Outcomes of Cleft Lip Repair for Internationally Adopted Children

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Background: Large numbers of international children with cleft lip–cleft palate are adopted in the United States; many underwent their first operation before arrival.
Methods: The authors reviewed records of internationally adopted children with cleft lip–cleft palate treated by one surgeon over 25 years. This study focused on anatomical types, frequency/methods of repair, correction of unrepaired deformities, and secondary procedures in this country.
Results: Of 105 internationally adopted children with cleft lip–cleft palate, 91 percent were Asian; 75 percent had labial or labiopalatal closure in their native country. Of repaired unilateral cleft lips, 43 percent required complete revision, 49 percent required minor revisions, and 8 percent required no revision. All repaired bilateral cleft lips were revised; 90 percent were complete and 10 percent were minor. "Delayed" primary nasal correction was always necessary in both unilateral and bilateral forms. Labial closure was scheduled first in young infants with an unrepaired unilateral defect, whereas palatal closure took precedence in older children. Premaxillary setback and palatoplasty were scheduled first in older children with unrepaired bilateral cleft lip–cleft palate. Of children arriving with repaired palate, 43 percent required a pharyngeal flap.
Conclusions: Whenever cleft lip–cleft palate is repaired in another country, revision rates are high for both unilateral and bilateral types. Nevertheless, primary closure in the native country may increase the likelihood for adoption. Traditional surgical protocols often are altered for an adoptee with an unrepaired cleft lip–cleft palate, particularly the sequence of labial and palatal closure, depending on the child's age and type of defect. (*Plast. Reconstr. Surg.* 135: 1439, 2015.)

Children born in another country and adopted by families in the United States sometimes have "special needs" such as cleft lip and palate. Most adoptees have labial repair in their native country, few have palatal closure,[1] and usually the nasal deformity is uncorrected. Infants born in the United States have the primary labial and palatal closure in the first year of life. Management and outcomes differ for adopted children with an unrepaired defect because their surgical care begins at a relatively late age.[1–3]

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Our purpose was to analyze the demographics of adopted children with labial cleft, frequency of repairs, and method of labial repair in the native country. We also document operative strategies for uncorrected nasolabial deformities and necessary secondary procedures.

PATIENTS AND METHODS

This study was conducted in accordance with the principles outlined in the Declaration of Helsinki. After approval of our institutional review board, we reviewed the medical records of 105 consecutive adopted children with cleft lip–cleft palate who arrived between 1985 and 2012. Admission records, clinical notes, operative reports, and photographs were examined to identify the

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methods of initial labial repair. We recorded date of birth, sex, age at first presentation, country of origin, type of cleft, age and type of labial repair, nasolabial revisions, and associated congenital anomalies. Nasolabial revisions were categorized as "partial" or "complete." Nasal repair was designated "delayed primary" because the cleft lip–related deformity was untouched in these children. Palatal parameters also were reviewed, in addition to age at closure in the child's native country, perceptual speech assessment using the Pittsburgh Weighted Values for Speech Symptoms Associated with Velopharyngeal Incompetence instrument,[4,5] and need for pharyngeal flap or closure of a fistula.

Statistical Analyses

Patient characteristics and descriptive statistics were summarized. Continuous data were compared using the *t* test, and proportions were analyzed using Fisher's exact test. Continuous data are presented as mean ± SD and range. All calculated *p* values were two-tailed and considered significant for values of $p < 0.05$. Statistical analyses were performed using StataSE version 12.1 (StataCorp, College Station, Texas).

RESULTS

Demographics

We identified 105 consecutive internationally adopted children, including 59 girls and 46 boys, who arrived between 4 months and 12.4 years of age (mean age, 2.9 ± 2.2 years). Children who came with an unrepaired cleft lip–cleft palate were significantly younger than those who had primary repair in their native country (1.3 ± 0.9 years versus 3.3 ± 2.3 years, respectively; $p = 0.001$). Most children were adopted from China and had a unilateral complete cleft lip–cleft palate; anatomical subcategories are listed in Table 1. The male-to-female ratio was 0.7:1 for children with unilateral cleft lip and 1:1 for children with bilateral cleft lip. Six children had other congenital anomalies, including cardiac defect ($n = 3$), hemifacial microsomia ($n = 1$), binderoid cleft lip ($n = 1$), and chromosome 1 duplication/deletion ($n = 1$). There was a steady increase in the number of intercountry adopted children over the period of study until 2007, followed by a sharp decline thereafter (Fig. 1).

Repairs in the Native Country

Seventy-nine children (49 unilateral and 30 bilateral) underwent either labial repair only or labiopalatal closure in the native country. The diagnosis of a bilateral or unilateral cleft lip was not associated with whether the primary labial repair was performed in the native or adoptive country ($p = 0.8$) (Table 2). Of children who underwent repair before adoption, 54 had only labial closure, whereas 25 had both labial and palatal closure. Bilateral incomplete cleft lip was the only anatomical type that was always repaired in the native country, presumably because the procedure is relatively uncomplicated.[6] No child had palatal repair without labial repair.

Table 1. Patient Characteristics

Characteristic	No. (%)
No. of patients	105
Age at adoption, yr	
Mean ± SD	2.9 ± 2.2
Range	0.3–12.4
Male-to-female ratio	46:59 (44:56)
Country of adoption	
China	83 (79.0)
Korea	11 (9.5)
Southeast Asia	2 (1.9)
Eastern Europe	8 (7.6)
Central America	1 (0.9)
Unilateral cleft lip	66 (63)
Complete plus cleft palate	53
Complete plus cleft alveolus	6
Incomplete plus cleft palate	4
Incomplete	3
Bilateral cleft lip	39 (37)
Complete plus cleft palate	24
Complete plus cleft alveolus	3
Asymmetric plus cleft palate	8
Incomplete plus cleft palate	3
Incomplete	1

For unilateral cleft lip, the common techniques were Millard or modified Millard ($n = 30$), Tennison ($n = 15$), and Davies ($n = 2$).[7] The type of primary repair could not be determined from clinical notes or photographs for two children. Representative examples of initial repair of unilateral clefts are shown in Figure 2.

There were more variations of bilateral cleft labial repair than unilateral cleft labial repair. Most procedures followed Millard's technique; however, only one child had "banked" tines of a forked flap. The other methods, in order of frequency, are listed in Table 3.[8–11] Examples of the most common types of primary bilateral cleft lip repair are illustrated in Figure 3.

Palatal closure was performed in the native country in 27 percent of children (25 of 92); 40 percent of these children (10 of 25) required a pharyngeal flap for velopharyngeal insufficiency; two children underwent closure of palatal fistula. Patients with velopharyngeal insufficiency had an average Pittsburgh Weighted Value of 11.9.

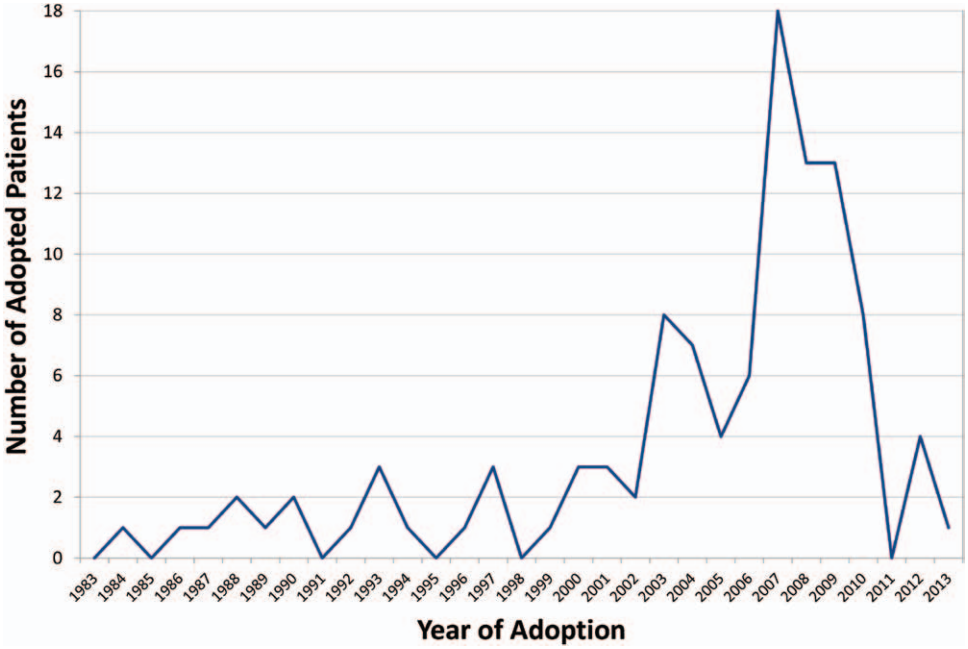

Fig. 1. Number of new internationally adopted children with cleft lip–cleft palate between 1983 and 2013.

Revision of cleft lip was common. Children with unilateral cleft lip needed nasolabial revision more often than those with bilateral cleft lip (Fig. 4). Of the 49 children who had prior unilateral labial repair, 21 were revised completely, 24 had a minor revision, and four did not require revision (Fig. 5). Minor revisions included dermal graft to the median tubercle ($n = 16$), unilimb Z-plasty at the vermilion-cutaneous junction ($n = 13$), scar excision ($n = 3$), and resection of mucosal free margin ($n = 3$).

All but one child underwent delayed primary correction of the unilateral cleft nasal deformity; these procedures included elevation and fixation of the lower lateral cartilage, V-Y plasty of the alar base, and correction of the vestibular web. Many children [16 of 49 (33 percent) required repeated nasal revisions, in particular, elevation and fixation of the lower lateral cartilage ($n = 16$), tightening of the alar base ($n = 6$), and excision of vestibular web ($n = 4$); some patients had as many as four revisions (Fig. 6).

All patients with bilateral complete cleft lip that was repaired in the native country had a secondary procedure: 30 percent (27 of 30) needed complete revision and delayed primary nasal correction, and 10 percent (three of 30) had a minor labial revision and delayed primary nasal correction (Fig. 7). Repeated nasal revisions were required in 13 percent (four of 30), which was less common than for children with the unilateral cleft nasal deformity (Fig. 8).

Table 2. Characteristics of Children with Cleft Lip Who Underwent Repair in Their Native Country

Characteristics	No. (%)
No. of patients	79
Age at adoption, yr	
Mean ± SD	3.3 ± 2.3
Range	0.7–12.4
Male-to-female ratio	33:46 (42:58)
Unilateral cleft lip	49 (62)
Complete plus cleft palate	40
Complete plus cleft alveolus	5
Incomplete plus cleft palate	1
Incomplete	3
Bilateral cleft lip	30 (38)
Complete plus cleft palate	19
Complete plus cleft alveolus	3
Asymmetric plus cleft palate	4
Incomplete plus cleft palate	3
Incomplete	1

Repairs in the Adoptive Country

Twenty-six children (13 boys and 13 girls) were adopted with unrepaired cleft lip; their characteristics are listed in Table 4. Nasolabial repair was scheduled first if the adopted child arrived in early-to-middle infancy with an incomplete or complete unilateral deformity. Dentofacial orthopedics was possible in a few younger children with bilateral complete cleft lip–cleft palate. Palatal closure took priority in those adoptees coming in late infancy or early childhood. For older patients with unilateral complete cleft lip–cleft palate or

Fig. 2. Examples of repaired unilateral cleft lip–cleft palate in adopted children. (*Above*, *left*) Straight-line (Rose-Thompson method), 3-year-old girl, before complete labial revision and nasal correction. (*Above*, *right*) Rotation-advancement (Millard method), 3-year-old girl, before complete labial revision and nasal correction. (*Below*, *left*) Triangular flap (Tennison method), 1-year-old girl. Nasal correction at 1.5 years; required repeated nasal revision at 9 years, synchronous with closure of alveolar cleft. (*Below*, *right*) Z-plasty (Davies method), 7-year-old girl. Nasolabial revision at age 9 years with closure alveolar cleft and oronasal fistula.

bilateral asymmetric cleft lip–cleft palate, nasolabial adhesion was the first priority, scheduled at the time of palatoplasty; usually, the alveolar cleft could not be closed. For older children with bilateral complete cleft lip–cleft palate, palatal closure was combined with premaxillary ostectomy, setback, and alveolar gingivoperiosteoplasty; nasolabial repair was accomplished later. The operative strategies for the various types of unrepaired cleft lip–cleft palate are summarized in Table 5. Palatal repair was scheduled before formal labial repair in 13 children. For the unilateral complete cleft lip–cleft palate ($n = 7$), palatoplasty was combined with labial adhesion to narrow the defect in preparation for nasolabial repair and to improve feeding. Dentofacial orthopedics is not possible in older children with a bilateral complete defect ($n = 6$); furthermore, it is difficult to craft a normal sized philtrum and nose over a protruding premaxilla. Premaxillary setback combined with palatal closure is a safer procedure than premaxillary setback with labial closure ($n = 3$); labial adhesion and palatoplasty leveled the operative field for synchronous bilateral nasolabial repair in patients with an asymmetrical bilateral defect.

Table 3. Techniques of Bilateral Cleft Lip Repair

Technique	No. (%)
Millard[8]	15 (50)
Cronin[9]	4 (13)
Veau III[10]	4 (13)
Veau II (Barsky)[10]	3 (10)
Manchester[11]	2 (7
Tennison	1 (3)
Triangle/rotation-advancement	1 (3)
Total	30

DISCUSSION

Parents in the United States adopt children from other countries, many of whom have cleft lip and palate. Most adoptees in this study were from China; the majority underwent labial repair (without nasal correction), and the minority had palatal closure. In our study group, there were more female than male children with unilateral cleft lip, whereas there were equal numbers of female and male children with bilateral cleft lip. The

Fig. 3. Examples of bilateral cleft lip–cleft palate repairs in the native country before adoption. (*Above*, *left*) Millard method, 3-year-old boy. Note bowed philtrum and uncorrected nasal deformity. Palatoplasty and premaxillary ostectomy/setback performed before complete nasolabial revision. (*Above*, *right*) Cronin method, 6.5-year-old boy; palatal repair also performed in the native country. Note preserved prolabial vermilion, wide upper philtrum, and nasal deformity. Complete nasolabial revision at age 7 years. (*Below*, *left*) Veau III method, 3.5-year-old girl. Note wide philtrum, strip of retrained prolabial vermilion, short columella, and broad nose. Complete nasolabial revision at age 4 years. (*Below*, *right*) Veau II (Barsky) method, 8-year-old girl. Premaxillary setback, closure of fistulas, and alveolar bone grafting at age 9 years and complete nasolabial revision at age 11 years.

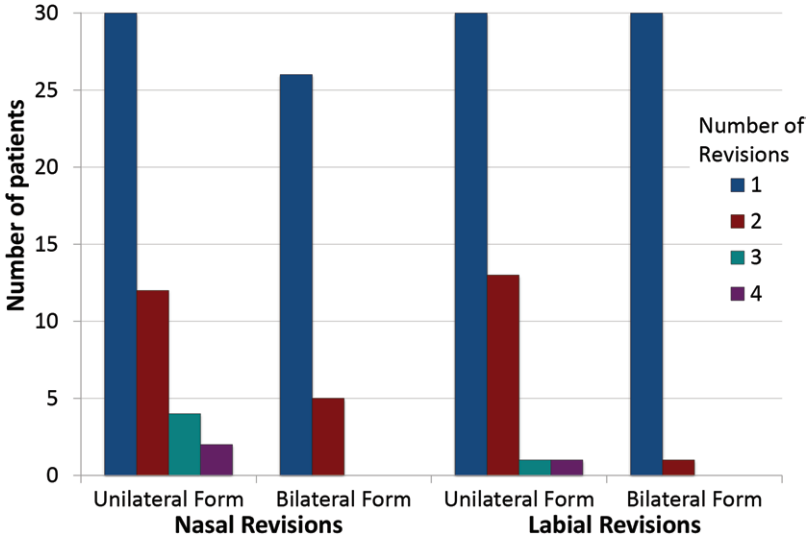

Fig. 4. Number of nasal and labial revisions in adopted children with repaired unilateral and bilateral cleft forms.

Fig. 5. Examples of revised unilateral cleft lip–cleft palate. (*Above*) Child from Figure 2, *above*, *left*, 4 years after complete nasolabial revision. Minor nasal asymmetry persists despite a second correction. (*Below*) Child from Figure 2, *above*, *right*, 2 years after complete nasolabial revision.

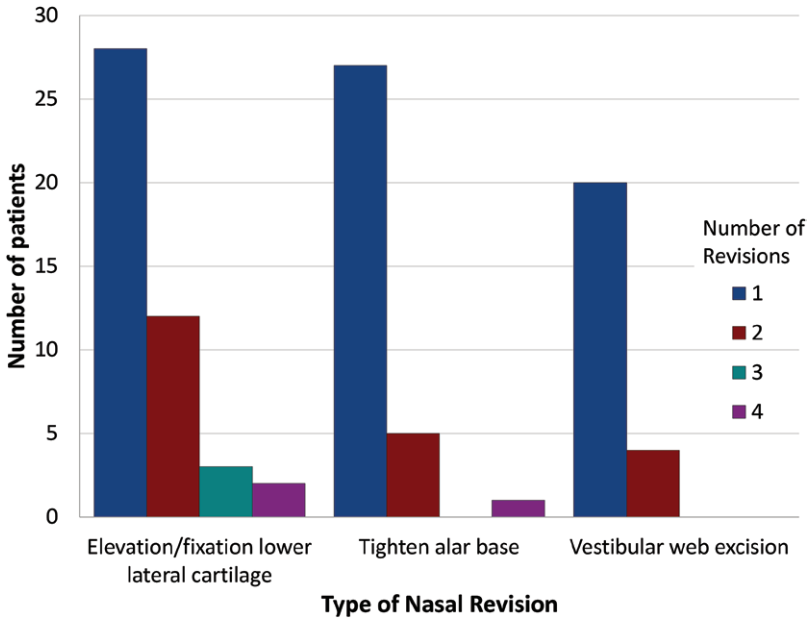

Fig. 6. Type and number of nasal revisions in adopted children with repaired unilateral cleft form.

Fig. 7. Examples of revised bilateral cleft lip–cleft palate. (*Above*) Child in Figure 3, *above*, *left*, 3 years after complete nasolabial revision with narrowed philtrum and lengthened columella. (*Below*) Child in Figure 3, *below*, *left*, 8 years after complete nasolabial revision, with narrowed philtrum and lengthened columella.

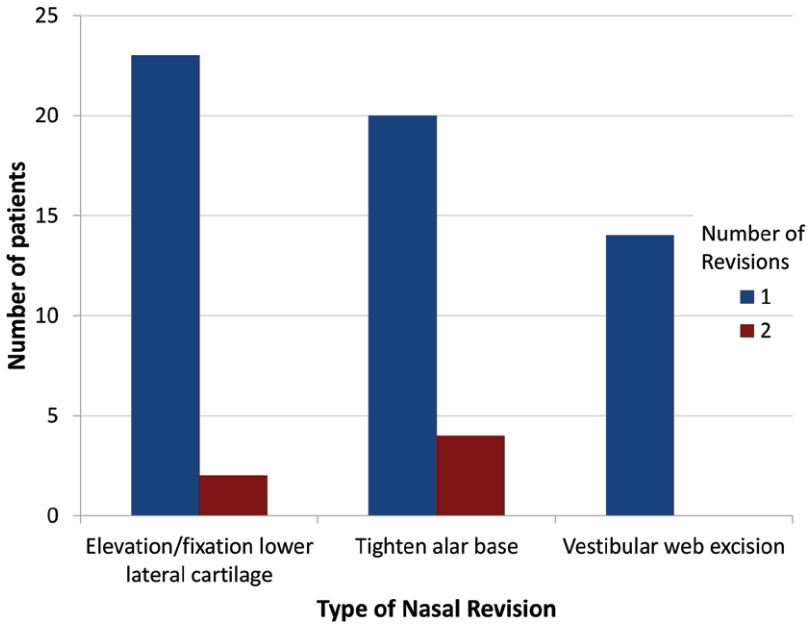

Fig. 8. Type and number of nasal revisions in adopted children with repaired bilateral cleft form.

male-to-female ratio for Asian adoptees with unilateral cleft lip (0.7:1) was less than the ratio reported from Shanghai (1.6:1), suggesting that more girls with cleft lip–cleft palate are given up for adoption than boys.[12] The 1.7:1 unilateral-to-bilateral ratio in adopted children was much higher than expected

Table 4. Characteristics of Children with Cleft Lip Who Underwent Repair in the Adoptive Country

Characteristics	No. (%)
No. of patients	26
Age at adoption, yr	
Mean ± SD	1.3 ± 0.9
Range	0.3–3.1
Male-to-female ratio	13:13 (50:50)
Unilateral cleft lip	17 (65)
Complete plus cleft palate	13
Complete plus cleft alveolus	1
Incomplete plus cleft palate	1
Incomplete	2
Bilateral cleft lip	9 (35)
Complete plus cleft palate	5
Complete plus cleft alveolus	0
Asymmetric plus cleft palate	4
Incomplete plus cleft palate	0
Incomplete	0

in North America[13], but was similar to that in demographic studies from Shanghai (2:1)[12] and the Republic of Korea (2.3:1).[14]

Influence of Adoption Laws on Influx of Adoptees from China and the Republic of Korea

Our data showed that the number of international children adopted with cleft lip–cleft palate increased until 2007, followed by a sudden decline over the past 5 years. This shift correlates with the 2007 changes in Chinese adoption laws that placed requirements on age, health, education, marital status, and income of adoptive parents.[15] Similarly, the South Korean government limited yearly quotas and added restrictions on adoptive parents.[16] Both Asian governments constricted international adoptions in an attempt to increase the number of domestic adoptions. The People's Republic of China has also altered her policy on family planning; this too has decreased the number of children available for intercountry adoption.[17] Russia recently banned intercountry adoption to the United States.[18]

Revision Rates

This study documented a high rate of nasal, labial, and palatal revisions in adopted children. For children arriving with repaired unilateral cleft lip, approximately one-half required complete labial revision, and the remainder required minor labial revision. Although these secondary labial corrections improved appearance, often they did not completely erase the stigmata of a poorly executed primary repair, especially if scarring extended beyond the primary operative incision. Triangular flap scars are difficult to alter, and even a Millard-type scar cannot be completely redressed if the advancement flap is too low or crosses the midline. For comparison, our published study using panel ratings of children who had or needed revision of repaired unilateral complete cleft lip were as follows: 21 percent minor labial revision and 74 percent minor nasal revision, either correction of alar base, lower lateral cartilage, or vestibular web.[19]

The labial revision rate was lower in bilateral cleft lip. Furthermore, secondary correction was often successful in bilateral clefts because sufficient skin and vermilion-mucosa had been preserved during the primary repair. For comparison, in a consecutive series of 50 patients with primary repair of bilateral complete cleft lip in our unit, the overall minor revision rate was 33 percent (23 percent if sulcoplasty excluded) and 12.5 percent if the secondary palate was intact. Both nasal and labial revision rates were 8 percent (interalar or interdomal narrowing) (adjustment of median tubercle or raphe); no revisions were necessary for philtral shape/width or columellar length.[20]

Neither the unilateral nor the bilateral cleft nasal deformity was addressed during labial repair in the birth country. Thus, all of the adopted children required a delayed primary nasal correction. Outcomes of these delayed nasal repairs were not as successful as would be expected following primary nasal correction in infancy, especially in the unilateral deformity. We believe this finding reflects the difficulty of repositioning, remodeling, and fixation of the deformed and relatively rigid lower lateral cartilage in an older child. The nasal revision rate in bilateral clefts was lower than in unilateral clefts because symmetry is easier to attain in this type of cleft lip, regardless of the child's age.

Table 5. Operative Strategies in the Adoptive Country for Unrepaired Cleft Lip–Cleft Palate

Cleft Lip Type	First Procedure	Average Age (yr)	Patients (n = 26)
Unilateral incomplete	Nasolabial repair	1	3
Unilateral complete	Labial adhesion	0.9	2
Unilateral complete plus cleft palate	Nasolabial repair	0.6	2
	Labial adhesion	0.5	3
	Labial adhesion plus palatal repair	2	7
Bilateral complete plus cleft palate	Dentofacial orthopedics nasolabial repair	0.7	3
	Premaxillary setback plus palatal repair	2.5	3
Bilateral asymmetric plus cleft palate	Labial adhesion plus palatal repair	2.5	3

Almost one-half of the children who underwent palatal closure in the native country exhibited velopharyngeal insufficiency; some had a palatal fistula. In a previous study of adopted children who had late palatoplasty (average age, 2 years) in the adoptive country, 49 percent required a secondary operation. Most children had a Veau type III or IV palatal cleft, with velopharyngeal insufficiency rates of 46 percent and 56 percent, respectively.[3] Alternatively, for children born in the United States with an average age at repair of younger than 1 year, we previously reported a 14.9 percent incidence of velopharyngeal insufficiency, with those with a Veau type IV cleft being most likely to have a poor speech outcome (23.8 percent), followed by those with a Veau type III cleft (17.5 percent).[21] When necessary, speech usually can be corrected secondarily by pharyngeal flap or other standard procedures.[22]

CONCLUSIONS

The number of children with cleft lip–cleft palate who are adopted from Asia appears to be diminishing. The explanation is multifactorial, and includes more restrictive laws, financial considerations, and in-country sociological and political changes. Nevertheless, regardless of how adoptive patterns continue to evolve, most newborns with cleft lip–cleft palate will undergo their initial repair in the birth country to increase chances for adoption, domestic or international. For a newborn with a severe cleft lip–cleft palate who is more likely to be given up for adoption, postponing primary repair until after arrival in the adoptive country should be considered. For such an infant, labial closure is scheduled first, preceded by dentofacial orthopedics if possible. For an older adoptee with an unrepaired cleft lip–cleft palate, the traditional sequence of labial repair before palatal closure is reversed. Palatal repair should be scheduled promptly, either in combination with labial adhesion in the unilateral complete form or with premaxillary setback and alveolar closure in a bilateral complete form. By following this agenda, children will receive interdisciplinary care, along with the many other opportunities provided in their adoptive land.

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