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The Contribution of Computed Tomography in the Diagnosis of Neonatal Bilateral Choanal Atresia: A Study of Three Cases at Bouaké's Teaching Hospital

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Abstract

Introduction: Bilateral choanal atresia is a rare and potentially lethal congenital malformation in newborns. It represents a neonatal emergency. It causes posterior nasal obstruction, leading to neonatal respiratory distress. Computed tomography (CT) is the gold standard for confirming the diagnosis and planning surgical management. **Case Presentation:** We report three newborns presenting with respiratory distress of varying intensity from the first days of life. Clinical examinations suggested bilateral choanal atresia, which was confirmed by CT. The forms observed included pure bone atresia and two mixed forms, with notable anatomical variations such as thickening of the vomer (6.4 mm) and hypoplasia of the paranasal sinuses. **Intervention and Follow-Up:** The patients received initial medical care. Surgery was considered, but could not be performed urgently in all cases. **Conclusion:** CT plays an essential role in the accurate diagnosis, anatomical characterisation, and surgical planning of neonatal bilateral choanal atresia.

Keywords

Choanal Atresia, Bilateral, Computed Tomography, Newborn

1. Introduction

Choanal atresia is a rare but serious congenital malformation, characterized by obstruction of the posterior nasal passages. The incidence of this malformation reported in the literature is about 1/5000 to 7000 live births [1]. The clinical diagnosis is based on neonatal respiratory distress, but it must imperatively be confirmed by imaging. Atresia can be unilateral or bilateral. Bilateral atresia is manifested in the newborn by respiratory distress immediately after birth, due to the inability to breathe, as newborns must breathe through the nose. Bilateral choanal atresia is an acute ENT emergency requiring immediate respiratory management [2]-[4]. The bilateral form usually manifests at birth (neonatal respiratory distress) and is often diagnosed immediately; the unilateral form is often discovered later (child or adult) [5]. In this context, computed tomography (CT) is the reference examination. It therefore not only allows for confirming the diagnosis but also specifies the anatomy of the anomaly, which is crucial for surgical planning. In Africa, particularly in Côte d'Ivoire, there is no comprehensive register to estimate a general incidence because the African literature consists mostly of a series of mono-centric cases and clinical reports [6]. We present three clinical cases illustrating the essential contribution of CT in the diagnosis and evaluation of choanal atresia at the University Hospital Center of Bouaké.

2. Clinical-Radiological Observations

2.1. Case 1

Clinical presentation: A 28-day-old newborn with severe respiratory distress (rapid and low oxygen) from birth, which was not well managed at first. The child also has a low weight and a heart defect (ventricular communication). Initial treatments for lung infection and heart failure did not resolve the respiratory problem, which oriented the diagnosis towards choanal atresia.

CT results (**Figure 1**): The nasosinusal CT revealed a complete and bilateral

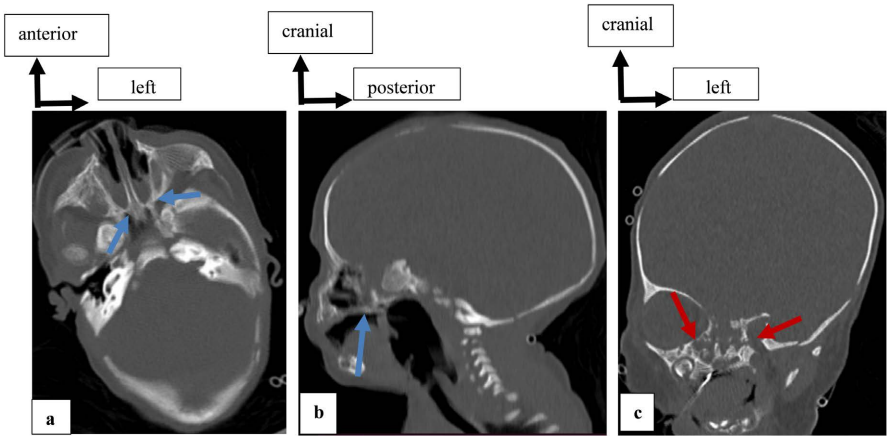

Figure 1. a, b, and c illustrate bilateral atresia of the bone-like choanae, with a blue arrow in axial section and sagittal reconstruction (b), hypoplasia of the maxillary sinuses (c) is indicated by a red arrow.

obstruction of the choanae. The images showed that the obstruction was caused by a thick bone plate, which is characteristic of bilateral osteochoanal atresia. The examination also highlighted the small size of the maxillary sinuses (hypoplasia).

This newborn, unfortunately, passed away before the surgical intervention could be performed. The delay in care was due to a lack of financial means and adequate healthcare support, highlighting the significant challenges of managing such a severe condition in a resource-constrained environment.

2.2. Case 2

Clinical presentation: 27-day preterm newborn, admitted for moderate respiratory distress that appeared two days after birth. The nasal tube test failed, leading to suspicion of choanal atresia. The rest of the examinations (blood test, echocardiography, X-ray) were normal.

CT results (**Figure 2**): A CT confirmed the diagnosis by showing complete obstruction of the right posterior nasal cavities with a thin membrane on the left and a bone plate on the right with a thickening of the vomer of 6.4 mm. The case was therefore diagnosed as bilateral mixed choanal atresia, a more common form. There was an association with bilateral asymmetric cerebral ischemia.

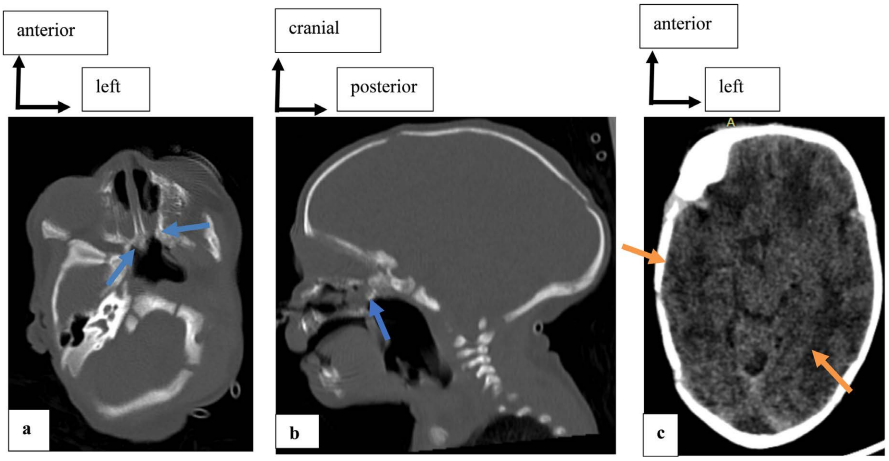

Figure 2. a, b, and c illustrate mixed bilateral choanal atresia in axial section (a) with the membranous component on the sagittal reconstruction (b) in blue arrow; bilateral parietal supratentorial ischaemia predominantly on the left in green arrow (c).

Following initial stabilization, this patient underwent a successful surgical procedure. The operation was performed to correct the mixed atresia and address the anatomical variations noted on the CT scan. The patient recovered well, and the outcome was successful.

2.3. Case 3

Clinical presentation: A 12-day-old neonate with very severe respiratory distress from birth. The examination revealed typical signs of choanal atresia, including difficulty in passing a nasal passage and particular facial features (flattened root of the

nose).

CT results (Figure 3): The CT confirmed the diagnosis and accurately characterized it. It showed mixed choanal atresia (membranous on the right and osseous on the left) without thickening of the vomer. Coexistence with paranasal sinus hypoplasia.

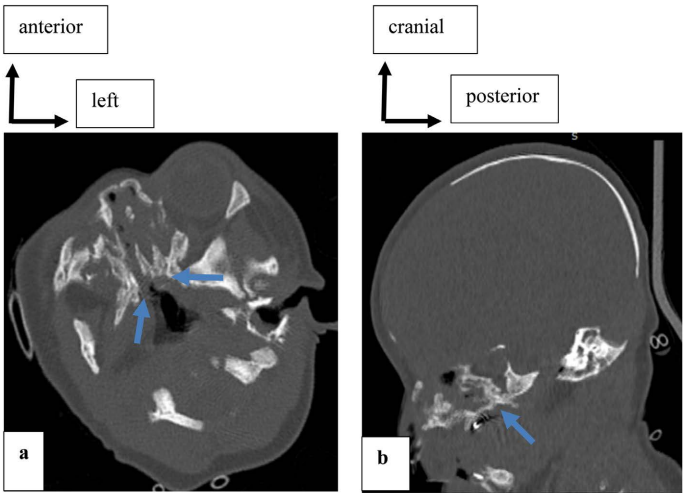

Figure 3. a and b illustrate a bilateral mixed atresia of the choanae, with a blue arrow as described above in axial section (a) and sagittal reconstruction (b).

Similarly, this neonate also underwent a successful surgical procedure to correct their mixed choanal atresia. Despite the initial challenges and the severity of their condition, the intervention was effective, leading to a positive outcome for the patient.

3. Discussion

Our three cases illustrate the essential contribution of CT in the diagnosis and evaluation of these neonatal respiratory emergencies at the University Hospital Center of Bouaké. Computed tomography not only confirms the diagnosis, but also specifies the anatomy of the anomaly, which is crucial for surgical planning.

3.1. Correlation between the Clinic and Radiology

Our clinical and radiological observations agree with the data from the medical literature. Choanal atresia, resulting from the absence of development of the posterior nasal cavity, leads to an inability of the nasal fossae to communicate with the nasopharynx. This obstruction, mainly due to the medialization of the medial lamina of the pterygoid process and the thickening of the vomer, can be osseous, membranous, or mixed [7].

- Case 1: This newborn presents with severe respiratory distress, congenital heart disease (CVD), and hypoplasia of the paranasal sinuses. These observations are consistent with the syndromic forms of choanal atresia, notably CHARGE syndrome, where multiple malformations are common [8]. While the full criteria

for this syndrome were not formally assessed, this association of clinical signs is a strong diagnostic pointer. CT scan revealed bilateral bone atresia, the most common form (about 90% of cases) [9]. Hypoplasia of the sinuses is a direct consequence of nasal obstruction, which prevents ventilation and normal development of these structures.

- Case 2: This case presents with moderate respiratory distress, and the diagnosis was made by CT scan. The examination highlighted bilateral mixed atresia, characterized by a membranous obstruction on the left and a bony obstruction on the right. Unlike pure bone forms, mixed atresia (about 10% of cases) involves both a bone plate and membranous tissue. Thickening of the vomer (6.4 mm) is a key radiological sign, corroborating studies that have established reference values for this parameter [1]. The association of bilateral cerebral ischemia, although not directly related to atresia, highlights the potential severity of neonatal pathologies and the need for a comprehensive assessment. Severe perinatal hypoxia, worsened by respiratory distress linked to atresia, could potentially have an indirect link to the observed cerebral ischemia.
- Case 3: The severe respiratory distress and signs of facial dysmorphism of this newborn are strong clinical indices of choanal atresia. CT confirmed bilateral mixed atresia (membranous on the right, osseous on the left). The absence of thickening of the vomer, although atypical, highlights the anatomical variability of this malformation. These cases demonstrate that CT is essential to confirm the clinical diagnosis, characterize atresia, and guide treatment.

3.2. CT Inputs and Anatomical Measurements

CT is the exam of choice for the radiologist and the ENT. It provides an accurate anatomical definition of atresia, which is crucial for surgical planning.

- Characterization of the obstruction: CT unequivocally distinguishes bone atresia, membranous or mixed, which is essential information for the surgeon in choosing the surgical technique (bone resection vs simple perforation) [10].
- Surgical planning: Anatomical measurements on a CT scan provide essential landmarks. The work of Slovis *et al*., which established parameters such as the width of the vomer and the distance between the nasal walls, laid the foundation for surgical planning [11]. Although our patients are newborns, the thickening of the vomer observed in case 2 is consistent with Slovis' conclusions. In addition, the studies by Waitzman *et al*. have validated the accuracy and reproducibility of craniofacial skeleton CT measurements, reinforcing their usefulness for diagnosis and surgical planning [12].

3.3. Therapeutic Interventions and Monitoring

The initial management of patients was medical. Although surgery is the therapeutic option of choice for bilateral neonatal choanal atresia, it cannot be performed urgently in all cases. The transnasal endoscopic technique is the reference surgical method. However, access to these specialized procedures is often

limited in resource-constrained settings, such as in Africa, which represents a major challenge.

3.4. Patient Outcomes and Perspectives

Post-operative monitoring is crucial for the prevention of restenosis, a frequent complication. Cases of stenosis or partial stenosis can be managed using stents, as reported by several studies, notably that of Schoemen [13] in 2004, which highlights their role in the prevention of restenosis. Although the parents' perspective was not formally assessed, their informed consent to anonymization and publication of clinical data and images underscores their commitment to contributing to the advancement of medical knowledge.

4. Conclusion

CT is an indispensable tool for the radiologist, providing vital information for characterization (bone, membranous, mixed), anatomical measurements (thickening of the vomer), and the detection of associated abnormalities. These data are essential to optimize surgical management and improve the vital and functional prognosis of newborns. The role of CT is therefore central to the accurate diagnosis and surgical planning of bilateral neonatal choanal atresia.

Consent

Written informed consent was obtained from the parents of the patients for the publication of this study.

Data Availability

The datasets used and analysed during the current study are available from the corresponding author upon request.

Authors' Contributions

Bouassa Davy Melaine Kouakou coordinated the study, conducted the research, and analysed the data. Iburaima Alamun Akanji Malick Soro, Sara Carole Sanogo, Brou Lambert, Kouamé Paul Bonfils Akoli Eklou Baudouin Bravo-Tsri, Kesse Emile Tanoh, Allou Florent Kouadio, Celine Yao, and Konaté Issa contributed to the drafting and critical revision of the manuscript. All authors read and approved the final version of the manuscript.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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