Austin Journal of Anesthesia and Analgesia

Open Access

Austin Publishing Group

Research Article

Effect of Topic Epinephrine on Opioid Consumption in Ear Surgery

Prusak M[1]*, Liu DT[2], Emich P[1], König SL[1] and Windpassinger M[1]

[1]Department of Anesthesia, Intensive Care Medicine and Pain Medicine, Medical University of Vienna, Vienna, Austria

[2]Department of Otorhinolaryngology, Medical University of Vienna, Vienna, Austria

***Corresponding author:** Michal Prusak, Department of Anesthesia, Intensive Care Medicine and Pain Medicine, Medical University Vienna, Vienna, Austria; Spitalgasse 23, 1090 Vienna, Austria

Received: April 01, 2022; **Accepted:** April 28, 2022; **Published:** May 05, 2022

Abstract

Background and Objectives: Topically applied epinephrine is used routinely in ear surgery to stop bleeding in the operating field. The data on its effect on postoperative pain perception has been missing so far.

Materials and Methods: We carried out a single center retrospective cohort study of patients undergoing ear surgery over a period of 12 months. Epinephrine given intraoperatively was compared to piritramide dose given postoperatively. Patients receiving no piritramide intraoperatively were additionally compared to postoperative VAS score.

Results: There was no difference in piritramid dose required for pain therapy as well as in VAS score in 230 patients included in the analysis.

Conclusions: Epinephrine used in ear surgery has no effect on pain perception and thus may not be taken in consideration in postoperative pain management.

Keywords: Epinephrine; Piritramide; Ear surgery; Pain

Abbreviations

VAS: Visual Analogue Scale; Epi: Epinephrine; LA: Local Anaesthesia

Introduction

Epinephrine added to local anesthetic in a low concentration (usually 1:50.000, 1:100.000 or 1:200.000) is able to prolong the duration of analgetic effect of the local anesthetic by vasoconstriction, thus lowering blood flow and slowing down the drug elimination [1,2]. Even these very low concentrations can impair inner ear perfusion though not causing any relevant clinical complications [3,4]. Besides that epinephrine can be applied superficially on the bleeding tissue in a high concentration (1:1.000) to diminish or stop bleeding in situations when surgical hemostatic methods fail or are technically not feasible, such es endoscopic or microscopic ear surgery [5-8]. It is believed that this may have an effect on local circulation as well as on pain perception, this phenomenon has not been investigated yet.

The overall percepted pain level is determined by a sum of various mechanisms. In case of excessive vasoconstriction tissue damage due to ischemia may occur and add on the surgical damage with consecutive pain increase. Activation of β2-and β3-adrenergic receptors of peripheral nociceptive cells is known to favor nociception, too [9-12]. Although epinephrine is a mediator of sympathetic automonic nervous system and thus a stress response including deminished perception of acute pain, any systemic effects on central nervous system in case of resorption are unprobable as there are no adrenergic receptors (in contrast to noradrenergic receptors) on the central nerve cells [13]. Despite of that there is still an evidence of interference with pain threshold level in animal models [14,15].

Materials and Methods

Study participants

We analyzed all adult patients who underwent ear surgery at the Department of Ear-Nose-Throat Medicine at Medical University of Vienna between 1st July 2019 and 30th June 2020 in general anesthesia and treated postoperatively in recovery room. The study protocol was approved by the local Ethics Committee of the Medical University of Vienna.

Methods

The data were collected manually from operating protocols and IntelliSpace Critical Care and Anesthesia information system (Philips Healthcare, Amsterdam, Netherlands). Recorded data included age, gender, type of the surgery (divided in four categories of middle ear surgery which includes mastoidectomy, tympanoplasty, ossiculoplasty and myringoplasty; cochlear implant surgery; tumor surgery; other surgery), duration of the surgery, amount of lidocaine 0.5% injection with epinephrine in ratio 1:200.000, dose of piritramide given in the operating room and in the recovery room, and pain intensity measured by 11-point numeric rating scale (NRS; 0 = no pain; 10 = the worst pain) on arrival to the recovery room and before leaving the recovery room.

Statistical analysis

We performed statistical analysis using IBM SPSS Statistics 27.0 (IBM Corporation, Armonk, NY, USA). Age, gender, type and duration of the surgery were assessed by the descriptive statistics. The difference in piritramide consumption in patients with and without epinephrine was compared by unpaired t-test. As there was a high proportion of patients receiving local anesthesia at the beginning of the surgery too, we created two categories within both groups resulting in four subgroups (non-Epi, non-LA; non-Epi, LA;

Citation: Prusak M, Liu DT, Emich P, König SL and Windpassinger M. Effect of Topic Epinephrine on Opioid Consumption in Ear Surgery. Austin J Anesthesia and Analgesia. 2022; 10(1): 1106.

Table 1: Description of the subgroups regardless if piritramide given in the operating room.

	non-Epi, non-LA	non-Epi, LA	Epi, non-LA	Epi, LA
Number of patients	28	104	9	89
Mean age (years) (SD)	50 (17)	50 (18)	45 (15)	53 (18)
Gender female/male	16/12	63/41	4/5	44/45
Surgery				
• Middle ear	17	55	6	41
• Cochlear implant	2	33	1	33
• Tumor	4	6	2	9
• Other	5	10	0	6
Duration of surgery (min) (SD)	95 (75)	154 (68)	88 (32)	137 (52)
Piritramide dose in operating room (mg) (SD)	1.43 (0.98)	2.37 (2.41)	1.33 (1.92)	1.53 (2.37)
Piritramide dose in recovery room (mg) (SD)	1.82 (2.55)	2.58 (3.32)	2.17 (2.92)	3.44 (3.52)
VAS on arrival to recovery room (SD)	1.00 (1.51)	0.94 (1.54)	0.67 (1.25)	1.15 (1.67)
VAS on leaving recovery room (SD)	0.35 (0.55)	0.39 (0.69)	0.22 (0.62)	0.45 (0.66)

Epi, non-LA; Epi, LA); the difference in these four subgroups was calculated with one-way ANOVA test. VAS score was calculated in the same way for the defined groups and subgroups, but only in those patients who received no piritramide at the end of the surgery.

Results

On total, ear surgery was performed in 252 patients in our center over the period of 12 months. In 16 patients the surgery was performed without general anesthesia and these patients were not treated in recovery room postoperatively. 5 patients were admitted to the intensive care unit because of ongoing mechanical ventilation and/or need for prolonged observation. In 1 patient the recovery room protocol was missing.

230 patients were included, among whom 127 (55%) were women and 103 (45%) were men with an average age of 51 years (SD 18 years). The most common type of surgery was middle ear surgery counting 119 cases (52%), followed by cochlear implant surgery with 69 cases (30%). Duration of the surgery was 138 minutes on average (SD 65 minutes). 37 patients (16%) did not receive any local anesthesia (non-LA) and in remaining 193 patients (84%) local anesthesia was applied at the beginning of the surgery (LA). In these patients the amount of lidocaine 0.5% injection with epinephrine in ratio 1:200.000 was 4.0 ml on average (SD 1.6ml). 132 patients (57%) did not receive any epinephrine (non-Epi), whereas 98 patients (43%) required application of epinephrine (Epi) in a concentration of 1:1.000.

At the end of the surgery - still in the operating room - 129 patients (56%) were given no piritramide and 101 patients (44%) received piritramide in average dose of 4.42mg (SD 1.58mg). The patients receiving no piritramide targeted VAS score 0.84 (SD 1.45, min 0, max 6) on arrival to the recovery room compared to VAS score of 1.23 (SD 1.72, min 0, max 6) in those patients who were given piritramide in the operating room.

During the stay in the recovery room the patients given no piritramide in the operating room received 2.64mg (SD 3.37, min 0, max 15) piritramide and those who were already given piritramide in the operating room required 3.41mg (SD 3.65, min 0, max 13.5) of additional piritramide. The average VAS score when leaving the recovery room was 0.37 (SD 0.67, min 0, max 3) and 0.44 (SD 0.66, min 0, max 3) in patients receiving no piritramide and some piritramide at the end of the surgery respectively. The attributes of the four subgroups are shown in Table 1 for all patients and in Table 2 for the patients who received no piritramide before attending the recovery room.

Between the groups receiving epinephrine or not, there is no difference in piritramide consumption (p=0.8277). Taking local anesthesia in consideration in the subgroups, there is no difference for piritramide dose (p=0.8162). VAS score was correlated only in patients who received no piritramide at the end of the surgery; here neither group analysis (p=0.2270) nor subgroup analysis (p=0.4522) showed any statistical difference.

Discussion

In the limited setting of a single-center retrospective design we could not prove any effect of epinephrine in ear surgery on piritramid dose needed in the early postoperative period which may have various reasons. The majority of patients (84%) received various amount of local anesthetic with a minimal compound of epinephrine (ratio 1:200.000 in our centre). The patients were spitted into subgroups and an unpaired ANOVA test was performed as a parallel effect on pain perception needs be taken into account.

Because essential part of the operations involved middle ear surgery and cochlear implant surgery (82%), the total dose of epinephrine may be rather small in these types of operations as it is used predominantly in small amounts as an effective tool to stop bleeding when working with a microscope. Thus the effect for the pain perception may not have reached the threshold of clinical significance.

An extent of surgical trauma as a main factor of the overall pain level may not have been similar in all patients. Additionally, piritramide was given in substantial proportion of patients at the end of the surgery (44%); these patients achieved paradoxically higher VAS scores on arrival to the recovery room and required higher

Table 2: Description of the subgroups with no piritramide given in the operating room.

	non-Epi, non-LA	non-Epi, LA	Epi, non-LA	Epi, LA
Number of patients	16	47	6	60
Mean age (years) (SD)	49 (20)	53 (21)	47 (14)	55 (18)
Gender female/male	7/9	25/22	3/3	28/32
Surgery				
• Middle ear	9	28	5	29
• Cochlear implant	2	13	0	23
• Tumor	3	3	0	5
• Other	2	3	1	3
Duration of surgery (min) (SD)	114 (83)	150 (49)	89 (36)	128 (49)
Piritramide dose in operating room (mg) (SD)	0	0	0	0
Piritramide dose in recovery room (mg) (SD)	1.5 (2.19)	2.27 (3.2)	2.00 (3.30)	3.30 (3.60)
VAS on arrival to recovery room (SD)	0.88 (1.54)	0.60 (1.20)	0.50 (1.12)	1.05 (1.59)
VAS on leaving recovery room (SD)	0.29 (0.59)	0.38 (0.71)	0	0.41 (0.67)

additional doses of piritramide in the recovery room. Application of piritramide by the anesthesist at the end of the surgery may probably suggest more extensive surgical trauma with higher opioid requirement postoperatively. Therefore we investigated the effect of epinephrine on VAS score solely in patients who were not given piritramide intraoperatively which similarly did not prove any effect on pain.

Most importantly, the biological effect of epinephrine may act on the both sides of the spectrum, it may increase pain perception (such as worsening ischemia) and decrease pain perception (such as prolonging effect of local anesthesia) at the same time.

Conclusions

The results of this study show no effect of epinephrine application on opioid consumption. This does not necessarily mean that there is no clinical effect on pain at all as there are several substantive limitations that need to be taken into consideration. Further research is required to find out the clinical, physiological and molecular consequences of topically applied epinephrine.

References

1. Sinnott CJ, Cogswell IL, Johnson A, Strichartz GR. On the mechanism by which epinephrine potentiates lidocaine's peripheral nerve block. Anesthesiology. 2003; 98: 181-188.
2. Gessler EM, Hart AK, Dunlevy TM, Greinwald JH Jr. Optimal concentration of epinephrine for vasoconstriction in ear surgery. Laryngoscope. 2001; 111: 1687-1690.
3. Hamed RA, Hamed EM. Topical use of tranexamic acid versus epinephrine to optimise surgical field during exploratory tympanotomy. Anaesth Crit Care Pain Med. 2020; 39: 771-776.
4. Hafner HM, Rocken M, Breuninger H. Epinephrine-supplemented local anesthetics for ear and nose surgery: clinical use without complications in more than 10,000 surgical procedures. J Dtsch Dermatol Ges. 2005; 3: 195-199.
5. Anschuetz L, Bonali M, Guarino P, Fabbri FB, Alicandri-Ciufelli M, Villari D, et al. Management of Bleeding in Exclusive Endoscopic Ear Surgery: Pilot Clinical Experience. Otolaryngol Head Neck Surg. 2017; 157: 700-706.
6. Chemmangath N, Aroor R, Pratap D, Bhat V. A comparative study between haemocoagulase and adrenaline in type 1 tympanoplasty. J Otol. 2019; 14: 117-120.
7. Alicandri-Ciufelli M, Molinari G, Beckmann S, Caversaccio M, Presutti L, Anschuetz L. Epinephrine Use in Endoscopic Ear Surgery: Quantitative Safety Assessment. ORL J Otorhinolaryngol Relat Spec. 2020; 82: 1-7.
8. List MA, Dirain CO, Haberman RS, Antonelli PJ. Efficacy of Topical Epinephrine in Tympanoplasty. Laryngoscope. 2021; 131: 2319-2322.
9. Nackley AG, Tan KS, Fecho K, Flood P, Diatchenko L, Maixner W. Catechol-O-methyltransferase inhibition increases pain sensitivity through activation of both beta2- and beta3-adrenergic receptors. Pain. 2007; 128: 199-208.
10. Hartung JE, Ciszek BP, Nackley AG. Beta2- and beta3-adrenergic receptors drive COMT-dependent pain by increasing production of nitric oxide and cytokines. Pain. 2014; 155: 1346-1355.
11. Kline RHt, Exposto FG, O'Buckley SC, Westlund KN, Nackley AG. Catechol-O-methyltransferase inhibition alters pain and anxiety-related volitional behaviors through activation of beta-adrenergic receptors in the rat. Neuroscience. 2015; 290: 561-569.
12. Ciszek BP, O'Buckley SC, Nackley AG. Persistent Catechol-O-methyltransferase-dependent Pain Is Initiated by Peripheral beta-Adrenergic Receptors. Anesthesiology. 2016; 124: 1122-1135.
13. Neal JM. Effects of epinephrine in local anesthetics on the central and peripheral nervous systems: Neurotoxicity and neural blood flow. Reg Anesth Pain Med. 2003; 28: 124-134.
14. Perl ER. Causalgia, pathological pain, and adrenergic receptors. Proc Natl Acad Sci USA. 1999; 96: 7664-7667.
15. Albayrak Y, Saglam MB, Yildirim K, Karatay S, Polat B, Uslu T, et al. Effects of epinephrine and cortisol on the analgesic activity of metyrosine in rats. Arch Pharm Res. 2011; 34: 1519-1525.