

# AMBULATORY SURGERY

International Journal covering Surgery,  
Anaesthesiology, Nursing and  
Management Issues in Day Surgery



*The Official Clinical Journal of the*  
INTERNATIONAL ASSOCIATION  
FOR AMBULATORY SURGERY

VOLUME 14.3 SEPTEMBER 2008



# AMBULATORY SURGERY

VOLUME 14.3

Editorial	59
Case Report: A Case of Meningitis of Undetermined Origin Following Spinal Anaesthesia	60
S. Gherardi, S. Sher, R. Monzani	
Foot Nerve Block as a Single Technique for Both Anaesthesia and Analgesia in the Hallux Valgus Percutaneous Surgery	62
R. Mansilla, A. Sapé, D. Sintes, J.A. Gonzalez-Ares, M. Pijoan, G. Ayala	
Effect on Postoperative Analgesia of Ketoprofen Added to Lidocaine during Intravenous Regional Anaesthesia	67
K Mjhed, A Youklif, I Tazi, K Yakini, L Barrou	
One-day otolaryngologic surgery: A one-year evaluation in an oriental community.	70
M.B. Naguib, L. Telmessani, H.A. Mowafi, K. Abo-Shama	
Haemorrhoidectomy with Ligasure <sup>®</sup> Vessel Sealing in Major Ambulatory Surgery – 4 years experience	73
C. Olona, J. Escuder, A. Caro, M.J. Alcaide, F. Gris, V. Vincente	
Sedation Quality with Two Different Formulations of Propofol Given by TCI in Ambulatory Surgery	80
S. Telletxea S, K. Intxaurraga, J. Aguirre, A. Martin A, S. Latorre, E. Mongil, I. Casado, A. Arizaga, U. Aguirre	



As most of readers of Ambulatory Surgery Journal will know, ambulatory or day surgery is the very important way of increasing surgical activity, quality of service and of treatment and at the same time reducing cost. In this way the increasing demand for health service may be overcome a good part of the way.

At the same time it is very difficult to make fellow surgeons and anesthetists aware of this fact and to give the “specialty” ambulatory surgery the status it deserves. Luckily the ICS (International Council of Surgeons) has now realized that ambulatory surgery “has come to stay” and therefore has dedicated a session of the World Congress of Surgery in December this year to ambulatory surgery and has invited among other the president of IAAS to present the state of ambulatory surgery to the delegates of the congress. This may hopefully increase the interest also for the scientific work presented in the Ambulatory Surgery Journal.

Another initiative also pointing in that direction is an agreement made with EBSCO Publishing so that the papers from Ambulatory Surgery Journal is included in their database in order to increase the visibility and spreading of the knowledge (see **[www.ebscohost.com](http://www.ebscohost.com)**).

So we believe that publishing data from Ambulatory Surgery in the leading journal for this field will increase the interest in this field, where still enormous advantages can be reached in many countries that has not the same level of activity as in the leading day surgery countries.

Claus Toftgaard  
Associate Editor, President IAAS

# Case Report: A Case of Meningitis of Undetermined Origin Following Spinal Anaesthesia

S. Gherardi MD<sup>1</sup>, S. Sher MD<sup>2</sup>, R. Monzani MD<sup>1</sup>

## Abstract

Meningitis occurring after spinal anesthesia (SA) is a rare and much feared complication of this anesthesiologic technique. We report the case of an ASA I woman who underwent SA for saphenectomy and 24 hours later developed meningitis which was ultimately classified as 'aseptic'. Etiology of post-spinal meningitis is much debated and includes failure of aseptic

technique with direct inoculation of bacteria into cerebrospinal fluid, the presence of asymptomatic bacteremia and contamination during puncture through microscopic bleeding, and ultimately the possibility of chemical meningitis. We discuss each specific cause and the possible ways of prevention.

**Keywords:** post spinal anesthesia meningitis, aseptic meningitis.

**Authors' addresses:** <sup>1</sup> Ambulatory Surgery Department, Istituti Clinici Humanitas, Rozzano (MI), Italy <sup>2</sup> Istituto di Anestesiologia e Rianimazione, Fondazione I.R.C.C.S. Ospedale Maggiore Policlinico, Mangiagalli, Regina Elena di Milano, Università degli Studi di Milano, Milan, Italy.

**Corresponding author:** Sara Sher MD Istituto di Anestesiologia e Rianimazione, Fondazione I.R.C.C.S. Policlinico, Mangiagalli e Regina Elena. Via F. Sforza 35, 20122, Milano, Italy Fax: +39-02-55033230 E-mail: sarasher@yahoo.com

## Case Report

Meningitis is a rare, but life-threatening complication of spinal anesthesia. In most instances its presentation is acute, within 24-48 hours of the procedure, and does not differ from meningitis arising from more common sources. Its etiology, though, is much debated and not always clear.

We report the case of a 40 year old, ASA I woman undergoing right saphenectomy with selective spinal anesthesia in ambulatory surgery. Preoperative evaluation was carried out the day before surgery and revealed no health problems. The patient arrived at eight o'clock on the morning of surgery, in good general condition with no signs of systemic infection, and was prepared for selective spinal anesthesia in the recovery room. Venous access with 18G catheter was positioned in the left arm and infusion of 500 ml saline solution was started. The patient was then premedicated with Midazolam 5 mg i.m. and was placed in the right lateral decubitus fetal position. No signs of skin infection were present. A sterile technique (mask, hat, and sterile gloves) was used. The surgical field was prepared with iodine solution (polivinilpirrolidone iodine complex 7.5%). Local anesthesia with 2 ml of lidocaine 2% was performed and then a 25 G Sprotte spinal needle (Polymedic) was inserted at the L3-L4 spinal interspace, obtaining free flow of clear cerebrospinal fluid (CSF) on the second attempt. 7 mg of 0.5% hyperbaric bupivacaine were injected. A disposable spinal kit was used. No antibiotic surgical prophylaxis was administered, as is routine for this kind of surgery.

After surgery the patient remained monitored in the recovery room with dedicated nursing personnel. She was able to urinate spontaneously after 3 hours, and had no nausea and thus had a light lunch. She readily gained back motor and sensory right leg function and was thus 4 mobilized twice. After 6 hours from the end of surgery the patient was dismissed in general good condition.

On the next morning the patient was admitted to the emergency department with an altered mental status, a Glasgow Coma Scale score of 10, fever and nuchal rigidity. She had closed eyes, was

arousable to localized painful stimulus, but did not answer to commands. Vital parameters were normal. During the night the husband reported repeated episodes of vomiting.

Lumbar puncture showed a turbid CSF with a protein concentration of 626 mg/dl (normal range, 20-50 mg/dl), a glucose concentration of 8 mg/dl (normal range, 40-70 mg/dl), and numerous polymorphonuclear cells. Blood chemistry was significant for a WBC count of 22,000. Chest radiography showed a right lower lobe paracardiac infiltrate with initial pneumonia screening for anti-Legionella and anti-S. Pneumoniae antibodies both negative. The patient was started on IV antibiotic therapy with Ceftriaxone 2g BID and Vancomycin 500 mg QID, was given dexamethasone 10 mg and was admitted to the neurology department with the diagnosis of acute bacterial meningitis. The pulmonary infiltrate was treated as atypical pneumonia.

Clinical progression was favourable and the patient had no permanent neurologic deficit. Repeated CSF cultures from day one through day 7 showed no growth of bacteria, and blood cultures were negative as well.

## Discussion

The pathogenesis of meningitis following spinal anesthesia is debated and only few cases of the latter are described in literature. Three possible explanations are currently given. First and foremost, there is the failure to obtain complete asepsis during the procedure, either from equipment contamination or from not following a strict aseptic technique, and thus with direct introduction of bacteria into the CSF. A second possible pathogenesis is the presence of prior asymptomatic bacteremia and the contamination of CSF fluid through microscopic bleeding caused by needle insertion. Finally, there is the hypothesis of a physico-chemical meningitis from introduction of iodine solution or by needle trauma, that may be supposed in the absence of bacterial growth.

In the described case, all sequential CSF cultures were negative for bacterial growth. Nevertheless, the low glucose CSF concentration and the rapid response to wide-spectrum antibiotic treatment do not exclude a bacterial origin for the meningitis. Appropriate antibiotic prophylaxis could inhibit bacterial growth in cultures, but no antibiotic was administered to this patient as per routine for this surgery. DNA extraction and amplification of samples of CSF could help in determining whether a bacterial cause was present, and should always be done in the absence of evident bacterial growth in culture<sup>1</sup>. The most frequent bacterium involved in this complication appears to be *Streptococcus Salivarius* but without DNA sequencing, in fact, it is not always isolated [1]. A strict sterile technique was followed in our case although we did not use single-use containers of polyvidone iodine solution. Multiple-use containers are less effective in creating asepsis and are more susceptible to colonization by bacteria [2].

The pulmonary infiltrate noticed on chest radiography may let us suppose a misdiagnosed flogistic process present before the procedure and surgery, but the absence of bacteremia with the negative blood cultures actually exclude this hypothesis.

Finally, the hypothesis of chemical meningitis may not be excluded in the presence of more than a single puncture attempt and with the use of 10% polyvidone iodine. Incidence of chemical meningitis has greatly decreased since the introduction of autoclaving and, more recently, of disposable anesthesia trays, but cases are still being reported [3].

Our patient was discharged in good condition with the diagnosis of post-spinal aseptic meningitis, since the precise etiologic determinant could not be ascertained. We believe that the rarity of this complication warrants the necessity to share the experience for such cases so that discussion and learning may help other practitioners.

## References

1. Rubin L, Sprecher Hannah, Kabaha Ahmed et al. Meningitis Following Spinal Anesthesia: 6 Cases in 5 Years. *Infect Control Hosp Epidemiol*. 2007 Oct; **28(10)**: 1187–90.
2. Birnbach DJ, Stein D, Murray OMT, Thys D, Sordillo EM. Povidone iodine and skin infection before initiation of epidural anesthesia. *Anesthesiology* 1998; **88**: 668–672.
3. Videira RL, Neto-Ruiz PP, Brandao Neto M. Post spinal meningitis and asepsis. *Acta Anesthesiol Scand* 2002; **46**: 639–646.

# Foot Nerve Block as a Single Technique for Both Anaesthesia and Analgesia in the Hallux Valgus Percutaneous Surgery

Mansilla R<sup>1</sup>, Sapé A<sup>1</sup>, Sintes D<sup>2</sup>, Gonzalez-Ares JA<sup>3</sup>, Pijoan M<sup>1</sup>, Ayala G<sup>1</sup>

## Abstract

**Objectives and Method:** The objectives were to assess the efficacy and the quality of both the surgical anesthesia and the postoperative analgesia achieved after a peripheral nerve block at the ankle level for percutaneous surgery of hallux valgus and/or metatarsalgia as ambulatory surgery. After the operation patients were given conventional intravenous analgesia and they left the hospital with a rescue analgesic regime. Postoperative analgesic control was assessed through phone calls after 24 and 48 hours.

**Keywords:** Postoperative pain control, Ambulatory surgery, Percutaneous surgery, Postoperative analgesia, Peripheral nerve block, Foot nerve block, Ankle block.

**Authors' addresses:** <sup>1</sup> Department of Anesthesiology and Critical Care Medicine, Hospital Municipal de Badalona, Barcelona, Spain.

<sup>2</sup> Head of Department of Anesthesiology and Critical Care Medicine, Hospital Municipal de Badalona, Barcelona, Spain

<sup>3</sup> Head of Department of Research and Teaching, Hospital Municipal de Badalona, Barcelona, Spain.

**Corresponding author:** Raquel Mansilla Folgado Servicio de Anestesiología y Reanimación. Hospital Municipal de Badalona. Via Augusta 9-13. 08911. Badalona. Barcelona. Spain. E-Mail: rmansilla@bsa.cat Fax: 0034 934648391

**Results and Conclusions:** The peripheral nerve block at the ankle level was an effective, easy and innocuous anesthesia technique. It provided good quality and prolonged postoperative analgesia, and an excellent degree of comfort and satisfaction for the patients, thus allowing surgery without hospitalization.

## Introduction

Hallux valgus corrective orthopedic surgery was, a few years ago, surgery with potential risks and difficult postoperative pain control. With the introduction of percutaneous surgery (Photograph 1), it now can be performed on an ambulatory regime and with one anesthesia technique that provides an excellent postoperative analgesia. This technique does not require the performance of ischemia on the extremity, what has allowed us to perform a peripheral nerve block at the ankle level, thus avoiding the risks associated both with the making of ischemia and with the neuroaxial or troncular anesthesia techniques.



Photograph 1 Percutaneous surgery.

The objectives of this study were to assess the efficacy and the quality of both surgical anesthesia and postoperative analgesia after peripheral nerve block at the ankle for percutaneous surgery of hallux valgus

and/or metatarsalgia in patients planned for ambulatory surgery without hospitalization.

## Material and Methods

We conducted a study of 49 patients planned for ambulatory surgery having percutaneous surgery of hallux valgus and/or metatarsalgia for the period September 2005–December 2005. These patients underwent an anesthesia technique consisting of a peripheral nerve block at the ankle level. Due to the difference in postoperative pain, patients were divided in two groups, those who underwent simple hallux valgus percutaneous surgery and those who underwent metatarsus correction associated or not to hallux valgus correction. Upon entrance to the preanesthesia area, patients had blood pressure, heart rate, pulse oximetry and electrocardiogram monitoring. We placed a n°18 intravenous catheter in the upper extremity with 500 ml of crystalloid solution and administered intravenous premedication with 1 mg of midazolam. To perform the anesthesia we injected 15-20 cc of a mixture of bupivacaine 0.5% and mepivacaine 2% with 1 ml of bicarbonate using 23G needles and a three-body syringe.

The anesthesia technique consists on the performance of three peripheral nerve blocks, with the patient in supine position. The first block is the tibial nerve block at the level of the internal malleolus of the ankle (Photograph 2). To do this, we had to localize the tibial artery, which is not always easy to palpate, and we performed the puncture in its external part, in the posterior inferior zone of the internal malleolus, in a spot at one third of the distance between the end of the tibial malleolus and the heel apex. At this point we performed an aspiration to dismiss accidental vascular puncture. Then we proceeded to inject 5 ml of anesthesia solution at a depth of 0.5–2cm, trying to avoid paresthesia. The second peripheral nerve we had to block was the deep peroneal nerve at the front of the ankle,



**Photograph 2** Tibial nerve block.

on the depression located between the tendons of the anterior tibial muscle and the first finger extensor muscle (Photograph 3). We made a puncture perpendicular to the skin between both tendons until we contacted the bone. Then we pulled back the needle some millimetres to infiltrate 5 ml of anesthetic between bone and skin. The last block we had to perform was that of the saphenous nerve. We did an additional subcutaneous infiltration of 5 ml of anesthetic along the supramalleolar line from the tendon of the anterior tibial muscle to the anterior end of the internal malleolus. In the cases in which surgery went as far as the fifth finger, we reinforced the block with the subcutaneous infiltration of 3 ml of anesthetic between the Achilles tendon and the external malleolus. We did this to block the sural nerve. With this type of block we got a general anesthesia of the foot that allowed us to carry out the surgical technique.



**Photograph 3** Deep peroneal nerve block.

Once the operation was finished, we infiltrated the operated zone with 8 mg of dexamethasone and the patient was sent to the postanesthetic recovery unit. There we administered the patient intravenous analgesia consisting on 50 mg of dexketoprofen trometamol, as long as there was not a contraindication for it, such as gastric intolerance or allergy. In case of such contraindication we administered intravenous paracetamol 1g. Once the required time had passed, and provided that the discharge criteria of the postanesthetic recovery unit were met, the patients left the hospital unaided and with a rescue analgesia regime, consisting on dexketoprofen trometamol 25 mg/8 h by oral route, paracetamol 500 mg/8 h by oral route and gastric protection. The patients were also given a contact telephone number of the anesthesia service to solve any kind of incident that may arise during the immediate postoperative period.

A qualified nurse assessed the postoperative analgesic control through

phone calls at the patient's home after 24 and 48 hours. They were asked in every case, how many hours he required to regain the normal sensibility of his foot; at what time he started the ingestion of analgesics; what amount of analgesia of the analgesia regime he had ingested and the VAS at the time of the phone call. Finally, they were asked about possible perioperative complications, like the presence of hematomas, paresthesia or other effects.

The data gathered in the study were the following: the demographic characteristics of the patients, the type of surgery performed and the block quality. The latter was assessed by the anesthetist present at the operating theatre as very good in case of lack of pain during the operation, good in the case that they required some type of sedation and medium if they required an analgesic reinforcement with local anesthetic due to pain in the surgical zone. The block was considered a failure if the patient required a change of the initial anesthesia technique. The quality of the postoperative analgesia was assessed, 24 hours and 48 hours after the operation using a visual analogical scale (VAS) from 0 to 10, where 0 means lack of pain and 10 means maximum possible pain. The duration of the sensitive block was defined as the time passed from the making of the nerve block to the time in which the patient had to ingest the first rescue drug. The amount of required analgesia was also collected after 24 and 48 hours. The motor block was assessed prior to the hospital discharge on the basis of whether the patient could or could not perform the plantar or dorsal flexion of the toes (lack of motor block), perform the flexion incompletely (partial block) or was able to perform toes movements (complete motor block). The hospital stay time was the period of time from the time of the patient's arrival to the surgery unit until the hospital discharge. We gathered possible complications of the anesthesia technique, like hematomas, paresthesia or other complications, and the medical, surgical, administrative or anesthetic causes for unplanned admission. Before leaving the hospital, the patients were asked to rate the comfort level during the operation as bad, medium, good, very good or excellent. They were also asked to rate the satisfaction level regarding the used anesthesia technique as rather unsatisfied, satisfied or very satisfied.

We carried out the statistical analysis through the description of the collected variables (univariate analysis), and we used the chi-square technique for the comparison among groups. All this was made with the SPSS statistical package version 9.0. The significance level used was 95%. The qualitative variables are expressed as number of cases and percentage.

## Results

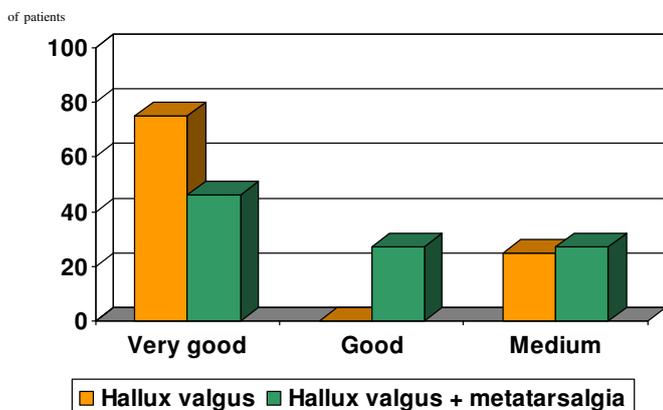
The study included 49 patients, 44 women and 5 men. 37 were operated on for hallux valgus + metatarsalgia (75.5%) and 12 for simple hallux valgus (24.5%). Table 1 shows the demographic characteristics of the patients included in the study.

As regards the efficacy of the nerve block, the anesthesia technique did not have to be changed because of its failure in any case. For every type of surgery, the results were as follows (Graph 1): the block was considered very good in 17 cases (45.9%) (IC 95% = 29.9–62) of hallux valgus + metatarsalgia and in 9 cases (75%) (IC 95% = 50.5–99.5) of simple hallux valgus; the block was good in 10 cases (27%) of hallux valgus + metatarsalgia; the block was considered medium in 10 cases (27%) (IC 95% = 12.7–41.3) of hallux valgus + metatarsalgia and in 3 cases (25%) (IC 95% = 0.5–49.5) of simple hallux, being necessary to reinforce the technique with local anesthetic during the operation.

Regarding the quality of the postoperative analgesia at the time of the hospital discharge, the VAS was 0 in 35 (94.6%) hallux valgus

**Table 1** Demographic characteristics.

	Simple hallux (n=12) Num. (%) [CI 95%]	Hallux + metatarsalgia (n=37) Num. (%) [CI 95%]	Total (n=49) Num. (%) [CI95%]
<b>ASA</b>			
1-2	11 (91.7%) [76-100]	35 (94.6%) [87.3-100]	6 (93.9%) [87.2-100]
3	1 (8.3%) [0-24]	2 (5.4%) [0-12.7]	3 (6.1%) [0-12.8]
<b>AGE</b>			
<40	3 (25%) [0.5-49.5]	1 (2.7%) [0-7.9]	4 (8.2%) [0.5-15.8]
41-60	5 (41.7%) [13.8-69.6]	18 (48.6%) [32.5-64.8]	23 (46.9%) [33-60.9]
61-75	4 (33.3%) [6.7-60]	17 (45.9%) [29.9-62]	21 (42.9%) [29-56.7]
>75	0	1 (2.7%) [0-7.9]	1(2%) [0-6]
<b>SEX</b>			
Female	10 (83.3%) [62.2-100]	34 (91.9%) [83.1-100]	44 (89.8%) [81.3-98.3]
Male	2 (16.7%) [0-37.8]	3 (8.1%) [0-16.9]	5 (10.2%) [1.7-18.7]
<b>BMI</b>			
<25 (normal)	9 (75%) [50.5-99.5]	21 (56.8%) [40.8-72.7]	30 (61.2%) [47.6-74.9]
25-30 (overweight)	3 (25%) [0.5-49.5]	12 (32.4%) [17.30-47.5]	15 (30.6%) [17.7-43.5]
30-40 (obesity)	0	4 (10.8%) [0.8-20.8]	4 (8.2%) [0.5-15.8]



**Graph 1** Block quality.

+ metatarsalgia cases and 1 in 2 of these cases (5.4%). In the case of simple hallux valgus, the VAS at the time of the discharge was 0 in 11 cases (91.7%), and 1 in one patient (8.3%). There were no significant differences as regards the postoperative analgesia between both groups at the time of the hospital discharge. After 24 hours, in the case of hallux valgus + metatarsalgia, the VAS were 0 in 26 cases (70.3%), 2 in 6 cases (16.2%), 4 in 4 cases (10.8%) and 9 in one case (2.7%). In the simple hallux valgus group, the VAS 24 hours after the surgery were 0 in 10 cases (83.3%), and 2 in 2 cases (16.7%). There were not, after 24 hours, significant differences as regards the analgesia between both groups.

Finally, after 48 hours, the VAS results for the hallux valgus + metatarsalgia group were the following: VAS 0 in 17 cases (45.9%), VAS 2 in 7 cases (18.9%), VAS 3 in 3 cases (8.1%), VAS 4 in 4 cases (10.8%), VAS 5 in 5 cases (13.5%) and VAS 6 in one case (2.7%). As regards the simple hallux valgus group, the VAS after 48 hours

were 0 in 7 cases (58.3%), 2 in 4 cases (33.3%), and 3 in one case (8.3%). The VAS in the hallux valgus + metatarsalgia group after 48 hours were significantly higher for the simple hallux valgus group ( $p=0.047$ ).

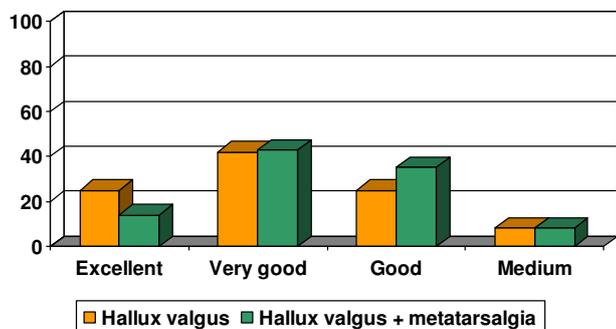
The amount of postoperative analgesic required 24 hours after the making of the block was assessed. 11 patients (22.4%) required the ingestion of dexketoprofen trometamol 25mg/8h by oral route and paracetamol 500mg/8h; 21 patients (42.9%) required dexketoprofen trometamol 25mg/8h by oral route only; 2 patients (4.1%) paracetamol 500mg/8h as the only analgesia and 15 patients (30.6%) did not ingest any analgesic drug. 48 hours after the operation, only 5 patients (10.2%) required analgesia with dexketoprofen trometamol 25mg/8h by oral route and paracetamol 500mg/8h; 16 patients (32.7%) ingested dexketoprofen trometamol 25mg/8h; 3 patients (6.1%) required paracetamol 500mg/8h, and 25 patients (51%) did not require any type of analgesia.

The average duration of the sensory block was 14 hours and 36 minutes. The motor block in the hallux valgus + metatarsalgia group at time of discharge was complete in 3 patients (8.1%), partial in 2 patients (5.4%) and there was no block in 32 cases (86.5%). In the case of simple hallux valgus there was not motor block in any case (100%). The average stay time in the hospital was 4.38 hours.

The only registered complication of the anesthesia technique was the deformity of the foot in the case of hallux valgus + metatarsalgia. There were no cases of unexpected hospitalization.

As regards the comfort level of the patient during surgery (Graph 2), it was medium in 3 cases of hallux valgus + metatarsalgia (8.1%) and 1 case of simple hallux (8.3%), good in 13 cases of hallux valgus + metatarsalgia (35.1%) and in 3 cases of simple hallux valgus (25%); the comfort level was very good in 16 cases of hallux valgus + metatarsalgia (43.2%) and in 5 cases of simple hallux (41.7%),

% of patients

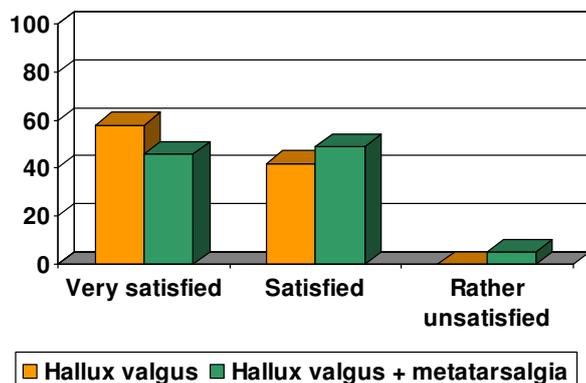


**Graph 2** Comfort level during the operation.

and finally, the intraoperative comfort degree was rated excellent in 5 cases of hallux valgus + metatarsalgia (13.5%) and in 3 cases of simple hallux valgus (25%).

Satisfaction with the anesthesia technique used (Graph 3) was described as rather unsatisfactory in 2 cases of hallux + metatarsalgia (5.4%), satisfactory in 18 cases of hallux valgus + metatarsalgia (48.6%) and in 5 cases of simple hallux valgus (41.7%), and very satisfactory in 17 cases of hallux + metatarsalgia (45.9%) and in 7 cases of simple hallux valgus (58.3%).

% of patients



**Graph 3** Satisfaction level regarding the used anesthesia technique.

## Discussion

Traditional surgery for hallux valgus correction [18] has been until recently a relatively complex surgery as regards surgical and anesthetic technique. An ischemia tourniquet on the affected extremity was necessary to get an adequate surgical field. This has been until now a very important limiting factor to choose an adequate anesthesia technique. But above all, patients undergoing this type of surgery suffered intense postoperative pain. [9, 22, 25] This required patients to stay confined in hospital to recover from anesthesia and to need postoperative pain control with intravenous analgesia. With the growing development of ambulatory surgery units, without confinement [24], and especially, the recent evolution of surgical techniques there is a change of direction in the anesthetic care of these patients. Hallux valgus percutaneous surgery permits a faster and less painful postoperative recovery because bone injuries and, especially, soft tissue injuries are reduced. The fact that ischemia is not required to perform the surgery has allowed us to go from conventional neuroaxial anesthesia techniques to using less expensive peripheral nerve block techniques with less complications. [23] Also, there is the additional advantage of offering the patient a lasting postoperative analgesia. [2] The results of our study confirm these assertions. The difference with other techniques described elsewhere [11, 7, 5, 6,

8] is that in our case the blocked nerve zone is smaller due to a more peripheral performance of the block. This has allowed our patients to walk unaided once the surgery is finished (Photograph 4). Also, another remarkable difference between our study and others [3, 4, 10, 14, 19, 20] is that there is no need to place a perineural catheter to get good postoperative analgesia.



**Photograph 4** Final result at the time of the hospital discharge.

In agreement with what the literature usually describes, hallux valgus pathology in our sample is more common in females, with a greater incidence in ages between 40 and 75. At these ages, an association with metatarsalgia is more common. Although we have not identified the connection between overweight and incidence of hallux valgus, there may be a greater incidence of metatarsalgia among those patients with a higher BMI. Despite the performance of the peripheral nerve blocks without a neurostimulator, the results obtained as regards its efficacy have been very satisfactory. Thus, we can assert that it is a valid technique for this kind of surgery. In more aggressive surgeries the results have been less satisfactory. Such is the case of like hallux valgus + metatarsalgia, in which the nerve zone that has to be blocked is bigger. Despite this, it was not necessary a change of anesthesia in any case of our study. The associated anesthesia complications have been minimal and there were no unplanned hospitalizations. However, the most important and remarkable advantage is the quality of the postoperative analgesia. This and the few incidences of anesthesia complications have allowed these patients to be included in a surgery circuit without hospitalization and with a short stay time before discharge. In the existing bibliography, most of the authors have required the use of analgesia techniques in addition to the anesthesia technique. [5] In our work, the obtained nerve block has been innocuous and prolonged enough to allow the patients to leave the hospital unaided, with VAS results significantly lower than in most cases, always <1 at the time of discharge, even in the case of more complex surgery. There were no differences between the groups as regards postoperative pain at the time of the hospital discharge and after 24 postoperative hours. However, we have identified that, after 48 hours, there are significant differences. This may be because at that time, the sensory block has already dissipated (14h36min average time) and hallux valgus + metatarsalgia surgery is still slightly painful. This is unlike simple hallux valgus surgery, where 48 hours after the operation the pain diminishes independently of the used anesthesia technique. During the first 24 hours the consumption of non-steroidal anti-inflammatory drugs was higher, in relation to the block ending and the manifestation of pain; whereas after 48 hours of surgery, the consumption of analgesics decreases. A possible explanation would be that the only patients that required analgesia at that time were those with higher VAS, such as the case of hallux valgus + metatarsalgia.

We conclude that in hallux valgus corrective surgery, the peripheral nerve block at the ankle level is considered an effective, easy and innocuous anesthesia technique. It provides a good and prolonged postoperative analgesia, thus allowing surgery without confinement and providing an excellent degree of comfort and satisfaction for the patients.

## Acknowledgements

The authors wish to acknowledge the staff members of the anesthesiology and reanimation service at the Hospital Municipal de Badalona, as well as the infirmary service of the surgery without confinement unit, for their invaluable cooperation and support in the making of this work.

## References

- Capdevila X, Dadure C, Bringuier S, Bernard N, Biboulet P, Gaertner E, Macaire P. Effect of Patient-controlled Perineural Analgesia on Rehabilitation and Pain after Ambulatory Orthopedic Surgery: A Multicenter Randomized Trial. *Anesthesiology*. 2006 Sep; **105**(3):566–573.
- Ferrer Gomez C, Puig Bitria R, Boada Pie S, Recasens Urbez J, Rull Bartomeu M. Oral analgesia versus posterior tibial nerve block for postoperative pain in ambulatory open hallux valgus surgery: a randomized clinical trial. *Rev Esp Anesthesiol Reanim*. 2006 Apr; **53**(4):220–5.
- Rodriguez J, Taboada M, Carceller J, Lagunilla J, Barcena M, Alvarez J. Stimulating popliteal catheters for postoperative analgesia after hallux valgus repair. *Anesth Analg*. 2006 Jan; **102**(1):258–62.
- Casati A, Fanelli G, Koscielniak-Nielsen Z, Cappelleri G, Aldegheri G, Danelli G, Fuzier R, Singelyn F. Using stimulating catheters for continuous sciatic nerve block shortens onset time of surgical block and minimizes postoperative consumption of pain medication after halux valgus repair as compared with conventional nonstimulating catheters. *Anesth Analg*. 2005 Oct; **101**(4):1192–7.
- G Valladares, A Martinez Navas, T Vazquez Gutierrez, S Merino, M Reina, M Echevarria. Analgesia postoperatoria en la cirugía del pie y tobillo mediante bloqueo ciático popliteo lateral con ropivacaina. *Rev. Soc. Esp. Dolor*. 2004; **11**(2).
- Casati A, Vinciguerra F, Santorsola R, Aldegheri G, Putzu M, Fanelli G. Sciatic nerve block with 0.5% levobupivacaine, 0.75% levobupivacaine or 0.75% ropivacaine: a double-blind, randomized comparison. *Eur J Anaesthesiol*. 2005 Jun; **22**(6):452–6.
- Suarez Ruiz P, Lopez Alvarez S, Sarmiento Penide A, Barbeito Vilarino MJ, Bonome Gonzalez C, Cobian Llamas JM. Popliteal fossa sciatic nerve block for ambulatory hallux valgus surgery: comparison of lateral and posterior approaches. *Rev Esp Anesthesiol Reanim*. 2005 Jan; **52**(1):4–8.
- Sinardi D, Marino A, Chillemi S, Siliotti R, Mondello E. Sciatic nerve block with lateral popliteal approach for hallux valgus correction. Comparison between 0.5% bupivacaine and 0.75% ropivacaine. *Minerva Anesthesiol*. 2004 Sep; **70**(9):625–9.
- Desjardins PJ, Black PM, Daniels S, Bird SR, Fitzgerald BJ, Petruschke RA, Tershakovec A, Chang DJ. A randomized controlled study comparing rofecoxib, diclofenac sodium, and placebo in post-bunionectomy pain. *Curr Med Res Opin*. 2004 Oct; **20**(10):1523–37.
- Casati A, Vinciguerra F, Cappelleri G, Aldegheri G, Grispigni C, Putzu M, Rivoltini P. Levobupivacaine 0.2% or 0.125% for continuous sciatic nerve block: a prospective, randomized, double-blind comparison with 0.2% ropivacaine. *Anesth Analg*. 2004 Sep; **99**(3):919–23.
- Taboada Muniz M, Alvarez Escudero J, Carceller J, Rodriguez J, Rodriguez, Forja MJ, Cortes J, Atanassoff PG. Sciatic nerve block by the lateral route at the level of the popliteal fossa with 0.75% ropivacaine: advantages of a more proximal approach. *Rev Esp Anesthesiol Reanim*. 2003 Aug–Sep; **50**(7):340–5.
- Reinhart DJ, Stagg KS, Walker KG, Wang WP, Parker CM, Jackson HH, Walker EB. Postoperative analgesia after peripheral nerve block for podiatric surgery: clinical efficacy and chemical stability of lidocaine alone versus lidocaine plus ketorolac. *Reg Anesth Pain Med*. 2000 Sep–Oct; **25**(5):506–13.
- Magistris L, Casati A, Albertin A, Deni F, Danelli G, Borghi B, Fanelli G. Combined sciatic-femoral nerve block with 0.75% ropivacaine: effects of adding a systemically inactive dose of fentanyl. *Eur J Anaesthesiol*. 2000 Jun; **17**(6):348–53.

- Levecque JP, Borne M, Saissy JM. Analgesia with continuous lateral posterior tibial nerve block. *Reg Anesth Pain Med*. 1999 Mar–Apr; **24**(2):191–2.
- Fanelli G, Casati A, Beccaria P, Aldegheri G, Berti M, Tarantino F, Torri G. A double-blind comparison of ropivacaine, bupivacaine, and mepivacaine during sciatic and femoral nerve blockade. *Anesth Analg*. 1998 Sep; **87**(3):597–600.
- Garcia-Enguita MA, Ortega-Lahuerta JP, Arauzo-Perez P, Laglera-Trebol S, Giron-Mombiela JA, Lopez-Sicilia S, Urieta-Solanas A. The utility of digital infiltration of mepivacaine and ketorolac in postoperative analgesia of the unilateral hallux valgus. *Rev Esp Anesthesiol Reanim*. 1997 Nov; **44**(9):345–8.
- Porter KM, Davies J. The control of pain after Keller's procedure—a controlled double blind prospective trial with local anaesthetic and placebo. *Ann R Coll Surg Engl*. 1985 Sep; **67**(5):293–4.
- Wrighton JD. A ten-year review of Keller's operation. Review of Keller's operation at the Princess Elizabeth Orthopaedic Hospital, Exeter. *Clin Orthop Relat Res*. 1972; **89**:207–14.
- Martinez Navas A, Vazquez Gutierrez T, Echevarria Moreno M. Continuous popliteal block with ropivacaine via a stimulant catheter for postoperative analgesia after foot surgery. *Rev Esp Anesthesiol Reanim*. 2003 Apr; **50**(4):188–91.
- Taboada M, Rodriguez J, Valino C, Vazquez M, Laya A, Garea M, Carceller J, Alvarez J, Atanassoff V, Atanassoff PG. A prospective, randomized comparison between the popliteal and subgluteal approaches for continuous sciatic nerve block with stimulating catheters. *Anesth Analg*. 2006 Jul; **103**(1):244–7.
- Taboada M, Lorenzo D, Oliveira J, Bascuas B, Perez J, Rodriguez J, Cortes J, Alvarez J. Comparison of 4 techniques for internal saphenous nerve block. *Rev Esp Anesthesiol Reanim*. 2004 Nov; **51**(9):509–14.
- Desjardins PJ, Shu VS, Recker DP, Verburg KM, Woolf CJ. A single preoperative oral dose of valdecoxib, a new cyclooxygenase-2 specific inhibitor, relieves post-oral surgery or bunionectomy pain. *Anesthesiology*. 2002 Sep; **97**(3):565–73.
- Agostinelli JR, Carter A, O'Neal J, Hadaway S, Tarleton D, Reilly MD, Pham HT. Postoperative transient bradycardia and asystole after bilateral bunionectomies performed using spinal anesthesia. *J Foot Ankle Surg*. 1995 Sep–Oct; **34**(5):498–500; discussion 511–2.
- Dawson J, Coffey J, Doll H, Lavis G, Cooke P, Herron M, Jenkinson C. A patientbased questionnaire to assess outcomes of foot surgery: Validation in the context of surgery for hallux valgus. *Qual Life Res*. 2006 Sep 25.
- Thippawong JB, Babul N, Morishige RJ, Findlay HK, Reber KR, Millward GJ, Otulana BA. Analgesic efficacy of inhaled morphine in patients after bunionectomy surgery. *Anesthesiology*. 2003 Sep; **99**(3):693–700.
- Casati A, Chelly JE, Cerchierini E, Santorsola R, Nobili F, Grispigni C, Di Benedetto P, Torri G. Clinical properties of levobupivacaine or racemic bupivacaine for sciatic nerve block. *J Clin Anesth*. 2002 Mar; **14**(2):111–4.
- Casati A, Borghi B, Fanelli G, Cerchierini E, Santorsola R, Sassoli V, Grispigni C, Torri G. A double-blinded, randomized comparison of either 0.5% levobupivacaine or 0.5% ropivacaine for sciatic nerve block. *Anesth Analg*. 2002 Apr; **94**(4):987–90.
- Casati A, Magistris L, Fanelli G, Beccaria P, Cappelleri G, Aldegheri G, Torri G. Small-dose clonidine prolongs postoperative analgesia after sciatic-femoral nerve block with 0.75% ropivacaine for foot surgery. *Anesth Analg*. 2000 Aug; **91**(2):388–92.

# Effect on Postoperative Analgesia of Ketoprofen added to Lidocaine during Intravenous Regional Anaesthesia

K Mjahed, A Youklif, I Tazi, K Yakini, L Barrou

## Abstract

**Aim:** Intravenous regional anaesthesia (IVRA) is a safe, effective technique for surgery on the upper extremities, but it provides no postoperative analgesia. The aim of this study was to evaluate the analgesic efficacy of small dose of ketoprofen with IVRA induced by lidocaine.

**Methods:** Forty eight patients undergoing ambulatory hand surgery were randomly assigned to one of three groups: They received 40 mL of 0.5% lidocaine and either 1 mL of isotonic saline (group Control, n = 16) or 50 mg Ketoprofen (group K50, n = 16) or 100 mg Ketoprofen (group K100, n = 16). Visual analogue scale was recorded for 2 h postoperatively. Postoperative pain was treated with morphine in post anaesthesia care unit (PACU) and oral acetaminophen at home.

**Keywords:** Intravenous regional block ; Lidocaine ; Ketoprofen.

**Authors' addresses:** Service d'Anesthésie-réanimation Centrale. CHU Ibn Rochd Casablanca Morocco.

**Corresponding author:** Dr. W.W.C. Ng Dr K. Mjahed 125, rue Larache. Hay Essalam CIL. Casablanca 20200 Morocco  
Email: kmjahed@yahoo.fr Fax: 00-212-22-26-54-16.hk

**Results:** The sensory recovery time was longer in the group K100 compared to control group ( $p < 0.01$ ). There was a statistically significant lower VAS in group K100 compared to control group, but not between group K50 and control group or group K50 and group K100. The K100 group needed significantly less morphine in the PACU when compared with control group or K50 group. Postoperative analgesic consumption (acetaminophen) was statistically lower during the first 24 h in group K100 compared to others groups.

**Conclusion:** The addition of 100 mg ketoprofen but not 50 mg to lidocaine for IVRA in patients undergoing hand surgery improves postoperative analgesia during the first postoperative day.

## Introduction

Intravenous regional anaesthesia (IVRA) is a safe and effective way to provide anaesthesia for hand surgery [1]. One the limitation of this technique compared to peripheral nerve is limited by the rapid offset of analgesia. Various analgesics including opioids and alpha2-agonists drugs have been administered with the local anaesthetic in IVRA, but only nonsteroidal anti-inflammatory drugs (NSAID) have shown benefits [2–4]. Multiple studies have investigated various NSAIDs as the sole adjunct to IVRA. The agents investigated were ketorolac [5,6] tenoxicam [7,8] and aspirin [9]. Ketorolac 20mg added to lidocaine provides effective postoperative analgesia after ambulatory hand surgery [10]. Ketoprofen is a NSAID commonly used in its parenteral form to provide peri-operative analgesia but it has never been added to lidocaine for IVRA. It is a widely used analgesic in many countries and has a good safety and efficacy record [11,12]. The usual recommended parenteral dose was 100 mg. We hypothesized that the addition of small dose of ketoprofen to lidocaine for use in IVRA might improve postoperative analgesia.

## Patients and methods

Informed consent was obtained from each patient and the study was approved by the local ethics committee. Forty eight patients, ASA physical status I, undergoing ambulatory surgery of the hand were studied prospectively in this trial. Standard monitors including continuous electrocardiography, noninvasive blood pressure measurement, and pulse oximetry were used. An intravenous catheter (20 gauge) was inserted into a distal vein on the dorsum of the hand of the operative extremity for injection of local anaesthetic solution. An additional intravenous catheter was placed in the contralateral upper extremity for crystalloid infusion.

A double-cuffed tourniquet was placed on the upper operative arm. The affected extremity was exsanguinated by elevating it and wrapping it with an Esmarch bandage. The proximal cuff was inflated to 250 mmHg and the Esmarch bandage was removed. IVRA was established in all patients using 40 mL of a solution of lidocaine 0,5%. The patients were randomly assigned to one of the following three double-blind groups.

- 1) K50-IVRA group received 50 mg of ketoprofen in 1 mL added to the lidocaine after inflation of the tourniquet;
- 2) K100-IVRA group received 100 mg of ketoprofen in 1 mL added to the lidocaine after inflation of the tourniquet;
- 3) control group received 1 mL of isotonic saline added to the lidocaine after inflation of the tourniquet.

After surgery, an anesthesiologist unaware of study-group assignment assessed the patients' pain levels 30 min, 60min, 90 min and 120 min after tourniquet deflation. Pain was assessed using a visual analogue pain scale (VAS), with 0 representing no pain and 10 representing the worst imaginable pain. Intravenous boluses of 2 mg morphine were provided in the postanesthesia care unit (PACU) whenever the visual analogue pain scale exceeded 3. The total number of morphine doses was noted.

Sensory recovery time, defined as "Time elapsed after tourniquet deflation up to recovery of pain in all dermatome determined by pinprick test", was recorded. Quantification of analgesic consumption was recorded and included the total amount administered during the first 24 h after surgery. Analgesics administered at home consisted of oral acetaminophen.

Data are expressed as mean as mean  $\pm$  SD. Demographic data, operative and tourniquet times were analyzed using analyse of variance. Sex, type of surgery were analysed with a chi-square

test. VAS scores and analgesic requirements were analysed using the Kruskal-Wallis non-parametric test. P-values < 0.05 were considered as being statistically significant.

## Results

There were no significant differences between the three groups with respect to patient age, sex, tourniquet time, the distribution of surgical procedures or the duration of the operation (Table 1).

Anesthesia was successful in all cases. There was no statistical difference between groups compared for mean arterial blood

**Table 1** Patient demographics and surgical data.

Group	Control (n=16)	K50 (n=16)	K100 (n=16)
Age (yr)	31±10	32±16	34±11
Weight (Kg)	66±8	67±13	67±9
Duration of surgery (min)	63±21	61±24	60±26
Tourniquet time (min)	70±19	68±20	67±22
Sensory recovery time (min)	12±7	16±14	24±18 §
Type of procedures (n)			
- bone	3	6	5
- muscle	13	10	11

Data are presented as mean ±SD § p < 0.01 between groups control and K100

K50: intravenous regional anesthesia with 50 mg of ketoprofen

K100: intravenous regional anesthesia with 100 mg of ketoprofen

pressure, heart rate and SpO<sub>2</sub> at any intraoperative or postoperative time. The sensory recovery time was longer in the group K100 compared to control group (p < 0.01). There was a difference between groups in postoperative VAS scores after tourniquet release at 30, 60, 90 and 120 min. Specifically, group K100 had statistically significant lower VAS scores compared to control group, but there were no differences between group K50 and control group or group K50 and group K100 (Fig 1). The K100 group needed significantly less morphine in the PACU when compared with control group or K50 group. Postoperative analgesic consumption (acetaminophen) was statistically lower during the first 24 h in group K100 compared to other groups (Table 2).

No postoperative complications were observed including wound

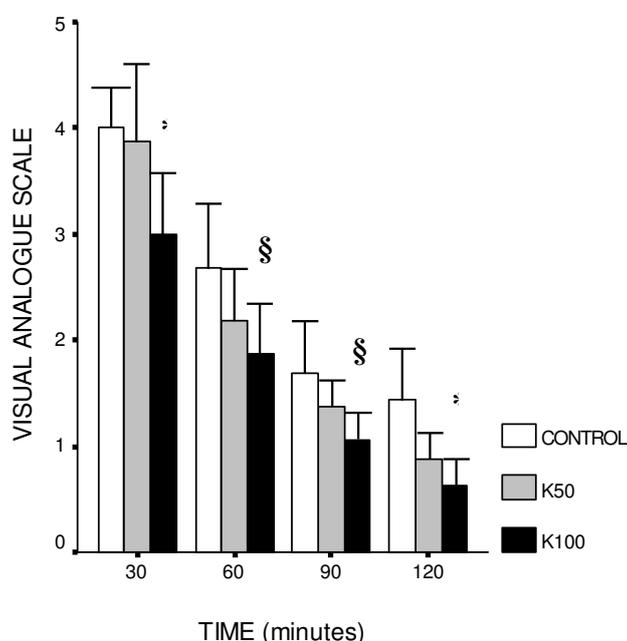
**Table 2** Postoperative Analgesic Requirements.

Group	Control (n=16)	K50 (n=16)	K100 (n=16)
Morphine in PACU (mg)	5.4±1.3	4.3±1.7§	3.1±1.1*
24 h total acetaminophen (mg)	2000±683	1625±341§	1542 ± 406*

Values are mean ± SD § p < 0.05 between group control and K50

\*p < 0.01 between group control and K100

bleeding.



**Figure 1** Visual Analogue Scale scores in the postoperative period. Data are presented as mean ± SD. § p < 0.05 between group control and K100 \*p < 0.01 between group control and K100.

## Discussion

Our study demonstrated that the addition of ketoprofen to lidocaine for IVRA improved the quality of postoperative analgesia without side effects.

Among the numerous studies that have investigated NSAID as the sole adjunct to IVRA, the most popular used was ketorolac [5,6,10]. In one study of IVRA with lidocaine 0,5%, ketorolac 60 mg as a component of IVRA was compared with systemic administration of ketorolac in patients following elective hand surgery. In this study, patients with ketorolac in IVRA had less pain during the first postoperative hour, required no supplemental analgesia in the PACU and consumed fewer analgesics during the first postoperative day [5]. In a similar study using a small dose of lysine acetyl salicylate (LAS) added to prilocaine for foot and ankle surgery, Corpataux et al. showed that pain scores were significantly lower in LAS-IVRA group during the first 3 postoperative hours compared with placebo [9]. Hoffman showed that tenoxicam, a long acting NSAID, improved the postoperative pain scores but only during the first 30 min after the release of the tourniquet [8]. In contrast Jones and Pugh observed a significant lower analgesia requirement during the first 24 hours when tenoxicam had been administered [7].

Ketoprofen is a NSAID with a short half-life (two hours) commonly used in its parenteral form to provide postoperative analgesia in many types of surgery [13,14]. The recommended dose usually used systemically is 100mg [11]. By concentrating ketoprofen at the surgical site, we hypothesized that a smaller dose of 50mg can provide optimal postoperative analgesia. It has been shown in systematic review that there is a relationship between the dose of NSAID and its analgesic effect [15].

Steinberg et al. found that 20mg of ketorolac is equally effective as 60mg in IVRA. A linear dose-response relationship was showed between the dose of ketorolac used and the duration of analgesia [10]. For tenoxicam and lysine acetylsalicylate, the dose response studies have not been performed so the ideal dose remains unknown. Kostawana et al. found that ketorolac 30mg was equally efficacious as diclofenac 75mg and ketoprofen 100mg for the treatment of postoperative pain after hip replacement surgery [16]. In our study

the dose of ketoprofen 100mg was more effective than ketoprofen 50 mg. Perhaps larger IVRA ketoprofen doses might have provided more prolonged analgesia than we observed. However, we chose to use a ketoprofen dose of 100mg based on previous studies.

Postoperative pain scores were significantly improved in IVRA ketoprofen 100 mg group compared with the control group. The 24h consumption of supplementary analgesics was significantly reduced in the IVRA ketoprofen 100 mg group compared with the control group. In fact, we considered the use of a systemic administration group to be unnecessary as the local effect of NSAID used as component of IVRA had been demonstrated in previous studies [17], but we cannot totally exclude a systemic effect of ketoprofen. A possible redistribution of residual ketoprofen from the operative arm to the systemic circulation after tourniquet deflation could explain the prolonged postoperative analgesia and less analgesic requirement.

Several studies have demonstrated an enhanced analgesic effect from NSAID when concentrated at a peripheral site compared to the systemic administration of the same drug. Studies suggest a predominantly peripheral site of action [18,19]. NSAIDs inhibit the production of arachidonic acid metabolites such as prostaglandins and thromboxanes that mediate the inflammatory process. Surgical trauma leads to the sensitization of peripheral nociceptors to the analgesic action of allogenic substances. NSAIDs alter peripheral nociceptors by reducing the local concentration of these agents such as bradykinin and histamine and lead to a reduction in postoperative pain.

There is evidence for a clinically relevant peripheral analgesic action of intra-articular NSAID, while results of IVRA with NSAID in postoperative pain were inconclusive [17]. The analgesic effect of NSAID appears to be mediated peripherally and not the result of central redistribution. Many studies suggest that the risk of bleeding varies among NSAIDs. In one tonsillectomy study, ketorolac was associated with a higher incidence of bleeding than ketoprofen [20]. In our work, there was no case of excessive bleeding in the ketoprofen groups during the postoperative period.

To our knowledge, this is the first clinical study using ketoprofen as a component of IVRA. However, interpretation of the data in this study must consider several limitations related to the absence of systemic administration group.

In conclusion the addition of 100 mg of ketoprofen but not 50 mg to lidocaine 0,5% for IVRA improved analgesia in the PACU during the first 2h after operation and diminished the need for analgesia supplements during the first 24 h after operation, without causing excessive bleeding.

## References

1. Brill S, Middleton W, Brill G, Fisher A. Bier's block; 100 years old and still going strong! *Acta Anaesthesiol Scand* 2004;**48**:117–22.
2. Memis D, Turan A, Karamanlioglu B, Pamukcu Z, Kurt I. Adding dexmedetomidine to lidocaine for intravenous regional anaesthesia. *Anesth Analg* 2004; **98**: 835–40.
3. Reuben SS, Steinberg RB, Klatt JL, Klatt ML. Intravenous regional anesthesia using lidocaine and clonidine. *Anesthesiology*. 1999;**91**:654–8.
4. Choyce A, Peng P. A systematic review of adjuncts for intravenous regional anaesthesia for surgical procedure. *Can J Anesth* 2002;**49**: 32–45.
5. Reuben SS, Steinberg RB, Kreitzer JM, Duprat KM. Intravenous regional anesthesia using lidocaine and ketorolac. *Anesth Analg* 1995; **81**:110–3.
6. Reuben SS, Duprat KM. Comparison of wound infiltration with ketorolac versus intravenous regional anesthesia with ketorolac for postoperative analgesia following ambulatory hand surgery. *Reg Anesth* 1996; **21**:565–8.
7. Jones NC, Pugh SC. The addition of tenoxicam to prilocaine for intravenous regional anaesthesia. *Anaesthesia* 1996; **51**: 446–8.
8. Hoffmann V, Vercauteren M, Van Steenberghe A, Adriaensen H. Intravenous regional anesthesia. Evaluation of 4 different additives to prilocaine. *Acta Anaesthesiol Belg* 1997;**48**:71–6.
9. Corpataux J-B, Van Gessel EF, Donald FA, Forster A, Gamulin Z. Effect on postoperative analgesia of small dose lysine acetylsalicylate added to prilocaine during intravenous regional anesthesia. *Anesth Analg* 1997;**84**:1081–5.
10. Steinberg RB, Reuben SS, Gardner G. The dose-response relationship of ketorolac as a component of intravenous regional anesthesia with lidocaine. *Anesth Analg* 1998;**86**:791–3.
11. Priya V, Divatia JV, Sareen R, Upadhye S. Efficacy of intravenous ketoprofen for pre-emptive analgesia. *J Postgrad Med*. 2002;**48**:109–12.
12. Aubrun F, Langeron O, Heitz D, Coriat P, Riou B. Randomised, placebo-controlled study of the postoperative analgesic effects of ketoprofen after spinal fusion surgery. *Acta Anaesthesiol Scand* 2000;**44**:934–9.
13. Oberhofer D, Skok J, Nesek-Adam V. Intravenous ketoprofen in postoperative pain treatment after major abdominal surgery. *World J Surg*. 2005;**29**:446–9.
14. Basto ER, Waintrop C, Mourey FD, Landru JP, Eurin BG, Jacob LP. Intravenous Ketoprofen in Thyroid and Parathyroid Surgery. *Anesth Analg* 2001;**92**:1052–7.
15. Collins SL, Moore RA, McQuay HJ, Wiffen PJ. Oral ibuprofen and diclofenac in post-operative pain: a quantitative systematic review. *Eur J Pain*. 1998;**2**:285–291.
16. Kostamovaara PA, Hendolin H, Kokki H, Nuutinen LS. Ketorolac, diclofenac and ketoprofen are equally efficacious for pain relief after total hip replacement surgery. *Br J Anaesth*. 1998; **81**:369–72.
17. Rømsing J., Møiniche S., Østergaard D., Dahl JB. Local infiltration with NSAIDs for postoperative analgesia: evidence for a peripheral analgesic action *Acta Anaesthesiol Scand* 2000; **44**: 672–683.
18. Ben-David B, Katz E, Gaitini L, Goldik Z. Comparison of i.m. and local infiltration of ketorolac with and without local anaesthetic. *Br J Anaesth* 1995; **75**:409–12.
19. O'Hanlon JJ, McCleane G, Muldoon T. Preoperative application of piroxicam gel compared to a local anaesthetic field block for postoperative analgesia. *Acta Anaesthesiol Scand* 1996; **40**:715–8.
20. Splinter WM, Rhine EJ, Roberts DW, Reid CW, MacNeill HB. Preoperative ketorolac increases bleeding after tonsillectomy in children. *Can J Anaesth*. 1996;**43**:560–3.

# One-day otolaryngologic surgery: a one-year evaluation in an oriental community

M.B. Naguib<sup>a</sup>, L. Telmessani<sup>a</sup>, H.A. Mowafi<sup>b</sup>, K. Abo-Shama

## Abstract

**Aim:** To evaluate the newly introduced one-day surgery unit for potentially ambulatory otolaryngologic cases in King Fahd University Hospital, Al-Khobar, KSA.

**Methods:** A prospective study of patients undergoing one-day otolaryngologic surgery from December 2006 to December 2007.

**Results:** The overall evaluation results of 70 patients undergoing one-day otolaryngologic surgery as regards safety and patient satisfaction justify one-day surgery as a new treatment policy.

**Keywords:** Tonsillectomy; One-day surgery; Bleeding; ENT procedures; Safety.

**Authors' addresses:** <sup>a</sup>Otolaryngology Dept. and <sup>b</sup>Anaesthesia Dept., King Fahd University Hospital, Al-Khobar, KSA.

**Corresponding author:** M. B. Naguib Tel: +966567655292 E-mail: magedbaher@yahoo.com

**Conclusion:** This study emphasizes that one-day surgery is not an operation but rather a "system" that calls for the staff, both doctors and nurses, to learn and accept the advantages and limitations of this new surgical policy and understand the importance of adequate patient information.

## Introduction

World wide reports have documented not only the safety of common otolaryngologic procedures such as adenotonsillectomy done as a one-day procedure but also have recorded a high percentage of patient satisfaction [1–5]. Most of these reports are Western and relate to foreign communities with different customs and habits. This limits how far we can generalise from the results of these reports in communities with diverse geographical, social and cultural characteristics without being critically evaluated. Therefore, we set out to evaluate our one-year experience with the one-day otolaryngologic surgery unit in the King Fahd hospital of the university, Al-Khobar, Kingdom of Saudi Arabia exploring the recommendations for safety and satisfaction pertinent to our part of the world.

## Materials and Methods

This is a prospective study involving patients undergoing one-day otolaryngologic surgery during the period December 2006 to December 2007 in the King Fahd University hospital, Al-Khobar, Kingdom of Saudi Arabia.

One-day otolaryngologic surgery included adenoidectomy, tonsillectomy, adenotonsillectomy and myringotomy either alone or with adenoidectomy. There was no age limit for the population undergoing one-day surgery in this study. The study included indigenous patients and expatriates. The only patients excluded were those with a history of a medical illness needing a post-operative stay of longer than 24 hours and those with a potential bleeding tendency.

All patients were seen by the surgeon on the day of the surgical booking and they and their families were given the choice between the one-day surgery procedure and the regular ward admission after adequate information about both.

If one-day surgery was preferred by the patients or their families, they were given an appointment for the anaesthesia pre-evaluation clinic and then referred to the one-day surgery unit which lies in the main hospital building occupying a separate suite but utilizing the main

operation room which is used also by the inpatient surgical wards. The one-day surgery nurse adequately informed the patients and/or their families about the expectations and the instructions before and after the one-day surgery. Patients scheduled for one-day surgery were listed first on the operating list to gain the maximum time for post-operative observation.

All surgery was performed under general anaesthesia. All patients had a standard anaesthetic protocol; nothing by mouth for at least 6 hours before surgery, no premedication, induction with fentanyl 1 µg/kg and propofol 2–3 mg/kg, muscle relaxation with rocuronium 0.5 mg/kg, endotracheal intubation and maintenance on 1–2% sevoflurane in oxygen, lung ventilation to maintain ET<sub>CO</sub><sub>2</sub> at 32–35 mmHg, reversal of muscle relaxation using neostigmine and atropine. After extubation all patients undergoing one-day surgery were kept in a post anaesthesia care unit adjacent to the operating room till fully conscious and alert after which they were transferred to the one-day surgical unit. Immediate post-operative analgesia for cases of tonsillectomy with or without adenoidectomy was given in the post anaesthesia care unit in the form of Voltarol suppositories for children and intramuscular injections in adults with dose adjustments according to the body weight.

All patients were kept in the hospital for an average period of 6–7 hours and discharged after being examined by the otolaryngology resident in charge.

The parameters for the analysis of the outcomes of the one-day surgery in this study were:

- post-operative haemorrhage
- post-operative rise in temperature
- post-operative vomiting
- post-operative pain and dizziness, and
- the incidence of hospital readmission.

Patient and/or family satisfaction as regards their experience with one-day surgery was also recorded by means of a questionnaire carried out by the one-day surgery nurse on duty.

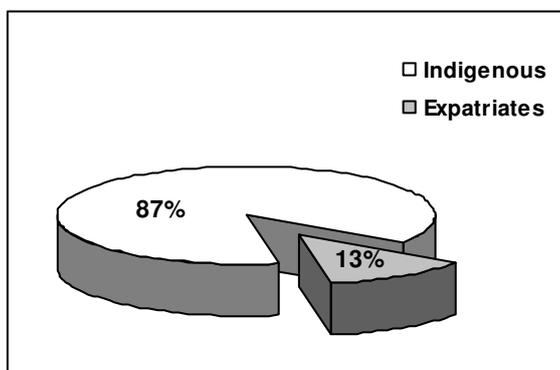
## Results

During a one-year period, 70 cases underwent one-day otolaryngologic surgery as detailed in Table 1. There were 61 (87%) indigenous and 9 (13%) expatriates (Fig1). On the other hand, there were 199 patients admitted for the same surgical procedures during the same time period (Table 2).

**Table 1** One-day otolaryngologic surgery inventory (n=70).

M = male, F = female

Procedure	Number	M	F	Mean age in years
Adenoidectomy	23	12	11	7.6
Tonsillectomy	5	0	5	12.8
Adenotonsillectomy	12	9	3	6.8
Adenoidectomy plus myringotomy	17	11	6	6.5
Myringotomy	13	8	5	11.0



**Figure 1** Indigenous to expatriate group of patients.

**Table 2** Regular surgery inventory (n=199). M = male, F = female

Procedure	Number	M	F	Mean age in years
Adenoidectomy	30	13	17	10.0
Tonsillectomy	32	15	17	18.3
Adenotonsillectomy	81	42	39	7.0
Adenoidectomy plus myringotomy	16	11	5	6.9
Myringotomy	40	21	19	10.0

In the group undergoing one-day surgery, the youngest patient was a 20 month old undergoing an adenoidectomy. The oldest was a 25 year old undergoing myringotomy with ventilation tube insertion (Table 3).

In the patients undergoing one-day surgery, the incidence of post-operative nausea was 30 per cent. All patients were encouraged to resume a normal diet before discharge. Only four cases (5.7%) experienced vomiting of blood tinged mucous and gastric secretions shortly after having their first snack meal. This stopped without the need for medication.

Body temperature was recorded upon patient transfer to the one-day surgical unit and on discharge. The maximum temperature recorded in the group of patients undergoing oneday surgery was 37.4°C

**Table 3** One-day otolaryngologic surgery. Age and number of patients (n=70).

Age	Number (%)
<2 years	1 (1.4%)
2-6 years	33 (47%)
>6-13 years	28 (40%)
>13-18 years	5 (7%)
>18 years	3 (4.3%)

(1.4%) in an adenotonsillectomy patient. All patients were afebrile on discharge.

Pain was generally tolerated by the patients undergoing one-day surgery. Only six (8.6%) patients needed an extra dose of an analgesic other than that given in the post anesthesia care unit. Dizziness was observed in four (5.7%) patients undergoing one-day surgery. Dizziness was judged by the sway of a child as he walked in the room needing assistance. Dizzy patients were not given medications but were encouraged to early ambulation. By the time of discharge, dizziness had all disappeared.

Weakness on the other hand was a more common observation. It was seen in 40 per cent of the patients and was more obvious in children than in adults. These patients felt sleepy and weak rather than dizzy. Their gait was normal and they walked without the need of assistance.

No cases of post-operative bleeding were encountered in the one-day surgery group of patients. In the group undergoing regular admission surgery, two cases (1%) were readmitted for post-operative bleeding. A boy 6 years old and a girl 11 years old who both underwent adenotonsillectomy and bled on the 6th and 9th days respectively. Two cases (3%) of the one-day surgery group of patients were admitted to the surgical wards. The first case was a 6 year old girl with sickle cell disease undergoing an adenoidectomy who bled intra-operatively. The decision for admission was taken for observation and possible blood transfusion. The second case was a 3 year old boy undergoing tonsillectomy who went into laryngeal spasm after extubation and needed admission for observation.

The questionnaire conducted by the one-day surgery nurse on discharge revealed 100% satisfaction by the patients and/or their families. Both indigenous and expatriate patients and/or their families agreed that the detailed information given by the surgeon prior to surgery as well as the one-day surgery nurse helped to dismiss their worries as regards the expected post-operative morbidity and whether the time spent in the one-day surgery unit would be enough to control it. The only worry for all the patients undergoing one-day adenoidectomy, tonsillectomy or both was what to do in case of emergency while at home.

## Discussion

In a busy tertiary referral institution, the growing number of operations performed by the different surgical subspecialties has brought about a simultaneous decrease in the number of beds available for the surgical departments in the surgical wards. This has led to an increase in the waiting lists of patients awaiting their operations. In an attempt to make more surgical beds available, a one-day surgical unit has emerged as a new treatment policy for potentially ambulatory surgical procedures not only as a solution for the problem of the congested surgical wards but to improve healthcare efficiency and

reduce healthcare costs as well. The evaluation of this new treatment policy can be judged by the outcomes of two main factors, safety and satisfaction.

Addressing the issue of safety, the results of this study proves the safety of one-day otolaryngologic surgery. Only two cases (3%) were admitted to the wards from the one-day surgical unit. The need for overnight careful observation was behind the decision for their admission. No cases of primary or secondary hemorrhage were seen in this study and therefore no cases were admitted for post-discharge bleeding.

This was compared to two cases (1%) undergoing regular admission surgery who were readmitted for post-operative bleeding some days after their hospital discharge.

We do not adopt a specific surgical technique in tonsillectomy. Haemostasis by bleeding vessel ligation, monopolar and bipolar cautery are all used according to the surgeon's preference. However, a much larger sample would be required to make the conclusions regarding post-operative bleeding more meaningful.

Post-operative laryngeal spasm has occurred once in this series of one-day surgery. Nevertheless, we do not use a laryngeal mask for fear of aspiration. Patients are strongly instructed not to have anything by mouth on the day of surgery. However, in practice we found that a small number of patients did not abide by the fasting instructions thinking that a snack shortly before being taken to surgery would not do much harm.

The low rate of post-operative pain, bleeding and vomiting in our study justifies the policy of one-day surgery. The use of post-operative non-steroidal anti-inflammatory drugs and the regular adequate dosing of paracetamol as well as the use of intravenous propofol for anaesthesia and the avoidance of opiates have reduced the incidence of pain and vomiting respectively.

However, safe surgery alone does not qualify it to be considered for one-day surgery.

While the competence of both surgical and anaesthetic endeavors is important, the role of the day-surgery nurse is crucial. The day-surgery nurse is trusted with patient education pre-operatively and post-operatively. We found that this task helped greatly in alleviating all fears about one-day surgery. Initially in the early days of one-day surgery, we had the impression that patients and/or their families were reluctant to accept the idea of one-day surgery for fear of inadequacy. Discussing the matter with the one-day surgery nurses, they agreed to spend more time on patient education which reflected positively on the general acceptance of one-day surgery among the patient population that showed clearly in the cases that followed.

The issue of patient satisfaction was investigated in this study for both indigenous and expatriate groups of patients. The availability of a hospital bed upon admission and the full attention of an undistracted devoted nurse were all common reasons for satisfaction mentioned in the questionnaire. Interesting were the additional reasons for satisfaction given by the indigenous group of patients versus the expatriate group. The expatriate group of patients added that the main reason for their satisfaction was their separation from the regular busy hospital wards favouring the idea of a rapid hospital discharge. On the other hand, most of the enrolled indigenous patients agreed that home was a better place to recuperate and were satisfied by not having disrupted their family life.

Although reasons might be somewhat different, the result was a general acceptance of and satisfaction in the service provided and the time of stay in the one-day surgery unit. In this study we followed the recommendations of Hellier and his colleagues [6] for a dedicated

day surgery unit and pre-operative one-day surgery unit for all patients. In contrast to Asiri [3] and his colleagues we performed all our one-day procedures in the main operating room suite. This might have supported our gradual introduction and presentation of one-day surgery as an alternative to in-patient operations and took away the feeling of inadequacy which was in turn reflected by the unanimous achievement of patient satisfaction. What remains is the patients' worry about what to do in case of emergency while at home. In our study we have reassured all patients and/or their families of their immediate hospital admission through the resident on call. We recommend the availability of a dedicated hospital phone number to answer the patients' queries especially those who live away from the hospital. Perhaps a dedicated home care team as suggested by Shah et al. [7] would prove effective in this particular issue by providing an effective home support to patients undergoing one-day surgery.

## Conclusion

The overall results of this study on one-day surgery seem promising. More time and more patients are needed for more reliable statistical data to be collected and to achieve more faith in the procedure.

According to Moralee [8], the economic benefits of one-day surgery depend on how many patients accept same day discharge. But before that, the staff, both doctors and nurses, should realize the fact that one-day surgery is not an operation but rather a "system" that calls for all to learn and accept the advantages and limitations of this new surgical policy and understand the importance of adequate patient information. Acknowledgment The authors acknowledge the efforts of Mrs. Nada Al-Shaif, RN, for conducting the patient questionnaire and providing the one-day surgical records for patients enrolled in this study.

## References

- 1 Bittmann S, Ulus H. Parent satisfaction with paediatric day-surgery: a questionnaire-based study. *Ambulatory Surgery*. 2004; **11**:3-5.
- 2 Church JJ. Day case tonsillectomy in children. *Ambulatory Surgery*. 1999; **7**: 17-19.
- 3 Asiri SM, Abu-Bakr YA, Al-Enazi F. Paediatric ENT day surgery is it safe practice? *Ambulatory Surgery*. 2006; **12**:147-149.
- 4 Moralee SJ, Murray JA. Would day-case adult tonsillectomy be safe? *J Laryngol Otol* 1995; **109**:1166-1167.
- 5 Panarese A, Clarke RW, Yardley MP. Early post-operative morbidity following tonsillectomy in children: implications for day surgery. *J Laryngol Otol* 1999; **113**:1089-1091.
- 6 Hellier WP, Knight J, Hern J, Waddell T. Day case paediatric tonsillectomy: a review of 3 years experience in a dedicated day case unit. *Clin Otolaryngol* 1999; **24**:208-212.
- 7 Shah C, Shahab R, Robb P, Roy D. Role of a home care team in paediatric day-case tonsillectomy. *J Otol Laryngol* 2001; **115**:39-43.
- 8 Moralee SJ. Adult tonsillectomy: What proportion would accept same day discharge? *J R Coll Surg Edinb* 1998; **43**:99-100.

# Haemorrhoidectomy with Ligasure® Vessel Sealing in Major Ambulatory Surgery – 4 years experience

C. Olona, J. Escuder, A. Caro, M.J. Alcaide, F. Gris, V. Vincente

## Abstract

**Aim:** In this study we evaluate the use of Milligan-Morgan haemorrhoidectomy with Ligasure vessel sealing in major ambulatory surgery (MAS).

**Materials and Methods:** Between January 2004 and December 2007 haemorrhoid surgery was performed on 189 ambulatory patients suffering from grade III haemorrhoids (after ruling out the possibility of haemorrhoidal ligature) and grade IV haemorrhoids. The surgical technique used was standard Milligan-Morgan haemorrhoidectomy with Ligasure vessel sealing. Post-operative complications were monitored in all patients.

**Keywords:** Haemorrhoidectomy; Ambulatory surgery; Vessel sealing.

**Authors' addresses:** Dept. General and Digestive Surgery, Hospital Universitario Joan XXIII de Tarragona, Spain.

**Corresponding author:** C. Olona Tel: +34 977295824 Fax: +34 977295805 E-mail: drolona@hotmail.com

**Results:** Two cases (1%) of post-operative haemorrhage were reported. One of these cases required hospital admission. Another case (0.5%) also required hospital admission in order to control the patient's post-operative pain. In all cases the patients' scars healed correctly. There was one case of anal stenosis, which was resolved by digital dilatation. The substitution index for haemorrhoid patients was 98%.

**Conclusion:** Haemorrhoidectomy with Ligasure vessel sealing is quick, easy, reliable and completely bloodless. The low number of complications and hospital admissions suggests that vessel sealing is an optimal technique for use in ambulatory haemorrhoidectomy.

## Introduction

In Europe traditional Milligan-Morgan haemorrhoidectomy (1) is the most common surgical technique for the treatment of haemorrhoids. This technique has been performed in our service as major ambulatory surgery (MAS) since its introduction in 1998.

Ligasure® vessel sealing is a method for ligating vessels of up to 7mm in diameter that is widely used in abdominal and thyroid surgery. The literature describing the benefits of the technique also for treating haemorrhoids encouraged us to use it for haemorrhoidectomies performed on an ambulatory basis by our service.

In this paper we present the results of four years of major ambulatory haemorrhoid surgery using Ligasure® vessel sealing.

## Material And Methods

We conducted a retrospective and descriptive study of 189 consecutive patients on whom haemorrhoidectomy was performed as major ambulatory surgery between January 2004 and December 2007. The subjects selected for surgical intervention were patients with grade III haemorrhoids for whom the possibility of ligature had been ruled out (either because the technique failed or because of the existence of a large external component) and patients with grade IV haemorrhoids. All subjects satisfied the criteria for inclusion as ambulatory surgical patients. The usual protocol for the admission of patients to the Major Ambulatory Surgery Unit was followed. On the day of their operation, all patients entered the unit accompanied by an adult. Preparation of the rectum with enemas was not performed.

The lithotomy position was employed for all operations. The mucous bridges were marked and submucous dissection of the haemorrhoids was performed using the Ligasure® vessel sealing system (Valleylab, Covidien, Spain). Successive seals were carried out proximally as

far as the vascular pedicle of the haemorrhoid and the tissue was sectioned using scissors along the sealed areas. A double seal of the haemorrhoidal pedicle was carried out.

After surgery the patients were taken to the post-anaesthesia care unit. Once their basic functions returned to normal, the patients were taken to the recovery ward where, with the adult who accompanied them to the unit, they waited to be discharged. On discharge, they were given verbal and written instructions on post-operative procedures.

Patients were discharged in accordance with the protocol of our hospital. They were given continuous intravenous analgesia (ketorolac and tramadol) using a Baxter® pump [2]. The next day they were monitored in their homes by members of the hospital's Home Hospitalisation Unit. The next week they visited the outpatients department, which they continued to visit every month until they fully recovered.

In this study we evaluate the post-operative complications and readmissions of patients undergoing haemorrhoid ambulatory surgery in our service over a four year period.

## Results

A total of 189 patients (76 men (40%) and 113 women (60%)), had haemorrhoid surgery during the period of study. The average age of these patients was 55 years. Of the 189 patients, 136 (78%) suffered from grade IV haemorrhoids and 53 (28%) suffered from grade III haemorrhoids.

Haemorrhoidectomy of three haemorrhoids was performed during the same operation on 178 patients (94%).

No haemorrhage occurred during the immediate post-operative period.

There were two cases (1%) of post-operative haemorrhage. One of these, caused by a faecaloma, occurred on the fourth day and required hospital admission for surgical revision and haemostasis. The other case occurred during the first 24 hours after operation and was resolved by medical care and change of dressing in the Emergency Ward.

One patient (0.5% of cases) required hospital admission to control post-operative pain caused by intolerance to the analgesic pump.

During outpatient treatment one case of anal stenosis (0.5%) was detected and resolved by digital dilatation. No cases of incontinence, acute urine retention or any other type of complication were reported and no re-interventions were necessary. Our substitution index for haemorrhoid patients is 98%.

## Discussion

Surgery is the normal treatment for III and IV degree haemorrhoids and the universally accepted technique is Milligan-Morgan [1]. The use of this technique in major ambulatory surgery is more controversial because difficult analgesic control and possible post-operative haemorrhage often make hospitalisation necessary [3]. Haemorrhoidectomy without hospital admission has been conducted by our Service since 1998. We have obtained good analgesic control via continuous intravenous analgesia and our substitution index is 98%.

The introduction of vessel sealing led to the publication of several articles describing its use in haemorrhoidectomy [4,5,6] leading to a statistically significant reduction in operation time and post-operative pain [7,8,9] and even to the absence of post-operative stenosis [4]. Also reported are reductions in blood loss, less need for analgesia, fewer hospitalizations and a significantly faster return to work [10], though no differences in complications are reported in comparison with the conventional group.

All of these advantages encouraged us to incorporate the technique in our ambulatory surgery procedures for treating haemorrhoids. Complications since the incorporation of the technique have been minimal, with no cases of stenosis or sphincter lesions and a very low rate of admission or readmission. We have also found the technique to be completely bloodless (unlike others) because the sections are always performed with sealed tissue, which provides greater visibility of the plane to be sectioned. This control of haemostasis also provides greater convenience for the surgeon and leads to good results in the surgery of thrombosed haemorrhoids, large external haemorrhoids, and even large mucosal prolapses.

We have not only maintained our substitution index for ambulatory haemorrhoidectomy, but actually increased it to 98%. Patients who receive surgery as hospital inpatients do so because they do not satisfy the criteria for their inclusion in MAS. Other authors are also reconsidering the possibility of incorporating haemorrhoidectomy in the MAS of their hospitals [6,11].

As this is a retrospective study we cannot evaluate the pain suffered by patients. However, no patient has been admitted to our hospital reporting feeling pain. Our readmission rate is 1% and when patients were readmitted this was not because of direct complications resulting from the surgery but because of a faecaloma in one case and intolerance to the analgesic pump in the other. A readmission rate of 5–10% is considered acceptable. Since most cases of readmissions reported in the literature are due to post-operative haemorrhage, our lower readmission rate may be due to the control of haemostasia provided by the seal. We should also bear in mind the important role of home hospitalisation in post-operative care.

Though this is a retrospective study, from the good results obtained—as well as those published in meta-analyses of randomised studies (6)—we can conclude that vessel sealing enables surgeons to perform haemorrhoidectomies bloodlessly, easily and reliably. Vessel sealing is therefore an optimal technique for performing haemorrhoidectomies in MAS.

## References

1. Milligan ET, Morgan CN. Surgical anatomy of the anal canal, and the operative treatment of haemorrhoids. *Lancet* 1937; **2**: 1119–1124.
2. Boada S, Recasens J, Papaceit J. Use of elastomeric pumps for continous intravenous analgesia administration in ambulatory surgery pain management. *Journ Ambulatory Surgery* 2002; **10**: 3–7.
3. Jayne DG, Botterill I, Ambrose NS, Brennan TG, Guillou PJ, O'Riordain DS. Randomized clinical trial of Ligasure vesus conventional diathermy for day-case haemorrhoidectomy. *Br J Surg* 2002; **89**: 428–432.
4. Palazzo FF, Francis DL, Clifton MA. Randomized clinical trial of Ligasure versus open haemorrhoidectomy. *Br J Surg* 2002; **89**: 154–157.
5. Sayfan J, et al. Sutureless closed hemorrhoidectomy: a new technique. *Ann Surg* 2001; **234**: 21–24.
6. Tan EK, et al. Meta-analysis of short-term outcomes of randomized controlled trials of LigaSure vs conventional hemorrhoidectomy. *Arch Surg* 2007; **142**:1209–1218.
7. Franklin EJ, et al. Randomized, clinical trial of Ligasure vs conventional diathermy in hemorrhoidectomy. *Dis Colon Rectum* 2003; **46**: 1380–1383.
8. Kwok SY, et al. A double-blind, randomized trial comparing Ligasure and Harmonic Scalpel hemorrhoidectomy. *Dis Colon Rectum* 2005; **48**: 344–348.
9. Chung YC, Wu HJ. Clinical experience of sutureless closed hemorrhoidectomy with Ligasure. *Dis Colon Rectum* 2003; **46**: 87–92.
10. Wang JY, et al. Randomized controlled trial of Ligasure with submucosal dissection versus Ferguson Hemorrhoidectomy for prolapsed hemorrhoids. *World J Surg* 2006; **30**: 462–466.

# Sedation Quality with Two Different Formulations of Propofol Given by TCI in Ambulatory Surgery

Telletxea S PhD, MD\*, Intxaurreaga K MD\*, Aguirre J MD\*, Martin A MD\*, Latorre S MD\*, Mongil E MD\*, Casado I MD\*, Arizaga A MD\*, Aguirre U MS #

## Abstract

**Objectives:** The objectives are to compare the incidence, severity and duration of pain during i.v. injection of two formulations of propofol for sedation in ambulatory surgery.

**Methods:** In this randomized, double blind study, propofol was infused using a Target Controlled Infusion to attain a drug plasma concentration of 1 mg/ml in one minute. Patients were asked about location, timing, intensity and duration of pain. Upon waking, patients were asked about their degree of satisfaction and their recall of pain.

**Results:** Pain was reported by 50% of patients upon i.v. injection.

The incidence, intensity and duration of pain could be significantly reduced in the LCT/MCT-propofol group when is used in sedation. No statistically significant differences were seen in any of the hemodynamic criteria or in the depth of anesthesia. The degree of satisfaction was in general very good.

**Conclusions:** We conclude that LCT/MCT-propofol is associated with reduced incidence, intensity or duration of pain of injection during TCI sedation in ambulatory surgery.

**Keywords:** LCT/MCT-propofol, LCT-propofol, ambulatory surgery, sedation, injection pain.

**Authors' addresses:** \* Department of Anesthesia, Ambulatory Surgery Unit. Galdakao Hospital, Galdakao, Vizcaya, Spain.

# Department of Investigation. Galdakao Hospital, Galdakao, Vizcaya, Spain.

**Corresponding author:** Dr. Sorkunde Telletxea Department of Anesthesia. Galdakao Hospital. E 48960, Galdakao, Vizcaya, Spain.

E-mail: arritelle@euskalnet.net

## Introduction

Propofol has become the most widely used intravenous (i.v.) anesthetic due to its favorable pharmacodynamic and pharmacokinetic characteristics (rapid recovery and a reduced incidence of post operative nausea and vomiting) [1]. Despite its numerous advantages, propofol has adverse side effects including injection pain, hypertriglyceridemia in prolonged administration schedules and a propensity for bacterial contamination. Thus pain during i.v. administration has been reported in 60% to 70% of cases [2, 3]. A number of factors may account for the appearance of pain including the injection site, the caliber of the blood vessel, the velocity of administration, the concentration, osmolality and pH of the preparation, the concentration of drug in the aqueous phase of the emulsion [4] and the solvent used in the pharmaceutical preparation [5].

In recent years, a number of attempts have been made to improve the formulation of propofol, in order to reduce these side effects. LCT/MCT (long-chain triglyceride/ medium-chain triglyceride) -propofol is a new formulation of propofol that has recently been introduced into the market. A number of clinical studies have found that the new formulation is associated with reduced incidence and intensity of pain during i.v. injection [2, 5, 6] and reduced hypertriglyceridemia was found with long-term administrations [7, 8]. However, to date, all comparative studies of pain due to i.v. injection have been carried out in patients to whom propofol was administered for general anesthesia, not in sedation.

The objectives of the present study were to compare the incidence, severity and duration of pain during i.v. injection of both formulations of propofol for sedation in ambulatory surgery and to characterize the

pharmacological effect of the two formulations and to compare the degree of patient satisfaction during recovering consciousness.

## Methods

Following approval by the Ethics and Clinical Research Committee of the Galdakao Hospital (Vizcaya, Spain) and having obtained written informed consent of patients, we performed a double blind study of 130 patients, ASA I–III, age 18–65 years, who were being operated in the outpatient surgery program. In order to randomly select patients, we used two equally sized computer-generated lists of the patients who had been randomly assigned by the software to sedation with propofol in the form of LCTpropofol or LCT/MCT-propofol, after spinal anesthesia with 5% prilocaine. Patients who presented with neurological, hepatic or advanced renal disease were excluded from the study. Other excluded patients included those who were positive for pregnancy test or were breast-feeding, those who presented a history of drug or alcohol abuse, allergy to egg or soya oil, those who required i.v. lidocaine as a support drug and those who had morbid obesity.

Patients had an intravenous cannula 18G inserted on the dorsum of the hand and a Ringer Lactate solution was infused at 200 ml/h. They had no premedication. In the operating room, standard routine monitoring was performed: non-invasive arterial blood pressure (BP), continuous electrocardiogram (ECG) with heart rate (HR), pulse oximetry measured using a Vitaro PM8060 monitor incorporated into a JULIAN Drager ventilator and measurement of the bispectral index (BIS, Aspect Medical System) in order to measure BIS values during the operation.

Following regional anesthesia and the stabilizing of regional block, sedation was performed with propofol using a Target Controlled Infusion (TCI) system, in order to achieve a plasma concentration of 1mg/ml in 1 minute. Propofol was administered using an infusion pump (ASENA-PK, TCI\_TIVA MIII, Alaris) without addition of local anesthetic. No other sedative or narcotic agents were administered prior to or after the regional block. Half of patients received LCT-propofol according to the randomization tables and the remainder were administered LCT/MCT-propofol. Numbered propofol syringes were filled by an anesthesiology nurse and administered to the corresponding patient according to the numbered patient list, thus ensuring that both researchers and patients were blind with regard to the preparation that was being used. Once infusion began, patients were asked if they perceived any kind of pain at the injection site or in any region of the arm. They were asked to describe the pain and its intensity using a simple descriptive scale "Keele Scale"<sup>9</sup> over a period of 5 minutes. Even if pain was not initially perceived, we continued to ask the patient about its presence over a five minute period. The level of sedation with propofol was maintained throughout the surgical intervention and was to be suspended only in the event of peripheral oxygen saturation falling below 90% despite oxygen therapy.

The following data were collected: sex, age, height, weight, ASA, location of venipuncture, the existence of any degree of pain at the injection site or in any region of the arm, the degree of pain (mild, moderate or intense) and its duration. BP, HR and BIS data were also obtained at five distinct moments: basal, upon reaching 1 mg/ml propofol and at 5, 10 and 15 minutes afterward.

Patients were asked in the Post Anesthesia Recovery Room about their degree of satisfaction and their recollection of pain, if experienced, using a Likert Scale<sup>10</sup>. The following variables were analyzed and compared between both groups: the presence of pain during i.v. injection and its localization (site of injection and/or vessel trajectory); the intensity of pain; the intensity of pain as a function of gender; the duration of pain; pharmacological effect variables (BP, HR, BIS), patient satisfaction after waking and recollection of pain.

## Statistical analysis

The size of the sample was calculated using the statistical program GPOWER. Calculations were performed on the basis of the intensity of pain during i.v. injection. Subsequently, and with the same program, the randomization of patients was achieved. We calculated means, standard deviations (s.d.) and percentages for the descriptive analysis of the studied sample. In order to examine associations between variables, we used the Chi-squared and Student t tests when the distribution was normal, and the Wilcoxon test for non-normal distributions. Data were considered to be statistically significant when the p value was less than 0.05. Statistical calculations were carried out using the SAS system, version 9.1.

## Results

All of the 130 patients who were enrolled completed this study. No patient was excluded from the study for reasons of oxygen desaturation. Both groups were demographically similar, with no significant differences between them (Table 1). The mean age of patients was  $46 \pm 13$  years, with 66.9% of the population being male.

65 (50%) of all patients reported experiencing pain upon i.v. injection of propofol. There were statistical differences in presence of pain between the study groups ( $p=0.02$ ) (Table 1). Pain was lower in the LCT/MCT-propofol group. We also found that LCT/MCT-propofol group had pain mostly limited to the injection site, whereas with LCT-propofol, a higher percentage of patients felt pain in the vessel trajectory or in both locations (site of injection and vessel trajectory). These differences were statistically significant ( $p=0.002$ ).

Regarding pain intensity, no significant differences were found between both formulations ( $p=0.06$ ) (Table 1). We found differences by gender. Analyzing the association between degree of pain and gender, we found differences in the men group ( $p=0.008$ ), but no in women group ( $p=0.06$ ) (Table 2). The mean duration of pain was significantly less in the LCT/MCT-propofol group compared to the LCT-propofol group, measured to be  $52.5 \pm 94.0$  seconds and  $112.8 \pm 117.5$  seconds respectively; ( $p=0.003$ ) (Table 1).

**Table 1** Demographic characteristics, as well as the degree, localization and duration of pain in the patients treated with LCT-propofol or LCT/MCT-propofol.

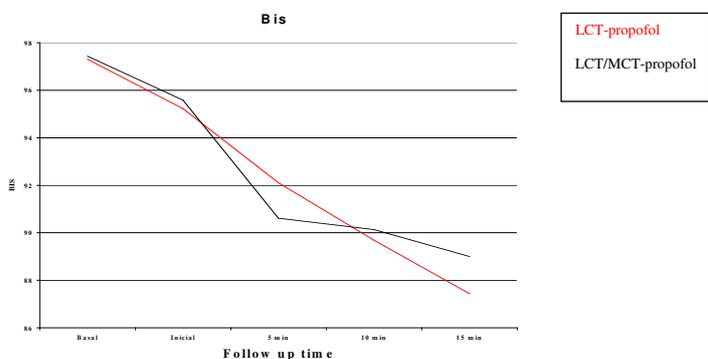
	LCT- propofol N=65 (%)	LCT/MCTp propofol N=65 (%)	p-value
<b>GENDER</b>			<b>0.57</b>
Male	42 (64.6)	45 (69.2)	
Female	23 (35.3)	20 (30.7)	
<b>AGE*</b>	<b>48.2±12.1</b>	<b>44.4±14.7</b>	<b>0.15</b>
<b>Body Mass Index*</b>	<b>26.0±3.8</b>	<b>26.6±3.5</b>	<b>0.42</b>
<b>PRESENCE OF PAIN</b>	<b>39 (60)</b>	<b>26 (40)</b>	<b>0.02</b>
<b>DEGREE OF PAIN</b>			<b>0.06</b>
Mild	17 (43.6)	19 (73.1)	
Moderate	14 (35.9)	5 (19.2)	
Intense	8 (20.5)	2 (7.7)	
<b>LOCALIZATION OF PAIN</b>			<b>0.002</b>
Injection site	10 (25.6)	20 (76.9)	
Vessel trajectory	15 (38.5)	4 (15.4)	
Both localizations	14 (35.9)	2 (7.7)	
<b>DURATION OF PAIN</b>	<b>112.8±117.5</b>	<b>52.5±94.0</b>	<b>0.003</b>

\* mean ± s.d..

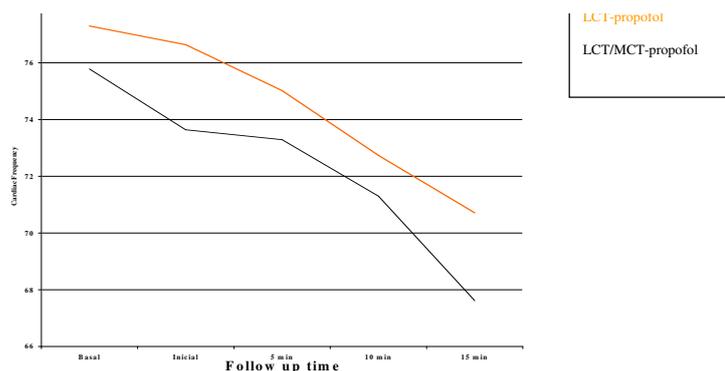
**Table 1** Degree of pain in the two study groups according to gender with LCT-propofol or LCT/MCT-propofol.

	MEN				WOMEN			
	LCT propofol N=42 (%)	LCT/MCT propofol N=45 (%)	TOTAL N=87 (%)	p-value	LCT propofol N=23 (%)	LCT/MCT propofol N=20 (%)	TOTAL N=43 (%)	p-value
				0.008				0.06
Nothing-mild	32 (76.8)	43 (95.8)	75 (86.2)		11 (47.8)	15 (75.0)	26 (60.5)	
Moderate-intense	10 (23.8)	2 (4.4)	12 (13.8)		12 (52.2)	5 (25.0)	17 (39.5)	
<b>TOTAL</b>	<b>42</b>	<b>45</b>			<b>23</b>	<b>20</b>		

No significant differences were found in the pharmacological effect of the formulations, as measured in terms of BP, HR and BIS parameters (Figs. 1,2,3).



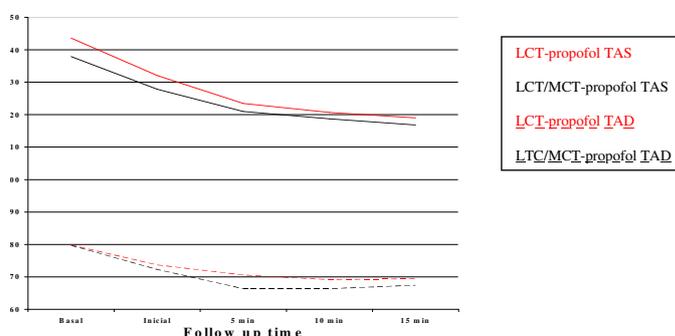
**Figure 1** Changes in BIS values in the two groups during the course of the study.



**Figure 2** Changes in heart rate in the two groups during the course of the study.

The degree of satisfaction reported by all patients when asked about the sedation experience was excellent (62%), good (31%), poor (4%) and not good (3%) (Table 3). In the 4 patients who reported satisfaction as “not good”, the intensity of pain was moderate (2 cases) and intense (2 cases). Moreover, in these cases, the duration of pain was very long, lasting over 300 seconds in 3 of the cases. However, pharmaceutical formulation was not associated with pain, since 2 belonged to the LCT-propofol group and 2 to the LCT/MCT-propofol group.

**Systolic and Diastolic Blood Pressure**



**Figure 3** Intraoperative changes in systolic and diastolic blood pressure.

**Table 3** Patient satisfaction using a Likert scale.

SATISFACTION SCALE	PATIENTS (%) n = 130
Strongly Agree (Excellent)	81 (62)
Agree (Good)	40 (31)
Neither Agree Nor Disagree (Poor)	5 (4)
Disagree (Not Good)	4 (3)

## Discussion

Propofol is a lipid soluble i.v. anesthetic that is widely used in the clinical setting as a hypnotic to achieve general anesthesia as well as sedation [11]. It is formulated in a fat emulsion, which contains almost exclusively long chain triglycerides. This formulation induces pain during i.v. injection, with a reported incidence in 64–67% of patients [2,3].

A multitude of strategies have been tried to reduce this pain, although not eliminate it. The most widely used and efficacious method consists of adding lidocaine to propofol [12], although other methods such as the addition of opiates [3], metoclopramide or modification of the temperature of the product [12,13] have also been tried. Alternatively, the pharmaceutical formulation of the drug can also be modified. New generic formulations of propofol have appeared on the

market [14], as well as variations of the original drug with changes in its formulation in order to try to minimize the undesirable side effects such as pain during i.v. injection, hypertriglyceridemia in prolonged administration regimes and ease of bacterial contamination [6]. One of these new formulations is LCT/MCT-propofol. This emulsion contains triglycerides with an equal proportion of medium and long chains. Since its appearance on the market, a reduced incidence of pain has been reported with LCT/MCT-propofol in one study, 37% vs. 64%. [2]

The pain produced by propofol may be associated with the quantity of drug in the aqueous phase of the emulsion and that reduced pain is associated with a lower concentration of propofol in the total volume [4]. LCT-propofol presents a concentration of propofol in the aqueous phase of the emulsion of about  $18.6 \pm 0.6$  mg/ml, whereas LCT/MCT-propofol presents a concentration of  $14 \pm 0.5$  mg/ml. This reduced concentration may explain the reduction in the irritation of the vascular endothelium [6].

Previous studies were conducted with patients who had received general anesthesia [3,6,15]. Thus, pain was monitored over short time intervals, from the administration of the drug until the loss of consciousness. However, Song et al. documented pain experienced during i.v. injection in sedation cases [16]. We believe that sedation is the ideal framework for studies of i.v. pain, since the patient is awake and can provide more and better quality information.

The objective of the present study was to report pain during i.v. injection when using propofol for sedation, in order to adequately ask patients about the characteristics and duration of the associated pain. It is very important to specifically ask the patient, because much information can be lost if we rely only on spontaneous patient reporting. This has been demonstrated by other authors such as Ayuso et al [5], who estimated the incidence of pain during i.v. injection and found that only a third of patients spontaneously reported pain, with the remainder of patients reporting pain only when asked about it. It is also important to note that pain is not felt by all patients immediately upon beginning drug infusion. Rather, in some cases it appears later. These data could be lost if one does not continue to specifically ask the patient.

It should be noted that in the reported studies, propofol was administered manually [3,5,6,15]. Manual administration may result in a large variation in the velocity of infusion between patients and this raises the possibility a conditioning factor in the appearance of pain. In order to reduce this bias, we used an infusion pump (TCI system) to administer infusion of propofol equal velocity in all patients.

There were statistical differences in presence of pain between the groups, with the LCT/MCT formulation of propofol associated with a decreased incidence of pain during sedation administered by TCI system, compared with the LCT formulation. These results are similar to other authors present, when use propofol to induction of anesthesia [17].

Significant differences were observed in the localization of pain between groups. In the case of LCT/MCT-propofol, pain was restricted principally to the site of injection, whereas in the case of LCT-propofol, a broader localization was reported (Table 1). This difference may be due to the concentration of propofol in the aqueous phase of the emulsion. Thus, in patients who received LCT-propofol, pain was perceived over wider areas, perhaps due to the larger concentration of drug in the aqueous phase of the emulsion in comparison to LCT/MCT-propofol and this may underlie why pain is perceived farther away from the injection site.

An important parameter that we could measure because our patients were sedated was the duration of pain. We found that the duration

of pain in patients administered LCT-propofol was almost double that of those who received LCT/MCT-propofol ( $112.8 \pm 117.5$  sec vs.  $52.5 \pm 94.0$  sec respectively) with a significant difference ( $p=0.003$ ). Significant differences were found in the severity of pain between treatment groups in men ( $p=0.008$ ), however in women no significant differences ( $p=0.06$ ) were found. There may have been too few women enrolled in the study to detect a statistical difference in the incidence of pain.

We assessed the commonly-used BP, HR and BIS values as a measure of pharmacological effect [18,19,20]. The BP-systolic, BP-diastolic and HR values, as well as BIS values were found to be similar for the two formulations (Figs. 1,2,3). These data corroborate those of other studies that also reported an absence of pharmacodynamic differences [21,22].

The degree of patient satisfaction was overall quite good (Table 3). In four cases where satisfaction was not good this was due to moderate to intense pain. Also, in three of these cases, the patients experienced long-duration pain; 300 secs in three of the cases which is the maximum duration that we measured. When pain is moderate or intense and in addition of long duration, the benefit which sedation offers may be lost because the patient feels uncomfortable and does not attain the intended degree of comfort. If the patient experiences moderate-intense pain, it may be advisable to employ a different sedative drug.

In conclusion, we monitored pain induced by i.v. injection for sedation, using the LCT/MCT-propofol and LCT-propofol, and we observed that LCT/MCT-propofol reduces the incidence, degree and duration of pain of injection when it is used for sedation by TCI. The degree of patient satisfaction with sedation was very good, except in cases in which pain was intense and prolonged over time.

## References

1. Hurlle M. Fármacos anestésicos generales en: Florez ed. *Farmacología humana*. 3º ed. Barcelona. Masson S.A. 1997: 477–488.
2. Larsen B, Beerhalter U, Biedler A, Brandt A, Doege F, Brun K, Erdkonig R, Larsen R. Less pain on injection by a new formulation of propofol? A comparison with propofol LCT. *Anaesthesist* 2001; **50**: 842–845.
3. Nathanson MH, Gajraj NM, Russell JA. Prevention of pain on injection of propofol: a comparison of lidocaine with alfentanil. *Anesth analg* 1996; **82**: 469–471.
4. Doenicke AW, Roizen MF, Rau J, Kellermann W, Balb J. Reducing pain during propofol injection: the role of the solvent. *Anesth Analg* 1996; **82**: 472–474.
5. Ayuso MA, Luis M, Sala X, Fernandez J, Gomar C. Estudio de la incidencia de dolor a la inyección de una nueva preparación de propofol en emulsión grasa conteniendo triglicéridos de cadena media y larga. *Rev Esp Anestesiol Reanim* 2004; **51**: 531–536.
6. Rau J, Roizen M, Doenicke A, O'Connor M, Strohschneider U. Propofol in a emulsion of long- and medium-chain triglycerides: the effect on pain. *Anesth analg* 2001; **93**: 382–384.
7. Theilen HJ, Adam S, Albrecht M, Ragaller M. Propofol in a medium- and long-chain triglyceride emulsion: pharmacological characteristics and potential beneficial effects. *Anesth Analg* 2002; **95**: 923–929.
8. Norton JR, Bailey PL, Litman RS y cols. Lower plasma triglyceride levels with a new propofol formulation. *Anesthesiology* 2001; **95**: A486.
9. Melzack R, Katz J. Pain measurement in persons in pain. In Wall PD, Melzack R Eds. *Textbook of Pain* (4th edition). Churchill Livingstone, Edinburgh 1999; 409–426.
10. Likert R. A technique for the measurement of attitudes. *Archives of Psychology* 1932; **140**: 1–55.
11. Bryson HM, Fulton BR, Faudls D. Propofol. An update of its use in anaesthesia and conscious sedation. *Drugs* 1995; **50**: 513–559.
12. Picard P, Tramer MR. Prevention of pain on injection with propofol. A quantitative systematic review. *Anesth Analg* 2000; **90**(4): 963–969.
13. Babl J, Doenicke A, Monch V. New formulation of propofol in an LCT/ MCT emulsion. *EHP* 1995; **1**: 15–20.
14. Telletxea S, Perez P, Gomez C, Makua P, Arizaga A. Propofol: nuevas formulaciones. *Rev Esp Anestesiol Reanim* 2006 ; **53**: 426–436.
15. Kam E, Abdul-Latif MS, McCluskey A. Comparison of propofol-lipuro with propofol mixed with lidocaine 10 mg on propofol injection pain. *Anaesthesia* 2004; **59**: 1167–1169.
16. Song D, Hamza M, White P, Byerly S, Jones S, Macaluso A. Comparison of a lower-lipid propofol emulsion with the standard emulsion for sedation during monitored anesthesia care. *Anesthesiology* 2004; **10**: 1072–1075.
17. Suzuki H, Myazaki H, Andoh T, Yamada Y. Propofol formulated with long/medium-chain triglycerides reduces the pain of injection by target controlled infusion. *Acta Anesthesiol Scand* 2006; **50**: 568–571.
18. Calvo R, Telletxea S, Leal N, Aguilera L, Suarez E, De la Fuente L, y cols. Influence of formulation on propofol pharmacokinetics and pharmacodynamics in anesthetized patients. *Acta Anaesthesiol Scand* 2004; **48**: 1038–1048.
19. Song D, Hamza M, White P, Klein K, Recart A, Khodaparast O. The pharmacodynamic effects of a lower-lipid emulsion of propofol: a comparison with the standard propofol emulsion. *Anesth Analg* 2004; **98**: 687–691.
20. Leal N, Rodriguez M, Telletxea S, Aguilera L, Calvo R, Suarez E y cols. Gender comparison of the effect-site disequilibrium constant, ke0 of propofol for the blood pressure endpoint under routine anesthesia. *Eur J Anesth* 2006; **23**: A527.
21. Doenicke AW, Roizen MF, Rau J, O'Connor M, Krugler J, Klotz U y cols. Pharmacokinetics and pharmacodynamics of propofol in a new solvent. *Anesth Analg* 1997; **85**: 1399–1403.
22. Shafer SL. Propofol formulations. *Seminars in Anesthesia* 2002; **21**: 248–257.



## **Ambulatory Surgery is the official clinical journal for the International Association for Ambulatory Surgery.**

Ambulatory Surgery provides a multidisciplinary international forum for all health care professionals involved in day care surgery. The editors welcome reviews, original articles, case reports, short communications and letters relating to the practice and management of ambulatory surgery. Topics covered include basic and clinical research, surgery, anaesthesia, nursing; administrative issues, facility development, management, policy issues, reimbursement; perioperative care, patient and procedure selection, discharge criteria, home care. The journal also publishes book reviews and a calendar of forthcoming events.

### **Submission of Articles**

All papers should be submitted by e-mail as a Word document to one of the Editors-in-Chief. Anaesthetic papers should be sent to **Beverly K. Philip** and surgical papers to **Doug McWhinnie**. Nursing, management and general papers may be sent to either Editor.

Electronic submissions should be accompanied, on a separate page, by a declaration naming the paper and its authors, that the paper has not been published or submitted for consideration for publication elsewhere. The same declaration signed by all the authors must also be posted to the appropriate Editor-in-Chief.

**Doug McWhinnie** Division of Surgery,  
Milton Keynes Hospital, Standing Way, Milton Keynes,  
Buckinghamshire MK6 5LD, UK  
Email: dougmcwhinnie@uk2.net

**Beverly K. Philip** Day Surgery Unit, Brigham and  
Women's Hospital, 75 Francis Street, Boston, MA 02115,  
USA.  
Email: bphilip@zeus.bwh.harvard.edu