SHIVERING DURING REGIONAL ANAESTHESIA AND ITS CONTROL WITH PETHIDINE

C K Koay, W Y Chan, M K Chin

ABSTRACT

Ninety-seven consecutive patients who underwent four different types of regional anaesthesia such as lumbar epidural, spinal, caudal and brachial blocks were studied for their incidence of shivering. Fifty percent of patients who received epidural anaesthesia shivered compared to 19% of patients who received either spinal or caudal anaesthesia. None of the patients who had brachial block shivered. Intravenous injection of 25mg pethidine would stop shivering in almost all patients who shivered during regional blocks.

Keywords : regional anaesthesia, shivering

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INTRODUCTION

It is a well known phenomenon that patients undergoing general anaesthesia may show muscle shivering during recovery from anaesthesia. This has been well studied[1-6]. Shivering after regional anaesthesia, especially epidural anaesthesia, is also a common phenomenon[7-10]. However, it is not a well-known complication for other types of regional anaesthesia.

The main objective of our study is to determine the incidence of shivering amongst patients undergoing various types of regional anaesthesia. The effectiveness of a small dose of pethidine in abolishing muscular shivering is also examined.

PATIENTS AND METHODS

Consecutive patients who were given regional anaesthesia for various elective surgical procedures were included in this study. These were general surgical, orthopaedic and gynaecological patients. Only patients in ASA class I and II were included. Excluded from this study were those who were older than 65 years of age, those who underwent transurethral resection of the prostate, those who were neurologically abnormal, those with evidence of infections and those patients who were anxious and were shivering before regional anaesthesia was administered.

No premedication was given except for oral diazepam. Informed consent was obtained from each patient after explaining the technique of the appropriate regional anaesthesia. The patients were divided into four groups according to the types of regional blocks and these were lumbar epidural, spinal, caudal and brachial blocks. The time of onset of shivering, the location of shivering, and the dosage of the local anaesthetic agents used were noted. Pulse rate, blood pressure and body temperature were closely monitored at regular intervals. Any evidence of shivering was noted. Temperature was measured using a nasopharyngeal probe or a sublingual mercury thermometer. The main aim of monitoring the temperature in this study is to detect changes of temperature in the same patient, therefore the route of measurement is not considered very important.

Shivering was graded according to the various degrees of severity. Grade I denotes minimal fasciculation of the facial and neck muscles; this can be shown as noise in the electrocardiographic display. In grade II shivering, visible tremors involving the head, neck, shoulders and extremities were noted. The most severe degree was grade III and this included those with generalised tremor of the whole body[11].

Precautions were taken to ensure that the patients were not shivering because of a cold environment. They were given electric warming blankets which were thermostatically maintained at 37°C. Intravenous pethidine would be given only if the patients complained of discomfort due to shivering or because the shivering had interfered with the surgery. This was given in small incremental dose of 5mg until a total dose of 25mg.

RESULTS

Ninety-five patients were included in this study and they were divided into 4 groups according to the types of regional anaesthesia that they underwent. Tables I and II show their biological and clinical parameters and they were comparable in terms of age, body weight and dosage of anaesthetic agents used.

Table I : Biological variables of the four groups of patients

	Types of Anaesthesia			
	Epidural (n = 20)	Spinal (n = 21)	Caudal (n = 37)	Brachial (n = 17)
Age (years) x (SD)	32.5* (7.1)	30.3* (10.4)	33.6* (12.3)	35.6* (11.1)
Sex M : F	10:10	17:4	24:13	15:2
Weight (kg) x (SD)	58.6* (9.9)	59.0* (6.6)	58.0* (9.6)	64.2* (12.5)

x = mean
SD = standard deviation
* NOT statistically significant ($p > 0.05$) among the 4 groups

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Table II : Clinical parameters of the four groups of patients

	Types of Anaesthesia			
	Epidural (n = 20)	Spinal (n = 21)	Caudal (n = 37)	Brachial (n = 17)
Surgery:				
Orthopaedic	9	15	1	17
O & G	9	1	7	
General	2	5	29	
Lignocaine (mg)	x = 341.4 SD = 32.9		x = 305.7 SD = 27.7	x = 345.0 SD = 45.0
Cincochaine (ml)		x = 1.3 SD = 0.1		
Bupivacaine (ml)		x = 2.7 SD = 0.2		

x = mean
SD = standard deviation
O & G = Obstetrics and Gynaecology
* NOT statistically significant (p > 0.05) among the 4 groups

There was no significant change in their temperature before regional anaesthesia and one hour after the block. Table II shows the number of patients who had developed muscle shivering in each group. Fifty percent of the patients who received lumbar epidural anaesthesia developed grade II and III shivering and 19% of the patients who received either spinal or caudal anaesthesia developed shivering. None of the patients who had brachial block developed shivering. Compared to either spinal or caudal groups, significantly more patients in the epidural anaesthesia group developed shivering ($p < 0.05$, Fisher's exact test). As shown in Table II, there was no significant change in the body temperature of all the patients ($p < 0.5$) and no significant difference among the 4 groups in terms of their body temperature and one hour after anaesthesia.

Tables III and IV show the clinical behaviour of the patients who shivered during the regional anaesthesia. The time of onset of shivering was about 10 minutes in each group. Except for one patient who had spontaneous cessation of shivering before pethidine administration, all the remaining patients needed pethidine injection. The administration of 25mg pethidine would abolish the shivering within 3 minutes. None of the cases in the study required more than 25mg of pethidine.

Table III : Proportions of patients with shivering

	Types of Anaesthesia			
	Epidural (n = 20)	Spinal (n = 21)	Caudal (n = 37)	Brachial (n = 17)
Temperature - before anaesthesia				
Mean	37.2°C	36.9°C	37.4°C	37.0°C
SD	0.4	0.6	0.4	0.5
1 hour after anaesthesia				
Mean	36.9°C	37.0°C	37.2°C	36.8°C
SD	0.4	0.5	0.4	0.5
Mean Temperature change in 1 hour	-0.3°C	+0.1°C	-0.2°C	-0.2°C
Shivering :				
Nil	8	16	28	12
Grade I	2	1	2	3
Grade II + III	10	4	7	0
Percentage with Grade II and III shivering	50%**	19%**	19%**	0%

** Fisher's exact test : epidural and spinal p = 0.039
epidural and caudal p = 0.017

There were a total of 78 patients, 51 males and 27 females in the epidural, spinal and caudal groups. Of the 51 male patients, 8 (16%) developed shivering. However, 13 out of the 27 female patients had shivered (44%). This is significant ($p = 0.005$, $X^2 = 7.877$), indicating that females were more likely to shiver during epidural and caudal regional anaesthesia. Distribution of female patients by types of regional anaesthesia is shown in Table I.

DISCUSSION

The incidence of shivering after inhalational anaesthesia varies from 22% to 60% from various reports, and the incidence of shivering after nitrous oxide-oxygen-relaxant-narcotic type of general anaesthesia is about half of that of inhalational anaesthesia[1-3]. Several causes have been postulated for post-anaesthetic shivering. One of the most common theories is that shivering is the result of a combination of causes, namely hypothermia from a cold environment, peripheral vasodilatative effect of inhalational agents and the resultant loss of heat. However, many studies also showed that there was no correlation between the patients who shivered and the fall of temperature below normal range. Other theories such as altered central or peripheral body temperature control mechanisms, shivering as an antagonistic effect of low anaesthetic concentrations, recovery of spinal activity before the upper motor neurones have recovered from inhibitions of anaesthesia have been postulated[4-6].

Shivering after epidural analgesia has been widely studied particularly on the parturient patients[7-9]. The incidence of shivering in this group of patients has been reported to be as high as 50%[7].

Sympathetic blockade and cutaneous vasodilation with the resultant heat loss was previously commonly regarded as the cause of shivering. However, Bromage et al has argued that this explanation does not match the observed time course of events because shivering usually appears within minutes after injection and long before sufficient time has elapsed for significant heat loss to have occurred. He postulated that the spinal cord response was secondary to misinterpretation of afferent thermal clues due to differential blockade of warm sensation and cold sensation[8,9].

Our study has shown that shivering if occurs usually occurs within 10 minutes after injection. This is the same for spinal, epidural or caudal bloçk. Level of sensory block does not seem to affect onset of shivering. There is no temperature

Table IV : The clinical behaviour of shiverers

Type of Analgesia	Epidural (n = 10)	Spinal (n = 4)	Caudal (n = 7)
Mean time of onset	10.0 min*	9.5 min*	9.7 min*
SD	3.5	2.7	2.8
Mean duration of shivering before 25mg Pethidine given	9.3 min*	10 min*	9.0 min*
SD	2.1	2.0	2.0
Mean duration of shivering after 25mg Pethidine given	2.5 min*	2.5 min*	2.5 min*
SD	0.5	0.4	0.5
Sex :			
Male	4	3	1
Female	6	1	6

* No significant difference among the 3 groups ($p > 0.05$) in terms of onset and duration of shivering, and duration of shivering after pethidine injection (Fisher's exact test)

drop in the shiverers compared to the non-shiverers. However, the incidence of shivering is more frequent in females compared to male patients.

Intravenous pethidine has been shown to be a good pharmacological control of shivering of various origins such as amphotericin-β infusions and post-inhalational anaesthesia. β-endorphins (intra-ventricular) injections has been shown to inhibit cold-induced shivering in anaesthetised cats, an effect which was readily reversed by naloxone. Epidural pethidine has been shown to be equally effective in preventing shivering following epidural bupivacaine blockade[10].

This unique property of pethidine is not shared by other narcotic agents like morphine or fentanyl[11]. It has been shown that pethidine relieved shivering in 95% of patients compared to morphine 45% and fentanyl 35%. Nausea and vomiting were minimal[11].

This study has confirmed that pethidine is a useful agent to control shivering. The mean time for shivering to disappear is about 2-3 minutes.

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