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Analysis of a Case of Airway Hemangioma in a 1-Month-Old Infant with Dyspnea – A Secondary Publication

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Abstract: Infantile hemangiomas are the most common benign tumors of infancy. However, hemangiomas located in the respiratory tract are rare and could cause life-threatening events due to airway obstruction. To date, the best recommended treatment for infantile hemangioma is oral propranolol as it exhibits faster effects with fewer adverse effects as compared to systemic corticosteroid therapy. In this study, we reported a case of a 1-month-old girl who was presented with respiratory symptoms and hemangioma on the scalp. The hemangioma extended from the right base of the skull to the thoracic inlet, causing inspiratory stridor and dyspnea. Treatment with oral propranolol was initiated and her symptoms regressed. Imaging showed regression of the hemangioma. This was a rare case of skin hemangioma found on the scalp, in which the hemangioma extended from the base of the skull to the subglottis, precipitating respiratory symptoms from airway obstruction. Based on this encounter, the presentation of skin hemangioma on the head, coupled with respiratory symptoms, necessitates the use of imaging studies, such as computed tomography, ultrasound, and magnetic resonance imaging to ascertain the extent of hemangioma.

Keywords: Infant; Hemangioma; Airway; Propranolol

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1. Introduction

Infantile hemangiomas are the most common benign tumors of childhood, occurring in 3%–10% of children, with a female-to-male ratio of 3:1 [1]. More than 60% of infantile hemangiomas occur in the skin of the face, head, and neck region, while endotracheal and subglottic hemangiomas are rare, accounting for approximately 1.5% of congenital laryngeal malformations [2,3].

Subglottic hemangiomas rarely cause stridor on inhalation and are typically present in the first few months of life, with 85% of cases occurring around 6 months of age, with a male-to-female ratio of 1:2. Other comorbidities include stridor, stridor cough, cyanosis, dysphagia, hemoptysis, and growth retardation. Only 1%–2% of patients with cutaneous hemangiomas have subglottic hemangiomas. However, there were reports of cutaneous lesions in 50% of patients with subglottic hemangiomas [4]. Corticosteroids and interferon-α have

been used to treat infantile hemangiomas in the past, but propranolol is currently the first-line treatment for infantile hemangiomas [5]. In this study, a case of a 1-month-old infant who was presented with respiratory distress, diagnosed with an upper airway hemangioma, and was treated with oral propranolol was reported. This resulted in lesion regression and symptomatic improvement.

2. Case description

A 1-month-old girl diagnosed with dyspnea and stridor on exhalation was the subject of this study. TThe patient was healthy after birth, but at 3 weeks of age, she developed dyspnea and stridor on inhalation and was hospitalized at a secondary hospital for treatment. She was transferred to our hospital because her symptoms did not improve. The patient reported that her breathing was not disturbed when feeding but became more difficult. Her breathing sound was also reduced when sleeping in the prone position. At the time of hospitalization at another hospital, there were no symptoms of hypoxia or apnea. However, antibiotic treatment did not alleviate the symptoms. There were no other symptoms such as coughing. Regarding the patient's past medical history, she was born at 40 weeks gestational age, with a 3,200 g birth weight. It was a spontaneous delivery and the patient had no unusual medical history other than receiving phototherapy for hyperbilirubinemia on the 6th day of life. The patient's family had no history of respiratory disease. Upon physical examination, it was found that the patient was 54.4 cm tall (10–25th percentile) and weighed 4.2 kg (3–5th percentile). On presentation, blood pressure was determined to be 80/50 mmHg, respiratory rate of 48 breaths/min, heart rate of 150 beats/min, body temperature of 36.6°C, and an oxygen saturation of 100% on room air. Stridor was auscultated on inspiration and retraction of the upper abdominal bones was observed on breathing, but there was no cyanosis or apnea, and no wheezing or bullae were heard during auscultation.

The patient had a 15 mm × 20 mm hemangioma with indistinct borders in the right parietal scalp area (**Figure 1**).

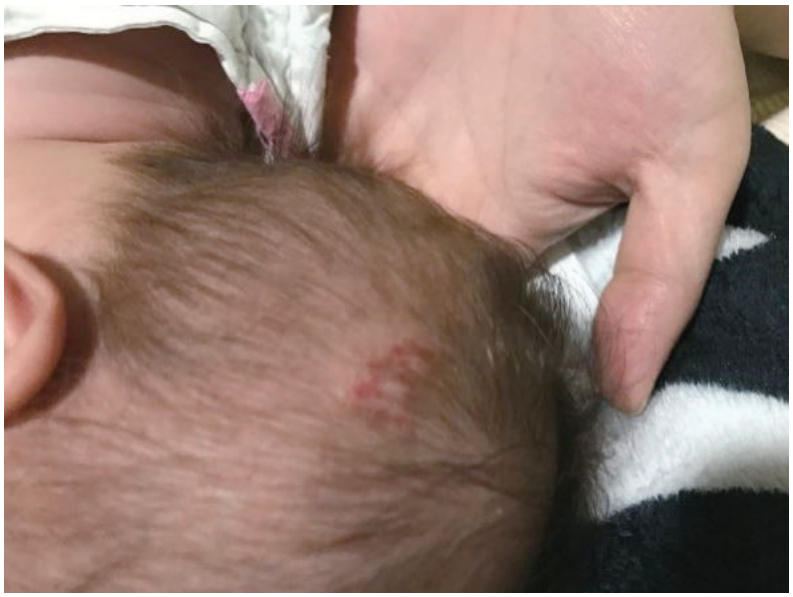

Figure 1. Hemangioma on the right parietal scalp

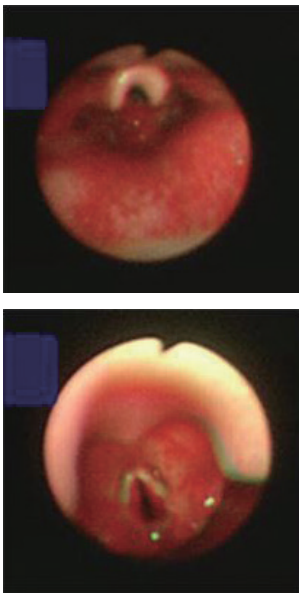

Figure 2. Initial findings of flexible bronchoscopy (A, B) show extended pink to red color mucosa with swelling of the posterior pharyngeal wall, vestibular folds, arytenoid cartilage, and vocal cord.

The chest radiograph and blood tests were unremarkable. Flexible bronchoscopy was performed, which revealed edema and redness of the vocal cords, pseudovocal cords, and subcondylar cartilage (**Figure. 2**). Nasopharyngeal aspirate specimens from other hospitalizations were tested for 14 respiratory viruses, all of which were negative. Neck cervical spine (AP) and lateral view via simple radiographs were unremarkable.

3. Treatment and patient outcome

The patient was diagnosed with laryngomalacia exacerbated by edema of the vocal cords and surrounding area due to an upper respiratory tract infection (URTI) of unknown etiology by bronchoscopy and was treated with intravenous cefotaxime (50 mg/kg, 3 times/day) and dexamethasone (0.3 mg/kg, total dose), with subsequent symptom improvements. Flexible bronchoscopy was repeated on the 4th day of hospitalization and showed significant improvement in the previous findings. The patient was discharged with the decision to follow up in the outpatient department.

Two days after discharge, the patient was readmitted to the hospital due to dyspnea. At the time of readmission, the patient's oxygen saturation dropped to 92%–93% in room air, so she was treated with a nasal cannula of 1 L/min oxygen. Due to similar symptoms as the previous hospitalization, she was suspected to have laryngomalacia with the same infection as before. The patient was treated with intravenous dexamethasone (0.6 mg/kg/day for a total of 3 doses) and inhaled steroids. However, her symptoms improved and then worsened again.

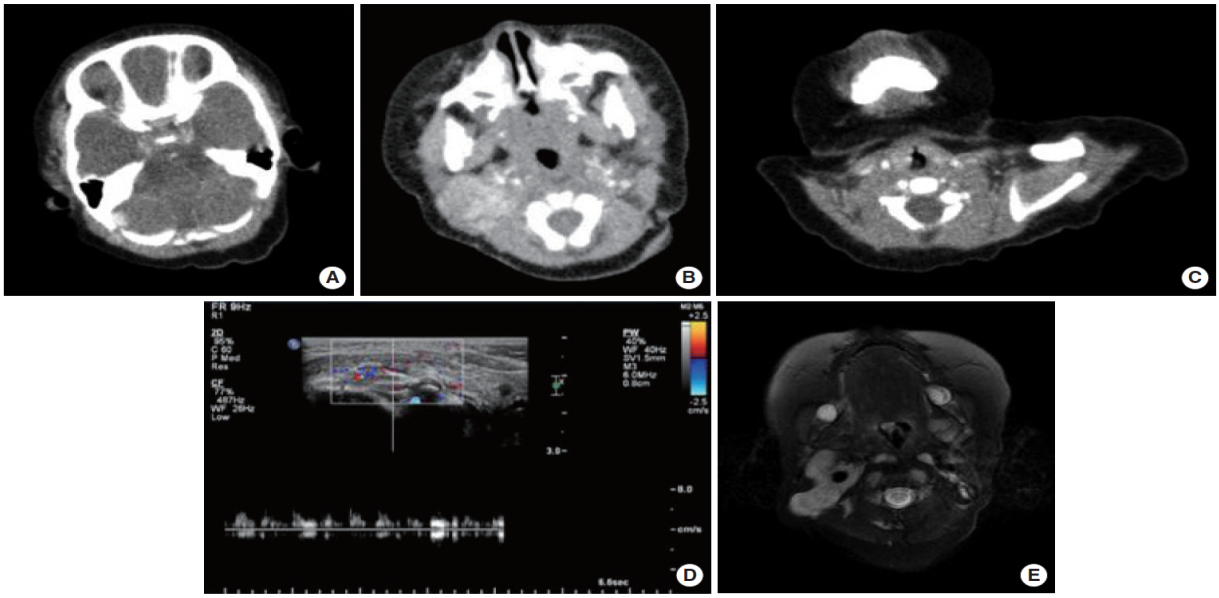

Figure 3. (A) Computed tomography (CT) image shows diffuse ill-defined, well-enhancing mass-like lesion at the parietal area. Panels B and C are continuous CT images, lesion was seen to extend to the thoracic inlet, causing a mass effect on the airway. (D) Soft tissue ultrasonography shows a hypoechoic mass-like lesion with prominent internal vascularity (venous flow noted) in the right posterior neck muscular layer which was posterior to the parotid gland. (E) Magnetic resonance image (MRI) shows a T2-weighted image high signal lesion in the right posterior neck area, including a right carotid space and posterior cervical space.

To differentiate the cause, a CT scan of the head and upper chest was performed. This showed a contrast-enhancing lesion with indistinct borders extending to the muscular layer from the right skull base to the thoracic inlet, suggesting a vascular malformation (**Figure. 3A, 3B, 3C**). It was hypothesized that the hemangioma observed in the right parietal scalp extended to the upper airway, causing airway edema. Ultrasonography

confirmed venous flow to the area of the hypoechoic mass from the right posterior neck muscle layer to the parotid gland (**Figure. 3D**), and magnetic resonance imaging (MRI) confirmed a hyperintense lesion on T2 weighted image (T2WI) in the right posterior neck region, including the right carotid artery region and posterior neck space, leading to the final diagnosis of hemangioma (**Figure. 3E**).

It was speculated that the patient's primary lesion, the upper airway, had fewer beta receptors, hence treatment with beta-blocker propranolol would be less effective. However, due to the recurrent dyspnea and the possibility that the lesion could develop into an airway obstruction, which requires tracheostomy and mechanical ventilation if it continues to increase in size, oral treatment with propranolol (0.5 mg/kg/day) with electrocardiogram (ECG) monitoring was initiated after full consultation with the guardian. On day 2, the patient did not develop dyspnea without intravenous dexamethasone or inhaled steroids and had no stridor on exhalation. The dose was increased to 1 mg/kg/day on day 3 and increased to 2 mg/kg/day on day 7, and no adverse events were observed.

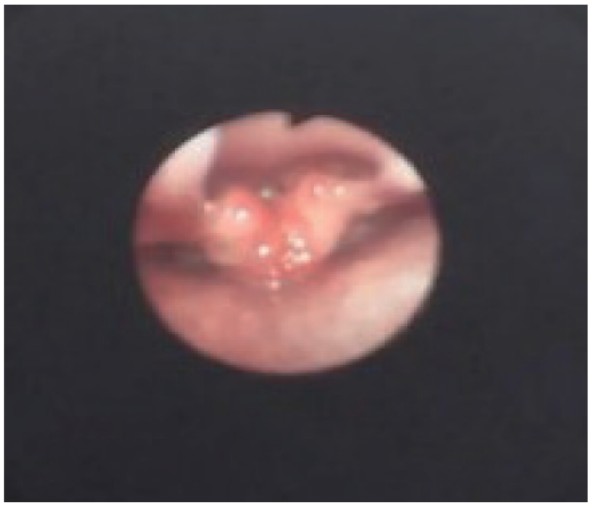

Figure 4. Follow-up bronchoscopy shows regression of hemangioma on the 7th day of treatment

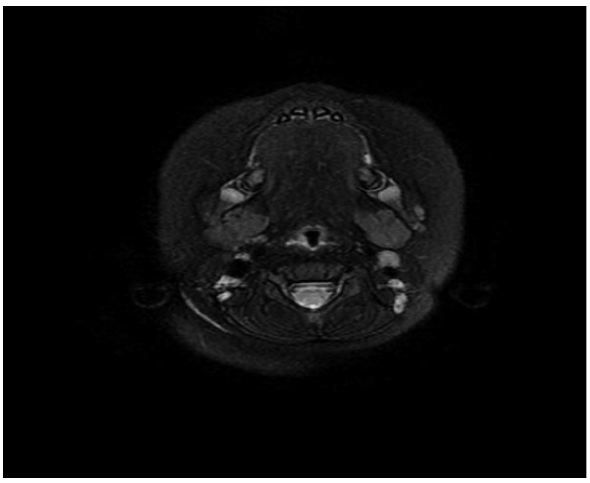

Figure 5. Brain MRI after 1 year of treatment shows regression of hemangioma

A follow-up bronchoscopy was performed on the 7th day of treatment and showed improvement of the hemangioma in the vocal cord and nearby tissues (**Figure. 4**). The patient was discharged as no adverse

drug reactions were observed. The patient continued to be treated outpatient for 1 year and subsequent MRI confirmed that the lesion disappeared. Drug treatment was discontinued and the patient has remained asymptomatic and stable ever since (**Figure. 5**).

4. Discussion

Infantile hemangiomas are the most common benign tumors in children that are often undetected at birth and diagnosed between the first 4–6 weeks of life, with a maximum increase in size over the next several months [6]. Characteristically, the lesion proliferates until approximately 1 year of age, after which there is a period of no change in size, followed by a gradual shrinkage. Most hemangiomas are small, uncomplicated, and shrink spontaneously, and do not require treatment. However, in approximately 5%–10% of children, depending on the tumor's location, they can be associated with impairment of physical functioning and require treatment due to their rapid rate of proliferation, damage to surrounding tissues, and in rare cases, life-threatening conditions [7].

Before 2008, systemic or topical corticosteroids and interferon-α were used to treat infantile hemangiomas. However, systemic corticosteroids are associated with unwanted side effects like hyperglycemia, weight gain, behavioral abnormalities, adrenal and immunosuppression, hypertension, and growth failure, while irreversible neurotoxicity, particularly spastic bilateral paralysis, was reported with the use of interferon-α. Hence, usage of both drugs requires close observation and caution [8–13]. Since the report of successful treatment with propranolol in 2008, propranolol has become the first-line treatment of choice for infantile hemangiomas [5]. Propranolol is a nonselective beta-adrenergic receptor blocker that has been used for cardiovascular disease and anxiety disorders. The exact mechanism of action of propranolol in infantile hemangiomas is not yet well understood, but it is believed to cause vasoconstriction and cellular apoptosis, thus decreasing the expression of pro-angiogenic factors, and leading to improvement in clinical symptoms [14]. Propranolol was also known to provide a faster and better response with fewer side effects than systemic steroid administration [15,16]. Adverse effects of propranolol include bradycardia, decreased blood pressure, hypoglycemia, and exacerbation of lower respiratory tract infections, including bronchospasm, gastrointestinal events, and sleep disturbances. However, treatment with propranolol has rarely been discontinued despite these events [17].

The oral propranolol hydrochloride formulation currently used in the Republic of Korea has been available since June 2016 after approval by the Food and Drug Administration (FDA) in Europe, the United States, and the Republic of Korea. It is used as a treatment for infants in a syrup formulation that can be conveniently administered. In this case, the improvement in respiratory distress was thought to have been due to hemangioma shrinkage over time upon treatment. As infantile hemangiomas often resolve spontaneously, it is important to discuss the side effects and efficacy when choosing a treatment.

Imaging studies were performed to determine the cause of the recurrent respiratory distress, which revealed a small cutaneous hemangioma on the scalp that was deeply embedded in the subcutaneous tissue and extended from the head to the upper airway. Although rare, subglottic hemangiomas have been reported primarily in patients with cutaneous hemangiomas of the facial region [18]. In this case, the cutaneous hemangioma was found on the scalp in the cephalic region and appeared to be distant from the airway, but imaging studies confirmed that it was a subglottic hemangioma that extended from the subcutaneous tissue to the airway, thus causing dyspnea. This was a rare case of a cutaneous hemangioma found on the scalp that extends from the skull base to the subglottis. The patient developed dyspnea due to the proliferation of the hemangioma, which improved with oral propranolol treatment.

5. Conclusion

This case highlighted the need for imaging studies such as CT, ultrasound, and MRI to determine the extent of the hemangioma when cutaneous hemangiomas are observed in the head region and dyspnea symptoms occur.

Disclosure statement

The authors declare no conflict of interest.

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