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Guidelines for the safe clinical practice of peripheral nerve blocks in the adult patient

M. Desmet (*), S. Bindelle (**), M.B. Breebaart (***), H. Camerlynck (***), S. Casaer (****), K. Fourneau (*****), P. Gautier (******), P. Goffin (**), J.P. Lecoq (*******), I. Lenders (********), I. Leunen (*********), D. Van Aken (**********), P. Van Houwe (****), S. Van Hooreweghe (***********), K. Vermeylen (*********), L. Sermeus (************)

Abstract : The Peripheral Nerve Block working group of the Belgian Association for Regional Anesthesia has revised and updated the "Clinical guidelines for the practice of peripheral nerve block in the adult" which were published in 2013.

Key words : Regional anesthesia ; peripheral nerve blocks ; guidelines.

Introduction

In 2013, the first "Clinical guidelines for the practice of peripheral nerve blocks in the adult" were published by the Belgian Association for Regional Anesthesia (BARA) Peripheral Nerve Block working group (1). Since then a plethora on research has been published providing new insights in the clinical practice of peripheral nerve blocks (PNBs). The aim of this revised version is to provide anesthesiologists an update of the 2013 guidelines according to the most recent evidence in an effort to further enhance quality and safety of clinical practice. These recommendations were composed by the BARA Peripheral Nerve Block working group which included elected BARA board members and non-board BARA all of them with an extensive experience in regional anesthesia (RA). A large-scale review of the literature regarding different topics was performed to support the guidelines by current evidence. However, in case of limited available data, expert opinion as a result of discussion within the working group, was used as a surrogate for robust data.

We would like to remind readers of this manuscript that although these guidelines are intended to optimize patient care, they do not replace sound clinical judgment and cannot ensure the avoidance of adverse outcomes. Furthermore, although great care has been taken to avoid conflict with the "Safety First Guidelines" issued by the Society for Anesthesia and Resuscitation of Belgium (SARB) and the Belgian Professional Association of Specialists in Anesthesia and Resuscitation (BSAR-APSAR), we emphasize that the "Safety First Guidelines" should be prioritized above the "Guidelines for the safe

Matthias Desmet, MD ; Simon P.F. Bindelle, MD EDRA ; Margaretha B. Breebaart, MD PhD EDRA ; Hélène Camerlynck, MD ; Sari Casaer, MD EDRA ; Kristof Fourneau, MD ; Philippe Gautier, MD ; Pierre Goffin, MD MSc ; Jean-Pierre Lecocq, MD ; Isabelle Lenders, MD ; Ine Leunen, MD ; David Van Aken, MD EDRA

(*) Dept of Anesthesia, AZ Groeninge, Belgium.

(**) Dept of Anesthesia, Clinique MontLegia, CHC Groupe Santé, Liège, Belgium.

(***) Dept of Anesthesia, Universitaire Ziekenhuizen Antwerpen, Antwerp, Belgium.

(****) Dept of Anesthesia, GZA Ziekenhuizen, Antwerp, Belgium.

(*****) Dept. of Anesthesia, AZ Alma, Eeklo, Belgium.

(******) Dept of Anesthesia, Clinique Ste Anne-St Remi, CHIREC, Brussels, Belgium.

(*******) Dept of Anesthesia, CHU Sart Tilman, Liège, Belgium.

(********) Dept of Anesthesia, UZ Leuven, Leuven, Belgium.

(*********) Dept of Anesthesia, AZ Turnhout, Turnhout, Belgium.

(**********) Dept of Anesthesia, AZ Klina, Brasschaat, Belgium.

(***********) Dept of Anesthesia, Jan Yperman Ziekenhuis, Ieper, Belgium.

(************) Dept of Anesthesia, Cliniques Universitaires Saint Luc, Brussels, Belgium.

The guidelines are endorsed by the Board of the Belgian Association for Regional Anesthesia (BARA) : Margaretha Breebaart MB, Casaer S, Coppens S, Desmet M, Dewandre PY, Gautier P, Guntz E, Leunen I, Roofthooft E, Sermeus L, Van de Velde M, Vermeylen K.

The guidelines are endorsed by the Society for Anesthesia and Resuscitation of Belgium (SARB) : Bonhomme V, Wouters P, Foubert L, Van de Velde M, Brichant JF, De Hert S, Kapessidou P, Moerman A, Momeni M, Poelaert P, Rex S, Saldien V, Van Obbergh L, Sermeus L.

Corresponding author : Matthias Desmet.
E-mail : Matthias.Desmet@azgroeninge.be

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clinical practice of peripheral nerve blocks in the adult patient." (2).

Clinical Guidelines

TOPIC 1 : Medicolegal aspects

— Information and informed consent

The patient should be adequately informed in accordance with the recommendations legally defined in the Royal Decree of the 22nd August 2002 (Chapter III, art. 5-11).

Patients should be clearly informed regarding the risks and benefits of the RA procedure that will be performed (3,4). This can be done through a written leaflet, video material or during a preoperative visit. Concerns and questions should be adequately addressed. An example of such an information leaflet is available on the BARA website (www.BARA2001.be).

Information regarding preoperative guidelines (e.g. fasting rules, continuation of medication, …) should be given according to current medical knowledge.

To document the information process, a documented informed consent should be obtained from the patient. This informed consent should not be different from the informed consent for "Anesthesia and/or Sedation", as conversion to general anesthesia is always a possibility.

— Block registration

The working group highly recommends to register the block procedure in the medical record of the patient. All aspects of the block (or blocks if multiple blocks were performed in the same patient) including possible adverse events should be noted. For purposes of quality control, the development of an electronic database is highly recommended. An example of such a registration form is available on the BARA website (www.BARA2001.be).

TOPIC 2 : Preoperative organization

— Fasting Guidelines

Fasting guidelines should be respected when PNBs are performed for elective surgery. This includes surgical procedures performed under PNB (with or without sedation) or when PNBs are performed for postoperative analgesia and thus combined with general or neuraxial anesthesia. Specific fasting guidelines are provided by the European Society of Anesthesiologists (5).

Adherence to fasting guidelines when blocks are performed for analgesic (non-surgical) indications e.g. PNBs for hip fracture analgesia, is not mandatory as it will lead to an unnecessary delay of adequate pain relief.

— Intravenous access and patient monitoring

Obtaining intravenous access is mandatory before any procedure including performance of PNBs.

Monitoring guidelines for standard patient care apply to all patients receiving general anesthesia, RA or procedural sedation. The anesthesiologist must ensure that appropriate monitoring equipment is available and working properly. The following monitoring equipment is required and should be attached before the start of the procedure :

- Pulse oximeter
- Non-invasive (or invasive) blood pressure measurement
- Electrocardiography

Patients should be monitored during the entire peripheral nerve block procedure and according to expert opinion, it is recommended to keep the patient monitored at least 30 minutes or longer after performance of the block according to clinical judgment.

— Block room organization

Some centers benefit from a dedicated "block room" but regional blocks can also be performed in the preoperative holding area, the recovery, or in the actual operating room. Regardless of the location, all necessary requirements regarding monitoring, staffing, resuscitation equipment and drugs should be respected.

Block rooms with dedicated staff aim to increase the quality of RA programs as more blocks can be performed by or under supervision of a skilled anesthesiologist. It aims to reduce failure rates, improve safety profiles, provide teaching opportunities and improve the overall patient experience. In addition to these benefits, a dedicated block room increases theatre turnover and efficiency, leading to significant time and cost savings (6).

The block room must be located in the operating theatre and should offer a quiet environment for patients. It should have all necessary features such as monitoring devices, anesthetic and resuscitation drugs and equipment.

A specific storage cart with all the necessary equipment and drugs, which should be appropriately labeled and readily identifiable, greatly enhances work place organization (6,7).

Block related equipment and drugs :

- Surgical caps, masks and gowns, sterile gloves, sterile drapes, dressings, antiseptic solutions, sponges/gauze, (sterile) marking pen and ruler for landmark identification, sterile ultrasound covers and gel, hypodermic needles for skin infiltration, specific nerve block needles and catheters, syringes, intravenous catheters and intravenous fluids.
- A selection of sedative drugs and opioids for patients requiring sedation.
- A selection of local anesthetics (LA). Ideally, LAs are stored in a separate compartment from other drugs to reduce possible drug error.

Resuscitation Equipment :

- Oxygen supply and different types of oxygen-masks.
- Oral airways of different sizes, laryngeal masks and endotracheal tubes.
- Laryngoscopes with different blades.
- Bag-mask ventilation device.
- Suction.
- Defibrillator.

Resuscitation Drugs :

- Atropine
- Adrenaline
- Ephedrine
- Phenylephrine
- Intralipid® 20%

Ideally, Intralipid should be kept in a container with a protocol for use and equipment to draw up the drug for immediate administration to the patient.

Other resuscitation equipment and drugs (e.g. difficult airway equipment, antiarrhythmic drugs) must be readily available on request.

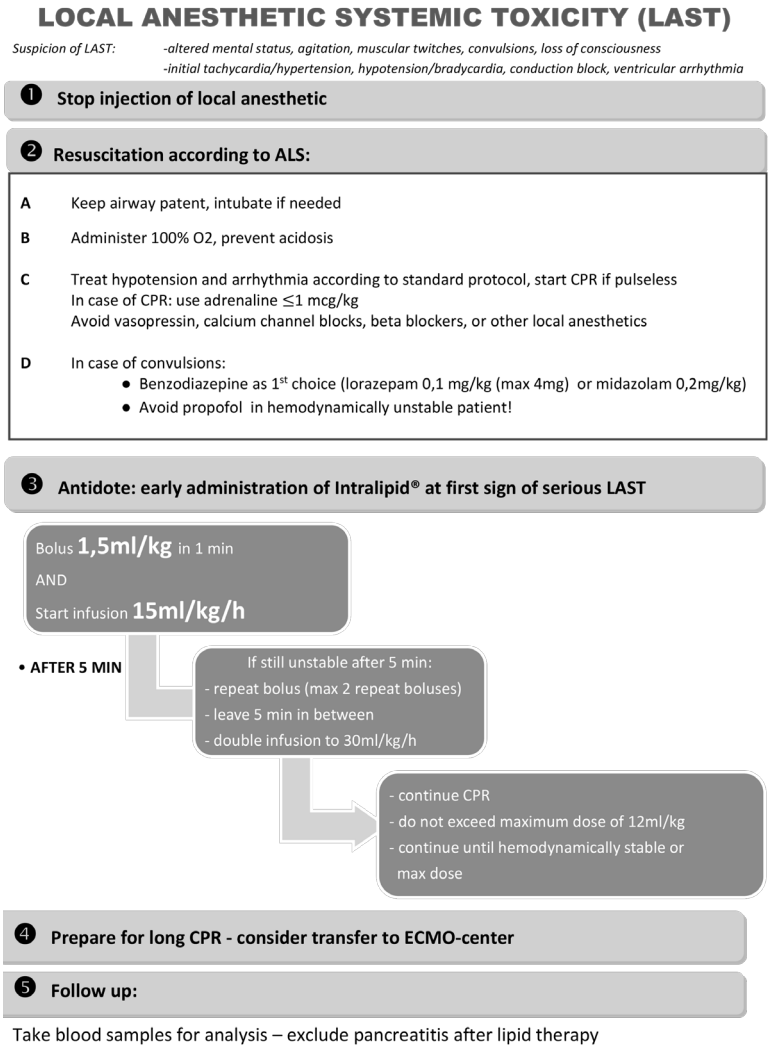

Figure 1. — LAST flowchart

— LA Systemic Toxicity

Although exceedingly rare, local anesthetic systemic toxicity (LAST) remains a feared complication related to PNBs (8). The most important recommendation is that all involved in the care of patients receiving PNBs should be vigilant and prepared to detect and treat LAST. We would like to emphasize that during general anesthesia, patients may present only with cardiac symptoms, as neurological symptoms remain often undetected due to the effects of anesthetics or sedatives (9). We recommend to regularly educate all those involved in placement and follow up of patients with PNBs (anesthesiologists, OR/PACU nurses and floor nurses) regarding the presentation and treatment of LAST. We recommend that a protocol regarding the treatment of LAST is available and clearly visible in the different locations where PNBs are performed or where patients that received a PNB are treated. As mentioned above, a 20% lipid emulsion should be readily available at all times (10). An example of the LAST protocol is available on the BARA website (www.BARA2001.be) and in Figure 1. We strongly recommend the registration of potential LAST events on the website www.lipidrescue.org.

— Sedation

It is probably preferable to perform PNBs in awake patients. There is nonetheless no evidence that PNBs performed in patients under general anesthesia, neuraxial block or deep sedation carry greater risks than when performed in awake or lightly sedated patients if all safety precautions are taken to minimize the risk of complications (11). However, the inherent risks of deep sedation and anesthesia will be added to the risks associated with PNBs. Therefore, the anesthesiologist should carefully outweigh the risks and benefits of performing a PNB in an awake or lightly sedated patient versus performing the block in a deeply sedated or anesthetized patient. The decision to perform a PNB has to be made on a case by case basis. The following points require consideration in this decision process : indication of the PNB, performance by an experienced anesthesiologist, availability of appropriate equipment and the consent of the patient after a clear explanation of the risks and benefits.

— Time out : STOP before you BLOCK procedure

In order to reduce the incidence of wrong-sided blocks, we advise to follow the WHO checklist prior to every PNB. Patient details, type and side of block as well as surgical site marking should be confirmed. Immediately before inserting the needle, a time out procedure must be performed where block details are confirmed by the anesthesiologist, the assisting nurse and, if possible, the patient. This procedure is described in the STOP before you BLOCK publication (12).

TOPIC 3 : Block technique

— Asepsis

When performing a PNB, adherence to standard asepsis guidelines is recommended (13, 14, 15).

With the exception of the role of antiseptic solutions, studies examining the role of asepsis during peripheral nerve block are lacking. Most recommendations to control infectious complications associated with PNBs are based on existing literature and guidelines for the prevention of epidural or intravascular catheter-related infection or derived from guidelines for prevention of surgical site infections.

Sterile surgical gloves should be used, not only to protect patients from cross-contamination, but also the health care worker from blood-borne pathogen exposure.

Wearing a surgical cap and mask, has been found to significantly reduce contaminations from micro-organisms growing in the upper airway of clinicians during neuraxial blockade. While the risks and consequences of infectious complications after neuraxial blockade cannot be compared with single shot PNBs, the panel recommends using cap and mask during both single shot and catheter procedures. These recommendations also apply for those assisting the anesthesiologist with the procedure.

In analogy with central line insertion, maximal barrier precautions should be taken while performing a catheter technique. This includes, in addition to the previously mentioned precautions, the use of sterile gowns and drapes.

For all peripheral nerve block techniques adequate skin antisepsis should be performed. Alcohol-based 0,5% chlorhexidine is considered as the antiseptic of choice to prepare the skin before regional anesthetic techniques. The application must be broad around the injection site and an adequate drying time should be respected to avoid subdermal introduction of the antiseptic with a risk of neurotoxicity (16).

Bacterial filters may be considered during extended continuous peripheral nerve block infusion. Periodically checking the catheter insertion place for signs of infection is mandatory. Infection risk with catheter use increases over time, especially after four days (17).

We strongly recommend against the performance of PNBs (single shot or catheters) in patients where there is a local infection of the insertion place (13).

When using ultrasound, special attention is required to ensure an adequate aseptic technique as both the ultrasound coupling gel and transducers can be sources of nosocomial infection.

The ultrasound equipment must be cleaned and disinfected between procedures according to specific institutional policy and manufacturers guidelines. A sterile ultrasound cover is the simplest solution to avoid infection and transmission from one patient to another (18). Alternatively, for single-shot PNBs, a sterile adhesive transparent dressing can be used assuming this can be applied aseptically (19). If a catheter is placed, a sterile cover with sleeve should be used, covering all portions of the ultrasound cord that might come in contact with the procedural field.

We recommend the use of sterile ultrasound gel when performing a PNB as tearing of the protective cover around the ultrasound probe when using non-sterile ultrasound gel would break asepsis. Use of RA packs, which contain prepared sterile equipment may help to become familiar to the aseptic technique.

— Performance of PNB and prevention of peripheral nerve injury (PNI)

Although the occurrence of severe PNI is rare, the performance of a PNB has an intrinsic risk of PNI (20). It is important to acknowledge that the vast majority of perioperative neurological complications are the result of non-PNB related causes (21, 22). However, safety precautions are recommended to reduce the risk of PNI to a minimum. Although intraneural extrafascicular needle positioning or injection does not consistently lead to functional nerve injury, histological changes may occur. More importantly, these changes can be caused by mere needle-nerve contact. Where histological changes often remain subclinical in healthy patients. These changes may be aggravated in patients with pre-existing neurological conditions, leading to clinical symptoms. Therefore, as a precaution measure, needle nerve contact and/or intraneural needle placement should be avoided (20).

— Equipment for nerve localization and prevention of peripheral nerve injury

Current evidence does not support superiority of one technique or device over another in terms of performing PNB and prevention of PNI. A combination of different techniques, devices and safety measures is advised (20).

Paresthesia : nerve contact/puncture may frequently occur without paresthesia. Using paresthesia as the sole guidance tool for nerve localization is therefore unreliable and is unacceptable according to current standards (23).

Nerve stimulation (NS) : presence of an evoked motor response (EMR) at currents between 0.3 and 0.5mA may indicate intimate needle-nerve contact or intraneural needle tip position. Avoid injection when an EMR is present at a current of 0.5mA or less. Absence of an EMR does not exclude needle-nerve contact or intraneural needle tip placement (24).

Ultrasound guidance : evidence supports the use of ultrasound compared to the use of NS alone. It increases block success including a faster onset of a PNB, decreases intravascular injections and the concomitant risk of LAST and facilitates teaching of PNBs (25, 26, 27). Ultrasound can but does not always detect intraneural needle tip placement and/or injection (28). Current evidence does not demonstrate a reduction of PNI by the use of ultrasound alone (29).

Opening injection pressure (OIP) monitoring : animal and cadaver data have linked high injection pressures (>20psi) to intrafascicular injections (30, 31). Research has demonstrated that a low OIP (<15psi) is associated with safe injections in non-neural tissue (32). However, due to the low incidence of post peripheral nerve block injury, robust in vivo human data confirming the effectiveness of pressure monitoring to prevent PNI is lacking (33). Furthermore, the debate regarding the ideal pressure monitoring system is ongoing. Subjective ‘syringe-feel’ pressure monitoring has been proven inaccurate (34). Unfortunately, in line pressure monitor devices do not reliably represent the pressure at the tip of the needle (35). Although, robust evidence is lacking, the working group considers pressure monitor devices valuable tools to increase safety for which further research is needed (33).

Needle type : we recommend the use of short-bevel needles as nerve and fascicle puncture are less likely to occur (36).

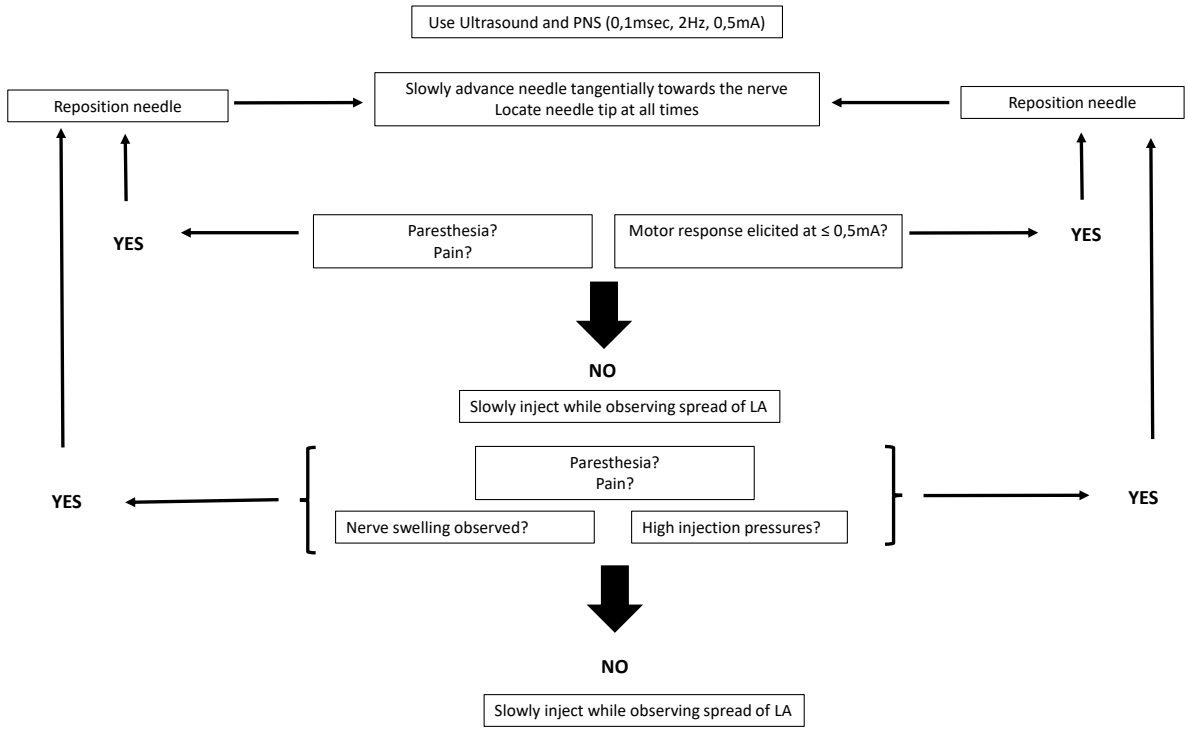

Figure 2. — Flowchart for performance of PNB.

— Needling Technique

Both in-plane and out-of-plane needling techniques can be used during ultrasound guided PNBs. However, the trajectory of the needle tip can be followed during the entire procedure with an in-plane technique.

According to the PNB working group the following points require special attention during the performance of PNB (Figure 2) :

- Always advance the needle slowly.
- The performer should be aware of the location of the needle tip at all times.
- A tangential approach to the nerve may minimize the possibility of nerve puncture (37).
- Use hydrolocalization and/or hydrodissection to confirm correct needle positioning and spread of LA, this advice is even more pertinent when performing fascial plane blocks.
- The presence of paresthesia or pain should prompt cessation of needle advancement or injection and the needle should be repositioned before injection.
- Reposition the needle when an EMR is obtained with a current of 0.5mA or less.
- Stop the injection and reposition the needle when nerve swelling is observed during injection.
- Avoid injections against high pressure (30).
- Follow the spread of the LA throughout the injection.

— Prevention of LA systemic toxicity

It has been demonstrated that ultrasound reduces the incidence of LAST (27). The use of Color Doppler mode to visualize vessels in the needle trajectory before puncturing is recommended to minimize inadvertent intravascular injection and subsequent systemic toxicity.

Aspiration before injection and after every needle repositioning should be performed and fractionated injections of small volumes (<5mL) with repeated aspiration are recommended. Forceful aspiration should be avoided as it could lead to false negative aspiration. Be aware of vein and even artery compression by forceful application of the ultrasound probe, which may impede aspiration of blood while injection is still possible in a compressed vein. It is important to trace spread of the LA solution with ultrasound during the entire procedure. Failure to detect the LA solution during injection can be a marker of intravascular injection.

Epinephrine can be used as a marker of intravascular injection when used as an adjuvant in a concentration of 1/200.000. A minimal of 15 micrograms intravenously is necessary to detect an increase in heart rate of 15/min and pulse pressure of 10 mmHg (10).

Table 1
Maximum recommended doses of LA.

Local Anesthetic	Plain		With epinephrine	
Bupivacaine	2 mg.kg^{-1}	175 mg	3 mg.kg^{-1}	225 mg
Levobupicaine	2 mg.kg^{-1}	200 mg	3 mg.kg^{-1}	225 mg
Lidocaine	5 mg.kg^{-1}	350 mg	7 mg.kg^{-1}	500 mg
Mepivacaine	5 mg.kg^{-1}	350 mg	7 mg.kg^{-1}	500 mg
Ropivacaine	3 mg.kg^{-1}	200 mg	3 mg.kg^{-1}	250 mg
Prilocaine	6 mg.kg^{-1}	400 mg	8 mg.kg^{-1}	600 mg

Concentrations of 5 micrograms per milliliter (1/200.000) are not associated with ischemic (neurotoxic) effects in healthy patients, data regarding safety of epinephrine in patients with pre-existing neuropathies are lacking (38).

— Advice on the use of additives and against the mixing of LAs

Perineural additives are widely used in regional anesthesia and analgesia. They are used to prolong the duration of the block, reduce pain scores, reduce analgesic requirements and improve overall patient satisfaction. However, these benefits must be balanced against the neurotoxic potential of additives and their undesirable systemic effects.

It is important to note that all commonly used additives for PNBs are not licensed for perineural use. The working group only provides information regarding the most effective additives.

Dexamethasone, a long-acting glucocorticoid, prolongs the analgesic duration of a PNB regardless of the route of administration. In the absence of evidence confirming the safety of perineural dexamethasone, intravenous administration is recommended as it similarly prolongs analgesia compared to perineural administration. An intravenous dose of 0.1mg/kg of dexamethasone is recommended to prolong analgesia with 8 hours (39).

The alpha receptor agonists clonidine (2hrs) and dexmedetomidine (6hrs) effectively prolong the duration of analgesia after perineural administration. Clonidine and to a lesser extent dexmedetomidine, is however associated with a high incidence of undesirable systemic effects such as bradycardia, hypotension and sedation (40, 41).

The partial μ-opioid receptor agonist buprenorphine prolongs the duration of analgesia with 6 hours, however its perineural use is associated with a 5 times higher incidence of PONV compared to a control group (42).

In accordance to recent international recommendations, the mixing of LAs is not advised (13). The presumed benefits like shortened onset times and block success could not be demonstrated in the literature. Furthermore, clinicians should be aware of the potential of additive toxic effects (43).

— Maximum doses of LAs

Maximum recommended doses have been advised by manufacturers, but their scientific basis has been questioned. Plasma concentrations differ according to the rate of absorption which depends on the site of injection (Rate of absorption : intrapleural > intercostal > caudal > epidural > brachial plexus > femoral/sciatic > subcutaneous > intra-articular > spinal) and the injection technique (44). Other risk factors for toxicity are extremes of ages, total mass of LA deposition, low protein binding, cardiac conduction disorders, heart failure with low perfusion states, hepatic dysfunction, metabolic diseases such as uremia with metabolic acidosis (10). As definitive recommendations regarding doses cannot be provided, the working group urges clinicians to use the lowest effective dose when performing a PNB. Subgroups of patients (e.g. pregnant, frail, malnourished, pediatric patients, the elderly and patients with hepatic or renal disease) have an increased risk of systemic toxicity as higher free plasma fractions of LAs can occur, these subgroups require special attention and vigilance.

The maximum recommended doses presented in Table 1 may serve as a general guideline.

— Neurotoxicity of LAs

The neurotoxic potential of LAs has been extensively described in both in vitro and in vivo studies (45, 46). The use of higher concentrations and longer exposure times play an important role in the pathophysiological processes (44). The working

group recommends the use of the lowest effective concentration of LAs, especially when continuous techniques are used (Table 1) (20, 47).

Patients with pre-existing neuropathies are particularly at risk of nerve injury induced by LAs. In these patients PNBs can be used, however a risk benefit analysis should be performed by the clinician and the patient should be informed of the higher risks.

— Exclusion criteria of peripheral nerve blocks

The sole absolute contraindications for PNB performance are refusal of the patient and infection at the puncture site. Regarding the performance of PNBs in patients receiving antithrombotic or thrombolytic therapy, we would like to refer to the guidelines provided by the American Society of Regional Anesthesia and Pain Medicine which have been recently updated (48).

Relative contraindications can be patient related (e.g. pre-existing neuropathies, diabetes, alcoholism, previous chemotherapy, …) or block related (e.g. interscalene block for patients with severe pulmonary pathology, femoral nerve block and need for early mobilization). In these patients PNBs can be used however a risk benefit analysis should be performed by the clinician and the patient should be informed of the higher risks.

TOPIC 4 : Postoperative Care

Peripheral nerve blocks provide superior pain relief with a lower incidence of side effects leading to faster and higher quality recovery and rehabilitation compared to general anesthesia. Patients recovering from PNBs must meet the same discharge criteria as patients recovering from general anesthesia. However, these patients must also fulfill additional criteria to ensure safe ambulation especially after lower limb nerve blocks. Furthermore, patients and their direct caregivers will need specific instructions on discharge from the hospital.

— PACU discharge criteria

The post-anesthesia care unit (PACU) is an expensive and labour-intensive environment. PNBs may allow a complete bypass of the PACU in the ambulatory setting. The use of an objective assessment tool with predefined discharge criteria is recommended. As many patients will fulfill the criteria for immediate discharge after surgery, the PACU can be bypassed in selected cases. We strongly recommend that patients are monitored at least 30 minutes after block performance. Further follow up after PACU discharge is strongly recommended, especially in patients with peripheral nerve catheters. This follow-up should be performed according to local policy, preferably by an Acute Pain Service providing 24/7 care.

— Hospital discharge criteria and recommendations

Similar to PACU discharge, post anesthesia scoring systems can be used for discharge from the hospital, the modified PADSS (post anesthesia discharge scoring system) is an example of such a discharge score. However, certain points require special attention and the working group recommends that patients are adequately informed regarding the risks and expected postoperative course after PNBs.

After single-injection nerve blocks, patients should be warned of the consequences of the effects of a sensory and motor block. Patients should be advised to respect the necessary precautions to prevent self-inflicted harm. Patients who undergo upper extremity blocks should be discharged with a protective sling. Patients with femoral nerve or lumbar plexus blocks and persistent quadriceps weakness at the time of discharge should be sent home with a knee immobilizer, crutches and the advice not to bear weight on the affected extremity.

Furthermore, information on the natural course of resolution of the peripheral nerve block should be provides as well as signs of possible nerve injury. These include new onset of pain, weakness, numbness, paresthesia or other abnormal sensations lasting beyond the expected duration of the specific block. Finally, an adequate analgesic regimen should be prescribed and patients should be informed on the postoperative analgesic protocol, including intake of analgesics prior to the expected resolution of the block.

For patients with continuous PNBs, the decision to send a patient home with a portable perineural infusion should be made very carefully following a strict protocol. Successful management of CPNB catheters at home should include detailed written instructions, daily telephone follow-up and contact information of a healthcare provider familiar with these techniques who is available 24/7.

— Follow up after discharge

It is advised to follow up on the patient the next day to assess block resolution or persistent symptoms, current level of pain, adequacy of pain

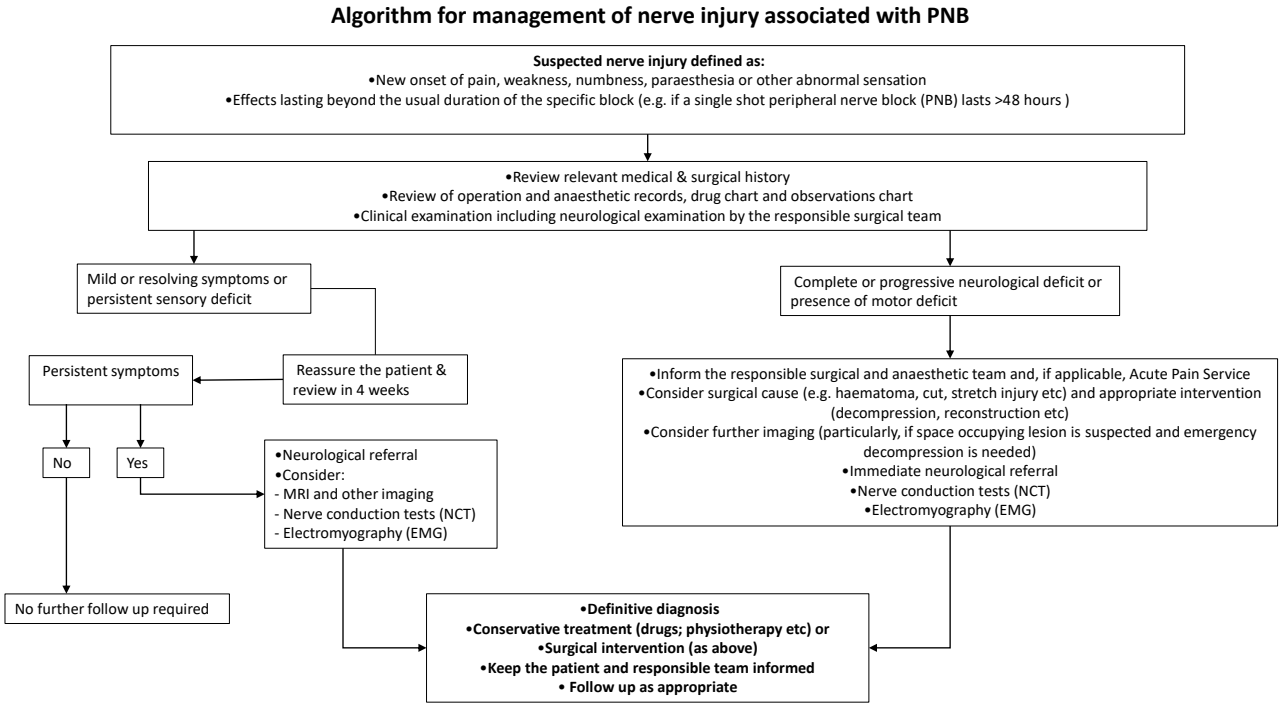

Figure 3. — Algorithm for management of nerve injury associated with PNB. Adapted with permission from RA-UK.

relief, and overall satisfaction with postoperative recovery.

TOPIC 5 : Peripheral nerve injury

— Incidence and risk factors

Early transient postoperative neurological symptoms such as paresthesia occur frequently with an incidence up to 15%. Fortunately, neurological symptoms resolve over time (0-2.2%, 0-0.8%, 0-0.2% at three, six and twelve months respectively) and rarely result in permanent injury (0.014-0.04%) (20, 22, 49)

As it is beyond the scope of these guidelines, the working group refers to the extensive description of the pathophysiological mechanisms by Brull et al. (29).

Peripheral nerve blocks are not an independent risk factor for peri-operative nerve injury. Peri-operative nerve injury can be linked to positioning, surgical, anesthetic or patient related factors. The risk is higher after orthopedic, cardiac, and neurosurgical procedures and in patients with specific comorbidities (e.g. pre-existing neuropathies, diabetes, extremes in weight, tobacco use, hypertension, …). Pre-existing neuropathies should be evaluated on an individual basis. They are present in 2-8% of the general population, increasing to 58% of patients with type I diabetes (49).

— Symptoms and follow up management

Symptoms of suspected PNI may be highly variable in onset and severity and may range from mild paresthesia and numbness to severe persistent pain or full sensory and motor loss. In such patients the medical and anesthetic file should be thoroughly reviewed. A complete clinical neurological examination with special attention to the distribution of symptoms is important to evaluate the location and etiology of a possible injury. This will often allow clinicians to differentiate block related nerve injury from other causes of peripheral nerve injury (e.g. peroperative compression neuropathies).

Prompt risk stratification to identify cases that require urgent attention is essential. Possible reversible factors (e.g. extrinsic compression by tight dressing, compartment syndrome, hematoma) should be immediately identified and appropriately managed. Urgent imaging (ultrasound, CT-scan) or compartment pressure measurement can be considered in selected cases. Recognition of nerve injury may be delayed in cases with excessive sedation, pain, strong analgesics, continuous catheters or in ambulatory surgery.

The working group strongly advises to develop a protocol on the management of suspected PNI injury. This protocol should include the following recommendations :

- Focus on patient information and support, remain available for short and long term follow up during the course of PNI.
- If only mild sensory symptoms are present in the distribution area of the block or a known site of compression, the patient can be reassured and reviewed in 4 weeks by a neurologist.
- If complete or progressive sensory or motor deficit is present, or if the deficit is difficult to localize then early neurologic consultand follow up is advised. Electrophysiological studies (nerve conduction tests, electromyography), performed by the neurologist, can only reveal abnormalities after 3 weeks, when sufficient signs of Wallerian degeneration appear. Nevertheless, those studies can be requested earlier to provide a baseline electromyography (EMG) and as EMG changes can detect and differentiate with preexisting neuropathies.
- There is no evidence of any pharmacological therapy to enhance neuro-regeneration. Only conservative measures like analgesics and physical therapy to maintain muscle mass and prevent contractures are beneficial.
- When no improvement occurs after 3-5 months, referral to a peripheral nerve surgeon should be considered.

[Figure 3 : Management algorithm of suspected PNI]

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