Characteristics associated with blood transfusion among women undergoing laparoscopic myomectomy

Abstract

Background: Laparoscopic myomectomy is a minimally invasive surgical procedure used to remove uterine fibroids. While generally associated with reduced recovery times and fewer complications compared to open surgery, the risk of blood transfusion remains a significant concern. Blood transfusions can introduce risks such as transfusion reactions and infections, and they are often indicative of intraoperative or postoperative complications. Understanding the factors associated with increased transfusion needs is crucial for optimizing surgical outcomes and improving patient safety.

Literature Review: A comprehensive analysis of recent studies reveals several key factors associated with blood transfusion during laparoscopic myomectomy. A large case-control study identified that Black race, preoperative anemia, and the choice of an abdominal/open surgical route were independently associated with increased transfusion needs. Similarly, a retrospective cohort study highlighted risk factors including specimen weight, operation time, and bleeding disorders, with Hispanic and Black patients showing higher transfusion likelihood compared to non-Hispanic White patients. Additionally, a study encompassing over 600 centers found that laparoscopic procedures generally had a lower transfusion risk compared to open/abdominal approaches. The review also examined the impact of preoperative anemia, which significantly increased the likelihood of needing a transfusion. The predictive model developed from a large dataset emphasized non-Hispanic Black race, bleeding disorders, and higher ASA classifications as critical factors, recommending more rigorous preoperative planning and anemia management. Lastly, preliminary research into preoperative uterine artery embolization (PUAE) suggested potential benefits in reducing intraoperative bleeding and transfusion rates, although further studies are needed to validate these findings.

Conclusion: This review highlights that several modifiable and non-modifiable risk factors contribute to the likelihood of requiring a blood transfusion during laparoscopic myomectomy. Effective preoperative management, including addressing anemia and considering preoperative interventions like PUAE, may help mitigate these risks.

Keywords: Blood transfusion, Myomectomy, Laparoscopy.

1. Introduction

A large number of women around the world will develop uterine leiomyomas, with a considerable portion of them requiring treatment(1). While hysterectomy is frequently performed to address symptomatic myomas, myomectomy offers an alternative that preserves the uterus and fertility(2).

Considering the diverse nature of myomas and the range of symptoms they can cause, the procedure of myomectomy can be quite complex and carries its own set of risks(3). One of the most frequent issues that can arise from a myomectomy is significant blood loss, which may require a blood transfusion(3). This bleeding, which can lead to the need for a blood transfusion, can happen during or after surgery(3). The rates of transfusion during myomectomy can vary significantly in different studies, ranging from 2.7% to 20%(3). Numerous studies have been conducted to determine the factors that contribute to perioperative blood loss and the likelihood of needing a transfusion(4). The risk of transfusion is associated with the type of myomectomy performed(4). In their study, Stanhiser et al discovered that the risk of transfusion was 4.8 times higher with a laparotomy compared to a laparoscopic approach(5). In a comprehensive study, the rates of transfusion were observed to be 6.7% for hysteroscopic procedures, 2.7% for laparoscopic procedures, and 16.4% for open/abdominal myomectomies, encompassing both emergent and elective cases(3). Additional factors that can contribute to increased risk include preoperative anemia and specific characteristics of the myoma(3). In their study, Murji et al discovered that individuals with preoperative anemia, characterized by a hemoglobin level below 12 g/dL, were nearly twice as likely to require a transfusion(6).

In their study, Vargas et al found that having a myoma diameter of at least 12 cm or a uterine volume of at least 750 cm3 were identified as additional risk factors for transfusion, hemorrhage, and overall complication rates(7).

There are calculators available to help estimate transfusion risk in gynecologic surgery, but they primarily focus on hysterectomy and may not take into account the specific details of myomectomy procedures(8). Based on the risk factors mentioned earlier, and possibly others that have not been discovered yet, it is possible to calculate a personalized assessment of the risk of transfusion with myomectomy(9). If the calculated transfusion risk is high, one may consider utilizing certain interventions that are more resource-intensive and variable in cost(10). These interventions could include the use of gonadotropin-releasing hormone analogs, preoperative blood-product hold, cell-salvage techniques, perioperative uterine artery embolization, preoperative intravenous iron infusions, and temporary occlusion(11,18-20). If the risk is determined to be moderate or low, implementing cost- and resource-containment strategies can be done with confidence(12). This will result in saving healthcare dollars, preventing surgical delays, and reducing patient morbidity. This literature review aims to assess the characteristics associated with blood transfusion among women undergoing laparoscopic myomectomy.

2. Literature Review

2.1 Demographic characteristics associated with blood transfusion among women undergoing laparoscopic myomectomy

A case-control study identified variables independently associated with postoperative/intraoperative blood transfusion at the time of myomectomy(10). The study involved 6,387 myomectomies performed during the defined study period, with African/Black American patients comprising 45.7% of the population. The majority of patients (57.5%) underwent an abdominal/open route of myomectomy. Among these, 623 patients (9.8%) experienced postoperative or intraoperative bleeding that necessitated a blood transfusion.At the bivariable level, several variables were found to be independently associated with the need for a blood transfusion during myomectomy. Further multivariable logistic regression, using only variables that can be reasonably known before surgery, elucidated that blood transfusion, Black race, the need for preoperative a planned abdominal/open route of surgery, and preoperative hematocrit value were independently associated with the need for blood transfusion.

Researchers conducted a study to identify risk factors for blood transfusion during laparoscopic myomectomies, using a retrospective cohort design(13). In the multivariable analysis, several factors were considered as potential risk factors for a blood transfusion. These included operation

time, postoperative anemia, intramural myomas, specimen weight, bleeding disorder diagnosis, and race. This study findings also revealed that Hispanic and Black patients had a higher likelihood of blood transfusion compared to non-Hispanic White patients. The study found that bleeding disorders had a significantly higher adjusted odds ratio (aOR) of 3.38, while ASA class 3 or 4 had a slightly elevated aOR of 1.47. Additionally, preoperative anemia was associated with a higher aOR of 3.20.1

Specimen weight exceeding 250 g or having a minimum of 5 intramural myomas, along with an operation time of 197 minutes or more, were found to be linked to higher risks of blood transfusion. The associated odds ratios were 1.87 and 4.08, respectively.The results of this study identified the factors that increase the risk of blood transfusion in women undergoing laparoscopic myomectomies. Further studies are recommended to validate these tools and find ways to optimize their use in clinical practice.

A retrospective cohort study examined the risks of blood transfusion and the morbidity rates within 30 days after myomectomy(3). There are several factors that increase the risk of transfusion. These include being of black or other race compared to white race, having a preoperative hematocrit of less than 30%, receiving a preoperative blood transfusion, having a high fibroid burden, undergoing a prolonged surgical time, and opting for an open/abdominal approach instead of a laparoscopic one. Even after accounting for other factors, it was found that women who needed blood transfusions were about three times more likely to experience a major postoperative complication (adjusted odds ratio 2.69).

In this issue of Fertility and Sterility, the study by Kim et al. aimed to understand the risk of blood transfusion following myomectomy for symptomatic uterine fibroids(14). They analyzed a database containing information from over 600 centers spanning from 2010 to 2016. The authors have included 3,407 myomectomy procedures in their study to define the risks associated with hysteroscopic, laparoscopic, and open/abdominal procedures. In this study, it was discovered that the risk of blood transfusion after myomectomies varied depending on the type of procedure. Laparoscopic myomectomy was associated with the lowest risk, while open/abdominal myomectomy had the highest risk. Furthermore, the authors also assessed the rate of 30-day morbidity after myomectomy as a secondary outcome. Even when considering other factors,

there was a noticeable rise in the likelihood of major postoperative complications for patients who underwent a blood transfusion.

A significant study aimed at developing a blood transfusion prediction model for laparoscopic myomectomy analyzed data from the National Surgical Quality Improvement Program (NSQIP), encompassing 11,496 cases from 2012 to 2020(15). The study identified that 2.9% of women undergoing laparoscopic myomectomy required blood transfusions, underscoring the need for better predictive tools and risk management strategies in clinical practice.

Several risk factors were found to significantly contribute to the likelihood of requiring a blood transfusion during the procedure. Non-Hispanic Black race emerged as a prominent risk factor, indicating a higher propensity for transfusion needs among this demographic. This finding suggests the importance of tailored preoperative assessments and interventions to mitigate transfusion risks in non-Hispanic Black women. Additionally, the presence of bleeding disorders was another critical predictor, highlighting the necessity for meticulous preoperative planning and potential prophylactic measures to manage bleeding risks effectively.

The study also revealed that a higher American Society of Anesthesiologists (ASA) classification was linked to increased transfusion rates, suggesting that patients with significant comorbidities require more intensive monitoring and preparation. Preoperative anemia was identified as a strong predictor of transfusion need, emphasizing the importance of correcting anemia before the procedure to reduce the likelihood of requiring a transfusion and improve patient outcomes. Other significant factors included larger specimen weights and longer operation times, which pointed to the complexity and invasiveness of the procedure as contributing factors to blood loss.

The predictive model developed from these findings demonstrated moderate accuracy, with researchers emphasizing the need for further validation and refinement in clinical settings to ensure its effectiveness and reliability. Incorporating this model into preoperative evaluations could aid in identifying high-risk patients and implementing appropriate preventive measures to reduce transfusion rates, thereby improving surgical outcomes and patient care.

Another study explored the potential of preoperative uterine artery embolization (PUAE) to reduce intraoperative blood loss in myomectomy procedures(5). PUAE is designed to decrease

blood flow to the uterus by embolizing the uterine arteries, potentially minimizing intraoperative bleeding and reducing the need for blood transfusions.

The study conducted a retrospective analysis of 16 patients who underwent PUAE before myomectomy. The results showed trends towards reduced bleeding and shorter operative times in patients who had undergone PUAE compared to those who had not. The findings also revealed modifiable factors such as preoperative anemia and intraoperative bleeding that were found to be directly targeted by PUAE.

These findings suggest that PUAE could be a valuable preoperative intervention to minimize intraoperative bleeding, thus reducing the need for blood transfusions. However, the results were not statistically significant, primarily due to the small sample size, indicating that larger studies are needed to confirm these preliminary findings.

The observation of shorter surgical durations for patients who had PUAE could be attributed to easier surgical dissection and reduced intraoperative complications, contributing to quicker and safer surgeries. Despite these promising trends, the main limitation of this study was its small sample size, which affected the statistical power of the findings. To confirm the benefits of PUAE, larger and more comprehensive studies are necessary. Furthermore, future research should explore the long-term outcomes of PUAE, including its impact on fertility and postoperative recovery.

2.2 Preoperative characteristics associated with blood transfusion among women undergoing laparoscopic myomectomy

In a study, 26,229 women underwent a myomectomy. Among them, 2,345 (9%) required a blood transfusion(16). Women who needed a transfusion had lower median preoperative hematocrit levels (34.7) compared to those who did not (38.2). Patients were grouped based on their surgical approach (laparotomic vs. laparoscopic) and the number and weight of myomas (1–4 myomas/weight ≤250 g or ≥5 myomas/weight >250 g), using Current Procedural Terminology codes (58140, 58146, 58545, 58546). The data showed a clear correlation between the need for a blood transfusion and lower preoperative hematocrit levels across all categories, with the risk of transfusion increasing as hematocrit levels decreased. The odds ratios comparing hematocrit

levels of 29% versus 39% were significantly different for patients who had laparotomic versus laparoscopic myomectomy. These odds ratios ranged from 4.85 to 6.16, with the corresponding confidence intervals indicating a strong association.

A study assessed the impact of preoperative anemia on blood transfusion rates in laparoscopic myomectomy(17). Including data from 2,345 patients, researchers found that lower preoperative hematocrit significantly increased transfusion risk. Other important factors were race, BMI, and ASA classification. Addressing preoperative anemia was recommended to minimize transfusion needs and enhance surgical outcomes.

3. Conclusion

This review highlights that several modifiable and non-modifiable risk factors contribute to the likelihood of requiring a blood transfusion during laparoscopic myomectomy. Non-modifiable factors include race (with non-Hispanic Black patients showing a higher risk) and inherent bleeding disorders. Modifiable factors encompass preoperative anemia, specimen weight, and the choice of surgical approach. Effective preoperative management strategies, such as correcting anemia and considering interventions like preoperative uterine artery embolization (PUAE), may help mitigate these risks. Tailored strategies based on individual patient profiles could enhance surgical outcomes and reduce transfusion-related complications. Further research is essential to refine predictive models, validate the efficacy of preoperative interventions, and provide evidence-based guidelines for optimizing patient care.

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