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ORIGINAL ARTICLE

Adult Cleft Lip Repair Under Local Anesthesia: An Effective Technique in Resource-Poor Settings

Kyle R. Eberlin, M.D., Raj M. Vyas, M.D., Youmna Abi-Haidar, M.D., Navil Sethna, M.D., Usama S. Hamdan, M.D.

Objective: **In developing countries there are many adults with unrepaired cleft lip deformities. These countries often lack the equipment and personnel to provide general anesthesia for all patients; therefore, a technique for repair under local anesthesia would be useful.**

Method: **A retrospective review was performed of 22 adolescent/adult patients on whom primary cleft lip repair was performed under local anesthesia in Bamako, Mali, in 2008 and 2009. Inclusion criteria for this technique were age greater than 12 with unilateral or bilateral deformity and ability to understand and tolerate the procedure under local anesthesia alone. Exclusion criteria included cardiopulmonary disease or inability to tolerate the procedure while awake. Demographic information and outcome data were collected including total time in the operating room, surgical time, and day of discharge.**

Results: **Twenty-two primary cleft lip repairs were completed in 12 male and 10 female patients. Mean age was 22.3 years and mean weight was 50 kg. Overall, mean total operating room time was 145 minutes. Mean operating room time was significantly ($p < .01$) longer in 2008 (159 minutes) than in 2009 (114 minutes). Although mean surgical time was 110 minutes, there was a similar significant ($p = .03$) decrease from 2008 (119 minutes) to 2009 (91 minutes). All patients tolerated the procedure without requiring intubation or intravenous sedation, and all were discharged the same day.**

Conclusion: **Cleft lip repair in adults under local anesthesia is safe and effective. Improvements in technique and efficiency have made this valuable in developing countries.**

KEY WORDS: *cleft lip, local anesthesia, medical missions*

In impoverished nations, a sizable number of adolescents and adults have unrepaired cleft lip deformities. The morbidity of impaired speech and feeding problems, as well as the associated social stigma, can be significant (Oluwasanmi and Adekunle, 1970; Olasoji et al., 2002), particularly in areas of the world where malnutrition is rampant and lack of education creates an oppressive environment within affected individuals' peer groups. In certain areas of Africa, for instance, cleft lip is thought to be associated with witchcraft or ancestral spirits (Mzezewa and Muchemwa, 2010).

Cleft repair is ideally performed during infancy; many authors now advocate surgical intervention before the traditional age of 10 weeks (Harris et al., 2010). Accordingly, cleft lip repair has historically been performed under general anesthesia for patient and surgeon comfort as well as for safety concerns. However, general anesthesia itself is not without risk. Postoperative care in patients undergoing cleft lip repair can be complicated by the known risks of general anesthesia, including laryngospasm, aspiration, airway edema, and other complications resulting from undocumented medical conditions. In children, general anesthetic risks total 13% to 22%, can affect patient recovery and the ultimate surgical result (Edomwonyi et al., 2008; Kwari et al., 2010). Although general anesthesia is typically safe in healthy adults, lack of longitudinal medical care can make risk assessment difficult on international medical missions.

In many countries to which international cleft mission groups travel, there are limited resources to provide comprehensive care for cleft patients. This creates a situation in which local poverty, combined with undesirable

Dr. Eberlin is resident, Harvard Plastic Surgery Training Program, Massachusetts General Hospital, Harvard Medical School, Boston, Massachusetts. Dr. Vyas is resident, Harvard Plastic Surgery Training Program, Massachusetts General Hospital, Harvard Medical School, Boston, Massachusetts. Dr. Abi-Haidar is resident, Tufts University Surgical Training Program, Boston, Massachusetts. Dr. Sethna is Associate Professor of Anesthesia, Children's Hospital Boston, Harvard Medical School, Boston, Massachusetts. Dr. Hamdan is President, Global Smile Foundation, Boston, Massachusetts and Assistant Clinical Professor of Otolaryngology, Tufts University School of Medicine, Clinical Instructor in Otology and Laryngology, Harvard Medical School, and Clinical Instructor of Otolaryngology, Boston University School of Medicine, Boston, Massachusetts.

Drs. Eberlin and Vyas contributed equally and are co-first authors on the manuscript.

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Address correspondence to: Dr. Kyle R. Eberlin, Harvard Plastic Surgery Training Program, Division of Plastic Surgery, Massachusetts General Hospital, 55 Fruit Street, WAC-43, Boston, MA 02114. E-mail keberlin@partners.org.

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economic factors and poor physician reimbursement, drives qualified specialist physicians to practice in more developed countries (Pham and Tollefson, 2007). This brain drain of the developing world inevitably contributes to the limited access to care for cleft patients in these countries, resulting in a cadre of adults with unrepaired cleft deformities. Furthermore, many local surgeons find cleft lip repair to be more challenging in adults than in children, as more extensive dissection may be required to perform a satisfactory repair (Adekeye and Lavery, 1985; Aziz et al., 2009). As a result, well-trained medical mission groups are uniquely positioned to help provide care for adults with cleft deformities.

Through the Global Smile Foundation, we previously described our initial experience in performing cleft lip repair using local anesthesia alone (Salloum et al., 2009), although there have been few studies in the literature concerning this method (Ahmad, 2008). Perhaps most importantly, this technique can provide adequate anesthesia to perform unilateral or bilateral cleft lip repair with primary rhinoplasty in adults, as well as cleft lip and nose revisions, without the need for general anesthesia or intravenous (IV) sedation. We have found this to be particularly useful when performing cleft surgery in resource-poor settings with limited access to the equipment and/or personnel required for general anesthesia.

In this article we present our experience performing adult cleft lip repair under local anesthesia in Bamako, Mali, on two distinct week-long surgical missions in consecutive years and describe the evolution of our technique over time.

Materials and Methods

A retrospective review was performed of the Global Smile Foundation's accumulated experience over a period of two years in treating adolescents and adults with primary cleft lip deformity in Bamako, Mali, in December 2008 and October 2009 on two distinct, week-long surgical missions. Inclusion criteria for exclusive use of local anesthesia during cleft repair were age >12 years, presence of primary unilateral or bilateral cleft lip deformity, and ability to understand and tolerate the proposed procedure under local anesthesia. Exclusion criteria included the presence of cardiopulmonary disease, allergy to local anesthesia, and uncertainty about the patient's willingness or ability to tolerate the procedure while awake.

All procedures were performed in Gabriel Toure Hospital by the same surgical team under the direction of the senior author (U.S.H., see technique below). Patient screening protocol was the same for both week-long surgical missions (Eberlin et al., 2008), and the patient referral system was identical: Radio and television advertisements were put forth to the local community approximately 2 weeks before the team arrived. Baseline patient demographics were recorded, including patient gender, age, weight, and primary diagnosis as well as concomitant medical conditions. Operative data endpoints included procedure, total time in the operating room, surgical time (from incision until closure), and postoperative date of patient discharge.

Statistical analysis was performed using chi-square analysis for comparison between binary variables and a single-tailed *t*-test assuming equal population variance for comparison between quantitative variables (Microsoft Excel 2007, Redmond, WA). A p value $<.05$ was considered statistically significant.

The principles outlined in the Declaration of Helsinki were followed to ensure ethical treatment of all subjects.

Local Anesthetic and Surgical Technique

In awake patients without the use of sedation, infraorbital and external nasal nerve blocks were performed after anesthetizing the injection sites with application of the topical anesthetic PainEase (Ethyl Chloride, GeBauer Company, Cleveland, OH) approximately 5 seconds before nerve block. The infraorbital nerve was located bilaterally by drawing a line extending from the oral commissure to the mid-pupillary line (Rajamani et al., 2007). The infraorbital injections were placed at the midpoint of these landmarks. A 1-inch, 30-gauge needle was introduced 0.5 cm lateral to the alar rim and directed superolaterally along the vector described. To avoid direct contact with the nerve and injury to the globe, injections were performed while palpating the infraorbital rim, avoiding penetration of the foramen and protecting the orbit (Fig. 1A). In adults, we used a mixture of equal volumes of 1% lidocaine with epinephrine 1:100,000 and 0.5% bupivacaine with epinephrine 1:200,000, and injected approximately 1.5 mL into each side (3 mL total).

The external nasal nerve (a branch of the ophthalmic nerve) was then located as it passes beneath the compressor nasi and supplies the integument of the ala and the tip of the nose. The same topical anesthetic, PainEase (Ethyl Chloride, GeBauer Company), was applied to the nasal skin right above the injection site approximately 5 seconds before nerve block. The aforementioned mixture of local anesthetics was injected (0.5 mL into each side, 1 mL total) at the nerve's exit from the distal nasal bone, cephalad to the upper lateral cartilage, approximately 7 mm lateral to the midline of the nasal dorsum (Fig. 1B) (Han et al., 2004).

A period of 15 to 20 minutes was allowed for the nerve blocks to take effect before using the same mixture of local anesthetics for subcutaneous infiltration of the surgical sites (approximately 5 to 10 mL total for adults). Cleft lip repair was performed using the previously described modified Millard technique and primary rhinoplasty with alar base flap and suspending suture (Fig. 2) (Numa et al., 2006).

Results

From 2008 to 2009, we completed 22 primary cleft lip repairs in 12 male and 10 female adolescents and adults.

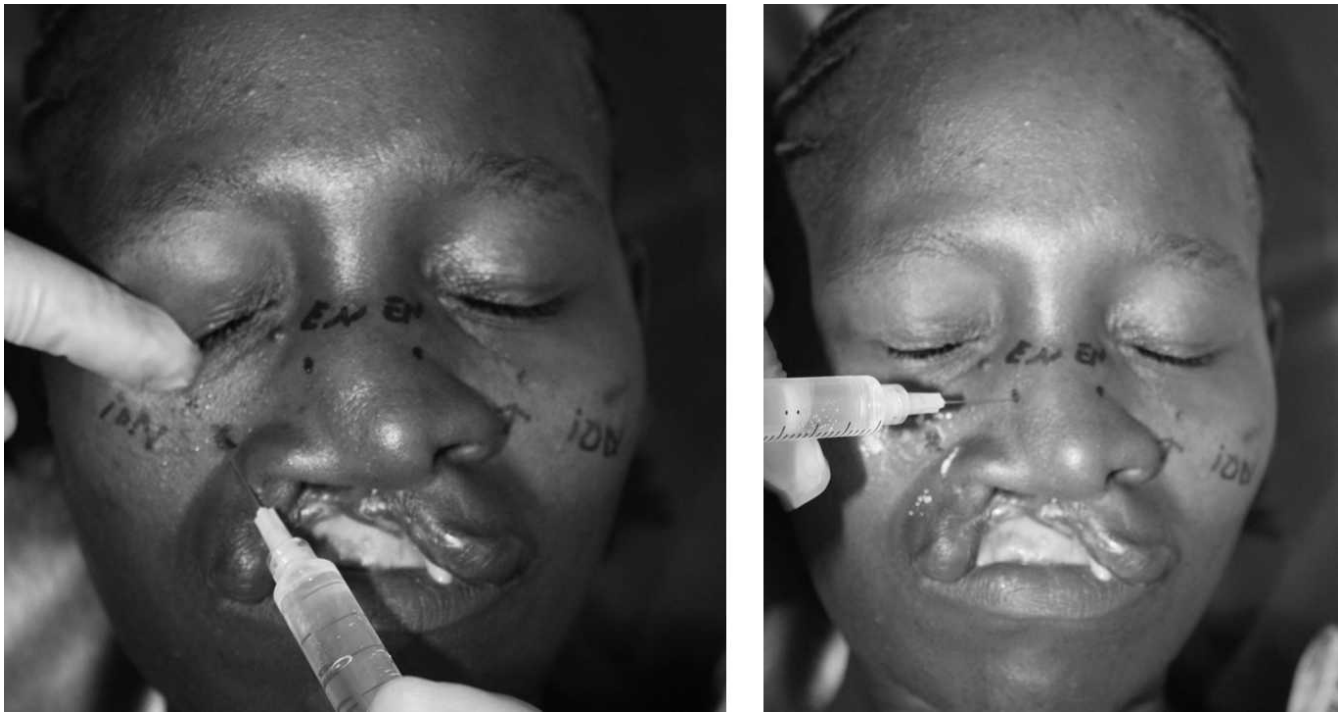

FIGURE 1 A: Technique of infraorbital block. B: Technique of external nasal nerve block.

Mean patient age was 22.3 years, and mean patient weight was 50 kg. Nineteen patients underwent repair of a unilateral defect and three patients underwent repair of bilateral clefts. Twelve had complete cleft lip deformities, and the remaining 10 had incomplete cleft lips. The data for 2008 and 2009, and the aggregate patient demographic data for Global Smile Foundation's cleft missions to Bamako, Mali, are summarized in Table 1. When comparing patients from 2008 and 2009, the only statistically significant difference in patient demographics was mean weight (61 kg in 2008 and 47 kg in 2009, $p = .03$).

Overall, total operating room (OR) time was 145 minutes for all procedures. Notably, total OR time was significantly ($p < .01$) longer in 2008 (159 minutes) than in 2009 (114 minutes). Although mean surgical time was 110 minutes, there was a similar significant ($p = .03$) decrease from 2008 (119 minutes) to 2009 (91 minutes) (Fig. 3).

Mean monitored recovery time from the end of surgery until the time of discharge from the recovery room was 53 minutes; all patients were discharged home on the same day of surgery. All patients were able to tolerate oral fluids at time of discharge.

All patients were evaluated at the end of the operative week by the Global Smile Foundation surgical team and at regular intervals thereafter by the local cleft team (plastic surgeons and pediatricians, approximately 1 week and 1 month after surgery). There were no known complications related to infection, hematoma, wound dehiscence, or

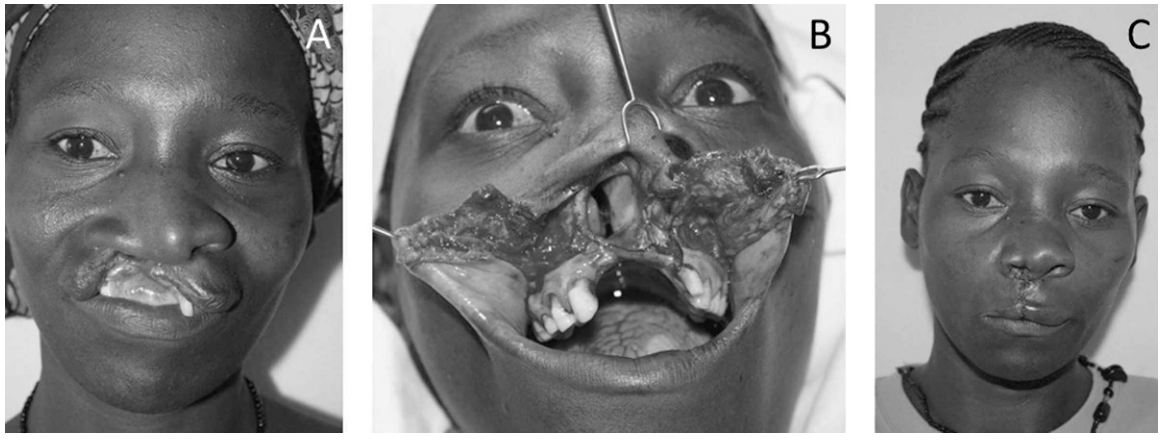

FIGURE 2 Cleft lip repair under local anesthesia, A: before, B: during, and C: after repair.

TABLE 1 Demographics*

	2008	*2009*	*Total*	*p-value*
No. of adults treated	7	15	22	
Mean age, range (years)	25.8 (15–33)	20.6 (12–45)	22.3	$p = .09$
Mean weight, range (kg)	61 (45–80)	47 (28–71)	50	$p = .03$
Male:female	3:4	9:6	12:10	$p = .45$
Unilateral:bilateral	7:0	12:3	19:3	$p = .20$
Complete:incomplete	3:4	9:6	12:10	$p = .45$
Right:Left:Bilateral	3:4:0	7:5:3	10:9:3	$p = .39$

* Data from 2008, 2009, and aggregate patient demographic data from Global Smile Foundation cleft missions to Bamako, Mali. The 2008 and 2009 data were compared and $p < .05$ was considered statistically significant (*t*-test).

ischemia. No patient required further operations. There were no adverse reactions to the local anesthetic. All patients tolerated the procedure under local anesthesia without aborting the procedure or requiring intubation/IV sedation.

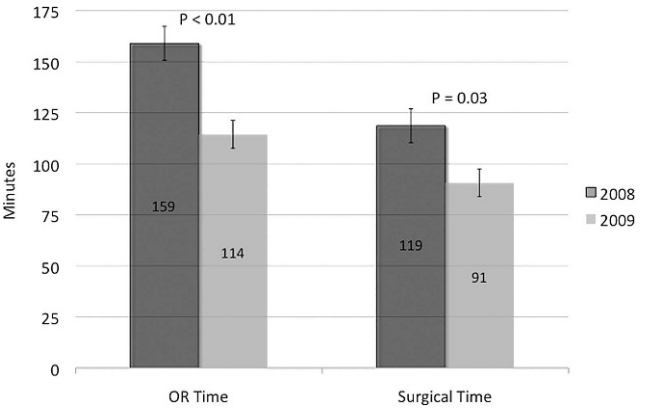

FIGURE 3 Mean time in the operating room (OR time) and time from incision to closure (surgical time) for 2008 and 2009 Global Smile Foundation cleft missions to Bamako, Mali. A statistically significant decrease was observed in total OR time ($p = .03$) and in surgical time ($p < .01$) from 2008 to 2009 (*t*-test).

Discussion

In this article, we present our ongoing experience performing cleft lip repair in adolescents and adults under local anesthesia alone, without the need for general anesthesia or IV sedation. All patients tolerated the procedure well without complication and were discharged home the same day. During the course of this study our injection technique has been refined to become more efficient, and we report a statistically significant reduction in total OR and surgical times.

This technique is safe and effective for cleft lip repair in adults, and it may help prevent complications associated with general anesthesia. Technically, administration of these blocks is easily learned and can be performed by any trained physician. Important factors for success include the type of anesthetic, precise location and timing of infiltration, and amount of medication administered. We recommend using a mixture of lidocaine and bupivacaine with epinephrine as this provides an extended anesthetic effect that can last up to 8.5 hours after injection (Moore et al., 1970) and can help achieve adequate postoperative pain control. Based on our experience, we now use approximately 1.5 mL for each of the bilateral infraorbital nerve blocks and approximately 0.5 mL for each of the external nasal nerve blocks to achieve reliable and satisfactory anesthesia before surgery. In our experience, we have found that approximately 75% of adolescents and adults older than 12 years are amenable to this technique.

We have previously reported this technique in its early stages of development, but have made the following modifications over time:

1. *Extensive preoperative patient counseling:* Patients are educated preoperatively in their native language about the expected procedure. This crucial step minimizes patient anxiety and maximizes the patient's cooperation during the operation.
2. *Use of PainEase (ethyl chloride) before nerve blocks as opposed to EMLA:* This allows for more streamlined administration of local anesthesia in the pre-operative holding area. PainEase provides rapid topical anesthesia and can be administered immediately before nerve blocks, within 45 seconds compared to 60 minutes with eutectic mixture of local anesthetics (EMLA).
3. *Improved coordination of nerve block administration with timing of surgical incision:* We now perform nerve blocks in the preoperative holding area approximately 15 to 20 minutes before planned local infiltration of the operative site, followed by a 12-minute waiting period to allow the vasoconstrictive effect of epinephrine to take place before surgical incision. This optimizes room turnover throughout the day. By having multiple trained physicians available for injection, blocks can be strategically timed to ensure complete anesthetic block when surgery begins.
4. *More comfortable surgical site infiltration of local anesthesia following nerve block:* Regional nerve blocks are performed before infiltration of local anesthetic along the planned incision. This renders the patient more comfortable and better able to tolerate local infiltration along the painful gingiva.
5. *Greater volume of infiltration for nerve blocks:* We now administer approximately 1.5 mL of lidocaine/bupivacaine with epinephrine for each infraorbital nerve block site and 0.5 mL for each external nasal nerve block site to ensure complete anesthesia. This provides complete anesthesia before the incision, without significant worry of lidocaine toxicity in most adolescents and adults.
6. *Smaller-gauge needles for nerve blocks:* We initially used 25-gauge, 1.5-inch needles but found that the patients better tolerated 27- or 30-gauge, 1-inch needle injections for nerve blocks because there is less tissue trauma.

7. *Increased experience and comfort with this technique:* This resulted in more easily administered and more effective anesthesia.

These changes, developed primarily between 2008 and 2009, likely account for the overall improved efficiency of the technique. Total time in the OR decreased in statistically significant fashion, primarily because of the improved timing of preoperative nerve blockade and increased experience and comfort with the technique. Surgical incision was therefore possible almost immediately upon entering the OR. Surgical time was also reduced between 2008 and 2009 (although to a lesser degree than total OR time), which can likely be attributed to more complete anesthesia requiring less intraoperative administration of additional anesthesia.

It is our experience that most patients age 12 years and older are candidates for local anesthetic repair of primary cleft lip deformity without the need for general anesthesia. It is important to select patients appropriately for this technique; we have found this approach to be difficult in patients with cognitive impairment or anxiety traits and in those who are not able to understand the technique. We are careful to ensure that a local interpreter who understands the technique is available to discuss the details with patients before surgery.

All patients in this study were discharged on the same day of surgery, which is practical and advantageous with regard to resource utilization. Few studies in the literature report large numbers of patients undergoing adult cleft lip repair under local anesthesia alone; in one case series all adult patients were discharged on postoperative day two or three (Kwari et al., 2010). With our technique using regional nerve blocks, patients recover quickly and are generally discharged home within 1 or 2 hours after surgery. This is valuable in settings where time and recovery-room space are limited, as is the case on many international medical missions.

This study has some limitations, as our sample sizes are small and the patient population is distinct and perhaps fundamentally different from that in the developed world. The patient demographics in 2008 and 2009 are similar, but there was a statistically significant difference in weight between the two groups. This likely reflects our increasing comfort level with the technique and willingness to perform it on younger (and therefore smaller) patients.

We believe this technique presents an effective, safe, and efficient way to perform adolescent and adult cleft lip surgery in the developing world. With limited resources and poor access to the equipment and personnel required for general anesthesia, this technique requires minimal supplies and is well suited to the countries where adult clefts are most prevalent.

Conclusions

Adult cleft lip surgery is safe and effective with the use of local anesthesia alone, and improvements in technique and efficiency have made this valuable for international mission groups in developing countries.

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