

Wide Awake Technique versus Local Anesthesia with Tourniquet Application for Minor Orthopedic Hand Surgery: A Prospective Clinical Trial

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Background: Most minor hand operations can be performed with local anesthesia and tourniquet. Some literature supports this concept based on the belief that the "patient can tolerate it". Nowadays, the wide-awake technique with epinephrine-contained lidocaine is safe. This technique does not need a tourniquet because epinephrine provides local vasoconstriction.

Objective: The present study was designed to compare patients' comfort and effectiveness of local anesthesia as well as bleeding at the surgical site between wide-awake anesthesia and local lidocaine with tourniquet application.

Material and Method: Prospective Clinical Trial was performed in 60 patients who received outpatient surgery for common hand problems at Maharaj Nakorn Chiang Mai Hospital. With randomization, 30 patients were in wide-awake group, who received adrenaline-contained lidocaine as a local anesthetic agent, with tourniquet wrapping but with no pressure applied (group 1). The other 30 patients were in the conventional group that received lidocaine (no adrenaline) and a 250-mmHg tourniquet application (group 2). Operations were performed with standard methods. Visual analog scores, surgical field bleeding, amount of bleeding, any complications within 4 weeks were recorded.

Results: There are no significant differences between the two groups in terms of patient profiles (sex, age and diseases), injected site pain and surgeon's opinion of surgical site bleeding. Tourniquet's pain and the amount of blood loss in the conventional group were significantly higher than the wide-awake group.

Conclusion: Wide-awake technique (no tourniquet applied) offers better comfort for patients and less total blood loss while providing effective anesthesia and patient safety as with the conventional technique.

Keywords: Wide-awake anesthesia, Carpal tunnel syndrome, Trigger finger, De Quervain's tenosynovitis, Tourniquet arm pain

J Med Assoc Thai 2015; 98 (1): 106-110

Full text. e-Journal: <http://www.jmatonline.com>

A tourniquet is considered an indispensable tool in hand surgery. Many operations in the hand can be performed appropriately under local or regional anesthesia. It has been taught that epinephrine should never be used on the finger and hand areas because there is a risk of vasospasm and digital ischemia⁽¹⁾. Most of the local anesthetic surgeries in the hand and finger use the tourniquet for hemostasis, especially for short-time procedures. Most patients can tolerate a cuff pressure of 250 mmHg for about 20 minutes⁽²⁾. Recent study determined upper extremity tourniquet tolerance in healthy volunteers. They found that the average tourniquet, tolerance time was 19.4 minutes with bandage exsanguinous method and was 24.1 minutes with arm elevation technique⁽³⁾. However, tolerance

may not equal painlessness, and a short-time operation may not reduce non-anesthetic arm's pain⁽⁴⁾.

The advantages of elective epinephrine use on the hands and fingers are temporary hemostasis, enhancing and prolonging the duration of anesthetic agents⁽⁵⁻⁷⁾. The main advantage is hemostasis so the surgery can be performed without the tourniquet or sedation. The term "Wide-awake anesthesia" is used to describe the local injection technique using an anesthetic agent and epinephrine with neither sedation nor tourniquet⁽⁸⁾. It provides patient comfort by eliminating tourniquet arm pain and reducing the risks associated with sedation or general anesthesia for most hand surgeries^(5-7,9). The safeness of epinephrine use on fingers and hands has been reported^(5,10-15). The main conclusion is there are no complications from commercial epinephrine-contained lidocaine from hand-area injections.

The objective of the present study is to evaluate patients' comfort and effectiveness of local

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anesthesia between the two techniques in terms of pain at the surgical site and tourniquet area as well as the amount of bleeding.

Material and Method

From August 2011 to February 2012, prospective-randomized control study was conducted on patients who received surgical treatment at Maharaj Nakorn Chiang Mai Hospital for the diagnosis of carpal tunnel syndrome, de Quervain's disease and trigger finger. The exclusion criteria are patients younger than 18 years old, revision surgery, history of allergy to lidocaine or adrenaline, carpal tunnel syndrome with suspected double crush lesions or proliferative tenosynovitis that required extensive surgery, previous digital artery injury, small vessel diseases, hematologic disorders, and those receiving thrombolytic agents.

After obtaining faculty ethical committee approval for this study, sixty inform-consented patients in Maharaj Nakorn Chiang Mai Hospital were randomly allocated to two groups (30 cases in each group) using a random number table. The patients in the wide-awake anesthesia group (group 1) received 2% lidocaine and 1:80,000 epinephrine (2% Drocanil-A, M&H manufacturing, Samutprakarn, Thailand) as local anesthetic agent. Tourniquet cuff was wrapped at the arm level, however no pressure was applied in this group. While the conventional group (group 2) used 2% lidocaine hydrochloride (GPO, Bangkok, Thailand), tourniquet cuff with 250 mmHg was applied after arm elevation for 5 minutes (during skin preparation). The amount of tourniquet pressure and types of anesthetic agents were blinded to patients and surgeons. Oxygen saturation was measured with pulse-oxymeter (BPM-200, Bionics Corp, Seoul, Korea) at the affected finger in trigger fingers, at the middle finger in carpal tunnel syndrome and at thumb in de Quervain's disease. Surgical procedures were performed by one of the three authors. In conventional group, the tourniquet was released and bleeding was checked before wound

closure. Pain at the injection site and at the tourniquet area was measured using visual analog scores (VAS).

Amount of surgical field bleeding was assessed in objective and subjective methods. The amount of blood loss was recorded by measuring the weight of blood-soaked gauze minus the weight of dry gauze. The second method is asking the surgeons opinion of surgeon's clear-field satisfactory scores (1 for bloodless, 2 for little blood, 3 for bloody field but performable, and 4 for bloody field).

After wound dressing, oxygen saturation was measured at the same finger. Digital color and capillary refill time were observed for any acute vascular complication. Appointments for follow-up visit at 2 and 4 weeks after surgery were scheduled. The stitches were removed at 2 weeks.

Results

The demographic data and diagnosis of the patients between both groups showed no significant differences as shown in Table 1. There was no vasoconstrictor-induced ischemia in any of the eleven fingers injected with epinephrine. No one needed an injection of phentolamine (1 mg/mL subcutaneous) to reverse the epinephrine-induce vasoconstriction. Injection site pain was comparable between both groups (2.90 ± 2.05 vs. 3.85 ± 2.75) whereas tourniquet arm pain score was significantly higher in the conventional group (0.03 ± 0.18 vs. 3.82 ± 2.12) (Table 2). Local injection provided adequate anesthesia throughout the procedures in all patients, no one needed an additional anesthetic agent. The bleeding at the surgical site during the procedure was assessed by surgeon's opinion to determine any bleeding at the surgical site and how well the surgery was performed. In the pressured tourniquet group, 33% of the cases showed some bleeding at the surgical field. However, in the wide-awake group, all cases had blood staining surgical fields. Seven of those were minimal bleeding and 77% (23 of 30 cases) were considered to be bloody surgical

Table 1. Demographic data and diagnosis of the patients

	Wide-awake group (n = 30)	Conventional group (n = 30)	p-value
Mean ages (years)	55.33 (± 9.98)	55.53 (± 11.49)	0.943
Female:male	30:0	25:5	0.062
Diagnosis			
CTS	18	21	0.118
de Quervain's	1	4	0.071
Trigger finger	11	5	0.058

CTS = carpal tunnel syndrome

Table 2. VAS at injection site and tourniquet site of both groups

	Wide-awake group (n = 30)	Conventional group (n = 30)	p-value
Injection site pain mean (SD)	2.90 (2.05)	3.85 (2.75)	0.134
Tourniquet site pain mean (SD)	0.03 (0.18)	3.82 (2.12)	<0.0001

VAS = visual analog scores

Table 3. Surgeon opinions on surgical field bleeding

	Bloodless	Few blood	Bloody field but performable	Bloody field
Wide awake group	0	7	23	0
Conventional group	20	9	1	0

field (Table 3). However, the surgery was still well performable, there was no need for any interventions such as electro-cauterization or application of tourniquet pressure. Measuring the net weight of blood within the gauze is the quantitative assessment of bleeding. The net weight was measured at the end of the operation. In the conventional group, the authors released the tourniquet pressure and inspected for any active bleeding point before suturing the skin. The amount of blood loss in the conventional group (3.78 ± 2.93 grams) was higher than the wide-awake group (2.30 ± 1.79 grams), statistical significance ($p = 0.02$).

Digital oxygen saturation in both groups was normal (>94%). All the patients came back at the 2-week and 4-week post-operative follow-up visits. All patients were satisfied with the surgical procedure. There was no major wound complication. Except one patient of the conventional group, who received open carpal tunnel surgery, had hematoma at the thenar area. However, this problem was resolved spontaneously at the 4-week visit.

Discussion

Epinephrine has been omitted for use on hands and fingers by traditional medical education. Most medical students have been taught about the risk of developing finger ischemia and necrosis by the vasoconstriction effect. There are comprehensive reviews⁽¹⁰⁾ and a prospective study⁽¹⁵⁾ of epinephrine use in the digital block. These studies uncovered the myth and encouraged the use of epinephrine on hands and fingers. The safety of its used has been proved^(5-7,9,11). The clinical advantage of these articles is that it is unnecessary to use a tourniquet or cautery in most of hand surgeries. The results of the present study show the benefit of epinephrine in minor hand operations. Firstly, the tourniquet is not required so this provides

better patient comfort during the surgery by eliminating tourniquet arm pain. Secondly, vasoconstriction effect reduces the total amount of blood loss. However, vasoconstriction from epinephrine cannot create a bloodless surgical field as with a tourniquet. There is minimal to moderate bleeding but the operation can be continued without the need of tourniquet to control bleeding. The authors observed that self-retaining retractor not only provides the better view of the operative field but also creates tension to the incision and reduces the amount of blood loss as well. Whereas, in the conventional group, tourniquet control bleeding to a bloodless surgical field. Nevertheless, after release of tourniquet pressure, there was vasodilatation with a moderate amount of bleeding.

The present study implies that the wide-awake anesthesia provides less surgical bleeding and eliminates tourniquet arm pain. Its effectiveness and safety are comparable with the conventional method. The limitation in the present study is that we did not randomize the patients according to their diagnosis. Thus, the number of patients with the same diagnosis in both groups is different even though the differences are not statistically significant and do not affect to patients' pain scores. However, we realized that these might affect the amount of blood loss due to different surgical procedures.

What is already known on this topic?

Previous studies report the safety profile of epinephrine use in hands and fingers. However, this application is not widespread especially for digital nerve block because they are afraid that epinephrine causes vasoconstriction and finger ischemia.

What this study adds?

It's safe to use epinephrine in hands and fingers.

Patients are more comfortable with no tourniquet used, while the surgical procedure does not interfere with the operative field bleeding.

Comparison pain and amount of bleeding between both techniques.

Acknowledgement

The authors gratefully thank Areerak Phanphaisarn from research unit, Department of Orthopaedics, Faculty of Medicine, Chiang Mai University for her dedication to this study, Sirichai Luevitonvechkij MD, for his helpful suggestions and to G Lamar Robert PhD, for reviewing the manuscript.

Potential conflicts of interest

None.

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การศึกษาเปรียบเทียบการฉีดยาชาเฉพาะที่โดยวิธี *wide-awake* และการฉีดยาชาเฉพาะที่ร่วมกับการห้ามเลือดที่ต้นแขนในการผ่าตัดเล็กบริเวณมือ

สมทบ รักษาสกุลวงศ์, จิรชาติ ไกรศรีนธ์, คณิตส์ สนั่นพานิช

ภูมิหลัง: การผ่าตัดเล็กบริเวณมือและนิ้วส่วนใหญ่ใช้ยาชาปราศจาก *epinephrine* และใช้ *tourniquet* ห้ามเลือด โดยคิดว่าผู้ป่วยทนต่อความปวดจาก *tourniquet* ได้มีรายงานถึงความปลอดภัยของวิธี *wide-awake* โดยฉีดยาชาผสม *epinephrine* โดยไม่จำเป็นต้องใช้ *tourniquet*

วัตถุประสงค์: เพื่อเปรียบเทียบความปวด ประสิทธิภาพในการระงับปวด และการห้ามเลือดของการระงับปวด 2 วิธี ในการผ่าตัดเล็กบริเวณมือ

วัสดุและวิธีการ: ศึกษาผู้ป่วยที่เข้ารับการผ่าตัดเล็กบริเวณมือ 60 ราย สุ่มเป็น 2 กลุ่ม กลุ่มที่ 1 ใช้วิธี *wide-awake* กลุ่มที่ 2 ฉีดยาชาปราศจาก *epinephrine* และใช้ *tourniquet* ห้ามเลือด บันทึกความปวดโดย *visual analog scores* ที่ตำแหน่งฉีดยาชา ตำแหน่งผ่าตัด และตำแหน่งพัน *tourniquet* บันทึกปริมาณเลือดจากการผ่าตัดโดยการประเมินจากศัลยแพทย์และซังน้ำหนักผ้าก๊อชซับเลือด ติดตามผลการผ่าตัดและภาวะแทรกซ้อนที่ระยะเวลา 2 และ 4 สัปดาห์หลังผ่าตัด

ผลการศึกษา: ไม่พบความแตกต่างอย่างมีนัยสำคัญในด้านข้อมูลพื้นฐานของกลุ่มตัวอย่างความปวดที่ตำแหน่งฉีดยาและความเห็นของแพทย์ต่อปริมาณเลือดที่แผลผ่าตัด ในขณะที่กลุ่มที่ได้รับยาชาที่ไม่ผสม *epinephrine* และห้ามเลือดด้วย *tourniquet* มีอาการปวดต้นแขนตำแหน่ง *tourniquet* และเสียเลือดจากการผ่าตัดมากกว่ากลุ่ม *wide-awake* อย่างมีนัยสำคัญ

สรุป: การใช้ *tourniquet* สามารถห้ามเลือดขณะผ่าตัดได้ดีแต่เสียเลือดมากขึ้นเมื่อคลาย *tourniquet* แล้ววิธี *wide-awake* ลดการเสียเลือดจากการผ่าตัด และลดความปวดจาก *tourniquet* ในขณะที่ให้ผลระงับปวดและปลอดภัยเทียบเท่ากับวิธีดั้งเดิม
