

**EFFICACY OF PC6 ELECTROACUPUNCTURE IN THE
PREVENTION OF NAUSEA VOMITING IN
CAESAREAN PATIENT UNDER SPINAL ANESTHESIA**

BY

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**A dissertation submitted in fulfillment of the requirement
for the degree of Master of Medicine (Anaesthesiology)**

**Kulliyyah of Medicine
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ABSTRACT

PC6 stimulation is a well-known technique to reduce nausea and vomiting during pregnancy. In current clinical practice, antiemetic medication is the most commonly used method for preventing post-operative nausea and vomiting. Although antiemetic medications have no significant side effects, their efficacy and safety profile among parturients are still not well established. Consequently, the PC6 stimulation technique has gained more popularity to prevent nausea vomiting in post-operative parturients. In this prospective, randomised, interventional study, we hypothesised that the combination of PC6 electroacupuncture stimulation with granisetron would reduce the incidence of IONV and PONV and reduce the need for rescue antiemetic drugs in patients undergoing caesarean section. One hundred patients who underwent elective caesarean section were randomly allocated to either EA or sham groups. All surgeries were performed under spinal anaesthesia, which includes the addition of 0.1mg intrathecal morphine during induction. EA group patient received EA stimulation; on the other hand, the sham group patient received sham acupuncture as control. The incidence of intraoperative and post-operative nausea vomiting was assessed for up to 24 hours. The requirement for rescue antiemetic drug for post-operative nausea vomiting was also assessed. Post-operatively, there was a significant reduction in the incidence of nausea and vomiting (50 per cent to 22 per cent and 24 per cent to 11 per cent respectively 0-12 hours after the surgery) in the PC6 group instead of the sham group ($p= 0.004$ and 0.01 respectively). There was no difference in the incidence of intraoperative vomiting in both groups. However, there was a partial significance for intra-op nausea incidence ($p=0.06$), with the sham group having double the figures compared to the PC6 group. The PC6 required nearly 2 times less metoclopramide than the sham group ($p=0.04$). A combination of PC6 and granisetron effectively reduces post-operative nausea vomiting, and the usage of rescue antiemetic drugs compared to granisetron alone in patients undergoing caesarean section under spinal anaesthesia.

APPROVAL PAGE

I certify that I have supervised and read this study and that in my opinion, it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Master of Medicine (Anaesthesiology).

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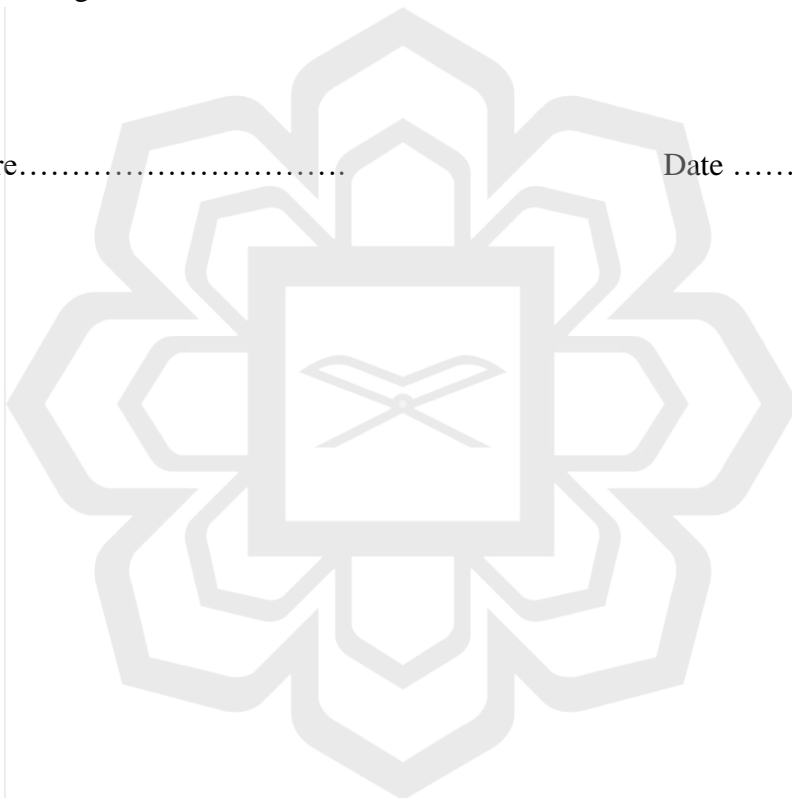
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*This dissertation is dedicated to my beloved daughter Tan Ee En for her endless love
and encouragement.*

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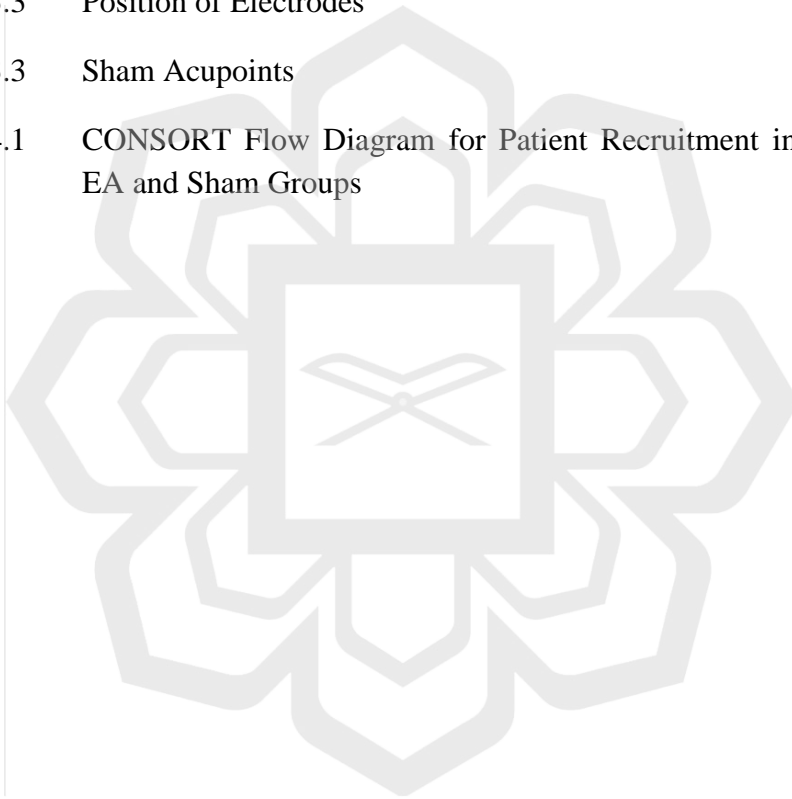
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LIST OF ABBREVIATIONS

ASA	American Society of Anesthesiologists
APS	Acute pain service
BMI	Body Mass Index
BP	Blood pressure
CS	Caesarean section
CSE	Combined spinal epidural
EA	Electroacupuncture
FDA	Food and Drugs Administration
IOV	Intra-operative vomiting
ION	Intra-operative nausea
IU	International Unit
IV	Intravenous
PONV	Postoperative nausea vomiting
IONV	Intra-operative nausea vomiting
LI	Large intestine (acupuncture point)
LSCS	Lower section caesarean section
L3-L4	Lumbar 3 to lumbar 4
NNT	Number needed to treat
PC	Pericardium (acupuncture point)
RCT	Randomized controlled trial
SPSS	Statistical package for the social sciences
T4-T6	Thoracic 4 to thoracic 6

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND OF THE STUDY

The caesarean rate in most countries is increasing year by year. A report shows that the caesarean section rate for government hospitals in Malaysia was 10.5% in 2000 and 11.0% in 2001 (Ravindran, 2003). It rises to 25% of total delivery in Hospital Raja Permaisuri Bainun, Malaysia, in the year 2018. Nowadays, about 7% of all surgical procedures worldwide are caesarean section (Y. et al., 2017). The majority of them are performed with the neuraxial blockade, i.e. epidural anaesthesia, spinal anaesthesia, or combined spinal-epidural anaesthesia (CSE).

Nausea and vomiting are common intraoperative and postoperative complications in women having caesarean section under neuraxial anaesthesia (Allen & Habib, 2008). Compared to the plethora of literature about PONV after general anaesthesia, little attention has been paid to nausea vomiting occurring during or after regional anaesthesia.

The current literature review indicates a high incidence of IONV during CS under spinal anaesthesia, up to 80% (M. Balki & Carvalho, 2005). Multiple risk factors predispose a patient to intraoperative and postoperative nausea and vomiting (IONV and PONV) (Allen & Habib, 2008; Y. et al., 2017). Pregnant women are already likely to suffer from nausea and vomiting because of the pregnancy itself. Additionally, according to Apfel's score for prediction (Pierre et al., 2002), parturients often meet at least two of these criteria: female gender and non-smoker status.

Despite prescribing prophylactic antiemetic, the incidence of nausea and vomiting in CS patient is still as high as 30-50% (Yin et al., 2017). Antiemetic drugs'

efficacy is limited, and their administration is not free from side effects (Yin et al., 2017). Nausea and vomiting not only cause dehydration and electrolyte imbalance it may potentially affect wound healing leading to increased wound pain, discomfort, and anxiety among postpartum patients. Subsequently, this may lead to increased medical expenses and extended hospital stay, leaving the patient with an overall negative surgical experience. Hence, the idea of multimodal therapy in the prevention of IONV and PONV arises.

Non-pharmacological techniques such as acupuncture, acupressure, and transcutaneous acupoint electrical stimulation of the pericardium 6(PC6) Neiguan point have been studied for the prevention of IONV and PONV (Allen & Habib, 2008; Numazaki & Fujii, 2000; Nunley et al., 2008; Yin et al., 2017). The increasing popularity of these modalities is, in part, due to their low cost, simplicity, and in obstetrics, concern about placental transfer and secretion in the breast milk of drugs (Allen & Habib, 2008; Mrinalini Balki et al., 2007).

We hypothesised that a combination of PC6 electroacupuncture stimulation with granisetron would reduce the incidence of IONV and PONV and reduce the usage of antiemetic drugs in post-CS patient.

1.2 STATEMENT OF THE PROBLEM

Despite the potential advantages of caesarean section under neuraxial anaesthesia compared to general anaesthesia, neuraxial technique is associated with many complications. One of the most typical undesirable complications is IONV and PONV (Y. et al., 2017). Although IONV and PONV may not be a severe complication and are almost always self-limiting, their presence can be distressing and uncomfortable. This is further worsened by surgical wound pain and anxiety. The usage of rescue antiemetic

also has safety concerns among breastfeeding post-partum patient; IONV and PONV may ultimately result in a longer stay in the hospital, adversely affect patient comfort and satisfaction, and delay in return to activity (M. Balki & Carvalho, 2005; Gan et al., 2003; Nze, 2011).

Risk factors for IONV and PONV in parturient population include female gender, non-smoker(majority), intraoperative usage of opioids (intrathecal morphine) (Pierre et al., 2002), intraoperative hypotension, surgical stimuli, usage of uterotonic agents and even commonly used antibiotics such as cefazolin, ampicillin and gentamicin may be associated with mild nausea and vomiting (M. Balki & Carvalho, 2005).

In the parturient population, the incidence of IONV and PONV is reported to be as high as 70% without any prophylaxis (Pierre et al., 2002), with some reports citing up to 80% incidence (M. Balki & Carvalho, 2005). Even with single or double prophylaxis therapy, the incidence is still reported from 20 to 50% (Candille & Talagrand, 2008; Gordon & Love, 2005; Numazaki & Fujii, 2000; Nunley et al., 2008; Yin et al., 2017). There is no standardised guideline used universally in Malaysia due to the different availability of the drugs, instruments (acupuncture needle, Relief Band) and electrostimulation machines in each hospital.

This study explores the ability of PC6 electroacupuncture in conjunction with granisetron to reduce the incidence of IONV and PONV in caesarean patients under spinal anesthesia compared to granisetron alone. There are no major side effects reported in the usage of electroacupuncture in pregnancy (Allen & Habib, 2008; Gordon & Love, 2005; Noroozinia et al., 2013; Numazaki & Fujii, 2000); in fact, acupuncture is widely used as a nonpharmacological antiemetic method in treating nausea vomiting during pregnancy and known to be effective (FUJII et al., 1994; KNIGHT et al., 2001).

We felt that with decreased IONV and PONV, there would be better patient comfort and satisfaction, and the overall experience of regional anaesthesia will improve. With the combination of electroacupuncture and granisetron, we hope to explore the possibility of decreased incidence of IONV and PONV. It will improve postoperative quality of care for patients who underwent caesarean section. This, in turn, may hasten patient recovery and discharge from the hospital.

1.3 PURPOSE OF THE STUDY

This study aimed to evaluate whether PC6 electroacupuncture able to reduce the incidence of nausea vomiting in patients who had a caesarean section under spinal anesthesia.

1.4 RESEARCH OBJECTIVES

This study aimed to achieve the following objectives:

Primary Objectives:

- i. To determine the incidence of PONV and IONV in caesarean section patient under spinal anesthesia in our setting.
- ii. To determine the ability of PC6 electroacupuncture in reducing the incidence of IONV in caesarean section patient under spinal anesthesia.
- iii. To determine the ability of PC6 electroacupuncture in reducing the incidence of PONV in caesarean section patient under spinal anesthesia.

Secondary Objectives:

- i. To investigate the correlation between pre-operative factors and PONV.
- ii. To investigate the correlation between intra-operative factors and PONV.
- iii. To investigate the correlation between post-operative factors and PONV.
- iv. To determine the ability of PC6 electroacupuncture in reducing the usage of antiemetic post-operatively.

1.5 RESEARCH QUESTIONS

This study was conducted to search for answers to the following questions:

- i. What is the incidence of PONV and IONV in caesarean section patient under spinal anesthesia in our setting?
- ii. Does PC6 electroacupuncture able to reduce the incidence of IONV in caesarean section patient under spinal anesthesia?
- iii. Does PC6 electroacupuncture able to reduce the incidence of PONV in caesarean section patient under spinal anesthesia?
- iv. What are the pre-operative factors causing PONV?
- v. What are the intra-operative factors causing PONV?
- vi. What are the post-operative factors causing PONV?
- vii. Does PC6 electroacupuncture able to reduce the usage of antiemetic post-operatively?

1.6 THEORETICAL FRAMEWORK

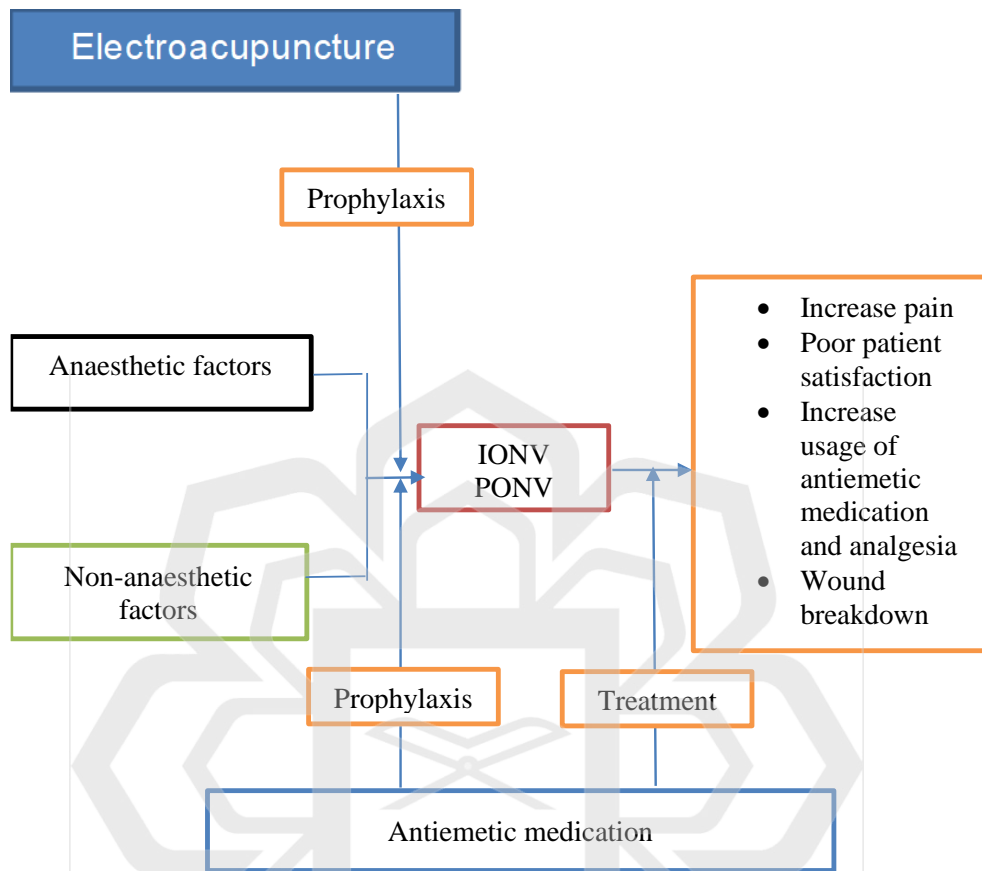


Figure 1.1: Theoretical Framework

1.7 RESEARCH HYPOTHESIS

In this randomised controlled trial, we hypothesised that the PC6 electroacupuncture could reduce the incidence of intra and postoperative nausea vomiting as compared to granisetron alone after caesarean section under spinal anesthesia. We also hypothesised that the PC6 electroacupuncture could reduce postoperative antiemetic drugs' requirement compared to granisetron alone after caesarean section under spinal anesthesia.

1.8 SIGNIFICANCE OF THE STUDY

This study might provide information regarding the efficacy of the PC6 electroacupuncture in the reduction of intraoperative and postoperative nausea vomiting incidence compared to granisetron alone in patients who had a caesarean section under spinal anesthesia. This could emphasise the importance of considering the addition of PC6 electroacupuncture as part of multimodal antiemetic prophylaxis after caesarean section under spinal anesthesia.

1.9 LIMITATIONS OF THE STUDY

There were a few limitations to this study, which were:

1. It is a single centred study
2. Small sample size
3. Operator dependent
4. Different duration of electroacupuncture stimulation depends on operation duration.
5. It did not include the high-risk pregnancy group
6. It did not include an emergency caesarean section

1.10 DEFINITION OF TERMS

1.10.1 Neiguan Point (PC6)

The Neiguan point (PC6) is an acupoint. The activation of this point can normalise the "qi" flow and lower the adverse flow of Qi, and may thus soothe the stomach and help to stop any vomiting that may occur. This point is located on the anterior part of the

forearm, on the line joining 'Daling'(PC7) and 'Quze'(PC3), between the tendons of the long palmar muscle and the radial flexor muscle of the wrist, 2 cun (1 cun= 2.5cm) proximal to the transverse crease of the wrist (Yan Zhen-guo, 2016).

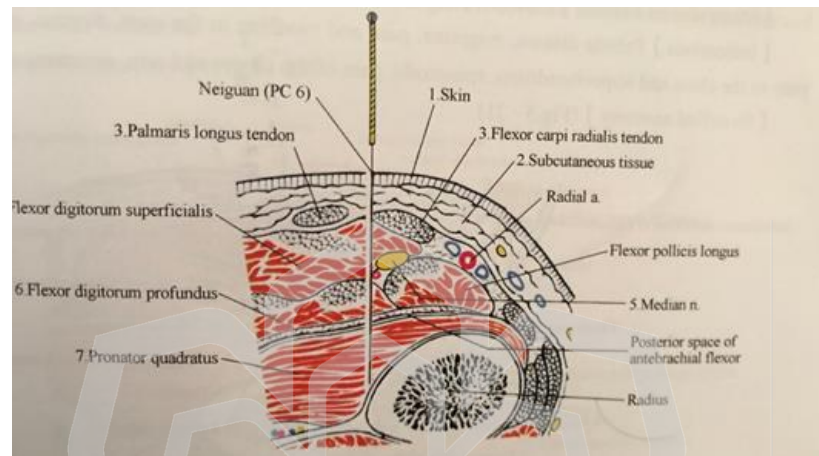


Figure 1.2 Transverse Section of Neiguan (PC6).

Source: (Yan Zhen-guo, 2016)

1.10.2 Hegu Point (LI4)

Hegu point is located on the dorsum of the hand, between the 1st and 2nd metacarpal bones, in the centre of the radial aspect of the 2nd metacarpal bone. Hegu point indications include headache, toothache, pain, sore throat, abdominal pain, diarrhoea, constipation, paralysis and fever (Yan Zhen-guo, 2016).

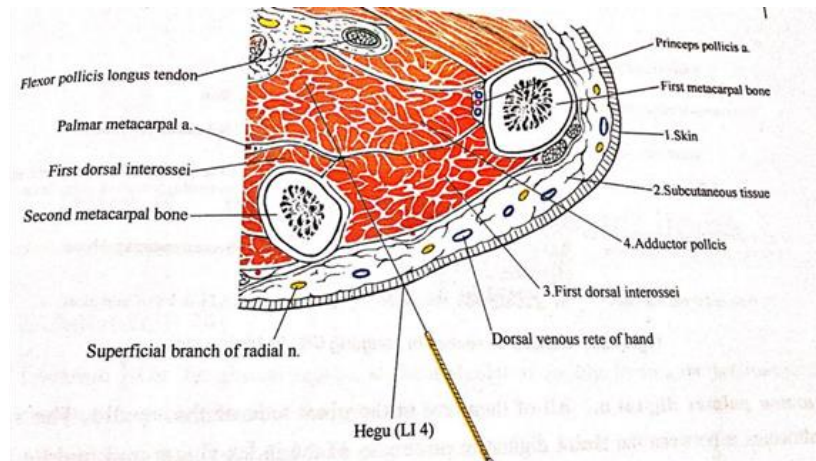


Figure 1. .3 Transverse Section of Hegu (LI4),
Source: (Yan Zhen-guo, 2016)

1.10.3 Electroacupuncture

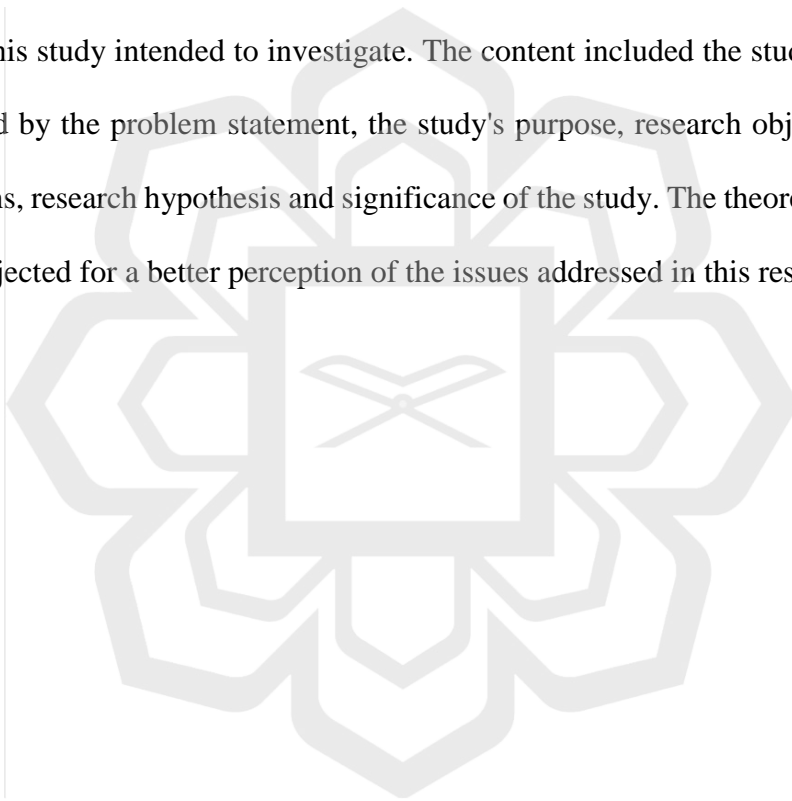
Chinese medicine recognises certain meridians that correspond with organs in the human body. There are twelve pairs of meridians on each side of the body, one meridian in the middle back and one in the middle front of the body. These meridians travel inside the body and on the body's surface. They are connected to each other and to organs by a complex network of accessory collaterals. These meridians function to regulate and modify the corresponding organ or group of related organs. There are 365 classic points and extra-meridian points located along the meridians. Each acupoint has a specific function and indication for its use (MW, 1999).

Electroacupuncture (EA) is a technique in which two needles are inserted as electrodes for passing an electric current. At least one of the needles is on an acupoint. Although electroacupuncture (dating back less than 50 years) is growing in popularity, the more commonly used acupuncture technique, manual acupuncture, involves the insertion of fine needles into acupoints, followed by manual manipulation (dating back

more than 2,000 years) such as twisting the needle or lifting and thrusting. One of the main advantages of using EA in clinical practice or acupuncture research is its capacity to set stimulation frequency and intensity objectively and quantifiably (Napadow et al., 2005).

1.11 CHAPTER SUMMARY

This chapter provided a glimpse to the reader regarding problems and gap in knowledge, which this study intended to investigate. The content included the study's background, followed by the problem statement, the study's purpose, research objectives, research questions, research hypothesis and significance of the study. The theoretical framework was projected for a better perception of the issues addressed in this research.



CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

IONV and PONV, while not a severe complication, can be extremely uncomfortable and distressing for patients. Although PONV is almost always self-limiting and non-fatal, it can cause significant morbidity, including dehydration, electrolyte imbalance, suture tension and dehiscence, oesophageal rupture and life-threatening airway compromise. However, more severe complications are rare (Gan, 2006). In a survey, patient ranked emesis as the most undesirable and nausea as the fourth most undesirable of 10 adverse post-operative outcomes; post-op pain ranked third in this study (A. et al., 1999).

This study was conducted to evaluate whether electroacupuncture of PC6 able to reduce the incidence of nausea vomiting in caesarean section patient under spinal anaesthesia. The literature review focuses on the factors affecting intra-operative and post-operative nausea, vomiting, prophylaxis methods with analysis of previous randomised controlled trials.

2.2 NAUSEA AND VOMITING IN PREGNANCY

The obstetric patient, due to physiological changes in pregnancy, is prone to have nausea and vomiting. This is attributed to impaired motility of the oesophagus and smooth muscle relaxation fostered by increased hormone levels, particularly progesterone, perhaps primed by estrogen during pregnancy (M. Balki & Carvalho, 2005). Hormonal changes are postulated to alter lower oesophageal sphincter (LES)

function, causing an incompetent sphincter. The large gravid uterus contributes to the manifestations of upper gastrointestinal symptoms by mechanically compressing the stomach. Alterations in small bowel transit times in the third trimester have also been investigated as potentially contributing to nausea and vomiting (M. Balki & Carvalho, 2005). Apart from these gastrointestinal effects, hormonal changes during pregnancy may influence the neurovestibular system and emetic centre in the brainstem (M. Balki & Carvalho, 2005).

The term "sick at stomach" was the most common patient descriptor of nausea, and the phrase "throw up" was consistently interpreted as vomiting. The following definitions clarify the separate concepts (Rhodes & Mcdaniel, 1995).

- 1 Nausea is a subjective, unobservable phenomenon of an unpleasant sensation experienced in the back of the throat and the epigastrium that may or may not culminate in vomiting; it is synonymously described as feeling "sick at the stomach." It is usually known through self-report but also may have some objective elements because of its intensity.
- 2 Vomiting is the forceful expulsion of the stomach, duodenum, or jejunum contents through the oral cavity. It may be objectively measured.
- 3 Retching is the attempt to vomit without bringing anything up; it is also called "dry heaves." Both subjective and objective measurements of this phenomenon are possible and valuable.