

The correlation between length of surgery and the incidence of post anesthetic shivering and urinary retention in patients pasca spinal anesthesia

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Abstract

Background: Surgical procedures are inseparable from anesthesia, one of the anesthetic procedures is spinal anesthesia. Spinal anesthesia is the most common regional technique performed by most anesthesiologists worldwide. Spinal anesthesia is injecting local analgesic drugs into the subarachnoid space in the area between the lumbar vertebrae L2-L3 or L3 L4 or L4-L5. This study aims to determine the relationship between the duration of surgery and the occurrence of Post Anesthetic Shivering and urinary retention in patients after spinal anesthesia in the recovery room of RSU Aisyiyah Padang.

Method: This research method is descriptive quantitative with a cross-sectional approach. The sampling technique used no random sampling with a total sampling of 30 respondents. Data was taken using demographic data for gender and age data. The data were analyzed by using univariate analysis and bivariate analysis was used spearman rank.

Results: Respondents with the most dominant age category were adults aged 26-45 years, namely 17 respondents (56.7%). Respondents with a more dominant Gender category, namely Women, were 18 respondents (60.0%). In the category of length of surgery, namely more than >1-2 hours, namely 20 respondents (66.7). The significance p-value in the Shivering category is 0.799 and In the category of Urinary retention is 0.204 (>0.05) indicating that there is no relationship between the incidence of length of surgery and the incidence of Post Anesthetic Shivering and urine retention

Conclusion: There is no relationship between the length of surgery and the incidence of post-anesthetic shivering and urine retention and the direction of the relationship is positive.

Keywords: Length of Operation; Spinal Anesthesia; Shivering; Urinary Retention.

INTRODUCTION

Surgery in the medical world or what is usually referred to as surgery is a form of medical therapy using invasive methods by opening parts of the body to remove problematic organs or tissues (1). According to WHO (2020 in Ramadhan et al., 2023) the number of clients undergoing surgery reaches a very significant increase every year. It is estimated that every year there are 165 million surgical procedures performed worldwide. It was recorded that in 2020 there were 234 million clients in all hospitals in the world. Based on data from the Indonesian Ministry of Health (2021) surgery ranks 11th out of 50 disease treatments in Indonesia,

32% of which are elective surgery. Surgery cannot be separated from anesthesia, one of the anesthetic measures is spinal anesthesia. Spinal anesthesia is the most common regional technique performed by most anesthesiologists worldwide (2). Approximately 5% or 15 million surgical procedures worldwide are performed with spinal anesthesia techniques (3). The development of regional anesthesia began with the isolation of local anesthetics, the first of which was cocaine (the only natural local anesthetic). The first regional anesthetic technique performed was spinal anesthesia, and the first operation under spinal anesthesia was performed in 1898 in

Germany by August Bier. Prior to this, the only local anesthetic techniques were topical anesthesia of the eye and infiltration anesthesia (4).

The use of spinal anesthesia does provide benefits but the side effects of the anesthesia cannot be ignored, one of the effects of anesthesia is Post Anesthetic Shivering (PAS) (5). Shivering is defined as involuntary body shaking caused by muscle contraction. It is a physiological response to an increase in core body temperature in an attempt to increase metabolic heat production and maintain temperature. However, shivering is associated with various adverse consequences such as increased metabolic heat production, increased oxygen consumption, and carbon dioxide production resulting in hypoxemia, triggering myocardial ischemia, increased wound pain, delayed wound healing, and impaired monitoring (6).

Surgery and anesthesia administration are the main causes of shivering in patients undergoing surgery. However, perioperative heat loss, skin exposure in a cool operating theatre, evaporation from exposed sites, administration of unwarmed fluids, systematic release of pyrogens, pain, and inhibition of the thermoregulatory system by inhibiting tonic vasoconstriction are the main factors that predispose surgical patients to shivering (6). Shivering is known to be a frequent complication in patients undergoing surgery under spinal anesthesia with an incidence of 40- 70% (7).

The findings of the study conducted by Amiarti et al. (2024) indicated that the majority of instances of chills occurred in: The findings of the study conducted by Arianda Ketaren et al. (2024) indicate that the majority of respondents (52.8%) experienced moderate hypothermia during intra-anesthesia, while 41.7% of respondents experienced moderate hypothermia post-anesthesia. The identification of hypothermia was based on the length of surgery, with moderate hypothermia occurring in respondents with a length of surgery <1 hour experiencing moderate hypothermia by 41.7%.

Furthermore, surgical and anesthetic procedures can also result in urinary

retention. The effects of anesthesia, drugs, pain and physiological changes resulting from surgery and local destruction have been observed to impact the patient's micturition, particularly the autonomic nervous system. The pharmacological effects of anesthesia can impact the normal micturition patterns. General, spinal and regional anesthesia can all result in postoperative urinary retention by suppressing micturition control and reflexes at the central and peripheral nervous system levels, through the blocking of nerve transmission in the sacral spinal cord (8). Perioperative medications, especially opioids, can also play a role in the development of postoperative urinary retention, as they have the effect of reducing the sensation of bladder distension by inhibiting the parasympathetic innervating the bladder while also increasing bladder neck tone through overstimulation of the sympathetic nervous system leading to increased outlet obstruction (8).

Postoperative urinary retention (POUR) is the inability to urinate after a surgical procedure despite a full bladder. It can be a source of great distress for the patient, or it can go unnoticed. It can be easily cured with minimal intervention from the provider, or it can have long-term effects on the patient. Its prevalence is mentioned between 5% to 70% in the literature (8).

The results of the research conducted by Indra Dewi et al. (2023) indicated that the prevalence of postoperative urine retention was observed in 41 patients (59.4%). The distribution of postoperative patients by age revealed that 39 patients (56.5%) were at risk of developing the condition at 50 years of age or above. Additionally, the distribution of postoperative patients by gender showed that 31 patients (44.9%) were male. The remaining 38 patients (55.1%) were female. The frequency distribution of postoperative patient BMI was as follows: 26 patients (37.7%) were normal, 30 patients (43.5%) were underweight, and 13 patients (18.8%) were overweight. The frequency distribution of postoperative patient surgery type was as follows: 50 patients (72.5%) underwent high-risk surgery, and 19 patients (27.5%) non-risk surgery, frequency distribution of

postoperative patient surgery duration: 13 people (18.8%) underwent a long duration surgery, while 56 people (81.2%) underwent a fast duration surgery. Frequency distribution of postoperative patient fluid balance: 25 people (36.2%) had a positive fluid balance, 31 people (44.9%) had a neutral fluid balance, and 13 people (18.8%) had a negative fluid balance. A statistically significant correlation was observed between age, surgical type and fluid balance and the occurrence of postoperative urine retention, with a p-value of 0.017, 0.004 and 0.023, respectively.

The risk of shivering will be higher if the duration of surgery or surgery is longer, because it will increase the time of exposure to cold temperatures and cause the accumulation of side effects of spinal anesthesia (9). This is consistent with the hypothesis that longer surgical procedures necessitate more prolonged anesthetics. The vasodilatory effects of spinal anesthetics can potentially result in heat loss to the surrounding environment. Furthermore, anesthetic drugs can impede the body's ability to compensate for heat loss, and the longer the operation, the longer the body is exposed to cold temperatures (10). According to the results of the Spearman rank test, there was a significant association (p-value of 0.000; $\alpha < 0.05$) between the length of the surgery and the frequency of shivering among patients who underwent spinal anesthetic (Nasrun and Azizah, 2022). The findings of Suwiknyo's study (2023) indicated a correlation between the duration of surgery and the incidence of shivering in patients who had undergone spinal anesthesia.

A various lengths of surgery are at risk of causing urinary retention (8). The duration of surgery that is more than two hours can increase the risk of postoperative urine retention (11). However, the results of research by Indra Dewi et al, (2023) statistical test, namely chi square, obtained a p-value of 0.863 more than the value of $\alpha = 0.05$, there was no significant relationship between the duration of surgery and postoperative urinary retention with an OR value of 1.115 (95% CI: 0.323-3.845). This indicates that a long duration has a 1.115 times chance of

experiencing postoperative urinary retention than a fast duration. However, this chance is not significant, because there are other factors that support the occurrence of urine retention such as comorbidities and types of anesthesia. The results of the author's preliminary study at RSU Aisyiyah Padang obtained data on spinal anesthesia patients in April 2024 as many as 70 people. Several incidents of Shivering and Urinary Retention in post spinal anesthesia were often encountered by the author while working at Aisyiyah Padang Hospital.

The description provided above indicates that research has been done on the correlation between the duration of surgery and the occurrence of post-anesthetic shivering (PAS). However, the correlation between the duration of surgery and the incidence of PAS and urinary retention in patients recovering from spinal anesthesia has not been investigated. A study titled "The relationship between the length of surgery with the incidence of post anesthetic shivering (PAS) and urinary retention in post-spinal anesthesia patients in the recovery room of Aisyiyah Padang Hospital" is therefore of interest to the researcher.

METHOD

The research design employed was quantitative observational analytic research, whereby data was subjected to analysis. The research was conducted at RSU Aisyiyah Padang from 13 to 21 August 2024. The population was determined as the first step in determining the research sample. The population in this study comprised 100 respondents, with sampling techniques utilizing non-random sampling. The analysis was conducted to determine the relationship between the duration of surgery and urinary retention, using the *chi square test* because the study used categorical data and this study has passed the ethical approval with no: B.LPPM-UHB/881/08/2024 at KEPK Universitas Harapan Bangsa.

RESULTS

Table 1. Frequency Distribution by Age and Gender

Characteristics		f	%
Age	Adult (26-45)	17	56.7
	Adolescent (12-25)	5	16.7
	Old (46-65)	8	26.7
Total		30	100
Gender	Male	12	40.0
	Female	18	60.0
Total		30	100

Based on table 1 of the frequency distribution results above, most of the respondents were in the adult group, namely ages 26-45 years, namely 17 respondents (56.7%). Based on gender, the more dominant respondent is Female as many as 18 respondents (60.0%).

Table 2. Frequency Distribution of Length of Operation

Length of Operation	f	%
<1 hour	10	33.3
>1-2 hour	20	66.7
Total	30	100.0

Based on the results of table 2 frequency distribution above, the length of surgery is more than >1-2 hours, namely 20 respondents (66.7%).

Table 3. Frequency Distribution of Shivering

Shivering	f	%
Not Shivering	16	53.3
Shivering	14	46.7
Total	30	100.0

Based on the results of table 3, the frequency distribution of shivering is not shivering as many as 16 people (53.3%).

Table 4. Frequency Distribution of Urinary Retention Events

Urinary Retention	f	%
No	27	33.3
Yes	3	66.7
Total	30	100.0

Based on table 4, the results of the frequency distribution of the incidence of urinary retention, most of the respondents did not experience urinary retention as many as 27 respondents or (90.0%).

Table 5. Relationship between length of surgery and incidence of Post Anesthetics Shivering (PAS) and urinary retention

Variable	Sig.	P-value
Shivering	0.799	0.846
Urinary Retention	0.204	0.530

Based on table 5, the significance value in the Shivering category is 0.799 (>0.05) indicating that there is no relationship between the incidence of length of surgery and the incidence of Post Anesthetic Shivering. The correlation coefficient value obtained is 0.846 which indicates that the strength of the relationship is strong. In the category of Urinary retention is 0.204 (>0.05) indicating that there is no relationship between the incidence of long surgery with Urinary retention. The correlation coefficient value obtained is 0.530 which indicates that the strength of the relationship is moderate. so that the conclusion given is Ho accepted or there is no relationship between the length of surgery with the incidence of Post Anesthetic Shivering (PAS) and urinary retention and the direction of the relationship is positive.

DISCUSSION

1. Characteristics of Respondents

Table 1 of the above-mentioned frequency distribution results indicates that the majority of respondents were in the Adult group, comprising individuals aged 26-45 years. This group accounted for 17 respondents (56.7%) of the total sample. With regard to gender, the majority of respondents were female, with 18 individuals (60.0%) identifying as such. This finding aligns with the research of Fischgrund et al. (2018), which revealed that the majority of patients undergoing spinal anaesthesia belong to the young adult age group (25-34 years), with 23 patients (57.5%) falling within this category. The next age group is that of the adult, comprising individuals aged 35-44 years, representing 15 patients (37.5%). The final age group is that of the elderly, comprising individuals aged 45-54 years,

representing two patients (5%). As demonstrated by the research conducted by Zulfakhrizal et al. (2023), the age frequency distribution of patients undergoing spinal anaesthesia revealed that the majority of patients fell within the productive age group of 25-45 years, comprising 35 patients (70%). The next largest age group was that of the elderly, comprising individuals aged 46-60 years, representing 12 patients (24%). The youngest age group was that of 20-24 years, comprising three patients (6%).

Patients aged 26-45 years typically exhibit superior health outcomes compared to older patients, conferring a greater propensity for undergoing spinal anaesthesia (12). According to Susanto, (2023) the physical abilities of patients aged 26-45 years generally have better physical abilities, so they are more able to undergo spinal anaesthesia and related surgical procedures.

In the study conducted by Ditya et al., 59.2% of the respondents were female, while 40.8% were male (Imelda, 2019). The study revealed that 58.3% of respondents were female, while 41.7% were male. It was found that women are more likely to experience elevated anxiety and worry prior to undergoing surgery, which leads them to opt for spinal anesthesia as a means of reducing pain and anxiety. Medical requirements, it was established that women are more prone to having medical conditions that necessitate the use of spinal anesthesia, including childbirth and gynecological surgery (13).

2. Frequency Distribution of Length of Operation

In light of the findings presented in Table 2, the length of surgery is predominantly in excess of one to two hours, with 20 respondents (66.7%) reporting a duration of over two hours. The findings of this study indicate that appendicitis surgery typically lasts between one and two hours and has an adverse impact on the patient's quality of life. This finding is consistent with the

results of a study by Supatmi & Agustiningsih (2014), which revealed that 70% of respondents who underwent surgery for a duration of 1-2 hours had a history of chronic disease, and 60% had a history of previous surgery. The findings of Ratnasari's (2022) research indicate that a surgical procedure exceeding one to two hours in duration is associated with an elevated risk of postoperative complications. This study's results demonstrate that prolonged surgical procedures have a detrimental impact on patients' quality of life, particularly in terms of physical and psychological well-being.

To prevent or minimize the adverse effects of the shivering response during surgery, it is essential to monitor and manage the patient's temperature during and after surgery. This can be achieved through the use of heating devices, blankets and medications to control shivering and maintain normothermia. Consequently, the side effects of the shivering response can be minimized, and patients can recover faster and better (14).

3. Frequency Distribution of Shivering

Table 4.3 reveals that the majority of respondents (53.3%) did not experience shivering. This finding aligns with the results of Muzaki's (2022) research, which also indicated that the majority of respondents exhibited no shivering, with 16 respondents (53.3%) falling into this category. Similarly, Ruskandi (2022) reported that the majority of respondents did not shiver, with 20 respondents (55.6%) falling into this category.

The utilisation of oxygen during surgical procedures and in the postoperative period has been demonstrated to reduce the incidence of shivering. The provision of oxygen can enhance oxygen saturation in the blood and diminish oxygen consumption by muscles (15). The administration of warm pillows to postoperative patients may also prove effective in reducing the incidence of shivering. Warm pillows can elevate

body temperature and reduce oxygen consumption by muscles (16).

Shivering is a common complication in post-operative patients under spinal anaesthesia. Therefore, it is important to prevent and manage shivering in post-operative patients under spinal anaesthesia. An effective shivering prevention system can help reduce the incidence of shivering and improve patient comfort (17).

A decrease in body temperature is identified by the hypothalamus, the brain region responsible for regulating body temperature, and this information is relayed to the sympathetic nervous system. The sympathetic nervous system then activates the skeletal muscles, particularly the small muscles located beneath the skin, prompting them to contract and relax rapidly and repeatedly. This contraction and relaxation of these muscles results in the body's tremors or shivering, a phenomenon known as shivering (18).

Shivering increases body heat production in several ways. Firstly, the contraction of the muscles increases energy metabolism, which produces heat as a by-product. Secondly, shivering increases blood flow to the muscles, which helps improve the delivery of oxygen and nutrients to the body tissues. Thirdly, shivering also increases the production of hormones that play a role in body temperature regulation, such as thyroid hormones and adrenaline hormones (19).

4. Frequency Distribution of Urinary Retention Events

Table 4 indicates that the majority of respondents (n=27, 90.0%) did not experience urinary retention. This finding is consistent with the results of the study by Prayitno et al. (2022), which demonstrated that GAL can reduce the incidence of urinary retention in patients undergoing haemorrhoidectomy surgery. The analysis revealed that only 2.3% of patients in the GAL group experienced

urinary retention, whereas 19.3% of patients in the SA (spinal anaesthesia) group experienced this complication.

Spinal anaesthesia has been demonstrated to affect the release of hormones such as oxytocin and vasopressin, which play a role in the regulation of bladder function and have been shown to reduce the incidence of urinary retention (20). The effects of spinal anaesthesia on bladder function and urinary retention have significant clinical implications. Spinal anaesthesia is commonly employed in surgical procedures, and the risk of urinary retention is a significant concern. By elucidating the mechanism of action of spinal anaesthesia on bladder function, anaesthesiologists and surgeons can implement measures to minimise the risk of urinary retention and optimise bladder function in patients undergoing spinal anaesthesia (21).

5. The Relationship between the Length of Surgery with the Incidence of Post Anaesthesia Shivering and Urinary Retention

According to Table 4.5, the shivering category has a significance value of 0.799, which is higher than 0.05. This implies that the length of operation and the frequency of post-anesthesia shivering do not correlate in a statistically meaningful way. The correlation coefficient value obtained is 0.846, indicating a strong relationship between the variables in question. In the category of urinary retention, the value of 0.204 is greater than 0.05, indicating that there is no statistically significant relationship between the incidence of prolonged surgery and the incidence of urinary retention. The correlation coefficient value obtained is 0.530, indicating a moderate strength of relationship. As a result, either there is no correlation between the duration of operation and the incidence of post-anesthesia shivering (PAS) and urine retention, or the null hypothesis (H₀) is accepted. Moreover, the relationship is

moving in a constructive direction. In line with the results of the study by Dewi et al 2023, namely with the results of the statistical test, namely chi square, the p-value was obtained 0.863 more than the value of $\alpha = 0.05$, there was no significant relationship between the duration of surgery and postoperative urinary retention with an OR value of 1.115 (95% CI: 0.323-3.845) with insignificant results, because there are other factors that support the occurrence of urinary retention such as comorbidities and types of anesthesia.

Regarding the association between the duration of surgery and the occurrence of shivering in postoperative patients under spinal anesthesia, the Spearman test results showed a statistically significant value of 0.000 ($p < 0.05$), which is in contradiction to the findings of Nasrun & Azizah (2022). The findings indicate that the hypothesis regarding the correlation between the duration of surgery and the occurrence of shivering in post-spinal anesthesia patients at IBS RSU Aisyiyah Padang is accepted, as the significance value is less than 0.05.

In line with the research results by Tutik et al., (2022), it was found that there was a significant relationship between the length of surgery and the incidence of shivering in the Anesthesia Installation of Dr. Saiful Anwar Hospital with a p-value of $0.046 < (0.05)$

There are several explanations for the lack of association between duration of surgery and shivering under spinal anaesthesia:

a. Effect of Spinal Anaesthesia on the Central Nervous System

The administration of spinal anaesthesia has the potential to influence the central nervous system, thereby reducing the surgical stress response and consequently the incidence of shivering. The central nervous system, comprising the brain and spinal cord, plays a pivotal role in

regulating the surgical stress response. Spinal anaesthesia may reduce central nervous system activity, thereby reducing the surgical stress response and the risk of shivering (22). The reduction in central nervous system activity may be achieved by inhibiting nerve impulse transmission and reducing the release of neurotransmitters associated with surgical stress. This may result in a reduction in the surgical stress response and the risk of shivering. In addition, spinal anaesthesia may also reduce sympathetic nervous system activity, which is associated with the surgical stress response and shivering (22).

b. The Effect of Spinal Anaesthesia on Oxygen Consumption and Cardiac Workload

The administration of spinal anaesthesia has been demonstrated to reduce oxygen consumption and cardiac workload, which in turn mitigates the risk of shivering. It is well established that an increase in oxygen consumption and cardiac workload can elevate the risk of shivering, as these factors contribute to an elevated energy demand and a concomitant reduction in the body's ability to regulate temperature (23).

Spinal anaesthesia may reduce oxygen consumption and cardiac workload by inhibiting sympathetic nervous system activity and reducing the release of catecholamines, which are associated with the surgical stress response. Additionally, spinal anaesthesia may reduce oxygen consumption and cardiac workload by reducing muscle activity and reducing energy demand (24).

In conclusion, the absence of an association between the length of surgery and shivering under spinal anaesthesia can be explained by two possible explanations. Firstly, spinal anaesthesia may affect the central nervous system and reduce the

surgical stress response, thereby reducing the risk of shivering. Secondly, spinal anaesthesia may reduce oxygen consumption and cardiac workload, thereby reducing the risk of shivering.

CONCLUSIONS

In consideration of the findings and analysis of the research conducted at Aisyiyah Padang Hospital, the following conclusions can be drawn:

1. The respondents with the most significant representation across the age categories are those aged 26-45 years, comprising 17 individuals (56.7%).
2. The majority of respondents were female, comprising 18 individuals (60.0%).
3. In the category of length of surgery, namely more than 1-2 hours, 20 respondents (66.7%) were identified.
4. The category of shivering frequency revealed that the most prevalent response was a lack of shivering among 16 individuals (53.3%).
5. The majority of respondents (n=27, 90.0%) did not experience urine retention.
6. There is no statistically significant relationship between the length of surgery and the incidence of post-anaesthetic shivering (PAS) or urinary retention. However, the data suggests a positive correlation between the two variables.

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