Current surgical management of recurrent cleft palate

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Table of contents

دراسة عن:
العلاجات الجراحية الحالية للشق المرتجع بسقف الحلق

مقدمة من:
الباحث الطبيب/ عماد يسرى دويدار
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Introduction

- Cleft palate is one of the most common birth defects, with a prevalence of about 1 in 2000 live births while the overall incidence of cleft palate with or without cleft lip is 1 case in 1000 live births.

- There is a female predominance of cleft palate, the ratio being approximately 3:2 females to males **(Cohen, 2000)**.

- The first recorded operation on a palate was performed in 500 AD for inflammation of the uvula.

- The etiology of the cleft palate is not well understood; however, some evidence exists that external factors may play a role; relatively few of the many recognized teratogens cause cleft palates. Alcohol consumption in the embryologic period does result in many infants with clefts; other teratogens associated with cleft palates include phenytoin, retinoids, and illegal drugs (e.g. cocaine). Mechanically induced clefts can occur inutero by means of direct impingement on the embryo.

- Recurrent cleft palate is a deformity that causes a multitude of problems and represents a special challenge to the medical community.

- The incidence of palatal fistula varies considerably in published series ranging from 0 to 34 percent **(Cohen et al., 1991)**.

- Factors contributing to the occurrence of the problem are variable and include:

- Severity of the original cleft i.e. the more extensive the original cleft the more likely palatal fistula will occur **(Musgrave and Bremner, 1960)**.
- Improper choice of operating technique at the time of primary cleft repair where proper technique will lead to less complications including fistula formation **(Lindsay 1971)**.
- Experience of the operating surgeon which inversely affects the rate of fistula formation **(Cohen et al., 1991)**.
- Use of peri-operative antibiotics has not been discussed adequately in the literature. However, it is accepted that the use of peri-operative antibiotics reduces the postoperative complications including fistula formation **(McGlelland and Patterson, 1963)**.

- Special care is needed for patients with recurrent cleft palate, Speech production; feeding, maxillofacial growth, and dentition are just a few important developmental stages that may be affected together with the psychological impact of the problem on both parents and children with recurrent cleft palate **(Bardach and Morris, 1990)**.

- Accordingly modern approach to the problem of recurrent cleft palate doesn't only involve the surgical repair but also involves the effort of a multispecialist team aiming at correction of the medical, dental, otolaryngologic, and psychological aspect of the problem **(Bardach and Morris, 1990)**.

- By surgical repair we mean the anatomical closure of the palate to restore the barrier between the oral and nasal cavities, together with the functional closure of the soft palate to restore the control of velopharyngeal sphincter.

- Surgical techniques for recurrent cleft palate repair vary widely from simple techniques such as simple fistula closure to more difficult techniques as the Facial artery musculo-mucosal flap where choice of the suitable technique mainly depends on the site and size of the fistula and of course the experience of the operating surgeon.

- Again and again recurrent cleft palate repair is not a one man show but it's a team work where multiple specialists make up the team that works together to improve the quality of life for patients with recurrent cleft palate **(Wyszynski, 2002)**.

Embryological development of the palate

This chapter is going to discuss the early embryological development of the palate and its relation to the development of cleft palate.

A- Face:

- At the end of the fourth week, facial prominences consisting primarily of neural crest-derived mesenchyme and formed mainly by the first pair of pharyngeal arches appear.

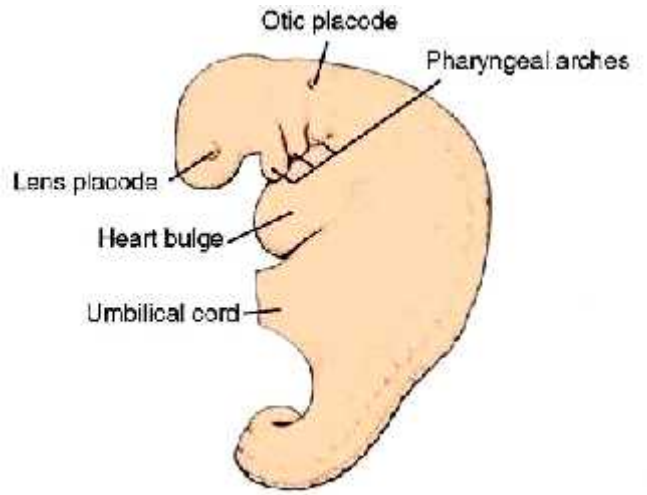

Fig.1 Lateral view of an embryo at the end of the fourth week, showing position of the pharyngeal arches **(Sadler, T. W., 2009).**

- Maxillary prominences can be distinguished lateral to the stomodeum, and mandibular prominences can be distinguished caudal to this structure.

- The frontonasal prominence, formed by proliferation of mesenchyme ventral to the brain vesicles, constitutes the upper border of the stomodeum.

- On both sides of the frontonasal prominence, local thickenings of the surface ectoderm, the nasal (olfactory) placodes, originate under inductive influence of the ventral portion of the forebrain.

- During the fifth week, the nasal placodes invaginate to form nasal pits. In so doing, they create a ridge of tissue that surrounds each pit and forms the nasal prominences.

- The prominences on the outer edge of the pits are the lateral nasal prominences; those on the inner edge are the medial nasal prominences.

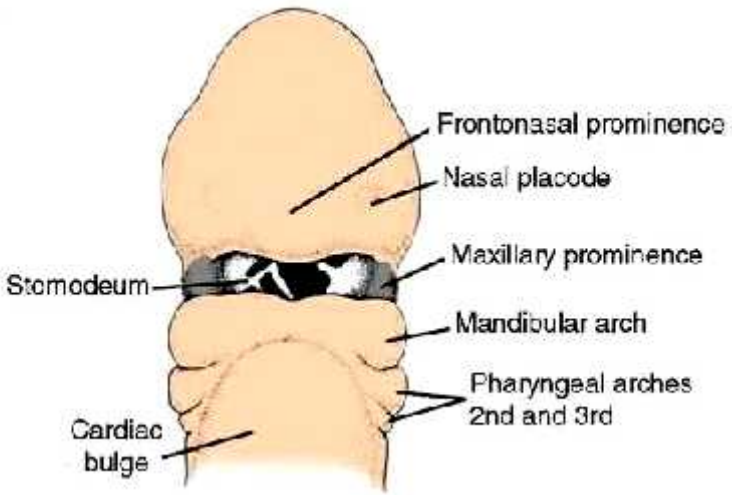

Fig.2 Frontal view of a 4.5-week embryo showing the mandibular and maxillary prominences (**Sadler, T. W., 2009).**

- During the following 2 weeks, the maxillary prominences continue to increase in size and simultaneously, they grow medially, compressing the medial nasal prominences toward the midline so that the cleft between the medial nasal prominence and the maxillary prominence is lost, and the two fuse.

- Hence, the upper lip is formed by the two medial nasal prominences and the two maxillary prominences.

- The lower lip and jaw form from the mandibular prominences that merge across the midline.

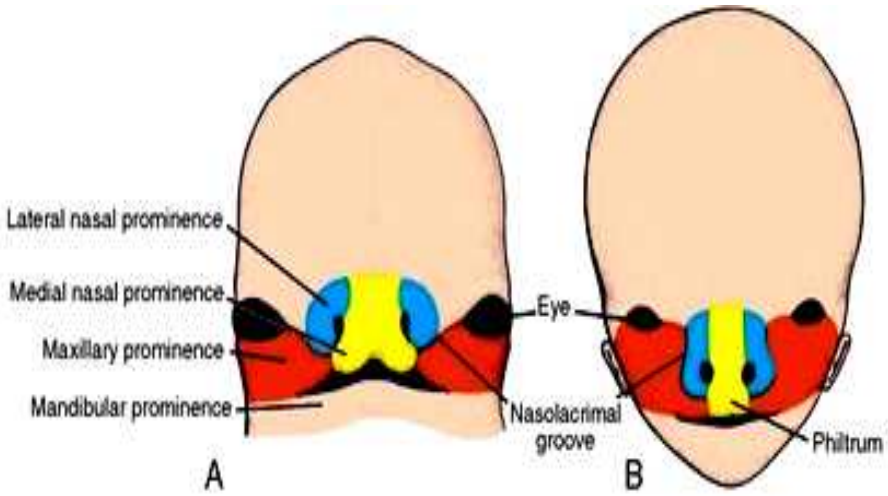

Fig.3 Frontal aspect of the face. A. 7-week embryo. Maxillary prominences have fused with the medial nasal prominences. B. 10-week embryo **(Sadler, T. W., 2009).**

- The nose is formed from five facial prominences, the frontal prominence which gives rise to the bridge; the merged medial nasal prominences which provide the crest and tip; and the lateral nasal prominences that form the sides (alae) (**Sadler, T. W., 2009).**

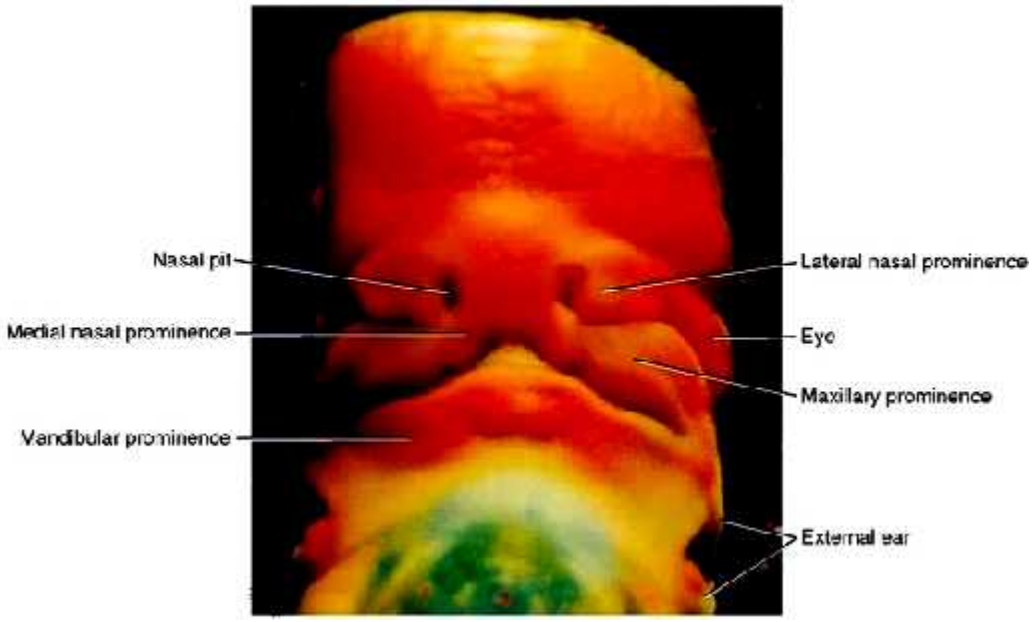

Fig.4 Photograph of a 7 weeks human embryo **(Sadler, T. W., 2009).**

PROMINENCE	STRUCTURES FORMED
FRONTONASAL	Forehead, bridge of nose, and medial and lateral nasal prominences
MAXILLARY	Cheeks, lateral portion of upper lip
MEDIAL NASAL	Philtrum of upper lip, crest, and tip of nose
LATERAL NASAL	Alae of nose
MANDIBULAR	Lower lip
The frontonasal prominence is a single unpaired structure; the other prominences are paired.	

Tab.1 Structures contributing to formation of the face **(Sadler, T. W., 2009).**

B- Intermaxillary segment:

- As a result of medial growth of the maxillary prominences, the two medial nasal prominences merge not only at the surface but also at a deeper level and the structure formed by the two merged prominences is the intermaxillary segment.

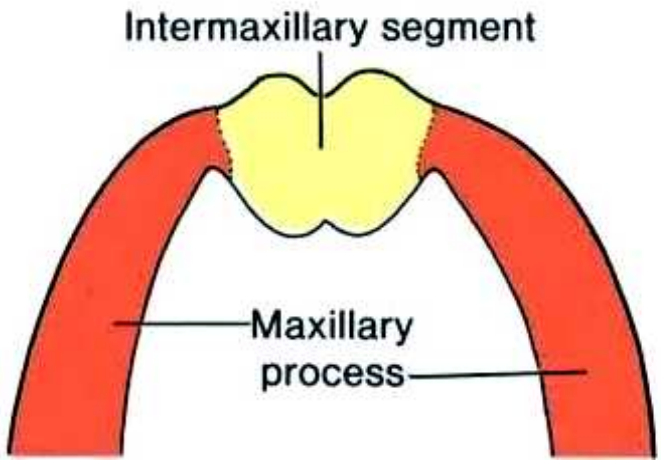

Fig.5 The maxillary processes and the intermaxillary segment **(Sadler, T. W., 2009).**

- The intermaxillary segment is composed of:

  1- A labial component, which forms the philtrum of the upper lip.

  2- An upper jaw component, which carries the four incisor teeth.

  3- A palatal component, which forms the triangular primary palate.

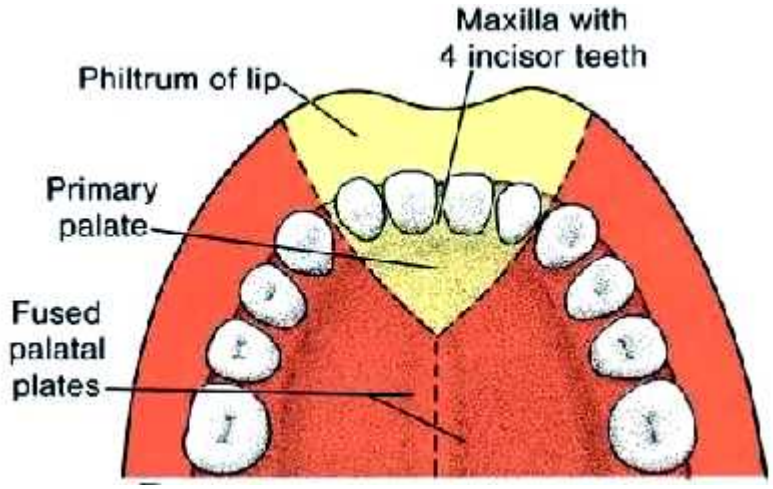

Fig.6 The intermaxillary segment giving rise to the philtrum of the upper lip, the median part of the maxillary bone with its four incisor teeth, and the triangular primary palate **(Sadler, T. W., 2009).**

- The intermaxillary segment is continuous with the rostral portion of the nasal septum, which is formed by the frontal prominence (**Sadler, T. W., 2009).**
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C- Secondary palate:

- Although the primary palate is derived from the intermaxillary segment, the main part of the definitive palate is formed by two shelf-like outgrowths from the maxillary prominences.

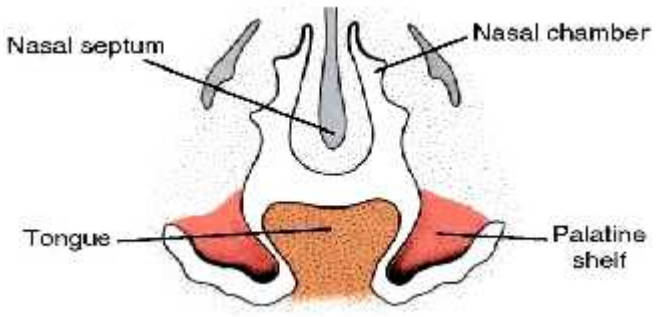

Fig.7 Frontal section through the head of a 6.5-week embryo where the palatine shelves are in the vertical position on each side of the tongue **(Sadler, T. W., 2009).**

- These outgrowths, the palatine shelves, appear in the sixth week of development and are directed obliquely downward on each side of the tongue.

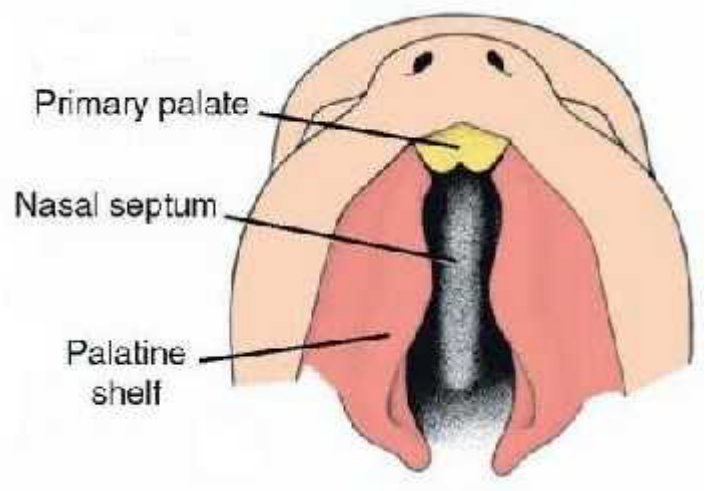

Fig.8 Ventral view of the palatine shelves after removal of the lower jaw and the tongue. Note the clefts between the primary triangular palate and the palatine shelves, which are still vertical **(Sadler, T. W., 2009).**

- In the seventh week, the palatine shelves ascend to attain a horizontal position above the tongue and fuse, forming the secondary palate.

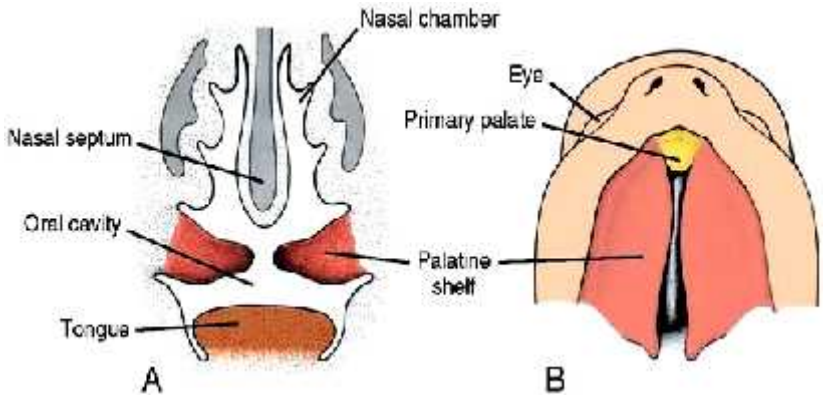

Fig.9 a. Frontal section through the head of a 7.5-week embryo**, b**. Ventral view of the palatine shelves after removal of the lower jaw and tongue. (The tongue has moved downward, and the palatine shelves have reached a horizontal position) **(Sadler, T. W., 2009).**

- Anteriorly, the shelves fuse with the triangular primary palate, and the incisive foramen is the midline landmark between the primary and secondary palates.

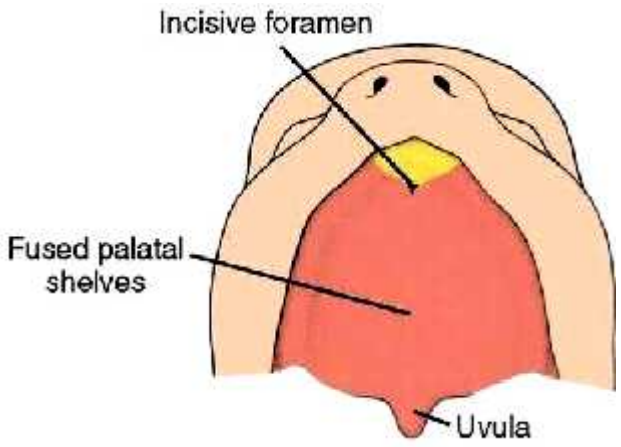

Fig.10 Ventral view of the palate of a10-week embryo where the incisive foramen forms the midline between the primary and secondary palate**(Sadler, T. W., 2009).**

- At the same time as the palatine shelves fuse, the nasal septum grows down and joins with the cephalic aspect of the newly formed palate (**Sadler, T. W., 2009).**

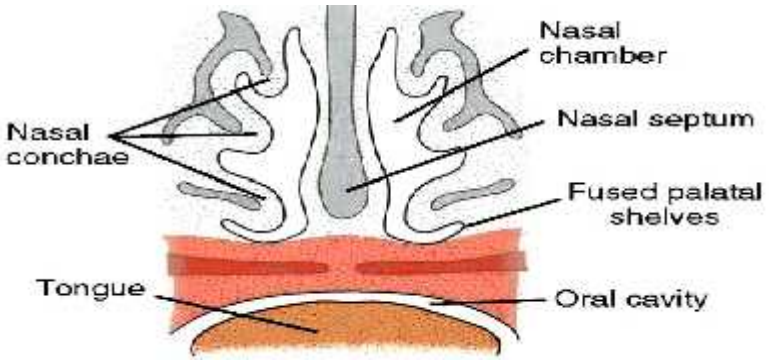

Fig.11 Frontal section through the head of a 10-week embryo. The two palatine shelves have fused with each other and with the nasal septum **(Sadler, T. W., 2009)**