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Regional block analgesia in trauma patients: Ground zero experience from battlefield

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Summary: *Providing analgesia to military trauma patients in austere and hostile operating conditions with shortage of advance care facilities in front is very challenging. Our study aims to evaluate efficacy, safety and feasibility of Regional Block Analgesia (RBA) by first responders in war scenario.We found RBA to be simple, safe and effective with consistent results in the setting of military trauma when performed by first responders. In war, it's of huge helpin management of battle casualties. It may be easily performed in war-scenario as well as primitive field conditions by a trained first responder. In developing countries out burdened with constraints of money, material and manpower, this technique can be used with safety, speed and precision. RBA ispriceless in permitting lifesaving operations in priority one victimsandalso providing analgesia to other neglected low priority patients.Weadvocate practice of RBA for military trauma patients by first responders at the field Hospital level.*

Keywords: *Military trauma, extremity injury, Regional Block analgesia, first responders*

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I. Introduction

Trauma is the greatest killer in young age bracket and is accountable for loss of most productive man-hours(1). It leads to pain and is sophisticated by "fear and anxiety" in patients. Trauma victims screaming with pain have a hopeless impact on environment(2). In most of trauma management protocols, pain management typically takes a backseat in the face of urgent life-saving measures.

Military surgeons usually manage flood of patients , be it in war or incidence of battle casualty or civilian disaster. Providing pain relief to such trauma victims in austere and hostile operating conditions with shortage of advance care facilities in front remains the foremost troublesome hurdle for primary caregivers. The dictum in current military-medicine practice is delivery of analgesics right at the point of injury(3).

Patients screaming in pain not solely affects adversly to patients outcomes however conjointly distracts doctor's attention from real cases thereby meddling with correct triage. Hunt for ideal analgesia (systemic or regional) for military trauma patients remains the foremost puzzling task for the medics.Though traditional style of providing pain relief is by systemic route however RBA is turning into a preferred modality currently. The most recent information from war-front has demonstrated many edges of RBA over systemic analgesia despite of its understated scope and underutilized efficacy(3).

Use of "regional blocks" is very limited in military hospitals(4). Use of RBA is confined to operation theatre despite of proof suggesting that "regional blocks" is feasible at the field hospital level by trained first responder(3). Modern warfare demands a necessity for this expertise to percolate all the way down to primary surgical caregivers. In our study we evaluated RBA by first responders in field hospitals.

II. Materials and Methods

A prospective-observational study was done at forward location military hospital for two years. Patients withisolated-extremity injury requiring daily dressings/debridement or minor surgical operation were included. "Critically-ill" and "hemodynamically-unstable" patients were excluded.

Brachial plexus block, periarterial axillary block, wrist and digital block were used for upper extremity injuries whereas three in one perivascular femoral block (Winnie's technique) combined with sciatic nerve block and ankle block were given for lower extremity injuries.

Aconcoction of 2% Lignocaine 3mg/kg and 0.5% Bupivacaine 1.5 mg/kg with dilution to create a volume of 0.75mg/kg was used.Anatomicallandmark was used to provide blocks. Needle from canula was removed once correct position was determined and catheter was fastened to skin and left unmoved for top up of drug within the ward. Failure of technique was tackled by infiltration of anaesthetic drug locally or administration of general anaesthesia.

Onset, period and scales of analgesia and side-effects if any were noted. Continuous hemodynamic monitoring every ten minutes was done throughout the procedure and half hourly thenceforth for two hours. Verbal Numerical Rating Scale (VNRS)was utilized to measure pain scores (5). Quality of analgesia was assessed and stratified by four-point scale.

Excellent – absence of all sensation
Good- absence of touch and pain
Moderate- borderline pain from operative procedure
Poor- Additionalsystemic drugrequirement

III. Results

203 patients who met inclusion-exclusion criteriawere studied in two years' time, of which 175 (86.2%) were males and 28 (13.8%) were females.The average age for males was twenty-eight years whereas it was thirty-four years for females. Table 1 shows the cause and distribution of injuries. 90% of injuries were battle casualties predominantly comprising of blast injuries during enemy action. Table 2 shows the details of surgical procedures done. In the same pain relief analgesia, we could carry out 19 lower limb amputations and 22 upper limb amputations and also do serial debridement in many patients.

Table 1 Cause and distribution of injuries

Nature of casualty	**Cause and distribution of injuries**				Total
			Upper extremity	**Lower extremity**	
Battle casualty (n=183, 90.1%)	Explosion	Mine	9 (7.6)	11 (13.1)	20
		IED	9 (7.6)	27 (32.1)	36
		RPG	11 (9.2)	1 (1.2)	12
		Grenades	39 (32.8)	6 (7.1)	45
		Others	12 (10.1)	1 (1.2)	13
	GSW		15 (12.6)	14 (16.7)	29
	Aircraft accidents		3 (2.5)	2 (2.4)	5
	Blunt trauma		4 (3.4)	5 (5.9)	9
	Fall		6 (5.04)	8 (9.5)	14
Non-Battle casualty (n=20, 9.8%)	RTA		10 (8.4)	8 (9.5)	18
	Others		1 (0.8)	1 (1.2)	2
Total			**119**	**84**	**203**

Figures in parenthesis indicate percentages; IED- Improvised explosive device; RPG- Rocket propelled grenade; GSW- Gunshot wound; RTA- Road traffic accident

Table 2 Surgical procedures

Upper limb	Debridement		97 (47.8)	**Lower limb**	Debridement	65 (32)	
	Amputation (n=22,10.8%)	Arm	1		Amputation (n=19,9.3%)	AK	3
		Forearm	5			BK	3
		Hand	1			Foot	9
		Digit	15			Ray	4

Figures in parenthesis indicate percentage; AK- above knee; BK- Below knee

Table 3 shows the analgesiatechniques administered to the patients. Brachial plexus block (n=59), wrist block (n=35), digital block (n=67), "3 in 1" perivascular femoral block (Winnie's block) (n=10), popliteal block (n=9) and ankle block (n=23) were given. In upper-extremity trauma group, out of 119 (58.6%) casesRBA was successful in 113 (95%) patients, supplemental local infiltration was given in 2 (1.6%) patients while 1 (0.8%) required GA (Table 3). Out of84(41.3%) patients in lower-extremity trauma group the procedurealone was successful in 76 (90.4%) cases.

Table 3 Analgesia techniques

			Regional block alone	Supplementation	
				Local anaesthesia	GA/DA
Upper extremity	Brachial Plexus	Supraclavicular	16	1	1
		Axillary	40	1	0
	Wrist		35	0	0
	Digital		25	0	0
Lower extremity	Femoral + Classical Sciatic		8	1	1
	Femoral + Popliteal Sciatic		7	1	1
	Ankle		19	4	0
	Digital		42	0	0

Quick onset of analgesia ranging between 14-35 minuteswas achieved, lasting 4 hours (upper limb) and 5 hours (lower limbs). RBA alone was effective in 192 (94.5%). Quality of analgesia was assessed by a four-point scale (Table 4). No patient had any systemic toxicityattributable to RBA.Local reactions limited to erythema and cellulitis was seen in 9 cases, that resolved on treatment.

Table 4 Parameters of effectiveness

		Upper limb	Lower limb
Onset*		15-27	14-35
Quality	Excellent	77	69
	Good	30	10
	Moderate	6	3
	Poor	6	2
Duration*		138-490	210-540
Average*		266	318

* Time in minutes

IV. Discussion

Even once over two centuries have passed since its discovery, RBA is very reluctantly used toady despite having various advantages(6–8).Systemic analgesia is a popular modality in trauma owing tothe safety profile of drugs and intensive monitoring offered despite its hindrance with sympathetic compensation and physiology of trauma victims(9).There's an ongoing debate on use of systemic versus RBA for many years(10). RBA is becoming popular because of its simplicity, safety and effectiveness.It'ssafe having lesser complications, requiring negligible monitoring and postoperative care. Its use liberates the anaesthetist to attend to more critical patients and offers the surgeons to intervene multiple times within the same block. Low cost, simple administration & ability to focus on painful areas specifically makes it standard selection for the administrators as well. Reduced hospital stay, quicker bed turnover time and pain free evacuation of casualties in tough terrain is the value-added advantage of military surgeons.

Most of our field hospitals are deployed on the international borders dealing primarily with combatants involved in intense counter-insurgency operation. In a 9 years study of a forward located sector showed that extremity trauma constitutes59% ofall military injuries(11). Such high figures are because of the very fact that shell splinters, mine blast and gunshot wounds are the major reason for military trauma in the current times. Availability of protective gears for torso in the form of “bullet proof jackets” and “patka” results in lesser incidence of trunk trauma as compared to extremity injuries(11).

Janice J Wu et alreported over 80% success rate with RBA for extremity injuriesin military setting(12).We had over 90% success rate. In this technique, patient’s consciousness and protective reflexes, are preserved which is an asset in mass-casualty scenario with scanty employees accessible at forward military locations. In addition, decreased stress response results in reduced morbidity and mortality (13).

60% of our patients had upper extremity injuries.The supraclavicular technique of brachial plexus block is associated with more complications(14,15). Axillary technique is a safer (16). We used supraclavicular technique in one third andaxillary block in two-thirdpatients of upper limb injuries.

40% of our patients had lower limb injuries. Winnie’stechnique of blockingfemoral, lateral femoral cutaneous and obturator nerves by a single injection was described in 1973(17).Depth of sciatic nerve at hip, requirement of 15 cm needle and cumbersome patient positioning makes combined sciatic and femoral block at hip very difficult technique to perform andhas low success rate (18). This techniquewas used for thigh injuriessolely. For below-knee injuries sciatic block was given at the popliteal fossa along with the femoral block“fempop” with good success rate. But, amazingly “fempop” isn't employed in many centres and limited scientific data exists on this technique(18,19).

Various means of drug delivery exists for blocks including “single shot injection”, “sheathed perineural canula”, “catheters” and “continuous pumps”. In field conditions we found “sheathed perineural canula” to be useful and effective. “Elicitation of paraesthesia”, “click-method of loss of resistance”, “peripheral nerve stimulator” and “ultrasound-guidance” are the various means available to verify correct needle placement, of which “click-method” is least reliable. According to Lewis SR et al utility of ultrasound in war is tokenish(20).No statistical difference has been found between“catheter insertion”, “elicitation of paraesthesia” or use of “nerve stimulator” when success of regional block is the measured outcome(21). There's no additional advantage of “nerve stimulator” over “paraesthesia elicitation” (22). We found “elicitation of paraesthesia” to be very effective indicator of right needle placement in field conditions.

Nerve injury because of blocks is extremely rare as demonstrated in a study by Brull et al and should not be a reason for dodging of this technique(23). Concoction of drugsdecreasesindividual drug-toxicity thereby increasing the overall-effect and utility(24). Faster onset, extended duration of action and safe results were achievable in our study because of mixture of lignocaine and bupivacaine. Small volume high concentration of drug is suggested by some authors which ends up in systemic complications(25). Inappropriate needle placement ends up in unsuccessful block. Therefore, we used large volumes of drug mixture after diluting it with normal saline to counterbalance the necessity for very correct needle placement while not compromising on the efficacy of the technique.Thus,wecould conduct 41 amputationsin the same analgesia block.

The most vital talent for giving nerve blocks is thorough knowledge of anatomy(26). Additionally, safety profile of RBA makes surgeons and first responders equally suited to anaesthetists while performing this technique. However, studies have shown increased complication rate when performed bynovice (27).

Regional anaesthesia isone of the safest modalities of pain management(28).Its advantages translate into improved patient outcomes in trauma (29). RBA ispriceless in permitting lifesaving operations in priority one victimsandalso providing analgesia to other neglected low priority patients(12,29,30). It lowersthe“catabolic hormones”, thereby limiting the “negative nitrogen balance” associated with trauma. Enhanced recovery of patient is ensured as there's no demand of any period of starvation preoperatively or post-procedure and low incidence of pulmonary and venous complications(31).

V. Conclusion

We found RBA to be simple, safe and effective with consistent results in the setting of military trauma when performed by first responders. In war, it’s of huge helpin management of battle casualties.Itmay be easily performed in war-scenario and primitive field conditions by a trained firstresponder. In developing countries out burdened with constraints of money, material and manpower, this technique can be used with safety, speed and precision. We advocate practice of RBA for military trauma patients by first responders at the field Hospital level.

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