



Update Article

Is it safe to use local anesthesia with adrenaline in hand surgery? WALANT technique[☆]



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ABSTRACT

In the past it was taught that local anesthetic should not be used with adrenaline for procedures in the extremities. This dogma is transmitted from generation to generation. Its truth has not been questioned, nor the source of the doubt. In many situations the benefit of use was not understood, because it was often thought that it was not necessary to prolong the anesthetic effect, since the procedures were mostly of short duration. After the disclosure of studies of Canadian surgeons, came to understand that the benefits went beyond the time of anesthesia. The WALANT technique allows a surgical field without bleeding, possibility of information exchange with the patient during the procedure, reduction of waste material, reduction of costs, and improvement of safety. Thus, after passing through the initial phase of the doubts in the use of this technique, the authors verified its benefits and the patients' satisfaction in being able to immediately return home after the procedures.

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É seguro o uso de anestésico local com adrenalina na cirurgia da mão? Técnica WALANT

R E S U M O

Aprendemos que não deveríamos usar um anestésico local com adrenalina para procedimentos nas extremidades. Esse dogma é transmitido de geração em geração. Não questionávamos a sua veracidade ou a origem da dúvida. Em muitas situações não entendíamos o benefício do uso, pois muitas vezes pensávamos não ser necessário prolongar o efeito anestésico, já que os procedimentos eram, na sua maioria, de curta duração. Após a divulgação de estudos dos cirurgiões canadenses, passamos a entender que os benefícios se estendiam além do tempo de anestesia. A técnica Walant permite um campo cirúrgico

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sem sangramento, possibilidade de troca de informações com o paciente durante o procedimento, redução de material de descarte, redução de custos e melhoria da segurança. Dessa forma, após passar pela fase inicial das dúvidas quanto ao uso dessa técnica, verificamos os seus benefícios e a satisfação dos pacientes em poderem retornar de imediato para casa após os procedimentos.

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Introduction

There is a growing interest in performing hand and wrist surgical procedures with local anesthesia without sedation. Studies have demonstrated that surgical procedures can be performed safely and on an outpatient basis. Experience has shown that the use of local anesthesia with epinephrine, in addition to providing safety, allows intraoperative control of movement and assessment of function during tendon repair or transfer procedures.

This article aimed to discuss possibilities and concepts, and to assess the safety and the techniques of local anesthetic use with epinephrine in hand surgery. Patients operated with this type of anesthesia do not require sedation, which allows an exchange of information during the procedure, active movement of the operated limb, and a faster hospital discharge after surgery.¹

What is the 'wide-awake' or WALANT technique?

The term wide-awake indicates that the hand surgery is performed with the patient fully awake. WALANT is the acronym for 'wide-awake local anesthesia no tourniquet'. WALANT is the current preferred term to indicate that the procedure is performed with the patient in a non-sedated state, under local anesthesia and without tourniquet. In this technique, only two drugs are used, lidocaine and epinephrine.²

Adrenaline or epinephrine

Epinephrine, also known as adrenaline, is a sympathomimetic hormone and neurotransmitter³ derived from the modification of an aromatic amino acid (tyrosine) secreted by the adrenal glands, so called because they are positioned above the kidneys. The name adrenaline comes from *ad-* (prefix that indicates proximity), *renalis* (pertaining to the kidneys), and the suffix *-ine*, which applies to certain chemical substances (amines).

It affects both the beta-1 adrenergic receptors (cardiac) and beta-2 adrenergic receptor (pulmonary). It has alpha-adrenergic properties that result in vasoconstriction. In Brazil, the name adrenaline is preferred.

Hemostasis instead of a tourniquet for hand surgery

Many hand surgeons have switched from traditional surgery with a tourniquet and sedation to the WALANT technique. Lidocaine and epinephrine are the only drugs injected for anesthesia and hemostasis at the dissection sites, and at the Kirschner wires insertion sites in osteosynthesis.

Benefits of WALANT

- (1) No use of sedation or tourniquet, which increases patient comfort and convenience. Patients can have their hands operated similarly to a small procedure at the dentist.
- (2) The elimination of the anesthesiology/sedation components decreases the surgical time for the procedures in the treatment of carpal tunnel syndrome, De Quervain's tenosynovitis, and trigger finger.
- (3) During the procedure, the possibility of observing and correcting sutured tendons and of verifying the stability of an osteosynthesis with the full range of active movements, and with the patient in a comfortable and cooperative position, allows better results in tendon repair, tendon transfer, and fixation of phalangeal fractures.
- (4) WALANT is not indicated for all patients, but most of those who can undergo dental treatments without sedation can also have their hands operated on using this technique.¹

Is it safe to use epinephrine in the finger?

The safety of epinephrine use in the finger implies no need to use tourniquet.

The rise and fall of the myth of the danger of injecting epinephrine in the finger goes back to before the 1950s, when surgeons believed that epinephrine caused finger necrosis. This dogma has spread and rooted in the teachings in medical schools, where it was common to teach that epinephrine should not be injected into the extremities (fingers, nose, penis, and feet). Evidence-based medicine has already cleared this misconception. The following is the story of how this happened.

The myth

The source of the epinephrine myth, which arose between 1920 and 1945, resulted from the use of procaine (Novocaine).⁴

It was “the new ‘-caine’,” invented in 1903 to replace cocaine. This local anesthetic was used until 1948, when lidocaine, which has a safer profile, was introduced. Procaine started with a pH of 3.6; when stored for a long time, it would acidify, and its pH would reach as low as 1. It was this acidity that caused finger necrosis, not the use of epinephrine.⁵ The Food and Drug Administration (FDA) of the United States reported in the *Journal of the American Medical Association* that they had found procaine lots for injection in humans with a pH of 1.⁶

Is it possible to reverse the effect of epinephrine?

Evidence shows that phentolamine, an alpha blocker that became available in 1957, reliably reverses the vasoconstrictor action of epinephrine.⁷ However, its use is seldom necessary in clinical practice.⁸

The literature features studies in which epinephrine has been used without inducing necrosis.^{8,9}

Furthermore, no cases of necrosis were reported even with high doses of epinephrine (1:1000) after accidental injections of epinephrine into a finger.^{10,11}

Therefore, epinephrine is unlikely to cause damage to the fingers at a concentration of 1:100,000. More cases of finger injuries have been reported from improperly used digital tourniquets than from lidocaine with epinephrine.^{12,13}

Safe dosage of lidocaine with epinephrine

- The most widely reported dose of lidocaine with epinephrine is 7 mg/kg. This dosage had already been suggested before 1950, at the beginning of the use of lidocaine. Since then, Burk et al.¹⁴ reported safe blood levels of lidocaine when 35 mg/kg are injected for liposuction.
- Since most patients submitted to WALANT are operated on an outpatient basis, the authors suggest the use of dosages within the very safe limit of 7 mg/kg for most hand surgeries. In a 70-kg adult, this means:
- Safe dosage: lidocaine/epinephrine.
 - <50 mL: 1/100,000
 - 50-100 mL: 0.5/200,000
 - 100-200 mL: 0.25/400,000

The concentrations of premixed epinephrine with lidocaine vary by country.

- In Canada and in the United States, the anesthetic is premixed as 1% lidocaine with 1:100,000 epinephrine.
- To date, 1% lidocaine with 1:200,000 epinephrine is available as a pre-mixed solution in many European countries and this works very well for surgeons. In Israel, lidocaine premixed with epinephrine is not available, and the mixture has to be made by surgeons themselves. In Hong Kong and Brazil, 2% lidocaine with 1:200,000 epinephrine is available as premix. In Egypt, premixed 2% lidocaine with 1:100,000 epinephrine is available, while in Indonesia, the premix 2% lidocaine with 1:80,000 epinephrine is available.

- There is still no evidence in the literature that proves an ideal and unique epinephrine concentration.

How to inject local anesthetic with minimal pain

It is possible and easy to learn and teach medical students and residents how to inject local anesthetic for hand surgeries. The authors use a thin needle (13 × 4.5) and minimize the pain of the first pinch. Patients will greatly appreciate the physician having invested the time needed to learn the ten simple rules listed below. The most important are rules 7 through 10. Patients will be surprised and captivated with the small amount of pain they will feel during the injections.¹⁵⁻²⁷

RULE 1. Buffer: 1% lidocaine, 1:100,000 epinephrine, and 10:1 8.4% sodium bicarbonate.

RULE 2. Do not use a refrigerated local anesthetic.

RULE 3. Local anesthesia with small needle (13 × 4.5).

RULE 4. Create a sensory distraction in the injection site.

RULE 5. Stabilize the syringe with both hands and keep the thumb ready to press the plunger to avoid the pain of a moving needle.

RULE 6. Inject 0.5 mL with a needle perpendicularly just below the dermis and then pause until the patient reports that the pain of the pinch has disappeared (Fig. 1).

RULE 7. Never let the needle progress in front of the local anesthetic (*blow slow before you go*) (Figs. 2 and 3).

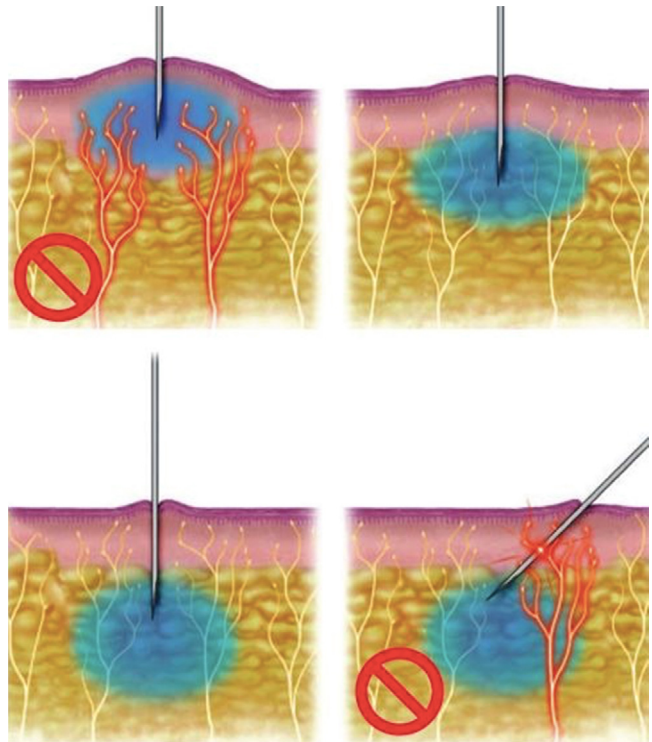


Fig. 1 – Injection technique. The needle penetrates perpendicular to the skin and below the dermis. The tilt will only be made after blocking (Courtesy Donald Lalond).

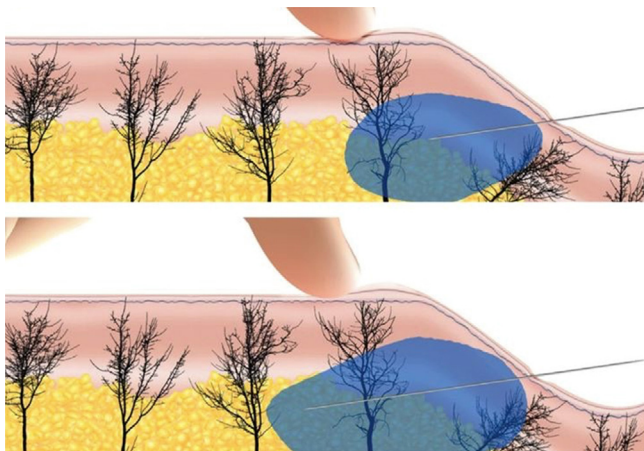


Fig. 2 – “Blow slow before you go” injection technique. The anesthetic is injected slowly before the needle is progressed. In this way, the nerve endings will be blocked by the anesthetic and the process will be painless (Courtesy Donald Lalond).

RULE 8. Reinsert the needle at least 1 cm into the already injected area. This can be defined by palpation or assessing the color of the skin;

RULE 9. Ask each patient to give a score (0–10) regarding the intensity of pain during the injection of the anesthetic.

RULE 10. More local anesthetic is better than insufficient local anesthetic.

Palmar and dorsal scars and folds are natural barriers to the diffusion of the local anesthetic solution

- The local anesthetic does not diffuse well into the scars. It will often be necessary to inject local anesthetic on both sides of a linear scar. For markedly scarred areas, the surgeon should try to initiate the injection from the proximal to distal and into healthy subcutaneous tissue, and then finish under the scar if necessary.



Fig. 3 – Blockade with lidocaine and adrenaline 30 min before the surgical procedure for carpal tunnel release.

- All natural skinfolds on the hand and wrist, as well as the folds between the fingers and palm, have ligaments that attach the skin to deeper structures, such as the flexor sheaths. These can slow the diffusion of the swollen local anesthetic to the other side of the fold. The local anesthetic will cross below the skinfold, but only slowly, under pressure, and at large volumes. It is sensible to inject on both sides of the natural folds, from proximal to distal, to decrease the injection pain (Fig. 4).

Epinephrine and vasovagal syncope adverse reaction

Although lidocaine and epinephrine are probably two of the safest medications in use, injecting them can cause relatively common side effects. After injection of local anesthetic with epinephrine, the patient may experience symptoms of agitation, tremors, and nervousness. The vasovagal reaction may appear in response to needle penetration.

Loss of consciousness or fainting after a vasovagal syncope occurs because there is not enough blood going into the brain. Nature's solution, fainting, brings the head down to allow more blood to reach the brain through the effect of gravity.

A simple change of bandages or the removal of a plaster cast may cause fainting. The pinch of a needle, with or without local anesthesia, is also another common trigger for fainting (vasovagal syncope).

If the patient shows signs that he/she is about to faint, more blood can be sent to the brain with simple gravity-shifting maneuvers.

If the patient is sitting, the surgeon can ask him/her to lie down. Injection of anesthetic in the seated position is not recommended.

If the patient is lying down, he/she can be asked to place the hands under the knees and raise them by flexing the hips and knees, so that the blood from the lower limbs increases cerebral irrigation.

The surgeon should remove the pillow under the patient's head and place it under his/her feet.

The surgeon can also lean the head of the bed to the Trendelenburg position (head down and feet up).^{28,29}

Tips on how to talk to patients about WALANT

For patients, the fear of the unknown and anxiety about pain are the two main concerns of being awake during the hand surgery. However, if the process is explained to patients calmly, clearly, and confidently, the fear of the unknown can be overcome. By gaining knowledge of the procedure, the patient can feel like an active participant in the treatment process, awake and cooperative. If the local anesthetic injection happens as described above and with a fine needle, the patient will be surprised at how brief and mild the discomfort will be.

Patients must be informed about the day of surgery.

The length of hospital stay will be shorter than in a sedation procedure.

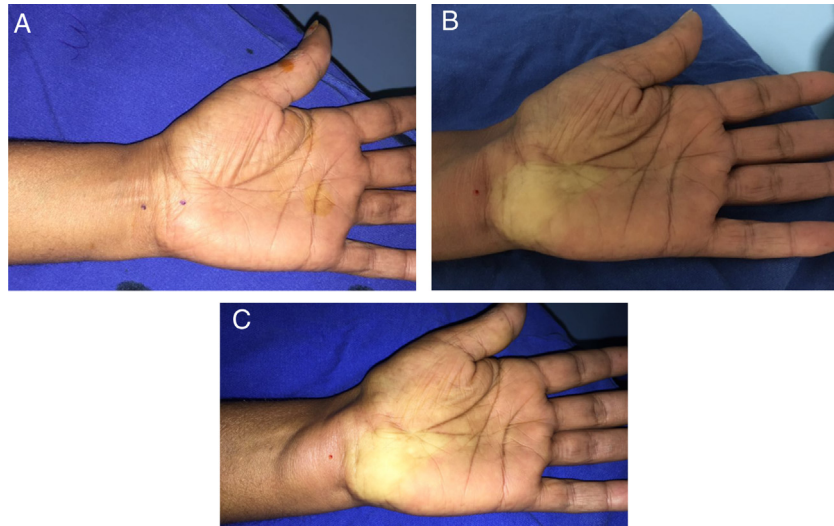


Fig. 4 – (A) Blockade with lidocaine and adrenaline proximal and distal to the wrist fold; (B) beginning of the vasoconstriction effect after 15 min; (C) complete effect after 30 min.

The patient may talk to the physician during the injection of the local anesthetic. A slow injection will be less painful.

After finishing the injection, the patient may feel a little nervous or a bit agitated, as if they have had too much coffee. They should be informed that this is not an effect of being nervous, but rather the fact that there is a bit of epinephrine in anesthetic medication. This sensation is completely normal and not dangerous. If this happens, it is important to mention that it will disappear in 5–30 min, and that it does not mean that something is wrong.

The patient should be informed that they will feel their hands cold and moist and that, during the surgery, they will feel pulling and moving in the operated site.

After surgery, they will simply get up and go home; their hand will feel as if it was bigger than their heart. The patients will have some restriction. They should keep the limb elevated to reduce swelling and pain.

Talking to patients during surgery

When hand surgery is performed with sedation, it is not possible to guide patients during the procedure. Sedation does not allow the patient to remember what the physician spoke to them due to drugs that cause amnesia. When using the WALANT technique, orientation passed to the patient during surgery is found to be very useful. During the procedure, surgeons can guide their patients about post-operative care and on how to avoid complications.

The time spent talking to patients during surgery is a time saved before or after surgery.

This time will help to reduce the complications that could take place in the postoperative period.

Things that should not be said or done during surgery

Never say something like “oops.” Surgeons must create an atmosphere of calmness, efficiency, and competence.

A silent surgeon may seem quite competent, while the one who talks a lot without listening to the patient cannot reassure him/her.

The patient will be fully awake and attentive to everything that happens. Therefore, when ordering instruments from the room nurse, surgeons must do so using signs or terms such as “number 15” instead of “scalpel blade 15”. “Single hook” should be used instead of “skin hook”.

The surgeon should avoid passing compresses, gauze, or instruments with blood in front of the patient.

Sterile surgical drapes for simple cases

In the sterile surgical field, small drapes sheets that are the size of compress sponges are used (fenestrated 40 cm × 40 cm sheet). The surgeon wears a mask and sterile gloves, and does not wear a sterile apron. Therefore, only the drape used will be sterile, as in skin cancer removal procedures. Studies have shown that, for some hand surgery procedures, the sterile drape is sufficient, does not increase the risk of infection, and reduces the cost by four times or more.³⁰⁻³³

The use of the surgical ward is justified by the sterility required in cases of osteosynthesis, complex tendon transfers, tendon reconstruction procedures, arthroplasties, or large reconstructions in the hand.

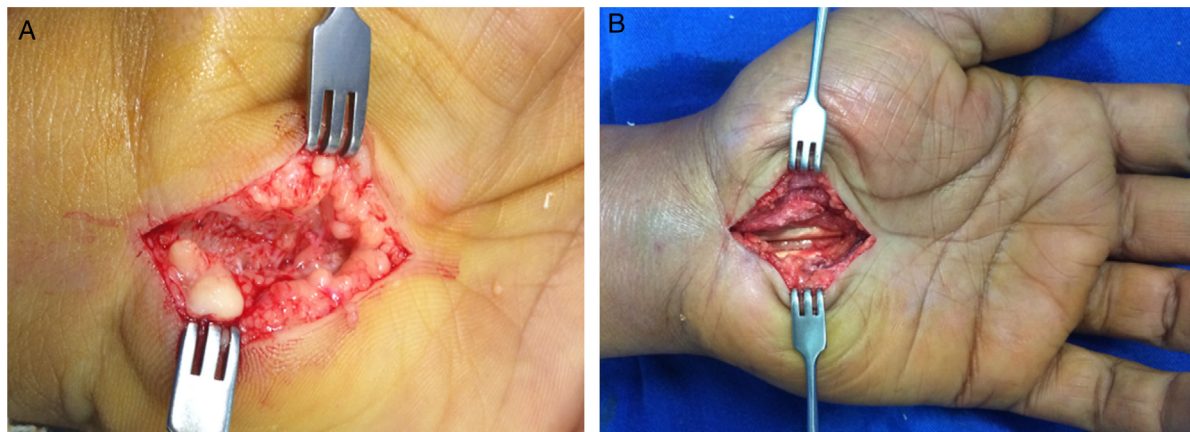


Fig. 5 – (A) Carpal tunnel release approach under lidocaine/adrenaline effect; (B) after the procedure and still under lidocaine/adrenaline effect, maintaining a bloodless operating field.

Increased revenue and reduced costs with WALANT

- If the need of a tourniquet is eliminated and a local anesthetic is injected in an almost pain-free procedure, the two main reasons for the need of sedation in most hand surgeries are removed. Once patients understand the benefits of WALANT, most will not want sedation for hand surgery (Fig. 5).
- The elimination of sedation also means that many hand surgeries can be easily performed in smaller procedure rooms, where only the operative field is sterile, in the same way as skin tumors are removed.
- The elimination of the tourniquet, sedation, and the need for a completely sterile room for hand surgery when using WALANT increases patient safety and convenience while lowering costs. It reduces unnecessary spendings and more patients will benefit from hand surgeries.³³
- Eventually, insurance companies and governments will understand that sedation is not necessary for many hand surgeries. They will become receptive to the concept of increasing patient safety and convenience while lowering costs.
- Over time, insurance companies and governments will be made aware of evidence-based medicine that supports the concept that a sterile field is safe and far less expensive for many hand surgeries. This will lower costs.
- Negotiation between health care providers, insurers, and the government will be necessary so that some surgeries can be performed using the WALANT technique in simpler operating rooms. Certainly, everyone will be receptive to the concept of increasing patient safety and convenience while lowering costs.

The accreditation process for a surgical room that does not use sedation is less expensive than that of a facility that uses sedation or general anesthesia. If sedation is not used, the costs of its equipments and medications disappear.

Final considerations

Surgical procedures of the hand with the patient fully awake are being practiced by a growing number of hand surgeons in most countries of the world. This number is increasing because the technique is safer, more convenient, and much more accessible for both patients and surgeons.

These innovations depend on the cultural changes of physicians, patients, institutions, and healthcare plans or insurers responsible for the costs of the procedures. Surgeons must remember that they are also responsible for the costs. Most surgeons who have tested WALANT continue to use it.

Conflicts of interest

The authors declare no conflicts of interest.

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