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Etiology and Management of Pediatric Nasal Obstruction: A Descriptive Cross-Sectional Hospital-Based Study

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Abstract

Background

Nasal obstruction is a common complaint in the pediatric population. In infants, particularly during the first few months of life, nasal obstruction may be life-threatening because they are preferential nasal breathers. This study aimed to characterize the common causes and clinical findings of nasal obstruction and describe the management modalities used in pediatric patients.

Methods

This descriptive, cross-sectional, hospital-based study included 217 pediatric patients (< 18 years) presenting with nasal obstruction at Khartoum ENT Teaching Hospital, Sudan, between July 2019 and July 2020. Patients were recruited consecutively. Data were collected using a structured questionnaire developed by the investigators and supplemented by review of patients' medical records for clinical examination findings, investigations, and management. The study variables included demographic characteristics, clinical presentation, associated symptoms, diagnostic findings, histopathological findings, and treatment modalities. Descriptive statistics were used, with categorical variables summarized as frequencies and percentages.

Results

Among 217 pediatric patients evaluated for nasal obstruction, bilateral obstruction was the predominant presentation (63.6%), with 40.0% reporting symptoms lasting more than 3 months. Nasal discharge was the most common associated symptom (74.2%), followed by snoring (47.5%) and sneezing (35.0%). Examination and investigations demonstrated decreased nasal lumen in 41.0%, complete nasal obstruction in 13.0%, and nasal foreign bodies in 16.6%. Abnormal nasopharyngeal findings were identified in 35.0%, including nasopharyngeal masses in 33.0%, with histopathology demonstrating inflammatory, benign, and malignant conditions. CT identified closed choana in 11.5%, midnasal stenosis in 3.2%, and nasolacrimal duct cysts in 1.4%. Surgical treatment was provided to 35.1% of patients, medical treatment to 33.2%, and combined medical and surgical treatment to 31.7%; adenoidectomy was the most common surgical procedure (25.7%).

Conclusion

Pediatric nasal obstruction has diverse clinical and investigative findings and requires individualized management. Nasal discharge was the most frequent associated symptom, while treatment included medical, surgical, and combined approaches. Further multicenter studies are needed to better characterize the causes and management outcomes of pediatric nasal obstruction.

Introduction

Nasal obstruction, defined as reduced or absent nasal airflow, is a common pediatric complaint with diverse congenital, inflammatory, structural, and neoplastic causes [1, 2]. Its etiology varies with age, with congenital and neonatal conditions predominating in infants [3, 4]. Because infants are preferential nasal breathers, severe obstruction may cause respiratory distress, feeding difficulties, and sleep disturbance [1]. The presentation ranges from mild symptoms to life-threatening airway compromise, with the age, onset, and laterality of obstruction providing important diagnostic clues [1, 4].

The predominant causes shift with advancing age. In infancy, inflammatory and idiopathic conditions such as neonatal rhinitis are among the most common contributors, whereas anatomical entities including choanal atresia, congenital pyriform aperture stenosis, and midnasal stenosis are less frequent but clinically critical [3, 4]. In older children, adenoid hypertrophy becomes a leading cause of nasal and nasopharyngeal obstruction, frequently accompanied by allergic rhinitis, acute and chronic rhinosinusitis, nasal foreign bodies, and septal deviation [1, 5]. Rarer causes across all age groups include sinonasal masses, meningoceles, gliomas, and congenital tumors, some of which may harbor intracranial communication and therefore warrant careful imaging before intervention [3, 6]. The clinical presentation is correspondingly variable and may include nasal discharge, snoring, mouth breathing, stertor, hyponasal voice, respiratory distress, epistaxis, and sleep-disordered breathing [1].

Prompt identification of the underlying cause is important to relieve symptoms and prevent complications [1]. Persistent obstruction and adenoid hypertrophy may contribute to sleep-disordered breathing and other long-term effects, including impaired quality of life [1]. Management depends on the underlying cause and severity and may include observation, saline irrigation, topical medications, or surgical intervention when indicated [1, 2]. Early, cause-directed treatment is particularly important in infants and children with severe or persistent obstruction [3, 4].

Despite this wide differential, data on the clinical characteristics, etiology, and management of pediatric nasal obstruction in Sudan remain scarce. This study therefore aimed to characterize nasal obstruction among pediatric patients presenting to the Ear, Nose and Throat (ENT) Department at Khartoum Teaching Hospital, focusing on age, sex, laterality, duration of obstruction, associated symptoms, underlying causes, and management modalities.

Methods

This descriptive, cross-sectional, hospital-based study was conducted at Khartoum ENT Teaching Hospital, a referral otorhinolaryngology center in Sudan, from July 2019 to July 2020. The study included 217 pediatric patients aged < 18 years who presented with nasal obstruction and were recruited consecutively over a 1-year period. Patients were eligible if their parents or legal guardians consented to participation; those aged ≥ 18 years or whose parents or legal guardians declined participation were excluded. Data were collected using a structured questionnaire covering demographic characteristics, presenting symptoms, duration and pattern of nasal obstruction, and associated symptoms. Clinical

information was subsequently abstracted from patients' medical records. The researchers did not provide, determine, or modify any treatment or clinical intervention; all clinical and management information reflected routine care provided by the treating physicians.

The study variables included age, sex, laterality and pattern of nasal obstruction, duration of symptoms, associated symptoms, clinical examination findings, diagnostic test results, imaging findings, histopathological findings, and treatment modalities. Descriptive statistics were used to summarize the study population and clinical findings, with categorical variables presented as frequencies and percentages. Percentages were calculated using the total study population (N = 217) unless a subgroup denominator was explicitly indicated. Due to the descriptive nature of the study, no inferential statistical tests were performed. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki and its subsequent amendments and was reviewed and approved by the Ethics Committee of Sudan National Medical Specialization Board, Khartoum, Sudan. Written informed consent was obtained from the parents or legal guardians of all participants before enrollment, and age-appropriate assent was obtained from participants capable of providing assent. Data were analyzed using IBM SPSS Statistics version 25 (IBM Corp., Armonk, New York).

Results

Table 1 presents the baseline characteristics of the study cohort. A total of 217 pediatric patients were analyzed. There was a male predominance, with males accounting for 58% and females for 42% of patients. The age distribution was 43% aged < 5 years, 23% aged 5–10 years, 14% aged 10–15 years, and 20% aged 15–18 years. Bilateral nasal obstruction was more common than right- or left-sided obstruction, accounting for 63.6%, 24.4%, and 12%, respectively. Obstruction was continuous in 63.6% of patients, intermittent in 36.4%, and seasonal in 20.7%. Duration of nasal congestion was more than 3 months in 40% of patients, followed by acute symptoms lasting less than 1 week in 22.4%, symptoms lasting 1 week to 3 months in 21.0%, and symptoms present since birth in 16.6%. The most common associated symptom was nasal discharge (74.2%), including bilateral discharge in 46%, right-sided discharge in 19.5%, and left-sided discharge in 8.8%. Other associated symptoms included snoring (47.5%), sneezing (35%), sleep apnea (27.6%), voice change (24.4%), respiratory distress (12.4%), epistaxis (12.4%; right-sided 5.5%, bilateral 4.6%, and left-sided 2.3%), nasal mass (11%), and epiphora (3.2%) (Table 1).

Table 1
Baseline characteristics of pediatric patients with nasal obstruction (N = 217)

Characteristic	Count (N)	Percentage (%)
Age group, years		
• < 5	93	43.0
• 5–10	50	23.0
• 10–15	30	14.0
• 15–18	44	20.0
Sex		
• Male	126	58.0
• Female	91	42.0
Bilateral obstruction	138	63.6
Right-sided obstruction	53	24.4
Left-sided obstruction	26	12.0
Continuous obstruction	138	63.6
Intermittent obstruction	79	36.4
Seasonal obstruction	45	20.7
Duration of obstruction		
• Since birth	36	16.6
• < 1 week	49	22.4
• 1 week–3 months	46	21.0
• > 3 months	86	40.0
Nasal discharge	161	74.2
Snoring	103	47.5
Sneezing	76	35.0
Sleep apnea	60	27.6
Voice change	53	24.4
Respiratory distress	27	12.4
Epistaxis	27	12.4

Characteristic	Count (N)	Percentage (%)
Nasal mass	24	11.0
Epiphora	7	3.2

Examination and investigations identified several structural and obstructive findings. Septal deviation was present in 1.8% of patients, including 0.5% with septal deviation alone and 1.4% with nasal bone fracture. Nasal bone fracture was identified in 3.2%, while the nasal lumen was decreased in 41% and completely obstructed in 13%. The cold spatula test was positive in 21%, negative in 41%, and not performed in 40%. Among patients with a negative test, inferior turbinate hypertrophy was identified in 16.6%, with 8.8% confirmed by Computed Tomography (CT). The catheter bypass test was positive in 0.5%, negative in 15%, and not performed in 84.5%. CT of the nose and paranasal sinuses identified closed choana in 11.5%, midnasal stenosis in 3.2%, and nasolacrimal duct cysts in 1.4%. Nasal examination identified foreign bodies in 16.6% of patients, including 13.4% on the right and 3.2% on the left, while nasal cavity masses were identified in 13.4%. CT confirmed nasal cavity masses in 11.1%, and biopsy was performed in 6.9%, showing predominantly inflammatory tissue, with teratoma and non-Hodgkin lymphoma each accounting for 0.5%. Abnormal nasopharyngeal findings were identified in 35% of patients, including nasopharyngeal masses in 33%. The masses were predominantly described as polypoid, with other features including a regular surface, solitary appearance, bleeding on touch, and ulceration. Nasopharyngeal X-ray supported the presence of a mass in 32.3% of patients, while CT was required for confirmation in 5.5%. Biopsy was performed in 5.5% of nasopharyngeal masses, with histopathological findings including nasopharyngeal carcinoma, rhabdomyosarcoma, meningocele, and inflammatory tissue (Table 2).

Table 2
Examination and investigation findings among pediatric patients with nasal obstruction.

Investigation / Examination	Finding	Count (N)	Percentage (%)
Physical examination			
	Decreased nasal lumen	89	41.0
	Complete nasal obstruction	28	13.0
	Septal deviation alone	1	0.5
	Nasal bone fracture alone	4	1.8
	Nasal bone fracture with septal deviation	3	1.4
Cold spatula test			
	Positive	46	21.0
	Negative	89	41.0
	Not performed	87	40.0
Among patients with a negative cold spatula test			
	Inferior turbinate hypertrophy	36	16.6
	Inferior turbinate hypertrophy confirmed by computed tomography	19	8.8
Catheter bypass test			
	Positive	1	0.5
	Negative	33	15.0
	Not performed	183	84.5
Nasal examination			
	Right nasal foreign body	29	13.4
	Left nasal foreign body	7	3.2
	Nasal cavity mass	29	13.4
Computed tomography of the nose and paranasal sinuses			
	Closed choana	25	11.5

Note: Percentages are based on the total study population (N = 217) and findings were not mutually exclusive.

Investigation / Examination	Finding	Count (N)	Percentage (%)
	Midnasal stenosis	7	3.2
	Closed choana and midnasal stenosis	6	2.8
	Midnasal stenosis alone	1	0.5
	Nasolacrimal duct cyst	3	1.4
	Nasal cavity mass confirmed	24	11.1
Biopsy of nasal cavity mass			
	Inflammatory tissue	13	5.9
	Teratoma	1	0.5
	Non-Hodgkin lymphoma	1	0.5
Nasopharyngeal examination			
	Abnormal findings	76	35.0
	Nasopharyngeal mass	72	33.0
	Polypoid mass	50	23.0
	Regular surface	41	19.0
	Solitary mass	26	12.0
	Bleeding on touch	6	2.8
	Ulcerated mass	3	1.4
Nasopharyngeal x-ray			
	Mass identified	70	32.3
Computed tomography of the nasopharynx			
	Required for confirmation	12	5.5
Biopsy of nasopharyngeal mass			
	Nasopharyngeal carcinoma	8	3.7
	Rhabdomyosarcoma	2	0.9
	Meningocele	1	0.5

Note: Percentages are based on the total study population (N = 217) and findings were not mutually exclusive.

Investigation / Examination	Finding	Count (N)	Percentage (%)
	Inflammatory tissue	1	0.4

Note: Percentages are based on the total study population (N = 217) and findings were not mutually exclusive.

Treatment modalities are shown in Fig. 1. Surgical treatment was provided to 35.1% of patients, including adenoidectomy (25.7%), foreign body removal (16.6%), choanoplasty (11.5%), polypectomy (10.1%), nasal bone reduction (3.2%), dacryocystorhinostomy (DCR) (1.4%), septal repair (0.5%), and nasal dilatation (0.5%). Medical treatment was provided to 33.2% of patients and included local nasal decongestants (71.9%), local nasal steroids (42.9%), antibiotics (40.1%), systemic decongestants (39.6%), antihistamines (31.3%), systemic steroids (11.5%), radiotherapy (4.6%), and chemotherapy (4.1%). Combined medical and surgical treatment was provided to 31.7% of patients. Individual surgical and medical treatment modalities were not mutually exclusive (Fig. 1).

Discussion

In this hospital-based cohort of pediatric patients presenting with nasal obstruction, the condition most often presented as bilateral obstruction accompanied by nasal discharge, with a substantial proportion of children having symptoms lasting more than three months. Clinical examination and investigations revealed a wide spectrum of underlying pathology, ranging from reduced nasal patency and nasal foreign bodies to structural anomalies such as choanal atresia and midnasal stenosis. Nasopharyngeal masses were also common, with histopathology spanning inflammatory, benign, and malignant conditions. Management was correspondingly varied, delivered through medical, surgical, and combined approaches in broadly similar proportions, with adenoidectomy the most frequently performed surgical procedure. Overall, these findings show that pediatric nasal obstruction in this setting encompassed a heterogeneous spectrum of symptoms, structural abnormalities, and nasal and nasopharyngeal pathology requiring individualized approaches to evaluation and management.

The predominance of adenoidectomy among the surgical procedures performed in this cohort is broadly consistent with contemporary pediatric otolaryngology practice, in which adenoid hypertrophy is recognized as one of the leading causes of nasal obstruction in young children and adenoidectomy remains one of the most commonly performed pediatric operations for obstructive and chronic sinonasal disease [5, 7, 8]. Adenoid hypertrophy has its major growth period between one and two years of age and is a well-established contributor to nasal obstruction, snoring, and obstructive sleep-disordered breathing, with surgery typically reserved for children in whom a trial of medical therapy, including intranasal corticosteroids, has failed [1, 2].

Regional data from sub-Saharan Africa similarly identify hypertrophic adenoids and allergic rhinitis as among the most frequent pediatric ENT diagnoses, supporting the pattern observed in the present setting [9]. However, the comparatively broad range of procedures required in this cohort including

foreign body removal, choanoplasty, and management of nasopharyngeal masses likely reflects the heterogeneous etiologies of nasal obstruction encountered, spanning nasal foreign bodies, choanal atresia, midnasal stenosis, and benign and malignant nasopharyngeal lesions [6, 10]. This breadth mirrors published series describing the diverse congenital, inflammatory, structural, and neoplastic causes of pediatric nasal masses and obstruction, in which imaging such as CT plays a key role in defining lesions that are not amenable to a single uniform treatment [1, 6]. Accordingly, the treatment profile in this study is best interpreted as a descriptive account of management applied across differing underlying diagnoses rather than as a head-to-head comparison of the effectiveness of medical versus surgical therapy, an important distinction given that the optimal approach, medical, surgical, or combined, is dictated by the specific underlying cause rather than by the symptom of obstruction alone [11].

CT imaging in pediatric nasal obstruction should be reserved for defined indications rather than used routinely, given radiation exposure and the frequent need for sedation in young children [12]. Clinical history and nasal endoscopy are first-line, with imaging used for inconclusive, persistent, or complicated presentations and for surgical planning [13]. Per the American Academy of Otolaryngology–Head and Neck Surgery (AAO-HNS) consensus, CT is clearly indicated at any age for suspected tumor, suspected complications of sinusitis, and before sinus surgery, as well as for chronic sinusitis that has failed appropriate medical management (with or without adenoidectomy); it is not indicated for acute uncomplicated sinusitis or a "cold" of under 10 days [12]. For structural causes, noncontrast CT is the modality of choice, it is the diagnostic standard for choanal atresia and pyriform aperture stenosis, distinguishing bony from membranous obstruction and guiding surgery (the nose should first be suctioned and decongested to avoid mimicking a plate or mass) [13, 14]. When obstruction is due to a mass, ultrasound is first-line for superficial lesions and magnetic resonance imaging (MRI) is preferred to characterize soft tissue, nasopharyngeal tumors, and intracranial extension, with contrast-enhanced CT complementing it for bony detail; midline masses must be imaged before any biopsy to avoid a cerebrospinal fluid leak [6, 15]. Throughout, radiation stewardship favors ultrasound or MRI where they answer the question, reserving CT for bony/structural detail or preoperative planning [12, 15].

Current pediatric otolaryngology guidance recommends that management of nasal obstruction be directed by the underlying cause and supported by appropriate clinical assessment [1]. For adenoid-related obstruction, key indications include persistent nasal airway obstruction and sleep disturbance, with the adenoids assessed by examination, endoscopy, or imaging as needed [1, 7]. For pediatric chronic rhinosinusitis, consensus supports clinical evaluation supplemented by nasal endoscopy and/or CT when appropriate, with medical therapy generally preceding surgery [12]. Imaging is not routinely required for uncomplicated initial sinusitis but is useful in persistent or chronic disease and when anatomic abnormalities or complications are suspected [12, 16].

The diversity of treatment approaches in our study cohort underscores that the underlying cause should be established before treatment is selected [1]. The identification of nasal foreign bodies and structural abnormalities requiring procedural intervention, alongside nasal cavity and nasopharyngeal masses

requiring imaging and, at times, biopsy, indicates that persistent or atypical nasal obstruction warrants evaluation beyond empirical medical therapy [1, 6]. Nasal endoscopy and appropriately selected imaging help characterize suspected structural or obstructive lesions, and histopathological confirmation may be necessary when a mass is present [6]. Taken together, these findings support a systematic, cause-directed approach to pediatric nasal obstruction rather than reliance on any single treatment strategy [1, 6].

This study has strengths. Information was collected prospectively from a defined pediatric cohort with consecutive recruitment, and questionnaire data were integrated with clinical examination, investigation, histopathological, and management information from medical records. This approach allowed the broad spectrum of clinical findings and management strategies in children presenting with nasal obstruction to be characterized in detail. Nonetheless, some limitations should be acknowledged. The study was conducted at a single tertiary ENT referral hospital, which may limit generalizability and introduce referral and case-mix bias. Its descriptive cross-sectional design precludes assessment of associations, causal relationships, or comparative treatment effectiveness. Treatment modalities were not mutually exclusive, and management decisions were made by the treating physicians rather than according to a predefined study protocol. Because certain investigations were performed only in selected patients, subgroup denominators varied. Finally, standardized follow-up and treatment outcomes were not captured; the reported management frequencies should therefore be interpreted as descriptive practice patterns rather than as evidence of treatment effectiveness.

Conclusion

Pediatric nasal obstruction in this cohort had diverse clinical, structural, and pathological findings, with nasal discharge and bilateral obstruction being the most frequent presenting features. Findings included nasal foreign bodies, reduced or complete nasal lumen obstruction, nasopharyngeal masses, and structural abnormalities such as choanal closure and midnasal stenosis. Management included medical, surgical, and combined approaches, with adenoidectomy being the most frequently reported surgical procedure. Pediatric patients presenting with nasal obstruction warrant careful clinical evaluation for structural abnormalities, foreign bodies, and nasal or nasopharyngeal masses. In this cohort, nasal foreign bodies and nasopharyngeal masses were identified in a substantial proportion of patients, highlighting the importance of considering these findings during evaluation, particularly when symptoms are persistent, unilateral, or atypical. Appropriate use of endoscopic examination and imaging may assist in characterizing suspected structural or obstructive abnormalities, while histopathologic evaluation may be appropriate when a nasal or nasopharyngeal mass requires tissue diagnosis. Larger multicenter studies are warranted to further characterize the causes of pediatric nasal obstruction and evaluate outcomes across different management approaches.

Abbreviations

AAO-HNS

Academy of Otolaryngology–Head and Neck Surgery
CT
Computed Tomography
DCR
Dacryocystorhinostomy
ENT
Ear, Nose and Throat
MRI
Magnetic Resonance Imaging

Declarations

Author Contribution

Conceptualization, Samra Elbashir; Methodology, Samra Elbashir and Ayman Ali; Formal analysis, Samra Elbashir and Ayman Ali; Writing-original draft preparation, Samra Elbashir and Noun Abdulgader; Writing-review and editing, all authors; Supervision, Abu Sufian and Siddig Kardman. All authors have read and agreed to the final version of the manuscript.

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Figures

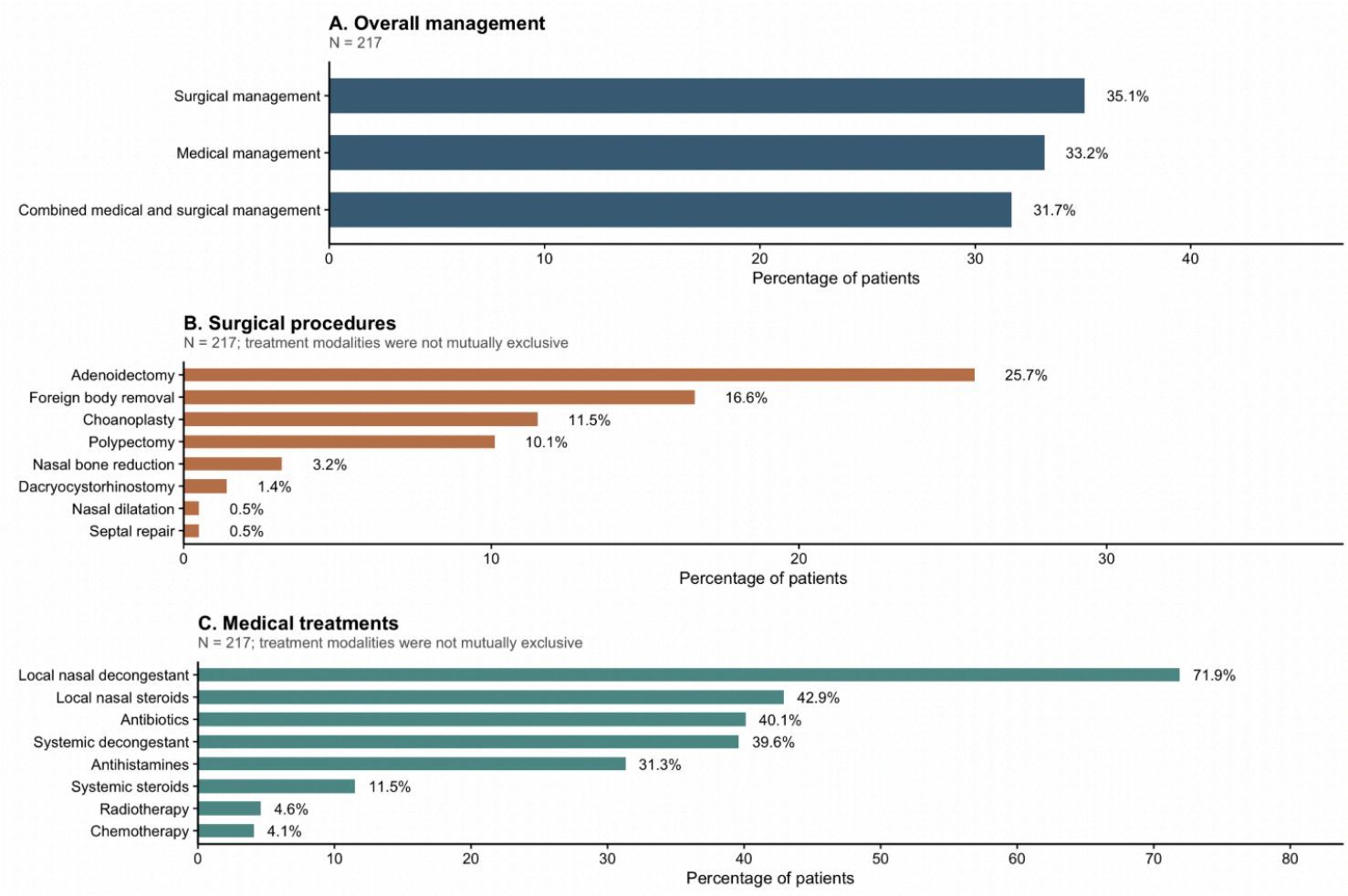


Figure 1

Management modalities among pediatric patients with nasal obstruction.