การศึกษาเปรียบเทียบการฟื้นตัวของผู้ป่วยนอกที่มารับการดมยาสลบระหว่างเทคนิคการให้ยาสลบทางหลอดเลือดดำโดยใช้ Propofol และการให้ยาสลบวิธีสูดดมโดยใช้ N_2O - Halothane ช่วง Maintenance Phase

นางอุบลรัตน์ สันตวัตร

สถาบันวิทยบริการ
จุฬาลงกรณ์มหาวิทยาลัย

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COMPARISON OF RECOVERY BETWEEN TOTAL INTRAVENOUS ANAESTHESIA (TIVA) USING PROPOFOL AND INHALATIONAL ANAESTHESIA (IA) USING N_2O - HALOTHANE DURING MAINTENANCE PHASE OF ANAESTHESIA IN OUTPATIENTS

Mrs. Ubolrat Santawat

สถาบันวิทยบริการ
จุฬาลงกรณ์มหาวิทยาลัย

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BY	Ubolrat Santawat
Faculty	Medicine
Thesis advisor	Prof. Chitr Sitthi-amorn
Co-advisor	Associate Prof.Jariya Lertakayamanee

Accepted by the Graduate School, Chulalongkorn University in Partial Fulfillment of the Requirements for the Master's Degree/

Thavorn Vajrabhaya
..... Dean of Graduate School

(Prof. Thavorn Vajrabhaya Ph.D.)

Thesis Committee

P. Komolratanakul
..... Chairman

(Prof. Pirom Komolratanakul, M.D., M.Sc.)

Chitr Sitthi-amorn
..... Thesis advisor

(Prof.Chitr Sitthi-amorn, M.D., M.Sc., Ph.D.)

Jariya Lertakayamanee
..... Co-advisor

(Assoc. Prof. Jariya Lertakayamanee, M.D., F.R.C.A(Eng.),M.P.H.)

A. Leelarasamee
..... Member

(Assoc. Prof. Amorn Leelarasamee M.D., Med.,Sci., F.R.C.P.T.)

หอสมุดกลาง สถาบันวิทยบริการ จุฬาลงกรณ์มหาวิทยาลัย

อุบลรัตน์ สันตวัตร : การศึกษาเปรียบเทียบการฟื้นตัวของผู้ป่วยนอกที่มารับการดมยาสลบระหว่างเทคนิคการให้ยาสลบทางหลอดเลือดดำโดยใช้ PROPOFOL และการให้ยาสลบวิธีสูดดมโดยใช้ N_2O-HALOTHANE ช่วง MAINTENANCE PHASE (COMPARISON OF RECOVERY BETWEEN TOTAL INTRAVENOUS ANAESTHESIA (TIVA) USING PROPOFOL AND INHALATIONAL ANEASTHESIA (IA) USING N_2O-HALOTHANE DURING MAINTENANCE PHASE OF ANAESTHESIA IN OUTPATIENTS) อ.ที่ปรึกษา : ศ.นพ.จิตร สิทธิอมร อ.ที่ปรึกษาวิทยานิพนธ์ร่วม: รศ.พญ.จริยา เลิศอรรรยมณี , 66 หน้า. ISBN 974-584-417-9

การศึกษานี้มีวัตถุประสงค์เพื่อ

1. เปรียบเทียบการฟื้นตัวของผู้ป่วยนอกที่มารับการดมยาสลบ โดยใช้การทดสอบทางคลินิค, Perceptual Speed (PST), Ball Bearing (BBT), การฟื้นตัวที่บ้าน, อุบัติการณ์ของภาวะแทรกซ้อนและความพึงพอใจต่อวิธีการดมยาสลบ ระหว่างเทคนิคการให้ยาสลบทางหลอดเลือดดำโดยใช้ Propofol (TIVA) และการให้ยาสลบวิธีสูดดมโดยใช้ N_2O - Halothane (IA) ในช่วง Maintenance Phase
2. หาความสัมพันธ์ระหว่าง Visual Analogue of Sedation Score (VASS) กับ PST และ BBT
3. หาต้นทุนของทั้งสองเทคนิค

ผู้ป่วย 40 คน แบ่งเป็น 2 กลุ่ม คือ TIVA และ IA กลุ่มละ 20 คน โดยวิธี Randomization อายุเฉลี่ยของผู้ป่วย กลุ่ม TIVA และ IA คือ 23.45 $\pm$ 5.13 ปี และ 25.15 $\pm$ 8.59 ปี ตามลำดับ 80 % ของผู้ป่วย 2 กลุ่ม เป็นผู้ป่วยที่ได้รับการวินิจฉัยว่าจมูกหัก เวลาเฉลี่ยของการผ่าตัดของผู้ป่วยทั้ง 2 กลุ่ม คือ 34.65 $\pm$ 24.4 นาที , 30.6 $\pm$ 17.18 ตามลำดับ

การฟื้นตัวของผู้ป่วยถูกประเมินโดยผู้สังเกต ซึ่งไม่ทราบเทคนิคการดมยาสลบ โดยเปรียบเทียบเวลาจนกว่าผู้ป่วยจะมี orientation, สามารถนั่ง, สามารถยืนและจนกว่าผ่านการทดสอบ PST และ BBT ผลของการศึกษาพบว่าไม่มีความแตกต่างในเวลาการฟื้นตัวข้างต้นระหว่าง 2 กลุ่ม เวลาการฟื้นตัวของการทดสอบ PST และ BBT ของกลุ่ม TIVA คือ 1.2 $\pm$ 0.41 และ IA คือ 1.1 $\pm$ 0.31 ชั่วโมง

จากแบบสอบถามภายหลังการดมยาสลบซึ่งให้ผู้ป่วยไปตอบที่บ้าน พบว่าผู้ป่วยทั้ง 2 กลุ่มไม่มีความแตกต่างในการฟื้นตัวที่บ้าน อุบัติการณ์ของภาวะแทรกซ้อน และความพึงพอใจต่อวิธีการดมยาสลบ สำหรับสาเหตุของปัญหาในขณะที่กลับบ้านพบว่า ไม่มีผู้ป่วยกลุ่ม TIVA มีอาการง่วงนอน ในขณะที่ผู้ป่วยกลุ่ม IA มีอาการง่วงนอน 6 ราย จาก 16 ราย ค่า $p = 0.018$

การศึกษานี้ไม่สามารถบอกถึงความสัมพันธ์ระหว่าง VASS กับ PST และ BBT

ต้นทุนยาและอุปกรณ์ของเทคนิค TIVA คือ 642.51 บาท และเทคนิค IA คือ 363.15 บาท เนื่องจากการฟื้นตัวของทั้งสองเทคนิคเหมือนกันดังนั้นเทคนิค IA มีความเหมาะสมกว่าเนื่องจากมีต้นทุนยาและอุปกรณ์น้อยกว่าเทคนิค TIVA

ภาควิชา ศูนย์วิทยาการวิจัยแพทยศาสตร์ ลายมือชื่อนิสิต .....

สาขาวิชา การพัฒนาสุขภาพ ลายมือชื่ออาจารย์ที่ปรึกษา .....

ปีการศึกษา ๒๕๓๖ ลายมือชื่ออาจารย์ที่ปรึกษาร่วม .....

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KEY WORD: ANAESTHESIA / PROPOFOL / HALOTHANE / RECOVERY / OUTPATIENT
UBOLRAT SANTAWAT : COMPARISON OF RECOVERY BETWEEN TOTAL INTRAVENOUS ANAESTHESIA (TIVA) USING PROPOFOL AND INHALATIONAL ANAESTHESIA (IA) USING N_2O - HALOTHANE DURING MAINTENANCE PHASE OF ANAESTHESIA IN OUTPATIENTS. THESIS ADVISOR : PROF. CHITR SITTHI-AMORN, M.D., M.Sc., Ph.D. THESIS CO-ADVISOR : ASSO. PROF. JARIYA LERTAKAYAMANEE, M.D., F.R.C.A., M.P.H. 66 pp. ISBN 974-584-417-9

The aims of this study are :

1. to compare recovery by clinical tests, Perceptual Speed test (PST) and Ball Bearing test (BBT), home recovery, incidence of side effects and satisfaction of anaesthesia between total intravenous anaesthesia (TIVA) using propofol and inhalational anaesthesia (IA) using N_2O - halothane during maintenance phase of anaesthesia in outpatients.
2. to find the correlation of the Visual Analogue of Sedation Score (VASS) to the PST and BBT.
3. to determine average cost per case of each technique.

40 patients were randomly allocated into TIVA or IA group. The mean ages were 23.45 $\pm$ 5.13 year and 25.15 $\pm$ 8.59 year for TIVA and IA respectively. The diagnosis of 80 % of both groups were nasal fracture. The operative times were 34.65 $\pm$ 24.4 minutes and 30.6 $\pm$ 17.18 minutes for TIVA and IA respectively.

Recovery was assessed by the time to orientation, to sitting up, to standing up and to success in obtaining base line of the PST and BBT. The observers were blind to the anaesthetic technique that the patients received. Recovery tests showed no difference between the two groups. The recovery times of TIVA and IA as assessed by the PST and BBT were 1.2 $\pm$ 0.41 and 1.1 $\pm$ 0.31 hour respectively.

From home questionnaire , both TIVA and IA patients showed no difference in the first 2-3 hours of home recovery , incidence of side effects and satisfaction of anaesthesia. When asked about the difficulty in getting home , no TIVA patients complaint of sleepiness whereas 6/16 IA patients complaint ($p = 0.018$).

The results showed no correlation of the VASS to the PST and BBT.

The average cost per case of TIVA and IA were 642.51 and 363.15 bahts respectively. We concluded IA was more suitable than TIVA because of its lower cost.

ภาควิชา ศูนย์วิทยาการวิจัยแพทยศาสตร์ ลายมือชื่อนิสิต .....

สาขาวิชา การพัฒนาสุขภาพ ลายมือชื่ออาจารย์ที่ปรึกษา .....

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CHAPTER I

INTRODUCTION

Outpatient Anaesthesia - An Overview

Outpatient surgery is widely practiced in the United States and is increasing in popularity throughout the world. The practice of ambulatory surgery was first described in the early 1900s by Drs. J.H. Nicoll at the Glasgow Royal Hospital for Sick Children and R. Waters at the "Down-Town" Anaesthesia Clinic in Sioux City, Iowa (Burn, 1979). During the 1960s the first hospital-based ambulatory surgery facilities were established at the University of California in Los Angeles and George Washington University in Washington, DC. In 1970, the first successful freestanding outpatient facility was established in Phoenix, Arizona (surgicenter) by Drs. W.A. Reed and J.L. Ford. In the 1980, ambulatory surgery has continued to grow with over 600 freestanding outpatient surgery centers performing more than one million operations per year. At present, hospital - affiliated outpatient surgery procedures account for over 40 percent of all operations performed in the hospital setting (White, 1990).

Rationale for Outpatient Anaesthesia

There are several factors that contribute to the rapid

growth in ambulatory surgery. Advantages and disadvantages of ambulatory surgery are summarized in table 1.1 (Ogg, 1980, 1985).

Table 1.1 Advantages and disadvantages of ambulatory surgery

Advantages	Disadvantages
- Large numbers of patients treated	- Regarded by some surgeons as "second-class" service
- Fewer nurses required	- Good pre-operative selection is essential
- Good recruitment of nursing staff (no night or weekend duties)	- Doubts about the ideal anaesthetic technique
- Psychological benefits for children (no hospitalization)	- Minor sequelae will occur after surgery and anaesthesia
- Reduce surgical lists	- Medico-legal consideration in terms of patient recovery and driving
- Reduce cross - infection rates	- Possible increase in the workload of community service
- Economic benefits (dependent on a reduction in inpatient beds)	

source: Ogg 1980, 1985

Anaesthetic Technique for Outpatient

Ideal outpatient anaesthesia should fulfill the following criteria (Fishburne et al., 1974):

1. Recovery from the effects of anaesthesia should be rapid.

2. The technique used should be a safe one, that is, it should be possible to avoid aspiration of gastric contents, cardiac arrhythmias, hypotension, hypertension, hypoxia and hypercarbia.

3. The technique should provide amnesia and adequate analgesia during the perioperative period.

4. Adequate relaxation should be provided so that the operation can be performed as safely and expeditiously as possible.

5. There should be few anaesthesia-related side effects.

Outpatient anaesthesia is a rapidly growing and dynamic specialty. The anaesthetists are challenged to provide brisk patient turnover rate without compromising safety and high quality care. Most anaesthetists adopt their own techniques for outpatient surgery. The ideal technique has not been found yet. Total intravenous anaesthesia(TIVA) is a serious alternative to the use of inhalational anaesthesia(IA). TIVA has many advantages when compared with IA (Camu and Kay, 1991). These are:

1. the potential for administration of hypoxic gas mixtures is reduced,

2. less environmental pollution,

3. absence of exposure of patients and staff to N_2O and volatile agents. The rapid turnover rate of patients may lead to high level of theatre pollution since high gas flow are required,

4. better and faster recovery.

Propofol is currently the shortest acting commercially available intravenous anaesthetic drug. Propofol is redistributed rapidly and metabolized to a pharmacologically inactive metabolite (Reves and Glass, 1990). It is suitable for day-case anaesthesia. This project would like to investigate the recovery characteristics of two anaesthetic techniques, total intravenous anaesthesia (TIVA) using propofol and inhalational anaesthesia (IA) using N_2O-halothane during maintenance phase of anaesthesia.

Literature Review

The alkylphenol, propofol (2,6, di-isopropylphenol), has a high lipid solubility, which enhances its ability to cross the blood brain barrier. The propofol emulsion has not been associated with hypersensitivity or anaphylactic reactions. The drug has a large distribution volume and high clearance rate. Its elimination pharmacokinetics have been described by two and three compartment models. Using a two-compartment model, the elimination half life is 1-3 hours. When a three-compartment model is employed, elimination from the highly perfused tissue occurs in 0.5-1 hour while the terminal elimination has been estimated to occur over 3-6 hours. This long elimination half life will increase the likelihood of drug accumulation when repeated boluses or prolonged infusion are used. Nevertheless, with careful titration, emergence from anaesthesia occurs rapidly after discontinuation of an infusion. Propofol is highly metabolized to inactive metabolite. Propofol has

many of the characteristics of the ideal intravenous sedative-hypnotic agents for outpatient anaesthesia. It has rapid onset and recovery, less residual postoperative depressant effect and psychomotor impairment, low incidence of postoperative side effects and possible anti-emetic actions.

Reported side effects include pain on injection, involuntary muscle movements, drug inducing, occasional dizziness, headaches, and euphoria on emergence.

Currently available short-acting intravenous drugs have made it possible to administer a total intravenous anaesthesia that can approach the commonly used inhalational techniques with respect to controllable intra-operative activity and residual postoperative side effects. It is impossible to achieve an adequate depth of anaesthesia with one drug alone without administering a dose that produces significant cardiorespiratory changes, disturbing side effect and delayed recovery. The use of drug combination is a logical approach to achieve an optimal anaesthetic state for ambulatory surgery. By utilizing the minimal effective doses of different intravenous drugs with comparable pharmacokinetics and compatible pharmacodynamic profiles the anaesthetists can achieve a rapid, smooth induction, maintenance, and emergence from outpatient anaesthesia without untoward side effects. There are many studies comparing the recovery from propofol and other drugs in different techniques such as:

Raeder and Misvaer (1988), Doze, Westphal and White(1986), Doze, Shafer and White (1988) found that induction with propofol resulted in faster awakening and improved recovery profile compared

to methohexitone,

Puttick and Rosen (1988) showed that anaesthesia with repeated doses of propofol for dental anaesthesia in children was also followed by a more rapid recovery than the thiopentone-isoflurane anaesthetic technique,

Milligan et. al. (1987) found that initial recovery was more rapid in the incremental propofol than propofol-isoflurane in patients undergoing minor outpatient gynaecological procedures,

Zuurmond, Van Leeuwen and Helmers (1987) found no difference in recovery tests by using clinical tests and p-deletion test between continuous propofol infusion and propofol-isoflurane,

Nightingale and Lewis (1992) compared recovery from day-case anaesthesia between total intravenous anaesthesia (TIVA) using propofol with an inhalation technique (IT). The Critical Flicker Fusion Threshold, the Simple Reaction Time occurred significantly earlier in TIVA but the Choice Reaction Time resulted in no significant results.

Many studies found that recovery time from TIVA were varied by duration of anaesthesia and combination of drugs used (Forrest and Galletly, 1987, Health, Ogg and Gilks, 1990, Korttila et al., 1988, Nightingale and Lewis, 1992). Korttila et. al. (1988) compared recovery between TIVA and IA using Thiopentone - Isoflurane in outpatient anaesthesia and the result of recovery time in TIVA was 138 ± 18 min. From our experience in dental anaesthesia using propofol-N_2O-Halothane at Siriraj hospital, average recovery time was 2-3 hours.

There is no study of comparison of recovery between TIVA using propofol and inhalation technique using N_2O-halothane. TIVA is

currently a new technique and more expensive compared with IA which is commonly used in our country. Therefore this study would like to compare recovery and cost between these two techniques.

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CHAPTER II

RESEARCH DESIGN

Primary Research Question

For the two anaesthetic techniques:

a. total intravenous anaesthesia (TIVA) using propofol during maintenance of anaesthesia,

b. inhalational anaesthesia (IA) using N_2O-halothane during maintenance of anaesthesia,

are there any differences in recovery times as assessed by the Perceptual Speed test and the Ball Bearing test in outpatients? (Recovery time = time from anaesthesia ended to time when patients can perform the test within control $\pm$ 10%.)

Secondary Research Questions

1. Between two anaesthetic techniques, are there any differences in recovery times assessed by clinical tests (orientation, sitting up unaided and Romberg's test)?

2. Are there any correlation of the Perceptual Speed Test and the Ball Bearing Test to the Visual Analogue of Sedation Score?

3. Are there any differences in home recovery, side effects and satisfaction of anaesthesia between the two techniques?

4. From a provider's perspective, what is the average cost per case in each technique?

Research Objectives

1. To compare the recovery times assessed by clinical tests, the Perceptual Speed Test and the Ball Bearing Test between these two techniques in outpatients.

2. To measure the correlation of the Perceptual Speed Test and the Ball Bearing Test to the Visual Analogue of Sedation Score.

3. To compare home recovery, side effects and satisfaction of anaesthesia between the two techniques.

4. To determine the average cost per case in each technique.

Research Design

The study is a randomized controlled trial.

Design overview (see figure I)

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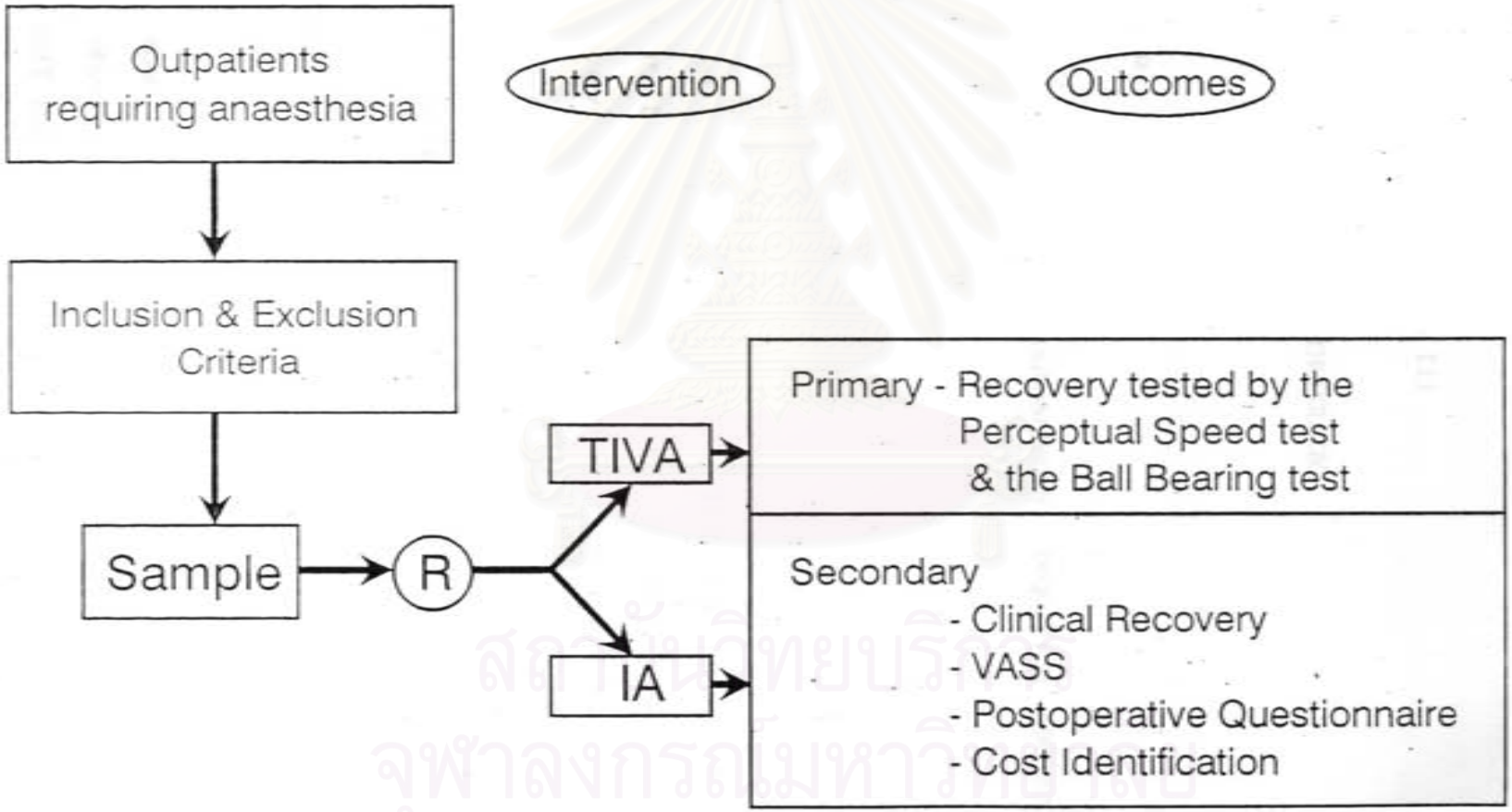
Design - overview



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CHAPTER III

RESEARCH METHODOLOGY

Target Population

Target population are outpatients requiring general anaesthesia.

Population Sampled

All nasal fracture and dental patients requiring general anaesthesia must be evaluated by anaesthetists before operation. Routine laboratory tests that will be obtained are complete blood count, urine analysis, chest X-ray and ECG for patients with age more than 45 years. Further investigations or specialist consultation will be needed if there are indications.

Inclusion criteria are:

1. nasal fracture and dental patients requiring general anaesthesia,
2. aged 12-60 years,
3. physical status I-II,

[Drips, Eckenhoff and Vandam (1982) stated that

Physical status I = The patients has no organic , physiologic,

biochemical or psychiatric disturbance. The pathologic process for which operation is to be performed is localized and does not entail a systemic disturbance.

Physical status II = Mild to moderate systemic disturbance caused either by the condition to be treated surgically or by other pathophysiologic processes.]

4. not taking psychoactive drugs,
5. no premedication before anaesthesia.

Exclusion criteria are:

1. patients having neurological or psychiatric problems,
2. illiterate patients,
3. BMI $\geq$ 30 kg/m^2 because halothane highly deposits in fat tissues and leads to delay in recovery.

Sampling Technique

We use simple block randomization into 2 groups:

1. Group I - TIVA
2. Group II - IA

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Sample Size Calculation

The study needs a pilot study to estimate sample size.

$$n/gr. = \frac{2\left[(Z_{\alpha} + Z_{\beta}) \sigma \right]^2}{\Delta^2}$$

Z_{α} = Type I error 5% = 1.96

Z_{β} = Type II error 10% = 1.28

σ^2 = variance $= \dfrac{(n_1-1)\sigma_1^2 + (n_2-1)\sigma_2^2}{n_1 + n_2 - 2}$

σ^2 = 0.17 (from pilot study)

Δ = difference of recovery time between two techniques.

We considered half an hour to be of minimum significance difference that results in more rapid turn over rate of bed for outpatient service. $\Delta = 0.5$

$$n/gr = \frac{2\,(1.96 + 1.28)^2 0.17}{(0.5)^2} = 14.28$$

The study needs at least 15 patients/group.

Maneuver

1. Each patient receives anaesthetic technique according to randomized selection.

2. The non - dominant hand should be taken for intravenous cannulation.

3. Semiclosed anaesthetic circuits with CO_2 absorbers will be used.

4. Steps and drugs used in the two anaesthetic techniques are described in table 3.1.

5. Patients are ventilated with tidal volume 10 cc/kg and rate 10/min.

6. All patients are monitored for blood pressure every 5 min., pulse oximetry, train of four and ECG.

7. The dental operations are combined with local anaesthesia at surgical sites for the least amount of anaesthetic agent to be used, rapid recovery and postoperative pain.

8. "Operation finished" means removal of surgical drapes.

9. In recovery room, there is no use of intravenous analgesic drugs. Droperidol would be given 0.5 mg. via intravenous to patients with severe vomiting. This dose did not prolong the recovery time (Van Steeberge, 1988).

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Table 3.1 Steps and drugs used in TIVA and IA.

Phase of Anaesthesia	TIVA (propofol)	IA N_2O-Halothane
Premedication	Atropine 0.3 mg intravenous Fentanyl 1-2 μg/kg intravenous	same
Induction	Propofol 2-2.5 mg/kg intravenous	same
Intubation	Succinyl choline 1.5-2 mg/kg intravenous	same
Muscle Relaxation	Vecuronium 0.08 mg/kg intravenous initially, then intermittent 1 mg every 20 -30 min	same
Maintenance	Fentanyl 0.5 μg/kg intravenous every 45 min	same
	- O_2 6 l/m via inhalation	- N_2O 4 l/m, O_2 2 l/m via inhalation
	- Propofol intravenous infusion 10-12 mg/kg/hr for 30 min. and then reduce to 5-6 mg/kg/hr (Mirakhur, Elliott and Stanley, 1991)	- Halothane 0.5-0.75 % via inhalation
	- Stop drug infusion when operation finished	- Stop inhalation of N_2O and halothane when operation finished and increase O_2 to 6 l/m
Reverse	Atropine 0.03 mg/kg and Prostigmine 0.06 mg/kg intravenous when operation finished	same

Measurements

1. Demographic data: age, sex, physical status, body weight, body mass index (BMI), diagnosis, operation.

2. Total dose of intravenous drug used.

3. Duration of anaesthesia;

- beginning of anaesthesia = time when premedication is given.
- end of anaesthesia = time when endotracheal tube is taken off.

Criteria for removing endotracheal tube were:

a. return of protective reflex,

b. normal respiration,

c. ability to follow command by eye opening.

4. Recovery are assessed by observers who were blinded to which anesthetic technique the patient received. Recovery are assessed in 4 parts:

a. Clinical tests,

b. Paper & Pencil test,

c. Psychomotor test,

d. Visual Analogue of Sedation Score (VASS).

Times to assess recovery are according to table 3.2.

5. Record number of patients who refuse to do or cannot not do the tests and their reasons such as nausea, vomiting or headache in both groups.

6. Postoperative questionnaire, this is a brief self-administered questionnaire with some open ended questions. The patients complete the questionnaire 24 hr. after discharge from

Table 3.2 Times to assess recovery

Tests	Time to assess recovery
I Clinical tests	
1. Orientation	
- Date of Birth	- every 5 min. after anaesthesia
- Day of Week	ended
- Place	
2. Sitting up unaided	- every 15 min. after patients get "success" in orientation
3. Romberg's Test	- every 15 min. after patients get "success" in sitting up unaided
II Paper Pencil Test	- before premedication and
1. Perceptual Speed Test	anaesthesia to get baseline
III Psychomotor Test	performance (control) then
1. Ball Bearing Test	every 1 hr after anaesthesia ended until patients could perform within control ± 10 %
IV VASS	- every 1 hr after anaesthesia ended until the Speed test and the Ball Bearing test ended

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hospital. In some questions more than 1 answer can be chosen. The questionnaire asks about subjective feeling regarding their recovery at home, side effects and satisfaction of anaesthesia (see appendix).

7. Cost identification

The cost consists of 2 part:

a. drug cost

b. equipment cost

total cost = drug cost + equipment cost.

From provider's perspective, we consider only operating costs of the anaesthetic techniques. We ignore the costs that are similar in both techniques such as intravenous catheter, intravenous fluid, syringe, endotracheal tube and supplies.

Drug cost

1. Intravenous drugs

We calculate costs of all drugs used in each technique.

drug cost = total amount of drugs used (unit) x market price (bahts/unit)

2. Inhalation agents

O_2 cost = (O_2 flow x duration of O_2 used) x price (bahts/l.)

N_2O cost = (N_2O flow x duration of N_2O used) x price (bahts/l.)

halothane cost = total amount (cc.) of halothane used x market price(bahts/cc).

Lists of drug cost at Siriraj Hospital:

1.	Atropine	=	2/0.6	bahts/mg.
2.	Fentanyl	=	50/100	bahts/µg.
3.	Propofol	=	250/200	bahts/mg.
4.	Succinyl choline	=	5/50	bahts/mg.
5.	Vecuronium	=	50/4	bahts/mg.
6.	Prostigmine	=	40/2.5	bahts/mg.
7.	O_2	=	0.01	bahts/l.
8.	N_2O	=	0.15	bahts/l.
9.	Halothane	=	750/250	bahts/cc.

Equipment cost

We express all costs of equipment into annual costs by using the formular (Drummond, Stoddart, and Torrance, 1987),

$$E = \frac{K - \frac{S}{(1+r)^n}}{A(n,r)}$$

s = the resale value

n = the useful life of the equipment

r = discount (interest rate)

A(n,r) = the annual factor (n years at interest rate r)

K = purchase price

E = equivalent annual cost

then we calculate each equipment cost/hour = E/working hours in 1 year. Equipment cost are devided into:

1. Non electrical equipment cost: anaesthetic machine

and vaporizer

cost = equipment cost/hr. x duration of equipment used(hr.)

2. Electrical equipment cost: infusion pump

cost = equipment cost/hr. x duration of equipment used(hr.) + electricity cost

Lists of equipment cost

1. Anaesthetic machine (MIE)

s = 0 because there is no permission to resale, by government legal, n = 15 years, r = 10%, A(15,10) = 7.61, K = 254,522 bahts then

$$E = \frac{254{,}522 - \frac{0}{(1+10)^{15}}}{7.61} = 33{,}445.73 \text{ bahts/yr.}$$

working hr.in 1 year = official day/yr. x official hr./day

= 244 x 8

= 1,952 hr./yr.

equipment cost /hr. = $\frac{33{,}445.73}{1{,}952}$ bahts/hr.

= 17.13 bahts/hr.

2. Vaporizer (Vapamasta 5)

s = 0, n = 15 years, r = 10%, A(15,10) = 7.61, K = 65,000 bahts then

$$E = \frac{65{,}000 - \frac{0}{(1+10)^{15}}}{7.61} = 8{,}541.39 \text{ bahts/yr.}$$

working hr. in 1 yr. = 1,952 hr./yr.

equipment cost /hr. $= \frac{8,541.39}{1,952}$

$= 4.38$ bahts/hr.

3. Infusion pump (Terumo syringe pump, power = 15 watt)

s = 0, n = 5 years, r = 10%, A(5,10) = 3.79, K = 35,000 bahts then

$$E = \frac{35,000 - \frac{0}{(1+10)^5}}{3.79} = 9,234.83 \text{ bahts/yr.}$$

working hr. in 1 yr. = 1,952 hr./yr.

equipment cost / hr. $= \frac{9,234.83}{1,952}$

$= 4.73$ bahts/hr.

electricity cost/unit = 1.65 bahts/u.

electricity cost(bahts) = 1.65 x duration of equipment used(hr.) x $\frac{15}{1,000}$

For TIVA, equipment cost = anaesthetic machine cost + infusion pump cost

and for IA, equipment cost = anaesthetic machine cost + vaporizer cost.

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Description of Measurement

The time course of recovery includes early recovery, intermediate recovery and late recovery. Early recovery refers to emergence from general, local anaesthetics and sedative drugs. Intermediate recovery refers to "home readiness" and discharge from the surgical facility. Patients continue to recover at home until they can resume normal daily activities, such as driving and returning to work. Table 3.3 illustrated different stages of recovery after anaesthesia (Korttila, 1990).

The tests used in this study are:

1. Clinical tests
   - orientation
   - sitting up unaided
   - Romberg's test
2. Paper & Pencil test
   - Perceptual Speed test
3. Psychomotor test
   - Ball Bearing test

All the tests above are chosen because they can be performed in daily clinical conditions and as part of the clinical routine, and do not need long training periods before anaesthesia. From a pilot study we found that these tests are not too boring or too difficult for the patient.

Table 3.3 Stages of recovery and some tests for the assessment.

Stage of recovery	Test of recovery
Awakening and recovery of vital reflexes	- Patients can open eyes and answer questions. Patients can maintain and guard their own airway.
Immediate clinical recovery	- Patients can stand unaided.
Home Readiness	- Patients can walk in a straight line, paper and pencil test, Maddox wing test, Simple Coordination and Reaction time test, Flicker Fusion test, Psychomotor test batteries.
Full recovery	- Carefully selected psychomotor test batteries, Real driving tests.
Psychologic recovery	- Psychological tests.

source: Korttila, 1990

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Clinical tests

"Success" and "failure" in performing the tests are evaluated by:

1. Orientation. Simple assessment include asking patients for their date of birth, where they are, and the day of the week;

"success" = all of them are answered correctly.

"failure" = some of the answers are incorrect.

2. Sitting up unaided is assessed by asking patients to sit up;

"success" = patients can sit up by themselves for 30 sec. with little or minor dizziness or headache.

"failure" = patients cannot sit up by themselves or cannot keep sitting up for 30 sec.

3. Romberg's test is assessed by asking patients to stand with eyes open, and their feet closed;

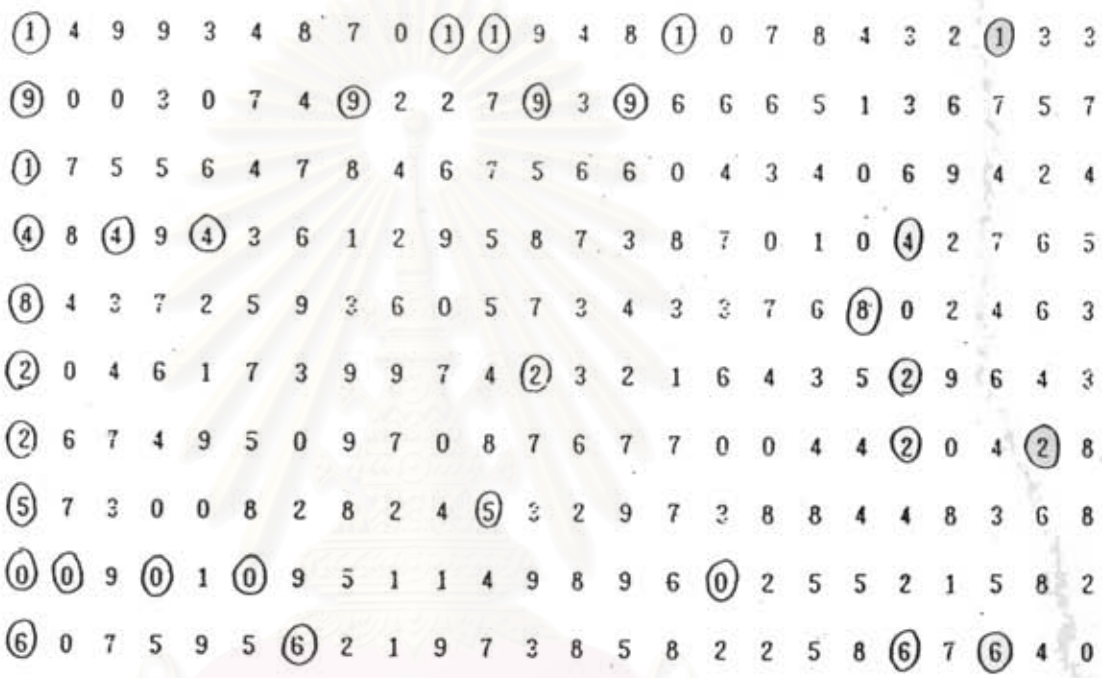
"success" = patients can stand still with slight swaying above the ankle or are well balanced for 30 ec.

"failure" = patients stand with swaying at ankle level or staggering.

The Perceptual Speed test

This test refers to home readiness of the patient. The patient is instructed to circle the number shown at the beginning of row (figure II). The score is the number of correct answers completed in 2 minutes.

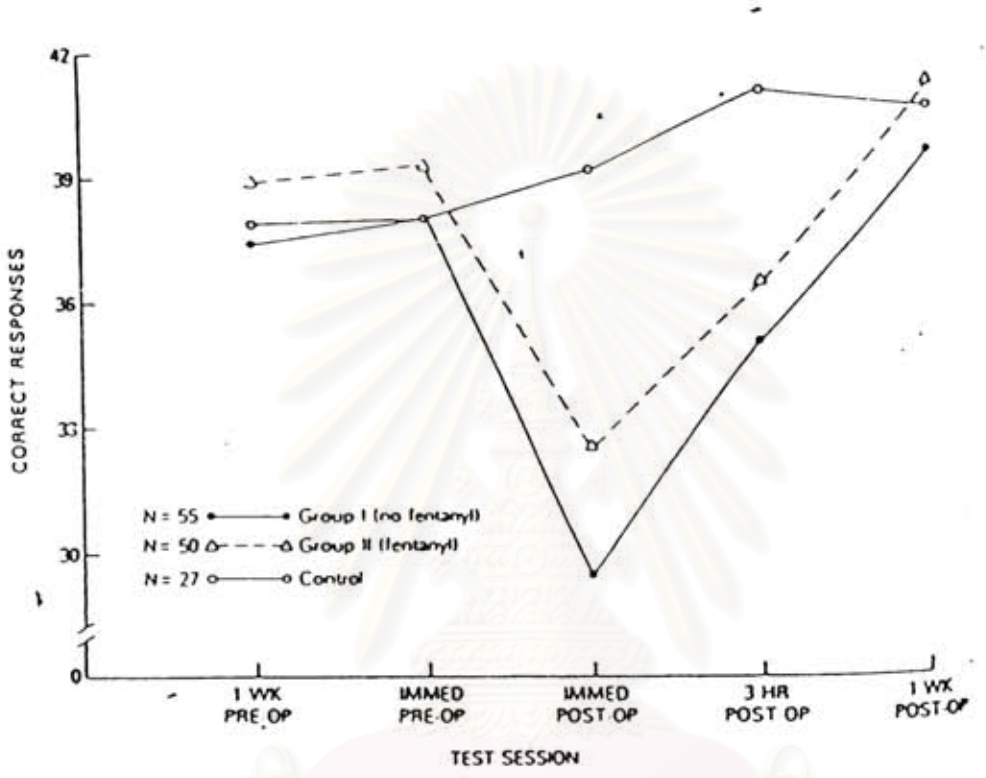
Figure II The Perceptual Speed Test



Validity

From the study of Gelfmann, Gracely and Driscoll (1979) comparing recovery test after intravenous sedation with diazepam-methohexitone and fentanyl, the Perceptual Speed test had significant discrimination between experimental groups and significant discrimination between baseline and post-treatment scores(see figure II).

Figure III Results of Perceptual Speed test ; ordinate shows total correct responses in one minute.



source: Gelfmann, 1979

The significant deficit on Perceptual Speed test was indicated by a decrease in the total number of correct responses in allotted time. This test is highly sensitive and free of practice effects. The test can be easily and objectively given and scored in a routine clinical setting. To eliminate the training effect slightly different but equivalent sheets are used when the test is repeated.

The Ball Bearing test

We use the Ball Bearing test to test manual dexterity. The patient has to use a pair of forceps to place balls in a vertical tube (figure IV).

Figure IV The Ball Bearing Test

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The score is the number of ball bearing inserts in 40 seconds. To eliminate the training effect, we will let the patients train for 15 minutes before recording the baseline performance. To obtain baseline data, we ask the patient to perform 3 times and select the last score to be the control value.

Validity

Steinberg (1954) reported selective effects of an anaesthetic drug on cognitive behaviour. He studied the effect of N_2O on 10 cognitive tasks and Ball Bearing test was one of the tasks. The experimental design was showed in the table 3.4.

Table 3.4. Experimental design of Steinberg

	Treatment	
	Trial I	Trial II
experimental group	10 cognitive tasks no drug	10 cognitive tasks drug (N_2O)
control group	10 cognitive tasks no drug	10 cognitive tasks no drug

source: Steinberg, 1954

The study showed that the Ball Bearing test had:

- no significant difference of mean scores between

control group and experimental group in trial I,

- significant discriminative effect between baseline data and post treatment of experimental group.

Reliability

From the same study (Steinberg, 1954) correlations were calculated between the test scores obtained in the first trials and the second trials by the control group. The resulting coefficients ranged from 0.573 - 0.888 and were statistically significant at 0.001 level.

VASS

Patients are asked to assess their degree of sedation by marking on a 10 cm linear analogue scale. The extremes are denoted with awake/alert and drowsy/dull. The patients mark on the line to represent their degree of sedation.

0 10

Full awake, alert Very drowsy, dull

The score is the distance from 0 to the point that the patient marked on the line.

Maneuver Bias

This study cannot be double-blinded because we cannot find intravenous solution that looks like propofol which has "milky" white appearance and when we use halothane, anaesthetists will recognize its odour. In addition, the logistics of administration an intravenous anaesthetic infusion during maintenance phase differ from inhalational anaesthesia in using a volatile agent. So the bias may occur because the personnel who gave anaesthesia modify the anaesthetic technique so that their preference will get satisfactory outcomes. To minimize this error, they should anaesthesize strictly to the protocol.

Measuring Bias

Measuring bias can occur from:

1. Environmental factors:

The number of distractions such as noise, undue heat or cold to the patient must be minimized for optimal performance. In this study we use the same recovery room for similar environmental factors.

2. Baseline Performance & Postoperative Performance:

Some tests have to compare with how well they were performed before anaesthesia. The postoperative tests must then be carried out under a similar condition as possible. The following factors are relevant:

- environmental factors,
- wearing similar clothes,

- wearing spectacles or contact lens or hearing aids,
- posture.

The Perceptual Speed test and the Ball Bearing test must be carried out with the patient sitting in bed and ensuring that the baseline tests are performed in similar conditions. For the Perceptual Speed test, to minimize the training effect we use slightly different but equivalent sheets when the test is repeated. The Ball Bearing Test needs to be practiced to achieve a reasonable baseline performance. In this study, we let them practice for 15 min. before recording baseline data. To obtain baseline data we ask them to perform 3 times and select the last score.

The investigator or observer

To reduce inter - observer variation, we use 2 observers who are blind to which technique each patient received. To avoid differences of the observers they should be trained in assessment and understand the protocol well. The way in which instructions about the test are given is important and should be as constant as possible. Distraction can be avoided by remaining quiet in the background for the duration of the test.

CHAPTER IV

DATA ANALYSIS

Data were entered into the coding forms and the verification was done, using dbase III plus. The analysis was done by SPSS-PC.

When variables were discrete, we used proportions to describe and the Chi-square test or Fisher-Exact test to test the differences between groups. When variables were continuous, we used means and standard deviations to describe, and independent t-test for parametric and Mann-Whitney U test for nonparametric to test the differences. To test correlation between the Perceptual Speed test and the Ball Bearing test to the VASS, we used the Pearson's correlation coefficient. Statistical significance was declared when p-value was below 0.05.

For economic evaluation, we used cost minimization analysis.

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CHAPTER V

ETHICAL CONSIDERATION

Evaluation of Risks and Benefits

Do the patients have any risks from TIVA or IA technique? They should not have any significant risks resulting from these techniques because both are accepted techniques used in outpatient anaesthesia. If TIVA reduce recovery time, it will benefit both the patients and health care providers.

Patients' benefits:
- early discharge due to short recovery time
- reduced hazard from administration of hypoxic gas mixtures
- absence of exposure to N_2O and volatile agents.

Health care providers' benefits:
- ability to give service to more patients
- rapid turnover rate of beds
- reduction of waiting lists
- less environmental pollution
- absence of exposure of staff to N_2O and volatile anaesthetic agents.

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Protection of Subjects

The human rights of patients should be preserved conscientiously by health care providers. The patients have signed their informed consents to be submitted to treatment in the hospital. We use the standard form of the consent in the outpatient department (see appendix) because both TIVA and IA are accepted techniques and the measurements are part of clinical recovery evaluation for discharge. Therefore this project does not have problems of ethics.

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CHAPTER VI

RESULTS OF THE STUDY

There were 40 patients enrolled in the study, 20 patients in each group.

Table 6.1 General informations of TIVA and IA patients

	TIVA (n=20)	IA (n=20)	P values
Age (yr.)	23.45±5.13	25.15±8.59	NS
Body weight (kg.)	55.45±9.67	58.10±9.14	NS
Height (cm.)	164.00±9.09	166.85±7.30	NS
BMI ($kg./m.^2$)	20.38±2.88	20.79±2.34	NS
SEX M:F	15:5 (75%:25%)	17:3 (85%:15%)	NS
Physical status 1:2	20:0 (100%:0%)	19:1 (95%:5%)	NS

Table 6.1 shows the mean age, weight, height, BMI, sex ratio and physical status ratio of the two groups. By independent t- test, their age, weight, height and BMI between TIVA and IA were not different and by Chi-square, their sex and physical status were not different.

Table 6.2 Diagnosis of TIVA and IA patients

	TIVA (n=20)	IA (n=20)
Diagnosis		
Fractured nose	16 (80%)	16 (80%)
Impacted teeth	2 (10%)	2 (10%)
Infected teeth	0 (-)	1 (5%)
Torus palatinus	1 (5%)	1 (5%)
Root abscess	1 (5%)	0 (-)

For diagnosis, 80% of patients in each group were nasal fractures and 20% were dental surgery which were impacted teeth, infected teeth, torus palatinus and root abscess (see table 6.2).

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Table 6.3 Anaesthetic drugs used in TIVA and IA techniques

	TIVA (n=20)	IA (n=20)
Atropine (mg.)	0.26 ± 0.10	0.26 ± 0.11
Fentanyl (µg.)	64.90 ± 14.79	68.25 ± 18.94
Propofol (mg.)	367.50 ± 124.30	133.50 ± 22.31
Succinyl choline (mg.)	77.50 ± 7.70	80.00 ± 10.26
Vecuronium (mg.)	5.73 ± 1.74	5.28 ± 1.49
Reverse drugs		
- atropine (mg.)	1.44 ± 0.30	1.29 ± 0.20
- prostigmine (mg.)	3.03 ± 0.67	2.61 ± 0.31
O_2 (l.)	254.40 ± 158.25	120.00 ± 40.68
N_2O (l.)	-	106.80 ± 67.59
Halothane (cc.)	-	3.78 ± 2.39

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Table 6.4 Duration of operation and anaesthesia of TIVA and IA groups

	TIVA (n=20)	IA (n=20)	P
Duration of operation (min.)	34.65±24.40	30.60±17.18	.548
Duration of anaesthesia (min.)	42.10±26.47	37.60±14.75	.532

All patients underwent anaesthesia and surgery without complications.

Table 6.4 shows that the duration of operation and anaesthesia did not differ.

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Table 6.5 Recovery of TIVA and IA patients

	TIVA (n=20)	IA (n=20)	P
Orientation (min.)	5.25±1.12	5.25±1.12	1
Sitting up unaided (min.)	21.75±5.45	21.00±3.48	0.938
Romberg's test (min.)	37.55±6.16	37.50±8.35	0.433
Perceptual speed test and Ball Bearing test (hr.)	1.20±0.41	1.10±0.31	0.382

For clinical tests, time from anaesthesia ended to orientation, sitting up unaided and Romberg's test showed no difference between TIVA and IA by Mann-Whitney U test (see table 6.5). For PST & BBT tests, the two groups showed similar pattern of recovery. There was no significant difference ($p = .382$) in time from anaesthesia ended to the end point of the tests by Mann-Whitney U test. The average times to complete the PST & BBT were 1.2±0.41 hr. and 1.1±.31 hr. for TIVA and IA respectively.

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Table 6.6 Incidence of side effects during 24 hours after hospital discharge by home questionnaire of TIVA and IA patients

	TIVA (n/total)	IA (n/total)	P
Nausea	0/15	2/16	NS
Vomiting	0/15	0/16	-
Dizziness	3/15	6/16	NS
Headache	8/15	11/16	NS
Sore throat	9/15	12/16	NS
Muscle pain	6/15	6/16	NS
Pain at injection site	1/15	3/16	NS

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Table 6.7 Other home questionnaire results of TIVA and IA patients

	TIVA (n/total)	IA (n/total)	p
Awareness during operation	0	0	-
Duration of hospital stay (hr.)	2.60±1.61	2.27±1.10	NS
Feeling back to normal self (hr.)	7.60±12.78	3.56±1.87	NS
Problem of getting home			
- Sleepiness	0/15	6/16	.018 *
- unsteadiness	4/15	6/16	NS
- others	1/15	3/16	NS
What he did,2-3 hr. after home arrival			
- Rest	7/15	6/16	NS
- Slept	8/15	9/16	NS
- Worked	0/15	0/16	-
Satisfaction of anaesthesia			
- Very good	2/15	6/16	NS
- Good	11/15	5/16	
- Satisfactory	2/15	5/16	
- Poor	0/15	0/16	
- Very poor	0/15	0/16	
Willingness to choose similar anaesthetic technique next time	14/15	15/16	NS

Table 6.8 Characteristics of nonresponders of TIVA and IA patients

	TIVA (n=5)	IA (n=4)	p
General informations			
Age(yr.)	24.20± 6.94	20.75± 0.96	NS
Body weight(kg.)	60.20±13.72	57.63± 1.89	NS
Height(cm.)	166.80± 7.12	165.75± 4.35	NS
BMI(kg./m^2)	21.65± 4.82	20.99± 1.27	NS
Diagnosis			
Nasal fracture	5	3	
Impacted teeth	0	1	
Duration(min.)			
Operative duration	29.20± 5.93	41.50±36.23	NS
Anaesthetic duration	32.20± 6.57	47.75±36.46	NS
Recovery			
Orientation (min.)	5.00± 0.00	6.25± 2.50	NS
Sitting up unaided (min.)	20.00± 0.00	21.25± 2.50	NS
Romberg's test (min.)	35.00± 0.00	43.75±17.50	NS
PST&BBT (hr.)	1.20± 0.45	1.25± 0.50	NS

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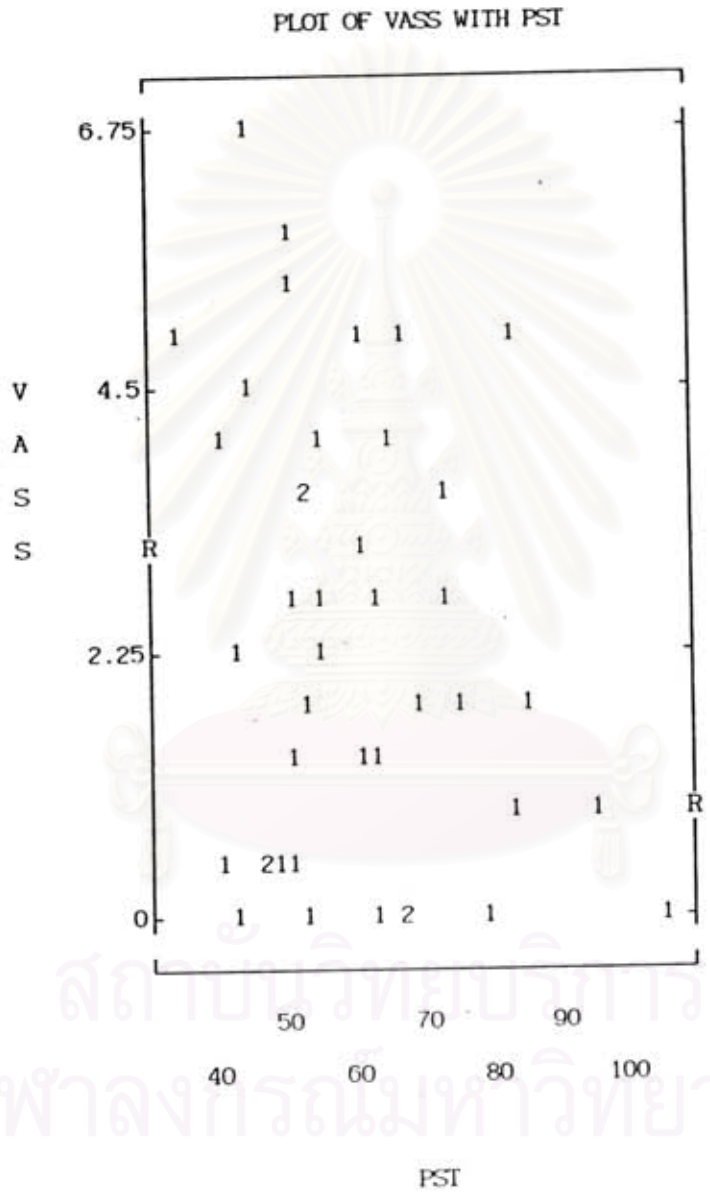
The results obtained from home questionnaire are given in table 6.6-6.7. We received 75% of questionnaires returned for TIVA and 80% of questionnaires returned for IA. The incidence of side effects are listed in Table 6.6. None of the TIVA patients suffered from nausea or vomiting. Only 2/16 patients in IA group suffered from nausea and 0/16 suffered from vomiting. The other side effects are the same in both groups.

As shown in Table 6.7, no patient had awareness during operation. Duration of hospital stay were not different. The time that TIVA patients recovered from anaesthesia to normal self was longer than IA patients but there was no statistical significance. For the difficulty in getting home, none of TIVA patients had difficulty from sleepiness but 6/16 (37.5%) of IA patients had difficulty from sleepiness and Fisher's exact test showed statistical significance (p 0.0177). Other reasons for the difficulty in getting home showed no difference. The first 2-3 hr. of home recovery and whether the patients were willing to accept similar anaesthetic technique did not differ between the two groups. Because of the number of patients, the five levels of satisfaction had to be grouped into two groups; very good and good to "high satisfaction" and satisfactory, poor and very poor to "low satisfaction" and Fisher's Exact test showed no difference.

Table 6.8 shows the characteristics of questionnaire nonresponders; 25% from TIVA and 20% from IA. Their age, weight, height, BMI, duration of operation and anaesthesia, and recovery did not differ by Mann-Whitney U test.

Figure V Scatter diagram between the VASS & PST

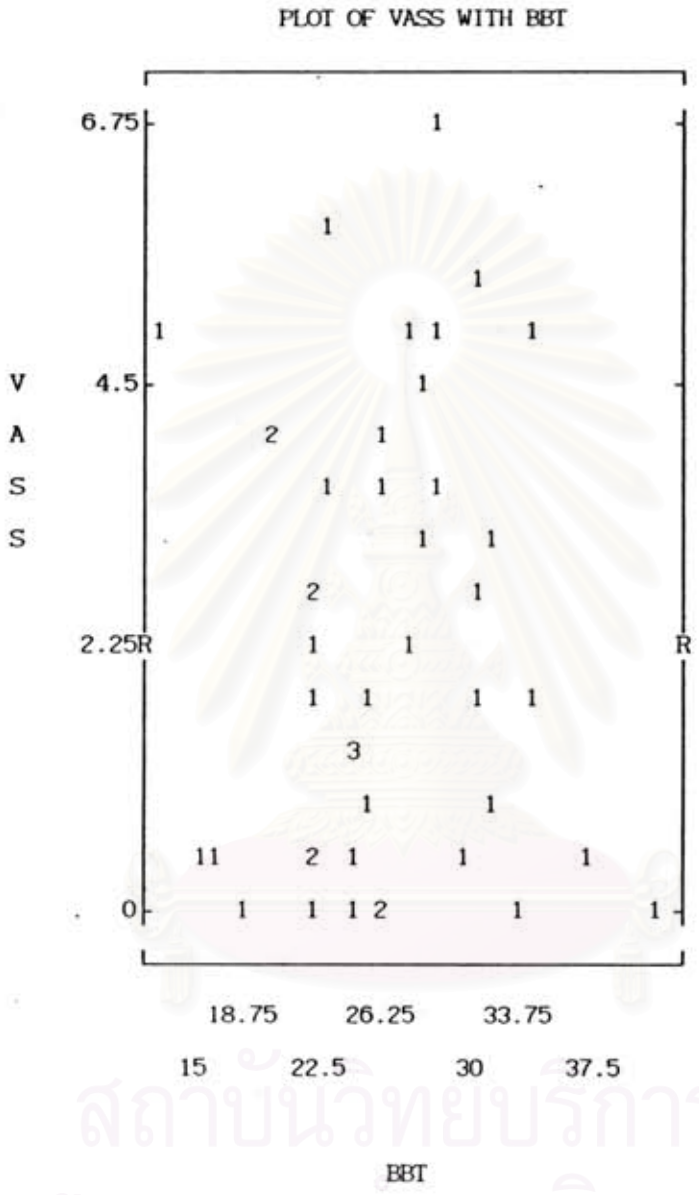


42 cases plotted. Regression statistics of VASS on PST:

Correlation -.23442 R Squared .05495 S.E.of Est 1.88995 Sig. .1351

Intercept(S.E.) 4.09939(1.17220) Slope(S.E.) -.02954(.01937)

Figure VI Scatter diagram between the VASS & BBT



44 cases plotted. Regression statistics of VASS on BBT:

Correlation .01601 R Squared .00026 S.E. of Est 1.94518 Sig. .9178

Intercept(S.E.) 2.15192(1.36006) Slope(S.E.) .00552(.05322)

As shown in Figure V-VI, there is no correlation between the VASS and PST and between VASS and BBT.

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Table 6.9 Average cost/case of TIVA and IA

	TIVA (n=20)	IA (n=20)	p
Drug cost (bahts)			
Atropine	5.67 ± 0.89	5.15 ± 0.81	
Fentanyl	32.45 ± 7.39	34.13 ± 9.47	
Propofol	459.38 ± 155.38	166.88 ± 27.89	
Succinyl choline	7.75 ± 0.77	8.00 ± 1.03	
Vecuronium	71.56 ± 21.70	65.94 ± 18.64	
Prostigmine	48.40 ± 10.69	41.80 ± 4.94	
O_2	2.54 ± 1.58	1.20 ± 0.41	
N_2O	-	16.02 ± 10.14	
Halothane	-	11.35 ± 7.18	
Total drug cost	627.75 ± 169.85	350.45 ± 53.66	0.000
Equipment cost (bahts)			
Anaesthetic machine	12.02 ± 7.56	10.73 ± 5.07	
Vaporizer	-	1.95 ± 1.23	
Infusion pump	2.75 ± 1.93	-	
Total equipment cost	14.77 ± 9.47	12.68 ± 6.29	NS
Total cost	642.51 ± 176.62	363.15 ± 57.49	0.000

CHAPTER VII

DISCUSSION, CONCLUSION AND RECOMMENDATION

DISCUSSION

1. Recovery

Adequate recovery from outpatient anaesthesia requires a rapid return to street fitness and propofol appears to offer advantages in this area. A standardised anaesthetic technique was employed to compare recovery from anaesthesia using propofol infusion or halothane during maintenance phase. Propofol was given for induction in both groups, and the muscle relaxant used was similar. Assessment of recovery should include a number of tests. The tests we used in this study were clinical tests (orientation, sitting up unaided and Romberg's test), paper and pencil test (PST), and psychomotor test (BBT).

We found that there was no difference between TIVA and IA with regard to the recovery period. Both anaesthetic techniques resulted in equally rapid recovery evaluated by the return of orientation, time to sitting up unaided, Romberg's test and the PST & BBT. Therefore both techniques are recommended for outpatient anaesthesia especially for the operative time less than 50 minutes. We did not apply this conclusion to the longer operation because the rapidity of recovery depends partly on the length of inhalation anaesthesia. The average operative times of TIVA and IA were

36.65±24.4 minutes and 30.6±17.18 minutes respectively. The longer the operative time, the more halothane deposited in tissue and the recovery may differ. Nevertheless, most of the outpatient surgery have the duration of less than 1 hour. For the longer operation, it needs further study to prove. The other reason of the recovery indifference between both techniques is time of assessment of the PST & BBT may be too late to detect the difference. However the disadvantage of early assessment is that it will disturb the patients.

2. Home questionnaire results

Every study that concerns recovery should include the patient's opinion about his function at home because the patient can offer a lot of information about their experiences after discharge. We received 75% of questionnaires back from TIVA and 80% from IA. We checked the characteristics of nonresponders in both TIVA and IA groups and they were similar. It could be expected that the outcomes and the comparison of responders should be reliable.

a. Side effects

Nausea and vomiting are common complications occurring 25-55% during the recovery period (Pandit et al., 1989). Contributing factors are pain, narcotic drugs, position changes, site of operation and anaesthetic drugs (Wetchler,1991). It is interesting to note that in our study no patient suffered from nausea or vomiting in TIVA and of 16 IA patients, 2 (12.5%) suffered from nausea and 0 (0%) suffered from vomiting. There is evidence to suggest that propofol may reduce the incidence of postoperative emesis sequale (McCollum, Milligan and Dundee, 1988).

b. Other results

From the reasons of difficulty in getting home, we found that no patient from TIVA had sleepiness while 6 of 16 patients (37.5%) from IA did. It might reflect that TIVA patients recovered to street fitness better than IA patients. For the first 2-3 hours of home recovery, there was no difference in their activities.

No patients had awareness during operation. Patient acceptability of the two anaesthetic techniques was high.

3. Correlation

This study would like to find whether VASS could represent PST or BBT. VASS which is commonly cited in anaesthetic journals is a subjective measurement and is easier to measure whereas PST and BBT are objective measurement. By using Pearson correlation, there is no correlation of the PST and BBT to the VASS. The reason might be:

a. the correlation is not linear due to the complexity of brain function. The PST tests of memory and perceptual function, the BBT tests of manual dexterity and the VASS tests of subjective sedation feeling. All neurological function do not recover with similar pattern.

b. sample size is not sufficient. This sample was not calculated to answer the secondary question.

4. Cost identification

Since both techniques showed similar recovery, we should consider their costs in order to choose which technique is more suitable by cost minimization analysis. By cost identification

(table 6.9), we did not calculate monitoring cost and personnel cost of anaesthesia, operation and recovery because duration of anaesthesia, operation and recovery are the same in both groups.

Nowadays outpatient surgery is gaining popularity. One of the advantages claimed is cost effectiveness. To form a new setting of outpatient service, the expense for investment of anaesthetic machines is very high. From this study we calculated anaesthetic machine cost to see its impact on the cost both in an operating theatre that anaesthetic machine is available and a new setting where it has not been bought. TIVA is a technique which does not require an anaesthetic machine. The results showed that the total cost (drug cost plus equipment cost) of IA (363.15 bahts) was less than TIVA (642.51 bahts). For the equipment cost, if we considered only the infusion pump cost as the equipment cost for IA (2.75 bahts) whereas the anaesthetic machine added with the vaporizer cost as the equipment cost for TIVA (12.86 bahts), the difference of the equipment cost (9.93 bahts) was very small when comparing with the difference of the drug cost (279.37 bahts) between the two techniques. Other advantages of having an anaesthetic machine are:

1. it has a longer working life than an infusion pump,
2. it is easy for anaesthetists to change techniques or to treat some complication during anaesthesia,
3. it can also be used in inpatient list.

So, even in a new outpatient surgery setting IA technique is cost effective and it is worthwhile to invest by buying an anaesthetic machine. For an old hospital, IA is preferable than TIVA because of its lower cost.

The limitation of this cost identification are:

a. we have not done sensitivity analysis by varying drug cost, equipment cost and discount rate within a plausible range at a time to assess the impact on the response. In this study the cost of propofol is the important effect because it is expensive now but in the future when it is widely used its cost will be reduced.

b. Indirect benefit from TIVA which is difficult to measure is that TIVA causes less pollution to both patients and staffs.

CONCLUSION

From the study we concluded that both TIVA and IA techniques demonstrated similarly rapid recovery, the condition during the first 2-3 hours of home recovery, incidence of side effects and patient acceptance. Either of them can be safely used in outpatient anaesthesia for the operative time less than 50 minutes. By cost minimization technique, we recommended IA technique because its cost was less than the cost of TIVA and the effectiveness or recovery were the same in both groups.

RECOMMENDATION

1. To be more generaliziable, both techniques should be compare for more varieties of operative time.

2. Further study of the correlation of the PST and BBT to VASS.

3. Both the PST or BBT are tests of recovery but they may influence the normal recovery period because they are extensive testing and could awaken patients artificially. Postoperative recovery is complex, therefore there is no single test to identify when a patient is sufficiently recovered to go home. Reliance has to be placed on clinical assessment and modifying the activities of patient for at least the ensuring 24 hours.

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References

Burn, J.B.M. A blueprint for day surgery. Anesthesia 34 (1979): 790-805.

Camu, F., and Kay, B. Why total intravenous anaesthesia (TIVA)? In T.E.J. Healy, and B. Kay (eds). Monographs in Anaesthesiology, Total Intravenous Anaesthesia, pp. 1-14. Amsterdam:Elsevier, 1991.

Dripps, R.D., Eckenhoff, J.E., and Vandam, L.D. (eds.). Preanesthetic consultation and choice of anesthesia. In Introduction to anesthesia: the principles of safe practice, pp. 15-32. Tokyo: Igaku-Shoin, 1982.

Drummond M.F., Stoddart G.L., and Torrance G.W. Cost analysis. In M.F. Drummond, G.L. Stoddart, and G.W. Torrance (eds.), Methods for the economic evaluation of health care programmes, pp. 39-73. Oxford: Oxford University, 1987.

Doze, V.A., Shafer, A., and White, P.F. Propofol - nitrous oxide versus thiopentone- isoflurane- nitrous oxide for general surgery. Anesthesiology 69 (1988): 63-71.

_____ , Westphal, L.M., and White, P.F. Comparison of propofol with methohexitone for outpatient anaesthesia. Anesthesia and Analgesia 65 (1986): 1189-1195.

Fishburne, J.I., Fulghum, M.S., Hulka, J.F., and Mercer, J.P. General anesthesia for outpatient laparoscopy with an objective measure of recovery. Anesthesia and Analgesia 53 (1974): 1-6.

Forrest, P., and Galletly, D.C. Comparison of propofol and

antagonised midazolam anaesthesia for day case surgery. Anaesth Intens Care 15 (1987): 394-401.

Gelfmann, S.S., Gracely, R.H., Driscoll E.J., Wirdzek, P.R., Butler, D.P., and Sweet, J.B. Comparison of recovery test after intravenous sedation with diazepam-methohexital and fentanyl. J Oral Surg 37 (1979): 391-397.

Health, P.J., Ogg, T.W., and Gilks, W.R. Recovery after day case surgery: a 24-hour comparison of recovery after thiopentone or propofol anaesthesia. Anaesthesia 45 (1990): 911-915.

Korttila, K. Recovery period and discharge. In P.F. White (ed.) Outpatient anaesthesia, pp.369-396. New York: Churchill Livingstone, 1990.

_____ , Faure, E., and Apfelbaum, J., Ekdawi, M., Prunskis, J., and Roizen, M. Recovery from propofol versus thiopentone - isoflurane in patients undergoing outpatient anaesthesia. Anesthesiology 69 (1988): A564.

McColloum, J.S.C., Milligan, K.R., and Dundee, J.W. Antiemetic action of propofol. Anaesthesia 43 (1988): 230-240.

Milligan, K.R., O'Toole, D.P., Howe, J.P., Cooper,J.C., and Dundee, J.W. Recovery from outpatient anaesthesia: a comparison of incremental propofol and propofol-isoflurane. Br J Anaesth 57 (1987): 1111-1114.

Mirakhur, R.K., Elliott, P., and Stanley, J.C. Use of propofol in anaesthesia for ophthalmic surgery. In Cedric Prys-Roberts (ed.) Focus on infusion; intravenous anaesthesia, pp. 134-138. London: Current Medical Literature, 1991.

Nightingale, J.J., and Lewis, I.H. Recovery from day-case anaesthesia: comparison of total intravenous anaesthesia

using propofol with an inhalation technique. Br J Anaesth 68 (1992): 356- 359.

Ogg, T.W. Aspects of day surgery and anaesthesia. Anesthesia Rounds 18 (1985): 3-25.

Ogg, T.W. Use of anesthesia: implications of day case surgery and anesthesia. Br Med J 2 (1980): 212.

Pandit S.K., Kothary S.P., Pandit U.A., Randel G., and Levy L. Dose-response study of droperidol and metoclopramide as antiemetics for outpatient anesthesia. Anesthesia and Analgesia 68 (1989): 798-802.

Puttick, N., and Rosen, M. Propofol induction and maintenance with nitrous oxide in paediatric outpatient dental anaesthesia: a comparison with thiopentone - nitrous oxide- halothane. Anesthesia 43 (1988): 646-649.

Reves, J.G., and Glass, P.S.A. Nonbarbiturate intravenous anaesthesia. In R.D. Miller (ed.), Anesthesia, pp. 262-267. London: Churchill Living Stone, 1990.

Raeder, J.C., and Misvaer, G. Comparison of propofol induction with thiopentone or methohexitone in short outpatient general anaesthesia. ACTA Anaesthesiol Scand 32 (1988): 607-613.

Steinberg, H. Selective effects of an anaesthetic drug on cognitive behavior. Quarterly Journal of Experimental Psychology 6 (1954): 170-180.

Van Steeberge, A. Special consideration for gynaecology and obstetrics. In S.K. Kallar, and J.G. Whitwam (eds.), Outpatient anesthesia, pp.85-88. Bussum: Medicom Europe, 1988.

Wetchler, B.V. Problem solving in the postanesthetic care unit. In

B.V. Wetchler (ed.), Anesthesia for ambulatory surgery, pp 375-436. London: J.B. Lippincott, 1991.

White, P.F. Outpatient anesthesia: an overview. In P.F. White (ed.) Outpatient anesthesia, pp.1-48. St.Louis: Churchill Livingstone, 1990.

Zuumond, W.W.A., Van Leeuwen, L., and Helmers, J.H.J.H. Recovery from propofol infusion as the main agent for outpatient arthroscopy: a comparison with isoflurane. Anaesthesia 47 (1987): 356-359.

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Appendices

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Critical Appraisal of the Journals Reviewed

I. Authors and study design

Author	Design
Raeder J.C. et al. (1988)	RCT
Doze V.A. et al. (1986)	RCT
Doze V.A. et al. (1988)	RCT
Puttick N. et al. (1988)	RCT
Milligan K.R. et al. (1987)	RCT
Zuurmond W.W.A. et al. (1987)	RCT
Nightingale J.J. et al. (1992)	RCT
Forrest P. et al. (1987)	RCT
Health P.J. et al. (1990)	RCT

II. Randomization

All patients in these journals were assigned to the treatment or anaesthetic techniques by randomization.

III. Clinical relevant outcomes reported

They all reported the clinical outcomes of interest or recovery. The observers who assessed the main outcomes were blind to anaesthetic techniques except in the Zuurmond study that did not mention blinding. Side effects of the treatments were reported except the study of Milligan et al. and Health et al.

IV. Similarity of the study patients to our own

Only the population in the Zuurmond study were similar to our own. They were outpatients requiring endotracheal intubation. Of the rest, they were outpatients who did not require endotracheal intubation, elective operative patients or paediatric patients.

V. Statistical and clinical significance considered

All the papers considered mainly statistical significance.

VI. Feasibility of the therapeutic maneuver

The maneuvers of all papers could be applied to our practice. They were described in sufficient details and they were clinical and biological sensible. No contamination or cointervention were on the trials.

VII. Accountability for all patients who entered the study at conclusion

Puttick's and Nightingale's patients were not accounted for at conclusion. Puttick excluded 2 from 20 patients in propofol group because of difficulty during the induction phase due to airway obstruction from tonsillar hypertrophy and laryngospasm from recent upper respiratory tract infection. Since such events are common regardless of anaesthetic techniques, the results were reliable. Nightingale reported 21/25 (84%) of questionnaire responders for TIVA and 18/25 (72%) of questionnaire responders for IA. The study did not explain about the characteristics of nonresponders so these outcomes should be carefully interpreted. However there were no missing patients in the main outcomes.

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NO_____

24 hr. Post-operative questionnaire

An attempt is being made to assess the effect of an outpatient anaesthesia on patients in Siriraj Hospital. Your reply will be treated confidentially. Please enclose the completed questionnaire in the stamped addressed envelope supplied.

Instruction: please check the correct answer or fill in the blank.

1. Approximately how long after your anaesthesia were you allowed to leave the hospital? _____hours.

2. Were you accompanied home by a responsible person?

   [ ] yes [ ] no

3. Did you have any difficulties in getting home?

   [ ] yes [ ] no

if yes, because of

   [ ] sleepiness

   [ ] unsteadiness

   [ ] others, specify _____

   _____

4. On arrival home, during the first 2-3 hrs, you

   [ ] went to bed

   [ ] slept

   [ ] worked

   [ ] others, specify _____

   _____

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5. Did you have awareness during the operation?

[ ] yes [ ] no

6. Did you have any of the following after your hospital discharge? (can choose more than 1 answers)

[ ] nausea

[ ] vomiting

[ ] dizzy or confusion

[ ] headache

[ ] sore throat

[ ] muscle pain

[ ] pain at the site of injection

[ ] others, specify _____

_____

7. Approximately how long after your anaesthesia did you feel back to your normal self? _____hours.

8. For how long were you off work or school?

_____days.

9. Over all, how would you rate your day-case anaesthesia?

[ ] very good

[ ] good

[ ] satisfactory

[ ] poor

[ ] very poor

10. Should it be required, would you like to have a similar anaesthesia again?

[ ] yes, because_____

_____

[ ] no, because_____

_____

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แบบสอบถาม (24 ชม.หลังดมยาสลบ) No. _____

แบบสอบถามนี้มีวัตถุประสงค์เพื่อประเมินประสิทธิภาพการดมยาสลบในผู้ป่วยที่นุตกรรมของโรงพยาบาลศิริราช คำตอบของท่านจะเป็นประโยชน์ในการปรับปรุงการรักษา โปรดตอบตามความเป็นจริง และเมื่อตอบเสร็จกรุณาส่งกลับตามที่อยู่ด้านหลัง

กรุณาใส่เครื่องหมาย / หน้าคำตอบที่ท่านเลือกหรือเติมคำตอบลงในช่องว่าง

1. ท่านได้รับอนุญาตให้กลับบ้านหลังการดมยาสลบเสร็จประมาณ _____ ชม.
2. ท่านมีผู้ที่รับผิดชอบพาท่านกลับบ้านด้วยหรือไม่ ? [ ] มี [ ] ไม่มี
3. ท่านมีปัญหาระหว่างการกลับบ้านหรือไม่ ? [ ] มี [ ] ไม่มี

   ถ้ามี เพราะ [ ] ง่วงนอน

   [ ] งุนงง รู้สึกไม่มั่นคง

   [ ] อื่น ๆ โปรดระบุ _____

   _____

4. เมื่อท่านกลับถึงบ้าน 2-3 ชั่วโมงแรกท่านทำอะไร

   [ ] พักผ่อน

   [ ] หลับ

   [ ] ทำงาน

   [ ] อื่น ๆ ระบุ _____

   _____

5. ขณะผ่าตัดท่านรู้สึกตัวหรือไม่ [ ] รู้สึก [ ] ไม่รู้สึก
6. ท่านมีอาการต่าง ๆ เหล่านี้หรือไม่เมื่อกลับถึงบ้าน ในรอบ 24 ชั่วโมง (เลือกได้มากกว่า 1 คำตอบ)

   [ ] คลื่นไส้

   [ ] อาเจียน

   [ ] รู้สึกมึนงง, สับสน

   [ ] ปวดศีรษะ

   [ ] เจ็บคอ

   [ ] ปวดเมื่อยกล้ามเนื้อ

   [ ] เจ็บบริเวณที่ฉีดยา

   [ ] อื่น ๆ โปรดระบุ _____

   _____

7. ท่านคิดว่าประมาณกี่ชั่วโมงภายหลังเสร็จการผ่าตัดท่านจึงมีความรู้สึกเป็นปกติเหมือนก่อนได้รับยาสลบ _____ ชั่วโมง

8. ในการผ่าตัดครั้งนี้ ท่านลางานหรือลาเรียนกี่วัน _____ วัน

9. ท่านรู้สึกต่อการดมยาสลบที่ท่านได้รับครั้งนี้อย่างไร

[ ] พอใจมากที่สุด

[ ] พอใจมาก

[ ] พอใจ

[ ] ไม่พอใจ

[ ] ไม่พอใจมากที่สุด

10. ถ้าท่านต้องรับการผ่าตัดแบบครั้งนี้อีกครั้ง, ท่านต้องการได้รับการดมยาสลบอย่างเดิมอีกหรือไม่

[ ] ต้องการ เพราะ _____

_____

[ ] ไม่ต้องการ เพราะ _____

_____

_____

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Consent Form

Date _____

I agree to the operation or the anaesthesia upon me.

_____

(Patient's signature)

(Parent/guardian)_____allow (patient's name) _____

_____to undergo operation or anaesthesia.

_____

(Parent/Guardian's signature)

_____

(Medical witness)

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Preoperative instructions:

1. NPO after midnight.
2. Bring laboratory results.
3. Accompany with responsible person.
4. Remove denture.

Postoperative instructions:

1. Patient must be discharged by physician.
2. Patient must be accompanied home by a responsible person.
3. Patient must not drive a car, ride a bicycle nor operate machinery for 24 hours after anaesthetic.
4. Patient agree to contact the dental unit in the event of any postoperative complications arising during office hours or emergency unit at outpatient department during non office hours.

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VITAE

Mrs. Ubolrat Santawat was born on 19 January, 1964 in Bangkok Province. She graduated Medical Doctor from Siriraj Hospital, Mahidol University, Thailand. In 1990, she got Thai Board of Anaesthesiology. She has been enrolled in the Master Degree of Science in Health Development at Faculty of Medicine, Chulalongkorn University since 1992. The present position is Assistant Professor of Anaesthesia at Siriraj Hospital, Mahidol University.

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