

Effect of Ultrasound-Guided Superficial Cervical Plexus Block on Severity of Pain After Tympano-Mastoidectomy

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Abstract- Postoperative pain is one of the most important factors in the recovery process after surgery. The incision site of tympano-mastoidectomy is related to the innervation of the superficial cervical plexus. The aim of this study is to evaluate the effect of superficial cervical plexus block on reducing post-tympano-mastoidectomy pain. This is a prospective, double-blind clinical trial study, and patients aged 20-61 years who were candidates for tympano-mastoidectomy were included in the study and were randomly divided into two groups. Before induction of general anesthesia, the subjects underwent superficial cervical plexus block with ultrasound guidance, injection of ropivacaine 0.2% in the treatment group, and normal saline in the control group, respectively. Hemodynamic parameters, intraoperative remifentanyl used to maintain hemodynamic stability, the severity of perioperative pain, nausea and vomiting, and perioperative analgesic use were compared between the two groups. Pain intensity in the recovery phase, 2, 6, 12, and 24 hours after surgery in the treatment was 2.6, 1.8, 1.4, 0.5, and 0.4 and in the control, group was 3.7, 2.5, 2.1, 1.5, and 0.9, respectively ($P<0.05$). Intraoperative use of remifentanyl was 410 ± 622.2 μg in the block group and 1340 ± 448.4 μg in the control group, respectively. The need for opioid administration was 8.2 ± 10.4 mg in the block group and 13 ± 13.2 mg in the control group, respectively ($P=0.046$). The need for administration of diclofenac in the first 24 hours after surgery was 8 ± 27.4 mg in the treatment group and 54 ± 50 mg in the control group, respectively ($P<0.001$). Superficial cervical plexus block can significantly reduce pain and the need for opioid administration after the tympano-mastoidectomy operation.

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Introduction

Postoperative pain is one of the most important and influential factors in the recovery process after surgery. According to the World Health Organization, measuring and recording postoperative pain is considered a fifth vital sign. Postoperative pain control as a common and unfortunate complication for the patient is a moral, human and professional duty of the patients and especially anesthesiologists. Control of postoperative pain can improve the prognosis of surgery and prevent unwanted perioperative complications such as cardiovascular problems, elevated blood sugar, and

coagulation disorders (1). In many cases, after ear surgeries, patients complain of acute and chronic pain in the lateral areas of the neck on the same side of the surgery and at the site of skin incision behind the ear, requiring medical interventions and referred to the chronic pain clinics (1,2). The two posterior branches of the superficial cervical plexus, namely the small dorsal branch and the large auricular branch, are responsible for innervating the lateral and posterior areas of the neck, as well as the back of the ear, which corresponds to the surgical incision site (2,3). According to similar studies, blocking of this plexus and subsequent blockade of the above-mentioned branches can reduce pain after

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tympano-mastoidectomy. We aimed to evaluate the effect of ultrasound-guided superficial cervical plexus block on the severity of pain after tympano-mastoidectomy.

Materials and Methods

This study is a prospective, double-blind clinical trial study. Patients who were candidates for tympano-mastoidectomy aged 20 to 61 years were included in the study. Exclusion criteria in this study included sensitivity to local anesthetics, altered neck anatomy due to previous surgery or congenital anatomical abnormality, and local infection at the site of the block. After approval of the study by the ethical committee of our hospital and obtaining informed consent, patients were randomly divided into two groups. The first group, after sedation and before induction of general anesthesia, underwent superficial cervical plexus block under ultrasound guide in the posterior region of the middle part of the sternocleidomastoid muscle with 10 ml of ropivacaine 0.2%. In the control group, patients underwent superficial cervical plexus block under ultrasound guide with 10 ml of normal saline as a placebo. For blinding of the study, the injection solution for the block was prepared by a nurse of anesthesia without knowledge of the groups based on the table of random numbers. The success of the block in the case group was measured by another nurse of anesthesia by pinprick test, and if the block was not successful, the patient was excluded from the study. The success of the block in the case group was measured by another nurse of anesthesia by pinprick test, and if the block was not successful, the patient was excluded from the study. After the superficial cervical plexus block, all patients in both groups underwent general anesthesia in the same way. The surgery was performed with the same technique and by the same surgical team. Hemodynamics of patients, including intraoperative blood pressure and heart rate, were evaluated and recorded in both groups. The amount of remifentanyl used to maintain hemodynamic stability was recorded and compared between the two groups. The severity of postoperative pain and the incidence of nausea and vomiting and the need for analgesics after the operation were evaluated and recorded for up to 24 hours postoperatively. The sample size was calculated based on 95% confidence, an accuracy of 0.7, and a standard deviation of 2.5 in each group of 50 patients. The data were analyzed using SPSS version 19 software and analysis of variance was used to compare the demographic characteristics of the patients, and a t-test was used for measurement data. The statistical significance was set at $P < 0.05$.

Results

A total of 108 patients who were a candidate for tympano-mastoidectomy were included in this study. Out of these, 8 were excluded from the study. These included 3 patients due to lack of complete sensory block after the block, one patient due to bleeding and the need for reoperation to drain the hematoma 24 hours after surgery, and 4 patients who were excluded from the study due to usage of opioids before the study. Out of 100 patients, 50 patients in each group were made based on a table of random numbers. The mean age of the control group was 41.7 ± 14.9 years, and the block group was 40.6 ± 15.4 years, respectively ($P = 0.7$). In the control group, 52% were females, and 48% were males, and in the treatment group, 56% were females, and 44% were males ($P = 0.7$). There were 6 cases in the control group, and 7 cases in the treatment group had a history of drug addiction ($P = 0.8$). Four cases in the control group and 2 cases in the block group reported chronic pain, respectively ($P = 0.7$). In terms of patients with a history of hypertension, 10 cases were reported in the control group and 8 cases in the treatment group, respectively ($P = 0.6$). The severity of pain during the recovery phase, 2, 6, 12, and 24 hours after surgery in the control group, the average pain was 3.7, 2.5, 2.1, 1.5, and 0.9, and in the treatment group, the average pain was 2.6, 1.8, 1.4, 0.5 and 0.4, respectively ($P < 0.003$) (Figures 1,2).

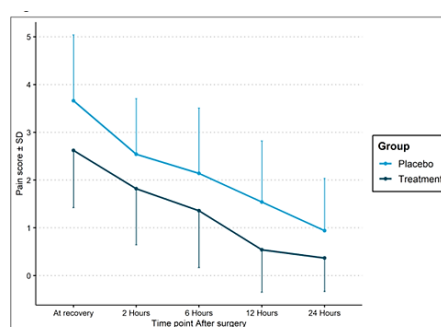


Figure 1. The severity of postoperative pain in both groups

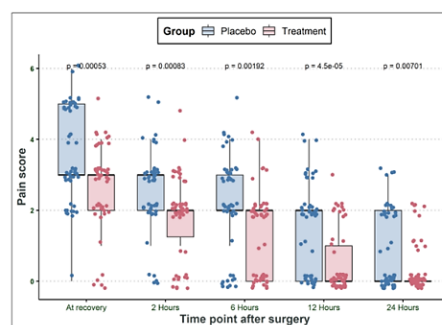


Figure 2. The compression of postoperative pain in both groups

Superficial cervical plexus block and pain after tympano-mastoidectomy

The mean intraoperative administration of remifentanyl was $1340 \pm 1158.1 \mu\text{g}$ in the control group and $410 \pm 622.2 \mu\text{g}$ in the treatment group ($P < 0.001$). In terms of hemodynamic conditions, the two groups did not have significant differences in blood pressure and heart rate before induction, so the mean of mean arterial pressure (MAP) was $102.8 \pm 14.4 \text{ mm Hg}$ in the control group and $101.9 \pm 13.3 \text{ mm Hg}$ in the treatment group ($P = 0.7$) (Figures 3,4). The incidence of nausea and vomiting was more in the control group versus the treatment group, but the two groups did not have a statistically significant difference. The mean dose of opioids for pain relief during the recovery phase was $13 \pm 13.2 \text{ mg}$ in the control group and $8.2 \pm 10.4 \text{ mg}$ in the treatment group, respectively ($P = 0.046$).

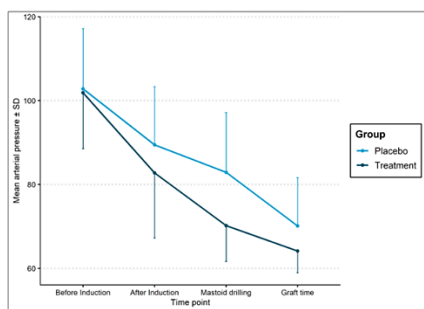


Figure 3. The comparison of mean arterial pressure in both groups

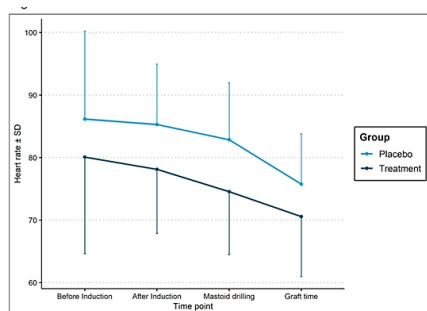


Figure 4. The comparison of heart rate in both groups

Discussion

Postoperative pain is one of the most unpleasant and scary experiences for patients (1). This morbidity is one of the most important and influential factors in the recovery process after surgery. The World Health Organization considers measuring and recording pain, especially in the postoperative period, as a fifth vital sign. The management of postoperative pain is a moral and professional duty of the treatment group and especially anesthesiologists (2). There is a proven role of postoperative pain control in improving the prognosis of surgery and preventing unwanted complications such as

cardiovascular problems, hyperglycemia, and coagulation disorders (3,4). After ear surgeries, many patients complain of chronic pain in the lateral areas of the neck on the same side of the surgery and at the site of skin incision behind the ear, requiring an interventional pain strategy (5-7). A case report by Flores *et al.*, evaluated the effect of a greater auricular nerve block under ultrasound guidance to repair ruptured tympanic membrane and drain abscesses in the emergency department (8). According to the results of the clinical studies, the two posterior branches of the superficial cervical plexus, namely the small dorsal branch and the large auricular branch, are responsible for the innervation of the lateral and posterior regions of the neck, as well as the back of the ear. By blocking this plexus and the above branches, postoperative pain can be reduced (9,10). According to the results of the present study, the pain after tympano-mastoidectomy in the superficial cervical block group was lower compared to the control group. A study by Neiderman *et al.*, evaluated the postoperative pain after tympano-mastoidectomy. Similar to our study, they showed that the mean pain in the control group was higher than the block group at all times, and the mean maximum pain recorded during recovery was 3.7 ± 1.4 (11). Our study showed that the mean pain at all times according to the numerical ratio scale (NRS) in the control group was statistically significantly higher than in the treatment group. The two groups differed significantly in the amount of remifentanyl required during surgery and additional opioid analgesic during recovery, and also need for diclofenac suppository 24 hours after surgery so that the use of these drugs was higher in the control group than in the treatment group. This indicates that superficial cervical plexus block can significantly control pain during and after tympano-mastectomy and reduce the use of analgesics during and after the operation. Despite the fact that the incidence of postoperative nausea and vomiting was higher in the control group, no significant difference was observed between the two groups in any of the postoperative periods. A case report was published in which an ultrasound-guided catheter was used to control postoperative pain in surgery of the ruptured tympanic membrane (12). Continuous injection of anesthetic through a catheter and nerve block was performed and resulted in the decrease of perioperative pain, and it was confirmation of our results (12). In the present study, both groups did not differ in terms of mean arterial pressure and heart rate pre-operatively, but during surgery, the hemodynamic conditions of the block group were significantly different from the control group at all times,

so that means arterial blood pressure and heart rate were lower in the treatment group. The amount of remifentanyl, which is commonly used to control hypotension, was lower in the treatment group than in the control group. This indicates that the superficial cervical plexus block under ultrasound guidance can be used to control tympano-mastoidectomy pain during the surgery and provide stable hemodynamic conditions for the patient during surgery. In conclusion, this study showed that the superficial cervical plexus block under the guidance of ultrasound could effectively and reliably control pain during and after tympano-mastoidectomy, and the amount of opioid and analgesic drug administration is reduced during and after surgery.

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