

# A comparison of spinal anaesthesia and propofol-sevoflurane-anaesthesia for ambulatory knee arthroscopy

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## Abstract

**Background:** The aim of this study was to compare spinal anaesthesia (SA) and general anaesthesia (GA) for outpatient knee arthroscopy in terms of recovery profiles and discharge times. **Methods:** Sixty ASA I–II patients were randomized to receive either SA ( $N = 30$ ) with lidocaine 50 mg/ml, 1 mg/kg or standardized propofol-sevoflurane-fentanyl GA ( $n = 30$ ). Postoperative pain, need for analgesics, recovery profiles, complications, discharge times and patient satisfaction were evaluated. Patients were asked to complete a questionnaire after 24 h and 1 week. **Results:** After GA, 27% of patients needed supplemental opioid analgesics in contrast to 3% after SA ( $P < 0.01$ ). Also, after GA 21(71%) patients suffered knee pain during the postoperative week compared to 10 (33.3%) after SA ( $P < 0.004$ ). Intensity of postoperative pain was low (VPS-values  $< 2$ ). Duration of knee pain tended to be longer in GA group: 2.97 days versus 1.37 days in SA group. There were no differences in discharge times. High degree of patient satisfaction was associated with both techniques without statistical difference. **Conclusion:** SA provided superior postoperative pain management and leads to reduced consumption of analgesics, especially strong opioids. Both techniques provide a high grade of patient satisfaction.

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**Keywords:** Spinal anaesthesia; General anaesthesia; Postoperative pain; Discharge times; Patient satisfaction; Knee arthroscopy

## 1. Introduction

The shift in surgery from inpatient to outpatient practice has taken place due to its cost-effectiveness. Endoscopic knee surgery is commonly performed on an outpatient basis because the operation is short and a rapid recovery is anticipated. The anaesthesia method suitable for ambulatory surgery must fulfill criteria of consistent onset and offset times, permitting a rapid recovery and in addition maximizing safety by having low incidence of side effects such as pain, nausea and vomiting.

Spinal anaesthesia (SA) is safe, has consistent onset and offset times and possesses favourable effects on pain [1]. SA is associated with a lower incidence of postoperative nausea and vomiting than general anaesthesia [2]. The major side effects of general anaesthesia (GA): difficult intubation, aspiration, and malignant hyperthermia, can be avoided. However, one must agree that traditional methods of spinal anaesthesia have proven problematic in ambula-

tory surgery. Though widespread availability of small-gauge pencil-point needles has largely alleviated the concerns of spinal headache, spinal anaesthesia for ambulatory surgery has fallen into disfavour because of concerns of transient neurologic symptoms (TNS) after intrathecal lidocaine [3] and, especially, concerns about delayed recovery and discharge [4,5].

The purpose of this prospective, randomized study was to determine the operating room efficiency, recovery profile, side effects, pain and patient satisfaction of lidocaine 1 mg/kg spinal anaesthesia compared with propofol-sevoflurane-fentanyl general anaesthesia in outpatients undergoing knee arthroscopy.

## 2. Methods

Approval was obtained from the institutional ethics committee to enroll 60 ASA I–II patients between the ages of 16 and 60 undergoing outpatient knee arthroscopy. Informed consent was obtained. Exclusion criteria included: morbid

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obesity (BMI > 30), chronic pain state, substance abuse, neurological disease, coagulopathy and infection at the spinal injection site.

The patients were randomly assigned to receive either spinal or general anaesthesia. As premedication all patients received 2 g of paracetamol p.o. Midazolam 7.5 mg was given as needed. An intravenous line was started and Na 0.9% solution was infused at a rate of 10 ml/kg/h. Intraoperatively EKG, SpO<sub>2</sub>, systolic, mean and diastolic blood pressure were recorded. In general anaesthesia group (GA) end-tidal CO<sub>2</sub> and end-tidal sevoflurane were recorded.

In the SA group, the patients were administered 1 mg of midazolam i.v. for sedation. The lumbar puncture was performed with the patient in the lateral recumbent position on the side to be operated. Lumbar punctures were made with Quincke-type 27G needle in the midline approach with the needle bevel parallel to the dural fibers. Upon free flow of cerebrospinal fluid (CSF), CSF was aspirated for dilution of hyperbaric lidocaine 50 mg/ml to a concentration of 20 mg/ml, and a dose of 1 mg/kg of lidocaine was administered. SA patients received no additional intraoperative sedation or analgesia.

In the GA group, the patients were given fentanyl 1 µg/kg, 1 mg of midazolam iv and propofol 2 mg/kg for induction and mivacurium 0.1 mg/kg for intubation. For maintenance of GA the patients were normoventilated with oxygen–air–sevoflurane mixture. Sevoflurane was used as 1 MAC fraction. Additional boluses of propofol 0.5 mg/kg and fentanyl at the discretion of the anaesthetist were administered. No local anaesthetic or opioid was used intra-articularly in either group.

Intraoperative time intervals recorded were: the time of anaesthesia induction (=time zero), duration of the surgical procedure, and total time in the operation room: postoperative time intervals recorded were: ability to take oral fluids, time to walk, time to eat, time to void and the time to home readiness. Patients were checked at 15 min intervals for home readiness. The criteria used were similar to our standard clinical practice: (1) vital signs within 20% of preoperative, (2) fully awake and oriented, (3) able to take oral fluids, (4) able to walk freely without aid, (5) minimal nausea, (6) minimal to moderate pain, (7) able to void, (8) no surgical problem and (9) adult escort person available.

A standard postoperative pain management was applied: primary choice was ibuprofen 600 mg × 1–3. If there were contraindications for NSAID a combination of paracetamol 500 mg and codein 30 mg was given. The same combination was used as additional medication in mild pain. Additional analgesia was provided with fentanyl 0.05 mg i.v. × 1–4. Pain was recorded on a verbal pain scale of 0 (none) to 10 (worst imaginable VPS). All medications were recorded. At the time of discharge the patients were asked about their postoperative pain, nausea, dizziness, vertigo, headache, backache and pruritus.

The patients were given a questionnaire where they were asked whether they had headache, backache, pain in the

knee or difficulties with daily activities (micturition, eating, walking, sleeping) during the first 24 h after operation or during the postoperative week. Positive responses were further clarified as to the degree of the complaint; in the case of headaches, whether the headache was positional in nature and, in the case of backache, whether there was associated radiation of pain. Degree of pain was assessed with a verbal pain scale. The patients were asked to rate their anaesthesia as poor, satisfied or good and in case of coming surgery on the other knee, would one want the same anaesthesia. All 60 patients returned the questionnaire.

A power analysis was initially conducted for recovery area stay. The sample size was estimated using an effect size of 15 min, a standard deviation of staying in recovery area of 20 min, and an alpha error of 0.05, and beta error of 0.2 (one-tail). The minimum number of patients required per group was 30.

Statistical analysis was conducted using SPSS-program. The values are given as mean and standard deviation. Nonparametric data such as VPS, incidence of headache, backache et cetera were analysed by Mann–Whitney *U*, chi-square or Fisher's exact test as appropriate. Continuous data were analysed using analysis of variance. Results were considered significant at a *P* value of 0.05.

### 3. Results

The demographic data were similar with respect to sex, age, height and body mass index between the two groups (Table 1). An exception was the somewhat higher mean weight in the GA group than in the SA group (76.4 kg versus 71.2 kg, *P* < 0.049). All spinal anaesthesias were successful. In the GA group, the total amount of propofol used was 188.0 mg (±33.7), equalling 2.3 mg/kg and total fentanyl dose 152.0 µg (±24.6), corresponding to 1.83 µg/kg per patient.

#### 3.1. Pain

During the first 24 h after operation the intensity of pain was consistently low, below 2 on the VPS. During the first 24 h at home, there were no significant statistical differences between the groups in incidence of knee pain, headache, backache or sore throat.(Table 2).

Table 1  
Demographic characteristics: age, sex, height, weight and BMI in spinal anaesthesia and general anaesthesia groups

	SA (n = 30)	GA (n = 30)	<i>P</i>
Age (years)	42.9 (11.9)	45.8 (7.2)	NS
Sex (male/female)	13/17	10/20	NS
Height (cm)	171.0 (8.2)	172.9 (10.3)	NS
Weight (kg)	71.2 (9.9)	76.5 (10.3)	0.049
BMI (kg/m <sup>2</sup> )	24.3 (2.9)	25.5 (2.5)	0.1

Values are given as mean and S.D.

Table 2  
Pain profile at home during the first 24 h in spinal anaesthesia (SA) and general anaesthesia (GA) groups

	SA (n = 30)	GA (n = 30)	P
Knee pain	18 (60%)	24 (80%)	NS
Headache	8 (26.7%)	3 (10%)	NS
Backache	10 (30%)	4 (13%)	NS
Sore throat	0	2 (6.7%)	NS

Results as number (percentage).

During the first postoperative week, significantly fewer patients experienced knee pain after SA than after GA ( $P < 0.004$ ). Table 3. Pain was consistently mild, VPS  $< 2$ . Knee pain tended to last longer after GA than SA: 3.0 (2.7) days versus 1.4 (2.3). Incidences of backache and headache were not statistically different. The headache was not positional and the backache did not radiate.

### 3.2. Pain medication

In GA group 28/30 patients had peroral postoperative analgesia. Ibuprofen was used in each case, mean dose was 840 mg per patient. In SA group, all patients had ibuprofen after operation, mean dose being 660 mg per patient.

After GA 11 patients (37%) needed additional pain medication and had paracetamol 500 mg with codein 30 mg. Fourteen GA patients (45%) needed one or several doses of fentanyl, mean dose 102 ug (range 50–510 ug). After SA 9 (31%) patients needed paracetamol with codein and one (3%) 50 ug of fentanyl. The need in postoperative fentanyl consumption was significantly lower in the SA group ( $P < 0.01$ ).

### 3.3. Complications

Two patients were not discharged until the following day. One patient in the SA group experienced vomiting and vertigo and one patient in the GA group experienced severe pain in the knee.

In the SA group, three patients (10%) complained of mild nausea and one of moderate nausea (3.3%). After GA mild nausea reported one patient (3.3%) and moderate nausea two (6.6%). The incidence of mild to moderate vertigo was 1/30 (3.3%) in the SA group and 4/30 (13.3%) in the GA group. The differences were not statistically significant. Two

Table 3  
Pain profile during the first postoperative week

	SA (n = 30)	GA (n = 30)	P
Knee pain	10 (33%)	21 (70%)	0.004
Headache	6 (20%)	2 (6.7%)	NS
Backache	7 (23%)	4 (13.3%)	NS
Sore throat	0	2 (6.7%)	NS

The number (percentage) of patients reporting pain in spinal anaesthesia (SA) and general anaesthesia (GA) groups.

Table 4  
Operation room and recovery times (in min)

	SA (n = 30)	GA (n = 30)	P
Duration of operation	27.0 (12.1)	31.7 (16.4)	NS
95% confidence interval	22.0–31.7	24.7–36.2	
Duration of induction	18.4 (4.6)	20.1 (5.7)	NS
Operation room time	62.0 (17.5)	64.3 (15.9)	NS
Total recovery room time	173.3(41.6)	175.6 (43.8)	NS
Time from induction of anaesthesia to			
Able to eat	153.5 (34.0)	154.6 (41.2)	NS
95% confidence interval	138.6–168.0	137.0–164.7	
Free walking	159.0 (36.4)	153.7 (36.8)	NS
95% confidence interval	143.0–170.5	139.7–167.7	
Urination	208.6 (7.9)	214.3 (9.8)	NS
95% confidence interval	201.1–236.7	206.6–248.1	
Home readiness	220.5 (46.0)	227.4 (54.6)	NS
95% confidence interval	192.3–224.9	194.1–234.5	

Values are given as mean (S.D.) and 95% confidence interval for mean.

patients after SA reported mild difficulty with micturition on the first postoperative day at home (6.7%). In the GA group two patients complained of drowsiness (6.7%).

### 3.4. Recovery times

Recovery time intervals are reported in Table 4. There were no statistical differences.

### 3.5. Patient satisfaction

One week after operation all patients would have a similar operation on ambulatory basis. Four of 30 (13%) after SA would prefer another method of anaesthesia whereas one patient (3%) after propofol-sevoflurane-fentanyl anaesthesia would prefer another method. The difference is not statistically significant. Two of the four SA patients who would prefer another anaesthesia deemed the postoperative observation period for too short. One of the two patients discharged not until the next day also disfavoured SA because of vomiting and vertigo. After GA four patients deemed the postoperative observation period for too short but only one of them would favour another anaesthesia.

## 4. Discussion

In this study, knee arthroscopy performed under spinal anaesthesia was associated with decreased pain immediately after operation and during the postoperative week.

Although more patients in the SA group tended to prefer another anaesthesia technique, patient satisfaction was good in both groups without statistical difference. Professionalism of staff and early discharge were mentioned on commentary sheets as important components of satisfaction in both groups. If complaints were given, it was because of inadequate preoperative information (three patients).

In previous reports comparing spinal anaesthesia with general anaesthesia similar results concerning the postoperative pain have been reported. In the study by Wong et al. [1] patients after GA had more pain in the postoperative recovery room than the patients receiving spinal anaesthesia (61% versus 15%,  $P < 0.01$ ) and a higher incidence of analgesic use (59% versus 7.5%,  $P < 0.01$ ) corresponding equally with our results. In the report by Martikainen et al. [2] the level of postoperative pain was low, below VAS four in all spinal anaesthetics and 86.7% of general anaesthetic patients. This is also in agreement with our findings. Better early pain relief after spinal anaesthesia is the result of residual analgesia in the recovery room.

In contrast to the favourable outcome regarding the postoperative knee pain, head- and backache dominated after spinal anaesthesia. The etiology of backache is unknown, but may be due to direct trauma of the interspinous ligaments by the spinal needle. In previous study of Wong et al. [1] reported that incidence of backache was 35% after SA compared with 13.6% after GA. This is in good agreement with our 30 and 13% during the first 24 h after operation. Brooks et al. [6] noted no difference in the incidence of backache whether an introducer needle was used or not. In contrast, Morris-Viñoles et al. [7] studied in large randomized prospective study effect of 27G and 29G Sprotte needles to head- and backache. Lumbar ache was reported in 26% of the patients in the 27G group and 18.5% in the 29G group. However, the rates decreased to 4.5 and 0.5% on the seventh day. In our study, difference in incidence of backache was not statistically significant. It is important to note that this study is not powered to address differences in any side-effects. An additional study powered to detect such differences would be needed to compare the techniques for those outcomes.

In agreement with the report of Martikainen et al. [2] 20% of our patients after spinal anaesthesia had headache after 1 week compared with 7% after general anaesthesia. This might be a sign of postspinal headache although the patients reported no positional alteration in headache intensity.

Anaesthesia induction time, operation room time, recovery room time and discharge times were similar in both groups. Martikainen et al. [8] reported in their earlier study significantly longer discharge time after lidocaine spinal anaesthesia compared with propofol-desflurane or propofol-isoflurane. However, no significant difference in recovery unit time was found between lidocaine spinal

anaesthesia and propofol-sevoflurane anaesthesia [2]. Applied criteria for home readiness may be the main cause for differing discharge times. Ben-David et al. [9] compared minidose-lidocaine-fentanyl spinal anaesthesia with local anaesthesia and found no difference in discharge times. Their criteria for discharge differed from our criteria in three points: able to stand up and remain standing for >1 min, having-and tolerated per os fluids and voiding was not required before discharge. Our patients walked, tolerated food and voided. In particular, voiding prolonged discharge times in this study.

In conclusion, lidocaine spinal anaesthesia provides superior postoperative analgesia and decreased consumption of analgesics, especially opioids, after ambulatory knee arthroscopy compared with propofol-sevoflurane-fentanyl anaesthesia. Although there appear to be different advantages and disadvantages, both techniques provide a high degree of patient satisfaction.

## References

- [1] Wong J, Marshall S, Chung F, Sinclair D, Song D, Tong D. Spinal anaesthesia improves the early recovery profile of patients undergoing ambulatory arthroscopy. *Can J Anaesth* 2001;48:369–74.
- [2] Martikainen M, Kangas-Saarela T, Lopponen A, Ohtonen P, Salomäki T. Two percent lidocaine spinal anaesthesia compared with sevoflurane anaesthesia in ambulatory knee surgery-cost-effectiveness, home readiness and recovery profiles. *Ambul Surg* 2001;9:77–81.
- [3] Pollock JE, Neal J, Stephenson C, Wiley C. Prospective study of the incidence of transient radicular irritation in patients undergoing spinal anaesthesia. *Anesthesiology* 1996;84:361–7.
- [4] Pavlin DJ, Rapp SE, Polissar NL, et al. Factors affecting discharge time in adult patients. *Anesth Analg* 1998;87:816–26.
- [5] Mulroy MF, Larkin KL, Hodgson PS, et al. A Comparison of spinal, epidural, and general anesthetic techniques for outpatient kneearthroscopy. *Anesth Analg* 2000;91:860–4.
- [6] Brooks RR, Oudekerk C, Olson RL, Daniel C, Vacchiano C, Maye J. The effect of spinal introducer needle use on postoperative back pain. *AANA J* December 2002;70(6):449–52.
- [7] Morros-Viñoles C, Pérez-Cuenca MD, Cedó-Lluís E, Colls C, Bueno J, Cedó-Vallobá F. Comparison of efficacy and complications of 27G and 29G Sprotte needles for subarachnoid anaesthesia. *Rev Esp Anestesiol Reanim* November 2002;49(9):448–54.
- [8] Martikainen M, Kaukoranta P, Kangas-Saarela T. Home readiness after day-case knee arthroscopy: spinal, desflurane, isoflurane or propofol anaesthesia? *Ambul Surg* 1998;6:215–9.
- [9] Ben-David B, DeMeo PJ, Lucyk C, Solosko D. A comparison of minidose lidocaine-fentanyl spinal anaesthesia and local anaesthesia/propofol infusion for outpatient knee arthroscopy. *Anesth Analg* August 2001;93(2):319–25 [2nd contents page].