Effect of Intrathecal Dexamethasone on Intra-operative Hemodynamics in Elderly Patients Undergoing Urologic Endoscopic Surgery

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Abstract

Background:
An adjuvant of local anesthetics (LA) with spinal anesthesia (SA) increases the SA length.

Aim:
This study investigates the impact of intrathecal addition of dexamethasone to bupivacaine on improving post-spinal anesthesia hypotension (PSAH) in elderly patients.

Primary Outcomes
Amount of fluids and vasoactive drugs needed to maintain blood pressure.

Secondary Outcomes
1. Demographic data, including duration of anesthesia, duration of surgery, gender, age, BMI, chronic medical disease, and ASA.
2. Blood pressure: systolic and diastolic blood pressure and mean arterial blood pressure.
3. Postoperative VAS score of pain assessment.
4. Postoperative shivering.
5. Postoperative nausea and vomiting.
6. Post-dural puncture headache (PDPH).

Patients and Methods:
90 patients were scheduled for endoscopic bloodless urologic surgeries under SA, including cystoscopic and ureteroscopic surgeries. They were divided into 2 groups; 1st group (A) included 45 patients who received 8mg (2ml) dexamethasone in addition to 3ml bupivacaine 0.5% intrathecally, and 2nd group (B) included 45 patients who received only 3ml 0.5% bupivacaine intrathecally as a control group.

Results:
The dexamethasone group was significantly higher in mean, systolic, and diastolic blood pressure readings. The dexamethasone group received significantly lower ephedrine dose and intravenous fluids. The two groups had no significant differences in postoperative nausea and vomiting, but the postoperative pain score was significantly better.

Conclusion:
Using dexamethasone in combination with bupivacaine in patients who underwent SA would decrease the amounts of IV fluids and doses of vasopressors to maintain blood pressure. Further research is needed to confirm such findings.

Keywords:
Dexamethasone, spinal anesthesia, shivering, post-spinal anesthesia hypotension.

Introduction

Spinal anesthesia often leads to post-spinal anesthesia hypotension (PSAH), one of the most common consequences. However, treating it in elderly patients presents a difficult task. This is because fluids and vasopressors are the standard of care. Vasopressors will increase the afterload on the heart, and fluids may impair the compensated diseased heart. These could make geriatric people more likely to experience hypervolemia and cardiac ischemia **[1]**.

Dexamethasone is an emerging drug that has a solution for this problem, which may be due to its ability to retain salt and water. In this study, we studied the effect of adding dexamethasone to bupivacaine intrathecally to improve the PSAH in elderly patients.

Patients and Methods

Study Setting: Assiut University Hospital, the operating room.

Study Design: This randomized, prospective trial between 1/3/2022 and 31/9/2022.

Participants

The study was done on 90 patients who had endoscopic urologic intervention.

Patients signed informed consent:

Written consent was obtained from patients who participated in the study before the procedure after explaining the nature of the research and their right to refuse to participate or withdraw without any rationale. The patient was assured that this research data would not be reused without second permission.

Assiut Faculty of Medicine approved the study: **(**IRB no.: 17200208)

Exclusion criteria

Patients with indeterminate neurological disease, infection at the site of injection, uncorrected hypovolemia, thrombocytopenia, allergy to local anesthetic agents, and those on steroids or serotonin-related medications were excluded.

Sample size calculation and randomization.

A total of 38 patients per group were required with 80% power and 5 % probability of Type I error based on a previous study **[2]**. We included 45 patients in each group. Simple randomization with a 1:1 ratio was done. The patient was allocated to:

1- 1st group (A) included 45 patients who received 8mg (2ml) dexamethasone and 3ml bupivacaine 0.5% intrathecally, each in a separate syringe after excluding air.

2- 2nd group (B) included 45 patients who received only 3ml 0.5% bupivacaine intrathecally as a control group.

Procedure:

The patients were scheduled for endoscopic urologic surgeries, including cystoscopies and ureteroscopies. Assessment of Socio-demographic and medical data such as patient age, gender, BMI, history, and present illness. After a thorough evaluation of the patients and recording baseline data. The patient wore a compression stocking before the operation as a prophylaxis against DVT. A wide pore cannula was inserted.

The patients in group (A) were then administered 15mg (3 ml) of 0.5% bupivacaine hydrochloride and 8 mg (2 ml) of dexamethasone.

The patients in group (B) were then administered 15 mg (3ml) of 0.5% bupivacaine hydrochloride.

Hemodynamics was recorded every 5 minutes till 30 minutes, then every 30 minutes till the end of anesthesia.

Duration of anesthesia was recorded after confirmation of sensory and motor levels until recovery from anesthesia was recorded.

The amount of crystalloid fluids needed to be infused to maintain perfusion after 20 ml/kg loading fluids was assessed by sonographic IVC collapsibility (to maintain IVC diameter> 15 mm and ratio of end-systolic to end-diastolic to be maintained less than 50%. The total dose of ephedrine was assessed as the total dose used to maintain the mean arterial blood pressure of more than 65 mmHg.

Statistical Analysis:

Data was collected and analyzed using SPSS (Statistical Package for the Social Science, version 26, IBM, and Armonk, New York). Continuous data was expressed as mean ± SD, while nominal data was expressed as frequency (percentage).

The *Chi²*-test was used to compare the nominal data of the studied groups. Continuous variables of both groups were compared using the Student's t-test. The confidence level was 95%, and the *P* value was significant if <0.05.

Results:

Characteristics of patients (table 1):

No significant difference was found between both arms of the study ($p > 0.05$).

Peri-operative assessment of diastolic blood pressure in studied groups (table 2, figure 1):

In intraoperative and postoperative assessment, mean DBP was significantly higher among the study group.

Peri-operative assessment of systolic blood pressure in studied groups (table 3, figure 2):

In intraoperative and postoperative assessment, mean SBP was significantly higher among the study group.

Peri-operative assessment of mean arterial pressure in studied groups (table 4, figure 3):

In intraoperative and postoperative assessment, mean MAP was significantly higher among the study group.

Intraoperative ephedrine and fluids among the studied groups (table 5):

Total ephedrine dose and number of intraoperative fluids were significantly lower among the study group ($\boldsymbol{P} < 0.001$, $\boldsymbol{P} < 0.014$), respectively.

Postoperative data among the studied groups (table 6):

The dexamethasone group had a significantly better visual analog score (VAS) (2.56 ± 1.82 versus 7.56 ± 2.39, *P* value=0.042). Two patients in each group had bradycardia. The control group reported more frequent shivering (66.7% vs. 26.7%; $p = 0.007$).

Discussion

In the current study, the dexamethasone group had significantly higher DBP, SBP, and MAP readings. In agreement with our study, a previous study included 110 patients who underwent different orthopedic operations. Those patients were subdivided into two groups: the study group, which received a single preoperative intravenous dose of dexamethasone, and the control group, which received a placebo. The authors reported no significant differences between groups regarding heart rate, but DBP, SBP, and MAP were significantly higher among the study group**[1][3]**. Also, the current study's control group had a higher intraoperative ephedrine dose. Previous study was consistent with this finding **[1]**.

Postoperatively, the dexamethasone group had a significantly better visual analog score (VAS), and many studies were in line with our data **[4-7]**.

Additionally, a prior study evaluated the average duration of analgesia for elective cesarean sections using intrathecal bupivacaine alone against intrathecal bupivacaine plus dexamethasone. The results were consistent with the current findings. The authors came to the statistically significant conclusion that the combination of dexamethasone and hyperbaric bupivacaine resulted in 391.25 minutes of analgesia as opposed to 179.43 minutes for hyperbaric bupivacaine alone **[8]**.

We stated that PONV was lower in the study group. Bani-Hashem et al. found no difference between the two groups for other problems such as bradycardia, nausea, or vomiting **[9]**.

Also, ***Moeen et al.*** found that both dexamethasone and control groups had insignificant differences as regards postoperative hypotension, bradycardia, nausea, and vomiting **[10]**. In contrast, ***Esmat et al.*** found that hypotension, nausea, and vomiting were significantly lower among the dexamethasone group in comparison to the control group. This difference in our findings may be attributed

to different enrolled patients and methods of dexamethasone delivery **[11]**.

We noticed more frequent shivering in the control group. In accordance, a previous study proved that the dexamethasone group had a decreased frequency of shivering among patients who underwent transurethral resection of the prostate (6.7% vs. 43.3%; $p< 0.001$) **[10]**.

Also, ***Kaur et al.*** noticed that none of the dexamethasone group had shivering**[12]**. Also, previous studies stated that dexamethasone effectively reduces the shivering threshold in patients who had surgeries under spinal anesthesia compared to the control group **[10, 11, 13, 14]**.

This work is limited with specific considerations: 1) being conducted in a single center, 2) included only one group of patients who underwent urological endoscopic surgery, and 3) we didn't recruit another group that received IV dexamethasone to compare between different delivery methods. And yet, the main strength of the current study is that it is a randomized controlled trial that allows us to avoid selection bias.

Conclusion: The dexamethasone group was significantly higher in Mean, systolic, and diastolic blood pressure readings. The dexamethasone group received significantly lower ephedrine dose and intravenous fluids. There were no significant differences between the two groups in PONV, but it was significantly better regarding postoperative VAS.

The current study favors the use of Dexamethasone in combination with bupivacaine to avoid using large amounts of IV fluids and/or high doses of vasopressors to maintain BP. Further research is needed to confirm our findings.

Legend of Tables

Table (1): Baseline data of the studied groups

	Study group (n= 45)	**Control group (n= 45)**	***P* value**
Age (years)	63.8 ± 5	63.6 ± 4.3	0.58
Gender			
Male	29 (64.4%)	26 (57.8%)	
Female	16 (35.6%)	19 (42.2%)	0.29
BMI (kg/m^2)	27.35 ± 3.95	26.70 ± 4.34	0.13
ASA class			
Class-I	24 (53%)	25(55%)	
Class-II	18 (40%)	17 (38%)	0.001
Class-III	3 (7%)	3(7%)	
Diabetes mellitus	29 (64.4%)	25 (55.6%)	0.25
Hypertension	27 (60%)	33 (73.3%)	0.13
IHD	15 (33.3%)	20 (44.4%)	0.19
Duration of surgery (min)	51.8 ± 25	54.8 ± 27	0.29
Duration of anesthesia (min)	214 ± 46	198 ± 42	0.02

Data expressed as frequency (percentage), mean (SD), and median (range). *P* value was significant if < 0.05. **BMI**: body mass index; **ASA**: American Society of Anesthesiologists; **IHD**: ischemic heart disease

Table (2): Diastolic blood pressure assessment at different times of assessment

Time of assessment	Study group (n= 45)	Control group (n= 45)	*P* value
Pre-induction	77.33 ± 11.27	80.04 ± 11.03	0.252
Intraoperative			
At 5 minutes	70.09 ± 9.60	68.02 ± 10.16	0.324
At 10 minutes	66.93 ± 8.56	63.24 ± 9.29	0.053
At 15 minutes	65.18 ± 10.10	60.16 ± 8.21	0.011*
At 20 minutes	65.09 ± 10.78	59.11 ± 8.64	0.005*
At 25 minutes	67.51 ± 10.45	59.89 ± 11.68	0.002**
At 30 minutes	69.24 ± 12.43	63.14 ± 14.52	0.037*
At 45 minutes	69.67 ± 8.08	64.75 ± 11.69	0.044*
At 60 minutes	71.11 ± 8.64	61.38 ± 10.34	0.001**
Postoperative			
After 60 minutes	73.54 ± 7.68	67.84 ± 7.90	0.001**
After 120 minutes	75.85 ± 9.74	68.89 ± 6.52	0.000**

Data expressed as mean (±SD). **P* value was significant if < 0.05.

Table (3): Systolic blood pressure assessment at different times of assessment

Time of assessment	Study group (n= 45)	Control group (n= 45)	*P* value
Pre-induction	131.47 ± 18.02	132.82 ± 20.01	0.736
Intraoperative			
At 5 minutes	122.53 ± 20.88	116.31 ± 18.23	0.163
At 10 minutes	117.93 ± 19.03	107.40 ± 14.83	0.004**
At 15 minutes	115.31 ± 15.99	104.11 ± 14.54	0.001**
At 20 minutes	114.93 ± 14.26	102.67 ± 13.33	0.000**
At 25 minutes	117.07 ± 13.19	103.27 ± 13.36	0.000**
At 30 minutes	118.16 ± 14.16	106.93 ± 14.94	0.001**
At 45 minutes	121.58 ± 10.94	108.54 ± 11.74	0.000**
At 60 minutes	123.87 ± 15.30	108.19 ± 13.22	0.001**
Postoperative			
After 60 minutes	124.33 ± 10.48	113.34 ± 10.22	0.000**
After 120 minutes	124.33 ± 11.36	115.59 ± 10.91	0.001**

Data expressed as mean (±SD). **P* value was significant if < 0.05.

Table (4): Mean arterial pressure assessment at different times of assessment

Time of assessment	Study group (n= 45)	Control group (n= 45)	*P* value
Pre-induction	95.96 ± 12.93	98.42 ± 13.45	0.37
Intraoperative			
At 5 minutes	87.67 ± 12.23	85.73 ± 12.69	0.45
At 10 minutes	83.84 ± 10.80	78.22 ± 10.89	0.016*
At 15 minutes	81.76 ± 10.95	75.27 ± 10.89	0.006**
At 20 minutes	81.51 ± 10.47	74.04 ± 9.50	0.001**
At 25 minutes	83.84 ± 10.38	74.89 ± 10.75	0.000**
At 30 minutes	85.07 ± 11.93	77.02 ± 13.60	0.004**
At 45 minutes	86.87 ± 8.82	79.96 ± 11.62	0.007*
At 60 minutes	87.53 ± 9.96	76.31 ± 11.94	0.001**
Postoperative			
After 60 minutes	90.15 ± 8.89	82.86 ± 7.88	0.000**
After 120 minutes	90.21 ± 9.39	83.75 ± 6.92	0.001**

Data expressed as mean (±SD). **P* value was significant if < 0.05.

Table (5): Intraoperative ephedrine and fluids among the studied groups

	Study group (n= 45)	Control group (n= 45)	*P* value
Intraoperative fluid (ml)	1000 ± 250	1200 ± 300	0.014*
Ephedrine dose (mg)	1mg ± 2.29	4.5 mg ± 5.5	< 0.001**

Data expressed as median (range). **P* value was significant if < 0.05.

Table (6): Postoperative data among the studied groups

	Study group (n= 45)	Control group (n= 45)	*P* value
VAS	2.56 ± 1.82	7.56 ± 2.39	0.042*
PONV	13 (28.9%)	18 (40%)	0.82
Bradycardia	2 (4.4%)	2 (4.4%)	0.69
Shivering	12(26.7%)	30 (66.7%)	**0.007***

Data expressed as mean (±SD). **P* value was significant if < 0.05.
VAS: visual analogue score; **PONV**: postoperative nausea and vomiting

Legend of Figures:

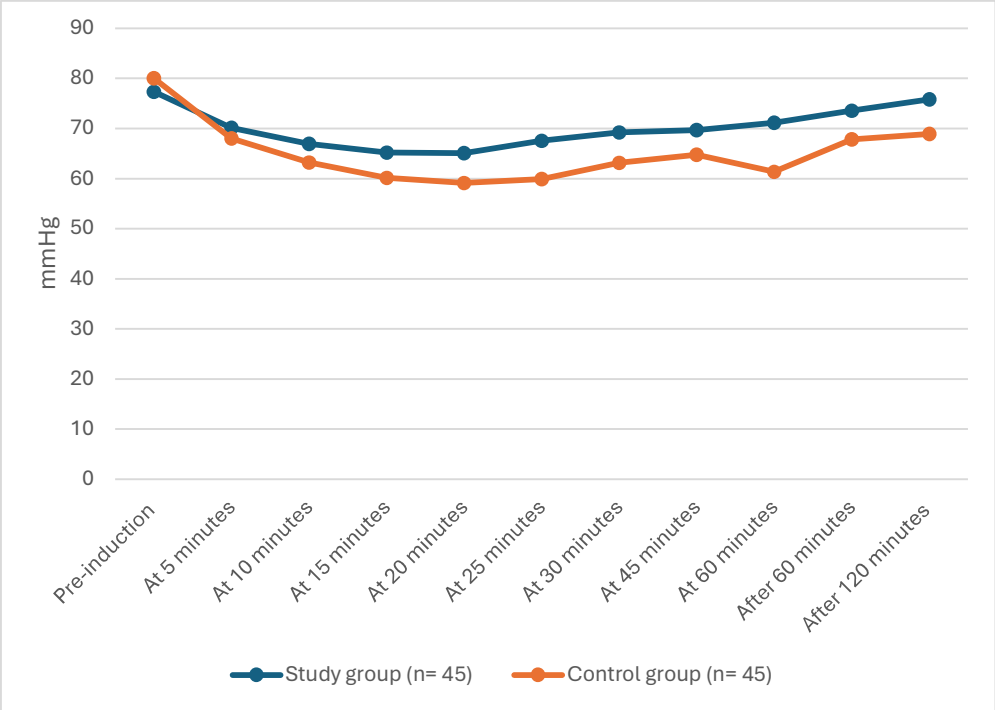

Figure (1): Diastolic blood pressure assessment at different times of assessment

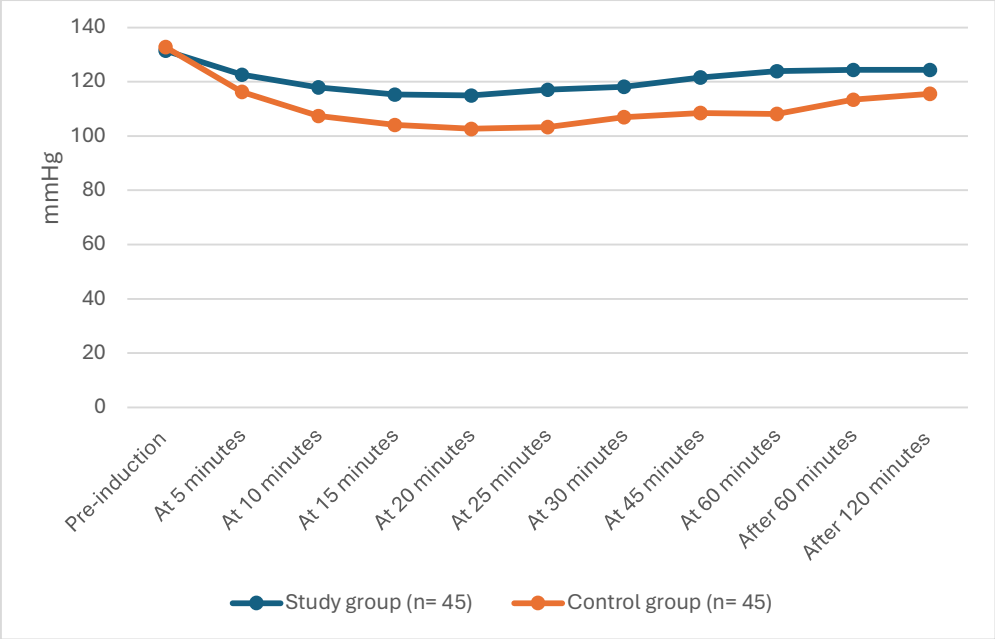

Figure (2): Systolic blood pressure assessment at different times of assessment

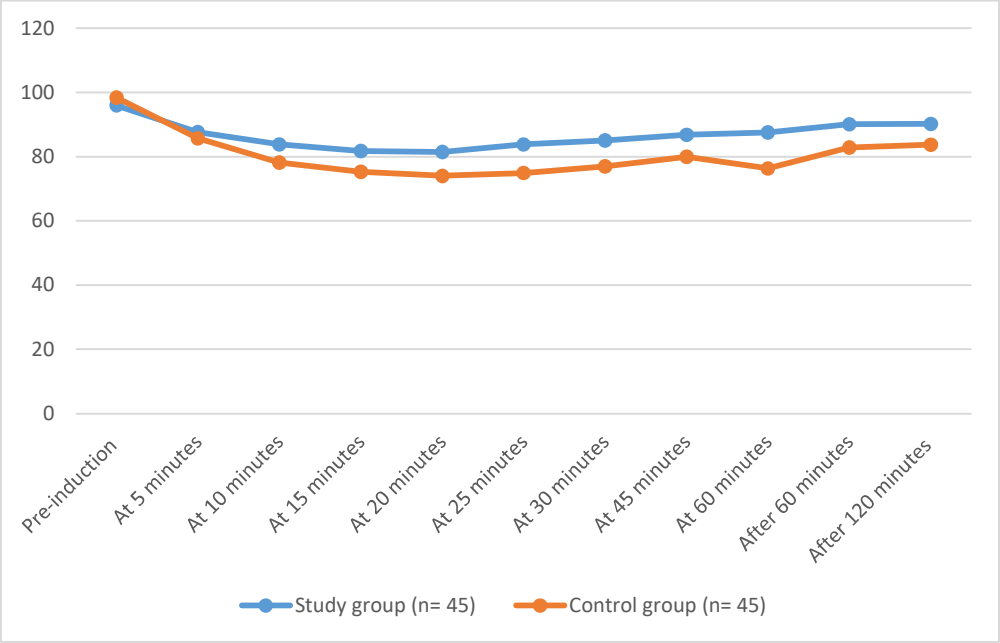

Figure (3): Mean arterial pressure assessment at different times of assessment

References

1. Ashoor, T.M., N.S. Hussien, S.G. Anis, I.M. Esmat, *Dexamethasone blunts postspinal hypotension in geriatric patients undergoing orthopedic surgery: a double blind, placebo-controlled study.* BMC Anesthesiol, 2021. **21**(1): p. 11.
2. Ashoor, T.M., N.S. Hussien, S.G. Anis, I.M. *Esmat*, *Dexamethasone blunts postspinal hypotension in geriatric patients undergoing orthopedic surgery: a* double *blind, placebo-controlled study.* BMC anesthesiology, 2021. **21**(1): p. 1-9.
3. Griffiths, R., F. Beech, A. Brown, J. Dhesi, I. Foo, J. *Goodall*, et al., *Peri-operative care of* the *elderly 2014: Association of Anaesthetists of Great Britain and Ireland.* Anaesthesia, 2014. **69**: p. 81-98.
4. Glasser, R.S., R.S. Knego, J.B. Delashaw, R.G. Fessler, *The peri-operative use of corticosteroids and bupivacaine in the management of lumbar disc disease.* Journal of neurosurgery, 1993. **78**(3): p. 383-387.
5. Aljabi, Y., A. El-Shawarby, D.T. Cawley, T. Aherne, *Effect of epidural* methylprednisolone *on postoperative pain and length of hospital stay in patients undergoing lumbar microdiscectomy.* The Surgeon, 2015. **13**(5): p. 245-249.
6. Drager, C., D. Benziger, F. Gao, C.B. Berde, *Prolonged intercostal nerve* blockade *in sheep using controlled-release of bupivacaine and dexamethasone from polymer microspheres.* The Journal of the American Society of Anesthesiologists, 1998. **89**(4): p. 969-979.
7. Hussain, N., T. Van den Langenbergh, C. Sermer, M.L. Fontes, A. Atrey, N. Shaparin, et al., *Equivalent analgesic effectiveness between perineural and intravenous dexamethasone as adjuvants for peripheral nerve blockade: a* systematic *review and meta-analysis.* Canadian Journal of Anesthesia/Journal canadien d'anesthésie, 2018. **65**(2): p. 194-206.
8. Fayyaz, M.A., A.A. Khan, R.L. Ali, Comparison *between Effect of Bupivacaine and Bupivacaine With Dexamethasone on Duration of* Analgesia *in Spinal Anaesthesia for Elective Caesarean Section.* PAKISTAN JOURNAL OF MEDICAL & HEALTH SCIENCES, *2015*. **9**(3): p. 979-982.
9. Bani-Hashem, N., B. Hassan-Nasab, E.A. Pour, P.A. *Maleh*, A. Nabavi, A. Jabbari, *Addition of intrathecal Dexamethasone to* Bupivacaine *for spinal anesthesia in orthopedic surgery.* Saudi J Anaesth, 2011. **5**(4): p. 382-6.
10. Moeen, S.M.,A.M. Moeen, *Intrathecal dexamethasone vs. meperidine for prevention of shivering during transurethral prostatectomy: a randomized controlled trial.* Acta Anaesthesiol Scand, 2017. **61**(7): p. 749-757.
11. Esmat, I.M., A.M. Elsayed, H.M. El-Hariri, T.M. Ashoor, *A Randomized Controlled Trial for Prevention of Postspinal Anesthesia Shivering in* Gynecological *Surgeries: Mirtazapine vs. Dexamethasone.* Anesthesiology Research and Practice, 2022. **2022**: p. 5061803.
12. Kaur, H., R. Misra, S. Mittal, G.A.S. Sidhu, *Prospective Randomized Control Trial Comparing Effect of* Dexamethasone *Versus Fentanyl as Adjuvants to Intrathecal Bupivacaine for* Orthopedic *Surgery.* Cureus, 2021. **13**(3): p. e13949.

13. Yared, J.-P., N.J. Starr, L. Hoffman-Hogg, C.A. *Bashour*, S.R. Insler, M. O'Connor, et al., *Dexamethasone Decreases the Incidence of Shivering After Cardiac Surgery: A Randomized, Double-Blind, Placebo-Controlled Study*. Anesthesia & Analgesia, 1998. **87**(4): p. 795-799.

14. Murphy, G.S., J.W. Szokol, S.B. Greenberg, M.J. Avram, J.S. Vender, M. Nisman, et al., *Preoperative dexamethasone enhances quality of recovery after laparoscopic cholecystectomy: effect on in-hospital and postdischarge recovery outcomes.* Anesthesiology, 2011. **114**(4): p. 882-90.