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The Complications after General Anesthesia between Female and Male Genders in the First 24 Hours after Surgery

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Abstract:

Background: During surgery, the body responds to injury. These physiological responses lead to an imbalance in the physiologic activity of the body.

Objective: This study aimed to compare the incidence of complications after general anesthesia between males and females in the first 24 hours postoperatively.

Methods: This is a cross-sectional study. The study population included 150 patients who were candidates for surgery in the age range of 18-55. The sampling method was simple and sequential, and the selection of samples continued to reach 75 in both male and female groups. The collected data were analyzed by SPSS v.18 software and descriptive statistics, chi-square and Repeated Measure tests. Finally, P <0.05 was considered statistically significant.

Results: The incidence of some complications after general anesthesia was significantly higher in women than in men, including hypertension, tachycardia, tachypnea, restlessness, reduction of SaO2, hypotension, pain, vomiting, nausea, and drowsiness. Also, some complications were observed in women more than men, but they were not statistically significant, including voice violence, urinary retention, bradypnea, and shivering. Bradycardia was the only complication that was seen in men more than women but was not statistically significant. It was also observed that all complications after 24 hours significantly decreased in all patients.

Conclusion: It is suggested that in future studies, this type of study should be conducted with a larger sample size in different populations and compared with other types of anesthetics.

Keywords: Complications, General anesthesia, Sex, Surgery, Male, Female.

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1. INTRODUCTION

Several factors influence the choice of anesthesia for each surgery, such as the procedure type, urgency level, and patient's condition. There is no universal anesthesia method suitable for all surgeries. Key considerations include effective pain management, monitoring physiological changes, individual responses to anesthetic drugs, and weighing the benefits and risks of different techniques. An anesthetist aims for a method that maximizes patient safety, comfort, and surgical conditions while minimizing complications [1].

Various anesthetic procedures, like local, topical, regional, and general anesthesia, offer distinct advantages and disadvantages [2]. An anesthetist selects the

appropriate type based on the patient's needs. For instance, regional anesthesia (*e.g.*, epidural, spinal) involves injecting drugs directly into the spinal area while the patient remains awake [3]. This method minimizes the risk of complications like pulmonary aspiration, speeds up oral nutrition, and reduces recovery time [4].

General anesthesia, administered *via* intravenous or inhaled injection, offers rapid deployment and better cardiovascular stability and respiratory control [5]. It is often chosen when regional anesthesia isn't feasible due to factors like coagulation defects or emergencies. During surgery, the body responds to injury with hormonal changes, disrupting physiological balance [6]. General anesthesia can exacerbate this imbalance due to its delayed effects, leading to complications like blood pressure fluctuations, nausea, vomiting, and others, such as changes in heart rate, sleep disturbances, urinary retention, and skin trauma [7, 8]. Different studies have reported varying rates of complications from general anesthesia. Kluger *et al*. (2002) found significant physiological complications requiring long-term care in 29% of patients in a New Zealand study [9]. Another study by Babin *et al*. (2004) observed tachycardia in 30% of ICU patients under general anesthesia [10, 11]. Morris *et al*. (year) reported hypoxia in 14% of patients in their study evaluating hypoxemia post-general anesthesia [12-14]. Ajuziegu *et al*. (2010) noted that females experienced significantly higher rates of nausea, vomiting, headache, and back pain compared to males ($P < 0.05$), with women also taking longer to recover to normal health ($P < 0.05$) [15, 16]. In a study by Stadler *et al*. (2003), women experienced significantly higher rates of nausea and vomiting after general anesthesia compared to men ($P < 0.05$) [17]. Conversely, Canby *et al*. (2008) found no significant difference in complication rates between sexes [18]. Given the prevalence of general anesthesia in surgeries and potential hormonal and physiological differences between genders, this study aimed to compare complication rates within the first 24 hours post-surgery.

2. METHODS

This is a cross-sectional study. The study population consisted of surgical candidates aged between 18 and 55 years who were hospitalized in the surgical wards of Shahada Ashayer Hospital in 2017 due to conditions such as Fisher's fistula repair, hemorrhoidectomy, and hernia repair. Sampling was done easily and sequentially, continuing until the desired number of cases was reached in both male and female groups.

To determine the sample size, considering the values below and using the sample size formula, a sample size of 72 was determined in each group, which, due to potential dropout, 75 samples were selected in each group of women and men, totaling 150 samples.

2.1. Entry Criteria

Patients who were surgical candidates for Fisher's fistula repair, fistulotomy, hemorrhoidectomy, and abdominal hernia repair and had received general anesthesia and consent to participate in the study.

2.2. Exit Criteria

Lack of consent to participate in the study.

Ninety-six surgery patients were enrolled in the study. The inclusion criteria were studied, and patients were given a written informed consent form to fill out. Then, the patients were divided into two groups: male and female. Inclusion criteria for entering into the study included age 18-55, ASA CLASS I, and no systemic illness. For patients, premedication was initially administered with 1-2µg / kg fentanyl and 1-2µg/kg midazolam. Then, induction was performed with thiopental 5-6 mg/kg and 0.3 mg/kg atracurium, and then the intubation was performed appropriately with the coated trachea tube.

Oxygen and isoflurane (1.5%) were used, and If necessary, the muscle relaxant and narcotic were repeated. At the end of the procedure, neostigmine and atropine were used as reversal agents for muscle relaxants. If the extubation criteria were met, the extubated patient with stable vital signs was transferred to recovery. Then, necessary treatments were administered as needed. In recovery and at 6, 12, 18, and 24 hours post-operation, adverse effects of general anesthesia were recorded in a questionnaire administered by an unaware interviewer. After collecting and statistically analyzing the questionnaires by the project statistician, the occurrence of post-anesthesia complications between the two genders was compared.

2.3. Data Analysis

After collecting the questionnaires, a statistical analysis of the results was computed by a statistical consultant, and the complications after general anesthesia were compared between the two sexes. Data were collected and entered SPSS software v.18 software, and the ratios of central indexes and dispersion were used to analyze the data using Chi-square, Cochrane, Friedman, and Repeated Measures, and the results were reported at a significant level of 5%.

3. RESULTS

In this cross-sectional study of 150 patients, evenly split between men and women aged 18-55, there was no significant age difference between the groups ($P = 0.536$). Post-surgery, 56% of women and 60% of men experienced hypertension within 6 hours, declining over time. After 12 hours, stability was observed in both groups. Generalized estimating equation (GEE) logistic regression indicated women had twice the likelihood of hypertension compared to men within 12 hours post-surgery ($p = 0.031$). Moreover, every 6 hours decreased the likelihood of hypertension by 33% ($p <0.001$).

In the female group, 3.58% had tachycardia upon recovery, increasing to 4.35% after 6 hours and then decreasing to 3.6% after 12 hours. For males, 80% had tachycardia at recovery, reducing to 20% after 6 hours. Stability was observed after 12 hours for females and 6 hours for males. GEE logistic regression indicated women

had a 5.4 times higher chance of tachycardia than men within 12 hours post-surgery (p <0.001). Additionally, every 6 hours decreased the chance of tachycardia by 33% (p <0.001).

In the female group, 7.50% had tachypnea at recovery, decreasing to 1.45% after 6 hours and then to 2.4% after 12 hours. For males, 5.62% had tachypnea at recovery, decreasing to 5.37% after 6 hours. Stability was observed after 12 hours for females and 6 hours for males. GEE logistic regression indicated women had a 4.6 times higher risk of tachypnea than men, which was statistically significant (p <0.001). Additionally, every 6 hours decreased the chance of tachypnea by 29% (p <0.001).

In the female group, 6.63% had sound atrocities at recovery, slightly increasing to 7.22% after 6 hours and then decreasing to 6.13% after 12 hours. For males, all cases occurred at recovery. Both groups remained stable afterward. GEE logistic regression showed women had twice the likelihood of sound violence compared to men, though not significantly (P=0.11). Moreover, every 6 hours reduced the incidence of voice violence by 30%, statistically significant (p = 0.001).

In the women's group, 7.65% were restless at recovery, decreasing to 3.31% after 6 hours and 3% after 24 hours. For men, 6.78% were restless at recovery, reducing to 4.21% after 6 hours. Both groups remained stable afterward. GEE logistic regression revealed women had an 8.3 times higher likelihood of restlessness than men, statistically significant (P<0.001). The negative time coefficient suggests a reduction of 18% in restlessness every 6 hours.

Regarding urine retention, 9.76% of women had it at recovery, decreasing to 1.23% after 6 hours. For men, 5.87% had it at recovery, decreasing to 5.12% after 6 hours. After 6 hours, both groups stabilized. GEE logistic regression indicated women had an 8.1 times higher likelihood of urine retention, though not statistically significant (p <0.001). The negative time coefficient implies a chance of reduction with time (every 6 hours).

In the women's group, 6.78% had a decrease in SaO_2 at recovery, decreasing to 4.21% after 6 hours. In the recovery group, all patients experienced SaO_2 reduction. Both women and men remained stable after 6 and 12 hours, respectively. GEE logistic regression revealed women had 2.4 times higher chance of SaO2 reduction than men, statistically significant (p = 0.014). Additionally, every 6 hours decreased the chance of SaO_2 reduction by 12%, statistically significant (p <0.001).

In the women's group, 7.6% experienced bradycardia, with no changes in the male group. There was no significant relationship between sex and bradycardia (P=0.58). Additionally, no significant sex-based difference was observed in bradypnea.

Regarding hypotension, 6.68% of women experienced it at recovery, decreasing to 3.5% after 12 hours and further reducing after 18 hours. In the recovery group, all patients had hypotension. Both women and men remained stable after 18 hours, and recovery, respectively. GEE logistic regression indicated women had a 5.3 times higher chance of hypotension than men, significant (p <0.001). Moreover, every 6 hours reduced the chance of hypotension by 19%, statistically significant (p <0.001). The results of the analysis of variance of repeated measures showed that in women, the mean score of pain severity in women and time is significantly difference (p <0.001), and in men, similarly, the mean changes, the severity of pain is also significant over time (p <0.001). It was also observed that between changes, the mean score of pain severity in both men and women over time is significant, and these changes are statistically significant between the two sexes, as these changes are significantly higher for women (Fig. **1**). In the female group, 8.56% had 1 or 2 vomiting episodes at recovery, reducing to 8.37% after 6 hours and 4.5% after 12 hours. Additionally, 9.75% vomited 2 times or more at recovery, decreasing to 1.24% after 6 hours. For men, 5.62% vomited at recovery, increasing to 8.18% after 6 and 12 hours. Both groups remained stable after 12 hours with no changes. GEE regression revealed women had a significantly higher risk of vomiting than men, about 6.4 times higher (p < 0.001). Moreover, vomiting rates decreased significantly over time in both groups (p < 0.001). In the women's group, 3.54% had 1 or 2 vomiting episodes at recovery, increasing to 40% after 6 hours and 7.5% after 12 hours. Additionally, 1.73% vomited 2 times or more at recovery, rising to 9.26% after 6 hours. For men, 6.63% vomited at recovery, decreasing to 2.18% after 6 and 12 hours. Both groups remained stable after 12 hours with no changes. GEE regression revealed women had a significantly higher risk of vomiting than men, about 6.4 times higher (p < 0.001). Moreover, vomiting rates decreased significantly over time in both groups (p < 0.001). In the women's group, 3.54% experienced 1 or 2 vomiting episodes at recovery, increasing to 40% after 6 hours and 7.5% after 12 hours. Moreover, 1.73% vomited 2 times or more at recovery, rising to 9.26% after 6 hours. In contrast, in the men's group, 6.63% had vomiting at recovery, declining to 2.18% after 6 and 12 hours. Both groups remained stable after 12 hours with no changes. GEE regression indicated significantly higher nausea levels in women than men, about 6 times higher (p < 0.001). Additionally, nausea levels decreased in both groups over time.

In the women's group, 70% had mild shivering at recovery, decreasing to 30% after 6 hours, while 5.45% had moderate shivering at recovery, increasing to 30% after 6 hours. Furthermore, 80% had severe chills at recovery, decreasing to 20% after 6 hours, with all patients having severe chills after 6 hours. In the men's group, 3.77% had mild shivering at recovery, increasing to 7.22% after 6 hours. Additionally, all patients experienced moderate shivering at recovery, and 100% had very severe chills at recovery, with one patient remaining after 6 hours. GEE regression indicated a higher risk of high cholesterol levels in women compared to men within 12 hours, with the severity of nausea about 3.1 times higher in women, although not statistically significant (p = 0.50). However, both groups experienced a significant decrease in the severity of nausea over time.

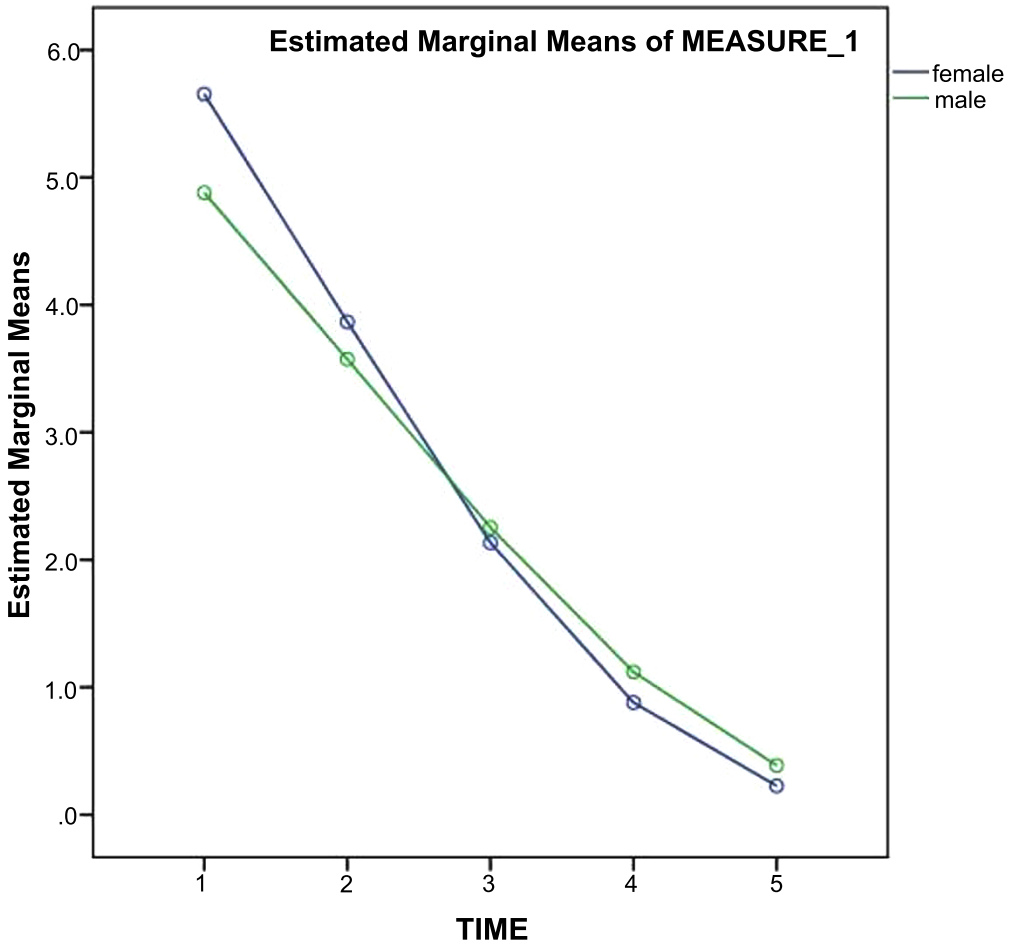

Fig. (1). Comparison of pain score between two sexes in 24 hours.

In the women's group, 4.52% experienced acoustic stimulation at recovery, increasing to 5.40% after 6 hours and decreasing to 1.7% after 12 hours. Additionally, 81% woke up with touch stimulation at recovery, decreasing to 19% after 6 hours. For men, 4.68% had acoustic stimulation at recovery, increasing to 6.31% after 6 hours, with all patients waking up with touch stimulation at recovery.

GEE regression revealed a higher risk of high sleepiness levels in women compared to men within 12 hours, approximately 3.3 times higher in women, statistically significant ($p < 0.001$). Both groups experienced lower levels of sleepiness over time ($p < 0.001$). No hyperthermia, hypothermia, myalgia, or skin trauma were observed in either group within 24 hours (Table **1**).

Table 1. The incidence of hypertension, tachycardia, tachypnea, voice hoarseness, restlessness, urinary retention, reduction in sao_2, hypotension, vomiting severity, nausea intensity, shivering intensity and drowsiness in both sexes within 12 hours after surgery.

Hypertension					
Time	-	Recovery	6h	12h	18h
Gender	Female	-	-	-	-
No	Frequency	47 (%26.9)	55 (%31.4)	73 (%41.7)	-
Yes	Frequency	28 (%56)	20 (%40)	2 (%4)	-
Gender	Male	-	-	-	-
No	Frequency	57(%29.2)	65(%33.3)	73 (%37.4)	-
Yes	Frequency	18(%60)	10(%33.3)	2(%6.7)	-
	Total	-	-	-	-
No	Frequency	104 (%28.1)	120 (%32.4)	146 (%39.5)	-
Yes	Frequency	46(%57.5)	30(%37.5)	4(%5)	-

(Table 1) contd.....

Tachycardia					-
Time	-	Recovery	6h	12h	-
Gender	Female	-	-	-	-
No	Frequency	39(%25.3)	43(%27.9)	72(%46.8)	-
Yes	Frequency	28(%58.3)	17(%35.4)	3(%6.3)	-
Gender	Male	-	-	-	-
No	Frequency	67(%31.2)	73(%34)	75(%34.9)	-
Yes	Frequency	8(%80)	2(%20)	0(%0)	-
	Total	-	-	-	-
No	Frequency	114(%29.1)	131(%33.4)	147(%37.5)	-
Yes	Frequency	36(%62.1)	19(%32.8)	3(%5.2)	-
Tachypnea					-
Time	-	Recovery	6h	12h	18h
Gender	Female	-	-	-	-
No	Frequency	47(%26.6)	58(%32.8)	72(%40.7)	-
Yes	Frequency	36(%50.7)	32(%45.1)	3(%4.2)	-
Gender	Male	-	-	-	-
No	Frequency (%)	60(%29.2)	66(%32.8)	75(%37.3)	-
Yes	Frequency (%)	15(%62.5)	9(%37.5)	0(%0)	-
	Total	-	-	-	-
No	Frequency	99(%27.9)	109(%30.7)	147(%41.4)	-
Yes	Frequency	51(%53.7)	41(%43.2)	3(%3.2)	-
Voice Hoarseness					-
Time	-	Recovery	6h	12h	-
Gender	Female	-	-	-	-
No	Frequency	61(%30)	70(%34.5)	72(%35.5)	-
Yes	Frequency	14(%63.6)	5(%22.7)	3(%13.6)	-
	Male	-	-	-	-
No	Frequency	67(%30.9)	75(%34.6)	75(%34.6)	-
Yes	Frequency	8(%100)	0(%0)	0(%0)	-
	Total	-	-	-	-
No	Frequency	128(%30.5)	145(%34.5)	147 (%35)	-
Yes	Frequency	22(%73.3)	5(%16.7)	3(%10)	-
Restlessness					-
Time	-	Recovery	6h	12h	-
Gender	Female	-	-	-	-
No	Frequency	31(%19.6)	54(%34.2)	73(%46.2)	-
Yes	Frequency	44(%65.7)	21(%31.3)	2(%3)	-
Gender	Male	-	-	-	-
No	Frequency	53(%26.9)	69(%35)	75(%38.1)	-
Yes	Frequency	22(%78.1)	0(%0)	0(%0)	-
	Total	-	-	-	-
No	Frequency	84 (%23.7)	123 (%34.6)	148 (%41.7)	-
Yes	Frequency	66 (%69.5)	27(%28.4)	2(%2.1)	-
Urinary Retention					-
Time	-	Recovery	6h	12h	-
Gender	Female	-	-	-	-
No	Frequency	55 (%44.4)	69 (%55.6)	-	-
Yes	Frequency	20 (%76.9)	6(%23.1)	-	-
Gender	Male	-	-	-	-
No	Frequency	61(%45.5)	73(%54.5)	-	-
Yes	Frequency	14(%87.5)	2(%12.5)	-	-
	Total	-	-	-	-
No	Frequency	116 (%45)	142 (%55)	-	-
Yes	Frequency	34(%81)	8(%19)	-	-
Reduction in SaO_2					-
Time	-	Recovery	6h	12h	-
Gender	Female	-	-	-	-

(Table 1) contd.....

No	Frequency	53(%43.4)	69(%56.6)	-	-
Yes	Frequency	22(%78.6)	6(%21.4)	-	-
Gender	Male	-	-	-	-
No	Frequency	61(%44.9)	75 (%55.1)	-	-
Yes	Frequency	14(%44.2)	0(%0)	-	-
	Total	-	-	-	-
No	Frequency	114 (%44.2)	144 (%55.8)	-	-
Yes	Frequency	36(%85.7)	6(%14.3)	-	-
Hypotension					-
Time	-	Recovery	6h	12h	18h
Gender	Female	-	-	-	-
No	Frequency	49 (%18.7)	66 (%25.2)	73(%27.9)	74(%28.2)
Yes	Frequency	26 (%68.4)	9(%23.7)	2(%5.3)	1(%2.6)
Gender	Male	-	-	-	-
No	Frequency	61 (%21.3)	75 (%26.2)	75 (%26.2)	75(%26.2)
Yes	Frequency	14 (%100)	0(%0)	0(%0)	0(%0)
	Total	-	-	-	-
No	Frequency	110 (%20.1)	141 (%25.7)	148 (%27)	149(%27.2)
Yes	Frequency	40 (%76.9)	9(%17.3)	2(%3.8)	1(%1.9)
Vomiting Severity					
Time	-	Recovery	6h	12h	18h
Gender	Female	-	-	-	-
No	Frequency	32(%20.1)	54(%34)	73(%45.9)	-
1 or 2 times	Frequency	21(%56.8)	14(%37.8)	2(%5.4)	-
2 times<	Frequency	22(%75.9)	7(%24.1)	0(%0)	-
Gender	Male	-	-	-	-
No	Frequency	62(%30.7)	68(%33.7)	72(%35.6)	-
1 or 2 times	Frequency	10(%62.5)	3(%18.8)	3(%18.8)	-
2 times<	Frequency	3(%42.9)	4 (%57.1)	0(%0)	-
	Total	-	-	-	-
No	Frequency	94 (%26)	122 (%33.8)	145 (%40.2)	-
1 or 2 times	Frequency	31(%58.5)	17(%32.1)	5(%9.4)	-
2 times<	Frequency	25 (%69.4)	11 (%30.6)	0(%0)	-
Nausea Intensity					
Time	-	Recovery	6h	12h	18h
Gender	Female	-	-	-	-
No	Frequency	37 (%22.6)	54 (%32.9)	73 (%44.5)	-
1 or 2 times	Frequency	19 (%54.3)	14 (%40)	2(%5.7)	-
2 times<	Frequency	19 (%73.1)	7(%26.9)	0(%0)	-
Gender	Male	-	-	-	-
No	Frequency	66 (%31.6)	70 (%33.5)	73(%34.9)	-
1 or 2 times	Frequency	7(%63.6)	2(%18.2)	2(%18.2)	-
2 times<	Frequency	2(%18.2)	3(%60)	0(%0)	-
	Total	-	-	-	-
No	Frequency	103 (%27.6)	124 (%33.2)	146 (%39.1)	-
1 or 2 times	Frequency	26 (%56.5)	16(%34.8)	4(%8.7)	-
2 times<	Frequency	21 (%67.7)	10 (%32.3)	0(%0)	-
Shivering Intensity					
Time	-	Recovery	6h	12h	18h
Gender	Female	-	-	-	-
No	Frequency	49 (%26.3)	62 (%33.3)	75 (%40.3)	-
Mild	Frequency	14 (%70)	6 (%30)	0(%0)	-
Average	Frequency	5 (%45.5)	6 (%54.5)	0(%0)	-
Severe	Frequency	4 (%80)	1(%20)	0(%0)	-
very intense	Frequency	3(%100)	0(%0)	0(%0)	-
Gender	Male	-	-	-	-
No	Frequency	45 (%23.7)	70 (%36.8)	75 (%39.5)	-
Mild	Frequency	17 (%77.3)	5 (%22.7)	0(%0)	-

(Table 1) contd.....

Average	Frequency	10 (%100)	0(%0)	0(%0)	-
Severe	Frequency	2 (%100)	0(%0)	0(%0)	-
very intense	Frequency	1 (%100)	0(%0)	0(%0)	-
	Total	-	-	-	-
No	Frequency	94 (%25)	132 (%35.1)	150 (%39.9)	-
Mild	Frequency	31 (%73.8)	11 (%26.2)	0(%0)	-
Average	Frequency	25 (%69.4)	11 (%30.6)	0(%0)	-
Severe	Frequency	6(%85.7)	1(%14.3)	0(%0)	-
very intense	Frequency	4(%100)	0 (%0)	0(%0)	-
Drowsiness					
Time	-	Recovery	6h	12h	18h
Gender	Female	-	54 (%33.3)	-	-
Awake	Frequency	36 (%22.2)	54 (%33.3)	72 (%44.4)	-
Sound stimulation	Frequency	22 (%52.4)	17 (%40.5)	3(%7.1)	-
Tactile stimulation	Frequency	17 (%81)	4(%19)	0(%0)	-
Gender	Male	-	-	-	-
Awake	Frequency	53 (%26.9)	69(%35)	75(%38.1)	-
Sound stimulation	Frequency	13(%68.4)	6(%31.6)	0(%0)	-
Tactile stimulation	Frequency	9(%100)	0(%0)	0(%0)	-
	Total	-	-	-	-
Awake	Frequency	89 (%24.8)	123 (%34.3)	147 (%40.9)	-
Sound stimulation	Frequency	35(%57.4)	23(%37.7)	3(%4.9)	-
Tactile stimulation	Frequency	26(%86.7)	4(%13.3)	0(%0)	-

4. DISCUSSION

This study aimed to compare the incidence of complications after general anesthesia between males and females within the first 24 hours post-surgery. Results indicated that women experienced significantly higher incidences of hypertension, tachycardia, tachypnea, restlessness, hypotension, pain, vomiting, nausea, and drowsiness compared to men. While some other complications were observed more frequently in women, the differences were not statistically significant. Conversely, bradycardia was slightly more common in men, albeit not statistically significant. Overall, all complications decreased significantly after 24 hours in both genders. These findings contribute to existing literature on gender differences in post-anesthesia complications, which have shown varying results across different studies.

Myles *et al*. found that women experienced a higher incidence of “minor” post-anesthetic side effects (nausea, vomiting, sore throat, back pain, and headache) compared to men (2000, 2003) [19].

The study aimed to compare nausea and vomiting after general anesthesia between genders, finding a higher incidence in women ($P < 0.05$), consistent with previous research by Beattie *et al*. (2013) [17] and Myles *et al*. (2013) [20]. Respiratory complications were also more frequent in women ($P < 0.05$), contradicting findings by Forrest *et al*. (2012) showing higher incidence in men [21].

The study aimed to compare cardiovascular side effects and shivering incidence after general anesthesia between males and females. Results revealed a significant increase in cardiovascular side effects in women compared to men ($P < 0.05$), consistent with previous findings. Conversely, the incidence of shivering was significantly higher in women than in men ($P < 0.05$), contrary to some previous studies, such as Hocker *et al*. (2010), which found no significant difference in shivering incidence between genders [22, 23].

In a study by Taenzer *et al*. in 2000, it was reported that the incidence of post-general anesthesia occurs more frequently in women than in men. Also, in a study by Wilson-Barnett *et al*. in 2012, the incidence of post-general anesthesia pain was higher in women than in men, but no significant relationship was reported [24]. Although in Puntillo *et al*.'s study, the incidence of post-general anesthesia in males was reported to be higher than in women [25, 26]. Similar results were observed in the study by Taenzer *et al*. [27].

Ajuzieogu *et al*. (2010) found a higher incidence of post-general anesthesia headaches in women compared to men, although the significance was not reported [15]. This aligns with previous studies examining gender differences in post-anesthesia headaches [28-31]. Conversely, Rasmussen *et al*. (2011) reported a significant increase in headache incidence in women compared to men after general anesthesia ($P = 0.02$, $OR = 1.2$), potentially attributed to differences in sex hormone levels [32], which is in line with McDowell *et al*.'s findings in 2011 [26], although significance was not reported.

Stout *et al*. (2007) found no gender difference in post-general anesthesia sore throat incidence [33]. Similarly, Ajuzieogu *et al*. (2010) observed no disparity in sore throat occurrence between males and females [12]. Myles *et al*. (2003) did not report a significant gender-based difference in sore throat incidence but noted respiratory issues in 21% of patients [16].

In Bagheri *et al*.'s 2007 study on 78 patients, the incidence of sore throat after general anesthesia was

determined. Similarly, Higgins *et al*. (2002) reported that 45.4% of 5264 patients experienced a sore throat post-general anesthesia, with women experiencing more severe symptoms than men [33]. Conversely, Ajuzieogu *et al*.'s 2010 study observed a higher incidence of low back pain after general anesthesia in women compared to men [12].

In a study by Morris *et al*. (2004), it was found that women are more likely to experience low back pain after general anesthesia compared to men [11]. Additionally, our study aimed to compare post-general anesthesia incidence between males and females over two years. Results showed a significantly higher incidence of violence in women compared to men ($P < 0.05$), consistent with findings from Stout *et al*. (2007), where women exhibited a significantly higher post-general anesthesia incidence compared to men (37% *versus* 18%, $P < 0.05$) [33].

In a study by Cohen *et al*. in 2006, it was stated that there was a significant difference between female and male sexually transmitted infections due to mortality or severe complications after general anesthesia [34, 35]. These results are consistent with the results of the study by Tiret *et al*., 2008 [36].

In a 2013 study by Saccò *et al*., findings imply that alterations in the interplay between cardiovascular and pain systems due to chronic pain may lead to a higher likelihood of hypertension. The study also indicates that chronic pain intensity significantly predicts hypertension, irrespective of age, race, ethnicity, or parental hypertension, suggesting a potential link between chronic pain and elevated hypertension risk [37].

In a 2015 study by Young-Hyeon *et al*., hypertension was found to have a negative correlation with the prevalence of lower back pain (LBP) and osteoarthritis, likely due to hypertension-related pain reduction. This relationship was weakened using antihypertensive medication and longer hypertension duration [38].

A 2020 study by R Pfoh *et al*., reported pain was linked to higher BP during the visit and less medication adjustment by physicians, yet no increased likelihood of high BP in subsequent visits [39].

CONCLUSION

These results are consistent with findings from some studies conducted for the same purpose, while they differ from others. The inconsistencies in findings between different studies are likely attributable to various factors, including diagnostic errors, variations in sample sizes, differences in statistical power, or differing definitions of post-anesthesia complications. These limitations should be considered in interpreting the results, and further research with standardized methodologies is needed to understand these gender-related differences in post-anesthesia outcomes better.

AUTHORS' CONTRIBUTIONS

Dr.S.V.: conceptualized and designed the study, drafted the initial manuscript, and reviewed and revised the manuscript; Dr.S.B. and Dr.F.H.K: designed the data collection instruments, collected data, carried out the initial analyses, and reviewed and revised the manuscript; Dr.H.R: Coordinated and supervised data collection and critically reviewed the manuscript for important intellectual content;.

LIST OF ABBREVIATIONS

GEE	=	Generalized estimating equation
LBP	=	Lower back pain

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

After obtaining a license and code of ethics from the University's Ethics Committee, patients at the Shohada Nashir Hospital 96 surgery patients were enrolled in the study (appendicitis and abdominal hernia repair).

HUMAN AND ANIMAL RIGHTS

All procedures performed in studies involving human participants were in accordance with the ethical standards of institutional and/or research committee and with the 1975 Declaration of Helsinki, as revised in 2013.

CONSENT FOR PUBLICATION

The patients were given a written informed consent form to fill in.

STANDARDS OF REPORTING

STROBE and SAGER guidelines were followed.

AVAILABILITY OF DATA AND MATERIALS

The data and supportive information are available within the article.

FUNDING

None.

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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Declared none.

SUPPLEMENTARY MATERIALS

Supplementary material is available on the Publisher's website.

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