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Non-obstetric surgery and anesthesia during pregnancy. Five-year single-center retrospective analysis

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Abstract

Background/Aim: Surgical procedures during pregnancy incur great difficulties for both the surgeon and the anesthesiologist. Changing maternal and fetal physiology changes both the pharmacodynamics and pharmacodynamics of the anesthetic drugs administered. In this study, the researcher aimed to determine the risk factors of non-obstetric surgery or anesthesia that cause preterm labor and/or low birth weight.

Methods: Our study was planned as a single-center retrospective study and was carried out by scanning the data of 52 pregnant patients between 2015 and 2020. Preterm labor and low birth weight were defined as adverse events. The patients were divided into two groups: those who developed adverse events and those who did not. The effects of age, parity, type of surgery and anesthesia, duration of surgery, gestational age, mode of delivery, and birth weight on mortality have been investigated.

Results: Comparing the patient groups with and without adverse events, no statistically significant difference was found between their general characteristics, anesthesia, and surgical characteristics (P>0.05).

Conclusion: In the study, the researcher analyzed the surgical and anesthesia factors of non-obstetric surgery. It was concluded that neither surgical nor anesthetic factors independently increased the risk of preterm labor or low birth weight.

Keywords: non-obstetric surgery, preterm labor, low birth weight

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Ethics Committee Approval
The study was approved by Sisli Hamidiye Etfal Training and Research Hospital Ethics Committee with the number 2363 on June 13, 2023. All procedures in this study involving human participants were performed in accordance with the 1964 Helsinki Declaration and its later amendments.

Conflict of Interest
No conflict of interest was declared by the authors.

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Introduction

Surgical procedures during pregnancy are a serious source of concern for both the surgeon and the anesthesiologist. Therefore, the tendency in pathologies requiring surgery is to postpone the procedure after pregnancy. Nonetheless, indications such as acute appendicitis, trauma-related orthopedic surgery, or maternal malignancy necessitate surgery during pregnancy. The need for non-obstetric surgery during pregnancy varies between 0.75% and 2% [1].

Acute appendicitis ranks first among the indications that constitute the need for this surgery, followed by acute cholecystitis and maternal trauma [2]. Data on both non-obstetric surgery and anesthesia methods and timing to be applied during pregnancy are contradictory. Although a clinical study conducted with retrospective analysis of data on 6.5 million pregnancies in the UK showed that fetal complications of non-obstetric surgery are low and non-obstetric surgery is safe during pregnancy, it was reported in other studies that non-obstetric surgery progressed with increased fetal and maternal complications [3–6]. Reviewing these complications, preterm labor, low birth weight, and pregnancy loss take the first place.

In this study, the researcher aimed to determine the risk factors of non-obstetric surgery or anesthesia that cause preterm labor and low birth weight.

Materials and methods

For the retrospective observational study, approval was obtained from the Sisli Hamidiye Etfal Training and Research Hospital Ethics Committee of our hospital on 13/06/2023 with number 2363. All procedures were carried out in accordance with the ethical standards specified in the Declaration of Helsinki (2008). Data analysis was performed by two anesthesiologists, and while reviewing the diagnoses of the patients, The International Classification of Diseases, 10th Revision (ICD-10) diagnostic codes were used. It was planned to list all patients who had been diagnosed with pregnancy with Z33 and Z32.1 codes between 2015 and 2020 by scanning the data processing system of our hospital. Patients who underwent non-obstetric surgery during pregnancy were included in the study. Patients who did not undergo non-obstetric surgery, whose antenatal follow-up and delivery were not performed in our hospital after surgery, who underwent non-obstetric surgery in the same session as cesarean section, who were operated under local anesthesia, or whose data were incomplete were not included in the study.

Non-obstetric surgery was defined as the surgery performed during pregnancy other than fetal surgery, cesarean section, uterine surgery, cervical circulation, tubo-ovarian surgery, and dilatation curettage. Non-obstetric surgical procedures were scanned by extracting the cesarean code in the operating room module of the hospital data processing system, considering the multitude of possible diagnostic codes. The type of surgery, duration of the surgery, and the gestational week in which it was performed were recorded. Non-obstetric surgical procedures applied were grouped under the headings of gastrointestinal surgery, urinary system surgery, and others. The gestational week in which the surgery was performed was also grouped under 1st, 2nd, and 3rd trimester headings.

In our hospital, the American Society of Anesthesiologists guide is taken into consideration in the application of obstetric surgery anesthesia [7]. In our hospital, for the last 10 years, general anesthesia induction for non-obstetric surgery has been routinely performed with propofol, fentanyl, and rocuronium, followed by sevoflurane, intermittent fentanyl, or remifentanil infusion. Bupivacaine is used in neuraxial anesthesia and peripheral nerve blocks. Anesthesia type was grouped under general anesthesia, neuraxial anesthesia, sedation, and regional anesthesia headings. The type and duration of anesthesia were recorded.

Among the listed patients who had non-obstetric surgery, age, parity, cesarean and vaginal delivery, gestational time of birth, birth weight, preterm labor, and abortion diagnoses were manually scanned and recorded.

Preterm labor and low birth weight were defined as adverse events. The patients were divided into two groups: those with and without adverse events. The primary finding of the study is to determine the risk factors related to anesthesia and surgical procedures that may cause adverse events. The secondary finding is to define the general characteristics of non-obstetric surgeries performed in our hospital.

Statistical analysis

For statistical analysis, the SPSS 15.0 program (SPSS Inc., Chicago, IL, USA) for Windows was used. The descriptive statistics were considered as number and percentage for categorical variables, and mean, standard deviation, minimum, and maximum values for numerical variables. Ratios in the groups were compared with the Chi-Square Test. Comparisons of numerical variables between two independent groups were made with the Student's T-Test when the normal distribution condition was met, and the Mann-Whitney U test when the condition was not met. Risk factors were examined by Logistic Regression Analysis. The alpha significance level was accepted as P-value <0.05.

Results

A total of 8,053 pregnant subjects were screened between 2015 and 2020. From these, 91 (1.13%) underwent non-obstetric surgery. Among them, 18 patients had concurrent cesarean, and 21 were missing in the follow-up. The remaining 52 patients were included in the final analysis. Characteristics of the patients analyzed are presented in Table 1. Gastrointestinal and urinary surgery were performed on the majority of the patients (19 patients each, 38 patients [73%] total). Double-J ureteral stenting (n=19) and appendectomy (n=15) were the leading causes for these surgeries. Details of the surgeries are presented in the Supplemental Table 1.

Adverse events of any type occurred in 13 (25%) patients. Of these, 5 had low birth weight alone, 2 had preterm labor alone, and 6 had both preterm labor and low birth weight. Most of the patients underwent sedation (n=22) and general anesthesia (n=19).

The type of surgery or type of anesthesia did not affect the outcome of having any adverse events upon the birth. Also, parity and the trimester in which the surgery was performed did

Table 1: Comparison of patient groups with and without adverse events.

			Adverse events		
		Total N=52	**Yes n=13 (%25)**	**No n=39 (%75)**	***P*-value**
Demography					
Age (yrs.)		27.5 (4.9) (19-37)	27.0 (3.9) (20-34)	27.7 (5.2) (19-37)	0.674*
Parity	Nulliparae	20 (38.5)	7 (53.8)	13 (33.3)	0.399#
	Primipara	13 (25.0)	3 (23.1)	10 (25.6)	
	Multipara	19 (36.5)	3 (23.1)	16 (41.0)	
Surgical Features					
Surgical type	Gastrointestinal Surgery	19 (36.5)	6 (46.2)	13 (33.3)	0.521#
	Urinary Surgery	19 (36.5)	3 (23.1)	16 (41.0)	
	Others	14 (27)	4 (30.8)	10 (25.6)	
Anesthesia type	General Anesthesia	19 (36.5)	6 (46.2)	13 (33.3)	0.166#
	Neuraxial anesthesia	10 (19.2)	3 (23.1)	7 (17.9)	
	Sedation	22 (42.3)	3 (23.1)	19 (48.7)	
	Regional anesthesia	1 (1.9)	1 (7.7)	0 (0.0)	
Trimester	1st Trimester	8 (15.4)	1 (7.7)	7 (17.9)	0.457#
	2nd Trimester	28 (53.8)	6 (46.2)	22 (56.4)	
	3rd Trimester	16 (30.8)	6 (46.2)	10 (25.6)	
Gestational age		23.1 (7.8) (5-36)	25.9 (7.9) (6-35)	22.1 (7.6) (5-36)	0.082£
Surgical Duration (hrs.)		70.4 (51.0) (25-290)	63.5 (37.9) (30-155)	72.7 (54.9) (25-290)	0.907£
Anesthesia Duration (hrs.)		87.9 (59.1) (35-330)	81.9 (42.9) (40-180)	89.9 (63.9) (35-330)	0.807£
Delivery Features					
Delivery type	Vaginal delivery	11 (21.2)	4 (30.8)	7 (17.9)	0.435#
	Cesarean	41 (78.8)	9 (69.2)	32 (82.1)	

* Student's T-Test £Mann-Whitney U test # Chi-Square Test

Table 2: Adverse events risk factors univariate and multivariate logistic regression analysis

	Univariate				**Multivariate**			
	P	**OR**	**95% C.I.**		***P***	**OR**	**95% C.I.**	
Age	0.667	0.972	0.852	1.108	0.767	0.970	0.791	1.188
Parity (Ref: Nulliparae)	0.390				0.146			
Primipara	0.469	0.557	0.114	2.716	0.132	0.156	0.014	1.746
Multipara	0.179	0.348	0.075	1.621	0.077	0.077	0.004	1.317
Surgery Type (Ref: Gast. Surgery)	0.509				0.258			
Urinary Surgery	0.260	0.406	0.085	1.947	0.682	0.459	0.011	19.130
Others	0.853	0.867	0.191	3.923	0.234	5.893	0.318	109.238
Anesthesia Type (Ref: General Anesthesia)	0.570				0.467			
Neuraxial anesthesia	0.930	0.929	0.176	4.897	0.435	0.375	0.032	4.394
Sedation	0.176	0.342	0.072	1.620	0.111	0.034	0.001	2.178
Regional anesthesia	1.000			.	1.000			
Trimester (Ref: 1st Trimester)	0.353				0.772			
2nd Trimester	0.579	1.909	0.195	18.692	0.474	4.582	0.071	295.269
3rd Trimester	0.227	4.200	0.410	43.035	0.542	6.803	0.014	3228.9
Gestational age	0.132	1.074	0.979	1.177	0.729	1.045	0.815	1.339
Surgical Duration	0.571	0.996	0.982	1.010	0.542	0.916	0.692	1.214
Anesthesia Duration	0.673	0.997	0.986	1.009	0.700	1.046	0.830	1.319

Ref: Reference, Gast: Gastrointestinal

Table 3: Preterm labor risk factors univariate and multivariate logistic regression analysis

	Univariate				**Multivariate**			
	P	**OR**	**95% C.I.**		***P***	**OR**	**95% C.I.**	
Age	0.751	0.975	0.833	1.141	0.278	0.812	0.557	1.183
Parity (Ref: Nulliparae)	0.998				0.909			
Primipara	0.976	1.030	0.148	7.193	0.685	2.648	0.024	293.5
Multipara	0.946	1.062	0.187	6.052	0.958	1.172	0.003	449.2
Surgery Type (Ref: Gast. Surgery)	0.365				0.712			
Urinary Surgery	0.181	0.208	0.021	2.070	0.999			.
Others	0.979	1.023	0.189	5.526	0.410	9.503	0.045	2019.8
Anesthesia Type (Ref: General Anesthesia)	0.986				0.846			
Neuraxial anesthesia	0.706	0.700	0.109	4.477	0.367	0.089	0.000	17.112
Sedation	0.998	0.000	0.000	.	0.998	0.000	0.000	.
Regional anesthesia	1.000			.	1.000			.
Trimester (Ref: 1st Trimester)	0.681				0.808			
2nd Trimester	0.999			.	0.999			.
3rd Trimester	0.999			.	0.999			.
Gestational age	0.099	1.109	0.981	1.255	0.265	1.472	0.746	2.907
Surgical Duration	0.891	0.999	0.983	1.015	0.254	1.300	0.828	2.042
Anesthesia Duration	0.990	1.000	0.987	1.013	0.214	0.774	0.516	1.159

Ref: Reference, Gast: Gastrointestinal

not alter the rate of complication. Finally, anesthesia or surgery duration did not influence the risk of having a complicated delivery. Multivariate regression also did not reveal any potential risk factors (Table 2).

When preterm labor and lower birth weight were analyzed for the potential risk factors associated with each outcome, no relationship was found. Additionally, multivariate regression similarly did not show any relationship between these assumed risk factors and the outcome (Tables 3 and 4).

Discussion

Surgical procedures during pregnancy can present great difficulties for both the surgeon and the anesthesiologist. Maternal and fetal physiology changes affect both the pharmacodynamics and pharmacodynamics of the anesthetic drugs administered [8]. In particular, the bioavailability, distribution, and excretion of some drugs are affected by the physiological changes associated with pregnancy. The most striking change in bioavailability is liver enzyme activity. This affects the metabolism and absorption of drugs. Maternal weight gain and increased plasma volume change the distribution of

Table 4: Low birth weight risk factors univariate and multivariate logistic regression analysis

	Univariate				Multivariate			
	P	**OR**	**95% C.I.**		***P***	**OR**	**95% C.I.**	
Age	0.383	0.938	0.814	1.082	0.546	0.934	0.748	1.166
Parity (Ref: Nulliparae)	0.170				0.137			
Primipara	0.228	0.338	0.058	1.972	0.146	0.159	0.013	1.901
Multipara	0.085	0.218	0.039	1.232	0.065	0.042	0.001	1.224
Surgery Type (Ref: Gast. Surgery)	0.733				0.207			
Urinary Surgery	0.430	0.525	0.106	2.603	0.869	0.718	0.014	37.09
Others	0.746	0.764	0.149	3.916	0.162	10.359	0.391	274.6
Anesthesia Type (Ref: General Anesthesia)	0.697				0.477			
Neuraxial anesthesia	0.833	1.200	0.220	6.534	0.558	0.450	0.031	6.508
Sedation	0.314	0.442	0.090	2.166	0.123	0.026	0.000	2.668
Regional anesthesia	1.000	0.000	0.000	.	0.999	0.000	0.000	.
Trimester (Ref: 1st Trimester)	0.480				0.612			
2nd Trimester	0.721	1.522	0.151	15.296	0.333	9.312	0.102	852.9
3rd Trimester	0.334	3.182	0.304	33.259	0.336	25.965	0.034	19697
Gestational age	0.291	1.052	0.958	1.155	0.976	0.996	0.769	1.290
Surgical Duration	0.871	0.999	0.985	1.013	0.567	0.919	0.689	1.226
Anesthesia Duration	0.900	0.999	0.988	1.011	0.713	1.045	0.827	1.320

Ref: Reference, Gast: Gastrointestinal

water-soluble drugs. The increase in plasma volume leads to a decrease in the concentrations of plasma proteins, resulting in an increase in the free levels of drugs that bind to plasma proteins. Increased cardiac output during pregnancy causes an increase in renal blood flow and glomerular filtration rate and decreases the half-life of drugs by causing rapid excretion.

It is possible to categorize the risk factors of anesthesia applied during pregnancy under the maternal and fetal risk factors heading. Aspiration pneumonia is one of the leading maternal risk factors. This is due to the prolonged gastric emptying time [9]. Another maternal risk factor is difficult airway and difficult intubation due to weight gain and upper airway edema. These complications were not encountered in the patients we scanned. However, the limited number of patients may be the reason for this. The most important of the fetal risk factors is the teratogenicity of anesthetic drugs. Although nitrous oxide has been shown to be teratogenic in animal experiments, there is no evidence that anesthetic drugs are teratogenic in humans [10]. Nevertheless, despite the fact that there are guidelines for the safe use of anesthetic drugs during pregnancy, there is no definitive evidence.

In the literature, the incidence of non-obstetric surgery needed during pregnancy was reported as 0.75%–2% [1]. The incidence of non-obstetric surgery was found to be 1.13% in our study. However, it is not exactly known whether non-obstetric surgery performed during pregnancy is associated with adverse events. Vujic et al. [11] and Cho et al. [12] reported in their study that non-obstetric surgery performed during pregnancy does not increase adverse events, and the procedures can be performed safely. On the other hand, in a study carried out with data on 6.5 million patients in the UK, it was shown that non-obstetric surgery increased the risk of low birth weight and preterm labor [3]. Nonetheless, risk factors of surgery or anesthesia were not analyzed in this study.

Appendectomy and cholecystectomy are the most common non-obstetric surgeries [13]. In our study, the most common indication for non-obstetric surgery was appendectomy, followed by double-J ureteral stenting. In their study, Vujic et al. [11] stated that 63% of the patients were operated on for acute appendicitis, 11% for adnexal mass, 5% for cholelithiasis, and 21% for other reasons. Cohen et al. [5] concluded in their meta-analysis of 54 studies that the most common non-obstetric surgery is acute appendectomy. Jenkins et al. [14] determined this rate as 34% ovarian mass and 16% appendectomy, but this result may be related to case selection and the fact that the hospital where the study was carried out was a branch hospital. The double-J ureteral stenting stood out in our study because it was not defined as non-obstetric surgery and was not included in many studies in the literature. However, since we applied sedation or general anesthesia and looked at the study from an anesthesia perspective, we included these patients. Another surgery frequently performed during pregnancy is cervical circulation, which is classified as obstetric. Yu et al. [15] stated in their study that the most common surgery performed during pregnancy was cervical circulation, with 33.12%. However, since cervical circulation was in the obstetric surgery group in our study and in the literature, it was not included in our studies. Nevertheless, the high incidence is again noteworthy.

When the studies in the literature were examined, Balinskaite et al. [3] stated that 55% of the patients who had non-obstetric surgery were multipara. However, no study in the literature, including this study, has evaluated parity as a risk factor. Although parity is not a statistical risk factor for complications in our study, it is significant that the rate is low in multiparous patients.

Cho et al. [12] and Jenkins et al. [14] also found that prolonged surgery was associated with increased adverse events. This was associated with longer exposure to anesthetic drugs and surgical stress. However, Vujic et al. reported that the mean duration of surgery was 50 minutes and did not increase the incidence of adverse events. In our study, the mean surgery duration was 70.4 minutes, which did not increase the risk of adverse events.

We observed that none of the anesthesia methods applied in our study independently increased the risk of complications. It was also observed that the most common anesthesia method was sedation. Patients who were sedated in the studies were either not included at all or included in the general anesthesia group. This situation may be associated with the low dose and anesthetic medication duration in sedation. Due to the retrospective and descriptive nature of the study, we found it correct to include the data of patients who underwent sedation in the study. Choosing the anesthesia method is very difficult for all clinicians. There is a perception that general anesthesia will increase these risks. Nevertheless, the data on this subject in the literature are extremely contradictory. Jenkins et al. [14] and

Devroe et al. [16] concluded in their study that general anesthesia increased adverse events. On the other hand, there are also studies that reached similar adverse event rates in the anesthesia methods [11,12,15].

Another difficulty in non-obstetric surgery is the timing of surgery. The American College of Obstetricians and Gynecologists Committee recommends postponing elective surgeries until after pregnancy; however, if the surgery cannot be postponed, it should be applied in the 2nd trimester [17]. In our study, the majority of surgeries were performed in the second trimester. It was observed that surgeries performed in all trimesters had similar adverse event rates. In the literature, it was observed that two studies examined the trimesters in which surgery was performed, and similar adverse event rates were obtained in all trimesters in those studies [14,16].

Limitations

Our study had limitations. The first of these is that we were only able to scan the data for the years 2015–2020. The reason for this is that the program regarding the database in our hospital has changed with the COVID-19 pandemic, and this program has not been integrated for analysis. Another limitation is that we could not access the data of patients who had non-obstetric surgery in our hospital yet had subsequent pregnancy follow-ups in another health center. This led to a decrease in the number of patients analyzed. Prospective observational studies planned in this field will make greater contributions to the literature.

Conclusion

Our study analyzed the surgical and anesthesia factors of non-obstetric surgery. It was concluded that neither surgical nor anesthetic factors independently increased the risk of preterm labor or low birth weight. However, these results alone cannot be sufficient due to the small size of the study group and the retrospective nature of the study. All of the studies in the literature were designed retrospectively. This is due to concerns about ethics and the sensitivity of the included patient group. Evaluating these studies in general, postponing elective surgery during pregnancy, performing the surgeries that cannot be postponed in the second trimester, keeping surgery and anesthesia duration short, and planning and applying the whole process by a multidisciplinary team are the prominent recommendations.

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