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Scalp Epidermal Inclusion Cysts in Neonates: A Case Series of Five Patients

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Abstract

Background

Epidermal inclusion cysts in neonates are rare congenital cystic lesions typically located on the scalp, resulting from sequestration of ectodermal tissue during embryogenesis. Presenting as painless, subcutaneous masses, they are benign but require careful diagnosis to distinguish from other scalp swellings.

Methods

This retrospective case series includes 5 neonates aged ≤28 days with histopathologically confirmed epidermal inclusion cysts of the scalp at Dr. Vithalrao Vikhe Patil Foundation's Medical College & Hospital, Ahmednagar from January 2023 to December 2024. Data on demographics, clinical features, prenatal/birth history, imaging, and histopathology were analyzed.

Results

All 5 neonates presented with painless, mobile, well-circumscribed scalp masses noted at birth or within the first three weeks. Ultrasound demonstrated well-defined cystic lesions with no internal vascularity or bony pathology. Histopathology confirmed epidermal inclusion cysts with stratified squamous epithelium and keratinous contents, without dermal appendages.

Conclusions

Neonatal scalp epidermal inclusion cysts, while rare, have classic clinical and imaging features. Early recognition aids diagnosis and avoids unnecessary intervention. Histopathology remains confirmatory.

Keywords: epidermal inclusion cyst, neonates, scalp, congenital, case series

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Introduction

Epidermal inclusion cysts, also known as epidermoid cysts, are benign cystic lesions lined by stratified squamous epithelium and filled with keratin debris 1 . While commonly encountered in adults, these lesions are extremely rare in the neonatal population, with only scattered case reports documented in the medical literature 2 . When they do occur in neonates, they most commonly present on the scalp, particularly in midline locations 3 .

1.1 Pathophysiology and Development

The pathogenesis of neonatal scalp epidermal inclusion cysts is believed to result from sequestration of ectodermal tissue during embryonic development, specifically during neural tube closure between the third and fifth weeks of gestation 4 . This developmental mechanism explains the predominant midline scalp location of these lesions, commonly

occurring over the anterior fontanelle or in the occipital region 5 .

The cyst wall consists of mature stratified squamous epithelium identical to the epidermis, with a well-defined granular layer. As epithelial cells desquamate, they accumulate within the cyst cavity as laminated keratin material, leading to gradual enlargement of the lesion 6 . Unlike dermoid cysts, epidermal inclusion cysts do not contain hair follicles, sebaceous glands, or other dermal appendages, which is an important histological distinguishing feature 7 .

1.2 Epidemiology and Clinical Significance

The exact incidence of neonatal scalp epidermal inclusion cysts is unknown due to their extreme rarity. Most epidermoid cysts typically present in adults, with a peak incidence in the second to fourth decades of life 8 . When they occur in neonates, there appears to be a slight female predominance, although this observation is based on limited case reports 9 .

The clinical significance of these lesions lies primarily in their potential for misdiagnosis as more serious conditions, particularly neural tube defects such as encephaloceles or meningoceles 10 . Accurate differentiation is crucial as incorrect diagnosis may lead to unnecessary anxiety for families, inappropriate management decisions, or potentially harmful interventions 11 .

1.3 Literature Review

A comprehensive review of the literature reveals fewer than 50 documented cases of neonatal scalp epidermal inclusion cysts worldwide 12 . Most reports consist of single case presentations, making this case series one of the larger reported experiences with this rare condition. Previous studies have emphasized the importance of ultrasonography in diagnosis, with characteristic features including well-circumscribed, hypoechoic masses with posterior acoustic enhancement and absence of internal vascularity 13 .

Histopathological confirmation remains the gold standard for diagnosis, with consistent findings of stratified squamous epithelium lining and keratin debris content 14 . The absence of dermal appendages is crucial for differentiating these lesions from dermoid cysts, which have a similar clinical presentation but different histological characteristics 15 .

1.4 Study Rationale and Objectives

Given the extreme rarity of neonatal scalp epidermal inclusion cysts and the limited available literature, this case series aims to contribute valuable clinical data to enhance understanding of these lesions. The primary objectives of this study are to:

1. Describe the clinical presentation and characteristics of neonatal scalp epidermal inclusion cysts
2. Evaluate the diagnostic utility of imaging studies in confirming the diagnosis
3. Document histopathological findings and confirm diagnostic criteria
4. Provide guidance for clinical decision-making in similar cases
5. Contribute to the existing literature on this rare condition

Methods

Study Design and Setting

This retrospective descriptive case series was conducted at Dr. Vithalrao Vikhe Patil Foundation's Medical College & Hospital, Ahmednagar, a tertiary care teaching hospital with a dedicated neonatal intensive care unit and pediatric surgery department. The study was designed to identify and analyze all cases of histopathologically confirmed neonatal scalp epidermal inclusion cysts treated at our institution over a defined period.

2.1 Study Period and Case Identification

The study encompassed a 2-year period from January 2023 to December 2024. Cases were identified through multiple sources:

Electronic medical record database searches using ICD 10 codes for epidermoid cysts L72.0, D23.4

Pathology department database review for neonatal scalp lesions Pediatric surgery department case logs

Cross-referencing with neonatal intensive care unit discharge diagnoses

2.2 Inclusion and Exclusion Criteria

Inclusion Criteria:

1. Age ≤28 days at initial presentation (neonatal period) Clinical diagnosis of scalp mass or cystic lesion

Volume 8, Issue 5; September-October 2025; Page No 212-219

2. Histopathologically confirmed epidermal inclusion cyst Complete medical records available for review
3. Adequate imaging studies performed

Exclusion Criteria:

1. Age 28 days at presentation
2. Scalp masses of other histological types (dermoid cysts, lipomas, etc.) Incomplete medical records or insufficient clinical data
3. Cases without histopathological confirmation
4. Patients with multiple congenital anomalies that could confound interpretation

Data Collection Methodology

A standardized data collection form was developed to ensure systematic and comprehensive data extraction. The following categories of information were collected:

Demographic and Perinatal Data:

1. Gender and gestational age at birth Birth weight and mode of delivery
2. Maternal age and relevant medical history
3. Family history of similar lesions or congenital anomalies Prenatal ultrasound findings

Clinical Presentation:

1. Age at presentation and initial recognition of the lesion Presenting symptoms and parental concerns
2. Physical examination findings including lesion characteristics Associated symptoms or neurological findings
3. Growth pattern of the lesion over time

Diagnostic Evaluation:

1. Imaging studies performed (ultrasound, MRI, CT Laboratory investigations when indicated
2. Differential diagnoses considered
3. Diagnostic challenges encountered

Histopathological Analysis:

1. Gross and microscopic examination findings
2. Specific histological features and architecture Presence or absence of dermal appendages
3. Any associated inflammatory changes or complications

2.4 Imaging Protocols

1. All patients underwent standardized imaging evaluation: Primary Imaging - Ultrasound:
2. High-frequency linear transducers 10 15 MHz) using GE Logiq P9 ultrasound system Assessment of cyst dimensions and characteristics
3. Evaluation of echo pattern and internal architecture Doppler studies to assess vascularity
4. Examination of relationship to underlying calvarium

Secondary Imaging (when indicated):

MRI performed for diagnostic uncertainty or suspected intracranial extension using 1.5T Siemens Magnetom Aera

CT scan reserved for cases with suspected bony involvement

2.5 Histopathological Examination

All surgical specimens underwent comprehensive evaluation by experienced pediatric pathologists using standardized protocols:

Gross examination with detailed morphological description Routine hematoxylin and eosin staining

Assessment of cyst wall architecture and epithelial characteristics Evaluation of cyst contents and any inflammatory changes Confirmation of absence of dermal appendages

2.6 Data Analysis

Given the descriptive nature of this case series, statistical analysis was primarily descriptive. Continuous variables were expressed as means ± standard deviation or medians with ranges, as appropriate. Categorical variables were expressed as frequencies and percentages. Statistical analysis was performed using SPSS version 26.0

IBM Corp., Armonk, NY, USA .

Results

Case No.		Gestational Age (weeks)	Age at Presentation (days)	Birth Weight (grams)	Mode of Delivery

Volume 8, Issue 5; September-October 2025; Page No 212-219

	Sex				
1	Female	38	10	2900	Vaginal
2	Male	39	14	3200	Cesarean
3	Female	37	7	2800	Vaginal
4	Female	40	21	3300	Vaginal
5	Male	38	12	2950	Cesarean

Case Numbers and Patient Characteristics

A total of five neonates with scalp epidermal inclusion cysts were identified at Dr. Vithalrao Vikhe Patil Foundation's Medical College & Hospital, Ahmednagar between January 2023 and December 2024. All patients were younger than 28 days at presentation and were confirmed by histopathological examination.

The cohort included 3 females 60%) and 2 males 40% , with a mean gestational age of 38.4 1.1 weeks (range: 37 40 weeks). Mean birth weight was 3030 205 grams (range: 2800 3300 grams). The mean age at presentation was 12.8 5.4 days (range: 7 21 days).

Clinical Presentation

All cases presented with painless, well-circumscribed, subcutaneous scalp masses noted at birth or in the first three weeks of life. Lesions were dome-shaped, mobile, with normal overlying skin and no signs of inflammation or neurological deficits.

Case No.	Location Scalp Region)	Size at Presentation (cm)	Consistency	Skin Overlying Lesion	Other Features
1	Anterior fontanelle	1.5 1.3	Soft, rubbery	Normal	Freely mobile
2	Right parietal region	1.2 1.0	Soft, cystic	Normal	Non-tender, fluctuant

Case No.	Location Scalp Region)	Size at Presentation (cm)	Consistency	Skin Overlying Lesion	Other Features
3	Occipital region	2.0 x 1.8	Firm	Normal	Well-demarcated, mobile
4	Left parietal region	1.8 1.5	Soft	Normal	No tenderness, no erythema

Volume 8, Issue 5; September-October 2025; Page No 212-219

5	Left temporal region	1.0 x 0.8	Soft, rubbery	Normal	No discoloration

The mean lesion size was 1.5 0.4 cm in maximum diameter (range: 1.0 2.0 cm). All lesions were located in the scalp region, with distribution as follows: anterior fontanelle 20% , parietal regions 40% , occipital region 20% , and temporal region 20% .

4.1 Individual Case Summaries

Case 1 A 10-day-old female neonate born at 38 weeks gestation to a 26-year-old primigravida mother presented with a gradually enlarging soft mass over the anterior fontanelle region, noted since birth. The lesion was cystic on palpation, freely mobile, with normal overlying skin. Ultrasound demonstrated a well-defined anechoic cystic lesion measuring 1.5 1.3 cm with posterior acoustic enhancement and no underlying bone involvement or intracranial extension.

Case 2 A 14-day-old male neonate born at 39 weeks gestation to a 28-year-old multigravida mother via cesarean section for previous cesarean presented with a painless, fluctuant mass at the right parietal scalp region. The lesion was mobile and non-tender. High-resolution ultrasound confirmed a unilocular cystic lesion measuring

1.2 1.0 cm, completely avascular on color Doppler studies, with no intracranial extension.

Case 3 A 7-day-old female neonate born at 37 weeks gestation to a 24-year-old primigravida mother had a firm occipital scalp nodule present since birth. Physical examination revealed a dome-shaped, well-circumscribed lesion measuring 2.0 x 1.8 cm with normal overlying skin and no neurological deficits. Imaging demonstrated a cystic lesion with thick walls and no underlying bony defect.

Case 4 A 21-day-old female neonate born at 40 weeks gestation to a 30-year-old multigravida mother presented with a 1.8 1.5 cm soft mass in the left parietal region. The lesion was asymptomatic with normal overlying skin and no neurological signs. Ultrasound showed a homogeneous hypoechoic lesion with clear margins and no internal vascularity on Doppler examination.

Case 5 A 12-day-old male neonate born at 38 weeks gestation to a 25-year-old primigravida mother via cesarean section for breech presentation presented with a small, soft, mobile cystic swelling measuring 1.0 x 0.8 cm over the left temporal scalp. No signs of inflammation, skin discoloration, or associated neurological abnormalities were noted.

4.2 Prenatal and Birth History

All mothers experienced uncomplicated pregnancies, except for Case 4 where the mother had mild gestational hypertension managed with antihypertensive medication and close monitoring. No scalp masses or abnormalities were detected on routine prenatal ultrasonography performed at 18 20 weeks and 32 34 weeks gestation in any case. Two neonates Cases 2 and 5) were delivered by cesarean section for obstetric indications (previous cesarean section and breech presentation, respectively), while three were delivered vaginally without complications.

4.3 Imaging Findings

Ultrasound Evaluation:

Ultrasound imaging was performed in all cases using high-frequency linear transducers 10 15 MHz) on a GE Logiq P9 system, revealing consistent findings:

Well-circumscribed, anechoic to hypoechoic cystic masses in all cases 100% Posterior acoustic enhancement in 4 cases 80%

Absence of internal vascularity on color and power Doppler studies in all cases 100% Intact underlying calvarium with no bony defects in all cases 100%

No evidence of intracranial extension or communication in any case 100%

4.4 Histopathological Confirmation

All five cases underwent histopathological examination following surgical excision performed between days 15 28 of life. Consistent findings were observed across all specimens:

Gross Examination:

Well-encapsulated cystic lesions with smooth, glistening external surfaces

Volume 8, Issue 5; September-October 2025; Page No 212-219

Cyst contents consisting of white to off-white, pasty, keratinous material with characteristic "cottage cheese" appearance

Absence of hair, teeth, cartilage, or other dermal structures Mean cyst wall thickness: 2.1 0.4 mm

Microscopic Examination:

Cyst wall lined by mature stratified squamous epithelium with intact granular layer 100% Presence of abundant laminated keratin debris within the cyst lumen 100%

Complete absence of dermal appendages including hair follicles, sebaceous glands, and sweat glands 100%

Mild chronic inflammatory infiltrate in the surrounding fibrous tissue 80%

No evidence of dysplasia, atypia, or malignant transformation in any case 100%

These histopathological findings confirmed the diagnosis of epidermal inclusion cyst in all cases and definitively differentiated them from dermoid cysts, which would contain dermal appendages.

4.5 Clinical Significance

The benign nature of these lesions was confirmed in all cases through comprehensive histopathological evaluation. No cases demonstrated evidence of malignant potential, rapid growth, or association with other congenital anomalies. All lesions were successfully managed with complete surgical excision, and histopathological examination provided definitive diagnosis while ruling out other cystic lesions of the scalp.

4.6 Diagnostic Approach

A standardized diagnostic approach was consistently applied across all cases:

Comprehensive clinical evaluation and detailed physical examination by experienced pediatricians

High-resolution ultrasound imaging as the primary diagnostic modality

Systematic consideration of differential diagnoses including encephalocele, dermoid cyst, subgaleal hematoma, and other scalp masses

Multidisciplinary consultation involving neonatology, pediatric surgery, and radiology

Complete surgical excision for definitive diagnosis and treatment

Comprehensive histopathological examination with immunohistochemical studies when indicated

Discussion

Clinical Significance of Findings

This case series represents one of the larger reported experiences with neonatal scalp epidermal inclusion cysts, contributing valuable clinical data to the limited literature on this rare condition. Our findings confirm that these lesions, while uncommon in neonates, present with characteristic clinical and imaging features that allow for accurate diagnosis and successful management when appropriate clinical expertise is available.

The uniformly benign nature of these lesions in our series supports the existing literature suggesting that epidermal inclusion cysts in neonates have an excellent prognosis with appropriate management 16 . The absence of any cases with malignant transformation is consistent with the extremely low reported incidence of malignant degeneration in pediatric populations, which is estimated to be less than 0.1% 17 .

Comparison with Existing Literature

Our demographic findings align with previous case reports, including the slight female predominance 60% vs 40% male) and typical presentation within the first three weeks of life 19 . The clinical presentation as painless, mobile, well-circumscribed masses matches descriptions in earlier publications from both Western and Indian literature 20 .

The imaging characteristics observed in our series are consistent with those described by Bansal et al. for pediatric superficial masses, where ultrasound features of well-circumscribed, hypoechoic masses with posterior acoustic enhancement provide reliable diagnostic criteria 21 . Our experience with 100% diagnostic accuracy using ultrasound alone supports its role as the primary imaging modality for these lesions.

Diagnostic Considerations

The primary diagnostic challenge in neonatal scalp epidermal inclusion cysts lies in differentiating them from more serious conditions, particularly neural tube

Volume 8, Issue 5; September-October 2025; Page No 212-219

defects such as encephaloceles 22 . Our experience confirms that careful clinical evaluation combined with high-resolution ultrasound imaging can reliably establish the correct diagnosis in all cases.

Key Diagnostic Features Identified in Our Series:

Clinical: Mobile, well-circumscribed, non-pulsatile mass with normal overlying skin and absence of neurological deficits

Imaging: Complete absence of calvarial defect and intracranial connection on ultrasound examination

Growth pattern: Gradual, non-rapid enlargement over time without acute changes

Management Approach and Outcomes

Our management approach of complete surgical excision proved successful in all cases, with histopathological confirmation providing definitive diagnosis. The decision for early surgical intervention in the neonatal period was based on several factors specific to our patient population:

High levels of parental anxiety about scalp masses in newborns Need for definitive diagnosis to rule out serious conditions

Prevention of potential complications from accidental trauma during handling Achievement of optimal cosmetic outcomes with early intervention

Cultural preferences for definitive treatment rather than prolonged observation

Limitations of the Study

Several limitations should be acknowledged in interpreting these results:

Small sample size: Despite representing one of the larger series, the overall number remains limited due to the extreme rarity of the condition

Single institution experience: Results may not be generalizable to other healthcare settings or populations with different demographics

Retrospective design: Potential for incomplete data collection and selection bias inherent in retrospective studies

Short follow-up period: Long-term outcomes and very late complications could not be assessed

Conclusions

This case series demonstrates that neonatal scalp epidermal inclusion cysts, while extremely rare, can be accurately diagnosed and successfully managed through systematic clinical evaluation and appropriate imaging. The key findings from our experience at Dr. Vithalrao Vikhe Patil Foundation's Medical College & Hospital include:

Clinical Recognition: These lesions consistently present as characteristic painless, mobile, well-circumscribed scalp masses in the first weeks of life, allowing for clinical suspicion based on physical examination alone.

Diagnostic Reliability: High-resolution ultrasound imaging provides excellent diagnostic accuracy and can reliably differentiate these benign lesions from serious conditions such as neural tube defects, eliminating the need for more expensive or invasive diagnostic procedures.

Management Success: Complete surgical excision provides definitive diagnosis through histopathological confirmation and achieves excellent clinical outcomes with minimal morbidity when performed by experienced pediatric surgeons.

Benign Prognosis: All cases in our series demonstrated completely benign histology with no evidence of malignant potential, supporting the excellent long-term prognosis of these lesions.

Clinical Take-Home Messages:

Neonatal scalp epidermal inclusion cysts are rare but well-recognized benign entities that can be confidently diagnosed through clinical examination and ultrasound imaging

Early clinical recognition combined with appropriate imaging evaluation allows for accurate diagnosis while avoiding unnecessary anxiety and interventions

Complete surgical excision provides excellent outcomes with minimal morbidity and definitive histopathological confirmation

These lesions have an uniformly excellent prognosis with appropriate management, allowing for confident reassurance of families

This series contributes important clinical data to the limited literature on this rare neonatal condition and provides practical guidance for clinicians

Volume 8, Issue 5; September-October 2025; Page No 212-219

encountering similar cases in both resource-rich and resource-limited healthcare settings.

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Volume 8, Issue 5; September-October 2025; Page No 212-219