

Research Article

Effect of Topical Hydrogen Peroxide on Postoperative Blood Loss in Patients Undergoing Laminectomy

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Abstract

Background: Massive blood loss occurs frequently and remains a challenge in spinal surgery, significant intra and postoperative hemorrhage negatively affects patient outcomes by increasing coagulopathy, postoperative hematoma and anemia. Many efforts have focused on reducing blood loss, Hydrogen peroxide (H₂O₂) is an inexpensive and readily available option with hemostatic and antiseptic properties. **Objectives:** to evaluate topical H₂O₂ application on wound in patients undergoing laminectomy. **Study design:** prospective randomized controlled double blinded study. **Methods:** this study involved 80 patients underwent thoraco-lumbar laminectomy. 40 patients received topical H₂O₂ 3% in 100 ml saline (group H), while 40 patients received 100 ml saline wash (group C) as control group. The outcome was measured by postoperative drains, total blood loss and hemoglobin (Hb), hematocrit (Hct) and platelet (PLT) levels after 24 hours and after 48 hours. **Results:** there was a significant difference in the postoperative blood loss & transfusion and Hb & PLT levels after 48 hours in H₂O₂ group when compared to the control group. **Conclusion:** H₂O₂ can reduce postoperative blood loss and preserves higher levels of Hb & Hct in a safe and effective manner compared to control group.

Keywords: Topical, Hydrogen peroxide, Blood loss, Laminectomy.

Introduction

Spine surgery may be indicated if non-surgical treatment such as medications and physical therapy fails to relieve symptoms. Surgery is only considered in cases where the source of pain can be determined such as a herniated disc, scoliosis, or spinal stenosis⁽¹⁾.

Spine procedures are associated with substantial blood loss and high incidence of postoperative transfusion, which associated with a several complications, including the transmission of blood-borne infection, thromboembolic events, and immune-suppression⁽²⁾.

Perioperative methods have been established to decrease the excessive blood loss and the need for blood products. H₂O₂ can be used as a chemical hemostasis agent that is easily

degraded by tissue catalase to form oxygen and water. It is a widely available topical antiseptic and nontoxic hemostasis agent that produces oxidative burst and local oxygen production⁽³⁾.

Methods

This prospective randomized controlled double blinded study was approved by the Faculty of Medicine, Minia University local ethical committee. It involved 80 adult patients underwent thoracolumbar

laminectomy. Patient's consent was taken, then randomly allocated by computer generated tables into one of two groups; Group H; where Patients received topical H₂O₂ 3% in 100 ml saline applied on wound, and Group C; patients received saline wash, before skin closure for 3 minutes.

Patients included were with age ranging from 20 to 70 years old of both sexes, with thoracic or lumbar degenerative disease who underwent thoracolumbar laminectomy. Exclusion criteria were patients with a dural tear accompanied by cerebrospinal fluid leakage detected intra-operatively, Spinal cord tumors and penetrating spinal cord trauma.

In the preparation room, all patients were cannulated, then in the OR they were pre oxygenated with 100% oxygen for 3 minutes during which the standard monitors; electrocardiogram, noninvasive blood pressure and pulse oximetry attached to the patient. operation was done under general anesthesia and patients were intubated with an appropriate size of endotracheal tube by using laryngoscope.

Patients were adequately positioned and ventilated using volume-controlled mode with a tidal volume of 8 ml/kg, respiratory rate 12 and PEEP 5, they were carefully turned prone and chest supports were used and extended from the clavicle to the iliac crest, the abdomen and genitalia were free from pressure, with proper padding of both eyes with soft pads under pressure sites.

The patients underwent instrumented surgery involving the thoracic or lumbar spine (between T1 and S1) by a posterior midline approach. A standard posterior midline incision and exposure of the posterior vertebral arches, decompression, spino-aminectomy by Kerrison rongeur with classic discectomy with or without spinal fixation by inter-body fusion or inter-pedicular screws and posterolateral bone grafting.

Then subcutaneous suction drains were placed at completion of surgery and maintained for 48 h postoperatively. After the end of operation, patients turned supine. Neuromuscular blockade was reversed with I.V atropine (0.01 mg/Kg) and neostigmine (0.05 mg/kg), after

return of spontaneous respiration. All the patients were extubated on table when awake and following commands.

The patients were transferred to the recovery room, then discharged to the neurosurgery ward and closely monitored 48 hours postoperatively in neurosurgery department. We followed up drains and estimated the blood volume inside them, and lab investigations were recorded (Hemoglobin & Platelets) after the first 24 hrs and after 48 hrs.

Statistical analysis

The collected data were coded, tabulated, and statistically analyzed using SPSS program (Statistical Package for Social Sciences) software version 24.

Descriptive statistics were done for para-metric quantitative data by mean, standard deviation while they were done for categorical data by number and percentage.

Analyses were done for parametric quantitative data between the two groups using independent T-test.

Analyses were done for qualitative data using chi-squared test. The level of significance was taken at (P-value < 0.05).

Sample size calculation

Patients will be subcategorized into two groups; the G power program version (3.1.9) was used to calculate sample size for this study with priori analysis, based on a previous study (Chen et al., 2020). The effect size was calculated 0.3 (moderate effect size), alpha error was 0.05 and power of 0.80 was used. The resulted sample size was 80 patients, each group has 40 patients.

Results

Patients who met the inclusion criteria were included in this study. Demographic data is presented in (Table 1), (table 2) shows surgical data without any significant differences between the two groups.

Table (1): Demographic data

Variable	Group H N= 40	Group C N= 40	P value
Age (yrs) mean \pm SD	40.55 \pm 15.9	43.1 \pm 12.6	0.362
Sex (n. %)			0.834
Males:	31(51.5%)	36(60%)	
Females:	29(48.5%)	24(30%)	
BMI (Kg/m ²) mean \pm SD	25.77 \pm 4.74	26.96 \pm 3.3	0.644

-SD: standard deviation -yrs: years -n: number -%: percentage - Analyses were done for parametric quantitative data between the two groups using independent T test- Analyses were done for qualitative data using chi squared test-The level of significance was taken at (P value < 0.05).

Table (2): surgical data

Variable	Group H N= 40	Group C N= 40	P value
Duration of surgery (min) mean \pm SD	111.3 \pm 20.0	113.2 \pm 16.2	0.430
Number of operated levels (n. %)			0.213
Two:	25(62.5%)	22(55%)	
Three:	12(30%)	13(32.5%)	
Four:	3(7.5%)	5(12.5%)	

-SD: standard deviation -yrs: years -n: number -%: percentage - Analyses were done for parametric quantitative data between the two groups using independent T test- Analyses were done for qualitative data using chi squared test-The level of significance was taken at (P value < 0.05).

Incidence of postoperative blood loss and transfusion were significantly lower in group H when compared to the control group (47%

versus 62%) and (36.5% versus 50%) as shown in table (3).

Table (3): Postoperative blood loss and transfusion

Variable	Group H N= 40	Group C N= 40	P value
Blood loss of 500 cc or more (n. %)	28 (47%)	37 (62%)	0.023
Blood transfusion (n. %)	22 (36.5%)	30 (50%)	0.043

- Quantitative data displayed as mean and SD, qualitative data displayed as number and percent, compared with chi-squared test - Significant difference at P value < 0.05

The Hb level was significantly higher in H₂O₂ group than control group, while there was no significant difference in the PLT level after 48 hrs. But the two groups were comparable in the

basal values (pre-operative) of Hb and PLT and intragroup comparison showed a significant decrease in Hb and PLT compared to the base line in group C (Table 4).

Table (4): Hemoglobin and platelet levels.

Variable	Group H N= 40	Group C N= 40	P value
Hb (baseline) (gm/Dl) mean ± SD	13.13±1.8	13.07±1.4	0.435
Hb after 24 hr. (gm/Dl) mean ± SD	11.79±1.4	11.14±1.1	0.044
Hb after 48 hr. (gm/Dl) mean ± SD	11.20±1.3	10.52±1.0**	0.035
PLT (baseline) mean ± SD	251.30±58.8	247.95±52.4	0.632
PLT after 24 hr. mean ± SD	245.32±60.8	234.10±49.5**	0.564
PLT after 48 hr. mean ± SD	239.15±60.8	229.33±48.4**	0.768

- Analyses were done for parametric quantitative data between the two groups using independent T test-The level of significance was taken at (P value < 0.05). -Hb: hemoglobin, PLT: platelet

Discussion

Spine surgery is usually associated with large amount of blood loss and blood transfusion. Effective control of peri-operative blood loss and blood transfusion is critical to ensure that patients undergo spine surgery safely and smoothly, particularly for multilevel or complicated spine surgery⁽⁴⁾.

This randomized controlled study shows the effectiveness of topical H₂O₂ on postoperative blood loss in patients who underwent thoracolumbar laminectomy. This study found that the application of H₂O₂ on wound for 2 minutes before wound closure can decrease post-operative blood loss in drains and preserves higher Hb levels.

Our findings correlate also with Chen et al., 2020 who studied 2626 patients; the control group (no H₂O₂ irrigation) included of 1345 patients, and the experimental group (H₂O₂ irrigation) included 1281 patients; The post-operative drain collection was significantly lower in the experimental group compared to the control group. In Farhang et al., 2019, suggested the use of a stack of 4×4-in gauze on the surgical tray is saturated with 3% H₂O₂ and used by the surgeon and surgical assistant throughout the procedure, they used this technique during standard excisions, repairs, and dermabrasion and recommended H₂O₂ soaks immediately postoperatively in patients with active bleeding.

Hydrogen peroxide is known to facilitate hemostasis with several accepted mechanisms that include regulating the contractility and barrier function of endothelial cells, activating latent cell surface tissue factor and platelet aggregation, and stimulating platelet derived growth factor activation⁽⁵⁾.

We are in agreement with Thejas et al., 2021 who studied the vasoconstrictive and hemostatic properties of H₂O₂ in tonsilectomy, and reported that the bleeding from the fossa in all the cases included in our study stopped with local pressure and the application of topical agents. None of the cases had a secondary hemorrhage and did not need other ways to control bleeding such as ligation of the external carotid artery, pillar suturing, or oro-pharyngeal packing around the endotracheal tube.

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