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# Modification of Gloves for Water Cushion As An Injury Prevention During Tumor Removal Procedure in Prone Position: Case Report

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**Abstract**

**Background:** Surgery in the prone position has been associated with various complications such as facial edema, pressure ulcers, and eye problems. It is important to prevent complications during prone position with head support. Modification of water cushions made from gloves to protect the facial area is often done, but needs to be considered between the benefits and risks to patient safety.

**Case:** A 29 year old woman with a tumor of the occipital region. The patient underwent tumor removal surgery in a prone position for +/- 9 hours. During the operation, the patient uses water cushions from the glove that are placed on the forehead and two sides of the eye. The cushion burst during positioning and in the middle of the operation a water cushion fell. After surgery, the patient complained of blurred vision and facial swelling for 2-3 days.

**Conclusion:** The cushion modification of gloves has the benefit of protecting the bony prominences of the face. Apart from that, the risks of using this modification need to be taken into account, such as the risk of contamination, risk of injury if the placement is uncorrect, and injury also can arise if the cushions shifts or falls due to poor fixation. The modifications can be improved by replacing the gloves used, the water used, and the level of elasticity of the cushion. They can also use head supports that have been proven effective and improve intraoperative monitoring.

**Keywords:** Post operative complications, prone position, water cushion modification

## 1. INTRODUCTION

The prone position has been widely used and developed as an access requirement for surgical procedures, one of which is tumor removal. Positioning the patient correctly is an important step of the surgical procedure. It is the responsibility of both surgical nurses and anesthesia nurses to ensure that patients avoid the risk of injury and maintain maximum airway (1).

The prone position is performed with the patient lying on his back with the head, neck, and spine maintained in a neutral position; the patient is then changed from supine to prone while maintaining a neutral position of the head, neck, and spine (2). Patient safety is the most important factor; therefore, when determining the patient's position, blood pressure and pulse oximetry must be monitored. The intubation tube must not be compressed, and we must also consider the comfort of the surgeon, especially for long-term interventions (1).

Surgery in the prone position has been associated with various complications originating from increased pressure on anterior structures, such as pressure ulcers, abdominal compression, facial edema, and postoperative visual loss (POVL). The rate of pressure ulcers as a complication in this position is reported to be between 5% and 66%. Postoperative vision loss

(POVL) can be caused by inappropriate orbital pressure and can also be a permanently debilitating condition. Inappropriate pressure on vital abdominal structures can cause ischemia and organ failure, resulting in prolonged hospitalization, permanent disability, or even death. Cardiovascular changes associated with surgery are prone to increasing the risk of intraoperative cardiac arrest. In addition, surgery in the prone position is also associated with airway management challenges and CPR problems due to limited access to anterior structures (3).

The use of a headrest or head support in this position is also a crucial factor that needs to be considered. The quality of the head support used during surgery will have a significant impact on the patient's condition. Quality head support will minimize the risk of injury that the patient may experience. Asok et al. (4) in their study recommended a Mayfield head brace to prevent external pressure on the orbit, while Roth et al. (5) suggested using a square foam headrest and avoiding the use of a horseshoe headrest during surgery because it can increase the risk of position changes and cause increased orbital pressure (3). In Indonesia, the quality of an effective headrest is not necessarily easy to apply in an operations room. The unavailability of tools made the hospital modify the headrest used for prone positioning during surgery. One form of modification is to place additional pads to reduce pressure on the prominent area of the face. A form of modification that can be found is the use of water cushions made from gloves as a tool to minimize pressure that used in SGH's surgical installation. Water cushions are placed on facial bony prominences and the eye area to avoid direct pressure from the headrest. Tool modifications can certainly support the success of the operation process, but the use of these modifications still needs to consider the security aspects and risks that accompany them.

## 2. Case

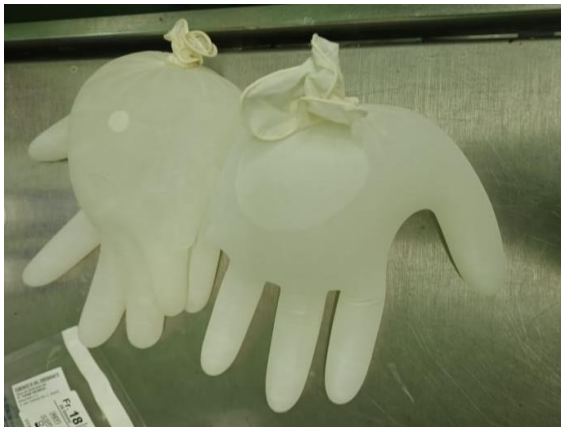
Patient Mrs. R is a 29-year-old woman who was accepted at Dr. Sardjito General Hospital on 03/06/2024 with an occipital tumor measuring 13x13 cm. She had been suffering from this tumor for eleven years before the patient entered the hospital. The patient's medical diagnosis at SGH was a tumor in the occipital area, which was suspected to be a hemangioma. The patient was planned to undergo surgery to remove the tumor and close the defect.

The results of the physical examination showed that the patient weighed 84 kg with a height of 162 (BMI 32.01 m2/kg). The patient is fully conscious with GCS: E4V5M6, blood pressure 134/83, N: 100, S: 36.90C. Head examination results: pupil size 3/3 mm, light reflex +/+, CN Palsy (-). Local status of the head shows a lump measuring 13x13 cm; the skin color is reddish; in some parts there is crust and pus; there is no tenderness; the lump feels springy and lumpy.

The patient underwent craniotomy tumor removal and defect closure on Monday, 10 June 2024, at 10.00 am under general anesthesia.

Before the incision is made, the patient is repositioned from the supine position to the pronation position, with the following description:

a. 3-4 cushions from non-sterile gloves filled with water and tied
b. The patient's eyes are given chloramphenicol eye ointment and covered with gauze.
c. The operating table uses an extended table with a horseshoe headrest, pads to support the chest, pads to support the thighs, and pillows to support the shins of the legs.
d. The patient is positioned slowly in pronation on the operating table.
e. The patient's face is placed in the headrest hole, the ETT is ensured that it is not bent, and 3 water cushions are placed on each forehead and right and left eye temples to avoid direct pressure from the headrest. The cushion is then fixed to the head using Hypafix plaster.
f. It is ensured that the patient's abdomen is free/hanging and not pressured by the pillow.
g. Both arms are aligned with the body (adducted), then tied using linen and additionally fixed with Hypafix.



A few minutes after the water cushions were positioned, one of the cushions broke, and the nurse immediately replaced it. During the duration of the operation, one of the cushions also fell.

The patient experienced a prolonged duration of the operation, up to 9 hours. This is because the wound defect obtained as a result of tumor removal is quite extensive, so the defect closure procedure takes quite a long time. The total perioperative bleeding experienced by the patient was 1720 cc. During the duration of the operation, the patient received 5000 cc of crystalloid fluid, 1000 cc of colloid, 500 cc of PRC, and 250 cc of albumin.

The patient was transferred to the SICU on June 10, 2024, at 21:15 PM with sedation and intubation. The patient was extubated on June 11, 2024, at 07.25 AM. The patient's GCS is E4V5M6, pupil is 3mm/3mm isochore, light reflex is +/+, the wound is not seeping, and there is no hemiparesis. The patient reported having a swollen face and blurry vision for two to three days following surgery. Five days post surgery, the patient's problems had subsided. The patient received discharge on June 15, 2024.

## 3. DISCUSSION

Mrs. R's procedure, which involved removing a tumor from the occipital region, results in a large defect. The resulting wound defect is roughly 10 cm x 10 cm. Initially, the wound was closed with flap procedure; however, this method was not able to cover the entire defect due to its extensive dimension. The plastic surgeon made the decision to treat the wound with an STSG as a result.

Mrs. R's surgery took nine hours to complete after being estimated to complete in just four hours. Prolonged surgery duration undoubtedly has an impact on the patient's risk of damage. Additionally, because the occipital region of the head is the surgical site, the patient must remain prone for the entire surgical procedure. The risk of problems from the pronation posture can be increased by extending the operating period to more than 6 hours (3) and by combining other risk factors that the patient has.

Mrs. R has several other risk factors that can increase the potential for complications due to the prone position. Among these include the following: Mrs. R is overweight (3). Mrs. R is categorized as obese due to her height of 162 cm, weight of 84 kg, and BMI of 32.01 m2/kg. Blood loss above 1000 milliliters is the second risk factor (3). Mrs. R had lost approximately 1720 milliliters of blood during surgery. The third factor is the increase ratio between the crystalloid to colloid ratio (6), with more crystalloids—5:1—being administered during Mrs. R's operation than colloids. According to DePessse et al. (6), external pressure on the eye is the fourth factor. This is caused by the use of water cushions placed around the eyes, which can put direct pressure on the eyeball.

It is important to examine the background surrounding the application of water cushions modifications. First of all, because the headrest is composed of a hard material, using it for extended periods of time without additional safety will make it harmful. Secondly, the surgeon will do procedures that can put more pressure on the region below—the facial area—during operations involving an incision in the occipital lobe. In order to lower risk of pressure sores, the face must be securely placed with soft cushions. Third, there are multiple bony prominence points in the face area that are prone to abrasions.

The main purpose of the use of water cushions from gloves is to protect the face from pressure caused by the head support. This region is extremely sensitive to pressure since it is where the bones are closest to the skin's surface. When the patient is positioned in a prone position, the zygomatic arch, pri-orbital arch, and frontal bone are among the bony prominence areas that require protection. This is the rationale behind using a protective pad to lessen pressure and shield the body from harm. Thus, in Mrs. R's operation, the water cushion modification was positioned at three points: the forehead and both temples.

Besides to its advantages, this change carries some risk, which needs to be taken into consideration. First of all, neither the water nor the gloves used in this modification are sterile. In addition, the gloves' material is typically thin and fragile, breaking easily under excessive pressure. During surgery, a broken water cushion can contaminate the sterile area and raise the risk of infection. Second, since the water cushion and

the headrest are different instruments, secure attachment is necessary to prevent the water cushion from moving or falling while the procedure is being performed. This could have a major effect, increasing the risk of harm to the areas unsupported by the cushion. Third, placing the water cushion next to the eye can exert external pressure on the eyeball. The periorbital area and zygomatic arch are meant to be protected by the cushion's positioning; yet, because of its proximity to the eye, the water cushion may press against the eyeball and raise the possibility of perioperative ocular damage. Patients may develop postoperative symptoms due to the use of less effective alterations.

Impaired vision post surgery may indicate complications. Patients who have had surgery have frequently reported having postoperative vision problems (3). According to Stambough et al. (7), pronation during surgical operations is thought to be the cause of 0.05% to 1% of ocular injuries. Simple corneal abrasion, retinal vascular occlusion, and ischemic optic neuropathy are among the possible causes of this occurrence. Prolonged hypotension, anemia, surgical trauma, gastrointestinal hemorrhage, shock, prone positioning, direct pressure on the eyeball, and extended operating times are among the factors that might cause an ophthalmic damage. Reduced venous return from the head is linked to visual loss in prone and Trendelenburg positions. Increased intracranial pressure, which adds to the optic nerve's extreme pressure, can also result in vision impairment. The prone position increases the risk of direct compression injury to the orbit and corneal abrasion (8).

Early postoperative swelling is another possibility, this facial swelling obviously appears after a few hours following surgery (9). It has been demonstrated that prolonged prone surgery, head-down positioning, and high intravenous fluid infusions may possibly be the cause of this complication. Venous congestive edema during occipital surgery can also result from extreme neck flexion and is potentially fatal. Swelling of the face and oropharynx can result from venous drainage from the pharyngeal, lingual, and facial vessels becoming disrupted by compression of the internal and external jugular veins by neck flexion (10).

## 4. CONCLUSIONS

Modifications of the water cushion can protect the facial bony prominences, such as the forehead, zygomatic, and periorbital prominences, from pressure caused by head support. Besides of the benefit, modifying water cushions using gloves also has some adverse effects that need to be considered. The risks that can arise from using this modification include the risk of infection and contamination because the water cushion is not sterile and breaks easily, the risk of injury if the placement is uncorrect, and injury can also arise if the water cushion shifts or falls due to poor fixation. Therefore, to avoid the side effects of using modified water cushions, hospitals can use a type of head support that has been proven to be effective in protecting the facial area from direct pressure, thereby minimizing the risk of injury, such as the Mayfield skull clamp and ProneView foam headrest. Apart from that, modification improvements such as the level of elasticity of the cushion, the materials and water used, as well as improving patient monitoring during the surgical period, can also be carried out as an effort to improve injury prevention.

## 5. Abbreviations

a. SGH: Sardjito General Hospital
b. CN: Cranial Nerve
c. STSG: Split-skin Thickness Skin Graft
d. POVL: Post Operative Visual Loss
e. BMI: Body Mass Index
f. PRC: Packed Red Cell
g. GCS: Glasgow Coma Scale

## 6. Acknowledgements

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## 7. Ethics approval and consent to participate

Consent to participate was performed to patient before manuscript submitted and available from corresponding author.

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