ELSEVIER

Ambulatory Surgery 5 (1997) 67–70

Ambulatory Surgery

Cost-effective anaesthesia for outpatient arthroscopic surgery: Desflurane versus propofol?

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Received 1 April 1997; received in revised form 21 April 1997; accepted 28 April 1997

Abstract

We compared desflurane to propofol as the main anaesthetic in a balanced anaesthetic technique during elective arthroscopic day-case procedures with special reference to cost-effectiveness. A total of 80 ASA classification I patients were studied in a prospective randomised fashion. Surgery and anaesthesia were uneventful in all cases. Time spent in the recovery room and time to discharge was equal between the two techniques, desflurane and propofol. The estimated cost for desflurane maintenance was 40.5 SEK as compared to 114 SEK for a propofol maintenance ($P < 0.01$). Desflurane was found to be a cost-effective alternative to propofol for day-case anaesthesia. © 1997 Elsevier Science B.V.

Keywords: Outpatient anaesthesia; Ambulatory surgery; Cost-effective; Desflurane; Propofol

1. Introduction

The constraints of day-case anaesthesia dictate a smooth induction, good perioperative conditions and a rapid and pleasant recovery to ascertain a safe discharge from the hospital. The patients should become home-ready in a minimum of time while limiting pain, nausea or drowsiness.

The introduction of propofol has made a major contribution to day-case anaesthesia by providing most of these characteristics. Desflurane (Suprane, Pharmacia) is a new fluorine halogenated methyl ether volatile anaesthetic agent. The blood gas solubility for desflurane is 0.42, which is similar to that of nitrous oxide. This allows for a fast equilibration and desflurane is therefore promoted as having rapid induction and emergence/recovery characteristics [1]. The properties of desflurane promote its use in day-case practice. Most studies on new agents have focused on the clinical advantages of the drugs, but have ignored their cost. Cost considerations are of increasing importance when choosing anaesthetic techniques and drugs [2].

The aim of the present study is to compare a balanced anaesthetic technique based on propofol or desflurane as the main anaesthetic during a typical ambulatory surgical procedure, arthroscopy, looking at which regimen is most cost-effective.

2. Methods

The study protocol was approved by the local ethics committee. A total of 80 ASA classification I patients scheduled for elective arthroscopy on a day-case basis were randomly allocated to one of two anaesthetic techniques. Exclusion criteria were: Body weight above 95 kg, drug allergy, bleeding disorder and liver or kidney dysfunction.

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PII S0966-6532(97)00036-X

All patients refrained from eating and drinking from the evening prior to surgery until after the surgery was completed. If surgery was planned for the afternoon, at 11:00 h the patients were given a balanced sugar-electrolyte drip i.v.

Pre-medication in the form of 5 mg of midazolam was given intramuscularly on the general ward 40–90 min prior to anaesthesia.

Fentanyl 1–2 μg/kg was given 2–3 min prior to induction with propofol. After induction, the patients were separated into two groups with differing methods of maintaining anaesthesia:

1. Propofol infusion in accordance with the scheme by Roberts [3]. Breathing nitrous oxide in oxygen at a ratio of 2:1.
2. Desflurane anaesthesia, after induction the patients were breathing nitrous oxide in oxygen at a ration of 2:1 and desflurane was added in 1% increments every two to four breaths.

A fresh gas flow of 3 l/min was used. All the patients were breathing spontaneously through a face mask or laryngeal mask airway. A pharyngeal airway was used when found necessary during mask breathing. Breathing was assisted when necessary.

Depth of anaesthesia was adjusted according to clinical needs in accordance with Evans score [4]. Desflurane as well as propofol was adjusted throughout the procedure in order to maintain an adequate depth of anaesthesia, no fixed MAC equivalent or infusion rate was used. During surgery, all patients were given 30 mg of ketorolac i.v. At the end of the procedure, nitrous oxide was discontinued and the patients were breathing oxygen for 2–5 minutes at a fresh gas flow of 6 l/min. Propofol, as well as desflurane, was discontinued as the last stitch was completed.

All patients were cared for in the same postoperative room. The patients were transferred back to the general day-care ward when found awake with stable vital signs and without major pain or nausea. The patients were considered home-ready according to the routine of the department when able to stand, walk, drink and void and when any pain and/or nausea had subsided [5].

Pain was treated initially with peripheral acting analgesics (1 g paracetamol). If this was insufficient to mitigate pain, a small i.v. dose (2–3 mg) of ketobemidine was given. In cases with severe persistent nausea or vomiting, 1 mg of droperidol i.v. was given as an antiemetic. All spontaneous complaints of pain, nausea and vomiting, need for pain relief and anti emetics were recorded as well as time spent in the recovery room and time to discharge.

The cost for each technique was calculated from the amount of main anaesthetic agent required times the cost for desflurane and propofol in SEK. The official list price for desflurane (2.2 SEK/ml) and propofol (0.28 SEK/mg) was used.

Table 1
Patients characteristics and type of surgery

	Desflurane ($n = 40$)	Propofol ($n = 40$)
Sex (men/women)	24/16	17/23 ns
Age (years)	34 ± 13	36 ± 12 ns
Weight (kg)	72 ± 11	70 ± 12 ns
Therapeutic procedure	29	26 ns
Diagnostic procedure	11	14 ns

ANOVA and χ^2-tests carried out. ns, not significant.

All values are given as mean + S.D. unless others stated. Continuous variables such as age and time spent in the recovery room was compared with Student's t-test and descrete variables with χ^2 test. A $P < 0.05$ was considered statistically significant.

3. Results

The two groups of patients were comparable in terms of demographic data and surgical procedures performed (Table 1). No major complications were observed during surgery or anaesthesia. Duration of surgery and anaesthesia was the same for both anaesthetic groups (Table 2). Mean endtidal desflurane concentration during surgery was 2.4%. Average time spent in the recovery room was 77 ± 16 min without difference between the groups (Table 2). A total of 42 patients complained about pain (53%) and two experienced nausea during the time spent in the recovery room (Table 3). Mean time from end of anaesthesia until considered home-ready was 255 ± 70 min and again there was no difference between desflurane and propofol anaesthesia (Table 2). The number of patients complaining of pain or emesis during the entire recovery period is shown in Table 4.

The calculated cost for desflurane was 40.5 ± 18 SEK and for propofol 114.0 ± 34 SEK ($P < 0.01$).

4. Discussion

The major finding of our study is that both techniques where found safe and effective and that time

Table 2
Perioperative observations

	Desflurane ($n = 40$)	Propofol ($n = 40$)
Duration of surgery (min)	23 ± 9	25 ± 9 ns
Duration of anaesthesia (min)	45 ± 20	48 ± 11 ns
Time in PACU (min)	78 ± 15	77 ± 18 ns
Time to discharge (min)	255 ± 60	254 ± 79 ns

ns, not significant.

Table 3
Number of patients experiencing pain or emesis in the recovery room

	Desflurane ($n = 40$)	Propofol ($n = 40$)
No pain	21	18 ns
Pain	19	22
No PONV	38	40 ns
Nausea	1	0
Vomiting	1	0

χ^2 Test carried out. ns, not significant.

spent in the recovery room as well as time to discharge was the same for the desflurane and propofol patients. In most previous studies it has been shown that desflurane creates an emergence comparable to propofol however the propofol anaesthetised patients have been discharged earlier [6]. The difference in result may be explained by a number of reasons.

Pain and emesis are factors well known to be of importance to discharge [7,8]. In most previous studies comparing propofol to desflurane PONV has been more frequently seen among the desflurane patients [9–12]. In the present study we chose patients having arthroscopic surgery. Patients having peripheral orthopaedic surgery in general are prone to have a low incidence of postoperative emetic sequelae [13].

We found no significant difference in respect to PONV. Propofol was used for induction in all patients. The low frequency of PONV associated with propofol anaesthesia is well recognised [14]. Some have even stated a antiemetic effect of propofol [15]. Although an induction dose of propofol is hardly effective to completely alleviate the emetic action of inhalation anaesthetics and surgery per se it may indeed reduce the intensity and frequency of the emetic symptoms [8].

In the present study a balanced anaesthetic technique was used. All patients had a loading dose of fentanyl immediately prior to induction in order to reduce intraoperative pain. Both groups of patients were also given 30 mg of ketorolac during surgery in order to reduce postoperative pains, there are studies using bolus doses of up to 60 mg of ketoralac i.v. [16]. A 30 mg dose of ketoralac has been found to have a significant opioid sparing effect in a previous study in our institution [17]. This prophylactic treatment may have reduced the need for further opiates during the recovery period. The intricate interaction between pain, opiates and emesis is well known as are the importance of these factors for delaying discharge [18,19]. Standardised discharge criteria were used and the number of patients should be sufficient to detect a clinical significant difference regards recovery.

Table 4
Total number of patients experiencing pain or emesis until discharged

	Desflurane ($n = 40$)	Propofol ($n = 40$)
No pain	13	17 ns
Pain	27	23
No PONV	33	38 ns
Nausea	4	2
Vomiting	3	0

χ^2 Test carried out. ns, not significant.

Apart from the main anaesthetic all drugs used were the same for both groups of patients. Propofol and desflurane was found equally safe and effective as main anaesthetics. We did not see any sparing effect of using propofol for time spent in recovery room or in the step down unit. The main determinant for cost-effectiveness is therefore the cost associated to the main anaesthetic. We found desflurane maitenance to be considerably less expensive than the profol based technique. This is a finding in agreement with Rosenberg et al. [20].

To summarise, we did find desflurane to be an interesting alternative as maintenance in a balanced anaesthetic technique for day-case arthroscopic procedures, creating a cost less then half that for a propofol based technique.

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