

CT 1

: CT
 : 27 14 99
 CT . CT
 , ,
 : 가
 3 , ,
 , 6
 , 가
 .
 가 , 13
 . 27 , 18
 , 3 , 6 2
 가 V Y
 가 66% (65/99) ,
 가 34% (34/99) .
 : CT
 CT .

(ossifica -
 tion)가
 (midline cleft)
 , 2 가
 가
 (1, 2).
 CT 15 99
 (meningoencephalocele) (nasal der -
 moid) . 99 가 54 , 가 45
 27 14 . CT HiSpeed Advantage (GE
 Medical Systems, Milwaukee, Wis, U.S.A.)
 (high spatial frequency algorithm)
 (3 - 8), 3 mm
 . 2 - 3 mm bone
 (CT) window setting(window width; 2000 - 2500, window level;
 0 - 450)
 (cribriform
 plate), , (vomer)

CT

가 V Y

(nasoethmoidal
junction) - (sphenothmoidal recess) (correlation analysis)

3 ANOVA test $p < 0.05$

(globe - optic nerve junction)

CT

(no ossification), (partial ossi -
fication), (complete ossification) 3 CT Table

가

가 2 2

20.0 mm 22.0 mm 3 - 5 ±

27.8 ± 1.7 mm (, 26.0 - 30.0 mm), 6 - 8

29.0 ± 1.4 mm (, 28.0 mm 30.0 mm), 9 - 11

28.5 ± 4.3 mm (, 21.0 - 36.0 mm), 12 - 17 31.6 ±

3.8 mm (, 26.0 - 36.0 mm), 18 - 23 32.0 ± 4.6

mm (, 27.0 - 36.0 mm), 2 - 5 37.0 ± 4.9 mm (,

26.0 - 48.0 mm), 6 37.8 ± 5.0 mm (

, 24.0 - 46.0 mm)

($r = 0.512$, $p < 0.001$)가

($F = 8.31$,

$= 7.91$, $p < 0.001$).

3 가

(Fig. 1)

3

가 3 2 (27 1)

가

Table 1. Development of Anterior Skull Base and Nasal Septum

Age (No. of Subjects)	Anteroposterior Length of Anterior Skull base mean ± SD in mm	No. of Subjects														
		Cribriform Plate									Perpendicular Plate			Crista Galli		
		Anterior			Middle			Posterior			NO	PO	CO	NO	PO	CO
		NO	PO	CO	NO	PO	CO	NO	PO	CO						
0 - 2 m (2)	21.1 ± 1.4	2	0	0	2	0	0	2	0	0	2	0	0	0	2	0
3 - 5 m (4)	27.8 ± 1.7	2	2	0	0	2	2	2	2	0	4	0	0	1	1	2
6 - 8 m (2)	29.0 ± 1.4	0	1	1	0	1	1	0	1	1	2	0	0	0	1	1
9 - 11 m (10)	28.5 ± 4.3	0	9	1	0	1	9	0	6	4	6	4	0	0	1	9
12 - 17 m (11)	31.6 ± 3.8	0	5	6	0	0	11	0	5	6	4	4	3	0	0	11
18 - 23 m (3)	32.0 ± 4.6	0	2	1	0	0	3	0	2	1	0	3	0	0	0	3
2 - 5 y (29)	37.0 ± 4.9	0	2	27	0	0	29	0	1	28	0	7	22	0	0	29
6 - 14 y (38)	37.8 ± 5.0	0	0	38	0	0	38	0	0	38	0	1	37	0	0	38

NO ; no ossification

PO ; partial ossification

CO ; complete ossification

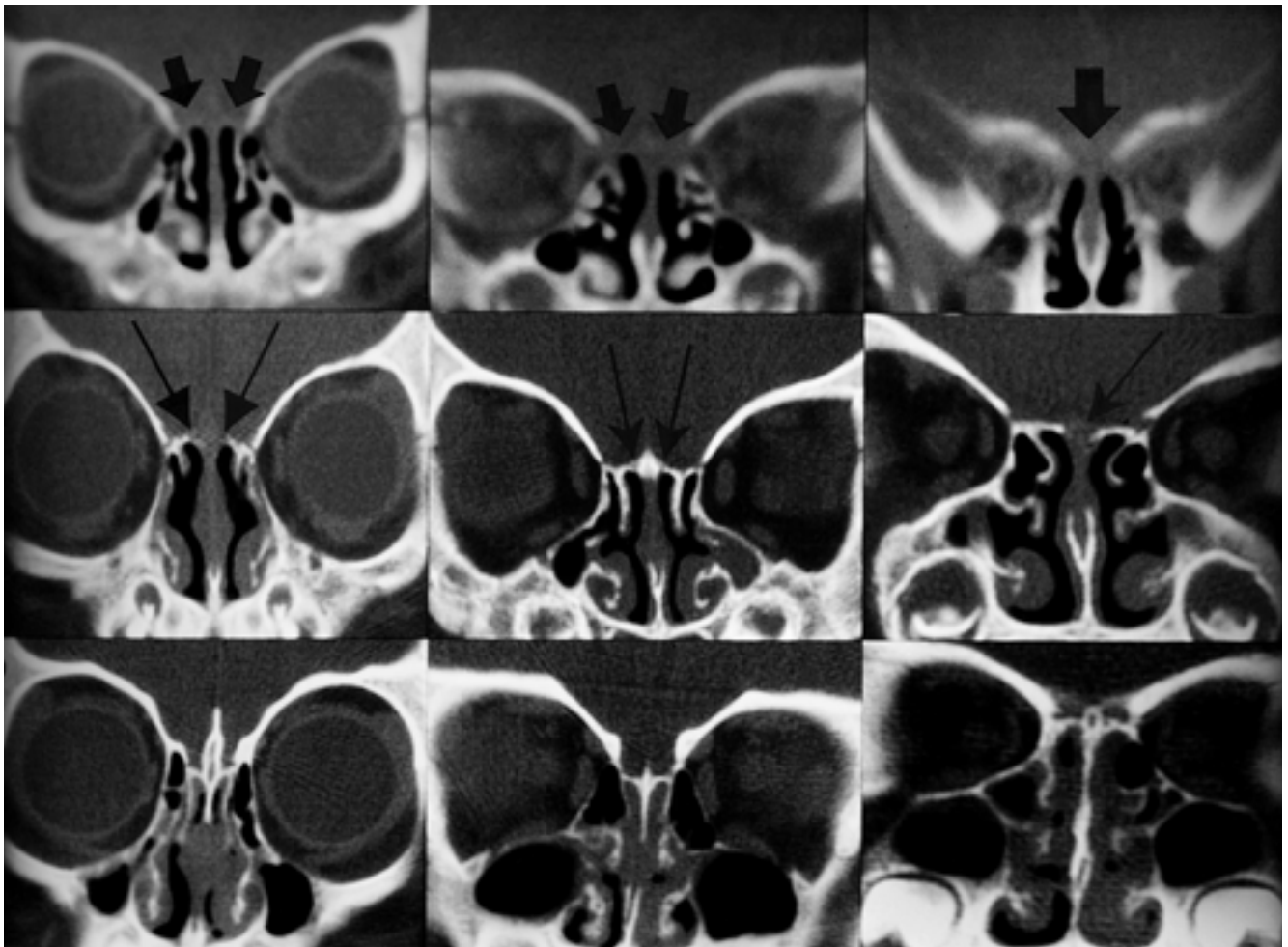


Fig. 1. Postnatal development of the cribriform plate.

Top row. CT scans of a 27-day-old boy show no ossification of the anterior (left), middle (center), and posterior (right) segments of the cribriform plate (arrows).

Middle row. CT scans of a 4-month-old girl show partial ossification in the anterior (left), middle (center), and posterior (right) segments of the cribriform plate. Note small gaps in ossification between the variously ossified crista galli and ethmoid bone (arrows).

Bottom row. CT scans of a 26-month-old boy show complete ossification in the anterior (left), middle (center), and posterior (right) segments of the cribriform plate.

, 3-5 4 99% (66/67)

. 6

가

가

5 4 2, 6-8 2 1, 3- (Fig. 2)

9-11 10 9 1 9 8

67% (12/18) 가 1, 9 가 9-11

가 10 4 (40%) 6

6 가

, 1 11% (2/18), 1 2, 18

50% (7/14), 2 97% (65/67)

8 9% (3/32), 2-5 76% (22/29), 6

가, 1 28% (5/18), 1 97% (37/38)

2 50% (7/14), 2

CT

(Fig. 3)

27

3

6 1 (17%)

3 (50%)

2 (33%)

12 2 (17%)

10 (83%)

가

가, 6-11

가

가 66% (65/99)

가 (34/99)

가 34%

가

가 12

가

chondral ossification)

(endo -

(4, 9). 1

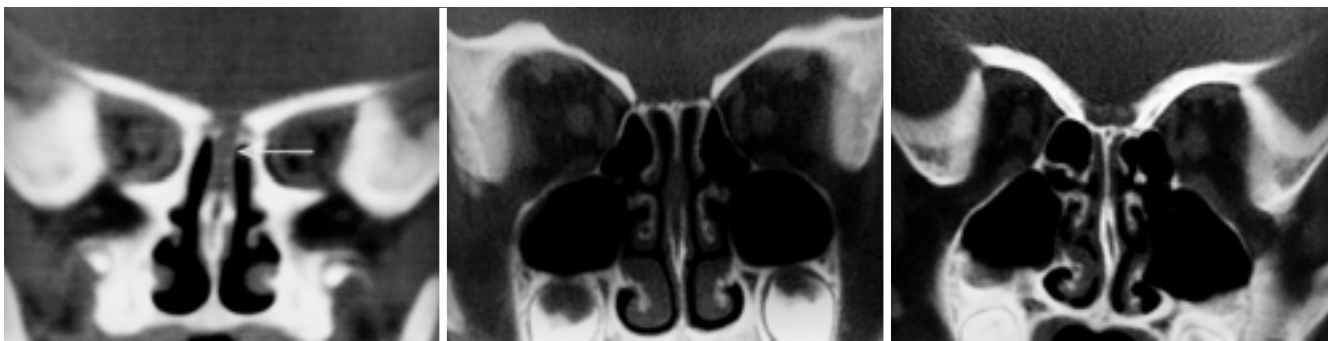


Fig. 2. Ossification of the perpendicular plate.
A. CT scan of a 4-month-old girl demonstrates no ossification of the perpendicular plate (arrow).
B. CT scan of a 32-month-old girl demonstrates partial ossification of the perpendicular plate.
C. CT scan of a 22-month-old boy demonstrates complete ossification of the perpendicular plate with no gap between it and the vomer.

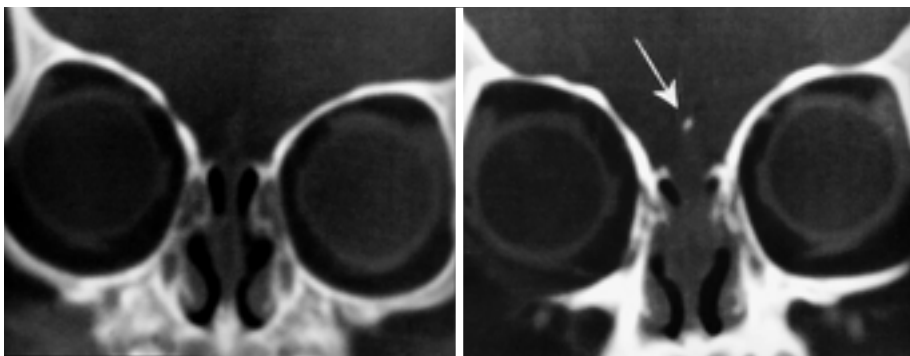
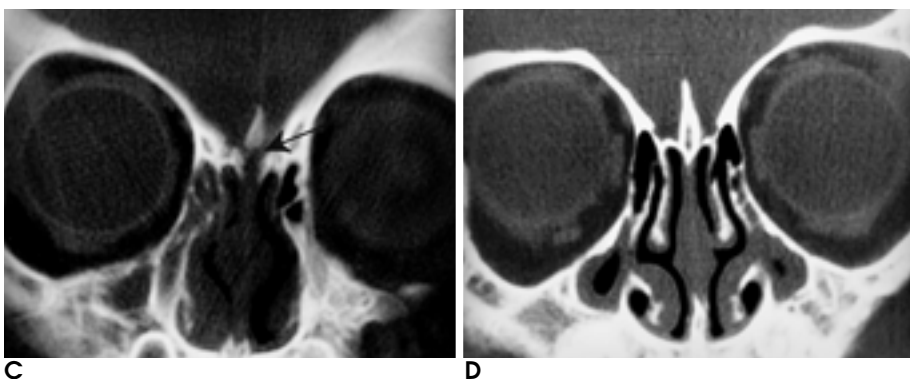


Fig. 3. Ossification of the crista galli.
A. CT scan of a 4-month-old boy shows no ossification of the crista galli.
B, C. CT scans of an 8-month-old boy (**B**) and a 17-month-old girl (**C**) show partial ossification of the crista galli (arrows), forming a hollow cap.
D. CT scan of a 32-month-old girl shows complete ossification of the crista galli.



(notocord) (primitive streak) (prechordal plate) 5A) (1, 2, 9).
 5 - 6
 (mesenchymal condensations)가 (1, 10).
 (desmocranium)가
 (chondrification) 2
 (parachordal cartilage), (hypophyseal cartilage), (suture) (synchondrosis)
 3 가 가 (4 - 8, 10),
 (basiocciput), (basisphenoid), 가
 (presphenoid) 가 (4, 8, 9). 가
 (Fig. 5B) (1, 2, 11). 가
 (Fig. 가

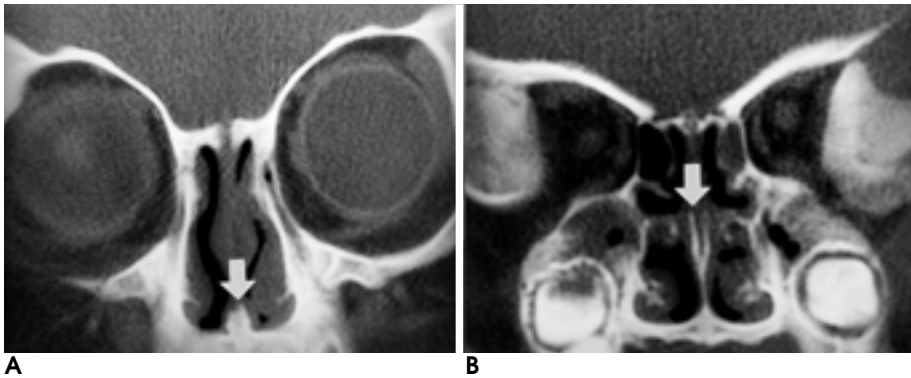


Fig. 4. Ossification pattern of the vomer.

A, B. CT scans of a 3-month-old girl demonstrate the superior aspect of the vomer, appearing as an undivided single lump anteriorly (**A**) and a Y posteriorly (**B**) (arrows).

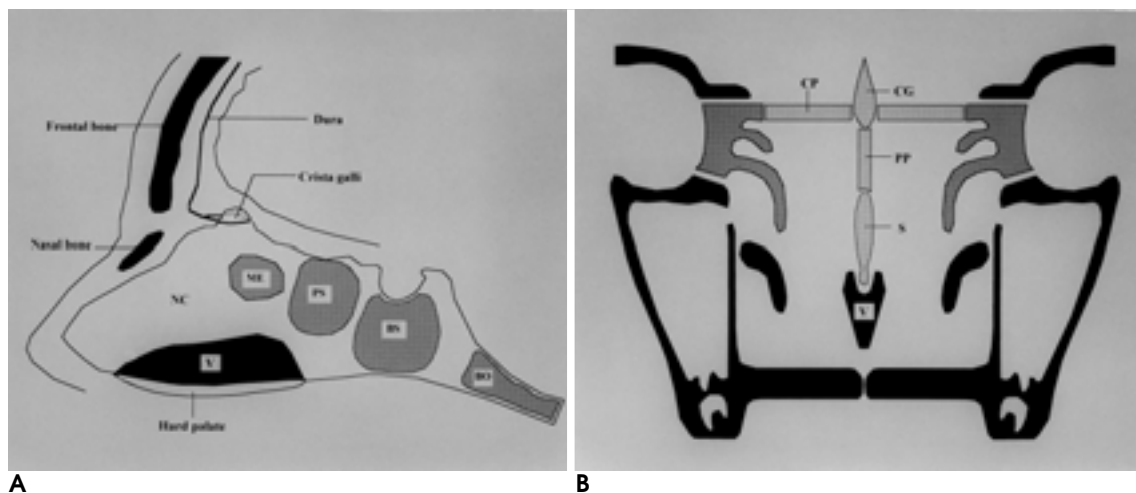


Fig. 5. Diagrams of development of the skull base and nasal septum.

A. Diagram of the ossification centers of the central skull base and nasal septum. The central skull base is formed by the basioccipital (BO), basisphenoidal (BS), and presphenoidal (PS) ossification centers. In front of the presphenoidal ossification centers lies the mesethmoidal (ME) ossification center, from which the perpendicular plate and the crista galli develop. The ethmoidal labyrinths and the cribriform plate are derived from the cartilaginous nasal capsule (NC). V = vomer.

B. Diagram of the developing anterior skull base and nasal septum. At birth, the entire midline structures of the anterior skull base and nasal septum (dotted areas) may be a lucent stripe of cartilage situated between the ossified lateral masses of the ethmoids (crosshatched areas) and the vomer (V). CG = crista galli, CP = cribriform plate, PP = perpendicular plate, S = nasal septal cartilage.

CT

(1, 2, 9, 11, 12).

가 , 14 가 가

24

Ford(9) 6 Naidich (2) 5

(n=11) 20.8 mm , 7 - 24 (n=8) , 2 가

24.5 mm , 2 가 (nasal septal diamond)

. Belden (1) 24 가 32%, 6

CT 6 (n=18) 92%, 13 100%

21.2 mm, 7 - 24 (n=43) 26.2 mm Ford Naidich (2) ,

9

가 13 , 18

, 6 (n=7) 25.9 mm (, 3.6

mm) 7 - 24 (n=25) 30.4 mm (,

4.2 mm) , 2 - 5 (, 37.0 mm) 6 ((22/29), 2 9% (3/32), 2 - 5 76%

37.8 mm) , 2 97% (37/38)

가 . 2 , Belden (1)

CT 가 -

2

Scott (12) 3 - 5 , van Loosen CT 가

(11) 2 - 6 가 , Ford . Naidich (2)

(9) 2 (1) 가 가 , 15% 2 가

가 . Naidich (2) , 30%

2 - 8 8 Y

, Belden (1) 2 가 Belden (1) 1 - 2

2 84% 가 가 14 가

Ford 3 , 6 가 24 가 2

, , Belden Naidich (2) 가 27

(1) Naidich (2) . Belden (1) , 3

가 - 6

33% (2/6), 6 - 11 83% (10/12),

1 12 100% (81/81)

67% (12/18), 1 100% (81/81)

1

11% (2/18) 28% (5/18), 1 2 가 . Naidich

50% (7/14) , 2 (2) 80% V Y ,

97% (65/67) 99% (66/67) 21% 가

Ford(9) V Y , 8%

, Belden (1) CT

가 V Y 가 66% (65/99)

34% (34/99)

Belden (1) 가 V Y

Naidich (2)

Belden (1) 2

, CT
(1,
11, 13). , (choanal atresia)
CT (13).
CT
가
,
가
2 가 ,
가 .
가 가
,
(multi - slice) CT
가 .
,
CT CT
가 .

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Postnatal Development of the Anterior Skull Base and Nasal Septum: CT Study¹

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Purpose: To know the normal CT appearance of the anterior skull base and nasal septum after birth.

Materials and Methods: Coronal CT scans with a helical mode were performed from the nasal bone to the sphenoid sinus in 99 children whose ages ranged from 27 days to 14 years. We investigated the CT appearance of the developing anterior skull base and nasal septum with particular attention to the anteroposterior length of the anterior skull base and the ossification patterns of the cribriform plate, perpendicular plate, crista galli, and vomer.

Results: The anteroposterior length of the anterior skull base statistically significantly increased with age. The cribriform plate showed partial or complete ossification in at least one segment at more than 3 months of age and in all three segments at more than 6 months of age. Ossification of the cribriform plate occurred earlier in the middle segment than in the anterior and posterior segments. It began exclusively in the region of the lateral mass of the ethmoid and proceeded medially toward the crista galli. Partial ossification of the perpendicular plate was noted as early as 9 months of age, and complete ossification as early as 13 months of age. All children at 18 months and older showed at least partial ossification of the perpendicular plate. Partial ossification of the crista galli was noted as early as 27 days of age, and complete ossification as early as 3 months of age. CT showed complete ossification of the crista galli in all but two children at 6 months and older. The superior aspect of the vomer exhibited a V- or Y-shape on all CT scans in 66%(65/99) of children at any age. It appeared as an undivided single lump anteriorly and a V or Y posteriorly in 34%(34/99).

Conclusion: Knowledge of the normal developing patterns of ossification of the anterior skull base and nasal septum could help prevent errors in interpreting CT scans in this region, especially in infants and young children.

Index words : Skull, CT

Skull, growth and development

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