is increasingly available close to the front: in a survey of clinicians in Ukraine, point-of-care ultrasound was reported to be used for nerve blocks by a substantial proportion of respondents [65]. Supply-chain disruption in besieged areas can remove general anaesthesia drugs altogether, forcing reliance on regional techniques [17,35].

Workforce and training

Workforce training is one of several barriers to RA in the field, alongside equipment availability, supply-chain constraints, and institutional capacity [7,17]; we found no study ranking their relative importance. In the 2003 Iraq experience, the first long-distance evacuation with a continuous catheter relied on a single fellowship-trained military anaesthesiologist [11], and military anaesthesia residents may not perform enough combat-relevant blocks, especially catheters and thoracic epidurals, to be presumed proficient [66]. An international Delphi consensus proposed 16-20 blocks per anatomical region and at least 50 neuraxial blocks for non-fellowship trainees [67]. Military physicians now advocate structured RA training for non-anaesthetist physicians, supported by doctrine, telemedicine, and artificial intelligence [7]; assistive artificial intelligence for sonoanatomy has been evaluated in regional anaesthesia [68]. Skill decay is rapid: physician assistant students correctly identified the fascia iliaca compartment in 78% of attempts after a brief course but only 13% after 60-90 days [69]. In conflict-affected Sudan, non-physician anaesthesia providers performed 91% of spinal anaesthetics, and adverse events were 2.8 times more frequent without supervision [31]. Task-sharing of RA in the field should therefore be limited to a small number of high-value blocks, with refresher training before deployment and remote supervision.

Pragmatic framework for field hospital practice

Based on the literature above, we propose the following principles, which are expert opinion and require local validation (Table *3*). For each recommendation, Table *3* states the type of evidence behind it. None is supported by randomised trials; the strongest support comes from observational series and expert consensus, and several items rest on our opinion alone. Most data come from single centres, from one side of a conflict, from specific injury patterns, or from well-resourced military systems, and may not apply to other levels of care, to civilian disaster settings or to teams with fewer staff and less equipment. The framework is therefore a starting point to be adapted locally, not a guideline. First, select the technique by level of care and patient state: neuraxial anaesthesia for resuscitated patients with known coagulation status undergoing lower-limb or lower-abdominal surgery; ultrasound-guided peripheral or fascial plane blocks for upper-limb surgery, haemodynamically fragile patients, and analgesia; ketamine-based general anaesthesia when neither is suitable. Second, standardise a minimum RA kit and drug stock, including lipid emulsion, a LAST checklist, and a dose-calculation sheet. Third, limit the repertoire to a few versatile blocks that the deployed team can perform reliably. Fourth, for limbs at risk of ACS, apply the surveillance sequence described above, from baseline examination to handover. Fifth, plan analgesia continuity across evacuation: catheter or not, expected block regression time, rescue plan, and handover on the evacuation record. Sixth, record every block in a simple registry capturing indication, technique, success, complications, and outcome at transfer, so that field practice generates evidence.

Domain	Practical recommendation	Type of evidence	Key sources
Technique selection	Spinal for stable, resuscitated patients with known coagulation status (lower limb, lower abdomen); ultrasound-guided peripheral/fascial plane blocks for upper limb, unstable patients and analgesia; ketamine-based GA otherwise	Observational series; expert opinion	[5,22,24,30]
Minimum kit	Portable ultrasound with linear probe, short-bevel needles of different lengths, long-acting local anaesthetics in different concentrations, catheter kits and pumps, standard monitoring, lipid emulsion; LAST checklist and dose-calculation sheet	Expert opinion	[5,8,63,64]
Repertoire	Limit to a few versatile blocks (e.g. interscalene or supraclavicular, axillary, femoral or fascia iliaca, popliteal or proximal sciatic, erector spinae) and train to competence	Expert consensus (Delphi); expert opinion	[7,67]
Compartment syndrome	Identify at-risk limbs with the surgeon; document baseline neurovascular examination; low-concentration local anaesthetic without adjuncts; scheduled observations by trained staff; treat breakthrough pain as a warning sign; measure compartment pressure when assessment is unreliable and equipment exists; hand over risk and monitoring plan	Expert consensus; case reports; expert opinion (pressure measurement)	[59-61]
Continuous catheters	Use when analgesia must outlast evacuation; plan anticoagulation timing, fixation, infection surveillance, and dose limits	Case series	[12,46-48]
Evacuation handover	Record block type, time, drug and dose, expected regression, rescue analgesia plan, and ACS risk on the evacuation document	Observational data; expert opinion	[13,23]
Training and task-sharing	Pre-deployment refresher and supervision; remote support; limit task-shared blocks to simple, high-value techniques	Observational studies; expert opinion	[31,66,69]
Data	Keep a simple field RA registry (indication, technique, success, complications, outcome at transfer)	Expert opinion	[9,70]

TABLE 3: Pragmatic framework for regional anaesthesia in the field hospital (expert opinion informed by the cited literature)

ACS: acute compartment syndrome, GA: general anaesthesia, LAST: local anaesthetic systemic toxicity, RA: regional anaesthesia.

Type of evidence: no recommendation is supported by randomised trials.

Limitations and research priorities

This review has the limitations of its narrative design: article selection was not systematic and was performed by a single author with AI assistance, without independent verification by a second reviewer, which increases the risk of selection bias and inconsistent inclusion; because the reference lists of included articles were not systematically screened and only the first 20 results of each Consensus search were examined, relevant studies may also have been missed; reasons for non-selection and stage-specific screening counts were not recorded, no formal risk-of-bias assessment was performed, and publication bias favours positive single-centre experiences. The underlying evidence is weak: most data come from retrospective series, case reports, field reports, and expert opinion, often from a single side of a conflict, and the few comparative studies are non-randomised. Data from Russian and Ukrainian journals are increasingly available in English but are difficult to appraise. The only randomised trial protocol identified in a disaster setting addressed RA for painful injuries after disasters [70]. The logistical advantages of RA have not been quantified in comparative studies. Priorities include standardised field RA registries, comparisons of resource use between RA and general anaesthesia, pragmatic comparative studies of blocks versus systemic analgesia during evacuation, prospective evaluation of ACS risk with low-concentration techniques, safety data for multi-week catheters in anticoagulated casualties, and evaluation of training models for non-anaesthetists.

Conclusions

RA is a pillar of anaesthetic care in field hospitals during armed conflict and disasters, because it matches the dominant injury pattern and is expected to reduce dependence on scarce oxygen, ventilators, recovery beds, and drugs, although this logistical benefit has not been measured in comparative studies. Neuraxial

techniques, ultrasound-guided peripheral and fascial plane blocks, and continuous catheters each have a defined place, determined by the level of care, haemodynamic and coagulation status, compartment syndrome risk, and the evacuation plan. The evidence base remains largely observational, and implementation depends on trained staff as well as on equipment, supply chains and institutional support. Field teams should standardise a limited set of techniques and a minimum kit, plan analgesia across evacuation, and systematically record their practice to build better evidence.

Appendices

Search strategies for the database searches, run on 25 October 2026

PubMed (144 records): ("Anesthesia, Conduction"[Mesh] OR "Nerve Block"[Mesh] OR "regional anesthe*"[tiab] OR "regional anaesthe*"[tiab] OR "nerve block*"[tiab] OR "plexus block*"[tiab] OR "plane block*"[tiab] OR "fascia iliaca"[tiab] OR neuraxial[tiab] OR epidural[tiab] OR "spinal anesthe*"[tiab] OR "spinal anaesthe*"[tiab] OR "perineural catheter*"[tiab] OR ((interscalene[tiab] OR supraclavicular[tiab] OR infraclavicular[tiab] OR axillary[tiab] OR popliteal[tiab] OR "adductor canal"[tiab] OR sciatic[tiab] OR femoral[tiab] OR PENG[tiab] OR "erector spinae"[tiab] OR serratus[tiab] OR paravertebral[tiab] OR caudal[tiab]) AND block*[tiab])) AND ("Military Medicine"[Mesh] OR "Warfare"[Mesh] OR "Armed Conflicts"[Mesh] OR "Military Personnel"[Mesh] OR "War-Related Injuries"[Mesh] OR "Disasters"[Mesh] OR "Mass Casualty Incidents"[Mesh] OR "Blast Injuries"[Mesh] OR military[tiab] OR combat[tiab] OR battlefield[tiab] OR war[tiab] OR wartime[tiab] OR "armed conflict*"[tiab] OR austere[tiab] OR "field hospital*"[tiab] OR humanitarian[tiab] OR disaster*[tiab] OR earthquake*[tiab] OR "mass casualt*"[tiab] OR blast[tiab] OR ukrain*[tiab] OR gaza[tiab] OR syria*[tiab] OR lebanon[tiab]) AND ("2022/01/01"[dp] : "3000"[dp]) NOT (animals[mh] NOT humans[mh])

Scopus (306 records): TITLE-ABS-KEY("regional anesthe*" OR "regional anaesthe*" OR "conduction anesthe*" OR "nerve block*" OR "plexus block*" OR "plane block*" OR "fascia iliaca" OR neuraxial OR epidural OR "spinal anesthe*" OR "spinal anaesthe*" OR "perineural catheter*" OR ((interscalene OR supraclavicular OR infraclavicular OR axillary OR popliteal OR "adductor canal" OR sciatic OR femoral OR peng OR "erector spinae" OR serratus OR paravertebral OR caudal) W/3 block*)) AND TITLE-ABS-KEY(military OR combat OR battlefield OR war OR wartime OR "armed conflict*" OR austere OR "field hospital*" OR humanitarian OR disaster* OR earthquake* OR "mass casualt*" OR blast OR "war-related injur*" OR soldier* OR ukrain* OR gaza OR syria* OR lebanon) AND PUBYEAR > 2021

Queries used in the eight Consensus (consensus.app) searches, run on 29 October 2026, in the order run. The first 20 results of each search were screened.

1. Regional anesthesia field hospital military combat casualties

2. Continuous peripheral nerve block catheters combat injuries evacuation

3. Regional anesthesia earthquake disaster victims crush injury

4. Regional anesthesia acute compartment syndrome extremity trauma missed diagnosis

5. Spinal anesthesia ketamine austere low-resource humanitarian surgery field hospital

6. Moroccan field hospital anesthesia experience

7. Regional anesthesia training non-anesthesiologist military physicians ultrasound-guided nerve block prolonged field care

8. High-volume spinal anaesthesia Gaza war casualties anaesthesia resources

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

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Disclosures

AI use statement: The authors used Claude (Anthropic) as follows: language polishing, structure or formatting, translation in Abstract, Introduction, Methods, All review sections, Discussion, Conclusion, Table 1, Reference list. The AI-assisted draft was critically read and revised by the first author and approved by all co-authors. All 68 references were checked against PubMed, Scopus, and publisher records for existence, DOI, and bibliographic metadata, and corrected where needed. Every figure reported in the text and in Table 1 was cross-checked against the original abstracts, and key sources were read in full. Final clinical interpretation and recommendations reflect the authors' own expertise in military anesthesia. The authors confirm that they have reviewed and verified all AI-assisted content and take full responsibility for the work. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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