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Congenital epulis of the newborn: A comprehensive narrative review of epidemiology, prenatal imaging, histopathology, management, and outcomes

Luigi Angelo Vaira [a,*], Jerome R. Lechien [b,c], Antonino Maniaci [d], Giannicola Iannella [e], Carlos M. Chiesa-Estomba [f], Giuseppe Consorti [g,h], Giulio Cirignaco [g], Stefania Perrotta [i], Carlos Navarro-Cuéllar [j], Paolo Boscolo-Rizzo [k], Giovanni Salzano [l], Pasquale Piombino [m], Giacomo De Riu [a]

[a] Maxillofacial Surgery Operative Unit, Department of Medicine, Surgery and Pharmacy, University of Sassari, Sassari, Italy
[b] Department of Surgery, Mons School of Medicine, UMONS. Research Institute for Health Sciences and Technology, University of Mons (UMons), Mons, Belgium
[c] Department of Otolaryngology-Head Neck Surgery, Elsan Polyclinic of Poitiers, Poitiers, France
[d] Department of Medicine and Surgery, University of Enna Kore, Enna, Italy
[e] Department of 'Organi di Senso,' University "Sapienza," Italy
[f] Department of Otorhinolaryngology-Head & Neck Surgery, Hospital Universitario Donostia, San Sebastian, Spain
[g] Division of Maxillofacial Surgery, Department of Neurological Sciences, Marche University Hospitals—Umberto I, Ancona, Italy
[h] Department of Biomedical Sciences and Public Health, Polytechnic University of Marche, Ancona, Italy
[i] Department of Neurosciences, Reproductive Sciences and Oral Sciences, Division of Orthodontics, University of Naples "Federico II", Naples, Italy
[j] Maxillofacial Surgery Department. Hospital Gregorio Marañon, Universidad Complutense de Madrid, Madrid, Spain
[k] Department of Medical, Surgical and Health Sciences, Section of Otolaryngology, University of Trieste, Trieste, Italy
[l] Maxillofacial Surgery Unit, Department of Neurosciences, Reproductive Sciences and Oral Sciences, University of Naples "Federico II", Naples, Italy
[m] Maxillofacial Surgery Unit, Caserta Hospital "Sant'Anna e San Sebastiano", Caserta, Italy

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ABSTRACT

Topic: This comprehensive narrative review summarizes the available evidence regarding neonates with congenital epulis, the epidemiologic profile, prenatal imaging findings, histopathologic features, management strategies (surgical excision versus observation), and clinical outcomes.
Clinical relevance: Congenital epulis is a rare benign gingival tumor of the newborn that can impair feeding and, occasionally, breathing. Because evidence is scattered across isolated case reports, clinicians lack clear guidance for counselling and perinatal management.
Methods: A comprehensive literature search of MEDLINE, Embase, Scopus, and Web of Science was conducted from database inception to the final search date. Published case reports and case series involving neonates with congenital epulis were reviewed. Data regarding epidemiology, prenatal imaging, histopathology, management strategies, and outcomes were extracted and synthesized descriptively.
Results: One hundred twenty-four publications reporting 147 neonates were included. Most infants were female and had a solitary mass arising from the anterior maxillary alveolar ridge. Prenatal detection occurred in a minority of pregnancies. Early neonatal surgical excision was the predominant management, under general or local anesthesia, with minimal perioperative morbidity. No recurrences or malignant transformations were documented. Spontaneous regression was described only in a few small, conservatively managed lesions.
Conclusion: Evidence, restricted to retrospective case reports, consistently indicates an excellent prognosis for congenital epulis. Simple early excision appears safe and curative for most lesions, whereas careful observation may be reasonable for selected small tumors. Further prospective, standardized reporting is needed to refine prenatal counselling and postnatal management.

* Corresponding author. Xillofacial surgery operative unit, Viale San Pietro 43B, Italy.
E-mail address: lavaira@uniss.it (L.A. Vaira).

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1. Introduction

Congenital epulis, also termed congenital gingival granular cell tumor, Neumann's tumor or gingival granular cell tumor of the newborn, is a rare benign soft-tissue lesion that arises almost exclusively on the alveolar mucosa of neonates [1–5]. Since its original description in the 19th century, the condition has been documented mainly in isolated case reports and small case series across pediatric, surgical, dental and radiological journals [1–5].

Clinically, congenital epulis typically presents at birth as a pedunculated or sessile, smooth or lobulated mass protruding from the alveolar ridge, most often in the anterior maxilla but also in the mandible; less frequently, multiple lesions may occur [1–7]. The lesion is usually flesh-pink to reddish in color, firm or elastic in consistency, and its size ranges from a few millimeters to several centimeters [1–7]. A striking female predominance has been consistently reported, and most affected infants are otherwise healthy, term or near-term newborns [2–4,6,7].

From a functional standpoint, congenital epulis is clinically relevant because of its potential to interfere with feeding and, in larger lesions, with airway patency. Reported problems include difficulty with sucking, inability to close the mouth, aerophagia and, in some cases, respiratory compromise in the immediate neonatal period [3,4,6–8]. In pregnancies with bulky intraoral tumors, polyhydramnios has occasionally been described, presumably due to impaired fetal swallowing [8–11].

Histopathologically, congenital epulis is composed of sheets and nests of large polygonal cells with abundant granular eosinophilic cytoplasm and small, uniform nuclei, covered by stratified squamous epithelium [1–4,6,7,12,13]. Immunohistochemical studies generally show negativity for S-100 protein and other Schwann cell markers, distinguishing this lesion from the more common adult granular cell tumour and supporting its recognition as a separate clinicopathological entity [1–4,12,13]. Despite its sometimes-alarming clinical appearance, the biological behavior is benign: malignant transformation and metastasis have not been reported, recurrence after excision appears exceptional, and spontaneous regression of small lesions has been documented in some infants [3,4,7,14].

Advances in prenatal imaging have extended the diagnostic window for congenital epulis beyond the postnatal examination. In addition to conventional postnatal diagnosis, several authors have reported antenatal detection by two-dimensional ultrasound, color Doppler, three-dimensional ultrasound and fetal MRI, usually in the late second or third trimester [8–11,15]. These modalities can help delineate the origin and extent of the mass, narrow the differential diagnosis with other fetal oral and facial tumors, and assist in planning perinatal management, including the mode of delivery and the need for specialized airway strategies [8–11,15].

Although this body of literature has provided important insights, most publications focus on individual cases or small series, and a comprehensive synthesis of neonatal congenital epulis remains limited. Therefore, we conducted a comprehensive review of the published literature to summarize the epidemiologic characteristics, prenatal diagnostic findings, histopathological features, management strategies, and clinical outcomes of congenital epulis in neonates.

2. Materials and methods

2.1. Search strategy

A comprehensive literature search was conducted in MEDLINE (PubMed), Embase, Scopus and Web of Science from database inception to the date of the final search. The search combined controlled vocabulary and free-text terms related to congenital epulis and neonatal gingival granular cell tumors, including the descriptors “congenital epulis”, “congenital gingival granular cell tumor”, “gingival granular cell tumor of the newborn”, “Neumann's tumor”, “congenital granular cell lesion” and “congenital granular cell myoblastoma”. Search strings were adapted to the syntax of each database, and the full search strategies are reported in Supplementary Table 1 [Supplementary Table 1]. No restriction on publication year was applied. Articles in English and in other languages with at least an English abstract were considered eligible at the screening stage. Reference lists of all eligible full-text articles and of key narrative reviews were screened manually to identify additional relevant reports.

2.2. Eligibility criteria

Studies were considered eligible if they fulfilled the following criteria. The population had to consist of human neonates (0–28 days of life) with an intraoral lesion present at birth or detected in the immediate neonatal period. The condition of interest was congenital epulis or congenital gingival granular cell tumor, as diagnosed clinically and, when available, confirmed histopathologically. Eligible designs included single case reports and case series in which individual-level clinical information could be identified. Only lesions arising from the gingiva or alveolar mucosa of the maxilla or mandible were included.

Reports were excluded when granular cell tumors occurred outside the neonatal period or were not clearly present at birth, when lesions did not arise from the gingiva or alveolar ridge (for example, isolated tongue or extraoral granular cell tumors without gingival involvement), when articles were non-original (reviews, editorials, letters without clinical data, conference abstracts without sufficient detail, animal studies), or when the diagnosis of congenital epulis could not be reliably distinguished from other entities based on the information provided. In instances of apparent multiple publications on the same patient or series, the most complete or most recent report was retained and overlapping reports were excluded.

2.3. Study selection

All records retrieved from the electronic searches were imported into a reference management software and duplicate entries were removed. Titles and abstracts were screened to identify potentially relevant articles according to the predefined eligibility criteria. Full texts of all potentially eligible studies were then obtained and assessed in detail.

Study selection proceeded in two stages, namely title and abstract screening followed by full-text review. Uncertainties regarding eligibility at either stage were resolved by consensus after re-examination of the article content.

2.4. Data extraction

Data were extracted into a pre-defined spreadsheet from each included case report or case series. The following information was collected where available: basic patient characteristics (sex, gestational age at birth, birth weight, mode of delivery, presence of polyhydramnios or other pregnancy complications), lesion characteristics (site in maxilla or mandible, more precise localization along the alveolar ridge, side, number of lesions, largest reported diameter, gross morphology including sessile or pedunculated base, surface and color), and clinical presentation (age at diagnosis, presence of feeding difficulty, respiratory compromise, inability to close the mouth, need for respiratory support, associated congenital anomalies or syndromes).

Information on prenatal findings was also extracted, including gestational age at first detection, imaging modality (two-dimensional ultrasound, color Doppler, three-dimensional ultrasound, fetal MRI), presence of polyhydramnios and suspected prenatal diagnosis or differential diagnosis. Management-related variables comprised timing of intervention (prenatal, at delivery, or postnatal, with postnatal age at surgery), airway management strategy (spontaneous breathing, endotracheal intubation, use of ex utero intrapartum treatment or analogous procedures), type of anesthesia (local or general), surgical approach (simple excision, electrocautery, ligature of the pedicle), completeness

of excision as stated by the authors, and any conservative, non-surgical management.

Histopathological and immunohistochemical data were collected when reported, including microscopic description, use and results of special stains such as periodic acid–Schiff, and immunohistochemical markers such as S-100, vimentin, neuron-specific enolase, CD68, desmin and actin, together with the authors' interpretation of the tumor origin. Outcomes included perioperative complications, need for transfusion, postoperative feeding and airway problems, length of hospital stay, recurrence or regrowth during follow-up, spontaneous regression in conservatively managed cases, mortality and any reported impact on subsequent tooth eruption or maxillofacial development.

When specific information was missing or only partially described, data were left as missing. In a limited number of cases, approximate values were inferred from textual descriptions or figures when this could be done without introducing major ambiguity; otherwise, no imputation was attempted.

2.5. Data synthesis and statistical analysis

Data were summarized descriptively. Continuous variables were reported as mean and standard deviation or median and interquartile range, depending on data distribution. Categorical variables were presented as counts and percentages.

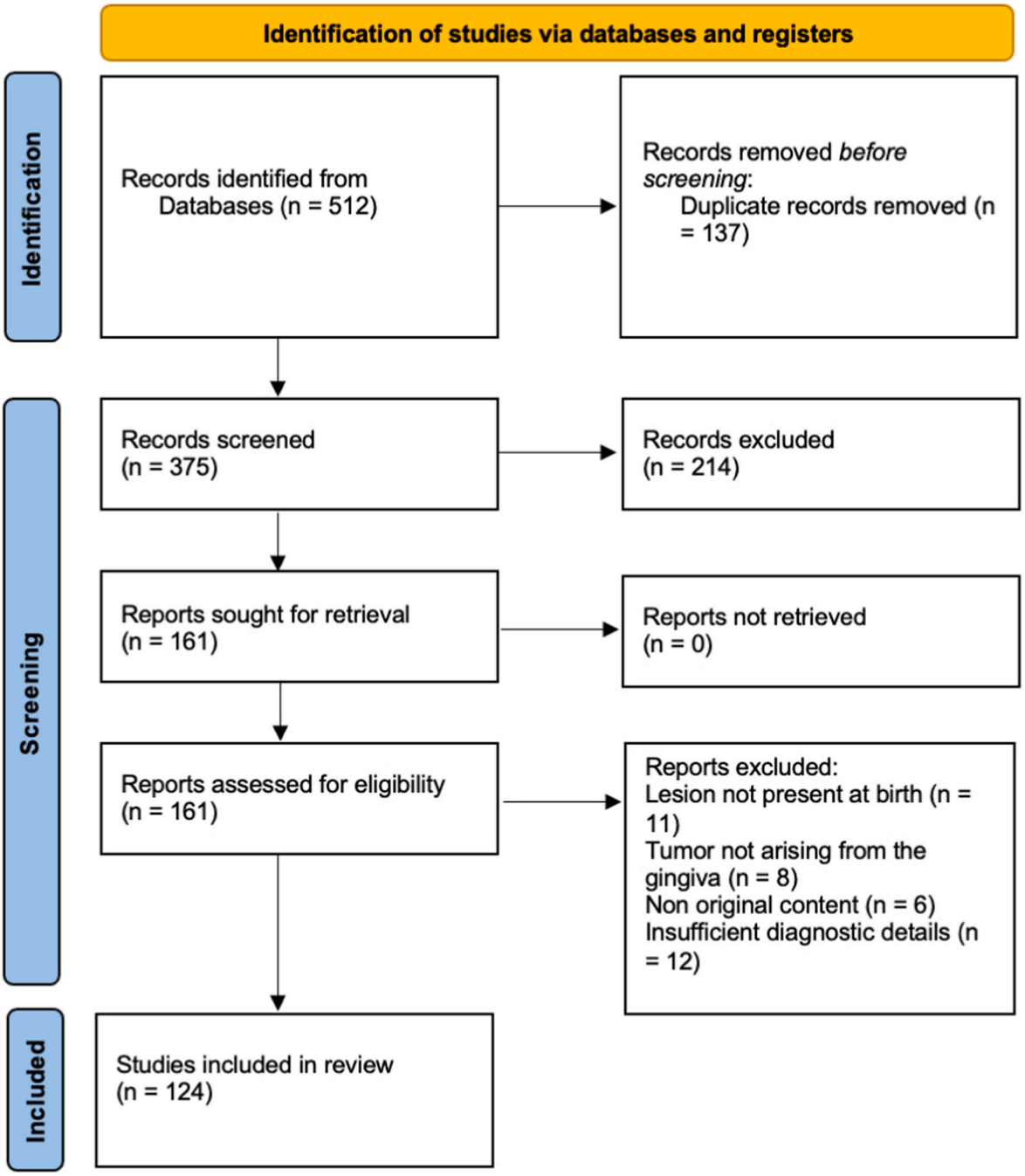

Fig. 1. Flow diagram of the literature search and study selection process.

3. Results

3.1. Study selection

The initial search across MEDLINE, Embase, Scopus and Web of Science retrieved a total of 512 records (PubMed: 250; Embase: 148; Scopus: 86; Web of Science: 28). After removal of 137 duplicates, 375 unique titles and abstracts were screened. Of these, 214 articles were excluded because they did not report congenital epulis, described granular cell tumors outside the neonatal period, or provided insufficient clinical data.

A total of 161 full-text articles were assessed for eligibility. Among these, 37 were excluded for the following reasons: lesion not present at birth (n = 11), tumor not arising from the gingiva or alveolar ridge (n = 8), non-original content such as reviews or abstracts without case-level information (n = 6), or insufficient diagnostic detail to confirm congenital epulis (n = 12) [Fig. 1].

Ultimately, 124 publications met the predefined inclusion criteria, yielding a total of 147 individual neonatal cases [Supplementary Table 2] [1–11],[16-50].

3.2. Patient and lesion characteristics

Across the 124 included publications, 147 neonates with congenital epulis were identified [Table 1]. Sex was reported for 116 infants, among whom 106 (91.4%) were female and 10 (8.6%) were male; in 31 cases sex was not specified. Gestational age at birth was available in 73 infants, and the vast majority were born at term, with 68 term births (93.2%) and 5 preterm births (6.8%). Polyhydramnios and other pregnancy complications were rarely documented in the underlying case reports and series [Supplementary Table 2].[51-80]

Prenatal detection of the lesion was described in a minority of cases. Information on prenatal imaging was available for 144 infants, 24 of whom (16.7%) had a mass identified antenatally, whereas in 120 (83.3%) the diagnosis was made only after birth; in 3 cases this information was not reported. When congenital epulis was recognized in utero, two-dimensional ultrasound was almost invariably employed (23 of 24, 95.8%), and fetal MRI was used in a smaller proportion (4 of 24, 16.7%), often as a complementary modality to further delineate the lesion.[81-129]

Most infants presented with a single intraoral lesion. Among the 146 cases with information on the number of lesions, 120 (82.2%) had a solitary mass, whereas 26 (17.8%) had multiple lesions; in the latter group, two lesions were present in 7 infants, three lesions in 17 infants, and four lesions in 2 infants. The maxilla was the predominant site of origin. Tumor location along the jaws was reported in 126 infants, with lesions confined to the maxilla in 79 cases (62.7%), to the mandible in 32 cases (25.4%), and involving both jaws in 15 cases (11.9%); in 21 infants the exact distribution was not specified. The largest reported tumor diameter had a median of 2.5 cm, with an interquartile range of 1.6–3.5 cm, indicating that most lesions were small to moderate in size, although some reached several centimeters.

Associated congenital anomalies were uncommon. Only 6 infants (approximately 4% of the total sample) were reported to have additional anomalies, while 141 were explicitly described as otherwise normal on clinical examination and perinatal evaluation. The reported anomalies were heterogeneous and each occurred in a single case: congenital goiter with hypothyroidism; midface hypoplasia with absent nasal spine in a pregnancy complicated by polyhydramnios; triple X (47,XXX) karyotype with left-hand postaxial polydactyly; isolated polyhydramnios; tetralogy of Fallot; and a pregnancy characterized by polyhydramnios and maternal gestational diabetes in the context of parental consanguinity but without structural fetal anomalies.

Management data were available for 146 infants. The overwhelming majority underwent surgical treatment, with 138 infants (94.5%) receiving operative excision of the lesion and 8 infants (5.5%) being managed conservatively with observation alone. In surgically treated cases, the intervention was typically performed very early in life, with a median postnatal age at surgery of 2 days (interquartile range 2–5 days). Information on anesthetic technique was provided for 86 infants: general anesthesia was used in 60 cases (69.8%), local anesthesia in 24 cases (27.9%), and no anesthesia was recorded in 2 cases (2.3%), usually in the context of simple ligature or excision of a pedunculated mass.

Across all reports, no recurrence or regrowth of the lesion was documented during the available follow-up, supporting the notion that congenital epulis behaves as a benign lesion with an excellent prognosis after either surgical removal or, in carefully selected small lesions, conservative management.

Table 1
Descriptive characteristics of the 147 neonates with congenital epulis included in the narrative review.

	N		% of the total
Gender			
Female sex	106		91.4%
Male sex	10		8.6%
Not reported	31		
Gestational age at delivery			
Preterm birth (<37 weeks)	5		6.8%
Term birth	68		93.2%
Not reported	74		
Diagnosis			
Prenatal diagnosis			
Yes	24	16.7%	
US	23	95.8%	
MRI	4	16.7%	
No	120	83.3%	
NR	3		
Characteristics of the lesion			
Number of lesions			
1	120	82.2%	
2	7	4.8%	
3	17	11.6%	
4	2	1.4%	
NR	1		
Lesion site site			
Mandible	32	25.4%	
Maxilla	79	62.7%	
Both	15	11.9%	
NR	21		
Tumor size	2.5 (IQR 1.6-3.5)		
Associated anomalies			
Yes	6	4.9%	
No	141	95.9%	
Management			
Surgery	138	93.8%	
Observation	8	5.4%	
NR	1	0.8%	
Timing of surgery	2 (IQR 2-5)		
Type of anesthesia			
Local	24	27.9%	
General	60	69.8%	
None	2	2.3%	
NR or NA	61		
Recurrence	0	0%	

4. Discussion

The term epulis originates from the Greek epi (“upon”) and oulon (“gingiva”), historically describing gingival masses of diverse etiologies. The congenital form was first formally documented by Neumann in 1871, who reported a gingival tumor arising at birth and introduced the designation congenital epulis of the newborn. Since that initial description, the nomenclature has evolved to reflect differing interpretations of the lesion's origin. Throughout the twentieth century, authors variably referred to the entity as congenital epulis [1–7], congenital gingival granular cell tumor [3,12], congenital granular cell

myoblastoma [17–19], granular cell fibroblastoma [21], congenital granular cell lesion [76], and Neumann's tumor [106]. Although these terms highlight different aspects of clinical presentation or histology, congenital epulis and congenital gingival granular cell tumor have become the most widely used names in contemporary literature.

Distinction from the granular cell tumor of adulthood (Abrikossoff tumor) is essential. Adult granular cell tumors exhibit pseudoepitheliomatous hyperplasia, demonstrate diffuse S-100 positivity indicating Schwannian differentiation, and may occur throughout life in various anatomical sites. In contrast, congenital epulis appears exclusively in neonates, arises almost invariably from the alveolar ridge, shows an atrophic or non-hyperplastic surface epithelium, and lacks S-100 expression [1–4,12,13,23]. These consistent differences strongly support the recognition of congenital epulis as a separate clinicopathologic entity rather than a neonatal variant of Abrikossoff's tumor.

In the World Health Organization (WHO) Classification of Head and Neck Tumors, the preferred designation is "congenital granular cell epulis", and the lesion is grouped within the oral cavity chapter under "tumors of uncertain histogenesis" in the 5th edition (2022), supporting its recognition as a distinct entity from the adult-type granular cell tumour [129].

4.1. Epidemiology and demographic features

Congenital epulis is rare, with most available data derived from isolated case reports or small case series rather than population-based studies. Estimates based on cumulative reports suggest only a few hundred documented cases worldwide since the late nineteenth century [3,4,18,20,31,73]. Across nearly all published series, a striking female predominance is observed. In the present synthesis, female infants accounted for more than 90% of cases, consistent with earlier reports noting female-to-male ratios between 8:1 and 10:1 [2–4,6,7,23,33,73].

Anatomically, the lesion most commonly arises from the maxillary alveolar ridge, typically anterior to the canine region. Historical and contemporary series converge on a maxilla-to-mandible ratio of approximately 3:1 [3–5,18,20,23,33,73]. The preferential localization to the anterior alveolar crest has been documented since the earliest case series [18,20], and remains a defining feature of the condition. Although most cases are solitary, multiple lesions occur with variable frequency, generally between 5% and 16% in published reports [2,3,23,34,41,42,76,83]. Multifocal involvement may include both the maxillary and mandibular ridges, and rare cases extend to atypical sites such as the tongue or buccal mucosa [18,22,56].

Associated congenital anomalies are exceptionally uncommon. In the present review, only a small minority of infants exhibited additional conditions, and each anomaly—such as congenital goiter, midface hypoplasia, trisomy X [9], polydactyly [9], tetralogy of Fallot [104], or polyhydramnios associated with maternal diabetes —occurred in a single case. Previous literature has similarly emphasized that congenital epulis is generally an isolated developmental lesion without syndromic correlations [3,4,33,73].

4.2. Etiopathogenesis and histogenesis

The histogenesis of congenital epulis remains unsettled despite more than a century of speculation. Early theories invoked an odontogenic origin, given the lesion's strict localization to the alveolar ridge, while others proposed a myogenic lineage based on analogy with Abrikossoff's granular cell tumor [18,19]. Alternative hypotheses have suggested fibroblastic, histiocytic, perivascular, neurogenic, mesenchymal, or myofibroblastic origins [12,13,21,23,27,32,76].

Histologic and ultrastructural data have helped refine these theories. Classic studies by Lack et al. [13], Damm et al. [12], and Kaiserling et al. [23] revealed polygonal granular cells with abundant intracytoplasmic lysosomes, small centrally located nuclei, and a delicate fibrovascular stroma, features indicative of a non-neural mesenchymal phenotype. Immunohistochemical analyses consistently demonstrate strong vimentin positivity, variable expression of CD68 or neuron-specific enolase, and uniform negativity for S-100 protein, cytokeratins, desmin, myogenin, and smooth-muscle actin [12,13,23,27,32,76,94]. This immunoprofile contrasts sharply with that of adult granular cell tumors, which are characteristically S-100 positive and show pseudoepitheliomatous hyperplasia [12,13,21,23].

The lesion's behavior further supports a non-neoplastic or reactive origin. Congenital epulis does not grow after birth, may regress spontaneously [14,55,58,60,72,89], and has never been reported to recur even after incomplete excision [3,4,33,73,85,93]. The marked female predominance has prompted speculation regarding an intrauterine hormonal influence, but studies have consistently failed to demonstrate estrogen or progesterone receptor expression [12,23,27,33]. Together, these findings suggest that congenital epulis may represent a hormonally responsive but receptor-independent proliferation of primitive gingival mesenchymal cells in late gestation.

4.3. Clinical presentation in the newborn

Clinically, congenital epulis manifests at birth as a smooth or lobulated, sessile or pedunculated mass arising from the alveolar crest [Fig. 2]. The color varies from pale pink to reddish, and the consistency ranges from firm to slightly elastic [1–7,18,20,31]. Lesions vary markedly in size, from small nodules only a few millimeters in diameter to

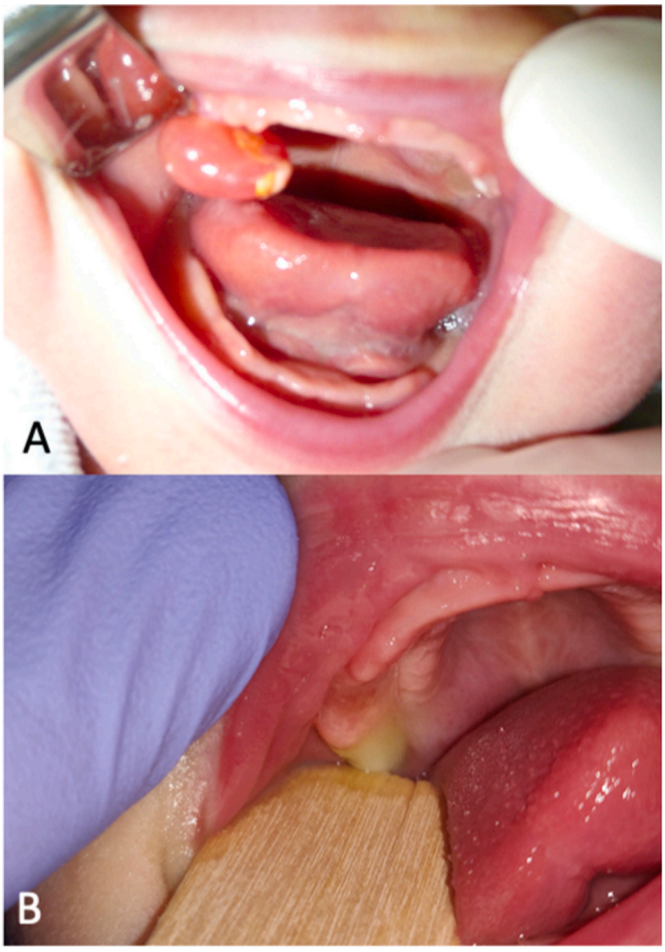

Fig. 2. Clinical presentation of congenital epulis in the newborn. (A) Intraoral view immediately after birth showing a pedunculated, smooth, pink mass arising from the anterior maxillary alveolar ridge. (B) Post-excisional appearance of the same site demonstrating complete removal of the mass and good soft-tissue healing without residual deformity.

large masses exceeding several centimeters, occasionally protruding from the mouth and preventing oral closure [33,39,44,70,100].

Symptoms depend primarily on size and location. Feeding difficulties are the most frequently reported functional problem, particularly with large anterior maxillary lesions that obstruct nipple placement or tongue movement [3,4,6,7,33]. Neonates may also exhibit impaired oral competence, excessive drooling, aerophagia, or tachypnea. Respiratory compromise is uncommon but can occur when the lesion limits mandibular excursion, displaces the tongue posteriorly, or narrows the oral airway [8,33,39,44,70,100]. Ulceration or bleeding is rare and usually associated with trauma during feeding or delivery [44,70].

Variants include multifocal lesions [2,34,41,83] [Fig. 3] and rare involvement of the tongue or buccal mucosa [18,22,56]. A key clinical feature distinguishing congenital epulis from other neonatal masses is the absence of postnatal growth; once delivered, the lesion remains stable or diminishes in size, and may undergo complete spontaneous regression [14,55,58,60,72,89].

4.4. Prenatal diagnosis and imaging

Although most cases of congenital epulis are identified only after birth, advances in obstetric imaging have allowed antenatal recognition with increasing frequency. The majority of prenatally detected lesions are first visualized in the third trimester, reflecting the lesion's apparent growth during late gestation. Two-dimensional ultrasound typically reveals a well-circumscribed, homogeneous, iso-to hyperechoic mass arising from the fetal alveolar ridge and protruding into the oral cavity [8–11,40,46,50,52,64,74,81,88,108,116,123]. The lesion is commonly seen with the fetal mouth partially open, a finding that may reflect mechanical separation of the lips rather than neuromuscular dysfunction.

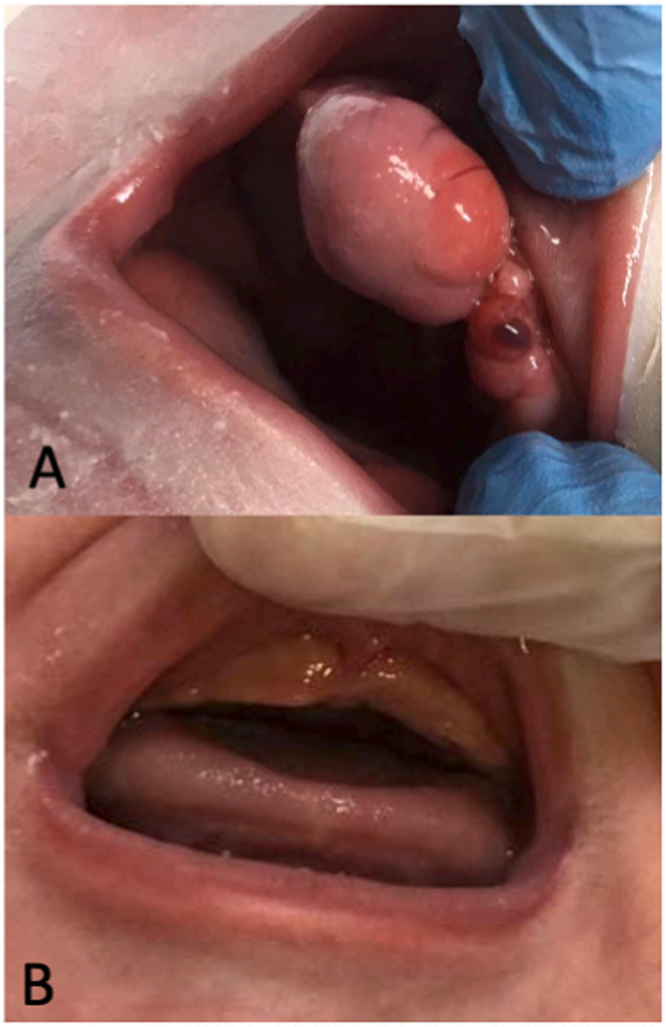

Fig. 3. Clinical presentation of multifocal congenital epulis in the newborn. (A) Intraoral view immediately after birth showing a multiple pedunculated, smooth, pink masses arising from the anterior maxillary alveolar ridge. (B) Post-excisional appearance of the same site demonstrating complete removal of the masses and good soft-tissue healing without residual deformity.

Prenatal ultrasound also plays an important role in evaluating potential complications. Large masses can impair fetal swallowing and contribute to polyhydramnios, an association reported in several cases [8–11,40,50,88,116]. However, most prenatally detected lesions are isolated findings without additional structural anomalies [40,46,74,81,108].

Three-dimensional ultrasound enhances visualization by allowing volumetric assessment and spatial rendering of the mass relative to the alveolar ridge, lips, tongue, and nasal passages. This modality improves counselling by offering parents a clearer anatomic representation and by helping clinicians assess the potential need for airway intervention at delivery [40,50,88,116].

Color Doppler imaging may assist in differentiating congenital epulis from vascular lesions such as hemangioma or arteriovenous malformations. Most congenital epulides show minimal or absent internal vascularity, in contrast to high-flow patterns typical of hemangiomas [40,64].

Fetal MRI serves as a valuable adjunct when ultrasound findings are inconclusive or when airway compromise is suspected. MRI provides superior soft-tissue contrast and delineates the lesion's extent, its relationship to the tongue and palate, and any encroachment on the oropharyngeal space [10,15,46,64,88,116]. T2-weighted images typically show a homogeneous mass of intermediate to low signal intensity, while T1-weighted sequences may demonstrate variable signal characteristics reflecting granular cytoplasmic content. Importantly, MRI helps determine whether the nasopharyngeal or laryngopharyngeal airway is patent, a factor critical for delivery planning. In large or obstructive cases, prenatal imaging has influenced the decision to perform cesarean delivery or, in rare situations, an ex utero intrapartum treatment (EXIT) procedure to secure the airway [8,52].

The prenatal differential diagnosis includes a range of congenital oral and maxillofacial tumors. Teratomas or epignathi typically appear as heterogeneous lesions with cystic, fatty, or calcified components and may show intracranial extension, which is not a feature of congenital epulis [11,40,46]. Hemangiomas and lymphangiomas display distinctive vascular patterns or multicystic morphology on ultrasound and MRI [40,64]. Other considerations include dermoid or epidermoid cysts, neuroectodermal tumors, and oropharyngeal cysts, although these entities differ in both imaging characteristics and typical anatomic location.

4.5. Pathology and immunohistochemistry

Grossly, congenital epulis presents as a smooth, dome-shaped or pedunculated mass with a pink to red surface and firm consistency. The cut surface is typically solid and homogeneous, without necrosis or cystic change, reflecting the lesion's uniform cellular architecture [1–7,12,18,23].

Microscopically, the lesion is composed of large polygonal cells arranged in sheets or nests within a delicate fibrovascular stroma. The cells exhibit abundant eosinophilic granular cytoplasm filled with lysosomes, along with small, uniform, centrally or eccentrically located nuclei [12,13,23,27,32,76,94]. The overlying stratified squamous epithelium is thin and often atrophic, a feature that contrasts with the pseudoepitheliomatous hyperplasia characteristic of the adult granular cell tumor [12,13,23].

Immunohistochemical studies have consistently demonstrated

positivity for vimentin, supporting a mesenchymal phenotype. Neuron-specific enolase and CD68 may be variably positive, although their expression is nonspecific and does not necessarily imply neural or histiocytic differentiation [12,13,23,27,32,76,94]. Importantly, congenital epulis is uniformly negative for S-100 protein, cytokeratins, desmin, smooth-muscle actin, myoglobin, myogenin, and other markers of neural, epithelial or myogenic lineages [12,23,27,33,76]. This immunoprofile provides a crucial diagnostic distinction from adult granular cell tumors, which show strong S-100 positivity and exhibit ultrastructural features compatible with Schwann cell derivation [12,13,21,23].

When the diagnosis is uncertain, immunohistochemistry aids in distinguishing congenital epulis from other granular cell lesions and from neonatal tumors such as rhabdomyosarcoma, melanotic neuroectodermal tumor of infancy (MNTI), infantile myofibromatosis, and congenital fibrosarcoma. Lack of mitotic activity, absence of atypia, negative staining for myogenic markers, and the characteristic granular cytoplasm together allow reliable diagnosis in the vast majority of cases.

4.6. Differential diagnosis

In the neonatal period, the differential diagnosis of an intraoral mass includes both benign and malignant conditions. Granular cell tumor of adulthood occurring congenitally is exceedingly rare but must be considered; its S-100 positivity and epithelial hyperplasia help distinguish it from congenital epulis [12,13,23]. Vascular lesions such as hemangiomas and lymphangiomas may present as soft, compressible oral masses but demonstrate distinct Doppler or MRI features and lack the granular histologic appearance [40,64].

MNTI represents an important differential because it commonly arises in the maxilla of infants and may exhibit pigmentation or blue-black discoloration. Histologically, however, it contains biphasic small round cells and larger melanin-producing cells, features not present in congenital epulis [21,32]. Rhabdomyosarcoma and congenital fibrosarcoma are rare but aggressive neonatal tumors that can involve the oral cavity; both show infiltrative growth and high mitotic activity and express myogenic markers, distinguishing them from congenital epulis [12,21].

Reactive lesions—including pyogenic granuloma, congenital fibroma, or other fibrous epulides—may superficially resemble congenital epulis but differ in consistency, surface characteristics, and histological architecture. Ultimately, definitive diagnosis requires histopathological examination, although the characteristic clinical context and imaging features often strongly suggest congenital epulis even prior to excision.

4.7. Management and surgical strategies

Management decisions for congenital epulis revolve primarily around airway safety and feeding ability. Because the lesion is benign, does not grow after birth, and may regress spontaneously, treatment must be individualized. Most infants with small, asymptomatic lesions can safely undergo elective excision or even observation, whereas larger masses that compromise respiration or feeding require prompt intervention [3,4,33,39,44,70,100].

Perinatal airway management is crucial in cases with suspected obstruction. Prenatal identification of a large mass allows delivery planning in a tertiary center with neonatal intensive care, anesthesiology, and pediatric surgical support [8,10,40,50,88,108]. In rare instances where severe airway compromise is anticipated, an EXIT procedure has been employed to secure the airway before complete delivery, often via endotracheal intubation while uteroplacental circulation is maintained [8,52]. However, most infants can be managed with routine airway approaches, including positioning, gentle suctioning, or elective intubation if early surgical excision is planned.

Surgical excision remains the most common treatment. The procedure is typically straightforward and can be performed using scissors, scalpel, electrocautery, or ligature of a pedunculated stalk [3,4,33,73,85]. The optimal timing of surgery depends on symptom severity. Many lesions are excised within the first days of life, although stable infants with small, non-interfering masses may undergo delayed surgery after feeding has been established. Local anesthesia is feasible for small, pedunculated lesions and has been used successfully in several reports [31,42,48,77,99], whereas general anesthesia is preferred for larger tumors or when airway control is a concern [33,44,70,84].

Complications are rare. Minor bleeding may occur but is typically well controlled with simple hemostatic measures [33,44,70]. Injury to the underlying periosteum or dental sac is theoretically possible, but reported long-term effects on tooth development are minimal [97,128]. Tracheostomy, though described in isolated historical cases, is seldom required with contemporary airway management practices.

4.8. Outcomes, recurrence, and long-term follow-up

The prognosis of congenital epulis is uniformly excellent. No cases of malignant transformation have been reported, and recurrence has not been documented even after incomplete excision [3,4,33,73,85,93]. This contrasts with many benign neonatal soft tissue tumors and further supports the notion that congenital epulis behaves as a self-limited developmental lesion rather than a true neoplasm.

Spontaneous regression represents a unique feature of congenital epulis. Multiple well-documented cases have shown partial or complete involution without surgical intervention over weeks to months [14,55,58,60,72,89]. Regression tends to occur in smaller lesions that do not interfere with feeding or respiration, suggesting that conservative management may be appropriate in carefully selected infants. The mechanisms underlying regression remain unknown but may relate to the cessation of in utero hormonal or growth factor stimuli.

Long-term follow-up studies indicate that dental eruption and maxillofacial development are generally unaffected by the presence or removal of congenital epulis. Most reports describe normal dentition in the region corresponding to the lesion, even after early surgical excision [96,127]. Rare cases describe localized enamel hypoplasia or mild alveolar contour irregularities, typically in infants with very large lesions or extensive surgical manipulation [33,97].

4.9. Ongoing debates and clinical implications

Taken together, the accumulated literature underscores that congenital epulis is a uniquely benign neonatal lesion with highly characteristic clinical, radiologic, and pathologic features. The evidence consistently demonstrates a strong female predominance [2–4,6,7,23,33,73], a predilection for the anterior maxillary alveolar ridge [3–5,18,20,23,33], and a uniformly favorable prognosis with no confirmed recurrences even after incomplete excision [3,4,33,73,85,93]. Prenatal imaging now allows for antenatal recognition in selected cases [8–11,40,46,50,52,64,74,81,88,108,116,123], facilitating delivery planning and multidisciplinary coordination, while well-documented examples of postnatal stability and spontaneous regression broaden the scope for conservative management in appropriately selected infants [14,55,58,60,72,89].

Despite this robust clinical consensus, several areas remain incompletely understood. The histogenesis of congenital epulis continues to be debated, with competing theories proposing fibroblastic, pericytic, histiocytic, or primitive mesenchymal origins [12,13,21,23,27,32,76], yet no definitive lineage marker has been identified. The persistent and unexplained female predominance has fueled speculation regarding intrauterine hormonal influences, but immunohistochemical studies have uniformly failed to demonstrate estrogen or progesterone receptor expression [12,23,27,33], leaving the mechanism of this sex-specific expression unresolved. Similarly, while spontaneous regression is documented, the biological triggers that drive postnatal involution remain unclear, and the precise boundaries between lesions amenable to observation and those warranting early surgical intervention have not

been formally defined. Available data suggest that conservative management may be reasonable for small, asymptomatic lesions that do not compromise feeding or the airway [14,55,58,60,72,89], but prospective data are lacking.

Importantly, the certainty of evidence synthesized in this review is constrained by the underlying literature, which consists almost entirely of retrospective single case reports and small case series. Accordingly, the findings should be interpreted as descriptive and hypothesis-generating rather than as definitive estimates of incidence or comparative effectiveness between management strategies.

From a practical perspective, the optimal management of congenital epulis benefits from a coordinated approach involving maternal–fetal medicine, neonatology, anesthesiology, and oral and maxillofacial surgery. When prenatal imaging suggests a large mass or potential airway compromise, planning for delivery in a tertiary center with advanced neonatal airway expertise is advisable [8,52]. Immediate postnatal assessment should focus on respiratory status and feeding ability, with early excision indicated for lesions that impede airway patency or effective feeding [3,4,33,39,44,70,100]. For smaller lesions, a tailored approach that weighs the safety and feasibility of observation against the simplicity of early removal can be considered. Intraoperatively, surgeons should remain mindful of the lesion's proximity to the developing dental sac, using conservative techniques to minimize the risk of injury, although long-term dental outcomes are generally excellent [97,128].

Looking forward, the field would benefit from collaborative case registries and systematic long-term follow-up to refine understanding of growth behavior, recurrence risk, and dental or maxillofacial outcomes. Further immunophenotypic and molecular studies may also clarify the lesion's cellular origin and the biological basis of its sex predilection and regression tendencies. Until such data become available, clinicians should continue to rely on the characteristic clinical presentation, benign biological behavior, and the principles of airway safety and feeding support to guide individualized and evidence-informed management.

Because the literature is dominated by single case reports and small case series, the clinical value of future publications depends largely on complete and standardized reporting. We encourage authors to follow established reporting guidance for case-based evidence (e.g., CARE) and to include, at minimum, the following items when reporting congenital epulis: (1) patient demographics (sex, gestational age, birth weight) and perinatal history; (2) lesion characteristics (number, site, maximal diameter, pedunculated/sessile appearance) and functional impact (feeding and/or airway compromise); (3) prenatal imaging details when applicable (gestational age at detection, modality, size, relationship to airway, and delivery planning); (4) diagnostic work-up (histopathology and immunohistochemistry, with differential diagnosis considered); (5) management details (observation vs excision, timing, surgical technique, and type of anesthesia/airway management); (6) outcomes (resolution of symptoms, duration of follow-up, recurrence/regression, dentition/maxillofacial development); and (7) adverse events/complications (including explicit statements when none occurred). More complete reporting would improve comparability across cases and enable more robust future syntheses.

4.10. Limitations

This review should be interpreted in light of the nature of the underlying evidence. Nearly all included publications were retrospective case reports or small case series, which inherently limits internal validity and precludes robust comparative conclusions. Even when a comprehensive search strategy and structured data extraction are applied, such evidence is vulnerable to publication bias, selective outcome reporting, and incomplete follow-up reporting. Accordingly, our synthesis is intended to provide a structured overview of reported patterns and outcomes, rather than definitive estimates of incidence or comparative effectiveness.

5. Conclusions

This comprehensive review highlights the clinical, radiological, pathological and therapeutic features of congenital epulis, synthesizing data from more than a century of published experience. Despite its dramatic presentation in some newborns, the lesion is benign, self-limited, and reliably treated with simple excision when necessary. Advances in prenatal imaging have improved detection and perinatal planning, but most cases can be managed safely without complex airway interventions. Persistent uncertainties remain regarding histogenesis, hormonal influences, and the biological basis of spontaneous regression. Future progress will likely depend on collaborative registries, molecular characterization, and long-term follow-up studies to clarify the developmental origins of this rare neonatal lesion and to refine management recommendations.

Ethical approval

Not required.

Credit author statement

Luigi Angelo Vaira: study conception, methodology, manuscript draft, final approval.

Jerome R. Lechien: study conception, methodology, manuscript draft, final approval.

Antonino Maniaci: data collection, reviewing and editing, final approval.

Giannicola Iannella: data collection, reviewing and editing, final approval.

Carlos M. Chiesa-Estomba: data collection, reviewing and editing, final approval.

Giuseppe Consorti: data collection, reviewing and editing, final approval.

Giulio Cirignaco: data collection, reviewing and editing, final approval.

Stefania Perrotta: data collection, reviewing and editing, final approval.

Carlos Navarro-Cuéllar: data collection, reviewing and editing, final approval.

Paolo Boscolo-Rizzo: data collection, reviewing and editing, final approval.

Giovanni Salzano: data collection, reviewing and editing, final approval.

Pasquale Piombino: data collection, reviewing and editing, final approval.

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Declaration of competing interest

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Appendix A. Supplementary data

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