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The effect of nasal obstructions on lung functions

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Objectives: **As a recent finding, the airflow through the nose plays a vital role in chest movements and lung aeration.** ***Methods:*** **We studied the cause of obstruction in 50 patients who had surgery due to nasal obstruction in Haydarpasa Numune Training and Research Hospital Otorhinolaryngology Clinic. Age, sex, height, and weight were determined. We measured blood gases and lung function tests before the operation and one month after the surgery. Submucous resection (SMR) was performed with local anesthesia in patients with septal deviation. Patients with Nasal Polyps underwent intranasal polypectomy, sinus surgery, and Intranasal Ethmoidectomy.** ***Results:*** **In our clinic, 50 (%70) septum deviation and 15 (30%) nasal polyps were formed in 50 cases who were operated due to nasal obstruction. The most common cause of surgical nasal obstruction is septum deviation. Most of our cases (72%) were male. Nasal obstruction is more common in men, and the majority of men who are exposed to nasal trauma more frequently have a septum deviation (77%). Nasal obstruction syndrome is common in the middle age group. In obese patients with overweight, lung functions were more affected. After corrective surgery, vital capacity and forced vital capacity values increased in one second. The difference is statistically significant. In our study, PaO_2 value decreased, and $PaCO_2$ value increased in proportion to the excess of nasal obstruction. PaO_2 increased, and $PaCO_2$ decreased after obstacle. Sinusitis was detected in 18 (36%) of 50 cases. Three of these cause septum deviation and 15 of them are nasal polyps. Nine of the 15 cases with nasal polyps (33%) had ethmoid sinus, and 11 cases had maxillary sinus involvement.** ***Conclusion:*** **Septum deviation and nasal polyps cause nasal obstruction, adversely affecting lung function tests and blood gases. Correcting the obstruction due to cardiopulmonary diseases is of great importance.**

INTRODUCTION

The nose, which forms the beginning of the respiratory system, has been defined as an organ which is considered to be only one air passage in the respiratory function, which has recently played a role in odor, phonation, breathing air, heating, and maintaining cleanliness. However, in recent years, it has been reported that the function of the nasal lung function is not only one channel for the lower respiratory tract (1). It has been suggested that the stimulation of the air flows on the ends of the nerve trigeminus in the nasal mucosa plays a vital role in the movements of the chest lung system with the mechanical effect (2, 30). It has been suggested that chest movement decreases due to lack of normal reflex in nasal blockages and this causes changes in lung circulation, vital capacity, and blood O_2 pressure decrease (3).

In diseases that cause upper airway obstruction, ear nose and cardiopulmonary and systemic pathological conditions may occur (4). Most patients with septum deviation have inadequate nasal breathing (5). Both septum deviations caused by congenital or traumas disrupt these functions (6). In this study, the cause of obstruction, age and gender distribution, height and weight, preoperative and one month after surgery, blood gases analysis and lung function tests were measured in 50 patients who applied to our clinic due to nasal obstruction. We investigated the effect of nasal obstruction on lung function by detecting the surgical correction of nasal obstruction, changes in blood gases and lung function tests.

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MATERIALS AND METHODS

In this study, we measured pulmonary function tests in 50 patients who had surgery due to nasal obstruction in Haydarpasa Numune Training and Research Hospital, Otorhinolaryngology Clinic. Age, sex, height, and weight were determined. We measured blood gases and lung function tests before the operation and one month after the surgery. The tests were performed in the same condition each time, and the patients were handled and explained. We used Mijnhardt Spirometer Vicatest P2 to evaluate lung function tests, vital capacity, difficult, vital capacity, timed vital capacity in 1 second and maximally demanded ventilation (MVV) values. We immediately sent the blood samples to the laboratory. Radiometer Copenhagen ABL-4 blood gas analysis was performed.

In clinical evaluation, the following procedures were performed:

1) Anamnesis: It has been asked how long the nasal obstruction has been present, whether he has a headache, the history of trauma, whether he has to snore at night, whether he has nasal obstruction medication or not.

2) Ear Nose Throat Examination: In addition to a complete ENT examination, the presence of serous otitis by tympanometric examination was sought. As a result, we classified as the septum deviation, unilateral and bilateral nasal polyps.

3) Laboratory Analyzes: In addition to blood gas analysis, routine hematological and urine tests were performed to determine whether or not there was a systemic disease other than nasal obstruction.

4) Radiological examinations: Paranasal sinus radiographs were used to determine the origin of the polybase in nasal polyps to assess the presence of sinusitis in our patients.

In our study, we paid attention to the fact that there were no allergic or any other diseases such as lung, heart, a nervous and muscular system

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Table 1 Distribution of cases by age, height, and weight

	Minimum	Maximum	Mean	Gender average
AGE	14	64	31.5	
LENGTH	152	180	166	M:168 F:164
WEIGHT	38	93	64.9	M:64.8 F:65.2

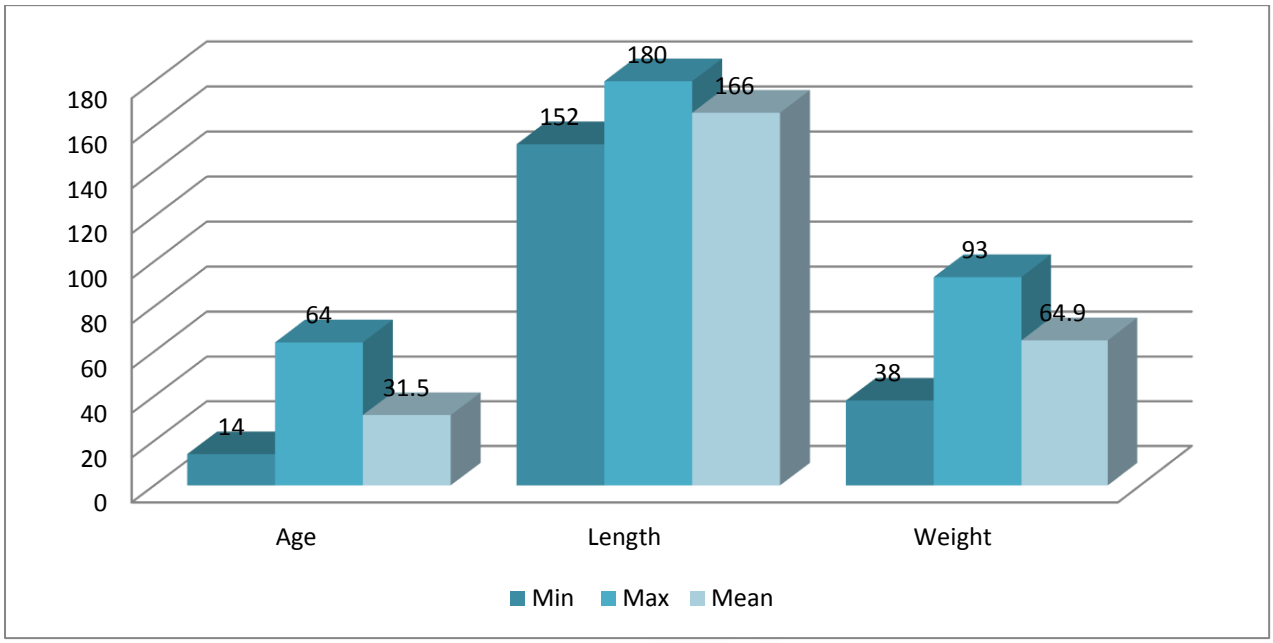

Figure 1 Distribution of cases by age, height, and weight

other than nasal obstruction. Submucous resection (SMR) was performed with local anesthesia in patients with septal deviation. Patients with Nasal Polyps underwent intranasal polypectomy and, when indicated, sinus surgery and Intranasal Ethmoidectomy. We used t-test results in statistical evaluation.

RESULTS

When we analyzed 50 cases with nasal congestion in our clinic, the cause of nasal obstruction was septum deviation in 35 instances and nasal polyps in 15 cases. Seven of the nasal polyp cases were bilateral, and 8 were single nasal polyps. Of the 50 cases, 36 (72%) were male, and 14 (28%) were female. When divided according to diagnostic groups, men with septum deviation formed the majority (27/35; 77%). Age distribution of the cases, the youngest 14, the oldest 64 years old and the average age is 31.5. The highest length of our cases is 180 cm, and the shortest was 152 cm. The average length is 164 cm. The average height according to gender was 168 cm in males and 164 cm in females. When the weight of our cases are measured, it varies between 38 and 93 kg and the average is 64.9. When discrimination was made according to gender, 64.8 was in women and 65.2 in men (Table 1, Figure 1). In Vital Capacity values, 9 of 50 cases decreased postoperatively, and 7 of them did not change. A total of 34 cases were achieved, and the success rate was 68%. The forced expiratory volume in one second showed no change in 3 cases after surgery and decreased in 3 cases. A total of 44 cases were achieved, and the success rate was 88%. When the partial oxygen values of the cases were examined, there was no change in 5 circumstances, and 2 cases decreased. In 43 cases, the postoperative recovery was achieved, and the success rate was 86%. When we look at the CO_2 values of the blood gases of the cases, there were no changes in 6 cases, but 2 cases increased after the operation. In 42 cases, the success rate was 84%. Our findings are given in Table 2-3-4, including septum deviation and nasal polyp. When the lung function tests and blood gases analysis values of the cases are evaluated, the results were shown in Table 5 and Figure 2. When sinusitis research was performed, maxillary sinusitis was detected in 3 (0.86%) of 35 cases with septum deviation. Eleven cases of nasal polyps (15 cases) had maxillary sinusitis, and 5 had ethmoid sinusitis (one with maxillary sinusitis). Bilateral serous otitis media was detected in 2 cases with nasal polyps, and postoperatively serous otitis improved.

DISCUSSION

Nasal obstruction has many effects on the body as a whole. Sometimes these effects cause symptoms and complaints of the patient and are recognized as part of the nasal obstruction syndrome. Detection and treatment of nasal obstruction and its impact will ensure patient confidence (4). The clogged nose is not present alone; it affects many organs as well as mental distress. Sometimes these secondary effects may leave behind the nasal obstruction complaint (4). Upper airway obstruction is also essential. It is often the cause of unexplained hypercapnia and dyspnoea, even in patients with normal expiratory spirograms (7).

The nose is undoubtedly part of the respiratory system, but nasal obstruction may have significant effects on the lower part of the upper respiratory tract (4). In several studies, researchers found a relationship between lung function and nasal obstruction (2,3,8,9). They revealed that there was an increase in pulmonary resistance directly related to the degree of nasal obstruction. This is demonstrated in both non-paralyzed anesthetized animals and in people who have nasal tamponade. As the

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Table 2 Patients with septal deviation

AGE	LENGTH	WEIGHT		VC	FVC	FEV1	FEV1/VC	FEV1/FVC	MVV	PaO_2	$PaCO_2$
25 M	168	68	PREOP	2.45	3.16	2.57	56	81	77	50.3	42
			POSTOP	4.48	4.40	4.29	90	97	29	61.9	38.4
31 M	168	75	PREOP	3.99	3.76	3.19	73	85	96	62.2	40.4
			POSTOP	4.20	4.18	4.03	96	96	102	68.5	39.7
26 M	168	60	PREOP	2.93	3.29	3.29	112	100	98	111.4	48.4
			POSTOP	2.75	3.62	3.34	121	92	100	130.1	29.3
21 M	169	67	PREOP	2.95	3.32	2.84	93	86	85	48.2	41.4
			POSTOP	3.99	3.76	3.53	82	94	106	54.2	29.4
28 F	157	52	PREOP	2.43	2.08	1.98	75	95	59	54.2	44.3
			POSTOP	2.21	2.32	2.05	83	88	62	59.5	46.6
17 M	150	50	PREOP	1.87	1.44	1.38	67	96	41	62.2	43.4
			POSTOP	1.75	1.96	1.94	102	99	58	66.2	42.5
22 F	159	49	PREOP	2.93	2.04	2.02	67	99	61	57.6	37.7
			POSTOP	2.78	2.60	2.07	70	80	62	58.9	43.3
20 M	180	69	PREOP	3.75	4.05	3.53	76	87	106	57.4	48.1
			POSTOP	4.14	4.22	3.82	81	91	115	82.3	35.2
51 M	172	87	PREOP	2.95	3.48	2.51	66	72	78	56.6	45.7
			POSTOP	3.72	3.44	3.28	88	95	98	62.0	46.2
42 M	170	62	PREOP	3.96	3.71	3.52	83	95	106	66.1	40.4
			POSTOP	3.52	3.89	3.55	80	91	107	78.3	40.1
62 M	165	56	PREOP	1.96	2.61	2.19	111	84	66	59.4	29.8
			POSTOP	2.15	2.46	1.65	76	77	50	64.8	41.9
21 M	163	58	PREOP	3.31	3.81	1.36	41	36	40	67.5	46.0
			POSTOP	3.56	3.93	1.39	39	35	48	73.6	30.9
37 M	181	93	PREOP	3.01	2.27	2.27	75	100	68	61.2	44.6
			POSTOP	3.23	2.67	2.42	75	91	80	60.4	45.0
21 M	177	65	PREOP	3.61	2.32	1.58	43	68	47	55.2	59.3
			POSTOP	3.74	2.38	1.76	47	74	68	65.9	44.3
19 M	175	63	PREOP	3.25	3.99	3.72	114	93	111	53.7	36.7
			POSTOP	3.80	4.21	3.86	105	92	114	75.6	38.4
20 M	170	67	PREOP	3.93	3.89	3.89	98	100	116	48.3	52.2
			POSTOP	3.99	3.96	3.95	98	99	117	56.2	34.3
30 M	177	84	PREOP	3.56	3.63	3.53	84	97	106	104.4	36.7
			POSTOP	4.07	3.98	3.88	95	97	111	123.5	48.8
49 M	165	85	PREOP	2.95	3.00	2.85	87	95	86	47.4	44.7
			POSTOP	3.26	3.32	3.16	97	95	92	50.7	37.2
23 M	169	61	PREOP	2.34	2.11	1.01	43	48	30	42.0	42.9
			POSTOP	2.36	2.14	1.00	42	47	34	43.0	32.1
22 M	167	80	PREOP	4.58	4.39	3.93	81	89	118	62.0	46.2
			POSTOP	4.56	4.41	3.98	87	90	114	65.0	3.38
21 M	169	68	PREOP	3.94	4.08	2.20	52	54	66	36.6	34.3
			POSTOP	4.31	4.68	3.52	82	75	84	43.1	29.2
26 F	168	56	PREOP	2.88	3.23	2.80	78	87	84	67.4	40.6
			POSTOP	3.62	3.78	3.17	87	84	88	68.5	34.0
37 M	175	75	PREOP	2.82	2.56	2.51	76	98	75	97.3	23.6
			POSTOP	3.50	3.16	3.04	87	96	83	124.7	10.0
29 F	167	53	PREOP	2.80	2.83	2.63	85	91	79	61.9	38.4
			POSTOP	3.20	3.00	2.89	90	96	87	66.1	40.4
23 F	155	50	PREOP	2.44	2.13	1.82	69	85	55	30.6	43.9
			POSTOP	3.16	2.87	2.80	89	98	72	43.4	27.9
34 F	156	50	PREOP	2.52	1.43	1.40	55	98	42	149.8	39.1
			POSTOP	3.52	1.97	1.78	51	90	56	179.1	35.8
27 M	180	72	PREOP	4.75	4.02	3.20	67	80	96	64.2	39.3
			POSTOP	4.86	4.32	3.31	68	77	100	66.0	35.2
26 M	173	67	PREOP	3.56	3.16	2.75	77	87	83	70.2	43.7
			POSTOP	3.62	3.31	2.86	79	86	84	72.8	38.9
21 M	172	70	PREOP	4.75	4.02	3.20	67	80	96	64.2	39.3
			POSTOP	4.86	4.32	3.31	68	77	100	66.0	35.2
22 M	170	57	PREOP	3.88	2.87	2.29	59	80	69	74.5	42.4
			POSTOP	4.00	3.98	2.42	60	60	72	75.0	40.2
28 F	165	52	PREOP	3.32	3.27	2.56	77	78	77	78.4	34.4
			POSTOP	3.32	3.24	2.54	76	78	74	79.2	34.0
23 M	175	82	PREOP	5.12	5.09	3.20	62	62	96	53.4	37.6
			POSTOP	5.32	5.29	3.16	59	60	96	55.8	35.2
20 M	178	64	PREOP	3.46	4.29	3.45	99	80	104	63.8	45. 3
			POSTOP	3.47	4.24	3.48	100	82	100	67.1	42.2
35 M	160	60	PREOP	1.87	1.96	0.99	52	50	30	58.3	46.5
			POSTOP	1.99	2.24	1.76	88	78	54	61.4	42.8
27F	155	41	PREOP	2.22	2.17	1.48	67	68	44	56.6	41.2
			POSTOP	2.30	2.22	1.63	71	73	49	69.9	36.3

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Table 3 Patients with a unilateral nasal polyp.

AGE	LENGTH	WEIGHT		VC	FVC	FEV1	FEV1/VC	FEV1/FVC	MVV	PaO_2	$PaCO_2$
48 F	152	75	PREOP	2.21	2.15	1.99	90	93	60	66.3	44.7
			POSTOP	2.20	2.28	2.07	94	91	62	67.0	37.6
40 M	168	75	PREOP	3.23	3.25	3.20	99	98	96	57.7	37.0
			POSTOP	3.44	3.49	3.20	93	92	96	61.8	27.5
58 M	174	58	PREOP	2.48	2.38	2.10	84	88	63	65.1	41.3
			POSTOP	2.31	2.56	2.32	100	91	70	69.7	39.1
18 M	170	62	PREOP	3.78	3.61	3.21	85	89	96	69.3	46.6
			POSTOP	3.76	3.64	3.29	87	90	97	85.5	36.2
14 F	155	69	PREOP	3.11	3.31	2.85	91	92	86	92.0	45.4
			POSTOP	3.19	3.24	2.84	89	88	84	102.0	40.2
57 F	155	60	PREOP	0.85	0.67	0.65	76	97	20	53.0	48.1
			POSTOP	2.25	2.08	1.94	86	93	34	52.1	46.4
15 F	155	38	PREOP	2.07	2.48	2.26	109	91	68	82.4	38.3
			POSTOP	2.78	2.66	2.54	91	95	74	87.6	35.2
56 M	167	64	PREOP	2.91	3.26	2.88	99	88	86	64.8	46.5
			POSTOP	3.17	3.44	3.08	97	90	89	69.6	41.2

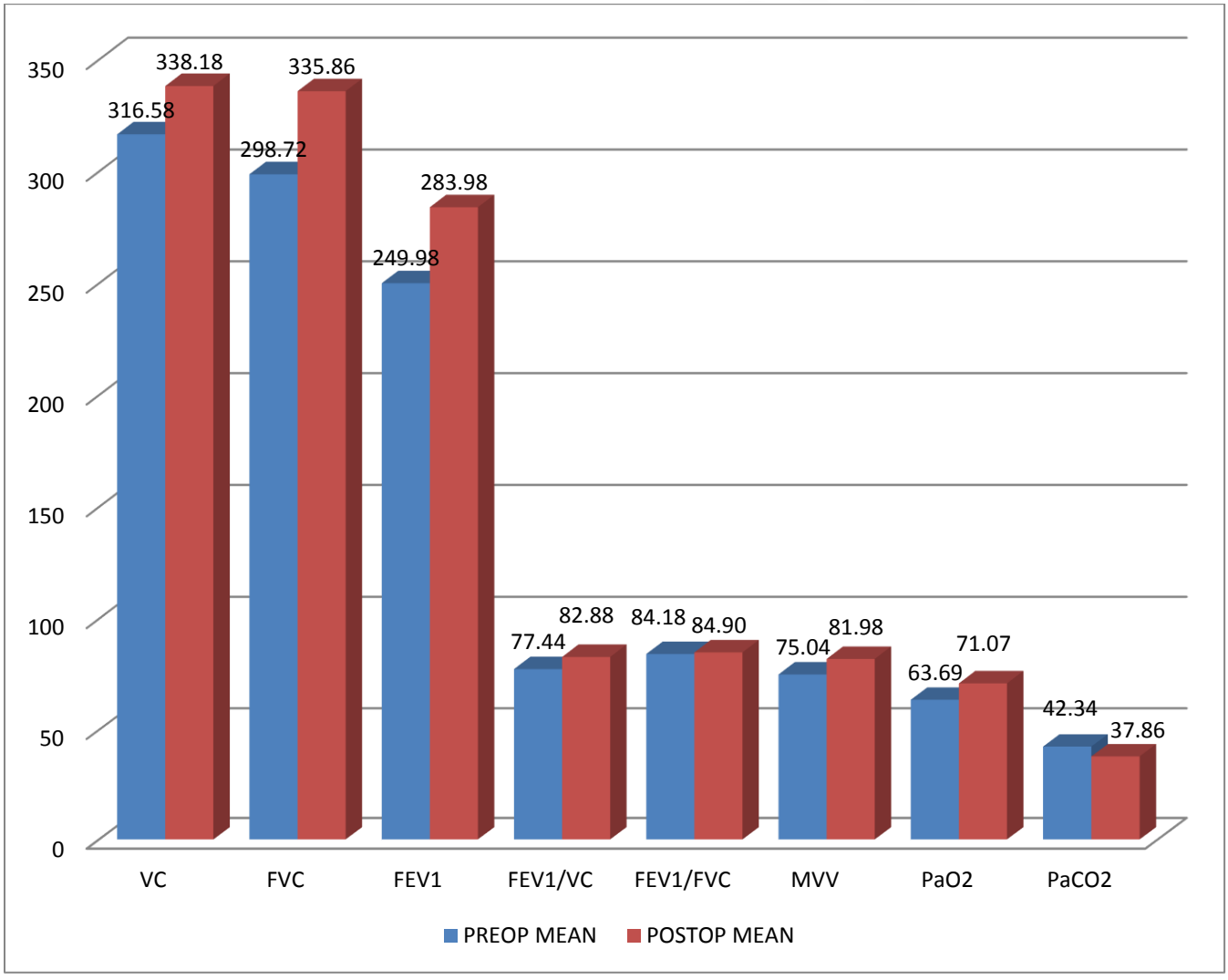

Figure 2 Comparison of the preoperative and postoperative mean values.

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Table 4 Patients with a bilateral nasal polyp.

AGE	LENGTH	WEIGHT		VC	FVC	FEV1	FEV1/VC	FEV1/FVC	MVV	PaO2	PaCO2
14 F	159	50	PREOP	2.31	2.46	2.18	74	89	65	58.9	43.3
			POSTOP	3.46	3.64	3.26	94	90	74	66.4	40.1
25 F	167	56	PREOP	2.52	2.55	2.51	99	98	75	67.9	41.8
			POSTOP	3.84	3.92	3.47	90	89	80	68.7	38.4
64 M	160	60	PREOP	2.90	2.47	1.90	65	77	57	51.9	31.6
			POSTOP	3.10	2.64	2.06	66	78	62	62.3	30.4
58 M	175	90	PREOP	3.56	3.26	3.02	85	93	91	74.2	38.4
			POSTOP	3.62	3.34	3.12	85	93	92	79.6	35.0
50 M	170	83	PREOP	2.80	2.80	1.96	70	70	59	78.3	40.1
			POSTOP	2.96	2.94	1.99	67	68	60	97.3	23.6
49 M	167	67	PREOP	3.61	3.45	3.45	95	100	103	64.1	48.6
			POSTOP	3.33	5.49	3.88	116	71	116	65.5	46.2
42 M	174	70	PREOP	2.67	2.81	1.20	45	43	36	78.8	38.7
			POSTOP	3.11	3.24	2.40	77	74	46	81.1	35.3

Table 5 Comparison of the preoperative and postoperative mean values.

	PREOPERATIVE MEAN	POSTOPERATIVE MEAN	DIFFERENCE	P
VC	306.58	338.18	31.6	0.000*
FVC	298.72	335.86	37.1	0.000*
FEV1	249.98	283.98	34	0.000*
FEV1/VC	77.44	82.88	5.38	0.009*
FEV1/FVC	84.18	84.90	0.72	0.635
MVV	75.04	81.98	6.94	0.000*
PaO2	63.69	71.07	7.38	0.000*
PaCO2	42.34	37.86	4.84	0.000*

*p<0.05; statistically significant

afferent path, Vidian nerve was accepted as the efferent path with the physiological changes observed with the Vagus nerve (i.e., bronchoconstriction), which was explained because of the nasopulmonary reflex.

It has been suggested that chest movement decreases in mouth breathing, normal reflexes in nasal blockages, this leads to changes in lung circulation, vital capacity and blood O_2 (oxygen) pressure decrease (3). Cassisi NJ et al, found hypoxemia in their study when they placed both anterior and posterior tampon in 20 patients aged 38-80 years. They suggested that bronchomotor tonus increased secondary to nasal obstruction because of the change in lung compliance (10). Jacobs JR et al. reported increased mortality due to hypoxemia and cardiac arrhythmias in patients with nasal tamponade. They suggested the nasopulmonary reflex as the reason for this. In their study, ten patients did not notice a significant difference in lung volumes, flow velocity and alveolar gas exchange when they were looking for lung function tests and blood gases before nasal tamponade and after removal of the tampon. Vital capacity was 101 mm before the tampon, 99 L after the tampon removed, PaO_2 was97 mmHg before the tampon and 99 mmHg after the tampon removed. PaCO2 was found to be 37 mm Hg before the tampon and 34 mmHg after the tampon was removed (11).

Shim C et al., showed a decrease in vital capacity in 4 of 9 cases (less than 80%) when the lung function test was applied in patients with upper airway obstruction; They found a significant reduction in 4 of 6 cases (below 60%), (7). Nelson JR et al. found that MVV (Maximum Voluntary Ventilation) and FEV1 (Forced Expiratory Volume in the first second) were generally decreased in nasal obstruction and this was related to the degree of nasal obstruction (1). It was found that males had higher vital capacity when they compared men and women who were equal in height and age. This difference was due to excess muscle weight rather than the lungs. The ratio of the vital capacity in the first second to the necessary function in the nasal congestion gives us an idea of the degree of obstruction. This rate usually is over 70% (8). The same researchers found that the ratio of vital capacity to vital capacity in the first second remained at the same rate between 20 and 49 years of age (80%) and this rate decreased at the period of 50 years. They showed that the vital capacity and one-second vital capacity in their measurements decreased concerning the degree of nasal congestion (8).

Ogura JH et al. found an increase in 13 of 19 cases (72%) of nasal measured vital capacity in 15 (79%) of 19 cases of essential size measured orally after corrective nasal obstruction in their study. They found an increase in 15 of 18 cases with vital capacity in the first second (3). In our study, we did not measure from the nose but routinely performed the oral measurement. Of the 50 cases with vital capacity, 34 (68%) had an increase in 44 (88%) of 50 cases with a critical role in the first second. This increase was statistically significant. Unno et al. examined pulmonary resistance, airway, and lung tissue resistance. According to these, increased airway resistance during oral respiration in a person with nasal obstruction suggests a disorder in pulmonary function. This situation is due to the increase in bronchomotor tone due to reflex in the nose. In cases of severe nasal obstruction, high airway resistance during oral breathing after corrective surgery can be explained by small organic changes in the lung. Again, these investigators have suggested that the increase in tissue resistance and the decrease in elasticity are caused by reversible changes in the broncho-bronchioalveolar system caused by a reflex effect (12). In their study Ogura JH et al, found a decrease in pulmonary resistance after surgery, increased compliance and a reduction in lung tissue resistance. These values were approximately 80% lower than the preoperative values (2).

Considering changes in the lower respiratory tract, secondary to the pathology in the nose, patients with increased respiratory resistance usually breathe through the mouth. Although they do not have lower respiratory tract problems, they often complain about shortness of breath. A successful nose surgery reduces lung tissue resistance and eliminates these complaints (2). Onishi T et al., in their study in dogs, achieved an average increase of 66.6% in lung resistance and an average

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16% increase in functional residual capacity after the obstruction was corrected. This increase is more significant in bilateral nasal obstruction than in single obstructed ones (13). Ogura JH et al. suggested that there are measurable changes in the lower airways in cases with high nasal resistance in their study, and this is clear evidence of the relationship between the upper and lower airways (5). Ogura JH and Harvey JE, In their experimental study on dogs, developed nasal obstruction and rhinosinusitis in dogs and increased pulmonary resistance (14).

In our study, necessary changes in the postoperative period were observed in 9 cases, as Unno et al. Patients reported that they were subjectively relieved. Then decrease the vital capacity, and there was no other reason for the change in the state of the person's soul and body during the test. In their study Massumi RA et al., reported that partial obstruction of the upper airway causes severe many heart diseases. This condition identified heart disease in black children with nasopharyngeal obstruction due to sizeable adenoid tissue. Respiratory acidosis was also detected in patients with hypercapnia and hypoxemia. No other cause for right heart failure was found in the nasopharyngeal obstruction. The patients recovered after emergency tonsillectomy and adenoidectomy. Radiological demonstration of the reduction in the width of the heart and normalization of the electrocardiogram confirmed this (15).

Chronic alveolar hypoventilation may lead to pulmonary hypertension and future cor pulmonale. This situation is infrequent in isolated nasal obstruction but may occur if it is accompanied by upper airway obstruction such as nasal obstruction, tonsillar hypertrophy and macroglossia (4). Acute nasopharyngitis and adenoid hypertrophy are the most common causes of nasal obstruction in children. Nasal congestion is secondary to adenoid hypertrophy in early childhood, changes in craniofacial development, sleep apnea, and sleep disorders can also (16). Menashe VD et al. found carbon dioxide retention and anoxia, which are cardiac symptoms of hypoventilation associated with severe tonsilla palatine and adenoid hypertrophy in two pediatric patients with chronic upper airway obstruction. Cor pulmonale symptoms were also found. They observed that after the necessary surgery, they improved significantly (17).

The cause of alveolar hypoventilation in these patients is the decrease in respiratory capacity. This is seen as a reduction in the minute volume of respiration. In these patients, the ratio of dead space to tidal volume increases. The tidal volume decreases with the decrease in alveolar breath (17). Because of the anatomical feature of the upper airway and oral cavity in children, young children have difficulty breathing due to loss of muscle control of the oral airway due to sleep. At the end of this, total lung resistance increased, and PaO_2 decreased (18). At the same time, advanced nasal deviation in any age can lead to apnea (19). Obstructive sleep apnea syndrome may occur in cases with severe nasal obstruction and correction of the nasal deformity results in an improvement of the apneic state (20). Nasal obstruction in children may affect the function of the Eustachian tube, causing fluctuant hearing loss, hyponasal speech, delayed speech and learning (21). In adults with nasal obstruction, the oral cavity may be replaced by the nasal cavity, but PaO_2 has been associated with a decrease in the physiological function of the nasal cavity (10, 22). Cook TA and Komorn RM, reported that the physiological effects of hypoxia and hypoventilation occur via chemoreceptors, a decrease in PaO_2 or an increase in $PaCO_2$, stimulating chemoreceptors. Chemoreceptors are more walled than changes in $PaCO_2$. Their stimulation is together. When the chemoreceptor is stimulated, four physiological changes occur in the cardiovascular and pulmonary system;

1) Increases the respiratory rate of Hern, as well as the volume per minute, and increases pulmonary ventilation.

2) Increased secretion from adrenal glands and increases systemic blood pressure with peripheral vasoconstriction.

3) Increases vagal tone and causes bradycardia.

4) Insomnia and even convulsions may occur due to increased cerebral cortex activity.

If hypoventilation corrects these four physiological changes, then the effects of chemoreceptors on the cardiovascular and pulmonary system will be minimal, so hypoventilation is useful. If the hypoventilation is prolonged due to nasal buffer, sedation and bed rest (5-7 days) then the importance of these four responses to the cardiovascular and pulmonary system is understood. As a result, myocardial infarction or cerebrovascular accident may occur (22). Cassisi NJ et al. suggested that vascular complications such as cerebral ischemia and myocardial infarction, and sudden unexplained deaths in patients who were buffered due to epistaxis were related to hypotension due to acute blood loss (10).

Morris HD et al., linked tissue oxygenation to three factors: 1-Respiratory function, 2-Heart function, 3-Hemoglobin concentration. They reported anemia, dysphagia, confusion, cerebrovascular events and cardiac arrest with impaired oxygenation of the tissues (23). The same investigators had PaO_2 79.1 mmHg on the posterior tamponade, and PaO_2 75.3 mmHg after the tampon was removed. PaO_2 was 77.3 mmHg on average in patients with anterior tamponade, and PaO_2 increased to 84.1 mmHg after the tampon was removed (23). In the study of Slocum CW et al., PaO_2 was 85 mmHg on average in 22 patients and 74 mm Hg after anterior pad was applied. $PaCO_2$ value was found to be 35.6 mmHg before tamponade and 36.4 mmHg increase when tamponade was placed. They are linked to hypoxia caused by a wholly obstructed nose (24).

The only anterior tamponade is thought to cause clinically significant hypoxia in patients with low lung reserve. Close observation is required when the bilateral anterior tampon is placed in these patients. Tamponades should be removed as early as possible, and 40% oxygen should be given to patients over 40 years of age (24). Therefore, the bumpers in our patients were removed on the second day. There were no complications. Patients with severe epistaxis require both anterior and posterior co-tamponade. In these patients (30%), hypertension, old age, and chronic obstructive pulmonary disease are present. Barbiturates, narcotics and absolute bed rest should be given in their treatment (24). Whenwe applied tamponade to the patients, the antihistaminic agent was provided with the effect of sedation as well as antibiotics, and they were followed up and hospitalized in our hospital.

Cook TA and Komorn RM, examined the blood gases obtained by placing an anterior and posterior tampon in the nose in 20 patients, and they found a significant increase in $PaCO_2$ and a decrease in PaO_2. They thought that hypoventilation played a crucial role in hypoxia development in patients. These investigators studied blood gases in patients who had tamponade due to epistaxis aged between 34-68 years. PaO_2 was 79 mmHg on average before buffering and 70 mmHg after buffering. $PaCO_2$ was 34 mmHg before buffering and 45 mmHg after buffering. The difference between averages is 8.9 mmHg for PaO_2 and 8.7 mm Hg for $PaCO_2$ (22). Massumi RA et al, had a preoperative PaO_2 of 42 mmHg in patients operated on for upper airway obstruction, it was 80 mmHg postoperatively, and $PaCO_2$ was 81 mmHg preoperatively, and 77 mmHg postoperatively (15).

Cavo JW et al. found a significant decrease in PaO_2 (12.8%) in blood gases after anterior and posterior nasal tamponade in dogs, and an

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increase in $PaCO_2$ (11.6%), (25). Cassisi NJ et al. examined the blood gas changes in the posterior tamponade in epistaxis. $PaCO_2$ was found to be 35 mmHg and 33 mmHg after the tampon was removed. They found a difference of 22 mmHg between the mean postoperative PaO_2 values of the next buffer and after removal (10). Comparing with the normal $PaCO_2$, reduction in PaO_2 was found to be associated with changes in pulmonary mechanics rather than hypoventilation. Bronchomotor tonus, secondary to nasal obstruction, explains the reason for the increased flow leading to changes in the distribution of alveolar ventilation (10).

In our research, $PaCO_2$ was 42.34 mmHg preoperatively and 37.86 mmHg in the patients who underwent surgery for nasal obstruction. PaO_2 was 63.69 mmHg preoperatively and increased to 71.07 mmHg postoperatively. These findings are consistent with the literature. In our study, we found that PaO2 value decreased in proportion to the excess of obstruction, and $PaCO_2$ value was increased. Cassisi NJ et al. recommended that patients should be given 40% oxygen by mask to prevent complications due to nasal tamponade and not to increase CO_2 levels (10). Septum deviations hurt lung function tests and blood gases analysis. Because of the cardiopulmonary diseases which may cause further correction, obstruction is of great importance (15). An important indicator of respiratory dysfunction is changing in blood gases. The most useful information about the severity of the disease, its course, the effectiveness of the treatment and its prognosis can be obtained by measuring blood gases (26).

The maximum expiratory flow is reduced if the airway obstruction lasts for months or years. When patients with healthy persons and airway obstruction are compared, the FVC is almost equal, but there is a significant difference in the maximum flow rate, especially during the first second (FEV1). In comparison with a standard, FEV1 is used (26). In our cases, postoperative FEV1 values were increased (Table 5). In chronic obstructive pulmonary diseases such as asthma, emphysema and chronic bronchitis, the rate of FEV1 / FVC decreases, even in the acute seizure episode this rate may drop to 20% (26). In a recent study, Ogreden et al. (27) studied the effect of Septoplasty on cardiopulmonary functions in the patients with nasal obstruction and The difference between preoperative and postoperative mean forced vital capacities (FVC), mean 1st second forced expiratory volumes (FEV1) and the mean value of preoperative FEV1/FVC were statistically significant.

Other researchers found that $FIF_{50\%}$ (maximum inspiratory flow at 50% of forced vital capacity (FVC) scores and peak expiratory flow (PEF) values improved significantly after surgery. Septoplasty improves the nasal breathing pattern. While reducing $FEF_{50\%}$ (maximum expiratory flow at 50% of FVC)/$FIF_{50\%}$, it increases PEF and $FIF_{50\%}$ values (28). Finally, Bachert et al. studied with 54 patients with nasal polyps. They compared these values before the treatment with Mepolizumab and 25 weeks after the treatment and they reported the reduced need for surgery in severe nasal polyposis with mepolizumab in their randomized trial (29). The FEV1 / FVC ratio, which is an indicator of chronic obstructive pulmonary disease, did not change in our cases. There is no difference between the preoperative and postoperative period, and there is no statistical significance because our study group was not included in patients with lung disease.

CONCLUSION

Septum deviation and nasal polyps cause nasal obstruction, adversely affecting lung function tests and blood gases values. Correcting the obstruction due to cardiopulmonary diseases is of great importance.

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