Original article

Oropharyngeal teratomas in newborns: Management and outcome

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ARTICLE INFO

Keywords:
Congenital oropharyngeal teratoma
EXIT procedure
Neonatal airway obstruction
Neonate
Tumour

ABSTRACT

Objectives: Congenital teratomas of the oropharyngeal cavity are extremely rare and are associated with a high neonatal mortality rate due to severe airway obstruction. Management has been improved with progress in antenatal diagnosis. The authors describe this progress in the light of a series of 4 cases and a review of the literature.

Methods: The medical charts of four neonates treated in the department since 1995 were reviewed. The following criteria were studied: age at diagnosis, clinical and radiological features of the tumour, management at birth and outcome.

Results: All four cases occurred in female neonates with an antenatal diagnosis in two cases, allowing preparation for endoscopy in the delivery room in one case and an EXIT procedure in the other case. Three neonates had to be intubated in the delivery room. Imaging showed invasion of the infratemporal fossa in 3 of the 4 cases. Surgical resection via various approaches to the infratemporal fossa was complete in every case. Adjuvant chemotherapy was administered in one case.

Conclusion: Surgery for these mostly benign tumours is very challenging and requires a multidisciplinary team. Perinatal planning allows appropriate management at birth, decreasing the risk of airway obstruction. Surgery is the mainstay of treatment of teratomas.

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1. Introduction

Teratomas are the most common congenital tumour (25–35%) [1] with an incidence of 1/4000 births [2]. Eighty percent of these tumours are situated in sacrococcygeal and gonadal sites. Teratomas of the head and neck represent 5 to 15% of all sites, predominantly involving the nasopharynx and neck [3], while oropharyngeal tumours are exceptional (2%). Systematic antenatal ultrasound allows early diagnosis of these tumours and planning of appropriate management. The objective of this review was to report the long-term outcome of 3 infants treated in our department [4] and to describe the management of a recent case treated after birth by the EXIT procedure.

2. Clinical cases

2.1. Case 1

F. was a baby girl born prematurely in 1995 at 32 weeks of amenorrhea (WA). Emergency caesarean section was necessary due to severe maternal pre-eclampsia. The baby was immediately transferred to the neonatology unit with rapidly resolving airway obstruction. However, airway obstruction gradually returned and examination demonstrated an oropharyngeal mass with retropalatal extension. Intubation was required at 3 weeks of life for airway obstruction. Computed tomography (CT) and magnetic resonance imaging (MRI) revealed a tumour arising from the soft palate with a heterogeneous appearance comprising calcifications and cysts. The lesion extended to the left infratemporal fossa with a fat density intracranial extension. Alpha-fetoprotein (AFP) assay was normal for age (1700 ng/ml) (Table 1 [5]). Endoscopy under general anaesthesia allowed biopsy of the mass and relief of airway obstruction. The lesion was implanted posteriorly to the tonsil, on the posterior pillar and dorsal surface of the soft palate. Histological examination revealed glial heterotopia suggesting teratoma with a probable immature contingent. Surgical resection was performed at the age of 2 months. The infratemporal contingent was resected via a superior transmandibular approach with resection of the coronoid process (according to Shaheen’s description [6]) and the oropharyngeal nodule was resected via an intraoral approach. Histological examination revealed a diagnosis of mature teratoma based on analysis of the epithelial, nerve, muscle, bone and cartilage contingents. Chronic Eustachian tube insufficiency subsequently required insertion of a tympanostomy tube in the left ear, followed by treatment of cholesteatoma. This child did not present...
any soft palate insufficiency. Trismus due to temporomandibular ankylosis required two surgical procedures. The child presented minimal persistent mandibular laterognathia. This patient, now a 14-year-old adolescent, has no signs of recurrence on clinical and MRI follow-up.

2.2. Case 2

S. was a baby girl born at term in 1996. Antenatal ultrasound revealed a very large nasopharyngeal mass from the second trimester of pregnancy. Severe airway obstruction due to an oropharyngeal tumour required intubation at birth by an otorhinolaryngologist present in the delivery room. CT and MRI imaging also revealed extension to the right infratemporal fossa and extrameningeal intracranial extension to the temporal fossa (Fig. 1A). AFP assay was normal for age (5000 ng/ml) (Table 1) [5]. Endoscopy under general anaesthesia, performed at 9 days of life, revealed an irregular, hard, whitish oropharyngeal mass arising from the free edge of the soft palate. Resection of this pharyngeal mass allowed extubation and histological examination revealed a diagnosis of mature teratoma. At the age of 2 months, surgical resection was planned in collaboration with a neurosurgeon. Pterional craniotomy allowed resection of the superior part of the tumour via the zygomatic arch as far as the infratemporal fossa and the soft palate portion of the tumour was resected via an intraoral approach. Histological examination confirmed the diagnosis of mature teratoma. At the age of 3 months, the child presented a temporomalar mass. MRI demonstrated recurrence in the infratemporal fossa extending to the floor of the middle cranial fossa and middle ear. Surgical revision comprised a type C infratemporal approach (according to the description of Fisch [7]) and temporal cranietomy. Histological examination of the lesion confirmed the diagnosis of mature teratoma. AFP on postoperative day 7 was normal. The child was reoperated at the age of 3 years for residual cholesteatoma after exclusion of the ear. At the age of 14 years, she is still regularly reviewed and presents no clinical or radiological signs of recurrence with a normal AFP. She presents right mandibular hypoplasia with limited mouth opening (Fig. 1B), but normal facial movements.

2.3. Case 3

E. was a baby girl born at term in 1998. She was immediately transferred to neonatal intensive care because of airway obstruction that was relieved after expelling a pink tumour from the mouth, but which rapidly relapsed on deglutition. A stay suture placed in the tip of the tumour prevented subsequent episodes of asphyxiation. This soft, pink lesion was implanted on the tonsil and extended to the soft palate. MRI did not reveal any signs of extension of this heterogeneous fat density lesion. Complete resection was performed on the first day of life with removal of the tonsil and the soft palate implantation. The lesion measured 5 cm long and 1.5 cm in its largest diameter. Histological examination revealed a diagnosis of mature teratoma. No clinical and radiological recurrence was observed at the age of one year. The child’s family subsequently left the region and this child has been lost to follow-up.

2.4. Case 4

G. was a baby girl born at term in 2009 by the EXIT procedure. Antenatal ultrasound was requested at the 17th week of amenorrhoea (WA) to document a triple test with abnormal elevation of AFP and revealed a left lateral cervical foetal cyst measuring 6 mm in diameter. Regular ultrasound and MRI surveillance diagnosed progressive enlargement of a heterogeneous, polycystic neck mass associated with a solid intraoral mass. At 36 WA, the cystic swelling measured 67 × 66 × 40 mm on MRI, but no deviation of the trachea and oesophagus was observed (Fig. 2A). Delivery

Table 1

<table>
<thead>
<tr>
<th>Age</th>
<th>Number of children</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Premature</td>
<td>11</td>
<td>134,734 ± 41,444</td>
</tr>
<tr>
<td>Neonate</td>
<td>55</td>
<td>48,406 ± 34,718</td>
</tr>
<tr>
<td>Birth – 2 weeks</td>
<td>16</td>
<td>33,113 ± 32,503</td>
</tr>
<tr>
<td>2 weeks – 1 months</td>
<td>43</td>
<td>9452 ± 12,510</td>
</tr>
<tr>
<td>1 months</td>
<td>12</td>
<td>2654 ± 3080</td>
</tr>
<tr>
<td>2 months</td>
<td>40</td>
<td>323 ± 278</td>
</tr>
<tr>
<td>3 months</td>
<td>5</td>
<td>88 ± 87</td>
</tr>
<tr>
<td>4 months</td>
<td>31</td>
<td>74 ± 56</td>
</tr>
<tr>
<td>5 months</td>
<td>6</td>
<td>46.5 ± 19</td>
</tr>
<tr>
<td>6 months</td>
<td>9</td>
<td>12.5 ± 9.8</td>
</tr>
<tr>
<td>7 months</td>
<td>5</td>
<td>9.7 ± 7.1</td>
</tr>
<tr>
<td>8 months</td>
<td>3</td>
<td>8.5 ± 5.5</td>
</tr>
<tr>
<td>&gt; 8 months</td>
<td>–</td>
<td>8.5 ± 5.5</td>
</tr>
</tbody>
</table>

Fig. 1. A. MRI, T2-weighted sequence in a neonate (case 2). The oropharyngeal teratoma has a heterogeneous, polycystic appearance, invading the right infratemporal fossa with intracranial and extrameningeal extension. B. Clinical appearance (case 2) of the child at the age of 14 years with right lateral mandibular deviation and limited mouth opening.
was planned for 38 WA by EXIT procedure (Fig. 2B), as ultrasound revealed an intraoral solid tumour protruding from the mouth. The baby was transferred to neonatal intensive care after orotracheal intubation with easy displacement of the intraoral mass (Fig. 3A). The lesion implanted in the left tonsil and palate was associated with cleft palate. Imaging (CT and MRI) confirmed extension to the left infratemporal fossa and a mandibular deformity (Fig. 3B). AFP assay was normal at 2 days of life (20,000 ng/ml) (Table 1 [5]). Surgical resection was planned for the 5th day, comprising an intraoral approach and a neck incision. Histological examination revealed a diagnosis of mature teratoma. Serum AFP returned to normal at the first postoperative week, but rapid elevation of AFP was observed on follow-up at 7 months. A large relapse in the infratemporal fossa and left submandibular compartment was observed on follow-up CT scan at the age of 8 months associated with very high AFP (>38,000 ng/ml) (Table 1 [5]). Because of the tumour volume, its secreting nature and its unresectability, it was decided to administer neoadjuvant chemotherapy, comprising etoposide (75 mg/m²/day from day 1 to day 5), ifosfamide (3 g/m²/day on the first two days of the cycle) and cisplatin (20 mg/m²/day from day 1 to day 5), with one cycle every 3 weeks. AFP returned to normal after the second cycle. The infant received the minimum 4 cycles required by the TGM95 protocol with two additional cycles prior to salvage surgery. The residual disease visible on imaging was resected via a transmandibular approach in collaboration with the head and neck surgical team of another hospital. Histological examination revealed chemotherapy-induced tissue changes with no viable yolk sac tumour, associated with several mature, epithelial and sometimes cystic structures. No tumour invasion was observed on bone and periosteal biopsies.

3. Discussion

Teratomas are the most common congenital tumours, but are rarely observed in the head and neck. A female predominance for teratomas of the head and neck has been reported in the literature and was also observed in this series.

Various hypotheses have been proposed to explain the formation of teratomas. The most widely accepted hypothesis is that of abnormal proliferation of pluripotent cells sequestered during embryogenesis that are able to form disorganized structures comprising various tissue types foreign to the region [8]. Teratomas are complex tumours composed of various embryonic cell lines: ectoblastic, endoblastic, neuroblastic or mesenchymal. About 90% of teratomas in children are composed of tissues derived from the three embryonic layers with a high proportion of neuroectodermal tissue [9]. Teratomas of the head and neck are considered to be mature teratomas in 60 to 80% of cases, i.e. composed of
well-differentiated tissues [3,10]. Due to the heterogeneous tissue structure, the benign nature of these tumours cannot be confirmed on simple biopsy. Complete resection of the teratoma must therefore be performed. All tumours in our series were mature teratomas. According to Carr et al. [11], immature teratomas in neonates have a good prognosis, with 5-year survival rates higher than 80%.

Teratomas are benign in 80% of cases [3]. Degeneration of mature forms is exceptional (1–2%) and is exclusively described in gonadal and sacrococcygeal sites [12]. Malignant transformation is observed more frequently for tumours diagnosed in older children. The diagnosis of malignancy is based on the degree of tissue differentiation. Malignancy does not depend exclusively on the histological nature of the tumour, but also on the presence of synchronous or asynchronous metastases. Jordan et al. [13] described a case of neonatal teratoma of the neck that was considered to be benign on histological examination, although the child presented synchronous liver metastases.

3.1. Antenatal diagnosis

Two cases in our series were diagnosed and closely followed by antenatal ultrasound (cases 2 and 4). Twenty to 50% of teratomas of the head and neck are discovered incidentally on the second trimester ultrasound examination (between 20 and 23 WA) and are associated with polyhydramnios in 40% of cases [13–15], as the very large pharyngeal or cervical mass induces oesophageal compression preventing resorption of amniotic fluid by foetal deglutition [16]. Other clinical features may also be observed: intrauterine foetal death, pre-eclampsia (case 1), dystocia delivery, prematurity [16,17]. The diagnosis of teratoma is suggested on ultrasound, following discovery of a neck mass or a pharyngeal tumour comprising solid and cystic contingents. Oropharyngeal teratoma can simulate macrognathia or anterior encephalocele [8].

Foetal MRI (case 4) can confirm the diagnosis by visualizing the structure of the tumour, and its size, site, growth and extension [8,14,18]. A diagnosis of teratoma should be considered in the presence of a heterogeneous, polycystic mass comprising fatty areas and calcifications with necrotic areas, or mineralization of bone, cartilage or even dental structures. Due to its high definition, MRI allows visualization of meningoencephalinevasion and secondary sites in the case of malignant teratoma. MRI is more accurate than ultrasound to assess airway obstruction [14].

Teratomas of the head and neck are associated with congenital malformations in 6% of cases [2]. Cleft palate, microcephaly, common carotid artery atresia and tonsillar malformations are some of the sporadic craniofacial anomalies reported [19]. Cleft palate (case 4) is the most common anomaly: due to their midline position, pharyngeal teratomas occurring before the 8th week of foetal life prevent midline closure of the secondary palate [8]. The four main non-craniofacial congenital malformations reported in association with teratomas of the head and neck are imperforate anus, chondrodysplasia, left ventricular hypoplasia and pulmonary hypoplasia [19].

Other examinations, such as the triple test, may guide the diagnosis. This examination is based on the correlation between serum assays of two hormones (AFP and HCG) and ultrasound findings, such as nuchal translucency. It is generally performed to screen for trisomy 21. Elevated AFP is also suggestive of teratoma (case 4), which is an AFP-secreting tumour [15].

When the antenatal assessment suggests a diagnosis of teratoma, the subsequent management is determined according to the prognosis and functional outcome. Large tumours, invasion of vital structures, complex deformities of the facial bones, or the presence of metastases are elements in favour of a poor prognosis. Therapeutic termination of pregnancy should then be proposed in these cases [8,9]. In less severe cases, antenatal diagnosis now allows prevention of airway obstruction at birth, thereby decreasing perinatal morbidity and mortality [18].

3.2. Management at birth

3.2.1. Planned management

Antenatal diagnosis allows planning of optimal management. Neonatal teratomas of the head and neck are frequently present in the form of neonatal airway obstruction (35%) with a high mortality rate (10–25%) [3,8,13].

Caesarean section is recommended for infants with very large neck tumours (>5 cm) to avoid dystocia [20]. The presence of an orthonalynologist in the delivery room is recommended, even when the antenatal assessment does not demonstrate any signs of airway obstruction. When the antenatal assessment is suggestive of difficult intubation, various procedures should be considered to reduce the risk of neonatal distress. The Operation On Placental Support (OOPS) technique consists of performing laryngobronchoscopy in neonates extracted before sectioning the umbilical cord [21]. However, maintenance of uteroplacental blood flow cannot be guaranteed due to uncontrolled uterine contraction [16]. In contrast, the main objective of the EXIT procedure is to maintain uterine hypotonia in order to preserve permanent oxygenation of the foetus via the cord, while ensuring a patent airway [16,17].

3.2.2. Diagnosis unknown at birth

Teratomas of the head and neck are generally observed during the first two months of life (case 1). Depending on the size, growth rate and site of the teratoma, airway obstruction may be absent or delayed [8]. However, acute respiratory distress is observed at birth in 35 to 45% of cases [3]. Various methods can be used to ensure a patent airway: change of the baby's position, traction on the oropharyngeal tumour (case 3) [22], intubation, tracheotomy.

3.2.3. Assessment

Clinical examination identifies the lesion, its site and its complications (deformity of the facial bones, cleft palate, etc.). It must be completed by flexible laryngoscopy. Biopsies under general anaesthesia are performed during upper aerodigestive tract panendoscopy.

Imaging (head and neck CT and MRI) is essential to define extension of the lesion, its anatomical relations with vital structures (large vessels, cerebromeningeal) and to determine the possibilities of resection [22].

On head and neck CT scan, mature teratoma is visualized as a well-demarcated, heterogeneous lesion, with calcifications and no signs of osteolysis. The presence of intracranial and mediastinal extensions and cervical lymph nodes must be systematically investigated. Contrast-enhanced imaging defines the vascular relations.

MRI is the essential imaging examination to detect intracranial extension.

Some teams propose AFP assays for the diagnosis and follow-up of teratoma. Very high AFP levels in sacrococcygeal teratomas appear to be correlated with intense tumour activity, immaturity or degeneration [23]. AFP assay can be used to classify germ line tumours as standard risk (AFP < 15,000 ng/ml) or high-risk (AFP > 15,000 ng/ml). However, this classification is difficult in children under the age of 1 year due to variability of AFP levels (Table 1 [5]) and it is unsure whether these results can be reliably extrapolated to teratomas of the head and neck (cases 2 and 4) [3,19].

3.2.4. Treatment

Treatment of teratomas of the head and neck is surgical, as these lesions continue to grow. Cysts may suddenly increase in size, worsening the mass syndrome and causing life-threatening airway
obstruction. Deformities of the facial bones can also rapidly evolve and compromise the functional prognosis. The mortality rate in the absence of surgery is 80–90%, due to mass syndrome and malignant degeneration (90%) [3].

Resection must be performed early [1,3,19], raising problems of the most appropriate surgical approach. Teratomas of the neck are accessible by open surgery, with few aesthetic and functional sequelae. However, neck surgery can be associated with certain complications: hypothyroidism, transient hypoparathyroidism, nerve lesions (spinal nerve, recurrent laryngeal nerve, hypoglossal nerve, facial nerve) [3].

An intraoral incision (case 3) allows resection of a pharyngeal teratoma by controlling the implantation base. Resection is rapid with low morbidity, the main complication being soft palate insufficiency [4].

The surgical approach to infratemporal fossa invasion is more complex and no consensus has been reached. The approaches described in adults [7] must be adapted to neonatal anatomy. Neonatal surgery is associated with a higher complication rate: nerve lesions (facial palsy), mandibular (temporomandibular ankylosis, mandibular hypoplasia, limited mouth opening) and iatrogenic cholestetomaloma (cases 1 and 2) [24]. These sequelae may deteriorate with the child’s growth [4]. Teratoma with intracranial extension may require dual-team surgery (ENT and neurosurgeons) (case 2) [24].

No consensus has been reached concerning the management of neonatal malignant teratomas of the head and neck. The mainstay of treatment is surgery, comprising resection of the tumour and its metastases when they are accessible (lymph node dissection, lobectomy, partial hepatectomy) [3,13]. Adjuvant radiotherapy is recommended when resection is incomplete. However, irradiation must be limited due to its long-term sequelae: neurological deficit, mental retardation, radiation osteonecrosis, sarcoma, anomaly of facial development.

Chemotherapy is administered as first-line treatment when surgery is impossible. It is therefore reserved for disseminated immature teratomas or recurrent or unresectable teratomas [3]. In the case of recurrence, elevation of AFP levels is sufficient to define the indication for chemotherapy without the need for biopsy. Chemotherapy protocols vary as a function of AFP levels and teratoma grade. Following incomplete initial surgical resection, adjuvant chemotherapy must be continued until AFP becomes negative.

3.2.5. Follow-up

Long-term follow-up is essential in children treated for teratoma of the head and neck and consists of regular clinical, radiological (MRI and CT) and laboratory (AFP) follow-up for the first year, and then annually thereafter. Clinical examination must look for signs of local recurrence and metastases. MRI is the imaging modality of choice, as it can be safely repeated. Although no studies have specifically assessed the sensitivity of AFP for the early diagnosis of recurrent teratoma of the head and neck, AFP assay has been recommended as part of follow-up [19]. Treatment of teratomas of the head and neck in neonates induces complications that also require long-term multidisciplinary follow-up [24]. Management must be continued throughout the child’s growth.

4. Conclusion

The presence of a head and neck teratoma in a neonate can be immediately life-threatening due to respiratory distress. The antenatal diagnosis (ultrasound and foetal MRI) allows anticipation of the risk of respiratory distress in a neonate with head and neck teratoma. The primary objective is to ensure adequate airways by means of appropriate multidisciplinary management.

The EXIT procedure is the safest technique to restore ventilation in a foetus with potential airway obstruction and it considerably reduces the morbidity and mortality of these newborns.

Surgical treatment is decided after clinical, radiological and laboratory assessment (AFP assay). The prognosis is generally excellent following complete resection. Recurrences are detected by a regular clinical, radiological (MRI) and laboratory surveillance.

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

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