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PRS GLOBAL OPEN

ORIGINAL ARTICLE
Craniofacial

Appropriate Characteristics for Cleft Palate Surgery by Chief Residency in Plastic Surgery Training Programs

Chantaramon Thanapaisal, MD*
Pattama Punyavong, MD†
Kamonwan Jenwitheesuk, MD†
Palakorn Surakunprapha, MD†
Kengkart Winaikosol, MD†

Background: Cleft palate repair is a challenge for residency training programs due to the small cavity, limited access, and delicate tissue handling, which can lead to complications such as oronasal fistula (ONF) in inexperienced surgeons. Practical hands-on experience is essential for training programs.

Methods: The retrospective study included 186 patients who underwent primary palatoplasty between January 2012 and December 2021. Chief residents performed the procedures under the supervision of surgeons. The analysis aimed to determine the suitable criteria for conducting cleft palate surgery, focusing on the chief residency of a plastic surgery training program.

Results: In all cases in this series, using the 2-flap palatoplasty technique resulted in an observed postoperative ONF rate of 22.04%. The study demonstrated that a cleft width exceeding 11.5 mm increased the likelihood of ONF by 5.23 times ($P = 0.001$). Furthermore, the implementation of preoperative nasoalveolar molding and buccal fat flaps was associated with a reduced risk of ONF (odds ratios = 0.34, 0.06, $P = 0.035$, 0.006). Notably, variables such as age at surgery, sex, Veau type, and the side of the cleft palate were nonsignificant predictors of ONF following palatoplasty.

Conclusions: Procedural practice on actual patients remains vital for training competent plastic surgeons. However, we must strike a balance between the surgical benefits and postoperative risks. Appropriate case selection is crucial, as demonstrated in our study on patients with cleft palates. *(Plast Reconstr Surg Glob Open 2025;13:e6711; doi: 10.1097/GOX.0000000000006711; Published online 14 April 2025.)*

INTRODUCTION

Orofacial clefts, including cleft lip with or without cleft palate, are the most common congenital anomalies.[1] Their global prevalence is 1.47 per 1000 live births, varying by geography, ethnicity, and socioeconomic status.[1–5] The highest rates were found in Asia, with Thailand having a prevalence of approximately 2081 cases yearly. In Northeastern Thailand, the rate is 1.93 per 1000 live births.[3,4,6] The goals of cleft palate repair are reconstruction of the communication between the oral and nasal cavities and reconstruction of a functional velum to provide a functional velopharyngeal mechanism for normal speech development, and minimizing any detrimental effects on maxillofacial growth with various types of surgical techniques[7–9] and proper timing of cleft palate repair.[10,11]

Insufficient surgical techniques for cleft palate surgery can result in serious complications, such as bleeding, respiratory obstruction, infection, and impaired velar function. The most prevalent complication is the formation of oronasal fistulas (ONF), with up to 37% of patients experiencing recurrent fistulas after their initial repair.[7,9,12–20] This surgery requires precise technique due to the small and deep cavity, limited access, delicate tissue handling, and the necessity for muscle dissection under poor visualization conditions.[21–23]

Trainees in a plastic surgery program need to have the necessary knowledge and experience to perform plastic surgical procedures. Repairing a cleft palate is particularly challenging for residents due to working with delicate tissue in a baby's small oral cavity, which can lead to complications if not handled with care, such as the development of an ONF.[14] Direct practical experience is crucial in training programs for performing cleft procedures. However, supervising surgeons may be hesitant to allow trainees to perform this procedure because

*From the *Plastic and Reconstructive Unit, Department of Surgery, Khon Kaen Hospital, Khon Kaen, Thailand; and †Plastic and Reconstructive Unit, Department of Surgery, Faculty of Medicine, Khon Kaen University, Khon Kaen, Thailand.*

Received for publication July 30, 2024; accepted March 6, 2025.

DOI: 10.1097/GOX.0000000000006711

Disclosure statements are at the end of this article, following the correspondence information.

the surgeon's expertise significantly influences the likelihood of fistula development, impacting the quality of outcomes.[7,18,24–26]

Consequently, the cleft palate simulator, which provides valuable hands-on training for surgical trainees, was developed and evaluated as realistic and anatomically accurate.[22,27,28] Although the simulator allows trainees to practice surgical procedures without compromising patient outcomes, more than simulation is needed for surgical skill training to train a surgeon due to the lack of human properties, such as bleeding, tissue consistency, and sensation of dissection.[14,21–23,25–31] This study aimed to indicate the suitable characteristics for performing cleft palate surgery by a chief residency of a plastic surgery training program that allows a natural anatomical approach and tissue properties with no increasing complication.

Takeaways

Question: Which characteristics of cleft palate patients are suitable for chief residents to operate on without raising postoperative risks?

Findings: In a study of 186 patients who had palatoplasty performed by chief residents under the supervision of experienced plastic surgeons, 22.04% developed an oronasal fistula (ONF). A significant risk factor for ONF was observed in cases with a cleft width greater than 11.5 mm. Preoperative nasoalveolar molding and buccal fat flaps were protective factors against ONF.

Meaning: Appropriate case selection is crucial for plastic surgery training and patient outcomes. The recommended cleft width for palatoplasty is less than 11.5 mm.

PATIENTS AND METHODS

The institutional review board approved the study (IRB No. HE671279), which included the surgical records of cleft palate patients who underwent primary palatoplasty with the 2-flap technique by chief residents under supervising surgeons at Srinagarind Hospital between January 2012 and December 2021. Since 2015, the adjunctive buccal fat flaps have been applied in palatoplasty cases. The buccal fat pads were transferred and sutured to the alveolar margin to cover both lateral defects.[32]

The study collected data on patient characteristics and surgical variables. First, a Shapiro–Wilk test was conducted to check data normality. Continuous variables were compared using the Mann-Whitney *U* test. Categorical variables were tested using the chi-square or Fisher exact test. Bivariate analysis by logistic regression was used to measure the association of patient characteristics and surgical variables with the occurrence of ONF following palatoplasty. The Hosmer–Lemeshow test was used to determine whether the logistic regression model was a good fit for the data. Odds ratios (OR) with a 95% confidence interval were obtained. A *P* value of less than 0.05 was considered statistically significant. All analyses used Stata version 10.1 (StataCorp LLC, College Station, TX).

RESULTS

The study involved 186 patients who underwent primary palatoplasty using the 2-flap technique. The median follow-up time was 77 months (42–92 mo), with 94 female patients and a mean surgery age of 13 months. The most common cleft palate types were Veau type 3 (51.61%), followed by Veau type 2 (26.34%) and type 4 (22.04%); 73.66% of cases were associated with cleft lip, with 37.10% on the left side, 15.59% on the right, and 20.97% bilaterally. The mean cleft palate width was 12.4 mm, with preoperative nasoalveolar molding (NAM) performed in 25.27% of cases (Table 1).

In 41 cases (22.04%), patients developed an ONF after surgery without any other complications, such as flap necrosis, postoperative bleeding, wound infection, or dehiscence. The ONF was of Pittsburgh types II, III, IV, V, and VI with 4, 13, 6, 17, and 1 case(s), respectively. The median size of the ONF was 5 mm (ranging from 3 to 7 mm), and 53.66% of these cases were pathological ONF requiring additional operative treatment (Table 2).

The analysis shows that certain risk factors are statistically significant for the occurrence of ONF if the width of the cleft palate is more significant than 11.5 mm (crude OR = 5.23, $P = 0.001$; adjusted OR = 5.53, $P = 0.015$). However, preoperative NAM and palatoplasty with adjunct buccal fat flaps can be protective (crude OR = 0.34, 0.06 and $P = 0.035$, 0.006; adjusted OR = 0.25, 0.09 and $P = 0.022$, 0.024). On the other hand, other factors such as delayed age at surgery of more than 18 months, sex, Veau type, and side of cleft palate were not statistically significant in predicting the occurrence of ONF following palatoplasty (Table 3). Figure 1 demonstrates the palatoplasty cases performed by chief residents, both with and without ONF postoperatively.

Table 1. Patient Characteristics

Variable	No. (%)
No. patients	186 (100)
Sex	
Male	92 (49.46)
Female	94 (50.54)
Mean age at surgery (median, IQR), mo	13 (11–16)
Veau classification	
2	49 (26.34)
3	96 (51.61)
4	41 (22.04)
Associated with cleft lip	137 (73.66)
Side of associated cleft lip	
Right	29 (15.59)
Left	69 (37.10)
Bilateral	39 (20.97)
Using preoperative NAM	47 (25.27)
Presented dental caries at surgery	5 (2.69)
Mean width of cleft palate ± SD, mm	12.4 ± 3.2
Median follow-up time (IQR), mo	77 (42–92)

IQR, interquartile range.

Table 2. Postoperative Outcomes

Characteristics	No. (%)
Flap necrosis	0
Postoperative bleeding	0
Wound infection	0
Wound dehiscence	0
Postoperative ONF	41 (22.04)
Type of fistula (Pittsburgh classification)	
I	0
II	4 (9.76)
III	13 (31.71)
IV	6 (14.63)
V	17 (41.46)
VI	1 (2.44)
VII	0
Median size of fistula (IQR), mm	5 (3–7)
Pathological ONF	22 (53.66)

IQR, interquartile range.

DISCUSSION

Cleft palate surgery is a complicated and technically demanding procedure for surgeons because of working in a small and deep oral cavity, limited access, delicate tissue handling, and muscle dissection with limited visualization.[21–23] The occurrence of postoperative ONF varies widely, ranging from 2.4% to 60%.[7,9,12–20] A fistula undermines the objectives of palatal repair and poses challenges for a multidisciplinary team. Factors contributing to fistula formation include cleft size, cleft extension, timing of repair, surgical technique, and surgeon experience.[11,12,15–20,24,32,33] ONF after primary palatoplasty is significantly associated with the surgeon's experience. The rate is as low as 3%–10% in the hands of highly skilled surgeons, and more complications occur with inexperienced surgeons, including surgical trainees.[14,18] Therefore, surgical experience significantly influences the outcomes of a surgical procedure.[7,18,24]

Experiential learning, the process of learning through experience, is vital in training programs for cleft procedures.[25] Still, patients' caregivers and supervising surgeons are concerned about allowing inexperienced trainees to perform this procedure.[26] Accordingly, several cleft palate simulators have been established to provide valuable hands-on practice training tools for surgical trainees.[22,27]

The first cleft palate simulator was developed by Vadodaria et al[22] in 2007 to facilitate training surgeons to learn a few basic surgical skills of cleft palate repair, such as cutting and suturing in limited areas such as a 6-month-old infant's mouth. Still, the anatomy and tissue properties are not provided. In 2017, one of the most complex and anatomically accurate cleft palate simulators was developed and evaluated by Podolsky et al.[29] The simulator contains a modeled cleft of the secondary palate to perform von Langenbeck palatoplasty with detailed musculature, soft-tissue layers, and cranial base. Participants strongly agreed that the simulator is a valuable and effective training tool for residents and fellows. This study evaluated the most realistic, highly detailed, and anatomically accurate model.[29] Recently, the internet-based cleft surgery simulator was developed to address global disparities in cleft care. This simulator is more valuable than textbooks, seminars, and lectures.[28] However, the simulators' lack of tissue properties and bleeding are limitations.[26,29]

Table 3. Logistic Regression Test for Risk Factors of ONF

Factors	No ONF	ONF	Crude OR (95% Confidence Interval)	*P*	Adjusted OR (95% Confidence Interval)	*P*
No. patient	145	41				
Age at surgery				0.556		0.375
≤18 mo	118 (81.38%)	35 (85.37%)	1		1	
>18 mo	27 (18.62%)	6 (14.63%)	0.75 (0.29–1.96)		0.56 (0.16–2.01)	
Sex				0.337		0.449
Female	76 (52.41%)	18 (43.90%)	1		1	
Male	69 (47.59%)	23 (56.10%)	1.41 (0.7–2.83)		0.70 (0.28–1.76)	
Veau classification				0.132		0.763
II	42 (28.97%)	7 (17.07%)	1		1	
III + IV	103 (71.03%)	34 (82.93%)	1.98 (0.81–4.82)		0.67 (0.05–9.21)	
Side of cleft lip				0.234		0.195
Left	25 (24.27%)	4 (11.76%)	1		1	
Right	51 (49.51%)	18 (52.94%)	2.21 (0.67–7.21)		2.51 (0.69–9.09)	
Bilateral	27 (26.21%)	12 (35.29%)	2.78 (0.79–9.75)		3.65 (0.88–15.08)	
Using preoperative NAM				0.035*		0.022*
No	103 (71.03%)	36 (87.80%)	1		1	
Yes	42 (28.97%)	5 (12.20%)	0.34 (0.13–0.93)		0.25 (0.07–0.82)	
Cleft width				0.001*		0.015*
<11.5 mm	61 (42.07%)	5 (12.20%)	1		1	
≥11.5 mm	84 (57.93%)	36 (87.80%)	5.23 (1.94–14.1)		5.53 (1.4–21.84)	
Using buccal fat flap				0.006*		0.024*
No	102 (70.34%)	40 (97.56%)	1		1	
Yes	43 (29.66%)	1 (2.44%)	0.06 (0.01–0.45)		0.09 (0.01–0.73)	

*Statistical significance, Hosmer–Lemeshow χ^2 (8) = 3.73, P = 0.8810.

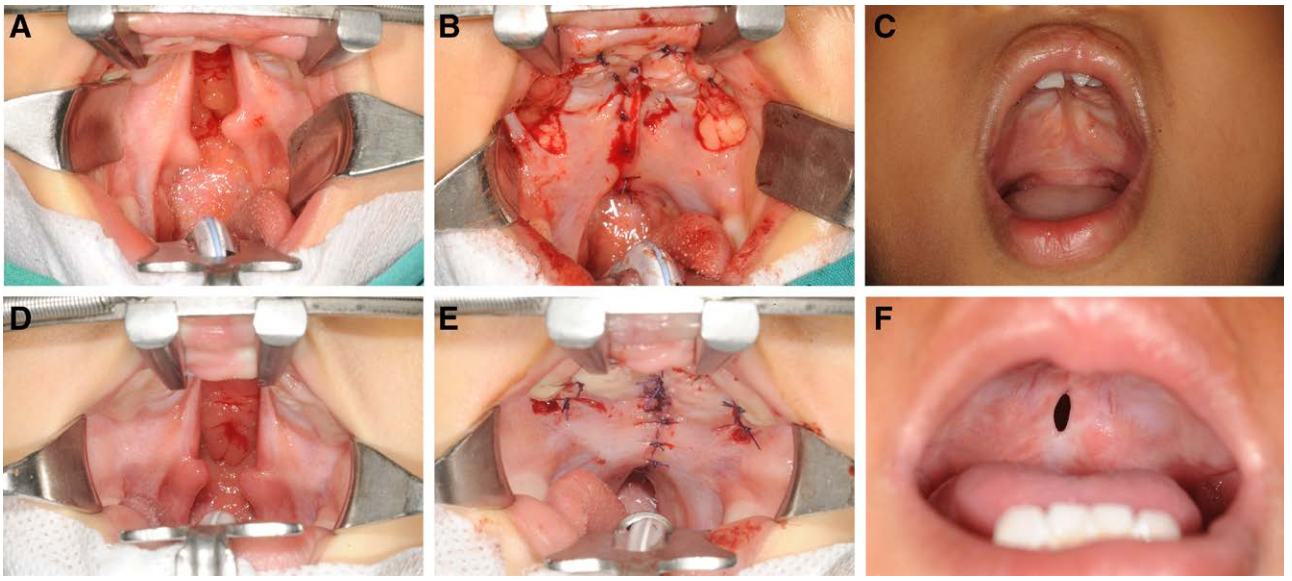

Fig. 1. An example of cleft palate repair performed by chief residency. Preoperative (A), intraoperative (B), and postoperative (C) photographs of palatoplasty with buccal fat flap cases, highlighting successful outcomes without ONF. D and E, Another palatoplasty case of the same width, which did not utilize the adjunctive buccal fat flap. F, The postoperative result revealed an ONF measuring 5 mm.

An ideal simulation model is anatomically correct, has similar natural tissue properties, and is easily manufactured and affordable. Cost-effective simulators were developed for application to teach the conceptual aspects of palatoplasty, efficiently providing accessible educational materials globally.[14,23] Despite being valuable, all simulators, including the cleft palate model, have some limitations, such as the tissue properties and anatomy and lack of human properties, such as bleeding or tissue flexibility, to provide flap creation.[14,21–23,25–31]

Training in cleft palate surgery requires gradual increases in hands-on experience. The teaching of cleft palate surgery has been done traditionally through intraoperative mentorship. Practice is performed on actual patients and provides the expertise of natural anatomy and tissue handling that is important to improve procedural knowledge, confidence, skills, and overall performance, which is essential to the training of the next generation of plastic surgeons.[27] Our study aimed to indicate the suitable characteristics for performing cleft palate surgery by the chief residency of a plastic surgery training program that balances the training program and compromises the postoperative complications, especially the ONF.

The incidence of ONF following primary cleft palate repair has varied.[7,9,12–20] This study found that 22.04% of ONFs were treated with palatoplasty by chief residents, and 53.66% required additional surgical correction. Although the ONF rate was found to average one-fifth, the prevalence of ONF has decreased yearly, especially after 2015, when the adjunctive buccal fat flap was applied in the palatoplasty procedure. A significant risk factor for postoperative ONF was a cleft palate width greater than 11.5 mm, with no other complications reported. However, the use of adjunct buccal fat flaps and preoperative NAM were found to be protective factors, as seen in previous studies.[32–34] Since 2015, we have applied the buccal fat flap during palatoplasty procedures in cases of cleft palate patients on every size of the cleft width. Forty-four patients underwent this procedure by the chief resident; only 1 case was found to have ONF. The same as when NAM was started in 2016, in the Veau type III and IV cleft palate cases, ONF was found in 5 of 47 cases. Prior studies have shown that palatal cleft width significantly decreases after lip repair, and presurgical NAM helps reduce cleft lip gap before cheiloplasty.[34,35] Consequently, presurgical NAM became integrated into the cleft care protocol to improve surgical outcomes by assisting with feeding, decreasing the palatal cleft width, forming the dental arch alignment, and minimizing tension at the surgical site due to decreased cleft width.

Based on this, cleft palate repair by chief residents or inexperienced surgeons is suitable for cases with a cleft width of less than 11.5 mm. Proper case selection for academic training is crucial for enhancing the experience and training the next generation of skilled plastic surgeons. When faced with cases of wide cleft palate, preoperative NAM and buccal fat flaps can reduce the occurrence of postoperative ONF. These techniques should be included in the training of palatoplasty procedures for young surgeons who are required to work with cleft palate patients.

Limitation

This retrospective study focused on perioperative outcomes but did not report speech outcomes after cleft palate repair. We will report the speech assessment in future research.

CONCLUSIONS

In the plastic surgery training program, the chief resident should perform the procedure on an actual patient

to obtain experience in natural anatomy and tissue handling, essential to improving procedural knowledge and skills. The appropriate characteristic of cleft palate patients for chief residents or nonexperienced surgeons is a cleft width of less than 11.5 mm. To prevent ONF, it is beneficial to use preoperative NAM and intraoperative adjunctive buccal fat flaps during palatoplasty procedures.

Kengkart Winaikosol, MD
Plastic and Reconstructive Unit, Department of Surgery
Faculty of Medicine
Khon Kaen University
123 Mittraparp Highway, Muang District
Khon Kaen 40002, Thailand
E-mail: kengkawi@kku.ac.th
Instagram: kopkap_kengkart

DISCLOSURES

The authors have no financial interest to declare in relation to the content of this article. This study was made possible by the Khon Kaen University, Thailand (grant no. TWG6613).

ACKNOWLEDGMENT

The authors thank the Khon Kaen University Center of Cleft Lip–Cleft Palate and Craniofacial Deformities, in association with the Tawanchai Project, for its support.

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