Transverse Versus Longitudinal Uterine Incision in Abdominal Myomectomy: A Randomized Controlled Trial

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SUBJECT AREAS
  Preventive Medicine

KEYWORDS
  myomectomy, blood loss, transverse uterine incision, longitudinal uterine incision, randomized controlled study.
Abstract

Background: It is unclear whether transverse uterine incision is non-inferior to longitudinal incision during myomectomy with regard to bleeding. Our aim was to compare between transverse and longitudinal uterine incisions in myomectomy. Methods: A parallel randomized controlled single-blinded study in a university affiliated hospital, in the period between January 2017 and April 2018, in which 52 women candidates for abdominal myomectomy were randomized into transverse uterine incision or longitudinal uterine incision groups (26 in each group). Intraoperative blood loss (estimated directly by blood volume in suction bottle and linen towels and indirectly by difference between preoperative and postoperative hematocrit), operative time and postoperative fever were analyzed.

Results: No statistically significant difference was found between transverse and longitudinal incisions regarding intraoperative blood loss (389.7 ± 98.56 ml vs 485.04 ± 230.6 ml respectively, p value=0.07), operative time (59.96 ± 16.78 min vs 66.58 ± 17.33 min respectively, p value=0.18), and postoperative fever (4% vs 8.33%, p value=0.6).

Conclusion: Transverse uterine incision does not cause more blood loss than longitudinal incision and is a reasonable option during abdominal myomectomy. Trial registration: NCT03009812 at clinicaltrials.gov, registered January 2017

Background

Uterine leiomyomomas are considered a chief health issue, with around 235 million females affected throughout the globe, and up to 70% of females could be diagnosed with uterine myomas before menopause. On the other hand, symptomatic leiomyomas requiring management exist in only 25% of patients. [1]

Myomectomy is the typical surgical management option for various women who suffer
from myomas and require future childbearing or basically desire preservation of their uterus. Various surgical approaches for myomectomy are implemented in practice involving laparotomy, laparoscopy, and hysteroscopy.\cite{2, 3}

Myomectomy is considered a risky bloody procedure, and the most considerable morbidity correlated to it is major blood loss.\cite{4} It has usually been proposed that vertical uterine incision was the most preferred as it causes less blood loss, being attributed to the fact that arcuate arteries run transversely from lateral to medial.\cite{4, 5} However, longitudinal incisions are associated with weaker scars and higher incidence of uterine rupture in subsequent pregnancies compared to transverse uterine incisions.\cite{6}

Radiological studies proved that the presence of the myoma disrupts the normal vascular design, so either transverse or longitudinal incision would transect the arcuate arteries.\cite{7}

Thus, it might seem a rational option to perform a transverse uterine incision\cite{8} if clinically-proven to be hemostatically equivalent to longitudinal incision. Unfortunately, up to our knowledge, no previous studies addressed this issue.

The current research study aims to prove that transverse uterine incision is not inferior regarding intra-operative blood loss compared to longitudinal incision during myomectomy.

**Material And Methods**

**Study design:**

A parallel randomized controlled pilot study conducted at Ain Shams University Maternity Hospital in the period between January 2017 and April 2018, in which fifty-two cases were recruited from those attending the outpatient gynecologic clinic, who were candidates for myomectomy.

**Sample size calculation:**
Sample size was calculated using the Power & Sample Size Calculator®, setting the power (1-b) at 0.8 and the type-1 error (a) at 0.05. The primary outcome of the current study is the mean intraoperative estimated blood loss (EBL). Reviewing the literature revealed no direct comparison between vertical and transverse uterine incision for abdominal myomectomy. A trial comparing the two types of incision in laparoscopic myomectomy was, however, found. This latter trial showed that the mean values for intraoperative EBL in transverse versus vertical uterine incision in laparoscopic myomectomy were 110.5 ± 81.7 ml and 136.4 ± 108.5 ml, respectively [9]. Therefore, transverse uterine incision would be assumed to reduce the mean intraoperative EBL by almost 18.9%. A previous study showed that the average blood loss during conventional abdominal myomectomy (which utilizes vertical uterine incision) was 621±121 ml [10]. The mean intraoperative EBL with transverse uterine incision would, therefore, be assumed to be 503 ml.

Calculation according to these values, produces a minimal sample size of 17 women in each group. Considering an attrition rate of 35% (to compensate for drop-outs due to the limited surgical experience with the novel technique in difficult myomectomies), a total of 52 women were recruited.

**Recruitment:**

Criteria for inclusion in the study were as follows; single myoma measuring 5-10 cm in diameter, causing uterine pressure-related symptoms, infertility or recurrent pregnancy loss in women between 20 and 35 years of age, with BMI between 18.5-29.9 kg/m².

Candidates were excluded from the study if they had any of the following criteria; pregnancy, cases with bleeding tendency, prior laparotomies, cases having coexisting pelvic pathologies, as ovarian cysts. All candidates had a complete preoperative evaluation via clinical history taking, clinical examination and sonographic examination for
confirmation of the exact site, size and number of uterine fibroids and to exclude any coexisting pelvic pathology, a venous blood sample for blood picture, liver and kidney functions as well as coagulation profile, as a part of anesthetic workup.

Convenience sampling was utilized. The process of recruitment and handling the study population during the course of the study is shown in the CONSORT flow diagram. Candidates were randomly assigned (with 1:1 allocation ratio) to one of two groups according to a computer generated sequence, distributed in sequentially numbered sealed opaque envelopes, allocated by the seventh author. Only the research candidates were blinded to the surgical technique.

**Intervention:**

All candidates received general anesthesia. Research group A included 26 women who were planned for transverse uterine incision in which a transverse elliptical uterine incision is accustomed within the false capsule in a manner that its transverse diameter is almost centralized over the myoma with a slight anterior shift. Its length is 2 cm shorter than the maximum diameter of the myoma and ends well away from the tubal ostia. Breadth of the ellipse is fashioned so that its edges wouldn't be under tension or redundant after closure, usually the breadth equals one third of its length [Figure 1]. Tissue planes are bluntly and/or sharply dissected and the myoma is resected with the overlying ellipse of myometrium and false capsule leaving a relatively smaller zone of dead space for closure [Figure 2]. Myometrium is re-approximated in two layers using absorbable suture [Figure 3]. The uterine serosa is sutured in a running fashion, exposing minimal suture material and raw area to minimize adhesion formation [Figure 4]. Research group B included 26 women who were planned for standard longitudinal uterine incision. No vasopressin or any other hemostatics were used to avoid their
confounding effect on blood loss. No peritoneal toilet was done and intra-peritoneal suction drains were left in all cases. Blood loss during the operation was estimated as follows: obtaining the volume difference of blood in suction bottle containers (in ml), obtaining weight difference of linen towels (in gm) [weight of soaked linen towels - weight of dry linen towels]. These differences were estimated from the beginning of the uterine incision till its closure. Estimated blood loss was also calculated by obtaining the difference between preoperative and 24 hours postoperative hematocrit using the following formula:

\[ EBV \times (Hi-Hf) \]

\( Hi \)

Where the Hi is the preoperative blood hematocrit, Hf is the postoperative one and EBV is the estimated blood volume. The estimated blood volume could be calculated by multiplying weight times average blood volume which is around 65ml/kg in females. After exclusion of three patients (as shown in the CONSORT flow diagram), a total of 25 women in the Transverse Uterine Incision group and 24 women in the Longitudinal Uterine Incision group were eligible for statistical analysis.

Postoperatively, all women were subjected to postoperative follow-up of vital data and suction drains for 24 hours, and received NSAIDs for analgesia.

**Research Study Outcomes:**

Intraoperative blood loss as primary outcome, operative time and postoperative fever as secondary outcomes.

**Statistical analysis:**

Conducted using SPSS for Windows version 20. Per protocol analysis was adopted to avoid dilution of treatment effect by excluded patients with surgically-difficult myomectomies.
Data was represented as mean +/- SD (95% CI) for continuous parametric variables and median (IQR) for non-parametric ones. Difference between two unrelated groups was analyzed using the independent Student’s t test as well as the mean difference [MD] and its 95% confidence interval [95% CI] (for numeric parametric variables); Mann-Whitney’s U test (for numeric non-parametric variables); paired t test (for paired numerical parametric variables); chi-squared test and Fischer exact test (for categorical variables). Significance level was set at 0.05.

Results

No statistically significant differences were found between women of both groups regarding age, body mass index or parity. Also there were no significant differences between women of both groups regarding frequency distribution of indications for myomectomy, myoma location [13], mean myoma size, preoperative hemoglobin or hematocrit. (Table 1)

Directly-estimated intra-operative blood loss (based on weight difference of gauze and towels and suctioned blood volume) was lower in the transverse uterine incision group compared to the longitudinal uterine incision group (389.7 ± 98.56 vs 485.04 ± 230.6); though this difference failed to reach statistical significance. (p value=0.07). Only one case needed postoperative blood transfusion, due to anemic symptoms after an estimated blood loss of 1000 ml, in the longitudinal incision group, but that was not statistically significant. (p value =0.48) (Table 2)

Postoperative repeated analysis of hemoglobin concentration revealed higher drop in hemoglobin concentration in the longitudinal uterine incision group in comparison to the transverse uterine incision group; though lacking statistical significance. (p value=0.68)

Similar findings were found on analysis of hematocrit values in the two groups (p
value=0.72). Calculated intraoperative blood loss (derived from difference between pre- 
and post-operative hematocrit values) between the two groups was higher in the 
longitudinal incision group, yet this difference did not reach statistical significance (p 
value=0.07). *(Table 2)*

No statistically significant difference was observed between the transverse uterine 
incision group and the longitudinal uterine incision group regarding the operative time (p 
value=0.18). *(Table 3)*

There was no statistically significant difference as regards the amount of blood lost in the 
suction drain or incidence of postoperative pyrexia (p value =0.27,0.60 consecutively). 
*(Table 3)*

**Discussion**

The primary research outcome of the current research study was to statistically compare 
the intraoperative blood loss in the two research categorical groups. Other secondary 
research outcomes involved comparison of operative time and post-operative fever.

The study proved that transverse uterine incision resulted in lower volumes of blood loss 
and postoperative drop of hemoglobin and hematocrit compared to longitudinal incision, 
although this difference did not reach statistical significance. The mean blood loss in both 
research groups lies in the average range of blood loss volume observed in previous 
studies that indicated that mean blood loss during open abdominal myomectomy would be 
between 200-800 ml. *[10, 14-18]*

The mean operative time ranged between 58-88.5 minutes in different studies using the 
standard longitudinal myomectomy incision,[*10, 19-20*] which matches our observed mean 
operative time in both research groups. The variation between different studies in 
calculated blood loss and operative time was correlated to the size and number of excised
myomas.

In this study, only one case required blood transfusion in the longitudinal incision group representing 4% of cases, while none required in the transverse incision group, making no significant difference between both groups. Studies on average blood loss during myomectomy stated that blood transfusion was widely variable extending from 2 to 28% of cases.\[21\]

To our knowledge, no research studies previously made investigated the difference between longitudinal and transverse uterine incision in open abdominal myomectomy, however in a previous research, this aspect was compared in laparoscopic myomectomy. The research was conducted on 50 cases with intra-mural fibroids undergoing laparoscopic myomectomy randomly allocated into 2 groups; vertical and transverse uterine incision research groups. The results showed statistically significant reduction of blood loss in the transverse uterine incision group (137.6 ±88.1 mL) in comparison to the vertical incision research group (235.8 ±169.4 mL).\[9\] However their calculated values for mean blood loss volume are lower than the current research study that could be explained by the fact that their operative approach for myomectomy was laparoscopic and not open which normally reduces blood loss indices due to pneumoperitoneum and extensive use of electrosurgery.\[3\] As regards the operative time, there was no significant difference between both procedures, although the mean time for myomectomy via laparoscopic approach is usually longer than abdominal myomectomy due to more meticulous operative skills.

After clarifying the anatomical facts about uterine vascularity and arcuate arteries that run transversely,\[22, 23\] a transverse uterine incision seems reasonable as it would probably run parallel to the vessels causing minimal injury and the closure if the
transverse incision would be more hemostatic. Moreover, the disruption of the vascularity caused by the mere existence of a myoma implies that the longitudinal incision would not necessarily cause less blood loss.

Postoperative pyrexia developed in one patient in the transverse incision group and in two patients in the longitudinal incision group, with no significant difference between both. Various studies showed variable incidence of postoperative pyrexia, ranging from 3-32% of cases. The variation in incidence may be related to postoperative use of NSAIDs for postoperative analgesia, although myomectomy has been proved to be an independent risk factor for postoperative pyrexia that could be attributed to the formation of intra-myometrial hematomas.

By proving that blood loss is comparable in both incisions, it might be convincing to routinely adopt a transverse uterine incision during myomectomy as with cesarean section. Future research is required to investigate long term sequelae of transverse and longitudinal incisions during myomectomy as regards reproductive sequelae, incidence of uterine rupture in subsequent pregnancies and its impact on formation of pelvic adhesions.

Among the strengths of this study: (1) adequate control of confounding factors for blood loss such as number of myomas and use of hemostatics; (2) estimation of intraoperative blood loss both directly and indirectly. Limitations include: (1) although we tried to restrict the range of myoma sizes, we failed to statistically adjust blood loss to varying myoma size due to limited sample size; (2) different surgeons were involved in the study, although all had similar adequate experience.

Conclusion

Blood loss from transverse uterine incision is comparable to longitudinal incision in
myomectomy.

Abbreviations

AUB: abnormal uterine bleeding

BMI: body mass index

EBV: estimated blood volume

EBL: estimated blood loss

RPL: recurrent pregnancy loss

Declarations

Ethical Considerations:

The study was approved by Ain Shams University, Faculty of Medicine Research Ethics Committee (FWA 000017585) in September 2016 (with the number FMASU MD 264/2016) and was registered as a clinical trial with the number NCT03009812 in January 2017. All candidates signed a written informed consent.

Consent for publication:

Not applicable.

Data availability:

The data used to support our findings are available from the corresponding author if requested.

Conflicts of interest:

The authors declare that they have no conflicts of interest.

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Authors’ contribution:

The first author; AE was concerned with the planning of the research, seventh author; AF
was responsible for data gathering, last author; KA conducted the statistical analysis, and all authors contributed to the experimental work.

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Tables
|                          | Transverse Uterine Incision Group [n=25] | Longitudinal Uterine Incision Group [n=24] | P     |
|--------------------------|-----------------------------------------|------------------------------------------|-------|
| Age (Yrs)                | 28.84 ± 3.77 (27.2 - 30.3)              | 29.04 ± 4.68 (27.0 - 31.0)               | 0.86<sup>a</sup> |
| BMI (Kg/m<sup>2</sup>)   | 24.36 ± 2.85 (23.1 - 25.5)              | 23.73 ± 2.45 (22.7 - 24.7)               | 0.41<sup>a</sup> |
| Parity                   | 3 (1 - 4)                               | 3 (2 - 5)                                | 0.29<sup>b</sup> |
| Indication for myomectomy|                                         |                                          | 0.76<sup>c</sup> |
| AUB                      | 16 (64%)                                | 15 (62.5%)                               |       |
| Pressure symptoms        | 5 (20%)                                 | 5 (20.8%)                                |       |
| Infertility              | 1 (4%)                                  | 0 (0%)                                   |       |
| RPL                      | 3 (12%)                                 | 4 (16.6%)                                |       |
| Mean myoma size (mm)     | 81.72 ± 14.03 (75.9 - 87.5)             | 82.29 ± 9.85 (78.1 - 86.4)               | 0.87<sup>d</sup> |
| Myoma localization       |                                         |                                          | 0.70<sup>c</sup> |
| Type 3                   | 3 (12%)                                 | 2 (8.33%)                                |       |
| Type 4                   | 4 (16%)                                 | 4 (16.66%)                               |       |
| Type 5                   | 8 (32%)                                 | 4 (16.66%)                               |       |
| Type 6                   | 7 (28%)                                 | 10 (41.66%)                              |       |
| Type 7                   | 0                                       | 0                                        |       |
| Type 8                   | 0                                       | 0                                        |       |
| Hybrid myomas            | 3 (12%)                                 | 4 (16.66%)                               |       |
| Preoperative hemoglobin concentration (gm/dL) | 12.34 ± 0.97 (11.9 - 12.7)              | 12.63 ± 1.22 (12.1 - 13.1)               | 0.35<sup>d</sup> |
| Preoperative hematocrit (%) | 37.35 ± 3.01 (36.1 - 38.5)              | 38.25 ± 3.80 (36.6 - 39.8)               | 0.36<sup>d</sup> |

AUB, abnormal uterine bleeding; RPL, recurrent pregnancy loss

<sup>a</sup> Analysis using unpaired t-test.
<sup>b</sup> Analysis using Mann-Whitney U-test.
<sup>c</sup> Analysis using chi squared test.
<sup>d</sup> Analysis using unpaired t-test with Welch’s correction.
<sup>e</sup> According to the Leiomyoma sub-classification system [13]
Table 2. Comparison between study groups regarding directly-estimated intra-operative blood loss, need for blood transfusion, postoperative hemoglobin and hematocrit drop and calculated blood loss.

|                        | Transverse Uterine Incision Group [n=25] | Longitudinal Uterine Incision Group [n=24] | P   |
|------------------------|------------------------------------------|---------------------------------------------|-----|
| Estimated intra-operative blood loss (mL) | 389.7 ± 98.56 (349.0 – 430.4)            | 485.04 ± 230.6 (387.6 – 582.4)              | 0.07<sup>a</sup> |
| Need for blood transfusion | 0 (0%)                                   | 1 (4.16%)                                   | 0.48<sup>b</sup> |
| Hemoglobin concentration (gm/dL) |                                           |                                             | 0.68<sup>c</sup> |
| Preoperative           | 12.34 ± 0.97                              | 12.63 ± 1.22                                |     |
| Postoperative          | 10.68 ± 1.02                              | 10.13 ± 1.81                                |     |
| Mean Paired difference (95% CI) | -1.65 ± 0.71                            | -2.50 ± 1.84                                |     |
|                        | (-1.95 - -1.36)                           | (-3.28 - -1.72)                             |     |
| Hematocrit (%)         |                                           |                                             | 0.72<sup>c</sup> |
| Preoperative           | 37.35 ± 3.01                              | 38.25 ± 3.80                                |     |
| Postoperative          | 29.92 ± 2.88                              | 28.37 ± 5.07                                |     |
| Mean Paired difference (95% CI) | -7.43 ± 2.12                            | -9.87 ± 5.28                                |     |
|                        | (-8.31 - -6.55)                           | (-12.10 - -7.64)                            |     |
| Calculated intraoperative blood loss (mL) | 311.78 ± 78.85 (279.2 – 344.3)           | 388.03 ± 184.55 (310.1 – 465.9)             | 0.07<sup>d</sup> |

<sup>a</sup> Analysis using unpaired t-test with Welch’s correction.

<sup>b</sup> Analysis using Fisher’s exact test.

<sup>c</sup> Analysis using repeated measure ANOVA test. Only p value for between-subject effect is displayed.

<sup>d</sup> Analysis using unpaired t-test.

Table 3. Comparison between study groups regarding operative time, blood loss in suction drain and incidence of postoperative pyrexia.

|                        | Transverse Uterine Incision Group [n=25] | Longitudinal Uterine Incision Group [n=24] | P   |
|------------------------|------------------------------------------|---------------------------------------------|-----|
| Total operative time (min) | 59.96 ± 16.78 (53.0 – 66.8)             | 66.58 ± 17.33 (59.2 – 73.9)                   | 0.18<sup>a</sup> |
| Blood loss in suction drain (mL) | 123.0 ± 37.79 (107.3 – 138.6)         | 113.5 ± 20.27 (104.9 – 122.0)                | 0.27<sup>b</sup> |
| Postoperative pyrexia | 1 (4.0%)                                  | 2 (8.33%)                                   | 0.60<sup>c</sup> |

<sup>a</sup> Analysis using Mann-Whitney U-test.
b Analysis using unpaired t-test.

c Analysis using Fisher’s exact test.

Figures

Figure 1

Transverse elliptical uterine incision
Figure 2

Transverse incision after removal of the myoma
Figure 3
Closure of transverse incision
Figure 4
Transverse incision after closure

Supplementary Files
This is a list of supplementary files associated with the primary manuscript. Click to download.
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