Ambulatory Surgery

Ambulatory Surgery 6 (1998) 215–219

Home readiness after day-case knee arthroscopy: spinal, desflurane, isoflurane or propofol anaesthesia?

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Received 13 February 1998; accepted 22 February 1998

Abstract

In this study, four accepted methods of anaesthesia were compared during out-patient knee arthroscopy (KA). Immediate (< 2 h) postoperative recovery was evaluated in terms of pain, sedation, nausea and time for home readiness. 173 patients undergoing elective KA were randomised to receive either spinal, propofol infusion, isoflurane or desflurane inhalation anaesthesia. Postoperative pain, sedation and nausea were recorded at 30, 60, 90 and 120 min after arrival in the recovery unit (RU). Discharge readiness was defined as fulfilment of the following criteria in all groups: alert, stable vital signs, able to ambulate, able to take oral fluids, no nausea and pain controllable by oral medication. Postoperative pain, in general, was low in all groups. The spinal patients had significantly lower VAS scores ($p < 0.001$) than the general anaesthesia patients at 30, 60 and 90 min after arrival in RU. At 120 min the pain level was equal in all groups. No remarkable differences between the general anaesthesia groups were noted in terms of pain and nausea. The overall incidence of nausea was 3.4%. Propofol and isoflurane patients were more sedated at 30 min postoperatively than spinal and desflurane patients. At 60 min postoperatively all groups were alert. The time required for home readiness was significantly shorter in all the general anaesthesia groups (propofol 55 min, isoflurane 56 min and desflurane 46 min) than in the spinal anaesthesia group (168 min) ($p < 0.001$). General anaesthesia is a practical alternative in elective knee arthroscopy. The immediate recovery profile is smooth with low levels of pain and nausea and home readiness is achieved significantly sooner than after spinal anaesthesia.

Keywords: Anaesthesia-ambulatory; Desflurane; Home readiness, Isoflurane; Knee arthroscopy; Propofol; Spinal

1. Introduction

Knee arthroscopy is a surgical procedure well suited to be performed on an out-patient basis [1]. The choice of the ideal anaesthetic technique, is still controversial [2,3]. Spinal anaesthesia is widely used in day surgery and has been proven to be safe and to provide satisfactory conditions for surgery [3,4]. However, the postoperative recovery period following spinal anaesthesia may be long compared to the short operation time. General anaesthesia with short-acting medication may be a practical alternative with a short postoperative recovery period.

The aim of this study was to compare four accepted methods of anaesthesia during out-patient knee arthroscopy, i.e. spinal, desflurane, isoflurane and propofol anesthesias. Postoperative recovery was evaluated in terms of pain, sedation, nausea and time for home readiness.

2. Methods

The protocol was approved by the Ethics Committee of the Medical Faculty, University of Oulu. After informed written consent, 173 patients (ASA I or ASA II, age under 65 years) scheduled for elective knee arthroscopy were randomly assigned into one of four groups. The exclusion criteria were: asthma, drug al-

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0966-6532/98/$ - see front matter
PII S0966-6532(98)00014-6

Table 1
Demographic characteristics, duration of operation and total time spent in operation theatre (OT)

	Group 1	Group 2	Group 3	Group 4
Number of patients (n)	55	32	38	48
Age (years)	41 (16–63)	37 (17–65)	41.5 (17–61)	37.5 (16--64)
Men/women (%)	46/54	38/62	62/38	63/37
Height (cm)	170 (153–187)	170 (153–183)	173 (153–184)	175.5 (155–186)
Weight (kg)	75 (46–95)	72 (51–95)	75.5 (52–95)	75 (54–95)
Operation time (min)	20 (7–75)	18 (6–77)	20 (7–67)	16 (7–70)
Total stay in OT (min)	64 (41–114)	64.5 (43–145)	65 (44–121)	60 (40–112)

Values are presented as medians and range (min–max).

lergy, non-steroidal anti-inflammatory drugs, obesity (women over 80 kg, men over 95 kg or BMI over 32), known epilepsy, pregnancy and active gastric ulcer. All patients had fasted for over 4 h before the anaesthesia. Upon arrival in the operating theatre, the patients were given 100 mg of ketoprofein diluted in 20 ml 0.9% NaCl intravenously over 30 min after i.v. cannulation, and 1000 ml of 0.9% NaCl was given i.v. during their stay in hospital. The patients received alfentanyl 0.5 mg i.v. as premedication just before the spinal puncture or the induction of anaesthesia. Group 1 ($n = 55$) was given spinal anesthesia with lidocaine 50 mg/ml in 7.5% glucose, 1.5–2.0 ml, through a 27 gauge needle. The block was performed laterally through the lumbar III/IV space with the patient lying on the side to be operated. Group 2 ($n = 32$) was anaesthetised with propofol, starting with a bolus 2 mg/kg i.v. followed by continuous infusion of 12 mg/kg per h for the first 15 min, 9 mg/kg per h for the next 15 min, and when needed, 6 mg/kg per h until the end of surgery. Group 3 ($n = 38$) was anaesthetised with isoflurane after a propofol bolus of 2 mg/kg. Isoflurane was given in rising concentrations up to 1 MAC before the skin incision. After that, anaesthesia was maintained with isoflurane on the 1 MAC level. Group 4 ($n = 48$) was anaesthetised with desflurane after the same induction dose of propofol as before. Desflurane inhalation was started at doses of 7.25% for patients aged over 30 and 6% for those less than 30 years old. The goal was to reach 1 MAC before the skin incision and to continue at that level during the operation. Anaesthesia was deepened if the patient showed evidence of light anaesthesia (sweating, haemodynamic and pupillary changes). All the general anaesthesia patients were relaxed with a single bolus of mivacurine 0.3 mg/kg and intubated. The patients were normoventilated ($EtCO_2$ 4.5–5.5%) with 30% oxygen in air. Alfentanil 0.5 mg was given for pain when needed (systolic blood pressure or heart rate rise of 20% over baseline value). All groups were anaesthetised by the same person. Preoperative monitoring included vital signs, such as blood pressure (BP), heart rate (HR), SaO_2 and the concentrations of inhaled and exhaled gases. Inhalation anaesthesia and propofol infusion were discontinued when skin closure was started. Postoperatively, all patients received 100 mg of ketoprofein i.v. or p.o. three times per

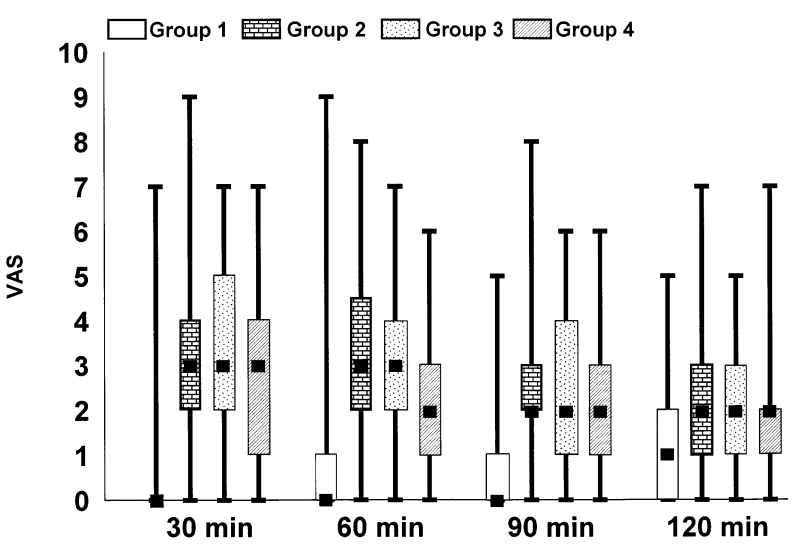

Fig. 1. Pain. Median, 25 and 75% percentiles and range.

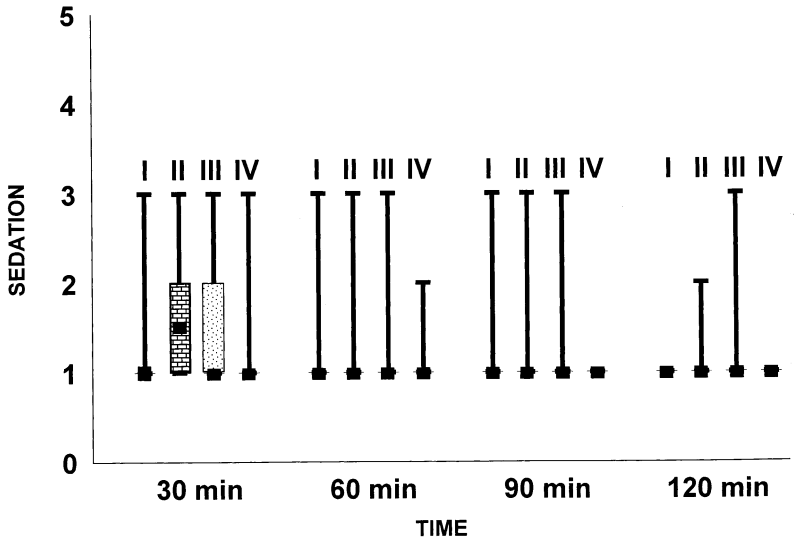

Fig. 2. Sedation. Median, 25 and 75% percentiles and range. I Group 1, II Group 2, III Group 3, IV Group 4.

24 h and 0.05 mg of fentanyl i.v. when needed for postoperative pain relief.

2.1. Postoperative period

The time of extubation, the patient's eye opening when asked, the ability to obey orders ('squeeze my hand') and orientation ('name and date of birth') were recorded. In the RU, vital signs were monitored regularly (HR, BP, SaO_2, alertness) at intervals of 30 min after arrival until discharge from the RU. The following parameters were recorded: degree of pain as estimated by VAS (0–10), degree of alertness (on a scale 1 = fully awake, 2 = sleepy, mostly awake, 3 = sleeps, wakable by words, 4 = sleeps, wakable, 5 = in coma), postoperative nausea and vomiting (PONV) (on a scale 0 = no PONV, 1 = mild PONV, no medical treatment, 2 = PONV with medical treatment, 3 = serious PONV, medical treatment ineffective). If the patient vomited or the nausea lasted for over 15 min, the patient was given metoclopramide 10 mg i.v. If the patient felt nausea after the metoclopramide dose, 4 mg of ondancetrone was given i.v. DSST [5] was administered preoperatively and 60 min after the end of anaesthesia to evaluate home readiness. In this test, the person is asked to replace random digits from 0–9 by a symbol given in the test paper. The score is calculated as the number of correctly substituted digits in 120 s. For Group 1, the time from the end of anaesthesia until full strength of the lower extremities was achieved and an ability to walk and void were noted. Discharge readiness was defined as fulfilment of the following criteria in all groups: alert, stable vital signs, able to ambulate, able to take oral fluids, no nausea and pain controllable by oral medication.

Table 2
DSST preoperatively (DSST 0), 60 min postoperatively (DSST 60) and difference between DSST 60 and DSST 0 (DSST-DIFF)

	DSST 0 (median)	DSST 60 (median)	DSST-DIFF (%)
Group 1	44.0	41.5	6.6
Group 2	46.3	39.4	15.0
Group 3	43.0	38.9	9.6
Group 4	44.4	38.7	13.0

2.2. Statistics

The Kruskall–Wallis test was used for the non-parametric variables and Anova for the parametric variables (Post Hoc Scheffe test). $p < 0.05$ was considered to be significant.

3. Results

5.5% of the patients who were asked to participate in the study refused, mainly because they wanted regional anaesthesia. 8.5% of the patients were excluded from the analyses because of lack of information or because the registrations had not been done according to the protocol. 173 patients were recruited for the study. 15.5% of the procedures were diagnostic scopies.There were no signifigant differences between the groups as to demographic data (Table 1). The patients were stable pre- and postoperatively and there were no significant differences in vital signs between the groups.

The level of postoperative pain, in general, was low in all groups. Group 1 had significantly lower VAS scores ($p < 0.001$) than the three general anaesthesia groups at 30, 60 and 90 min after arrival in RU (Fig.

Table 3
Recovery characteristics

	Group 2 ($n = 32$)	Group 3 ($n = 38$)	Group 4 ($n = 48$)
Opens eyes (min)	11 (2–32)	12 (4–29)	8 (1–18)
Extubation (min)	9 (2–32)	11 (3–24)	8 (1–18)
Follows order (min)	12 (2–32)	12 (4–29)	8 (2–18)
Orientation (min)	13 (2–32)	13 (5–33)	9 (2–19)
Sitting (min)	35 (2–75)	32 (17–60)	28 (12–57)
Drinking (min)	38 (13–97)	37 (14–110)	31 (12–117)
Standing (min)	51 (21–125)	46 (23–131)	38 (14–127)
Walking (min)	50 (22–102)	50 (23–131)	38 (14–127)
Home readiness (min in RU)	55 (22–107)	56 (23–165)	46 (19–154)
Total stay in RU (min)	184 (130–300)	204 (135–325)	197 (80–340)

Mean and range (min–max).

1). At 120 min after arrival in RU, the pain level was equal in all the groups. No remarkable differences between the general anaesthesia groups were noted. The need for opioid analgesia postoperatively was low. During the first 2 h in RU, 12.2% of the patients needed fentanyl 0.05 mg i.v. (2.0% in Group 1, 4.7% in Group 2, 2.7% in Group 3 and 3.4% in Group 4). Two patients were given oxycodone in RU: one because the spinal anaesthesia ended rapidly and one because the VAS level was high in Group 4. 2.3% of the patients (one in Group 1 and three in Group 2) had to stay in hospital until the next day because of pain. The incidence of postoperative nausea was 3.4% (no statistical difference between the groups). Because of nausea, 0.5% of the patients had to stay at hospital until the next day.

The patients were alert postoperatively (Fig. 2). At 30 min postoperatively, the Groups 2 and 3 were more sedated than the Groups 1 and 4 ($p < 0.001$). Although the patients were alert in all groups at 60 min postoperatively and no statistical difference was noted in terms of sedation, the preoperative DSST values were not reached (Table 2). The recovery characteristics are shown in Tables 3 and 4. The time before home readiness was significantly shorter in all the general anaesthesia groups than in the spinal anaesthesia group ($p < 0.001$).

Table 4
Recovery characteristics

	Group 1 ($n = 48$)
Moves toes (min after spinal injection)	100 (54–156)
Moves ankle	100 (54–137)
Flexes knee	90 (42–137)
Lifts foot	98 (55–152)
Sitting	108 (57–190)
Standing	169 (90–254)
Walking	173 (90–254)
Voiding	210 (130–314)
Home readiness (min in RU)	168 (90–260)
Total stay in RU (min)	208 (124–375)

Mean and range (min–max).

4. Discussion

The principal result of the study was that when spinal anaesthesia with short acting lidocain is used, the time before home-readiness is over three-fold longer compared to general anaesthesia with propofol, isoflurane or desflurane. This means that spinal anaesthesia patients need RU services for over 2 h longer than general anaesthesia patients. An elective knee arthroscopy patient, regardless of anaesthesia, stays in OT for about 1 h and the operation lasts for about 20 min. The choice of an anaesthesia method that shortens the postoperative period is an important determinant of how many patients per day can be operated on. In previous studies the costs of anaesthetic medication were estimated to account for less than 10% of the overall costs, while the salaries of the medical and nursing staff accounted for more than 85% of the total cost of anaesthesia [6]. While staff costs are difficult to reduce, overall savings may be achieved by increasing the number of cases operated per day. The cost of special anaesthetic drugs may not be then so important [7]. The total time of stay in RU (mean 198 min) was long compared to the home readiness time (mean 52 min in the general anaesthesia groups and 168 min in the spinal anaesthesia group). The most common reason for a long stay in RU was that the patient had to wait to be escorted from the hospital. After 1 h the vital signs were stable and the patients were alert and able to walk, drink and eat in all the general anaesthesia groups. DSST at 60 min was lower than preoperatively, showing that the higher cognitive functions had not been fully recovered. This does not mean that the patient should be in hospital. With an adult escort, recovery at home is possible.

In this study, immediate postoperative pain after knee arthroscopy was not a problem. The general level of pain was lower in this study than in other studies on knee arthroscopy [2,7]. We ascribe this to the fact that all the patients received pre-emptive analgesia with an anti-inflammatory drug as premedication. The inci-

dence of postoperative nausea and vomiting was low in all groups and the incidence of delayed discharge after surgery was lower than in earlier studies [2,8]. The low VAS scores due to pain and the minimal use of postoperative opioids may have reduced the risk of postoperative nausea and vomiting [9].

We conclude that general anaesthesia is a practical alternative in elective knee arthroscopy. The immediate recovery profile is smooth with low levels of pain and nausea and home readiness is achieved significantly sooner than after spinal anaesthesia. More studies will be needed to assess longer recovery profiles (24 h–1 week).

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