PAR PERIOPERATIVE ANESTHESIA REPORTS

NARRATIVE REVIEW

Regional anesthesia overview: historical aspects, dissemination, and safety

Pedro Paulo Kimachi[1,2], Marcio Matsumoto[1,2], Raquel Chacon Ruiz Martinez[1,3]

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ABSTRACT

Regional anesthesia has been widely debated in the literature. This article presents a brief historical overview of regional anesthesia, including critical aspects for its dissemination. In addition, local anesthetics with less neuro and cardiotoxicity and techniques initially guided by electrical stimulation, later followed by ultrasound-guided regional anesthesia, are discussed. Finally, the main recommendations for safety are considered.

KEYWORDS

Regional anesthesia; history of regional anesthesia; safety recommendations

INTRODUCTION

History of regional anesthesia

"Regional anaesthesia always works—provided you put the right dose of the right drug in the right place"[1].

The above aphorism concisely reflects the history of regional anesthesia from its inception to the present day. The development of regional anesthesia occurred in 1884 when Koller discovered the local anesthetic properties of cocaine by instilling a cocaine solution in the eye[2]. Subsequently, Corning, in 1885, tried to inject cocaine into the epidural space unsuccessfully[3].

August Bier tried for the first time to inject cocaine into the subarachnoid space, and all patients developed post-dural puncture headaches, discouraging the use of this technique. Later, he performed the spinal block on his assistant, and the assistant also performed the block on Bier. Both evolved with vomiting, vertigo, and headache symptoms for four consecutive days[4].

It has been documented that Barker[5] described 2000 blocks performed by Tuffier in France and 1000 cases by Bier in Germany. Also, H. Tyrrell Gray, superintendent of the Hospital for Sick Children, London, published results involving more than 200 cases of subarachnoid anesthesia in children[6,7]. At that time, surgeons supervised the administration of general anesthesia and, at the same time, performed the anesthetic blocks.

Gaston Labat, a French surgeon, taught regional anesthesia at the Mayo Clinic, having written a book that became a reference in the area: "Regional anesthesia: its technique and clinical application"[8]. Still, in 1924, John Lundy was the first anesthesiologist and coordinator of the Anesthesia Sector at the Mayo Clinic.

[1] Hospital Sírio-Libanês, Division of Neuroscience, Sao Paulo, Brazil
[2] Hospital Sírio-Libanês, Anesthesiology Medical Center, Sao Paulo, Brazil
[3] University of São Paulo, School of Medicine, Institute of Psychiatry, Laboratory of Psychopathology and Psychiatric Therapeutics (LIM/23), Sao Paulo, Brazil

One of the most critical aspects of regional anesthesia was the discovery of safer local anesthetics since cocaine use caused serious adverse effects, especially addiction, and was highly toxic. Alfred Einhorn, patented, in Germany, 18 para-aminobenzoic acid derivatives, and compound number 2, procaine, was tested and cited for the first time by Professor Heinrich Braun, with excellent results for that time. Consequently, procaine was introduced as an anesthetic in clinical practice due to improved safety[9]. Subsequently, Nils Loefgren and Bengt Lundquist developed a xylidine derivative called lidocaine, a class of amide-type local anesthetics. Then, mepivacaine and bupivacaine were developed in 1957, prilocaine in 1969, and etidocaine in 1972[9]. The most up-to-date local anesthetics are ropivacaine and levobupivacaine, having less neuro and cardiotoxicity.

DISSEMINATION OF REGIONAL ANESTHESIA USE

As the aphorism mentioned above, the fundamental requirement of regional anesthesia is the precise distribution of the local anesthetic close to a nerve structure, directly or indirectly[10]. The first reports of peripheral blocks at the beginning of the 20th century involved percutaneously positioning the needle in relation to the nervous structure through anatomical repairs in studies using dead bodies. In addition to the reported paresthesia by the patient when the needle tip approached (or touched) the nerve structure.

From the 1980s onwards, regional anesthesia was popularized using electric stimulation. This portable device could generate an electric current at the tip of the needle, eliciting a motor response consistent with the investigated nervous structure and increasing the chance of a successful blockade. Thus, electrostimulation became the gold standard for identifying nervous structures. However, the technique was still at risk of failure during blocks and did not prevent injuries by direct puncture of nervous structures[11].

In recent decades, regional anesthesia has advanced significantly, particularly after the introduction of ultrasound-guided regional anesthesia[12,13]. The first report of ultrasound-guided regional anesthesia was in 1978, and its use has increased dramatically due to the image resolution quality and portability of ultrasound devices. Thus, safety and efficacy in performing the blocks were observed, with better dispersion of the local anesthetic around the nerve targets and decreased risk of injury to adjacent structures[10,13,14]. Also, the increase in the duration of the blockade, the decrease in the latency time, and the reduction in opioid consumption were observed[12-15].

REGIONAL ANESTHESIA SAFETY RECOMMENDATIONS

Although widely described in the literature, block failure, bleeding/hematoma, neurological injury, and local anesthetic toxicity can occur during regional anesthesia[16].

Safety procedures in regional anesthesia must be followed to avoid infection[17-19]. However, the literature points out that the rate of complications is rare and frequently occurs during the epidural technique performed in patients that are immunocompromised, diabetic, obese, with dental abscesses, abusers of injectable drugs, and on long-term venous catheters users[17,19-21].

Removing jewelry and washing hands properly are recommended prophylactic measures against infections[22-25], as well as the use of sterile gloves and face mask[17,19,26]. Skin antisepsis should be performed, preferably with chlorhexidine, having a superior bactericidal effect than iodophors or polyvinylpyrrolidone iodine[17,26,27].

The primary etiological agent of infectious processes is *Staphylococcus aureus*[28] which can colonize the epidural catheter causing neuraxis infection[21,29]. In contrast, *Staphylococcus epidermidis* is associated with phlogistic signs at the insertion of the catheter in the peripheral nerve[30,31].

To minimize the risks of infection, we use the following precautions during regional anesthesia[32]: before the procedure, a solution of 2% chlorhexidine with 70% isopropyl alcohol must be applied to the skin together with a sterile ultrasound conductive gel. The operator must wear sterile gloves, a face mask, and a sterile cover on the transducer (transparent film) should be applied. Before and after each procedure, the ultrasound device must be adequately cleaned and disinfected[33]. Figure 1 illustrates the process for regional pericapsular nerve group block (PENG Block) guided by ultrasound and the safety recommendations.

After carrying out the procedure, the material used should not be reprocessed[18,19].

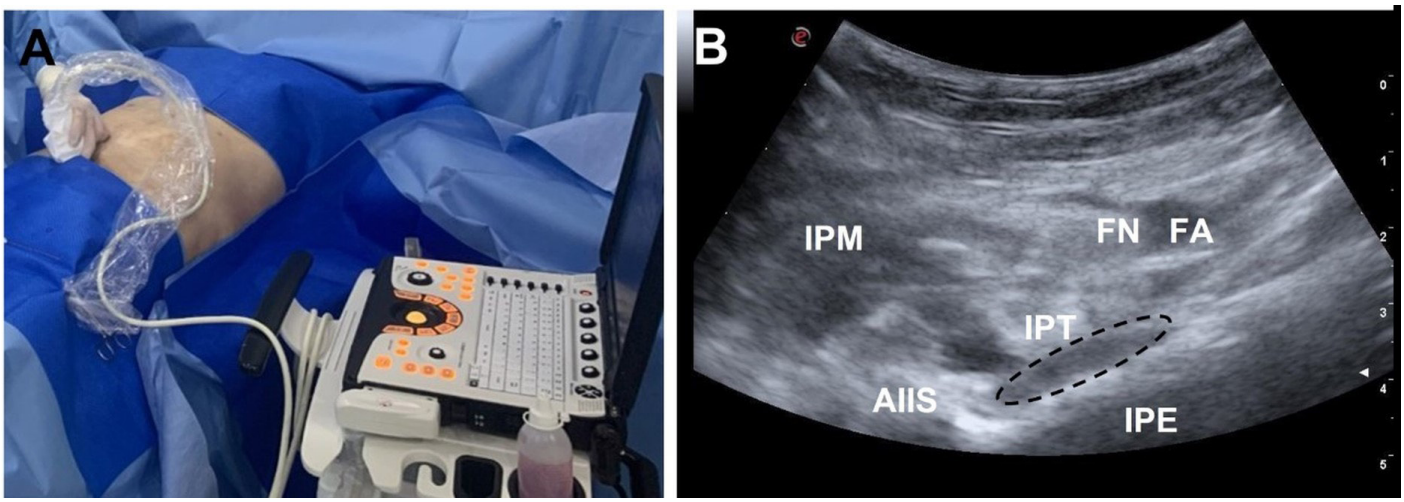

Figure 1. A – image illustrating the use of ultrasound to perform a regional block; **B –** ultrasound image after administration of local anesthetic – shown in the dashed area – for pericapsular nerve group block (PENG block). AIIS: anterior inferior iliac spine; IPE: iliopubic eminence; IPT: iliopsoas tendon muscle; IPM: iliopsoas muscle; FA: femoral artery; hatched area: dispersion of the anesthetic.

CONCLUSION

This work provides subsidies for understanding the beginning of regional anesthesia use and the critical factors for its wide dissemination, including the development of local anesthetics with less neuro and cardiotoxicity and the electro stimulator use. Next, we discussed the use of ultrasound in regional anesthesia and, finally, the safety recommendations.

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Correspondence
Raquel Chacon Ruiz Martinez
Hospital Sírio-Libanês, Division of Neuroscience,
69, Professor Daher Cutait, Sao Paulo, Brazil
Phone: +55 11 98288-5251
quelmartinez@yahoo.com.br