Skull Deformity: Radiographic Diagnosis of "Sticky Suture" in Occipital Plagiocephaly

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“Back-to-Sleep”

Since 1992 when the AAP suggested supine sleep position, the incidence of Occipital Plagiocephaly has dramatically risen.
Occipital Plagiocephaly: OC

OC may result from either:

- Non-synostotic occipital plagiocephaly (NSOP)
  - positional molding
  - deformational plagiocephaly
- Lambdoid craniosynostosis (LC)
  - posterior synostotic plagiocephaly
Occipital Plagiocephaly: Diagnosis

- Historically controversial
- LC thought to be unique: characteristic radiographic findings not necessary for diagnosis
- Lambdoid suture described as functionally fused or “sticky-suture”
Occipital Plagiocephaly

- Recent clinical criteria for diagnosis NSOP and LC have been delineated
- However radiographic differentiation is obscure
Clinically NSOP presents with a parallelogram shaped vertex cranial morphology and a symmetric mastoid skull base.

As seen in this clinical case, with an abnormal, however patent and non-fused lambdoid suture.
Clinically LC presents with a trapezoid shaped vertex cranial morphology with ipsilateral mastoid skull base bossing.

As illustrated in this clinical case of right sided LC.
Aim of the study

- To characterize changes of lambdoid suture in NSOP
- To establish radiographic criteria for NSOP
- To compare affected sutures in NSOP and LC
Methods

• CT scans children clinically diagnosed with NSOP and LC were evaluated by both Neuroradiologist and Craniofacial Surgeon to compare:
  – lambdoid suture
  – cranial morphology
  – ear position
  – endocranial base angles
• Statistical analysis was performed
Methods

• CT scans of 26 children with NSOP
  – 18 male, 8 female
  – 12 right side, 8 left side, 6 bilateral
• 7 children diagnosed with LC
  – 5 male, 2 female
  – 4 left side, 3 right side
• 32 sutures of NSOP and 7 sutures LC were compared
Sutures of NSOP evaluated for

- focal fusion
- endocranial heaping/ridging
- narrowing
- perisutural thinning
- sclerosis
- change in orientation: overlapping to end-to-end and were

Compared to sutures of LC (p values)
NSOP
Focal-Skip Fusion:
25%  (p=0.308)
NSOP sutures demonstrated areas of skip fusion 25% of the time.

NSOP
Endocranial Heaping:
78%  (p=0.313)
Ectocranial Heaping:
0%  (p=<0.001)
No ectocranial heaping was noted in NSOP.
NSOP Suture Narrowing: 

63% (p=0.008)

NSOP sutures demonstrated sutural narrowing in 63% of cases.

NSOP Sclerosis:

16% (p=0.319)

Sutural sclerosis was noted in 16% cases.
NSOP Change in Suture Orientation:

63%  (p=0.001)

Sutures of NSOP demonstrated a change in suture orientation from overlapping to end-to-end morphology.
**Suture Morphology: LC**

- Near complete obliteration: 100% (p=<0.001)
- Endocranial heaping: 100% (p=0.313)
- Ectocranial heaping: 100% (p=0.001)

**Cranial Morphology: LC**

- Ipsilateral occipital flattening: 100%
- Compensatory ipsilateral mastoid bossing: 100% (p=<0.001)
- Contralateral parietal bossing: 100% (p=0.003)
- Trapezoid vertex morphology
Cranial Morphology: NSOP
- Ipsilateral occipital flattening in all cases: 100%
- Ipsilateral frontal bossing: 85% (p=0.012)
- Contralateral occipital bossing: 95% (p=0.003)

Suture Morphology: NSOP
- Comparing affected to contra-lateral non-affected “control” suture
- Significant difference (p<0.05):
  - overlapping
  - endocranial ridging/heaping
  - perisutural bone thinning
NSOP Perisutural Thinning: 78% (p=0.313)

Subarachnoid Spacing: 47%

Ipsilateral increase in subarachnoid spacing was noted in 47% of NSOP and in no cases of OP.
Midline Cranial Base Deviation Angle

- Significant difference was found
- LC: Angles were greater and represented a larger deviation from mid sagittal cranial base axis
  - average 10.3° (range 0-15°)
- NSOP
  - average 4.1° (range 0-9°)
- p=0.02

Petrus Ridge Angle

- Significant difference between affected and non affected side also between the affected sides in NSOP and LC
- NSOP
  - affected: av. 121.8° (range 117-127°)
  - non-affected: av. 125.8° (range 117-134°)
  - p=0.0016
- LC
  - affected: av. 115.7° (range 112-120°)
  - non-affected: av. 132° (range 128-140°)
  - p=0.0156
- NSOP vs. LC
  - p=0.0039
Ear Position

- **Vertex view**
- **LC**
  - anterior 14%
  - symmetric 86%
- **NSOP**
  - anterior 85%
  - symmetric 15%
Conclusions

- Cranial sutures
  - Open - infants
  - Closed - adults
  - Obliterated - craniosynostosis (not prematurely fused)
  - Deformed or “sticky” - non-synostotic plagiocephaly
Conclusion: Radiographic Diagnosis

- Changes in lamboid suture previously considered to be LC:
  - endocranial heaping
  - focal fusions
  - sutural narrowing
  - perisutural thinning
  - Sclerosis

- LC not unique among craniosynostosis:
  - suture obliteration
  - compensatory bossing