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HYPOTENSIVE ANAESTHESIA IN MAXILLOFACIAL SURGERY

Jonė Jackevičiūtė[1], Greta Kraujalytė[1], Dainius Razukevičius[2], Lina Kalibatienė[3], Andrius Macas[3]

[1]Medical Academy, Lithuanian University of Health Sciences, Kaunas, Lithuania, [2]Department of Plastic and Reconstructive Surgery, Medical Academy, Lithuanian University of Health Sciences, Kaunas, Lithuania, [3]Department of Anesthesiology, Medical Academy, Lithuanian University of Health Sciences, Kaunas, Lithuania

Key words: deliberate hypotension, controlled hypotension, maxillofacial surgery, orthognathic surgery.

Summary

Introduction. Deliberate hypotension (DH) is a widely used anaesthesia technique for decreasing intraoperative bleeding and improving the visibility of the operating field. Orofacial region has rich blood supply, therefore adequate bleeding management is needed.

Methods. A literature search was performed using the search terms and was limited to English language. We used specific databases for our literature search.

Discussion. The positive effect of DH is associated with mechanism of action leading to reduction of blood loss and reduced blood transfusion rate, accompanied by proper pain management. However, adverse effects are distinguishable, although the presentation completely depends on the hypotensive anaesthetic used for induction of DH.

Conclusion. The application of controlled hypotension in maxillofacial surgery is highly advisable. Despite the positive effects, constant monitoring of the vital signs and drug induced side effects in perioperative period is needed.

Introduction

Controlled hypotensive anaesthesia is a widely used technique for decreasing intraoperative bleeding and improving the visibility of the operating field [1]. Deliberate hypotension (DH) is described as controlled reduction and maintenance of blood pressure (BP) in range of mean arterial pressure (MAP) between 50 and 65 mmHg or intraoperative reduction of baseline MAP from 20 to 30% [2]. Also, it can be classified as the safe minimal BP limit, during which the autoregulation of the cerebral blood flow (CBF) force is still in function [3]. DH was introduced by Cushing in intracranial surgery, approximately a century ago [4]. Although, the first presentation of controlled hypotension in clinical practice was done almost 30 years later, in 1946 [5]. The primary introduction of DH in maxillofacial surgery was started in 1950 by Enderby, however documented release was done only 10 years later in 1961, after completely finishing the study [6]. In addition, the beneficial effect on the reduction of blood loss in maxillofacial surgery was highlighted by Schaberg et al. [7], in 1976. For decades, DH has been used in various types of surgeries, such as: spinal surgery, other neurosurgery, orthopedic surgery, craniosynostosis, sinus and middle ear surgery and even in head-injured multi-trauma patients [3, 8-13]. Oromaxillofacial surgery is not an exception [14]. Due to rich blood supply in orofacial region controlled hypotensive anaesthesia is commonly applied in maxillofacial surgery, in order to reduce the bleeding and improve the visibility of the surgical field. Indications for applying DH depends on the type of surgery, for instance, Le Fort I osteotomy, genioplasty, bi-maxillary surgery, sagittal split of the mandible and the mandibular symphysis osteotomy are associated with DH application more frequently in comparison with other surgical procedures [15].

The aim of this study was to review scientific literature about DH appliance in maxillofacial surgery and present the key advantages and disadvantages of such method use in the clinical practice.

Methods

A literature search was performed using the search terms: deliberate hypotension, controlled hypotension, induced hypotension, maxillofacial surgery, orthognathic surgery. The search was limited to English language. We used PubMed, Cohrane, ScienceDirect, Medline and Medscape databases for our literature search.

Correspondence to: Jonė Jackevičiūtė, e-mail: jonejackeviciute@gmail.com

The benefits of DH. The use of DH is based on the belief that inducing hypotension will result in decreased blood loss, accompanied by reduction of blood transfusion rate, satisfactory bloodless field and shorter surgery duration [16, 17]. Even though, controlled hypotension has been used for almost a century, its application remains controversial. The mechanism of DH is debatable, considering that hypotension is the reflection of BP in large vessels. The circulation of blood in the operating field depends on three factors: central BP and its regulation, measured in a large artery, sympathetic nervous system regulation on the local arteriolar vasomotor tone and microcirculatory autoregulation of the organ [18]. Therefore, drug selection is the key determinant of the anticipated outcome. Moreover, the benefit of decreased bleeding has been demonstrated in several studies, accompanied by positive effect on blood transfusions rate reduction in orthognathic surgery [2, 3, 18-24]. However, data gathered on surgery field visibility is inconsistent, assuming that subjectivity of the evaluation and different pharmacological agents' interactions may have affected the results [18, 19, 21, 25]. Additionally, the reflection of the bleeding control on shorter surgery duration was not observed [26]. Moreover, pain is frequently observed in orthognathic surgery, therefore, adequate pain control is crucial [27]. DH leads to decreased metabolism of the drugs, due to induced hypotension and lowered pain threshold, as a result improved perioperative pain management is accomplished. In addition, DH combined with intravenous lidocaine contributes with decreased demand of analgesia and well-balanced pain management [28]. Therefore, the positive effect of DH is associated with mechanism of action leading to reduction of blood loss and reduced blood transfusion rate accompanied by proper pain management. To provide evidence based data on DH effect on visibility of the surgery field standardized protocols are needed.

Adverse effects of DH. Controlled hypotension is induced by various pharmacologic agents, which are categorized in groups of agents: that can be used alone; alone or in combination and adjuncts to limit drug requirements. Inhalation anaesthetics, sodium nitroprusside (SNP), nitroglycerin, trimethaphan camsilate, alprostadil, adenosine, remifentanil and drugs used in spinal anaesthesia can be fully used alone, whereas calcium channel blockers, β-adrenoreceptor blockers and fenoldopam are used either alone or in combination with other agents [18]. Ideal hypotensive anaesthetic drug must include rapid onset, easy administration, rapid elimination without toxic metabolites, quick wearing off of the effects after discontinuation, dose dependent and the irrelevant effects on vital organs [29]. However, the ideal agent does not exist, therefore the adverse effects of DH almost entirely depend on the drugs used to induce hypotension. The impact on cardiovascular system is the most commonly observed adverse effect, presenting with: increased heart rate, rebound hypertension and myocardial depression. Most of these adverse effects are caused by SNP [19]. SNP has a direct vasodilating effect - rapid decrease in vascular resistance, determining venous dilation, consequently decreasing venous return and inducing secondary vasodilation of the arteries [18]. Subsequently, SNP increases heart rate and causes rebound hypertension after rapid discontinuation of the drug [3, 18]. Correspondingly, clinically irrelevant myocardial ischemic changes are conditioned in electrocardiogram by SNP [19]. Morevorer, SNP can decrease CBF, cause tachyphylaxis and cyanide toxicity due to accumulation of metabolites [3, 18]. Along with the effect on cardiovascular system, decreased renal function during DH was observed, due to reduced urine excretion in comparison with patients under normotensive anaesthesia [14, 21, 30]. Even though, duresis recovers shortly after the surgery, with no signs of kidney impairment, the nephroprotective properties of another hypotensive agent - nicardipine, are worth mentioning [31]. Blindness after non-ocular surgery is a dreadful complication. Nevertheless, blindness due to direct effect of DH should not be taken into consideration [32]. Moreover, skin necrosis due to DH in orthognathic surgery were reported [15, 19]. It is crucial to consider that hypotensive agent may cause local ischemia and protective measurements must be applied prior to the adverse outcome. Concluding, Shear et al. [33] demonstrated by means of NIRS, that DH within recommended MAP values of 55 to 65 mmHg is safe and causes no long term adverse outcomes. Even though, the myocardial ischemia or mortality due to DH was not confirmed, the population under research of DH was practically healthy. In this light, we should be aware that prolonged perioperative hypotension or poorly managed BP may be fatal to the patients with high risk of myocardial ischemia and multiple comorbidities [34, 35].

Conclusion

The application of controlled hypotension in maxillofacial surgery is highly advisable. Considering, that it has the impact on blood transfusion rate reduction and decreased blood loss. Although, importance of constant monitoring of the vital signs and drug induced side effects is crucial for well-balanced BP control and proper patient management in perioperative period.

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HIPOTENZINĖ ANESTEZIJA VEIDO IR ŽANDIKAULIŲ CHIRURGIJOJE

J.Jackevičiūtė, G.Kraujalytė, D.Razukevičius, L.Kalibatienė, A.Macas

Raktažodžiai: tikslinė hipotenzija, kotroliuojama hipotenzija, veido ir žandikaulių chirurgija, ortognatinė chirurgija.

Santrauka

Įvadas. Kontroliuojama hipotenzija yra plačiai naudojamas nejautros būdas, padedantis sumažinti kraujavimą bei pagerinantis operacinio lauko matomumą. Burnos ir veido sritis yra labai vaskuliarizuota, todėl reikalingas adekvatus kraujavimo valdymas.

Metodai. Atlikta literatūros paieška naudojant raktinius žodžius. Naudotos specifinės literatūros paieškos bazės.

Diskusija. Kontroliuojamos hipotenzinės anestezijos veikimo mechanizmas yra susijęs su sumažėjusiu kraujo netekimu bei kraujo perpylimo dažniu, taip pat efektyvesniu skausmo valdymu. Pažymėtina, jog nepageidaujamo poveikio pasireiškimas neabejotinas, tačiau tai visiškai priklauso nuo tikslinės hipotenzijos indukcijai panaudoto farmakologinio medikamento.

Išvados. Kontroliuojamos hipotenzinės anestezijos panaudojimas yra rekomenduotinas veido ir žandikaulių chirugijoje. Net ir esant teigiamam nejautros poveikiui, būtinas nuolatinis gyvybinių funkcijų monitoravimas bei vaistų sukeliamų šalutinių poveikių perioperaciniu periodu stebėjimas.

Adresas susirašinėti: jonejackeviciute@gmail.com

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