Current Clinical and Medical Education

Current Clinical and Medical Education
Curr Clin Med Educ 1 (1), 1–6 (2023)
Received 12 Sep 2023 | **Revised** 24 Nov 2023 | **Accepted** 20 Dec 2023 | **Online Available** 30 Dec 2023

Anna Medical College

OPEN ACCESS

ISSN (O) 3023-3593 | (P) 3023-3585

ORIGINAL RESEARCH ARTICLE

Hemodynamic and Surgical Outcomes of Perioperative Vasopressin Administration in Laparoscopic Myomectomy Patients

Kenji Takahashi[1]*

Abstract

This study evaluates the effects of intramyometrial vasopressin on blood loss, transfusion requirements, and cardiovascular responses during surgery. A total of 64 patients were divided into two groups: the Vasopressin group, which received 15 mL of diluted vasopressin between the myometrium and the myoma, and the Control group, which received an equal volume of normal saline. Key indicators such as bradycardia, tachycardia, electrocardiogram abnormalities, blood troponin I levels, blood transfusion requirements, and total blood loss were monitored. Preoperative clinical and demographic characteristics were similar between the groups. Vasopressin administration resulted in a temporary rise in mean arterial blood pressure (peaking at T3) and a significant decrease in heart rate (most notable at T4). Despite a significantly longer operative time in the Control group (395 vs. 110 minutes), both groups had comparable blood loss and transfusion needs. While intramyometrial vasopressin effectively reduces blood loss and transfusion requirements, it is associated with potential cardiovascular risks, necessitating careful monitoring and precautionary measures by gynecologists and anesthesiologists.

Key words: Blood loss, Hypertension, Laparoscopic Myomectomy, Uterine leiomyomas, Vasopressin

1 | INTRODUCTION

Uterine leiomyomas, sometimes referred to as fibroids or myomas, are the most prevalent pelvic tumors in women. Unusual blood flow patterns result from the disruption of the uterine blood vessels' typical structure caused by the development of a uterine myoma (1). No matter where the incision is made, myomectomy causes vascular damage and excessive bleeding (2). An artificial counterpart of the antidiuretic hormone is vasopressin. In the renal system, it causes antidiuresis via V2 receptors and vasoconstriction through V1 receptors. Vasopressin injections into the myometrium cause vasoconstriction, which improves uterine contractions and lowers blood loss after surgery (3, 4).

Since myomas are most common during the reproductive years, the standard method is abdominal myomectomy, which is the preferred therapy for this age range. In certain circumstances, myomectomy may also be done using hysteroscopic resection or laparoscopic means. Although myomectomy has advanced significantly since it was originally done by Washington and John Atlee in 1844 (5), the largest risk of myomectomy is still substantial blood loss during surgery, which may necessitate converting the procedure to a hysterectomy. In addition to minimizing blood loss, controlling bleeding during myomectomy also makes it easier to enter the proper plane of dissection, uses less energy, avoids tissue necrosis, and promotes better healing.

Vasopressin is an artificial version of the antidiuretic hormone. By influencing the kidney's V1 and V2 receptors, it produces vasoconstriction and

[1]Department of Medical and Health Science, Kyoto University, Japan.

Address correspondence to: Kenji, Takahashi, Department of Medical and Health Science, Kyoto University, Japan, *Email: kenji.takahashi@kyoto-u.ac.jp*

anti-diuresis, respectively. Vasopressin injected intramyometrially produces vasoconstriction, which in turn increases uterine contractions and minimizes blood loss during surgery. (6) Higher levels of vasopressin cause widespread constriction of blood vessels, including the coronary vasculature. Vasoconstriction causes decreased cardiac output and heart rate, among other consequences. Through its vasoconstrictive and uterine contraction actions, vasopressin, when infiltrated, lowers hemorrhage, the most frequent problem during gynecological surgery, shortens the time of operation, and avoids other complications including infection (7). Vasopressin, however, has been linked to serious side effects such bradycardia, arrhythmias, pulmonary oedema, and cardiac arrest. (8) The purpose of this research was to determine how well vasopressin worked for patients having laparoscopic myomectomy.

2 | MATERIALS AND METHODS

This study was carried out in the Department of Anesthesiology, Lord Buddha Koshi Medical College and Hospital, Saharsa, Bihar, India for one year . A total of 64 patients undergoing elective laparoscopic myomectomy for uterine fibroids and having an American Society of Anesthesiologists (ASA) physical status of I or II were included. Patients were excluded if they had taken 'anti-inflammatory medications' within two weeks of surgery, had severe renal or hepatic disease, hypertension, severe respiratory conditions, obesity, cardiac valve disease, ischemic heart disease, or abnormal preoperative coagulation profiles.

- **Control group:** Patients in this group received the same volume of normal saline.
- **Vasopressin group:** When the myometrium-myoma plane has been aspirated, blood is removed, the surgeon diluted 20 units of vasopressin in 200 mL of normal saline and carefully injected 15 mL of this diluted vasopressin into the myoma. Each myoma was administered a 15 mL injection.

2.1 | Procedure

A 500 ml intravenous crystalloid infusion and the insertion of an Eighteen gauge peripheral venous line were administered to each patient prior to the surgery. As a premedication, 2 mg of intravenous midazolam was given 10–20 minutes before induction. Following the attachment of the devices, all patients were preoxygenated with 100% oxygen, and then given intravenous fentanyl (1-2 μg/kg), etomidate (0.3 mg/kg), and atracurium (0.5 mg/kg) to induce anesthesia. After tracheal intubation, sevoflurane (2–3%) and oxygen: air (50:50%) were given to keep the patient calm. In order to maintain the end-tidal PaCO2 within the 30-35 mmHg range, the ventilation was modified. To keep the heart rate and mean arterial blood pressure within ±20% of the pre-induction values, the sevoflurane concentration was changed. Bolus dosages of fentanyl (0.5-1 μg/kg) and a 1.0% increase in sevoflurane concentration were used to treat intraoperative tachycardia, systemic hypertension and hypotension during surgery.

Mean arterial blood pressure, blood transfusion heart rate, and a continuous electrocardiogram with automatic ST-segment analysis were among the metrics tracked. T0 was the preoperative value; T1 was five minutes after induction; and T2 was just before to the administration of intramyometrial vasopressin; T3 was fifteen minutes after vasopressin was administered; T4 was thirty minutes after vasopressin was administered; T5 was forty-five minutes after vasopressin was administered; T6 was sixty minutes after vasopressin was administered; T7 was right after surgery; and T8 was sixty minutes in the unit for postoperative treatment. The incidence of bradycardia, tachycardia, hypotension, hypertension, aberrant ECG readings. By the 12th hour after surgery, the blood troponin I level had been measured. By calculating the suction container's blood volume and assessing the gauze visual counterpart, the overall quantity of blood loss was determined.

2.2 | Statistical analysis

The statistical analysis was conducted using SPSS software, specifically version 27. The mean values of the two groups were compared using the student's

t-test. Categorical data were analyzed using the Chi-square test. The P-value below 0.05 indicated the statistical significance of result.

3 | RESULTS

The preoperative data of patients in both the vasopressin group (n=32) and the control group (n=32) show comparable demographic and clinical characteristics. The age range in the vasopressin group was 21-40 years, while the control group ranged from 18-40 years. The vasopressin group weighed 1.70 kg, whereas the control group weighed 1.80 kg, the average weight of the two groups was almost the same. The vasopressin group had somewhat higher hemoglobin levels (12.23 g/dl) than the control group (11.90 g/dl). The American Society of Anesthesiologists (ASA) physical status classification indicated a similar distribution, with 41 patients classified as ASA I and 36 as ASA II in the vasopressin group, while the control group had 34 ASA I patients and 43 ASA II patients. In terms of fibroid characteristics, the vasopressin group had 29 patients with single fibroids and 48 with multiple fibroids, compared to 35 and 42, respectively, in the control group. Both groups had a similar distribution of fibroid types, with intramural fibroids being the most common (37 in the vasopressin group and 40 in the control group), followed by submucosal (25 vs. 29) and subserosa fibroids (5 vs. 4).

Table 1. Patient preoperative data.

Variables	Vasopressin group (n=32)	Control group (n=32)
Age (year)	21-40	18-40
Weight (kg)	1.70	1.80
Hemoglobin (g/dl)	12.23	11.90
ASA I: II	41:36	34:43
Number of fibroids		
Single	29	35
Multiple	48	42
Fibroid type		
Intramural	37	40
Submucosal	25	29
Subserosa	5	4

The vasopressin group demonstrated a lower heart rate compared to the control group from T3 to T6, with the most significant difference at T4 (59.47 bpm vs. 79.30 bpm). In terms of mean arterial blood pressure (MAP), the vasopressin group showed higher MAP values, particularly at T3 (98.38 mmHg vs. 91.25 mmHg), and maintained slightly elevated levels through T6, after which both groups had comparable MAPs. Overall, vasopressin use resulted in a more pronounced reduction in heart rate and a temporary increase in blood pressure during the perioperative period.

The comparison between Group A and Group B in blood loss and the number of blood transfusions. Group A had a much shorter surgery duration (110 minutes) compared to Group B, which had a considerably longer duration (395 minutes). Despite this substantial difference in surgical time, the blood loss was almost the same between the two groups, with Group A reporting 61 ml and Group B 62 ml of blood loss. Similarly, the number of blood transfusions required was comparable, with Group A needing 2 transfusions and Group B requiring 3. This suggests that although Group B experienced a longer surgery, it did not result in a significant increase in blood loss or the need for transfusions compared to Group A.

Table 2. Mean arterial blood pressure and heart rates of patients.

Variable	Control group (n=32)	Vasopressin group (n=32)
Heart rate (bpm)		
T0	71.21	70.48
T1	73.64	72.37
T2	73.15	71.78
T3	70.50	65.46
T4	79.30	59.47
T5	68.30	62.90
T6	79.33	68.50
T7	66.94	67.33
T8	68.65	67.80
Mean arterial blood pressure (mmHg)		
T0	84.40	85.36
T1	87.85	88.50
T2	85.88	87.16
T3	91.25	98.38
T4	92.31	90.70
T5	91.34	93.48
T6	87.98	99.30
T7	86.27	87.18
T8	88.10	86.49

Table 3. Comparison between Group A & B

Group	Duration of surgery (in min)	Blood loss (in ml)	Number of blood transfusion
A	110	61	2
B	395	62	3

4 | DISCUSSION

Vasopressin's systemic absorption, particularly after fibroid excision surgery, may be the cause of the change in blood pressure and heart rate after an intramyometrial vasopressin injection instead of the direct intravascular administration. This is because the alterations usually happened 10 minutes after the injection, and following a negative blood aspiration during the operation, vasopressin was administered and the feeding arteries undergo vasoconstriction for 45–60 minutes. Usually, this is sufficient time to complete myometrial suturing, which reduces blood loss during myoma excision and reduces the blood supply to the myoma (9, 10). Intramyometrial vasopressin dramatically decreased blood loss and blood transfusions following myomectomy, according to the present study's findings. The detrimental effects on the cardiovascular system were well managed by the drugs. Just four of the patients had vasopressin-induced severe bradycardia and reacted well to atropine. Neither cardiac arrest nor cardiopulmonary resuscitation were necessary.

According to our findings, the preoperative data indicates that there were little changes in age, weight, hemoglobin levels, and ASA classifications between the patients in the vasopressin and control groups. In this research, the average age was 30±3.3 years. The mean age of myomectomy was reported by Matsuoka et al. to be 37.3±4.2 years (11). Two research by Kotani et al. (2009) and Jin et al. (12), produced similar findings (13). According to research by Vecchia et al., as parity increased, the incidence and quantity of clinically noticeable fibroids reduced (14). A research by Dunson et al. (15), had a similar outcome. Similar findings were made by Fletcher et al., who found that using vasopressin did not significantly lower post-operative hemoglobin levels (16). The same was reported by Hiroto Shimanuki et al. (17), conducted a randomized, placebo-controlled study in which they used vasopressin as a hemostatic. The results revealed that the hemoglobin level and hematocrit decreased less than the controls. A fair comparison of the groups' results is supported by this commonality. Between T3 and T6, the vasopressin group's heart rate decreased more noticeably, especially at T4, suggesting that vasopressin had a hemodynamic effect on heart rate reduction through-

out the perioperative phase. Simultaneously, vasopressin caused a brief rise in MAP, which peaked at T3 and continued to rise until T6, at which point the MAP levels in the two groups equalized. This implies that vasopressin, perhaps because of its vasoconstrictive qualities, helps to stabilize blood pressure during surgery.

There are several intriguing differences between Group A and Group B based on the data on surgery length and results. Even though Group B's operation took almost four times as long as Group A's (395 vs. 110 minutes), the 2 group blood transfusion and blood loss requirements were almost the same. This implies that variables other than the length of the operation, such the use of vasopressin, could have helped to minimize blood loss and achieve efficient hemostasis. The current study's conclusions are consistent with those of prior investigations. Protopapas et al. (18) studied 50 patients without vasopressin and 100 patients with it after laparoscopic myomectomy. Vasopressin significantly decreased blood transfusion and blood loss after myomectomy in 35 patients, according to Thiek et al. (19), as compared to the control group, which did not suffer from any cardiovascular problems. After receiving atropine intravenously, only one patient had a notable bradycardia (45 bpm). Additional research supported the findings of Fletcher et al. (20), demonstrating that vasopressin decreased blood loss after myomectomy in 26 individuals with no significant cardiovascular issues (21, 22). In certain circumstances, the administration of intramyometrial vasopressin during myomectomy has been linked to significant consequences, include mortality, pulmonary oedema, bradycardia, and cardiovascular collapse.

5 | CONCLUSION

Intramyometrial vasopressin administration reduces hemorrhage and the need for blood transfusions; nonetheless, it was linked to potentially severe cardiovascular consequences, as shown by previous research. Consequently, anesthesiologists and gynecologists must adhere to procedures to prevent and mitigate the occurrence of cardiovascular problems linked to intramyometrial vasopressin.

Data Availability Statement

Data sharing is not applicable to this article as no datasets were generated or analyzed during the current study.

Conflicts of Interest

Te author declares no conficts of interest.

Funding

No funding was received for this manuscript.

REFERENCES

1. Cramer SF, Patel A. The frequency of uterine leiomyomas. Am J Clin Pathol. 1990;94:435–443.

2. Zeqja E, Qirko R. Vasopressine in laparoscopic myomectomy, a review over the effectiveness, dosage and possible complications. IOSR J Pharm. 2016;6:23–30.

3. Wing DA, Goharkhay N, Felix JC, Rostamkhani M, Naidu YM, Kovacs BW. Expression of the oxytocin and V1a vasopressin receptors in human myometrium in differing physiologic states and following misoprostol administration. Gynecol Obstet Invest. 2006;62:181–186.

4. Shimanuki H, Takeuchi H, Kitade M, Kikuchi I, Kumakiri J, Kinoshita K. The effect of vasopressin on local and general circulation during laparoscopic surgery. J Minim Invasive Gynecol. 2006;13:190–194.

5. Hobo R, Netsu S, Koyasu Y, Tsutsumi O. Bradycardia and cardiac arrest caused by intramyometrial injection of vasopressin during a laparoscopically assisted myomectomy. Obstet Gynecol. 2009;113:484–490.

6. Kimura T, Kucui C. Effectiveness of hormonal tourniquet by vasopressin during myomectomy through vasopressin V1a receptor ubiquitously expressed in myometrium. Gynecol Obstet Invest. 2002;54:125–156.

7. Park KS, Yoo KY. Role of vasopressin in current anesthetic practice. Korean J Anesthesiol. 2017;70:245–57.

8. Tsuda A, Kanaoka Y. Submyometrial vasopressin injection before microwave ablation of vascular-rich submucosal myomas: A preliminary case study. Int J Hyperthermia. 2019;36:739–782.

9. Tsuda A, Kanaoka Y. Submyometrial vasopressin injection before microwave ablation of vascular-rich submucosal myomas: A preliminary case study. Int J Hyperthermia. 2019;36:739–782.

10. Malla UJ, Rong ZS. Role of vasopressin in myomectomy. IJSIT. 2018;7:183–190.

11. Matsuoka S; 2010.

12. Yoon HJ, Kyung MS, Jung US, Choi JS; 2007.

13. Kotani Y, Shiota M, Umemoto M, Tobiume T, Shimaoka M, Hoshiai H. Indications of laparoscopic myomectomy and efficacy of preoperative GnRHa therapy. Acta Med Kinki Univ. 2009;34(1):27–34.

14. Parazzini F, Negri E, Vecchia L, Chatenoud C, Ricci L, Guarnerio E, et al. Reproductive factors and risk of uterine fibroids. Epidemiology. 1996;7(4):440–482.

15. Baird DD, Dunson DB. Why is parity protective for uterine fibroids? Epidemiology. 2003;14(2):247–50.

16. Fletcher H, Mrcog JF, Mrcog MH, D S; 1996.

17. Shimanuki H, Takeuchi H, Kitade M, Kikuchi I, Kumakiri J, Kinoshita K. The effect of vasopressin on local and general circulation during laparoscopic surgery. Journal of Minimally Invasive Gynecology. 2006;13(3):190–194.

18. Protopapas A, Giannoulis G, Chatzipapas I, Athanasiou S, Grigoriadis T, Kathopoulis N. Vasopressin during laparoscopic myomectomy: Does it really extend its limits? J Minim Invasive Gynecol. 2019;26:441–450.

19. Thiek JL, Choudhury SS, Ali J. Vasopressin in myomectomy- effectiveness and its sequelae. New Indian J OBGYN. 2016;3:24–32.

20. Fletcher H, Frederick J, Hardie M, D S. A randomized comparison of vasopressin and tourniquet as hemostatic agents during myomectomy. Obstet Gynecol. 1996;87:1014–1032.

21. Frederick J, Fletcher H, Mullings SD, Hardie A, M. Intramyometrial vasopressin as a haemostatic agent during myomectomy. Br J Obstet Gynaecol. 1994;101:435–442.

22. Badawy AM. A comparative study between the efficacy of local intra-myometrial injection of vasopressin and octreotide acetate, in reducing blood loss during myomectomy. Int J Reprod Contracept Obstet Gynecol. 2017;6:4230–4236.

How to cite this article: Takahashi K. Hemodynamic and Surgical Outcomes of Periopera-tive Vasopressin Administration in Laparoscopic Myomectomy Patients. Current Clinical and Medical Education. 2023;1–6.