ORIGINAL ARTICLE

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DURATION OF SURGERY DEPENDING ON THE NUMBER OF FIBROID NODULES AND THE SURGICAL APPROACH – OPEN, LAPAROSCOPIC, ROBOTIC

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Abstract. *Uterine fibroids are the most common benign tumors of the female reproductive system. Their treatment can be medicinal, with a more limited effect, or surgical. While operative treatment in elderly women is most often performed by hysterectomy, myomectomy with maximal preservation of the functional integrity of the uterine body is of utmost importance for future reproductive plans in women with reproductive intentions. Choosing the optimal operative approach, both in terms of efficiency and quality of life, is a key point in the operative treatment of uterine fibroid disease.*

Key words: *uterine fibroids, myomectomy, robot assisted surgery*

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INTRODUCTION

Uterine fibroids are the most common benign gynecological neoplasm during a woman's reproductive years, with a wide prevalence ranging from 5.4% to 77% [1]. More than 30% of women have fibroid tumors [2, 3]. Uterine fibroid disease is one of the most common causes of hospitalization for gynecological reasons (accounting for 1/3 of all hospitalized women) [4].

Clinically, fibroids can be classified as symptomatic and asymptomatic. For asymptomatic fibroids, it is generally recommended to monitor them objectively: an ultrasound examination every 3-6 months to assess the stability of size and symptoms. If stable, annual follow-ups may suffice. These asymptomatic fibroids, usually confined to the pelvis, do not undergo malignant degeneration, and expectant management is recommended due to the possibility of regression after the onset of menopause. In such cases, treatment is not required. For symptomatic cases, however, treatment is necessary. It can be conservative, most commonly hormonal, or surgical – either abdominal, vaginal, or hysteroscopic. Treatment should be individualized, taking into account the following factors: medical, social, age, fertility, desire to preserve the uterus, severity and specificity of symptoms, location, size, evidence of degenerative changes in the fibroid nodules, presence of comorbidities (especially oncological), and the overall health of the patient.

The significance of uterine fibroids in infertility is controversial. Studies have shown a relationship between the presence of subserosal and intramural fibroids and the outcomes of in vitro reproductive pro-

cedures. Fibroids in such locations may not deform the uterine cavity, but those larger than 5 cm are clinically significant. Submucosal fibroids, on the other hand, can cause deformation of the uterine cavity, changes in the position of the cervix, blockage of the tubal ostia, and disruption of sperm, egg, and embryo implantation [5]. Local disruption of endometrial vascularization, endometrial inflammation, and the secretion of vasoactive substances have also been reported. Studies involving pregnant women with fibroid nodules have shown an increased incidence of spontaneous abortions and preterm births compared to women without fibroids [6, 7]. Uterine fibroid disease during pregnancy can also have negative effects, including abnormal fetal presentation, placental attachment pathology, placental insufficiency, primary and secondary uterine inertia, and postpartum necrosis [8, 9].

Myomectomy is a surgical procedure to remove fibroid nodules with the goal of preserving fertility or the uterine body if desired by the woman. The main surgical techniques used for myomectomy via abdominal access are open (abdominal) myomectomy, laparoscopic myomectomy, and robot-assisted (robotic) myomectomy. The choice of approach depends on several factors: size, number, and location of the fibroid nodules, the overall size of the uterus (since this is related to spatial considerations during surgery), body mass index (BMI), comorbidities, and, importantly, the surgeon's experience.

While laparoscopic myomectomy has become the gold standard for surgical treatment of fibroid disease in recent years, robotic surgical systems have also been gaining ground. This is an evolving technology with broad applications in various surgical fields. Its superiority lies in intuitive manipulation and a true three-dimensional view, allowing it to be rapidly adopted worldwide. The robotic system offers the same benefits as laparoscopic surgery, including reduced morbidity, less pain, and fewer postoperative adhesions. It significantly improves surgical efficiency in myomectomy by ensuring delicate dissection and stronger suturing. Experienced endoscopists face no difficulty applying robot-assisted myomectomy, as long as they are familiar with robotic surgical tools. The notion that an open abdominal approach is preferable for larger uterine bodies to provide better spatial access and reduce surgery time and blood loss is now under investigation.

The aim of the present study was to analyze the intraoperative parameter duration of robotic, laparoscopic, and abdominal myomectomy, in relation to the number of fibroid nodules.

MATERIALS AND METHODS

A retrospective analysis was conducted, including 300 patients who underwent myomectomy, divided as follows: 100 robot-assisted myomectomies, 100 open abdominal myomectomies, and 100 laparoscopic myomectomies from Doverie Hospital, Dr. Shterev Hospital, and University Hospital "Maichin Dom," Sofia, during the period 2016-2020. Patients who underwent surgical treatment for fibroid disease using one of the three abdominal approaches were divided into three groups based on the preoperatively determined number of fibroid nodules, as assessed by transvaginal ultrasound: a single fibroid nodule, two/three nodules, and patients with up to or more than four nodules.

Statistical analysis was performed using one-way ANOVA (analysis of variance) for independent samples – a procedure for testing the statistical significance of the difference between the mean values for several independent groups of the independent variable (factor) by decomposing the total variance in the dependent variable into effects caused by different levels (values) of the independent variable (factor), plus error variance.

RESULTS

The results are presented in tabular form below. Through correlation analysis, we determined the presence or absence of a relationship between the number of fibroids and an indicator that significantly characterizes the success of a surgical procedure – distribution of women into groups according to the number of uterine fibroid nodules as shown in Table 1 below and duration of the surgery in minutes (Table 2).

Table 1. Distribution of operated women by number of fibroids

Number of Fibroids	Number of Women	Relative Share (%)
One	138	46.0%
Two-three	115	38.3%
Four or more	47	15.7%
Total	**300**	**100%**

Table 2. Distribution of patients with one fibroid according to the type of surgery

Surgical Method	Number of Women	Relative Share (%)
Laparoscopic	53	38.4%
Robotic	50	36.2%
Open surgery	35	25.4%
Total	**138**	**100%**

Patients with a single fibroid nodule – duration of the surgery based on the surgical approach (Table 3).

Through correlation analysis, we analyzed the presence or absence of a relationship between the number of fibroids and the duration of the surgery.

A one-way analysis of variance (ANOVA) was applied to the data to determine whether there is a difference in surgery duration depending on the surgical method used in patients with a single nodule.

Table 3. Average surgery duration in patients with one fibroid according to the type of surgery

Duration (minutes)	Laparoscopic	Robotic	Open Surgery
Number of Surgeries (n)	53	50	35
Mean Duration ()	116.9	100.4	100.9
Min. value (Min)	40	40	40
Max. value (Max)	280	240	210
F-statistic (F)	1.982		
Significance (P)	0.421		
Statistically significant difference	None		

The difference is statistically insignificant ($p>0.05$), indicating that there is no difference in the duration among the different types of surgeries in women with a single nodule.

Patients with two to three nodules were distributed in groups depending the duration of the surgery based on the surgical approach as shown in Table 4 below:

Table 4. Distribution of patients with two-three fibroids according to the type of surgery

Surgical Method	Number of Women	Relative Share (%)
Laparoscopic	33	28.7%
Robotic	37	32.2%
Open surgery	45	39.1%
Total	**115**	**100%**

A one-way analysis of variance (ANOVA) was applied to the data to assess whether there is a difference in the duration depending on the surgical method used in patients with two to three nodules as shown in Table 5 below.

The difference is statistically insignificant ($p>0.05$), indicating that there is no difference in mean duration among the different types of surgeries in women with two to three nodules.

Patients with four or more nodules were distributed in groups depending the duration of the surgery based on the surgical approach as shown in Table 6.

Table 5. Average surgery duration in patients with two-three fibroids according to the type of surgery

Duration (minutes)	Laparo-scopic	Robotic	Open Surgery
Number of Surgeries (n)	33	37	45
Mean Duration ()	119.7	106.5	106.8
Min. value (Min)	50	45	45
Max. value (Max)	280	260	220
F-statistic (F)	1.015		
Significance (P)	0.365		
Statistically significant difference	None		

Table 6. Distribution of patients with at least four fibroids according to the type of surgery

Surgical Method	Number of Women	Relative Share (%)
Laparoscopic	14	29.8%
Robotic	13	27.7%
Open surgery	20	42.6%
Total	**47**	**100%**

A one-way analysis of variance (ANOVA) was applied to the data to evaluate whether there is a difference in surgical duration depending on the surgical method used in patients with four or more nodules as shown in Table 7 below.

Table 7. Average surgery duration in patients with at least four fibroids according to the type of surgery

Duration (minutes)	Laparo-scopic	Robotic	Open Surgery
Number of Surgeries (n)	14	13	20
Mean Duration (	134.7	133.5	115.3
Min. value (Min)	80	65	60
Max. value (Max)	280	240	220
F-statistic (F)	12.198		
Significance (P)	0.001		
Statistically significant difference	Significant		

The difference is statistically significant ($p<0.05$), indicating that there is a difference in the duration between the different types of surgeries. A post-hoc Tukey HSD test was applied to determine between which types of surgeries the difference occurs as shown in Table 8.

A statistically significant difference in time duration was found among the three types of surgeries in patients with at least four nodules. The Tukey HSD test showed that the mean time duration in open surgeries for patients with four or more fibroids is significantly lower compared to laparoscopic and robotic surgeries.

Table 8. Surgical Method Comparison: P-values and Statistical Significance

Method Comparison	P	Stat. Significance
Laparoscopic vs. Robotic	0.290	None
Laparoscopic vs. Open Surgery	0.008	Significant
Robotic vs. Open Surgery	0.043	Significant

DISCUSSION

From the results obtained, it is evident that in the surgical treatment of uterine fibroid disease, the duration of surgery for the removal of one or two/three fibroids does not show significant differences, regardless of the surgical approach used. A statistically significant difference in duration was observed among the three types of surgeries for patients with at least four fibroids. The duration of open surgeries in patients with a minimum of four fibroids is shorter than that of laparoscopic and robotic surgeries. Although the difference in duration is approximately 20 minutes, this is nonetheless a period during which the patient is under general anesthesia and the surgeon is subjected to strain.

Therefore, in cases with more than four fibroids, an open abdominal approach is more suitable as it provides better spatial access and reduces the operation time. Predictably, surgeons tend to prefer the open approach in cases with a higher number of fibroids—the number of patients undergoing open abdominal surgery increases with the number of fibroids.

Some advantages of this type of myomectomy include the absence of limitations regarding the size and/or number of fibroids, the ability to palpate and completely remove all fibroid nodules. The simplicity of this open surgical technique, depending on the surgeon‘s experience and skill, is also a significant advantage.

From a reproductive standpoint, studies indicate favorable reproductive outcomes and a high pregnancy rate in patients undergoing robotic myomectomy [10, 11, 12]. Robotic myomectomy is considered a minimally invasive and safe alternative to open myomectomy for appropriately selected candidates. It is associated with shorter hospital stay compared to abdominal myomectomy, improved cosmetic outcomes due to smaller skin incisions, reduced use of analgesics, quicker return to normal activities, and faster recovery of bowel function [13]. However, a major disadvantage of robotic myomectomy remains its high cost.

CONCLUSION

In recent years, surgical techniques for the treatment of uterine fibroid disease have expanded significantly. Both open and laparoscopic myomectomy have their indispensable applications. Laparoscopic myomectomy is emerging as the gold standard due to its lower procedural cost and reduced patient trauma, particularly in cases involving up to four fibroid nodules.

The data obtained from our study clearly support the use of open surgeries over other approaches for patients with more than four fibroid nodules. The analysis demonstrates satisfactory surgical outcomes concerning operation duration. Optimization of endoscopic techniques and enhancement of surgeon expertise are necessary to minimize operative time while leveraging the advantages of the endoscopic surgical approach.

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