

INTERVENTIONS TO REDUCE HEMORRHAGE DURING MYOMECTOMY FOR FIBROIDS: PEARLS AND PITFALLS OF EACH TECHNIQUE

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Abstract: Uterine myomas (fibroids) are benign tumors of the uterus. Myomectomy, the surgical removal of the myomas, is an important treatment option, especially for women who desire to preserve their uteri. The major problem with myomectomy is excessive bleeding from the increased uterine blood supply, which can be life-threatening and prolong post-operative stay. Knowledge of the effectiveness of the interventions used to reduce blood loss during myomectomy is essential to enable evidence-based clinical decisions.

Keywords: Myomectomy, Hemorrhage, Fibroid.

1. INTRODUCTION

Uterine leiomyomas (fibroids or myomas) are benign, smooth muscle tumors of the human uterus, which represent the most common neoplasms in women of reproductive age and have a lifetime incidence of approximately 70% in the general population.¹ Most myomas are asymptomatic and are discovered incidentally during a routine pelvic examination or imaging studies.² Approximately 20–40% of women with fibroids experience significant symptoms and consult gynecologic care. Common clinical symptoms include abnormal uterine bleeding, dysmenorrhea, pelvic pain, infertility, and recurrent pregnancy loss.¹

Currently, there are several strategies for treating fibroids. However, the standard treatment of symptomatic leiomyomas is hysterectomy for women who have completed childbearing, and myomectomy remains the most common and efficient uterus-sparing treatment for women who wish to preserve fertility.³ Hysterectomy, the surgical removal of the uterus, eliminates the symptoms and the chance of recurrence.

Many women who suffer from myomas desire future childbearing or want to preserve their uterus. Thus, myomectomy the surgical removal of the myomas with reconstruction and preservation of the uterus is an important option. Myomectomy can be accomplished by laparotomy, laparoscopy, or hysteroscopy.⁴

Nevertheless, this procedure is associated with known risks, one of which is excessive perioperative blood loss which sometimes necessitates a hysterectomy. The risk of bleeding depends on the number, size, and position of fibroids removed.

To reduce intraoperative hemorrhage many interventions have been proposed to reduce bleeding and blood transfusion.⁵ Recent Cochrane database systematic review highlights that misoprostol, vasopressin, bupivacaine plus epinephrine, tranexamic acid (TA), and mechanical tourniquet are shown to be more effective in controlling myomectomy-associated bleeding compared to a placebo or no treatment.⁶

Recently, TA has been said to significantly reduce blood loss if given prophylactically at myomectomy. Studies from cardiac and orthopedic surgery have shown an equal or superior effect of topical compared with intravenous TA on both bleeding and transfusion requirements. Topical treatment is cost-effective, and adverse effects or drug interactions have not been reported.⁷ However, none of these has been approved as the gold standard. The purpose was to assist gynecologists in selecting the most appropriate method with the least complications.

2. TOURNIQUET TECHNIQUE

There are two types of tourniquets, mechanical and hormonal tourniquet. The mechanical tourniquet has been used during myomectomy to reduce intraoperative blood loss. However, this technique usually creates a pressure that may cause damage to the uterine artery and its branches, mask inadequate hemostasis, and becomes apparent once the tourniquet is removed. It has been confirmed that the ascending branch of the uterine artery forms an anastomosis with the ovarian artery. Therefore, it is believed that ligation of the uterine artery, even by intermittent release of the tourniquet, may reduce blood flow in the ovarian artery and ultimately reduce the ovarian reserve.⁸⁻¹⁰

A recent randomized controlled trial (RCT) used a tourniquet that fastened to the inferior segment and the broad ligament to reduce blood flow in the uterine isthmus. The study found that fastening a tourniquet at the uterine isthmus during abdominal myomectomy reduced blood loss significantly compared to controls. However, a tourniquet did not increase the duration of surgery and had no adverse effect on ovarian reserve.¹¹ The intervention group experienced significantly less intraoperative blood loss than controls (129.28 ± 90.07 vs. 313.63 ± 211.05 mL). Hormonal tourniquets such as natural or synthetic vasopressin act on vasopressin V1a receptors, ubiquitously expressed in the myometrium, to reduce blood loss. Hormonal tourniquets act as peri-cervical tourniquets when administered in the cervix but act as utero-tonics when administered in the myometrium.

Blood loss during myomectomy may be correlated with pre-operative uterine size, the total weight of myomas removed, operating time, patient co-morbidities, some accompanying conditions, and intraoperative complications.¹² In the present study, the duration of surgery was shorter in tourniquet group than in controls, despite the time spent on fastening and opening the tourniquet consistent with previous studies.¹³ This indicates that myomectomy without a tourniquet is associated with complications, especially blood loss.¹⁴ Fastening a tourniquet during myomectomy is an additional procedure but does not prolong the duration of surgery.¹²

3. TRANEXAMIC ACID

Traditionally, anti-fibrinolytic agents have been administered intravenously in surgical settings. Safety concerns associated with intravenous administration of tranexamic acid include thrombosis, increased seizure risk, and renal impairment.¹⁵ Considering the safety concerns with intravenous administration, there has been a growing interest in the topical use of tranexamic acid for prevention of bleeding associated with major surgical procedures.

Topical application of TA provides a high drug concentration at the site of the wound and a low systemic concentration. Studies from cardiac and orthopedic surgery have shown an equal or superior effect of topical compared with intravenous TA on both bleeding and transfusion requirements. Topical treatment is cost-effective, and adverse effects or drug interactions have not been reported. There are several published clinical trials for the use of TA in myomectomy, but no consensus on its use or guidelines for management. Topical application of TA to decrease postsurgical bleeding after major surgical procedures is a promising strategy.^{5,15}

A first study conducted to study the effect of TA in myomectomy in a prospective randomized placebo-controlled trial involving 100 patients undergoing open myomectomy found a statistical difference in terms of total blood loss ($804 \text{ ml} \pm 482$ versus $1047 \text{ ml} \pm 617$, $p = .03$) and duration of surgery ($72 \text{ min} \pm 22$ in the treated group versus $84 \text{ min} \pm 29$ in the control group, $p = .03$).¹⁶ No thromboembolic events or side effects were reported. A meta-analysis of RCT also found a similar result, with a significant difference between groups in terms of total blood loss (standard mean difference [SMD] = -1.512 , 95% confidence interval [CI]: -2.746 to -0.278 , $P = .016$), post-operative hemoglobin level (SMD = 0.650 , 95% CI: 0.045 – 1.255 , $P = .035$), transfusion requirements (SMD = -0.102 , 95% CI: -0.199 to -0.006 , $P = .038$), and duration of surgery (SMD = -0.514 , 95% CI: -0.749 to -0.280 , $P = .000$). In addition, no adverse effect was identified in treatment groups.¹⁵ Thus Intravenous and Topical Tranexamic acid is a safe and reliable method to help decrease blood loss during open myomectomy.¹⁷

4. UTERO-TONICS

The three main medications used are oxytocin, misoprostol, and vasopressin. There are always controversies among gynecologists for choosing the best method with minimal adverse effects and cost along with availability and effective results because the types of these interventions are so varied. Pre-operative misoprostol, a prostaglandin E1 analogue, was registered in many countries for gynecology and obstetrics, for example in the evacuation of uterus. Its popularity in developing countries is accounted for by its advantages over other interventions as being an inexpensive choice. A RCT suggest that misoprostol significantly reduced blood loss (1 trial with 25 participants: MD 149.00 ml, 95% CI -229.24 to -68.76), shortened duration of surgery (MD -9.50 min, 95% CI -15.90 to -3.10), and increased post-operative hemoglobin.¹⁸

Another study found similar result with patient who had misoprostol showing 15% - 18% reduction in blood loss.¹⁹⁻²¹ Misoprostol is also associated with reduced but statistically insignificant need for post-operative blood transfusion thus reducing post-operative complications and length of stay in hospital. Blood transfusion was advised only after taking into consideration the 24 hours post-operative hemoglobin.²²

Oxytocin is widely used to prevent and treat postpartum hemorrhage (PPH). Most obstetric units use intravenous (IV) oxytocin as the first-line agent to prevent uterine atony after vaginal delivery and to decrease blood loss during cesarean section (CS). A RCT conducted in 2020 showed the average blood loss in the patient who had Oxytocin group was significantly lower than patient who didn't use oxytocin. Also, 11 patients who didn't use oxytocin required blood transfusion within 24 hours of the surgery which was significantly higher. Main side effects caused by oxytocin are tachycardia, hypernatremia, and hypotension. The RCT study did not find any of these side effects probably due to low dose of oxytocin given as infusion.²³ Other study found no evidence of a statistically significant difference between oxytocin and placebo in blood loss (2 trials with 154 participants: MD (random) -69.84 ml, 95% CI -296.74 to 157.06), need for blood transfusion (OR (random) 0.54, 95% CI 0.03 to 8.51), and duration of surgery (MD 3.50 min, 95% CI -1.88 to 8.88).¹⁸

Two trials were conducted to see does vasopressin reduce hemorrhage during myomectomy, and those on vasopressin and analogues had a significant reduction in blood loss (MD (random) -298.72 ml, 95% CI -593.10 to -4.34). Though the two trials of vasopressin showed significant reduction on blood loss in the vasopressin group there was significant heterogeneity between them ($P < 0.00001$, $I^2 = 98.7\%$), this heterogeneity may be due to the use of different type of vasopressin. But a study found there was no significance difference in the effect for the need for blood transfusion, duration of the surgery, and patient length of stay.¹⁸

5. UTERINE ARTERY LIGATION

Artery ligation usually demonstrated as a valid strategy in the treatment of hemorrhage, uterine artery ligation consists in suturing of both uterine arteries, a technique which can also be accomplished by laparoscopy.²⁴ There is still back and forth regarding this technique in reducing hemorrhage during myomectomy, a RCT reported no difference with respect to intraoperative blood loss and total operation time duration.²⁵ But on the other hand another RCT reported significant differences in operative blood loss ($433.8\text{ml} \pm 285.21$ versus 823.23 ± 237.33 ml, $p < 0.001$), mean operation times (50.5 ± 8.7 versus 76.3 ± 9.4 min, $p < 0.001$), post-operative stay (4.1 ± 0.1 versus 5.1 ± 0.2 days $p < 0.001$) and number of patient needing blood transfusion (3 - 5.8% versus 32 - 62.7%, $p < 0.001$).²⁶

6. CONCLUSION

Hemorrhage is still the most important concern with open myomectomy. Blood loss during surgery largely depend on number or dimension of fibroids removed and technique adopted during myomectomy.

Further study on the effectiveness of different interventions in reducing blood loss during myomectomy still needed. To date, there is a need to fill the current gap of knowledge which has very important practical implications. Apart from the effectiveness, data on the cost-effectiveness, and adverse effects of different interventions are lacking. This is important for clinical decision making since such decisions are based on tradeoffs between benefits on the one hand and costs and adverse events on the other.

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