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Effects of Head Position on Postoperative Conjunctival Swelling After Prone Spinal Surgery

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The purpose of this randomized prospective study was to determine the effects of head position on postoperative conjunctival swelling (chemosis) after prone spinal surgery. On the basis of the head position, 140 patients scheduled for prone lumbar surgery were randomly allocated into 2 groups: head neutral group (n = 70) versus Head Down (HD) group (n = 70). Head position was defined as neutral when the imaginary line from the occipital protuberance to the top of C7 spine process is parallel to the operating table. HD position was maintained by adjusting the height of the prone headrest 5 cm lower than neutral position. Chemosis was evaluated after surgery. The overall incidence of chemosis in the Head Neutral group was significantly lower than the Head Down group [25 (35%) vs 48 (68%), p = 0.003]. The severity of chemosis, which was graded as none, mild, moderate and severe, showed statistically significant difference between the head neutral group [45 (65%), 14 (20%), 7 (10%), 4 (5%), respectively] and Head Down group [22 (32%), 13 (18%), 25 (36%), 10 (14%), respectively, $p<0.05$]. This result suggested that neutral head position was useful in decreasing the development of postoperative chemosis after prone spinal surgery.

Key words: Conjunctival swelling, head position, prone position, spine surgery

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INTRODUCTION

Eyes should be protected from injury during anesthesia. Several postoperative eye injuries have been reported particularly when the patient is positioned prone (Roth *et al*., 1996; Cheng *et al*., 2001; Dunker *et al*., 2002; Abraham *et al*., 2003; Hunt *et al*., 2004; Thakker *et al*., 2005; Lee *et al*., 2006; Leibovitch *et al*., 2006).

Facial swelling, especially conjunctiva, is one of these postoperative findings in patients who underwent spinal surgery in the prone position (Sinha *et al*., 2001; Roth, 2005; Leibovitch *et al*., 2006).

Conjunctival swelling (Chemosis) may be mild and asymptomatic or may manifest with hyperemia and foreign body sensation, or even conjunctival or corneal infection secondary to ocular surface exposure (Thakker *et al*., 2005).

There has been only one controlled and randomized study related to the effect of head position on postoperative chemosis after prone lumbar surgery by Jeon *et al*. (2007).

They conducted a study on 108 patients scheduled for lumbar surgery and found that when a patient is placed on prone position for surgery, the head tends to be lower than body. Such Head Down (HD) position can play an important role in the development of postoperative chemosis provoked by the prone position via increases in ocular venous pressure due to gravitational effect and that neutral or elevated head position during prone position can decrease postoperative chemosis (Jeon *et al*., 2007).

Since chemosis after spine surgery in prone position is common and sometimes sever in our neurosurgical patients; we conducted a study to evaluate factors contribute to the development of this complication.

MATERIALS AND METHODS

This randomized clinical trial was performed in Dr. Shariati Hospital of Tehran University of Medical Sciences from January to June 2007. The study protocol conformed to the ethical guidelines of the 1989 Declaration of Helsinki.

After Institutional Ethics committee approval, each patient's informed consent was obtained separately. One hundred and forty American Society of Anesthesiologists (ASA) I (a normal healthy patient) and II (a patient with mild systemic disease that results no functional limitation) patients aged over 16 years, who were scheduled for prone spinal surgery under general anesthesia were enrolled in the study. Exclusion criteria were preexisting primary and secondary eye disease or previous eye surgery.

On arrival in the operating room, standard anesthesia monitors were placed and noninvasive blood pressure, electrocardiogram and SpO_2 were monitored throughout the perioperative period. Anesthesia protocol was standardized for all study patients. After induction of anesthesia with thiopental sodium 5 mg kg^{-1}, fentanil 2 μg kg^{-1} and atracuronium 0.5 mg kg^{-1} were injected intravenously. Ventilation was assisted with O_2 via a face mask and tracheal intubation was performed by an anesthesiologist. Anesthesia was maintained with O_2-N_2O and isoflurane. Thereafter, an arterial line was placed in radial artery of nondominant hand for monitoring of mean arterial pressure during operation.

An occlusive dressing applied to both eyes in all patients to protect the eyes from the injury due to eye opening. The patient was positioned prone and the head was placed on a viscoelastic polymer headrest (Action® operating pads and positioners, USA) without external direct compression to both eyes and the neck was in the midline position. Depending on the head position, 140 patients were randomly allocated to equal 2 groups: Head Neutral (HN) group (n = 70) versus Head Down (HD) group (n = 70). Randomization was based on computer-generated codes that were concealed until interactions were assigned.

Head position was defined as neutral when the imaginary line from the occipital protuberance to the top of C7 spine process is parallel to the operating table. HN position was accomplished by laying a hard board with height of 5 cm beneath the prone headrest and by adding some towels if necessary. HD position was similar with HN position except that the height of the prone headrest was lower by 5 cm than neutral position by removing the hard board (Fig. 1).

The prone headrest and the patient's head were covered with a single large towel, respectively. Thereafter, another anesthesiologist was enrolled in the study to avoid an anesthesiologist's intentional control over the amount of administered fluid. Throughout the operation, the operating table was in the horizontal position and the patient's eyes were checked every 30 min for the prevention of external direct compression.

Mean Arterial Pressure (MAP) was measured continuously through arterial line and was kept within 20% of awake value and ventilation was adjusted to keep end-tidal carbon dioxide (ECO_2) in the range of 30 to 35 mm Hg throughout the operation. After the surgery was completed and patients were rolled supine, the degree of chemosis was evaluated by only an anesthesiologist blinded to the type of head position. The degree of chemosis was graded using a 4 point scale: (none, mild = nasal or temporal, moderate = nasal and temporal, severe = total, corneal involvement).

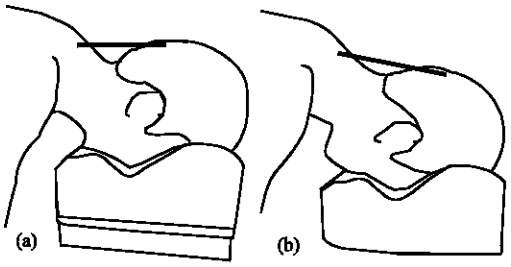

Fig. 1: Schema of the head positioning. A hard board with height of 5 cm is shown in the HN position (A) but is not shown in the HD position (B).The line between the occipital protuberance and the top of C7 spine process is shown in the Fig. The head is lower and the neck is more flexed in the HD position, compared with the HN position

Statistical analysis: A sample size of 70 patients in each group will be sufficient to detect a 25% difference of in the incidence of postoperative chemosis between 2 groups, assuming power of 85% and a significant level of 0.05. Statistical analysis was performed With SPSS package version 11.5. Demographic data were analyzed by independent sample t-test and the degree of chemosis between the two groups was analyzed by chi-square test. After classifying patients according to presence or absence of the postoperative chemosis, binary logistic regression was used to determine which factors were related to the development of postoperative chemosis.

RESULTS

The patients' demographic and intraoperative data such as fluid balance [(fluid input+transfused blood)-(urine output+estimated blood loss)] and duration of surgery were not statistically different between the two groups (Table 1).

Arterial pressure, heart rate and end-tidal CO_2 did not change significantly during the study period.

The overall incidence of chemosis in the Head Neutral group was significantly lower than the Head Down group [25 (35%) vs 48 (68%), p = 0.003, Table 2].

The severity of chemosis, which was graded as none, mild, moderate and severe, showed statistically significant difference between the head neutral group [45 (65%), 14 (20%), 7 (10%), 4 (5%), respectively] and Head Down group [22 (32%), 13 (18%), 25 (36%), 10 (14%), respectively, p<0.05, Fig. 2].

Binary logistic regression analysis including of head down position, fluid balance and duration of surgery demonstrated that all of them were significantly predictors for developing chemosis (p<0.05, Table 3).

All the patients reported normal vision by an ophthalmologist assessment after the surgery.

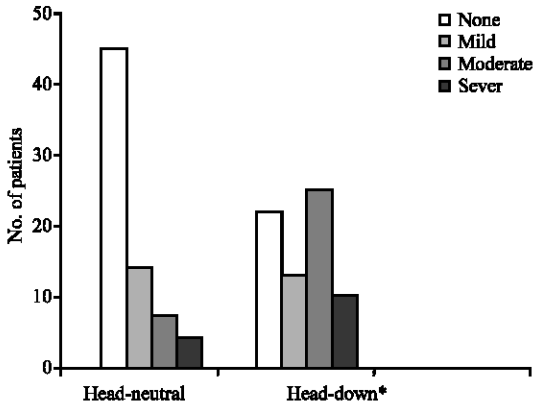

Fig. 2: The degree of chemosis after spinal surgery in prone position in the study groups. None, mild = nasal or temporal, moderate = nasal and temporal and severe = total. *p<0.05 versus HN group

Table 1: Comparison of demographic and intraoperative data between the study groups

Variables	Head neutral (n = 70)	Head down (n = 70)
Age (year)	58±6	53±13
Sex (M/F)	36/34	38/32
Weight (kg)	70±11	69±13
Type of surgery		
Diskectomy	12	11
Laminectomy	40	38
Interbody fusion	18	21
Duration of surgery (min)	101±11	121±20
Estimated blood loss (mL)	458±166	480±123
Fluid balance (mL)	1310±560	1570±480

Data are presented as mean±SD. Fluid balance: (fluid input+transfused blood) - (urine output+estimated blood loss)

Table 2: Demographic and intraoperative data according to the postoperative chemosis

Variables	No chemosis (n = 67)	chemosis (n = 73)	p-value
Head position (N/D)	45/22	25/48	0.003
Age (year)	58±15	54±18	0.153
Sex (M/F)	36/23	47/34	0.241
Weight (kg)	68±23	61±31	0.540
EBL (mL)	175±110	553±410	0.001
Fluid balance (mL)	435±122	1078±547	0.010
Duration of surgery (min)	90±24	130±17	0.012

Data are presented as mean±SD. Fluid balance: (fluid input + transfused blood)-(urine output+estimated blood loss), EBL: Estimated Blood Loss

Table 3: Factors related to the development postoperative chemosis based on binary logistic regression analysis

Parameters	Number (%)	OR (95% CI)	p-value
Head position			0.002
Neutral	70 (50)	1	0.010
Down	70 (50)	6.7 (4.5-7.3)	0.003
Fluid balance (mL)			0.006
<1000	38 (27)	1	
1000-1500	55 (39)	5.8 (3.4-8.3)	0.014
>1500	47 (34)	23.2 (18.1-24.2)	0.001
Duration of surgery (min)			0.004
<120	34 (24)	1	
120-160	86 (62)	4.3 (2.1-7.5)	0.010
>160	20 (14)	16.4 (9.9-19.7)	0.002

OR: Odds Ratio, Fluid balance: (fluid input+transfused blood)-(urine output+estimated blood loss)

DISCUSSION

In this study, we showed that the patients whose heads were positioned neutral in prone position for spinal surgery, had lower incidence of conjunctival swelling compared with those in head down position. Positive fluid balance and duration of surgery also were strongly related to the development of postoperative chemosis.

Postoperative eye complications, especially blindness after prone spinal surgery is a major area of concern for anesthesiologists. But postoperative chemosis after spine surgery has been considered as only a minor concern, because, in most cases, it spontaneously resolves in the early postoperative period without sequel, but anesthesiologists may pay attention to severe chemosis. Although chemosis does not represent a risk for the development of a serious problem such as visual loss, but it may occur initially or simultaneously in some patient with ischemic orbital compartment syndrome or posterior ischemic optic neuropathy related to postoperative blindness (Lee *et al*., 2006; Leibovitch *et al*., 2006).

Chemosis may be a rare but potential problem in itself. It was well known that corneal exposure secondary to conjunctival chemosis or lid damage was the principal risk factor for bacterial keratitis and can give some patients a discomfort. In the study by Jeon *et al*. (2007), some patients complained of foreign body sensations in the eye due to chemosis in immediate postoperative period.

Chemosis after spine surgery is predisposed to be developed in cases of increased hydrostatic pressure, such as venous pooling in the dependent areas with the prone or the HD position or decreased venous/lymphatic drainage. In addition, in HD position, the head to be flexed with some degrees during prone positioning. Because the internal jugular vein and veins of orbit do not have valves, venous stasis will increase with every degree of the head flexion.

In this study, the incidence of chemosis was more common in patients with HD position, compared with neutral head position [48 (68%) vs 25 (35%)] that was correlated with Joen *et al*. (2007) study. They found that the overall incidence of chemosis in the HN group was significantly lower than the HD group [30 (56%) vs.44 (81%), $p<0.05$].

In our study the severity of chemosis was statistically different between the two groups and was more sever in HD group. These findings were correlated with the study by Jeon *et al*. (2007).

We also found that development of postoperative chemosis was related to the duration of surgery (surgeries longer than 120 min, resulted more chemosis) and positive fluid balance ($p<0.05$, Odds Ratio>1).This finding was also similar to Jeon *et al*. (2007) study.

In the prone position, positioning of the head can be accomplished with various headrests such as a cushion, a horseshoe head rest and head holder with pins. To reduce the extent of chemosis, the head holder with pins might be superior to other headrests in avoiding periorbital compression from the device, because periorbital compression can lead to venous stasis by obstructing venous and lymphatic drainage.

In this study we only used the viscoelastic polymer headrest for prone position but Jeon *et al*. (2007) used Wilson frame for prone positioning. There might be difference in the height between the head and the body and the degree of the neck flexion in the prone position with these different type of head rest. On the other hand, in our study the duration of surgery was almost, less than 3 h. Further study may be needed with different type of head rest and longer operation to determine how much head position will affect the degree of chemosis for significantly longer operations.

In conclusion, this study showed that chemosis after spine surgery was a common and un avoidable side effect of the prone position. Neutral head position, smaller fluid administration and shorter duration of operation were recommended to decrease the severity of postoperative chemosis in patients undergoing prone spinal surgery.

REFERENCES

Abraham, M., N. Sakhuja and S. Sinha *et al*., 2003. Unilateral visual loss after cervical spine surgery. J. Neurosurg Anesthesiol., 15 (4): 319-322.

Cheng, M., A. Todorov and R. Tempelhoff *et al*., 2001. The effect of prone positioning on intraocular pressure in anesthetized patients. Anesthesiology, 95 (6): 1351-1355.

Dunker, S., H. Hsu and J. Sebag *et al*., 2002. Perioperative risk factors for posterior ischemic optic neuropathy. J. Am. Coll. Surg., 19 (5): 705-710.

Hunt, K., R. Bajekal and I. Calder *et al*., 2004. Changes in intraocular pressure in anesthetized prone patients. J. Neurosurg. Anesthesiol., 16 (4): 287-290.

Jeon, Y.T., Y.O. Park, J.W. Hwang, Y.J. Lim, Y.S. Oh and H.P. Park, 2007. Effect of head position on postoperative chemosis after prone spinal surgery. J. Neurosurg. Anesthesiol., 19 (1): 1-4.

Lee, L.A., S. Roth and K.L. Posner *et al*. 2006. The American society of anesthesiologists postoperative visual loss registry: Analysis of 93 spine surgery cases with postoperative visual loss. Anesthesiology, 105 (4): 652-659.

Leibovitch, I., R. Casson, C. Laforest *et al*., 2006. Ischemic orbital compartment syndrome as a complication of spinal surgery in the prone position. Ophthalmology, 113 (1): 105-108.

Roth, S., R. Thisted and J. Erickson *et al*., 1996. Eye injuries after nonocular surgery: A study of 60, 965 anesthetics from 1988-1992. Anesthesiology, 85 (5): 1020-1027.

Roth, S., 2005. Postoperative Blindness. In: Anesthesia, Miller, R.D. (Ed.). 6th Edn. Elsevier, New York, pp: 2991-3020.

Sinha, A., A. Agarwal, A. Gaur and C.K. Pandey, 2001. Oropharyngeal swelling and macroglossia after cervical spine surgery in the prone position. J. Neurosurg. Anesthiol., 13 (3): 237-239.

Thakker, M., K. Tarbet and B. Sires, 2005. Postoperative chemosis after cosmetic eyelid surgery: Surgical management with conjunctivoplasty. Arch. Facial. Plast. Surg., 7 (1): 185-188.