



RESEARCH ARTICLE

Description of Post Anesthetic Shivering (PAS) in Post Spinal Anesthesia Caesarean Section

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Abstract

Objective: Post anaesthetic shivering (PAS) is a fasciculation of the face, jaw, or head or the occurrence of muscle hyperactivity so that the body can produce heat after anesthesia. Multiple factors can influence the incidence of PAS including age, sex, ASA physical status, body mass index, type of anesthesia, duration of surgery, room temperature, preoperative body temperature (<36,5°C), and type of surgery. The purpose of this study was to describe the incidence of PAS in post-spinal anesthesia caesarean section patients at RSIA Siti Hawa Padang;

Method: This research is a descriptive observational study using accidental sampling technique and obtained a total sample of 52 patients;

Result: The result showed that 25 of 52 patients (48,1%) experienced PAS. Most PAS events were experienced by moderate grade (25%), the age group >35 years (60%), underweight body mass index (62,5%), ASA II status (52,2%), preoperative temperature in the hypothermia group (51,4%), postoperative temperature in the normothermia group (66,7%), and operation duration >30 minutes (57,1%);

Conclusion: Most of the patients did not experience PAS and most of PAS experience was moderate grade.

Keywords: Caesarean section; PAS; Post Anesthetic Shivering; Spinal anesthesia

INTRODUCTION

Spinal anesthesia as one of the regional anesthetics is relatively widely used in surgery. Rapid onset and small doses of local anesthetic drugs used can minimize the risk of systemic drug toxicity in patients, so this anesthetic is used as the main choice in cesarean section.^{1,2} According to WHO data in 2018, 21.1% of women giving birth by cesarean section has increased over the past three decades.³ According to 2018 research data, the United States reported 94% of obstetric patients performed cesarean section surgery under spinal anesthesia.⁴ Basic Health Research (Riskesdas) 2018, cesarean section in Indonesia was 17.6%, and specifically in West Sumatera Province, it stood at 23.6%.⁵

Spinal anesthesia has the advantages of keeping the mother awake during surgery, minimizing maternal aspiration, avoiding the risk of neonatal depression, and reducing the risk of postoperative deep vein thrombosis.² Anesthesia interferes with core body temperature control, inhibiting thermoregulatory responses to cold, such as vasoconstriction and tremor.⁶ One of the most frequent complications of spinal anesthesia is Post Anaesthetic Shivering (PAS). PAS is one of the complications that makes patients uncomfortable during recovery from anesthesia which manifests as involuntary oscillatory mechanical movements and clonic movements ranging from 5-30 minutes after cessation of anesthesia. Approximately 20% of patients experience perioperative hypothermia resulting in an increased incidence of PAS in the Post Anesthesia Care Unit (PACU) ranging from 60%-90%.⁶ The effects of shivering can stretch the surgical incision wound which will increase post-surgical pain, increase metabolic heat by 600% above basal values, increase oxygen consumption by 300%-400%, increase carbon dioxide, induce lactic acidosis, release catecholamines, increase cardiac output, increase the risk of hypoxemia, increase the risk of complications after surgery such as pain, infection, and bleeding. Shivering is associated with delayed wound healing and may increase the duration of hospital stay.⁷

The cause of PAS has not been confirmed to date. The theory that can be associated with shivering is that autonomic thermoregulatory changes induced by spinal anesthesia cause a decrease in core body temperature.⁷ Changes in body temperature regulation will cause vasodilation under anesthesia block resulting in the transfer of body heat from central to peripheral by lowering core temperature (0.5-1°C) so as to increase body heat generation through muscle contraction.^{8,9} Several factors can affect the incidence of PAS, including age, gender, BMI, ASA physical status, duration of surgery, type of anesthesia, room temperature, preoperative body temperature <36.5°C, and type of surgery.⁹ Multiple studies on PAS have yielded varied results. Masithoh et al. obtained 52.5%, Hidayah ES et al. obtained 37.7%, Tantarto T et al. obtained 26.41%, Susilowati A et al. obtained 52.5%, Putri YR obtained 41.7%, and Cahyawati FE et al. obtained 39 (24.1%) of 162 cesarean section surgery patients.¹⁰⁻¹⁵

The increased occurrence of shivering is associated with temperatures that are too cold. For instance, at RSIA Siti Hawa Padang set the temperature in the operating room at 16°C and in the recovery room, it ranges from 18-24°C. However, according to the Regulation of the Indonesian Minister of Health Number 7 of 2019, the standard operating room temperature is 22-27°C and the

standard temperature in the recovery room is 22-23°C.¹⁶ The purpose of the study was to examine the description of the incidence of PAS in post spinal anesthesia cesarean section patients at RSIA Siti Hawa Padang.

METHODS

This study is a descriptive observational study with accidental sampling technique. The research was conducted in the recovery room of Siti Hawa Hospital Padang in May 2022-January 2023. The sample in this study were all cesarean section patients with spinal anesthesia technique as many as 52 patients. The inclusion criteria in this study were patients who gave birth by cesarean section with spinal anesthesia classified into ASA I-II physical status, while the exclusion criteria were patients who were not willing to be research samples, patients with incomplete anesthesia status, hypothyroid or hyperthyroid patients, and preoperative body temperature > 37.5°C.

During the study, researchers looked at the patient's anesthesia status to assess the inclusion criteria. If in accordance with the inclusion criteria, the researcher conducted informed consent when the patient arrived in the recovery room then the researcher will measure the patient's axillary body temperature. If the patient is shivering, it will be assessed using the Bedside Shivering Assessment Scale (BSAS).¹⁷

This research has been approved by the ethics committee of the Faculty of Medicine, Andalas University 788/UN.16.2/KEP-FK/2022. Data analysis in this study was processed using data processing applications. Data were analyzed descriptively with univariate analysis to describe the results of each variable studied such as degree of PAS, age, body mass index, ASA physical status, body temperature before surgery, body temperature after surgery, and duration of surgery.

RESULT AND DISCUSSION

Table 1. Characteristics Respondents

	Frequency (n)	Percentage (%)
Age		
<20	0	0
20–35	42	80,8
>35	10	19,2
Total	52	100
BMI		
Underweight	8	15,4
Normal	11	21,2
Overweight	10	19,2
Obesity type 1	16	30,8
Obesity type 2	7	13,5
Total	52	100
ASA physical status		
I	29	55,8
II	23	44,2
Total	52	100
Body temperature before surgery		
Hypothermia	35	67,3
Normothermia	17	32,7
Total	52	100
Body Temperature after surgery		
Hypothermia	44	84,6
Normothermia	6	11,5
Hyperthermia	2	3,8
Total	52	100
Duration surgery		
≤30 minutes	17	32,7
>30 minutes	35	67,3
Total	52	100

The results of the study in **Table 1** showed that patients with the highest frequency based on the age were the age group of 20–35 years by 42 people (80.8%), based on BMI is the obesity group level 1 by 16 people (30.8%), ASA physical status by 29 people (55.8%), body temperature before surgery in the hypothermia group by 35 people (67.3%), body temperature after surgery in the hypothermia group by 44 people (84.6%), and the duration of surgery in the > 30 minutes by 35 people (67.3%).

Table 2. Grade Post Anesthetic Shivering (PAS)

Grade PAS	Frequency	Percentage (%)
0 (without PAS)	27	51,9
1 (Mild PAS)	12	23,1
2 (Moderate PAS)	13	25
3 (Severe PAS)	0	0
Total	52	100

Based on **Table 2** of the incidence and degree of PAS, it was found that the incidence of PAS was 25 out of 52 people (48.1%). This result is in line with Susilowati A et al. who found that 21 out of 40 people (52.5%) experienced PAS.¹⁸ Kishore et al. obtained 49.52% incident of PAS.¹⁹ Patients who experienced PAS included 12 people with mild PAS (23.1%), and 13 others with moderate PAS (25%). These results are not much different from Palanisamy et al. Obtained 15 of 75 cesarean section patients had mild PAS (20%), 23 other patients had moderate PAS (30%).²⁰ Several studies regarding the incidence of PAS obtained varied data. This is influenced by the induction of spinal anesthesia which plays a major role in disrupting thermoregulation so that the body's response arises in the form of vasoconstriction and the formation of body heat through shivering.⁷ Used to treat PAS may vary. In this study, the anesthesiologist at RSIA Siti Hawa Padang used pethidine as a premedication.

Table 3. Distribution of PAS in cesarean section patients after spinal anesthesia by age

Age	PAS		Without PAS		Total	
	f	%	f	%	f	%
<20	0	0	0	0	0	0
20–35	19	45,2	23	54,8	42	100
>35	6	60	4	40	10	100
Total	25	48,1	27	51,9	52	100

The age group **Table 3** shows that ages >35 years experience PAS most (60%). These results are not much different from the study of Susilowati A et al. found that 11 out of 14 patients (27.5%) experienced more PAS in the late adult group.¹⁸ Tantarto T et al. obtained early elderly patients (46-55 years) experienced more PAS (31.36%).¹² The ability of the thermoregulation system differs in each age group because it is influenced by the physiology of the individual body. Anesthesia with spinal anesthesia technique at an older age will lower the shivering threshold by 1°C which makes hypothermia easier than at a young age. Decreased compensation occurs due to changes in several body functions such as changes in metabolic function, stiffness of the blood vessel walls, increased peripheral vascular resistance, decreased cardiac output, and decreased ability of the respiratory muscles so that the capacity of oxygen delivery to the tissues also decreases. As a person's age increases, the thermoregulation of heat and cold will decrease, which reduces the body's ability to maintain body temperature. When the body fails to maintain body temperature with or without anesthesia, the cause is probably due to increasing age followed by a decrease in

vasoconstriction.^{21–23}

Table 4. Distribution of PAS in cesarean section patients after spinal anesthesia by body mass index (BMI)

BMI	PAS		Without PAS		Total	
	f	%	f	%	f	%
Underweight	5	62,5	3	37,5	8	100
Normal	5	45,5	6	54,5	11	100
Overweight	5	50	5	50	10	100
Obesity type 1	7	43,8	9	56,3	16	100
Obesity type 2	3	42,9	4	57,1	7	100
Total	25	48,1	27	51,9	52	100

Classification of BMI in **Table 4**, PAS was mostly experienced by underweight BMI (62.5%). This study supports Yunita et al. that 5 out of 7 morphometrically deficient patients had the most PAS (71.4%).²⁴ Kim et al. obtained 5 out of 9 patients with underweight BMI experiencing PAS.²⁵ The function of fat is as a form of body temperature defense and protection from loss of body heat. Patients with greater BMI have body fat with lower temperature conductivity, which reduces heat loss from the skin. Obese patients have thick subcutaneous abdominal fat which is interpreted as a protector that can prevent heat transfer and as a protection so that they remain in a normothermic condition.²⁶ Leptin hormone levels will increase at a greater BMI so that peripheral resistance to protein activity increases. Adipocytes secrete the hormone leptin, which increases sympathetic nerve activity and stimulates energy expenditure in adipose tissue to increase metabolism and generate body heat.²⁷ This reason also reinforces that low BMI has less fat reserves so that its thermoregulation ability is not as good as normal BMI which allows the work of anesthetic drugs can be responded by the body so that heat production is maintained.^{18,24}

Table 5. Distribution of PAS in cesarean section patients after spinal anesthesia by ASA Physical Status

ASA Physical Status	PAS		Without PAS		Total	
	f	%	f	%	f	%
I	13	44,8	16	55,2	29	100
II	12	52,2	11	47,8	23	100
Total	25	48,1	27	51,9	52	100

The results of the study in **Table 5** show that the physical status is ASA II (52.2 %) had more PAS events than ASA I (44.8%). According to the 2020 ASA physical status classification that normal pregnancy starts from ASA II but at RSIA Siti Hawa Padang still uses the 2014 ASA physical status classification that pregnancy starts from ASA I.²⁸ The results of the study in table 5 show that the physical status is ASA II (52.2 %) had more PAS events than ASA I (44.8%). This is in line with research

by Kanchan et al. of the 60 patients, ASA I experienced PAS in 25 patients (41.7%) and ASA II in 35 patients (58.3%).²⁹ Patients with ASA I had normal health conditions, while ASA II and above had health conditions from light to heavy. Thermoregulatory control can be disturbed in patients who have health problems. A good physical condition is able to compensate the body by producing body heat quickly compared to patients with mild to severe medical conditions.²³

Table 6. Distribution of PAS in cesarean section patients after spinal anesthesia by body temperature before surgery

Body temperature before surgery	PAS		Without PAS		Total	
	f	%	f	%	f	%
Hypothermia	18	51,4	17	48,6	35	100
Normothermia	7	41,2	10	58,8	17	100
Total	25	48,1	27	51,9	52	100

Measurement of body temperature before surgery in **Table 6** found that more hypothermic patients had PAS (51.4%). Mukarromah et al. found that all patients with preoperative body temperature $<36^{\circ}\text{C}$ experienced PAS.³⁰ Hypothermia can occur in low-risk patients or short procedures so warming the patient's body before surgery is highly considered because it can minimize the redistribution of body heat loss after anesthesia induction.³¹ Research conducted that the incidence of PAS was less in patients who were warmed before surgery compared to the group of patients who were not warmed.³² The cause of low body temperature for undergoing surgery can be caused by the low room temperature factor and the anxiety factor. Pregnant women with anxiety are more likely to shiver than those who are not anxious.³³

Table 7. Distribution of PAS in cesarean section patients after spinal anesthesia by body temperature after surgery

body temperature after surgery	PAS		Without PAS		Total	
	f	%	f	%	f	%
Hypothermia	20	45,5	24	54,5	44	0
Normothermia	4	66,7	2	33,3	6	100
Hyperthermia	1	50	1	50	2	100
Total	25	48,1	27	51,9	52	100

Measurement of body temperature after surgery in **Table 7** found that the normothermic group experienced more PAS (66.7%). There is a difference in measurement time while in the recovery room so some patients have reached a normothermic state but still experience chills which cause the data obtained to be more normothermic patients who experience chills. Kanchan et al. obtained from 60 patients, hypothermic was experienced by 47 patients (78.3%) and normothermia in as many as 13 patients (21.7%) experienced PAS.²⁹ Apart from the thermoregulatory mechanism, decreased activity of the sympathetic nervous system, alkalosis, endogenous pyrogen release,

surgical stress, and pain can affect the incidence of PAS.²³ The state of normothermia when experiencing chills is a form of protection or compensation for the body when exposed to cold. The posterior region of the hypothalamus will directly increase skeletal muscle activity through descending pathways that end in motor nerves that control skeletal muscles to generate heat by shivering and reduce heat dissipation through skin vasoconstriction.³⁴

Table 8. Distribution of PAS in cesarean section patients after spinal anesthesia by duration surgery

Duration Surgery	PAS		Without PAS		Total	
	f	%	f	%	f	%
≤30 minutes	5	29,4	12	70,6	17	100
>30 minutes	20	57,1	15	42,9	35	100
Total	25	48,1	27	51,9	52	100

Table 8 shows that the duration of surgery >30 minutes experienced more PAS (57.1%). This result supports Renaningtyastutik et al. who found that operations >120 minutes experienced more PAS.²¹ Putri YR at Mdjamil Hospital Padang found that incidents of PAS were experienced more in patients with operations >90 minutes, this study found a significant relation between the length of operation and incident PAS.¹⁴ The duration of surgery causes the patient's body to be exposed to the cold temperatures of the operating room for longer and the duration of anesthetic drugs will be longer.²¹ The temperature of the operating room at RSIA Siti Hawa Padang is 16°C, whereas according to Regulation of the Minister of Health of the Republic of Indonesia Number 7 of 2019, the standard operating room temperature is 22–27°C. The low temperature of the operating room can increase the risk of hypothermia and shivering.²³ The longer duration of this operation indicates that the operation is more complex and invasive so the injured tissue releases pyogenic substances. The effect is that there is an increase in the set point in postoperative thermoregulation and then the triggering of PAS.²¹

CONCLUSION

The results of this study is that the incidence of PAS in post spinal anesthesia cesarean section patients at RSIA Siti Hawa Padang showed that the majority of patients did not experience PAS and most had moderate degrees of PAS, most PAS events were experienced by the age group >35 years, at thin BMI, at ASA status II, in the hypothermic group measured before surgery, in the normothermic group after surgery, and the duration of surgery was >30 minutes.

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