WALANT: A Discussion of Indications, Impact, and Educational Requirements

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Abstract

Wide-awake, local anesthesia, no tourniquet (WALANT) is a technique that removes the requirement for operations to be performed with a tourniquet, general/regional anesthesia, sedation or an anesthetist. We reviewed the WALANT literature with respect to the diverse indications and impact of WALANT to discuss the importance of future surgical curriculum integration. With appropriate patient selection, WALANT may be used effectively in upper and lower limb surgery; it is also a useful option for patients who are unsuitable for general/regional anesthesia. There is a growing body of evidence supporting the use of WALANT in more complex operations in both upper and lower limb surgery. WALANT is a safe, effective, and simple technique associated with equivalent or superior patient pain scores among other numerous clinical and cost benefits. Cost benefits derive from reduced requirements for theater/anesthetic personnel, space, equipment, time, and inpatient stay. The lack of a requirement for general anesthesia reduces aerosol generating procedures, for example, intubation/high-flow oxygen, hence patients and staff also benefit from the reduced potential for infection transmission. WALANT provides a relatively, but not entirely, bloodless surgical field. Training requirements include the surgical indications, volume calculations, infiltration technique, appropriate perioperative patient/team member communication, and specifics of each operation that need to be considered, for example, checking of active tendon glide versus venting of flexor tendon pulleys. WALANT offers significant clinical, economic, and operative safety advantages when compared with general/regional anesthesia. Key challenges include careful patient selection and the comprehensive training of future surgeons to perform the technique safely.

Keywords
- WALANT
- wide awake hand surgery
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- education
- training
- simulation

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Historically, hand surgery following trauma has utilized a combination of local/regional/general anesthetic and a tourniquet. Over 10 years ago, Canadian hand surgeon Donald Lalonde popularized wide-awake, local anesthesia, no tourniquet (WALANT). This technique involves injecting the operative site and associated area with local anesthetic and adrenaline solution, leaving sufficient time for the onset of vasoconstriction preoperatively; this aims to provide adequate analgesia without the need for a tourniquet.[1] Safe doses of plain lidocaine are 3mg/kg up to a maximum dose of 200mg, and, when mixed with adrenaline/epinephrine 7mg/kg up to a maximum dose of 500mg.[1] These doses can also be mixed with 0.9% saline to increase the volume of anesthetic fluid, and therefore enable a larger field of anesthetic effect.[1]

Numerous studies have demonstrated favorable outcomes and patient satisfaction when using WALANT.[2,3] Performing hand surgery without the use of a tourniquet improves patient comfort, while still maintaining a relatively bloodless surgical field.[1] A wide-awake patient is also able to confirm site and location of surgery which reduces the likelihood of wrong site or wrong side surgery. Integration of WALANT has already taken place in a range of countries with varying levels of health care resources; in low income countries, the technique offers a significant opportunity for performing hand surgery when it may not have been possible previously.[4]

Initially, the lack of adoption of WALANT for hand surgery was based on the belief that large quantities of adrenaline cause digital ischemia.[2] While adrenaline has been shown to cause a temporary reduction in oxygen saturation in the fingertips, numerous studies have found no risk for long-term ischemia; this is supported by a large series of consecutive cases of adrenaline use in the fingers (3,110 fingers) which reported no episodes of finger ischemia.[2,5] Careful patient selection is, however, still essential, as those with peripheral vascular disease or Raynaud's disease may be at a higher risk of finger ischemia, and those with cardiac disease may suffer adverse effects from systemic absorption of local anesthetic.[6] While the novel coronavirus disease 2019 (COVID-19) pandemic caused decreased anesthetic coverage for hand surgeries, the demand for hand trauma operating remained high; WALANT has proven to be an extremely useful tool during this time.[7–9]

Hand trauma units face the challenge of modifying existing practice and adapting to the increasing demand on limited hospital resources.[10] In response to the pandemic, the British Society for Surgery of the Hand (BSSH) and the British Association of Plastic Reconstructive and Aesthetic Surgeons (BAPRAS) issued guidance and highlighted the importance of "minimum hospital contact" for patients treated with the technique.[11] Adopting such guidelines enabled safe provision of high-volume hand surgery without an increased COVID-19 related risk to patients.[11,12]

Impact of WALANT

Economic

As well as enabling procedures to be performed in a clinic setting, WALANT reduces the time patients spend in recovery, removes the need for anesthetist involvement, and reduces need for theater personnel.[13,14] Utilization of field sterility reduces the environmental impact of theater waste, and numerous studies have found no differences in infection rates between field sterility and theater sterility.[15–17] A 2019 study analyzed the economic impact of WALANT surgery for 150 carpal tunnel and trigger finger surgeries performed in an outpatient setting; they found an average saving of over €1,000 per case with superior postoperative pain scores.[18] In a separate A1 pulley release study, WALANT led to a shorter mean turnover time versus regional anesthesia and tourniquet (mean: 31.1 vs. 65.3 minutes, $p < 0.001$), as well as lower cost ($993 vs. 3,304).[13] Over a 2-year period, a single U.S. hand center made a $13,000 saving from "lean and green" surgical packs aimed at reducing waste from hand surgeries and utilized WALANT surgery for carpal tunnel release, achieving a 96% patient satisfaction rate.[19]

Operative

Carpal tunnel release under WALANT has been demonstrated to have similar or better analgesic effects and patient satisfaction rates when compared with tourniquet and regional anesthesia. Better postoperative hand function scores and range of movement have also been demonstrated.[18,20,21] Indeed mixing of a weakly alkaline solution, such as sodium bicarbonate, with the weakly acidic lidocaine reduces the sting of pain that accompanies local anesthetic injection. Other methods of reducing pain include a slow rate of injection, use of a small needle for infiltration, and injection through areas already anesthetized from the initial injection.[1]

Ayhan and Akaslan compared 22 carpal tunnel releases under WALANT with 24 under traditional local anesthetic with tourniquet. Using a 0–10 Likert scale; the WALANT group reported pain scores of 0.73 versus 1.88 for the tourniquet group ($p < 0.001$).[21] Only one patient in the WALANT group described "deep nerve pain" which can be resolved by using 10 to 20 mL of total solution for infiltration, to maximize the region of anesthesia.[16] A systematic review of carpal tunnel releases using the WALANT technique (8 studies, 765 patients, and 866 hands) found a 2.12-point reduction in the visual analogue scale (VAS) pain score (4.27/10 vs. 2.15/10, $p < 0.001$); however, a slower operating time was reported in this study (24.97 vs. 21.69 minutes, $p = 0.01$) when compared with the procedures performed with tourniquet.[20] The benefits of WALANT are further exemplified by a 2015 study which involved operating on patients with bilateral carpal tunnel syndrome with one side treated with WALANT and the other with regional anesthesia and tourniquet; there was no significant difference in median pain scores between the two techniques (0/10 vs. 0/10, $p = 0.07$).[21] In this same study, 91.6% of the patient group reported WALANT carpal tunnel release to be an easier procedure than expected with 83.3% of patients preferring the use of WALANT.[21]

The importance of leaving sufficient time for the adrenaline component of the WALANT infiltration mix to have an optimum vasoconstrictor effect, and haemostasis does infer

that there is an optimum lag time of 20 to 30 minutes from administration to operation.[1,16] A 72-patient, single-center series of minor hand trauma operations (carpal tunnel release, ganglion excision, and trigger finger release) found improved pain scores in WALANT (2.33/10 vs. 4.72/10, $p < 0.05$), but with a longer duration of preoperative surgical preparation (19.17 vs. 3.44 minute, $p = 0.01$). However, this lag time is far less than the hours the patient would spend in recovery after sedation or with an entirely numb upper limb for many hours following a regional block.[22] In a 78-patient trigger finger release study comparing the use of WALANT to regional anesthesia, the use of WALANT was associated with a shorter operating time (25.2 vs. 27.2 minutes, $p < 0.05$) and shorter time in recovery (30.2 vs. 72.3 minutes, $p < 0.01$).[14] There are varying results in the literature regarding the operative time for WALANT procedures versus traditional tourniquet methods. This is linked to the learning curve for trainees operating in a field with more blood than that generated by an arm tourniquet, as well as the waiting time for the local anesthesia being added to the operative time.[16] Various solutions for the optimization of theater time have been successfully demonstrated, including administration of local anesthetic in advance of the patient's allotted time in theater.[23,24]

A systematic review of nine WALANT hand surgery studies found lower postoperative pain scores in WALANT patients (average of 2 points lower on the VAS pain scale) with similar outcomes for patient satisfaction and complication rates when compared with conventional methods.[25] Tang et al successfully performed flap reconstructions in the hand under WALANT in a 27-patient series.[26] These included some of the most commonly used flaps, that is, the modified Segmuller homodigital reverse digital artery flap, dorsal metacarpal artery perforator flap, and Atasoy's advancement flap.[26,27] The combined effect of the shorter operating time, no requirement for inpatient stay and noninferior analgesic effect offers a considerable improvement in the patient's experience of hand surgery.[26,27] In a 100-patient series, WALANT was demonstrated to lead to lower anxiety levels versus traditional methods.[28]

Innovative Use of WALANT

Tendon transfer surgery has also been successfully performed under WALANT.[29,30] Having an awake patient allows normal movement of the hand and enables intraoperative correction of gapping, even allowing the patient to grip and move the fingers to assess and manage any issues before skin closure.[30] In a 12-patient series, Xu et al performed abdominal and thoracic skin flaps for repair of fingertip defects under WALANT and found it to provide a good surgical field in 91.7% and achieved a 100% flap survival rate with no complications.[31] All patients tolerated the procedure without the need for sedation and had an average Quick Disabilities of the Arm, Shoulder, and Hand (QuickDASH) score of 9.1; there was also an associated 11% cost saving versus traditional techniques.[31]

Tendon Surgery

Tendon transfer and flexor tendon repair are ideal for WALANT, as it allows the surgeon to check active intraoperative tendon glide, allows adjustment of the repair to reach the desired length and avoid gapping, enables intraoperative testing of the strength of the repair and assessment of appropriate tension and range of movement.[32] There is also the opportunity to engage with a wide awake and fully coherent patient intraoperatively, and gain the support of the patient in the process of hand therapy and compliance with postoperative instructions.[33,34] By engaging with an awake patient during the operation, there is a significantly reduced chance of wrong site surgery, and the patient is able to give real-time feedback to the surgeon on the quality of the repair.[1–3]

Tendon transfers performed under WALANT give an opportunity for the patient to perform the new movement intraoperatively, and has been reported to be an excellent tool for accelerating the neuroplastic transfer of nerve signals for the new movement.[33] Hand therapists have also expressed that WALANT makes the process of hand therapy far more effective due to involving the patient in the therapy process at an earlier stage.[19] Intraoperative venting and repair of gapping enables half fist formation 3 days postoperatively.[34]

Upper Limb Fractures

Hand and distal radius fracture fixation under WALANT has been successfully performed with no reported side effects or issues.[29] A 60-patient study compared results between three groups of distal radius fracture fixations; these were with general anesthetic, Bier's block, or WALANT.[35] The WALANT group had a shorter time from injury to return to work when compared with general anesthetic (7.8 vs. 20.1 days $p < 0.001$) and also versus Bier's block (14.1 days, $p < 0.001$). There were also no complications in the WALANT group versus three in the Bier's block group ($p = 0.032$), and three in the general anesthesia group ($p = 0.032$). There were lower mean costs in the WALANT versus general anesthetic group (\$428.50 vs. 630, $p < 0.001$) and Bier's block group (\$734, $p < 0.001$).[35] Positive clinical results were also demonstrated in other patient series.[36–40]

A 47-patient volar radius plate study found no significant difference in mean operating time of WALANT versus general anesthesia with tourniquet (68.1 vs. 64.42 minutes, $p = 0.214$) or in mean time to union (20.26 vs. 22.46 weeks, $p = 0.180$). The study did find a significant difference in mean blood loss (22.62 vs. 8.62 mL, $p < 0.001$).[40] Fixation of clavicular fractures under WALANT has also been successfully performed.[41] Similarly positive analgesic results were reported with olecranon fracture plating, hand fracture fixation,[42] wrist arthroscopy for triangular fibrocartilaginous complex repair,[43] and trapeziometacarpal joint prosthesis implantation.[42–44] Repair of an ulna shaft fracture has also been performed under WALANT with the addition of a periosteal nerve block.[45]

Lower Limb

The potential for WALANT is still growing, with lower limb surgeries being performed using the technique. In a 16-patient series of ankle fracture fixation, pain was reported

as 0 in 14 of 16 patients (two patients reported the pain as 1 and 2 out of 10).[46] In a second 57 patient series, open reduction and internal fixation of ankle fractures was performed successfully with no complications.[4] The impact of WALANT in the lower limb is not limited to the ankle, with a comminuted patella fracture and quadriceps tendon repair being successfully performed using the technique.[33] Removal of fibular hardware under WALANT also showed reduced pain scores and no difference in postoperative complication rates when compared with traditional methods.[47] In a 31-patient series, fixation of bony and soft tissue injuries of the foot and ankle were safely performed with the technique, with no requirement for additional anesthesia and no observed complications.[48]

Educational Requirements

Due to reduced exposure, WALANT is primarily performed by senior trainees and consultant surgeons; a contributory factor here may be that the field is not completely bloodless.[1] Developing further competencies in hand surgery may involve the use of simulated models by trainees which could be adapted to simulate this type of surgical field.[16]

Simulation in Hand Surgery

Thomson et al identified 12 plastic surgery simulators in 2018, none of which focused on hand surgery.[49] However, courses using animal tissue and synthetic models have been running for decades with the use of silicone and other materials to mimic the process of lifelike hand surgery.[49] High fidelity hand fracture simulation training with three-dimensional (3D) printing has been increasing in recent years with the technology becoming more available and affordable.[50–52] Farrell et al describe the 3D printing of a malleable, cost effective, and anatomically accurate hand surgery simulator, with fracture bridges for fixation and silicone soft tissue cover to mimic the process of dissection down to the fracture site.[50] Prsic et al developed a similar model for $40.[51] Both of these models were printed using computed tomography scans of patients' hands and present an affordable mechanism for at home/laboratory-based practice for surgeons in training.[50,51] Papavasiliou et al developed a six-step curriculum using a simulated hand for fracture fixation but are yet to demonstrate concurrent validity.[52] All of these models show the importance of simulation in shaping the direction of hand surgery training for the future.

The role of virtual simulation is growing with applications, such as Touch Surgery, being accessible and available to trainees globally.[49,53] Tulipan et al demonstrated improvement of simulator performance with the use of the application among fellowship-trained hand surgeons, orthopaedic surgery residents, and medical students.[53] The clear correlation of seniority with performance score also suggests high-content validity and supports the use of the tool in predicting likely real world performance.[53]

Simulation for hand surgery will need to adapt and take into account the lack of an entirely bloodless field with WALANT and support trainees in identifying anatomical structures in real time and with an awake patient.[1] There is a significant opportunity for this area of simulation training to be further developed. With WALANT surgery being more senior led and the challenge of a non-bloodless field, the learning curve has been made steeper.[4,31,38] WALANT facilitates a "see and treat" approach for a more efficient patient flow with shorter operative time.[13] Junior surgeons are likely to have reduced exposure to hand surgeries performed under WALANT, compared with a controlled theater setting which facilitates time for training opportunities.[16]

A possible solution for surgical trainees could include training in centers where combinations of general/regional anesthetic and WALANT surgery are performed. This would allow trainees to become confident with the procedure, including dissection and repair of structures. Once trainees become confident, they may then wish to try the same procedure using WALANT under Consultant supervision. WALANT in this respect can be considered a higher level of training and ultimately should make its way onto international surgical curricula as a competency to master prior to the completion of training.

The reduction in the need for regional blocks and sedation may also result in loss of learning opportunities for trainee anesthetists.[16] Maintaining the skillset for regional blocks is essential in the next generation of anesthetists to facilitate the safe practice of more complex limb reconstruction and fracture surgeries. With lack of training of the technique, patient care in future may be adversely impacted. Similarly, a potential solution for trainee anesthetists could involve training in centers where both methods of surgery are performed. These factors must be weighed against the inherent clinical benefit of shorter operations and hospital stay for patients, and the economic savings from reduced theater time and anesthetic staffing requirements. Both BAPRAS and BSSH have recommended the implementation of WALANT into the curriculum for plastic surgery trainees in the United Kingdom.[54]

WALANT Hand Trauma Services in the United Kingdom

St. Andrew's Centre for Plastic Surgery and Burns, as with other Hand Surgery services worldwide, offers WALANT as an option for patients due to multiple potential associated benefits; a recent prospective controlled cohort study of 731 hand trauma patients referred to St. Andrew's during the first 2 months of the COVID-19 pandemic peak (April–May 2021) in the United Kingdom, demonstrated maintained high volume hand trauma service provision, without compromising patient safety.[10,12] Service adaptations were immediately implemented according to national guidelines, with a shift toward "see and treat" WALANT operating, such that only 25% (63/250) of operations were undertaken using general or regional anesthesia.[12] Furthermore, there were no differences in patient-reported service satisfaction (10/10 vs. 10/10, $p = 0.067$) and treatment outcome (10/10 vs. 10/10; $p = 0.961$) scores, postoperative/first assessment COVID-19 symptoms (1%, 1/100 vs. 0.8%, 2/250, $p = 1.000$), or proportion of positive COVID-19 tests (7.1%, 1/14 vs. 2.2%, 2/92, $p = 0.349$) between the control ($n = 100$) and surgery ($n = 250$) groups.[12]

Adaptability and improvement have been essential to high quality hand trauma service provision and such findings are supportive of the significant potential for this when using WALANT as an anesthetic modality.[10,12] Manchester University National Health Service Foundation trust has also implemented a Consultant-led WALANT one-stop clinic at a community hospital to offload pressure on the local trauma center.[32] The impact of this led to improved compliance with national predefined standards for injury to treatment time (85 vs. 53%) and a reduced demand on hospital trauma services.[32] The Royal London Hospital has also set up a WALANT "see and treat service" for hand trauma; the clinic itself involves two stops, the first being where the patient is clerked and consented by the junior doctor.[55] If the injury can be operated on under WALANT, the local anesthetic is administered; following a COVID-19 swab and 30 minutes to allow the adrenaline component of the WALANT mixture to have an optimum vasoconstrictor effect, the patient is brought to the minor operation theater list; they are then able to go home the same day.[55]

It is essential to select patients carefully before performing an operation under WALANT.[6] The technique is not suitable for children, patients with compromised peripheral circulation, anxious patients who may struggle with compliance and patients with lidocaine sensitivity/allergy.[6] Cardiac disease is not regarded as an absolute contraindication, but diluting the adrenaline down to 1:400,000 is advised by the BSSH.[6] Despite the importance of careful patient selection, some centers have challenged the relevance placed on certain contraindications; a 102-patient series found no dangerous arrythmias associated with WALANT in patients without cardiac history.[56]

Conclusion

WALANT for hand surgery has been practiced in numerous countries for decades.[1,16] The long-held belief that adrenaline use in the fingers can result in ischemia has been disproven by several large studies.[2,57,58] Procedures performed using the WALANT technique have been shown to reduce cost, pain, postoperative opioid use and promote patient engagement with therapy.[12,16] Further innovations have taken WALANT beyond the hand and wrist.[4,38,42] Considering a global pandemic stretching anesthetic resources, the difficulties caused can and should act as an accelerant for the integration of WALANT into the hand surgery curriculum, and hand trauma services globally.[10,12,32,55] This will ensure that the surgeons of the future will be better equipped to begin utilizing this useful technique.

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