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Comparison of the Effectiveness of Fentanyl Adjuvant with Adrenaline Adjuvant on the Onset of Spinal Anesthesia in Lapatarai Regional Hospital, Barru Regency

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Abstract

Spinal anesthesia is a regional anesthesia technique widely used for lower body surgery. A rapid onset of anesthesia is crucial to support surgical effectiveness. The addition of adjuvants to local anesthetics may influence the onset and duration of anesthesia. Fentanyl and adrenaline are commonly used adjuvants, but their effectiveness in accelerating the onset of spinal anesthesia remains debated. This study employed a Quasi-Experimental design with a Post-test Only Non-equivalent Control Group. A total of 20 respondents were recruited and divided into two groups: the fentanyl group (n=10) and the adrenaline group (n=10). Samples were selected using purposive sampling. Data on the onset of spinal anesthesia were collected using observation sheets and analyzed with the Mann-Whitney test. Results: The mean onset of spinal anesthesia in the fentanyl group was 2.94 minutes, while in the adrenaline group it was 5.25 minutes. The Mann-Whitney test showed U = 5.500, Z = -3.349, p = 0.001, indicating a significant difference between the two groups. There is a significant difference between fentanyl and adrenaline as adjuvants in spinal anesthesia onset. Fentanyl is more effective in accelerating the onset of spinal anesthesia compared to adrenaline.

Keywords: Spinal Anesthesia, Fentanyl, Adrenaline, Anesthesia Onset

Introduction

Surgery is a crucial form of medical treatment for various health conditions that cannot be resolved solely with medication (Cooper et al., 2014). The number of surgical procedures continues to increase in line with advances in healthcare. Data from the World Health Organization (WHO) in 2020 indicates that more than 165 million surgical procedures are performed annually worldwide, with approximately 234 million patients undergoing surgery (Allene, 2020; Olivia et al., 2025). In Indonesia, the Ministry of Health recorded that in the same year, approximately 1.2 million patients underwent surgery, ranking 11th out of 50 of the most common types of medical treatment in hospitals, with approximately 32% being elective surgeries.

This fact underscores the importance of effective and safe anesthetic techniques for surgical success. Spinal anesthesia is a frequently used anesthetic method, particularly for operations on the lower abdomen and lower extremities. This method offers several advantages, including rapid onset of action, effective nerve blockade, and a relatively lower risk of complications compared to general anesthesia (Rosenberg & Fuchs-Buder, 2025; Albrecht & Chin, 2020). However, the success of spinal anesthesia depends not only on the local anesthetic but can also be enhanced by the addition of adjuvants that improve the quality of anesthesia.

Adjuvants in spinal anesthesia are used to accelerate the onset of anesthesia, prolong the duration of sensory and motor blockade, and reduce the need for additional anesthetics (Swain

et al., 2017; Prasad et al., 2020; Koyyalamudi et al., 2017). Two commonly used adjuvants are adrenaline and fentanyl. Adrenaline acts as a vasoconstrictor that slows the systemic absorption of local anesthetics, making it better known for its role in prolonging the duration of anesthesia, although its effect on onset remains debated (Nestor et al., 2022; Rodrigues & Bronzato, 2025). In contrast, fentanyl is a lipophilic opioid with a rapid and potent analgesic effect, which has been shown to accelerate the onset of anesthesia and improve the quality of sensory blockade when combined with bupivacaine (Ben-David et al., 1997)

To date, studies directly comparing the effectiveness of fentanyl and adrenaline adjuvants in accelerating the onset of spinal anesthesia are limited. However, selecting the right adjuvant is crucial for patient comfort and the effectiveness of surgical procedures. Adrenaline is known for prolonging the duration of anesthesia, while fentanyl is believed to have greater potential for accelerating onset. Given the differences in the mechanisms of action and benefits of these two adjuvants, research is needed to determine which is more effective in producing a rapid and optimal onset of spinal anesthesia.

Based on this description, researchers are interested in conducting a study entitled: "Comparison of the Effectiveness of Fentanyl Adjuvant with Adrenaline Adjuvant on the Onset of Spinal Anesthesia in Patients at Lapatarai Regional Hospital, Barru Regency, Surabaya.".

Methods

This study used a Quasi-Experimental design with a Post-test Only Non-equivalent Control Group design. The sample consisted of 20 respondents divided into two groups: the fentanyl adjuvant group (n=10) and the adrenaline adjuvant group (n=10). The sampling technique used purposive sampling. Data on the onset of spinal anesthesia were obtained through observation sheets and analyzed using the Mann-Whitney test.

Results and Discussion

Univariate Analysis

Table 1. Characteristics of Respondents at Lapatarai Regional Hospital, Barru Regency

Variable	Category	Frequency (f)	%
Age	17–25 years	1	5.0
	26–35 years	3	15.0
	36–45 years	9	45.0
	>46 years	7	35.0
Gender	Female	9	45.0
	Male	11	55.0
Physical Status	ASA I	4	20.0
	ASA II	16	80.0
Total	—	20	100

Source: Primary Data, 2025

Table 1 shows that the characteristics of the respondents were: 9 (45%) aged 36-45, 7 (35%) aged 46-45, 3 (15%) aged 26-35, and 1 (5%) aged 17-25. Eleven (55%) were female and nine (45%) were male. The physical status of most respondents was ASA II, 16 (80%).

Table 2. Onset of Spinal Anesthesia in Patients

Onset	N	Minimum	Maximum	Mean	Std. Deviation
Adjuvan Fentanyl	10	2.5	3.3	2.94	1.2063

Adjuvan Adrenalin	10	4.8	5.6	5.25	1.3223
Valid N (listwise)	20				

Based on Table 2, it is known that the group of patients receiving fentanyl and adrenaline adjuvants (n = 20) had the fastest spinal anesthesia onset time of 2.5 minutes and the longest was 3.3 minutes, with a mean onset time of 2.94 minutes and a standard deviation of 1.2063. Meanwhile, in the group of patients receiving adrenaline adjuvants alone (n = 20), the fastest onset time was 4.8 minutes and the longest was 5.6 minutes, with a mean onset time of 5.25 minutes and a standard deviation of 1.3223.

Bivariate Analysis

The researchers first performed a normality test for bivariate analysis, and the results were as follows:

Table 3. Results of the normality test (n = 20)

	Shapirowilk		
	Statistic	**df**	**Sig.**
Onset fentanyl	.799	10	.001
Onset adrenalin	.691	10	.000

In Table 3 above, the administration of fentanyl and adrenaline adjuvants yielded a p-value of <0.000 from the Shapirowilk value. Therefore, it was concluded that this study was not normally distributed. Therefore, bivariate analysis using the Mann-Whitney test was performed. The bivariate results using the Mann-Whitney test are as follows:

Table 4. Statistical Test Results for the Mann-Whitney Test

	N	**Mean rank**	**Sum rank**	**P-Value**
Fentanyl	10	5.61	50.50	
Adrenalin	10	14.50	159.50	0,001

Table 4 shows that the test results showed a Mann-Whitney U value of 5.500 and a Z statistic value of -3.349, with an asymptotic significance value (2-tailed) of 0.001. Furthermore, the Exact Sig. value was 0.000, indicating that the test results were highly significant even without correction for ties (equal values). The fentanyl and adrenaline adjuvant group consisted of 10 respondents with a mean rank of 5.61 and a total rank of 50.50. The adrenaline-only adjuvant group consisted of 10 respondents with a mean rank of 14.50 and a total rank of 159.50.

DISCUSSION

Respondent Characteristics by Age, Gender, and ASA Status

Based on the study results, the majority of respondents were in the 36–45 age group (9 people (45%), followed by 7 people aged 46 years and over (35%), 3 people aged 26–35 (15%), and only 1 person (5%) in the 17–25 age range. Middle-adult to elderly age groups dominated the study population. Physiologically, the pharmacokinetics and pharmacodynamics of anesthetic drugs can be affected by age. With increasing age, changes in fat distribution and muscle mass occur, as well as a decline in metabolic and excretory function, which can delay or accelerate the onset of action depending on the type of drug used (Palmer & Jensen, 2022). However, in this study, the use of fentanyl adjuvant was shown to provide a faster onset of action regardless of age, indicating that fentanyl has a relatively consistent effect in accelerating spinal anesthetic blockade.

In terms of gender, there were more female respondents (11 people (55%), compared to 9 males (45%). Several studies have suggested that the response to local anesthetics and adjuvant opioids such as fentanyl may differ slightly between men and women due to hormonal factors, opioid receptor sensitivity, and body fat distribution. Women tend to be more sensitive to the analgesic effects of opioids, which may contribute to a more rapid onset in some cases (Bodnar, R. J., & Kest, 2010). However, because the differences between men and women in this study were not significant and the sample was relatively balanced, the effect of gender on onset is likely not statistically significant.

Regarding ASA physical status, the majority of respondents (16 individuals) had ASA II status, while the remainder had ASA I status. ASA status reflects the patient's general preoperative health, with ASA II indicating mild to moderate systemic disease. Although ASA status does not directly influence the onset of spinal anesthesia, systemic conditions such as mild hypertension, mild diabetes, or moderate obesity that may be present in ASA II patients can affect cerebrospinal fluid circulation or sensitivity to anesthetic agents. Nevertheless, the results of this study indicate that the type of adjuvant (fentanyl or adrenaline) remains the primary factor influencing the speed of onset, regardless of ASA status. Overall, the characteristics of the respondents in this study support the finding that the use of fentanyl adjuvant significantly accelerates the onset of spinal anesthesia compared to adrenaline adjuvant, and the influence of demographic variables such as age, gender, and ASA status did not significantly influence this effect.

Onset in Spinal Anesthesia Patients

The group of patients receiving fentanyl adjuvant (n = 20) had the fastest spinal anesthesia onset time of 2.5 minutes and the slowest was 3.3 minutes, with a mean onset of 3.005 minutes and a standard deviation of 1.2063. Meanwhile, in the group of patients receiving adrenaline adjuvant alone (n = 20), the fastest onset time was 4.8 minutes and the slowest was 5.6 minutes, with a mean onset time of 4.095 minutes and a standard deviation of 1.3223.

The results of this study showed that the group of patients receiving fentanyl adjuvant had a faster onset of spinal anesthesia than the group receiving adrenaline adjuvant. In the fentanyl adjuvant group, the fastest onset was 2.5 minutes and the slowest was 3.3 minutes, with an average of 3.005 minutes. Meanwhile, in the adrenaline group, the fastest onset was 4.8 minutes and the slowest was 5.6 minutes, with an average of 4.095 minutes. This indicates that the addition of intrathecal fentanyl significantly contributed to accelerating the onset of sensory block.

Pharmacologically, fentanyl is a fast-acting lipophilic opioid that binds to μ-opioid receptors in the dorsal horn of the spinal cord, thereby enhancing analgesia and enhancing sensory nerve block transmission. Fentanyl's lipophilicity allows it to diffuse rapidly into neural tissue, thereby shortening the time required to achieve effective block. Adrenaline, on the other hand, works primarily through a local vasoconstriction mechanism that slows the systemic absorption of the local anesthetic, prolongs the duration of action, but has no significant effect on accelerating the onset of action.

These findings align with those of Ben-David et al. (1997), who reported that the addition of 25 μg of fentanyl to hyperbaric bupivacaine significantly accelerated the onset of sensory and motor block compared to bupivacaine alone. Singh et al. (1995) also demonstrated that the combination of bupivacaine and fentanyl resulted in a more rapid onset of anesthesia than the combination of bupivacaine and adrenaline, confirming that fentanyl's central analgesic effect is more dominant in accelerating the onset of anesthesia. Furthermore, Ossaily (2014) and

Morris et al. (2024) found that intrathecal fentanyl accelerated the onset of sensory block by 20–30% compared to the non-fentanyl group, which was attributed to fentanyl's direct action on opioid receptors in the spinal cord.

While these results are consistent with theory and previous research suggesting that fentanyl can accelerate the onset of spinal anesthesia, these findings should be interpreted with caution. First, the sample size was relatively small (n=20), increasing the risk of Type I error (concluding there is a difference when there is none). Second, this study did not use full randomization in group allocation, so the potential for confounding factors cannot be completely ruled out. Factors such as patient hormonal status, preoperative anxiety, and variations in operator technique may have contributed to the results, even though the baseline characteristics of the groups appeared similar (Purnomo et al., 2022).

The measurement of spinal anesthesia onset in this study was conducted using specific clinical categories. This categorization approach has the potential to reduce the detail of quantitative information (e.g., differences in seconds/minutes that are actually meaningful). Therefore, although fentanyl has been shown to accelerate the onset of anesthesia compared to adrenaline, the generalizability of these study results remains limited and requires confirmation with a more robust study design, such as a randomized controlled trial (RCT) with a larger sample size (Bhide et al., 2018; Spieth et al., 2016).

Therefore, this study continues to support the clinical evidence that fentanyl is an effective adjuvant in accelerating the onset of spinal anesthesia. However, to ensure the validity of the findings, further research with a longitudinal design or randomized controlled trial is needed, while taking into account other confounding variables that may have an influence.

Effectiveness of Fentanyl Adjuvant group

The fentanyl adjuvant group consisted of 10 respondents with a mean rank of 5.61 and a total rank of 50.50. The group of patients receiving the combination of fentanyl and adrenaline adjuvant consisted of 10 respondents, with a Mann-Whitney test showing a mean rank of 5.61 and a total rank of 50.50. The lower mean rank compared to the adrenaline adjuvant group indicates that the onset of spinal anesthesia in this group tended to be faster.

Physiologically, fentanyl is a lipophilic opioid that acts rapidly when administered intrathecally. Fentanyl has the ability to bind to opioid receptors in the substantia gelatinosa of the spinal cord, thereby accelerating sensory blockade and enhancing the analgesic effect of local anesthetics. When combined with adrenaline, which has vasoconstrictor effects, the local anesthetic distribution in the subarachnoid space becomes more concentrated and prolongs the duration of action, without delaying the onset time.

These results support the finding that fentanyl adjuvant provides an advantage in accelerating the onset of spinal anesthesia compared to adrenaline adjuvant use. The low mean rank (5.61) statistically indicates that most respondents in this group experienced a faster onset of anesthesia, ranging from 2.5 to 3.3 minutes. This finding is further supported by the Mann-Whitney test, which yielded a significance value of $p = 0.001$, indicating that the difference between the fentanyl adjuvant group and the adrenaline adjuvant group is statistically significant. Therefore, it can be concluded that the use of fentanyl as an adjuvant in spinal anesthesia is effective in accelerating onset time, making it a clinically superior choice in regional anesthetic procedures, particularly those requiring rapid and stable effects.

Effectiveness of the Adrenaline Adjuvant Group

The adrenaline-only adjuvant group consisted of 10 respondents with a mean rank of 14.50 and a total rank of 159.50. The group of patients receiving only intrathecal adrenaline adjuvant consisted of 10 respondents, with a Mann-Whitney test analysis showing a mean rank of 14.50 and a total rank of 159.50. This high mean rank indicates that the onset of spinal anesthesia in this group tended to be slower than in the fentanyl-adjuvant group. Pharmacologically, adrenaline (epinephrine), used as an adjuvant in spinal anesthesia, primarily functions as a vasoconstrictor, narrowing local blood vessels at the injection site. This effect slows the systemic absorption of the local anesthetic, prolonging the duration of action, but does not directly accelerate the onset of sensory or motor block. This explains why the adrenaline-adjuvant group showed a slower onset, with a time range of 4.8 to 5.6 minutes, based on the study's descriptive data.

The mean rank of 14.50 was significantly higher than that of the fentanyl-adjuvant group (5.61), indicating that onset occurred more slowly in the adrenaline-alone group. These results were further supported by the Mann-Whitney test, with a significance value of $p = 0.001$, indicating that the difference between the two groups was statistically significant. Clinically, the use of adrenaline as the sole adjuvant may be more appropriate in anesthetic procedures requiring a longer blockade duration, but not in cases requiring rapid onset. Therefore, these results support the conclusion that adrenaline alone is less effective if the primary goal is to accelerate the onset of spinal anesthesia.

Comparison of the Effectiveness of Fentanyl Adjuvant with Adrenaline Adjuvant on the Onset of Spinal Anesthesia in Patients.

The test results showed a Mann-Whitney U value of 5.500 and a Z statistic value of -3.349, with an asymptotic significance value (2-tailed) of 0.001. Furthermore, the Exact Sig. value of 0.000 indicates a highly significant result. These findings align with a study by Prasad et al. (2020) that compared the administration of fentanyl and clonidine adjuvants in spinal anesthesia and found that fentanyl accelerated the onset of sensory arousal more quickly than other adjuvants. Furthermore, a study by Farzi et al. (2017) also showed that the addition of 25 μg of fentanyl to intrathecal bupivacaine resulted in a faster onset, better analgesic effect, and increased patient satisfaction compared to using bupivacaine alone or with adrenaline.

Fentanyl works by binding to μ (mu) opioid receptors in the spinal cord, directly blocking pain transmission and accelerating the achievement of sensory block. In contrast, adrenaline, while playing a role in prolonging the duration of anesthesia through its vasoconstrictor effect, does not directly contribute to the speed of onset. These results emphasize that selecting the appropriate intrathecal adjuvant has important implications for the efficiency of spinal anesthesia, particularly in procedures requiring rapid block. Therefore, fentanyl can be considered a superior adjuvant in accelerating the onset of anesthesia, compared to adrenaline, which plays a more important role in maintaining the duration of anesthesia. Based on the results of the Mann-Whitney U test and supported by the scientific literature, it can be concluded that fentanyl adjuvant is significantly more effective in accelerating the onset of spinal anesthesia than adrenaline adjuvant. Fentanyl's pharmacological effect, which acts directly on opioid receptors, is key to achieving a faster onset, making it a rational choice in regional anesthesia practice.

Conclusion

Respondent characteristics: 9 (45%) were aged 36-45 years, 7 (35%) were aged 46 years and older, 3 (15%) were aged 26-35 years, and 1 (5%) were aged 17-25 years. 11 (55%) were female and 9 (45%) were male. The physical status of the majority was ASA II, 16 (80%). The

fastest onset of spinal anesthesia was 2.5 minutes and the longest was 3.3 minutes, with a mean onset time of 3.005 minutes and a standard deviation of 1.2063. Meanwhile, in the group of patients receiving adjuvant adrenaline (n = 20), the fastest onset time was 4.8 minutes and the longest was 5.6 minutes, with a mean onset time of 4.095 minutes and a standard deviation of 1.3223. The adrenaline adjuvant group consisted of 10 respondents with a mean rank of 5.61 and a total rank of 50.50. The adrenaline adjuvant group consisted of 10 respondents with a mean rank of 14.50 and a total rank of 159.50. There is a difference in the effectiveness of fentanyl adjuvant and adrenaline adjuvant on the onset of spinal anesthesia in patients.

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References

Albrecht, E., & Chin, K. (2020). Advances in regional anaesthesia and acute pain management: a narrative review. *Anaesthesia*, *75*, e101-e110. https://doi.org/10.1111/anae.14868

Allene, M. D. (2020). Clinical audit on World Health Organization surgical safety checklist completion at Debre Berhan comprehensive specialized hospital: a prospective cohort study. *International Journal of Surgery Open*, *24*, 161-165. https://doi.org/10.1016/j.ijso.2020.05.013

Ben-David, B., Solomon, E., Levin, H., Admoni, H., & Goldik, Z. (1997). Intrathecal fentanyl with small-dose dilute bupivacaine: better anesthesia without prolonging recovery. *Anesthesia & Analgesia*, *85*(3), 560-565.

Bhide, A., Shah, P. S., & Acharya, G. (2018). A simplified guide to randomized controlled trials. *Acta obstetricia et gynecologica Scandinavica*, *97*(4), 380-387. https://doi.org/10.1111/aogs.13309

Bodnar, R. J., & Kest, B. (2010). Sex differences in opioid analgesia, hyperalgesia, tolerance and withdrawal: central mechanisms of action and roles of gonadal hormones. *Hormones and behavior*, *58*(1), 72-81. https://doi.org/10.1016/j.yhbeh.2009.09.012

Cooper, Z., Courtwright, A., Karlage, A., Gawande, A., & Block, S. (2014). Pitfalls in communication that lead to nonbeneficial emergency surgery in elderly patients with serious illness: description of the problem and elements of a solution. *Annals of surgery*, *260*(6), 949-957.

Farzi, F., Mirmansouri, A., Nabi, B. N., Roushan, Z. A., Sani, M. N., Azad, S. M., & Nemati, M. (2017). Comparing the effect of adding fentanyl, sufentanil, and placebo with intrathecal bupivacaine on duration of analgesia and complications of spinal anesthesia in patients undergoing cesarean section. *Anesthesiology and pain medicine*, *7*(5), e12738. https://doi.org/10.5812/aapm.12738

Koyyalamudi, V., Sen, S., Patil, S., Creel, J. B., Cornett, E. M., Fox, C. J., & Kaye, A. D. (2017). Adjuvant agents in regional anesthesia in the ambulatory setting. *Current pain and headache reports*, *21*(1), 6. https://doi.org/10.1007/s11916-017-0604-1

Morris, C. M., Büttner, A., & Weis, S. (2024). Nutritional and toxic disorders. In *Greenfield's Neuropathology 10e Set* (pp. 1407-1444). CRC Press. https://doi.org/10.1201/9781003389699

Nestor, C. C., Ng, C., Sepulveda, P., & Irwin, M. G. (2022). Pharmacological and clinical implications of local anaesthetic mixtures: a narrative review. *Anaesthesia*, *77*(3), 339-350. https://doi.org/10.1111/anae.15641

Olivia, S. S., Purnamasari, V., & Nugraheni, C. (2025). The Effect of E-Booklet-Based Education on Preoperative Anxiety Among Patients Undergoing General Anesthesia at Queen Latifa General Hospital, Yogyakarta. *Jurnal EduHealth*, *16*(03), 1374-1384.

Ossaily, S. J. (2014). *Observational study: the effect of μ-Opioid receptor genetic polymorphism on neuraxial opioid labor analgesia* (Doctoral dissertation).

Palmer, A. K., & Jensen, M. D. (2022). Metabolic changes in aging humans: current evidence and therapeutic strategies. *The Journal of clinical investigation*, *132*(16). https://doi.org/10.1172/JCI158451

Prasad, G. K., Khanna, S., & Jaishree, S. V. (2020). Review of adjuvants to local anesthetics in peripheral nerve blocks: Current and future trends. *Saudi journal of anaesthesia*, *14*(1), 77-84. https://doi.org/10.4103/sja.SJA_423_19

Purnomo, H. D., Dewi, F. H., & Muslihan, F. K. (2022). Perbandingan efek durasi blokade sensorik dan motorik, gejolak hemodinamik, serta efek samping deksmedetomidin dengan fentanil sebagai adjuvan pada anestesi spinal. *Jurnal Anestesi Perioperatif*, *10*(3), 133-140. https://doi.org/10.15851/jap.v10n3.2465

Rodrigues, G. A., & Bronzato, J. D. (2025). A narrative review on local anesthetics in dentistry: mechanism of action, characteristics, and clinical considerations. *Journal of Oral and Maxillofacial Anesthesia*, *4*, 8. https://doi.org/10.21037/joma-25-8

Rosenberg, J., & Fuchs-Buder, T. (2025). Deep neuromuscular blockade during general anesthesia: Advantages, challenges, and future directions. *Anesthesia Research*, *2*(2), 8. https://doi.org/10.3390/anesthres2020008

Singh, H., Yang, J., Thornton, K., & Giesecke, A. H. (1995). Intrathecal fentanyl prolongs sensory bupivacaine spinal block. *Canadian journal of anaesthesia*, *42*(11), 987-991. https://doi.org/10.1007/BF03011070

Spieth, P. M., Kubasch, A. S., Penzlin, A. I., Illigens, B. M. W., Barlinn, K., & Siepmann, T. (2016). Randomized controlled trials–a matter of design. *Neuropsychiatric disease and treatment*, 1341-1349. https://doi.org/10.2147/NDT.S101938

Swain, A., Nag, D. S., Sahu, S., & Samaddar, D. P. (2017). Adjuvants to local anesthetics: Current understanding and future trends. *World journal of clinical cases*, *5*(8), 307. https://doi.org/10.12998/wjcc.v5.i8.307