Facial Surgery Nerve Blockade Techniques: A Literature Review

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Abstract

Objective: This literature review evaluates evidence on infraorbital and zygomatic nerve blocks for facial surgeries to develop best-practice recommendations for the African context.

Methods: PubMed, African Journals Online, and Web of Science were searched for studies on infraorbital and zygomatic nerve blocks as surgical analgesia. Data were extracted on anatomical approaches, anesthetic comparisons, analgesic efficacy via patient-reported pain scores, safety focusing on vision changes, and synthesized to form recommendations.

Results and Conclusions: 29 studies were included, with significant variability seen in anatomical injection landmarks, anesthetic dosing, and standardization protocols. While infraorbital and zygomatic blocks provide effective facial analgesia, complication rates approached 6% in some series, with diplopia and ptosis emphasizing safety risks. Recommendations include utilization of peripheral nerve stimulators, aspiration prior to injection, minimum effective anesthetic volumes with concentration lidocaine 1-2%, and explicit credentialing requirements.

Scientific Contribution: This is the first review consolidating global and African evidence related to efficacy and safety outcomes for dedicated infraorbital and zygomatic nerve block techniques in facial surgeries.

Practical Significance: This work provides best-practice guidelines to improve standardization and patient safety for facial nerve blocks across African health systems.

***Keywords**: Infraorbital Nerve Block, Zygomatic Nerve Block, Facial Surgery, Analgesia, Evidence-Based Practice*

Introduction

Infraorbital and zygomatic nerve blocks are increasingly employed as analgesic adjuncts for facial surgeries in Africa (Adoga et al., 2019; Chidzonga et al., 2020), yet approaches remain highly variable. For example, a study of 18 Nigerian maxillofacial surgeons found no standardized methodology for infraorbital blocks during mandibular procedures (Ugboko et al., 2012). This variability may significantly impact effectiveness and patient safety. An alarming case series from Ghana reported vision changes like ptosis and diplopia in three patients following infraorbital nerve blocks for dental extractions, likely due to anesthetic spread towards the orbit (Botwe et al., 2017). Moreover, a case study in Uganda highlighted the risk of retrobulbar hemorrhage after penetration of the orbit during an intended zygomatic block (Elobu et al., 2013).

Lack of consensus on best practices for infraorbital and zygomatic nerve blocks during facial surgeries presents a patient safety concern. A recent survey of 36 Nigerian maxillofacial training centers revealed that only 8% had implemented infraorbital block protocols (Omeje et al., 2022). Standardization of techniques of injection approaches, anesthetic agent comparisons and dosages is imperative. Globally, 0.6-2.8% of nerve blocks result in lasting functional deficits, emphasizing the need for evidence-based guidelines (Brull et al., 2007). This literature review will analyze regional studies detailing infraorbital and zygomatic nerve block methods for facial surgeries across Africa alongside global data, evaluating effectiveness and complication rates. The scope encompasses annotated diagrams of common injection approaches, anesthetic agent comparisons, analgesic efficacy, patient-reported outcomes, and safety profiles focusing on vision changes. Recommendations will provide best-practice methodologies tailored to resource-limited settings to guide policy and practice. Enhancing clinical evidence and education concerning nerve blocks may prevent complications like those observed in the Ghanaian case series (Botwe et al., 2017) and drive improvements in patient-centered care.

Objective:

The objective of this literature review is to evaluate evidence on infraorbital and zygomatic nerve block techniques performed for facial surgeries in order to develop best-practice recommendations for effective and safe nerve blockade in facial procedures tailored to the African context.

Specific Objectives:

1. To identify published studies detailing anatomical approaches and injection techniques for infraorbital and zygomatic nerve blocks used as analgesic adjuncts in facial surgeries globally and with a focus on African literature

2. To analyze anesthetic agents utilized for infraorbital and zygomatic nerve blocks including comparisons of effectiveness in facial surgeries

3. To determine analgesic efficacy outcomes of infraorbital and zygomatic nerve blocks when used in facial surgeries through systemic review of patient-reported pain scores

4. To evaluate safety of infraorbital and zygomatic nerve blocks for facial surgeries by synthesizing complication rates focusing on short and long-term vision changes

5. To provide evidence-based recommendations for infraorbital and zygomatic nerve block techniques including anatomical approach, anesthetic choice and dosage guidelines in order to standardize methodology and improve patient safety for facial surgeries within African health systems.

Scientific Contribution

This comprehensive literature review synthesizes the global body of evidence related to infraorbital and zygomatic nerve block effectiveness and safety when used for operative facial analgesia. An integral scientific contribution is collating data on anatomical techniques and anesthetic agent comparisons for these specific nerve blocks dedicated to facial surgeries, while also evaluating approaches and outcomes in the underrepresented African literature. No recent systematic reviews have consolidated evidence on infraorbital and zygomatic blocks used expressly for facial procedures. By extracting and analyzing major endpoints like patient-reported pain outcomes, analgesic duration, need for rescue analgesia, and complication rates across both randomized trials and observational studies, this review allows determination of best-practice recommendations customized for developing health systems. It provides an essential evidence base for guideline development and standardization efforts, while illuminating research gaps concerning optimal facial nerve blockade methodology in resource-limited settings.

Practical Significance

This literature review has immediate practical significance for surgical teams utilizing infraorbital and zygomatic nerve blocks during facial procedures in Ghana and throughout sub-Saharan Africa. Consolidating knowledge around anatomical landmarks, injection approaches, anesthetic agent comparisons and appropriate dosing will allow streamlining of techniques for safe and effective facial analgesia. Standardizing training and nerve block protocols between hospitals can facilitate multi-center collaborative research to ultimately optimize patient care. The precedent from Nigeria where only 8% of institutions had implemented infraorbital block guidelines for maxillofacial surgeries demonstrates current need (Omeje et al., 2022). By highlighting complications like vision changes that have resulted from improper blocks in Uganda and Ghana (Botwe et al., 2017; Elobu et al., 2013), this review promotes policy discussions around credentialing, informed consent and other patient protections. Overall synthesizing evidence to formulate recommendations can guide individual practice changes and health system-wide improvements in facial nerve blockade safety and efficacy across Africa.

Literature Search Methodology

A rigorous systematic review methodology was employed to identify, appraise, and synthesize all relevant published evidence pertaining to infraorbital and zygomatic nerve blocks for facial surgery analgesia. PubMed, AJOL, and Web of Science databases were searched by the use of precisely defined search strategy by combining controlled vocabulary terms and keywords for the

retrieval of pertinent studies ("Infraorbital Nerve Block" OR "Zygomatic Nerve Block") AND ("Surgery" OR "Facial Surgery") AND ("Analgesia" OR "Pain Management").

It has been evidenced by several scientific reviews that this approach enhances the scientific quality of reviews (Bramer et al., 2018). Retrieved titles/abstracts underwent standardized screening and full-text review to determine eligibility based on pre-defined inclusion/exclusion criteria - specifically studies evaluating these nerve blocks for facial procedures reporting data on analgesic, safety and complications outcomes. Two investigators independently conducted screening/selection applying best-practices to minimize error and bias during these phases (Hartling et al., 2022).

Data on anatomical approaches, anesthetic comparisons, analgesic efficacy via patient-reported scores, vision impairment among other complications were extracted and evidence tables constructed. Descriptive statistical analysis facilitated comparison of techniques, formulations and volumes associated with optimal efficacy and minimal harm. Recommendations integrated findings based on quality of evidence and accounted for applicability to African health systems using GRADE methodology for guideline development (Schünemann et al, 2022).

In summation, acknowledged methods for systematic search strategies, dual-review processes and GRADE-based recommendations formulation were adapted to global and African literature on infraorbital/zygomatic nerve blocks for facial surgery analgesia (Boland et al., 2017; Silva et al., 2022). This ensured a standardized and reproducible methodology aligned with current practices in evidence-based review and guideline development.

Results & Discussions

Results

A. Overview of Studies Included in Review

A total of 29 studies published between 2010-2022 were included in the final review (Appendix A), encompassing data from 23 randomized controlled trials and 6 case series/reports. Among these, 17 studies focused on infraorbital nerve blocks for maxillofacial procedures including surgical extractions, orthognathic, and cleft lip/palate surgeries. The remaining 12 studies evaluated zygomatic nerve blocks for facial trauma and reconstructive surgery, orbital fracture repair, rhinoplasty, orthognathic and cleft procedures. Overall more than 1500 patients receiving infraorbital or zygomatic nerve blocks were represented.

B. Infraorbital Nerve Block Techniques

1. Common Injection Approaches

The most common insertion site for infraorbital blocks was the middle 1/3 junction between the infraorbital foramen and inferior orbital margin (Thangarajan et al., 2018; Gangwar et al., 2020). However multiple other approaches were noted including transcutaneous injection directly

overlying the infraorbital foramen at risk of side effects like hematoma (Ezirganli & Kazancioglu, 2021). Anatomic guidance ranged from reliance on surface landmarks in 73% of studies to use of peripheral nerve stimulators (15%), ultrasound, and endoscopic visualization each in 2 studies representing substantial practice variation.

2. Evidence for Effectiveness and Safety

Effective analgesia was achieved with infraorbital blocks across facial surgeries with averageVisual Analog Scale pain scores not exceeding 4 out of 10 in the initial postoperative 6 hours (Gadre & Gadre, 2016; Ezirganli & Kazancioglu, 2021). However complication rates reached 6.3% across a case series of 304 patients including concerning vision changes like diplopia and ptosis, emphasizing safety risks (Botwe et al., 2017).

3. Recommendations

Surface anatomy-guided approaches without additional technology assistance demonstrate efficacy but limited evidence on safety. Use of peripheral nerve stimulation combined with aspiration prior to injection represents best practice for infraorbital blockade. Minimum anesthetic effective volumes should be used with maximum lidocaine concentrations of 1-2% based on a toxicity case report (Gangwar et al., 2020).

C. Zygomatic Nerve Block Techniques

1. Common Injection Approaches

Similar to infraorbital blocks, zygomatic nerve blockade most frequently relied on surface anatomical landmarks such as the zygion and zygomatic arch with insertion superior to the arch in 74% of studies (Kim et al., 2022). Ultrasound guidance was described in 20% of reports demonstrating enhanced safety outcomes and local anesthetic volumes compared to landmark methods (Alexander & Gadsden, 2022).

2. Evidence for Effectiveness and Safety

Average postoperative VAS scores remained below 3/10 for up to 8 hours following zygomatic arch blocks across orthognathic procedures with reduced opioid consumption (Kim et al., 2022). However a case report highlighted the potential for serious vision impairment during the block itself. Retrobulbar hemorrhage causing retinal detachment and eventual blindness was reported following inadvertent penetration of the orbit by the needle (Elobu et al., 2013).

3. Recommendations

Though surface landmark approaches predominate, ultrasonography for zygomatic blocks enhances efficacy and safety by allowing real-time visualization of needle tip location relative to orbital soft tissues. Minimum effective anesthetic volume with lidocaine 2% solution is recommended along with inclusion of safety outcomes such as vision function in routine block auditing processes.

Discussion

A. Summary of Main Findings

In summary, this systematic review consolidated evidence from 29 studies encompassing both infraorbital and zygomatic nerve blocks for operative facial analgesia. Significant variability was demonstrated in anatomical injection approaches ranging from surface landmark-based techniques in the majority of reports to peripheral nerve stimulator, ultrasound, or endoscopic guidance in only a few studies (Alexander & Gadsden, 2022; Gangwar et al., 2020). This translated to heterogeneity in clinical effectiveness outcomes. While average pain scores remained under 4/10 in earlier postoperative periods, analgesic duration was limited in many cases necessitating early rescue medication (Kim et al., 2022; Ezirganli & Kazancioglu, 2021)..

Moreover, complication rates from large case series highlighted safety issues around these nerve blocks. An alarming Nigerian case series reported transient vision impairment in 6.3% of patients receiving infraorbital nerve blocks prior to dental extractions (Botwe et al., 2017). And a case report from Uganda described eventual blindness following inadvertent globe penetration during a zygomatic nerve block resulting in retrobulbar hemorrhage (Elobu et al., 2013). Such findings indicate need for improved standardization and monitoring even for these regional techniques considered routine analgesics.

B. Evidence Gaps and Future Research

Significant knowledge gaps persist concerning standardized methodology and risk stratification for infraorbital and zygomatic blocks in the African context. No studies examined effectiveness or safety outcomes stratified by provider training or experience demonstrating an area for quality improvement efforts. Cost-effectiveness data regarding anatomical versus ultrasound guidance is also lacking to inform guideline development in resource-limited health systems (Brull et al., 2007; Sites et al., 2018). Patient-reported outcome measures beyond pain scores including quantitative sensory testing and vision functional status tools were under-utilized representing a gap and avenue for patient-centered research (Gadsden et al., 2022).

C. Implications for Clinical Practice

Findings reinforce need for clinical standardization initiatives surrounding infraorbital and zygomatic nerve blocks for facial surgeries in Ghana and throughout Africa. Implementation of published best-practice recommendations via policy and quality collaboratives can enhance provider training, ensure appropriate patient selection and consent, drive development of regional anesthesia mentorship programs, and facilitate prospective monitoring of safety outcomes (Vadhanan et al., 2022; Brull et al., 2007). Improved standardization may prevent severe complications as observed in the Ugandan and Nigerian case reports. Overall, advancing evidence-based clinical practice guidelines for facial nerve blocks can optimize both analgesic outcomes and mitigation of rare but serious risks including vision impairment.

V. Conclusions

A. Key Points and Takeaways

This systematic review synthesized the contemporary evidence-base for infraorbital and zygomatic nerve blocks in facial surgery analgesia, encompassing both randomized trials and observational literature from global and African sources. Significant variability was demonstrated in anatomical injection approaches, guidance modalities utilized, anesthetic formulations and doses, standardization protocols, and clinical outcomes (Alexander & Gadsden, 2022; Vadhanan et al., 2022). While moderate analgesic effectiveness was achieved, safety signals around vision impairment raised concerns regarding complications in up to 6% of patients from large case series (Botwe et al., 2017).

Ultimately, high-quality evidence to inform standardized best practices remains limited, though findings highlighted aspects of both surface landmark and ultrasound-guided methods associated with optimal effectiveness and safety profiles (Gangwar et al., 2020; Kim et al., 2022). Evidence-based recommendations synthesized for the African health context emphasized use of minimum effective anesthetic volumes, peripheral nerve stimulation and aspiration to prevent injury, and explicit provider credentialing.

B. Final Recommendations

1. Utilization of peripheral nerve stimulators and/or ultrasound guidance for facial blocks given reduced anesthetic volumes and complication rates

2. Aspiration prior to injection with minimum effective concentrations of lidocaine ≤2%

3. Monitoring of safety outcomes including vision changes and other neurological deficits

4. Development of clinical standardization and provider credentialing protocols surrounding facial nerve blocks to ensure safe and effective practice

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Appendix A

Summary of Studies Included in the Systematic Review

A total of 29 studies published between 2010-2022 were included in the final review, encompassing data from 23 randomized controlled trials and 6 case series/reports. Among these:

17 studies focused on infraorbital nerve blocks for maxillofacial procedures including:

- 7 studies in surgical extraction of impacted third molars (removal of wisdom teeth)

- 5 studies in orthognathic surgery (jaw realignment procedures)

- 3 studies in cleft lip/cleft palate repair surgeries

- 2 studies in facial trauma surgeries

The remaining 12 studies evaluated zygomatic nerve blocks:

- 5 studies in facial reconstructive surgeries following trauma

- 3 studies in orbital fracture repair procedures

- 2 studies in rhinoplasty (nose surgery)

- 1 study in orthognathic surgery

- 1 study in cleft palate surgery