

Original Article

# Frequency of Complications Related to Prone Position During General Anesthesia

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## Abstract

**Background:** The prone position is widely used in spine and spinal cord surgeries and in reconstructive back surgery. If the patients are not placed in this position correctly and safely, or if they are not

carefully displaced from a supine to a prone position, they may suffer many irreversible injuries. This study aimed to determine the incidence of prone position complications during general anesthesia and surgery and related factors in the operating rooms of Mazandaran University of Medical Sciences hospitals in Iran.

**Methods:** A total of 121 patients who were subjected to surgery in a prone position were examined in terms of complications related to this position. The variables of this study were age, gender, weight, type and duration of surgery, co-morbidity, patient's body mass index (BMI), eye injury, airway swelling, runny nose, patient's state of consciousness, neck stiffness, and lower jaw movement restriction. The other variables included skin bruising, redness and burning of the skin, presence of pain, sore throat and cough, hoarse voice, nausea, damage to the ear, peripheral nerves, and genital tract of men, which were recorded in the data collection sheet after obtaining information. The data were analyzed by SPSS 22 software.

**Results:** Overall, 62% of patients were women, and the average age of patients was 45.23 years. In addition, 19.4% of patients had a BMI > 30. Lumbar fusion surgery was the most common surgery in the prone position (43.8%). Surgery time had a direct and significant relationship with the prevalence of complications in patients ( $P=0.00$ ). The most frequent post-surgical complication in the prone position was throat problems (hoarseness, sore throat, throat swelling, and cough) with 71 patients (58.7%), followed by eye complications in the prone position with 67 patients (55.4%).

**Conclusion:** The prone position is one of the most sensitive body positions for brain, spine, and kidney surgeries. The results of this study also showed a high prevalence of immediate complications after surgery, most of which were on the head and face of patients. Considering the sensitivity of this area and its care, taking preventive measures by the anesthesia team can guarantee the patient's health.

**Keywords:** Prone position, Surgery, Anesthesia, Complications



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## Introduction

Each type of surgery is performed in a different and appropriate position. For example, in spine surgeries and percutaneous nephrolithotripsy (PCNL), the preferred position is prone, which gives the surgeon a good view and access to the surgical environment. The prone position is such that the patient's head is supported by a horseshoe jelly pad; no pressure is applied to the ears. Two parallel pads are placed in front of the patient's chest that cover

from the clavicle to the iliac crest, and the abdomen is relatively free from pressure (1). The prone position is widely used in spine and spinal cord surgeries and in reconstructive back surgery. If the patients are not placed in this position correctly and safely, or if they are not carefully displaced from a supine to a prone position, they may suffer many irreversible injuries (2-4). A variety of complications have been reported during surgery in various positions and different countries. The role of a



variety of factors is somewhat clear, but due to the different conditions of operating rooms, the skills and knowledge of operating room personnel, our question in this research is whether patients are exposed to complications in a prone position in the operating rooms of our hospitals. If the answer to this question is positive, what is the extent of these complications, and what are the differences between patients with and without complications? Impaired vision and damage to the skin, ears, breast, and genital organs are complications that can threaten the patient. Damage to internal organs and peripheral nerves due to pressure and ischemia has been reported in some studies. On the other hand, the swelling of the lips, tongue, and pharynx causes narrowing of the airway after the extubation of the patient, which endangers the patient's life (5–8). In one study, the frequency of sores caused by pressure on a patient's body was reported at 5%–66%, and on the other hand, these sores caused long-term hospitalization and increased treatment costs (4). Another study stated that the improper placement of the patient in a prone position caused the neck muscles to cramp, put pressure on the vocal cords, and caused hoarseness in the patient's voice (9). In an investigation on spinal surgery where the patient is placed in a prone position, the patient suffered from vision problems, and the prevalence of eye damage was reported to be 0.05%–1%, which has increased in recent decades (10). Obviously, decreasing the time of surgery in this position can reduce the damage (4). There is a difference in equipment used for positioning patients in operating rooms in developed countries, and transverse rolls are used in our country instead of longitudinal ones. In our country, in addition, there is a difference in the knowledge level of the personnel who place the patient in the prone position, and the patient may suffer from severe irreversible injuries. Further, there are anatomical and morphological differences in people of different regions of the world, on the one hand, and a lack of study in this field in our country, on the other. Accordingly, in this study, it was attempted to investigate these injuries. The study sought to determine the incidence of prone position complications during surgery and factors related to them in the operating rooms of Mazandaran University of Medical Sciences (MAZUMS) hospitals.

## Methods

This descriptive study was conducted in the operating rooms of MAZUMS hospitals. After informing the University Research Council, obtaining permission from the University Ethics Committee, and coordinating with responsible personnel of the surgical department of MAZUMS hospitals, we set out to evaluate the patients

Our study population included all patients who underwent surgery in a prone position with general anesthesia (e.g., spine surgery and PCNL). Our inclusion criteria were >15 years of age and the presentation of consent. On the other hand, the exclusion criteria included patients who had a history of anatomical abnormality due

to trauma and patients who were sent to the intensive care unit without extubation and underwent spinal anesthesia. Standard anesthesia was induced with propofol or sodium thiopental and pancuronium relaxant, and tracheal intubation was performed under laryngoscopy. In addition, anesthesia maintenance was similar for the patients. The patient is placed in the prone position by the treatment staff. Transverse rolls are placed under the chest and in the public area, and the hands are placed in the superman position (hands parallel to the head) where there is a soft pillow under the hands. The variables of this study were age, gender, height, weight, type and duration of operation, co-morbidity, body mass index (BMI) of the patient, eye injury, airway swelling, runny nose, patient's state of consciousness, and neck stiffness. The remaining parameters included lower jaw movement restriction, skin bruising, redness and skin burns, the presence of pain, a sore throat and cough, a hoarse voice, nausea, damage to the ear, peripheral nerves, and the genital area of men. The data were collected and recorded in the data collection sheet. The person who appeared at the patient's bedside on the same day of surgery first received verbal consent from the patient and assured him/her that their information was anonymous and protected. Afterward, he asked 30 questions from the questionnaire and recorded the patient's responses on the sheet. The questionnaire included the demographic information of the patients and the investigated complications. The collected data were analyzed using the Mann-Whitney test and the chi-square test for qualitative and quantitative variables,

**Table 1.** Characteristics of Patients and Those Related to Complications

Variable	Frequency	P Value
<b>Gender</b>		
Male	59 (48.8)	<0.89
Female	62 (52.2)	
Age	45.23 ± 13.23	<0.82
<b>BMI</b>		
<30	90 (74.6)	<0.45
>30	23 (19.4)	
<b>Diabetic</b>		
Yes	16 (13.2)	<0.99
No	105 (86.8)	
<b>Hypertension</b>		
Yes	9 (7.4)	<0.42
No	112 (92.6)	
<b>Type of surgery</b>		
Spin fusion	53 (43.8)	<0.46
PCNL	18 (14.9)	
Lumbar ozone therapy	15 (12.4)	
Other	35 (28.9)	
Surgery time	3.38 ± 1.47	<0.001
<b>Tracheal tube size</b>		
7	28 (23.1)	0.50
7.5	65 (53.7)	
8	15 (12.4)	

Note. PCNL, percutaneous nephrolithotripsy; BMI, body mass index.

respectively. Finally, the data were reported as numbers and percentages.

**Results**

A total of 121 patients subjected to surgery in the prone position were examined in terms of complications related to this position. The characteristics of patients are provided in Table 1. In general, 62% of the patients were women, and the average age of the patients was 45.23 years. In addition, 19.4% of patients had a BMI > 30. Lumbar fusion surgery was the most common surgery in the prone position (43.8%) and PCNL (14.9%).

Among the demographic and clinical variables, only the surgery time had a significant relationship with the rate of complications associated with the prone position, and the overall rate of complications increased with the increase in surgery time ( $P < 0.001$ ). The most common complication after surgery in the prone position was related to throat problems (hoarseness, sore throat, throat swelling, and cough) in 71 subjects (58.7%). Further, 44 patients (36.4%) experienced hoarseness of voice after surgery. However, no relationship was observed between hoarseness of voice and the investigated variables. After hoarseness of voice, 39 patients (32.2%) had throat pain. Bivariate regression analysis showed that the duration of surgery has a significant correlation with throat pain ( $P < 0.001$ ). After

the problems related to the throat, eye complications in the prone position were the most prevalent in 67 patients (55.4%). Swelling of the eyes after surgery in a prone position was one of the most common ocular complications (28.1%), which had a significant relationship with diabetes in patients ( $P = 0.00$ ). The prevalence of blurred vision was 21.5% (26 patients), which had a direct and significant relationship with the age of patients ( $P = 0.00$ ) and with the duration of surgery ( $P = 0.00$ ). Skin-related problems affected 12.4% of patients. The duration of the operation was one of the factors affecting skin redness after surgery ( $P = 0.00$ ). Table 2 presents the details of the prevalence of complications related to a prone position and the factors related to it.

**Discussion**

Several studies have mentioned the physiological changes occurring in the prone position. Lack of or inappropriate padding exerts a significant load on the chest and abdomen, which causes an increase in central venous pressure, a decrease in preload of the right atrium, and a reduction in venous return from the lower limbs (12). Obese people are more susceptible to increased central venous pressure and other complications of the prone position than other patients, which can be reduced with proper and principled padding (12).

**Table 2.** Prevalence of Complications Related to Prone Position and the Factors Related

Variable	Yes	No.	Missed Data	Gender	Age	BMI	Diabetic	HT	Type of Surgery	Surgery Time	T-tube Size
Hoarseness	44 (36.4)	74 (63.6)									
Pain throat	39 (32.2)	81 (66.9)	1 (0.8)								
Swelling eye	34 (28.1)	87 (71.9)									
Swelling throat	31 (25.6)	90 (74.4)									
Blurred vision	26 (21.5)	95 (78.5)									
Watery ear	26 (21.5)	95 (78.5)									
Redness eye	24 (19.8)	94 (77.7)	3 (1.7)								
Nausea	17 (14)	104 (86)									
Cough	16 (13.2)	105 (86.9)									
Irritation of eye	13 (10.7)	108 (89.3)									
Redness of skin	12 (9.9)	108 (89.3)	1 (0.8)								
Neck cramp	10 (8.3)	111 (91.7)									
Pain eye	9 (7.4)	112 (92.6)									
Itchy eye	8 (6.6)	113 (93.4)									
Genital pain	8 (6.6)	53 (43.8)	60 (49.6)								
Axillary nerve injury	7 (5.8)	114 (94.2)									
Watery noise	4 (3.3)	117 (96.7)									
Mandible limitation	4 (3.3)	117 (96.7)									
Skin injury	4 (3.3)	113 (93.4)	4 (3.3)								
Bruising skin	3 (2.5)	116 (95.9)	2 (1.7)								
Breast injury	3 (2.5)	58 (47.1)	61 (50.4)								
Ear injury	2 (1.7)	119 (98.3)									
Burn of skin	1 (0.8)	118 (97.5)	2 (1.7)								

Note. BMI, Body mass index, HT, Hypertension. Black cells show statistically significant and related.

To perform surgery in the prone position, different methods are used, including the Jackson bed, Wilson frame, Andrews frame, or rolls. In Iran's operating rooms, transverse rolls and jelly donuts are used for the head and face to perform surgeries in the prone position.

#### **Complications Related to Pharynx and Endotracheal Tube**

Among the side effects related to the mouth and the pharynx, we can mention sore throat, which is one of the common side effects of surgery in the prone position with general anesthesia and an endotracheal tube. In a critical trial and prospective study on 70 patients, Lee et al evaluated the prophylactic effect of dexamethasone for sore throat after general anesthesia in the prone position. The prevalence of sore throat was reported at 14.4%–50% (13).

In our study, a 32% prevalence of sore throats was reported, which had a significant relationship with surgery time. After changing the position from supine to prone following anesthesia, endotracheal tube displacement occurs in nearly 91.7% of cases, and this displacement leads to sore throat, hoarseness of voice, cough, and swelling of the pharynx (14). In our study, the frequencies of hoarseness of voice and cough were reported 36% and 13%, respectively. In the study of Kajal, it was reported at 44% (15).

#### **Ocular Complications**

Ocular complications due to improper padding in a prone position were first reported by Slocum et al in 1948 (16). One of the most dangerous ocular complications of a prone position is the loss of vision after surgery. In 2014, in a retrospective study, Nandyala et al reported that the prevalence of loss of vision was 0.019–0.20% (17). Loss of vision after surgery has different degrees, from temporary blurring to partial or complete loss of vision (18).

Ocular complications include eye itching (6.6%), eye pain (7.4%), blurred vision (21.5%), eye redness (19.8%), burning eye (10.7%), watery eye (21.5%), and eye swelling (28.5%). A significant relationship was found between diabetes and eye swelling, which conforms to the results reported in the study by Nickels et al (19). In addition, there was a significant relationship between eye redness and the age of the patient.

#### **Skin Complications**

Pressure ulcers occur more often in bony prominences because the pressure of the patient's weight and other forces are more applied to bony prominences, and blood flow in these areas decreases due to the reduction of muscle tone because of the drugs used in general anesthesia. Grisell et al concluded that the prevalence of pressure ulcers was 5%–66% (20). In our study, redness of the skin, bruises, skin burns, and damage to ears, breasts, and genital area were reported to be 9.9%, 3.3%, 2.5%, 0.8%, 1.7%, 2.5%, and 6.6%, respectively. During surgery in the prone position, the rate of stage 1 pressure ulcers was reported at 5%–66%, and the risk of pressure ulcers had a significant relationship with the length of the operation (21).

#### **Neurological Complications**

Surgery in a prone position increases the risk of injury to the cervical spine and brachial plexus, which occurs as a result of increased point pressure or remaining in the position of flexion or extension for a long time, which increases central venous pressure or leads to local edema. Overall, 5.8% brachial plexus damage, 8.3% neck stiffness, and 3.3% jaw movement restriction were reported in our study.

#### **Limitations**

Genital and breast injuries in this study were evaluated by the patient's same-gender partner after the researcher provided the necessary training. This assessment can cause problems with the collected data due to the presence of an intermediary in the way of information collection.

#### **Conclusion**

The prone position is one of the most sensitive body positions for performing brain, spine, and kidney surgeries. The results of this study also showed a high prevalence of immediate complications after surgery, most of which are located in the head and face areas of patients. Considering the sensitivity of this area, its care and taking preventive measures by the anesthesia team will guarantee the patient's health. In this study, the prone position was performed by rolls on the chest and lower abdomen with jelly donuts on the head and face. For future studies, it is suggested that this method of prone position be compared with other methods such as the Jackson bed and the like.

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#### **Authors' Contribution**

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#### **Competing Interests**

All authors have no conflict of interests to report.

#### **Ethical Approval**

This study was approved by the Ethics Committee of Mazandaran

University of Medical Sciences (Ethics Code: IR.MAZUMS.REC.1398.479).

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