

Effects of hypotensive anesthesia compared to normotensive anesthesia in orthognathic surgery

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ABSTRACT

INTRODUCTION Orthognathic surgery is widely accepted for correcting dentofacial deformities. Due to the rich blood supply in the head and neck region, considerable bleeding can occur from the incised soft tissues and bone during orthognathic surgery. Hypotensive anesthesia is a method used in surgical practice by which blood pressure is decreased predictably and deliberately to reduce blood loss and improve surgical field. However, there is still uncertainty regarding its effectiveness and safety in orthognathic surgery.

METHODS We searched in Epistemonikos, the largest database of systematic reviews in health, which is maintained by screening multiple information sources, including MEDLINE, EMBASE, Cochrane, among others. We extracted data from the systematic reviews, reanalyzed data of primary studies, conducted a meta-analysis, and generated a summary of findings table using the GRADE approach.

RESULTS AND CONCLUSIONS We identified three systematic reviews, including 11 studies overall, which are randomized trials. We concluded that hypotensive anesthesia may reduce intraoperative blood loss and may improve the quality of surgical field, however, the certainty of the evidence has been assessed as low. On the other hand, orthognathic surgery with HA may make little or no difference in surgical time (low certainty evidence). Finally, no studies were found that reported adverse effects or mortality.

KEYWORDS Hypotensive anesthesia, orthognathic surgery, blood loss, Epistemonikos, GRADE

PROBLEM

Orthognathic surgery (OS) is widely accepted for correcting dentofacial deformities. It includes surgical manipulation of the facial skeletal components to readjust the anatomic and functional relationships in patients with dentofacial skeletal abnormalities [1], and bimaxillary osteotomies are frequently necessary to achieve an acceptable result. However, due to the

rich blood supply in the head and neck region, considerable bleeding can occur from the incised soft tissues and bone during orthognathic surgery [2,3]. In addition, factors like prolonged procedure length, major vascular injury, and surgical inexperience can lead to an increase in the intraoperative bleeding (IOB) volume [4].

Because both anemia and allogeneic blood transfusions can increase postoperative morbidity, with several risks including the transmission of bacterial, viral, or protozoal infections and alloimmunization, in previous decades, IOB and the need for blood transfusions in OS has been prevented using different techniques such as hypotensive anesthesia (HA), and the use of antifibrinolytic agents [4–6].

HA is a method used in surgical practice by which blood pressure is decreased predictably and deliberately, and it was first described concerning maxillofacial surgery in 1950 by Enderby [2]. Controlled hypotension is defined as a reduction of the systolic blood pressure to 80–90 mm Hg, a decrease of mean

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arterial pressure (MAP) to 50-65 mm Hg, or a 30% reduction of baseline MAP [3].

Several clinical trials have been reported in the literature regarding the effects of HA on reducing blood loss, and operation time, and improving the quality of the surgical field for patients undergoing OS. However, there is a risk of hypoperfusion of vital organs during deliberate hypotension [3]. Furthermore, these studies have yielded conflicting results regarding the effectiveness of HA in reducing IOB, and the value of HA in OS remains controversial [2,5,7].

METHODS

We used Epistemonikos database, which is maintained by screening more than 30 databases, to identify systematic reviews and their included primary studies. With this information we generated a structured summary using a pre-established format, which includes key messages, a summary of the body of evidence (presented as an evidence matrix in Epistemonikos), meta-analysis of the total of studies, a summary of findings table following the GRADE approach and a table of other considerations for decision-making.

Key messages	
<ul style="list-style-type: none"> • The use of hypotensive anesthesia in orthognathic surgery may reduce the intraoperative blood loss (low certainty evidence). • The use of hypotensive anesthesia in orthognathic surgery may make little or no difference to operation time (low certainty evidence). • The use of hypotensive anesthesia in orthognathic surgery may improve the quality of surgical field (low certainty evidence). • No studies were found that reported adverse effects or even mortality associated to hypotensive anesthesia in orthognathic surgery. 	

About the body of evidence for this question	
What is the evidence See evidence matrix in Epistemonikos later	We found three systematic reviews [2], [4], [5], including eleven randomized controlled trials reported in 11 references [3], [7], [8][8], [9], [10], [11], [12], [13], [14], [15], [16]. This table and the summary in general are based on the randomized controlled trials, since the observational studies did not increase the certainty of the existing evidence, nor did they provide additional relevant information.
What types of patients were included*	All studies included patients classified as American Society of Anesthesiologists physical status I or II, within a range of mean age of 14.6 to 42.7 years. One study included only patients classified as ASA I [11]. The types of osteotomies included: anterior maxillary osteotomy, Le Fort I, bilateral sagittal split osteotomy, double jaw, and combined maxillary and mandibular osteotomy
What types of interventions were included*	All the studies evaluated the use of hypotensive agents compared with no use of hypotensive agents, three studies used only sodium nitroprusside [8,15,17], one study used nitroglycerin and halothane [3], one study used sodium nitroprusside and enflurane [11], two studies used only isoflurane [10,12], one study used isoflurane and labetalol [9], one study used propranolol [14], one study used nitroglycerin and remifentanil [7], and one study used nitroglycerin and esmolol [13]. In three studies the mean arterial blood pressure was 55-65 mm Hg [7],[11],[12], one study with a MAP 50-55 mm Hg, [15], one study with a MAP 50-60 mm Hg [9], one study with a MAP 50-64 mm Hg [10], one study with a MAP 60-70 mm Hg [17], one study with a MAP 70 mm Hg [8], one study with a MAP 72 mm Hg [13], and one study with a MAP of systolic blood pressure ≤ 75% baseline [14].
What types of outcomes were measured	All the studies reported multiple outcomes, which were grouped by systematic reviews as follows [2], [4], [5]: <ul style="list-style-type: none"> • Intraoperative blood loss. • Surgical time. • Quality of the surgical field.

SUMMARY OF FINDINGS

Information on the effects of hypotensive anesthesia is based on ten randomized controlled studies involving 358 patients. All the studies reported intraoperative blood loss, operation time and quality of the surgical field. The types of osteotomies included: anterior maxillary osteotomy, Le Fort I, bilateral sagittal split osteotomy, double jaw, and combined maxillary

and mandibular osteotomy. All the studies evaluated the use of hypotensive agents compared with normotensive pressure.

- The use of hypotensive anesthesia in orthognathic surgery may reduce intraoperative blood loss (low certainty evidence).
- The use of hypotensive anesthesia in orthognathic surgery may make little or no difference to operation time (low certainty evidence).

- The use of hypotensive anesthesia in orthognathic surgery may improve the quality of surgical field (low certainty evidence).
- No studies were found that reported adverse effects or even mortality associated to hypotensive anesthesia in orthognathic surgery.

Effect of hypotensive anesthesia in orthognathic surgery

Patients	Adults subjected to orthognathic surgery		
Intervention	Hypotensive Anesthesia		
Comparison	Normotensive Anesthesia		
Outcome	Absolute effect*		Certainty of evidence (GRADE)
	WITHOUT Hypotensive anesthesia	WITH Hypotensive anesthesia	
Intraoperative blood loss	524 ml	355.32 ml	⊕⊕○○ ^{1,2} Low
	MD: 168.68 ml less (Margin of error: 228.19 ml less to 109.77ml less)		
Surgical time	248 min	238.54 min	⊕⊕○○ ^{1,3} Low
	MD: 9.46 min less (Margin of error:22.87 min less to 3.95 min more)		
Quality of surgical field+	The quality of surgical field assessment scale was on average 0.66 standard deviations lower in the hypotensive group		⊕⊕○○ ^{1,2} Low
	SMD**: 0.66 less (Margin of error: 1.05 less to 0.28 less)		
Adverse effects	The included systematic reviews did not report adverse events like renal, hepatic, cardiac or cerebral hypoperfusion during surgery.		
Mortality	The outcome mortality was not measured or reported by included systematic reviews		

Margin of error: 95% confidence interval (CI).
MD: Mean difference.
SMD: Standardized mean difference.
GRADE: Evidence grades of the GRADE Working Group (see later).
 +: The studies reported the quality of the surgical field using different assessment scales, where lower scores indicated better quality of the surgical field.
 *The risk **WITHOUT hypotensive anesthesia** is based on the risk in the control group of the trials. The risk **WITH hypotensive anesthesia** (and its margin of error) is calculated from relative effect (and its margin of error).
 **The standardized mean difference is used when the outcome has been measured on different scales, being difficult to interpret clinically. It is commonly accepted that values close to 0.2 would have little clinical relevance, values of 0.5 would have moderate relevance (clinically recognized) and values above 0.8 would have high relevance.
¹ The certainty of evidence was downgraded in one level for risk of bias since in most of the included trials there were a lack of description of the randomization method, lack of blinding, and inadequate allocation concealment of patient randomization.
² The certainty of evidence was downgraded one level for inconsistency due to trials presenting different conclusions (I² 56%).
³ The certainty of evidence was downgraded one level for imprecision since each end of the confidence interval leads to a different decision.

About the certainty of the evidence (GRADE)*

⊕⊕⊕⊕	High: This research provides a very good indication of the likely effect. The likelihood that the effect will be substantially different† is low.
⊕⊕⊕○	Moderate: This research provides a good indication of the likely effect. The likelihood that the effect will be substantially different† is moderate.
⊕⊕○○	Low: This research provides some indication of the likely effect. However, the likelihood that it will be substantially different† is high.
⊕○○○	Very IVery low: This research does not provide a reliable indication of the likely effect. The likelihood that the effect will be substantially different† is very high.

*This concept is also called 'quality of the evidence' or 'confidence in effect estimates'.
 † Substantially different = a large enough difference that it might affect a decision.

Other considerations for decision-making

To whom this evidence does and does not apply
<ul style="list-style-type: none"> The evidence in this summary applies to individuals older than 14 years who were treated by orthognathic surgery.
About the outcomes included in this summary

(Continued)

(Continued)

Other considerations for decision-making	
<ul style="list-style-type: none"> All the selected outcomes are considered critical for decision making according to the opinion of the authors of this summary, which coincide in general with those evaluated by the systematic reviews. The outcome mortality was included in the summary of findings table because it is a relevant outcome for clinical experts, even though it is not a frequent outcome, and was not reported by the reviews either. This also applies to the outcome of adverse effects, which was included because it reports relevant information regarding complications or post-operative aspects associated with orthognathic surgery. However, they were not reported in the reviews. 	
Balance between benefits and risks, and certainty of the evidence	
<ul style="list-style-type: none"> The evidence included for this summary shows a slight benefit in the use of hypotensive anesthesia compared to normotensive anesthesia, in orthognathic surgery. With the use of hypotensive anesthesia there is little benefit reducing intraoperative blood loss, operation time, and improving the quality of the surgical field Based on the above, the risk/benefit balance could be in favor towards the use of a hypotensive anesthesia in orthognathic surgery. 	
Resource considerations	
<ul style="list-style-type: none"> None of the trials conducted a cost analysis regarding the use of hypotensive anesthesia. However, there is evidence that the additional costs associated with complications of orthognathic surgery can be considerable. Currently, there are no economic trials that evaluate the real cost-effectiveness of this treatment, which would be necessary to be able to evaluate this aspect in greater depth. 	
What would patients and their doctors think about this intervention	
<ul style="list-style-type: none"> Given the evidence presented in this summary, most patients and surgeons should prefer hypotensive anesthesia rather than normotensive anesthesia, since with hypotensive anesthesia, there is a likely reduction in the intraoperative blood loss and operation time, and thus in their socio-economic consequences. Additionally, it is important to emphasize that this is valid as long as there is a correct and precise indication for hypotensive anesthesia. Controlled hypotension is not universally applicable across all patient cases, necessitating meticulous patient selection in collaboration with the anesthesia team. This approach aims to avert exacerbation of ischemic events in the heart, brain, and kidneys during hypotensive surgical procedures. 	
Differences between this summary and other sources	
<ul style="list-style-type: none"> The conclusions of this summary are consistent with all of the identified systematic reviews [2], [4], [5], which consider that the use of hypotensive anesthesia probably reduces the intraoperative blood loss, thus reducing the operation time and improving the quality of the surgical field. On the other hand, none of the included systematic reviews assessed the certainty of the evidence regarding the outcomes. 	
Could this evidence change in the future?	
<ul style="list-style-type: none"> The probability that future evidence will change the conclusions of this summary is high, due to the uncertainty associated with some critical outcomes for decision making. Searching the International Clinical Trials Registry Platform of the World Health Organization and the PROSPERO database, we did not identify any ongoing clinical trial or systematic review. 	

HOW WE CONDUCTED THIS SUMMARY

Using automated and collaborative means, we compiled all the relevant evidence for the question of interest and we present it as a matrix of evidence (Figure 1

Follow the link to access the **interactive version**: <https://www.epistemonikos.org/en/documents/b3c4eb5c2ecf8ad03ef239b5487f9b90bee241e1/matrix?current=630d7d856ec0d6623194a934>

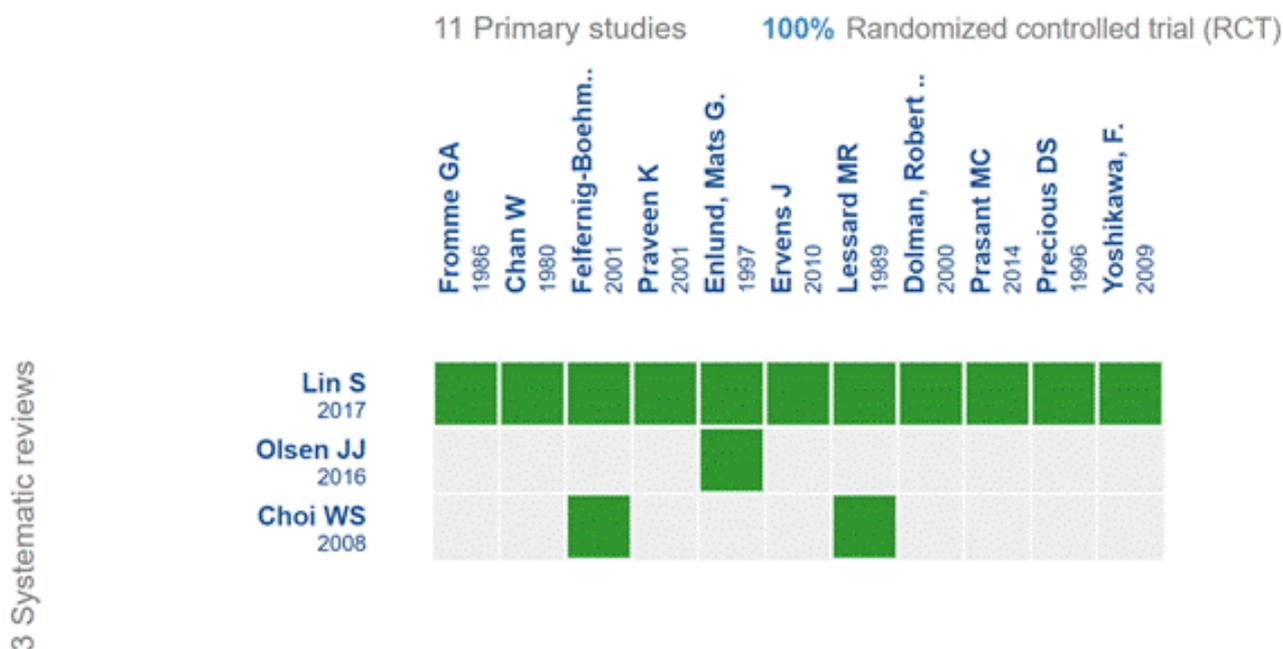
NOTES

The upper portion of the matrix of evidence will display a warning of “new evidence” if new systematic reviews are published after the publication of this summary. Even though

the project considers the periodical update of these summaries, users are invited to comment in Medwave or to contact the authors through email if they find new evidence and the summary should be updated earlier. After creating an account in Epistemonikos, users will be able to save the matrixes and to receive automated notifications any time new evidence potentially relevant for the question appears.

This article is part of the Epistemonikos Evidence Synthesis project. It is elaborated with a pre-established methodology, following rigorous methodological standards and internal peer review process. Each of these articles corresponds to a summary, denominated FRISBEE (Friendly Summary of Body of Evidence using Epistemonikos), whose main objective is to synthesize

Figura 1. Matrix of evidence.



the body of evidence for a specific question, with a friendly format to clinical professionals. Its main resources are based on the evidence matrix of Epistemonikos and analysis of results using GRADE methodology. Further details of the methods for developing this FRISBEE are described here (<http://dx.doi.org/10.5867/medwave.2014.06.5997>)

The details about the methods used to produce these summaries are described here (<http://dx.doi.org/10.5867/medwave.2014.06.5997>)

Epistemonikos foundation is a non-for-profit organization aiming to bring information closer to health decision makers with technology. Its main development is Epistemonikos database (www.epistemonikos.org).

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Efectos de la anestesia hipotensora comparada con la anestesia normotensora en cirugía ortognática

RESUMEN

INTRODUCCIÓN La cirugía ortognática se encuentra ampliamente aceptada para la corrección de anomalías dentofaciales. Debido al importante suministro de sangre en la región de cabeza y cuello, puede ocurrir una considerable pérdida de sangre proveniente de los tejidos duros y blandos intervenidos durante una cirugía ortognática. La anestesia hipotensiva es un método utilizado en la práctica quirúrgica mediante el cual se disminuye de manera predecible y deliberada la presión sanguínea con el fin de reducir la pérdida hemática y mejorar el campo quirúrgico. Sin embargo, aún existe incertidumbre respecto a su efectividad y seguridad en cirugía ortognática.

MÉTODOS Realizamos una búsqueda en Epistemonikos, la mayor base de datos de revisiones sistemáticas en salud, la cual es mantenida mediante el cribado de múltiples fuentes de información, incluyendo MEDLINE, EMBASE, Cochrane, entre otras. Extrajimos los datos desde las revisiones identificadas, analizamos los datos de los estudios primarios, realizamos un metanálisis y preparamos una tabla de resumen de los resultados utilizando el método GRADE.

RESULTADOS Y CONCLUSIONES Identificamos tres revisiones sistemáticas, que en conjunto incluyeron 11 estudios primarios, todos ensayos aleatorizados. Concluimos que la anestesia hipotensiva podría reducir la pérdida de sangre intraoperatoria y mejorar la calidad del campo quirúrgico, pero la certeza de la evidencia es baja. Por otro lado, el uso de anestesia hipotensiva podría resultar en poca o nula diferencia en el tiempo quirúrgico (certeza de la evidencia baja). Finalmente, no se encontraron estudios que reportaran efectos adversos o mortalidad.



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