Pediatric Septoplasty: A Case Series Study

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ABSTRACT

Background: The controversy of pediatric septoplasty exists. Septoplasty is an uncommon procedure in pediatric populations. Still, there is a lack of consensus about the age and extent of septoplasty in this age group. Moreover, delayed surgical correction of septal deviation may adversely affect normal nasal and facial growth. There is a recent trend toward major cartilage work in pediatric patients with severe septal deviation.
The aims of this study are to evaluate the health-related quality of life in pediatric patients after septoplasty and to assess the early as well as the long-term outcomes of surgery.
Ethical Approval: The Collegiate Committee for Medical Research Ethics approved the study with approval code CCMRE-MED-22-1 on 17/01/2022. It aligns with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.
Patients and methods: This case series study was conducted on 25 children (24 males and one female) who underwent septoplasty for severe symptomatic septal deviation. This assessment was done three months and 1-year post-operatively to assess the operation's effect on the quality of life and overall patient satisfaction. The follow-up was done utilizing NOSE and VAS scales and they were compared with pre-operative ones. In most cases, the cartilage was delivered, remodelled, and reinserted.
Results: The mean age of patients was 8.5±3.8 years. There were 24 (96.31%) males and 1 (3.69%) females. The current study reveals significant differences in postoperative NOSE and VAS scores compared to pre-operative ones at three months and one year post-operatively with *P-values* <0.001. Synechia, infection due to crust formation, and residual deviation were the common complications in this study.
Conclusion: The significant improvement in quality of life and the low complication rate justifies septoplasty in the pediatric age group in indicated cases, even if considerable cartilage work was needed.

Keywords: Pediatric, Septoplasty, Quality of life.

جراحة الحاجز الأنفي للأطفال: دراسة حالة متسلسلة

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الخلاصة

الخلفية: الجدل حول رأب الحاجز الأنفى للأطفال موجود. يعتبر رأب الحاجز الأنفى إجراءً غير شائع لدى الأطفال. ومع ذلك ، لا يزال هناك نقص فى الإجماع حول عمر ومدى عملية رأب الحاجز الأنفى فى هذه الفئة العمرية. علاوة على ذلك ، قد يكون للتصحيح الجراحى المتأخر لانحراف الحاجز آثار سلبية على النمو الطبيعى للأنف والوجه.
تهدف هذه الدراسة إلى تقييم نوعية الحياة ذات الصلة بالصحة لدى مرضى الأطفال بعد رأب الحاجز الأنفى وتقييم النتائج المبكرة وكذلك طويلة الأجل للجراحة.
الموافقة الأخلاقية: تمت الموافقة على الدراسة من قبل اللجنة الجماعية لأخلاقيات البحث الطبى مع رمز الموافقة-CCMRE MED-22-1وهى تتماشى مع إعلان هلسنكى لعام ١٩٦٤ وتعديلاته اللاحقة أو المعايير الأخلاقية المماثلة.
المرضى والطرق: هذه دراسة حالة متسلسلة أجريت على ٢٥ طفلاً (٢٤ ذكرًا وأنثى واحدة) خضعوا لعملية رأب الحاجز الأنفى بسبب انحراف الحاجز الحاد المصحوب بأعراض. تمت المتابعة باستخدام مقاييس NOSE و VAS وتمت مقارنتها بمقاييس ما قبل الجراحة. تم إجراء هذا التقييم بعد ٣ أشهر وسنة واحدة بعد الجراحة من أجل تقييم تأثير العملية على نوعية الحياة ورضا المريض بشكل عام.

النتائج: كان متوسط عمر المرضى ٨.٥ ± ٣.٨ سنة. كان هناك ٢٤ (٩٦.٣١٪) من الذكور و ١ (٣.٦٩٪) من الإناث. تكشف الدراسة الحالية عن فروق ذات دلالة إحصائية فى درجات ما بعد الجراحة الأنف و VAS بالمقارنة مع تلك قبل الجراحة. فى عمر ٣ أشهر وبعد عام واحد بعد الجراحة بقيم .P <0.001 كانت الالتصاقات والالتهاب بسبب تكوين القشرة والانحراف المتبقى هى المضاعفات الشائعة التى تمت مواجهتها فى هذه الدراسة.

الخلاصة: التحسن الملحوظ فى نوعية الحياة وانخفاض معدل المضاعفات يبرر رأب الحاجز الأنفى فى الفئة العمرية للأطفال فى الحالات المشار إليها.

الكلمات المفتاحية : طب الأطفال ، جراحة الحاجز الأنفى ، جودة الحياة .

INTRODUCTION

Historically, pediatric septal surgery has been performed since the 1970s.[1] Septoplasty is an uncommon procedure in pediatric populations. Still, there is a lack of consensus about the age and extent of septoplasty in this age group. Performing nasal surgery on children has been the subject of controversy among surgeons.[2] The nasal septum is a midline structure responsible for giving the nose its central position. When significantly deviated, it might result in functional and esthetic problems.[3]

There is concern that surgical intervention on a developing structure can adversely affect the normal growth of the nose and face [4]. However, most recent studies have indicated that delay in surgical correction of the deviated septum may cause children to develop misalignment of their dentition, abnormal facial growth and worsening progression of their respiratory problems.[5] Furthermore, pediatric septoplasty does not seem to affect midfacial growth.[6] Recently, there was a trend toward removal of the cartilage and re-insertion after remodelling in pediatric patients, [7] which is called in some papers external septoplasty.[7,8]

The aims of this study are to evaluate the health-related quality of life in pediatric patients after septoplasty and to assess the early as well as the long-term outcomes of surgery.

PATIENTS AND METHODS

Study Design and Setting

A case series study was conducted on 25 pediatric patients (24 males and one female) who underwent a limited septoplasty. The study was conducted in Mosul teaching and private hospitals. This retrospective study dealt with the data on cases of pediatric septoplasty over the last 12 years.

Ethical Approval

The Collegiate Committee for Medical Research Ethics approved the study with approval code CCMRE-MED-22-1 on 17/01/2022. It aligns with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Sampling

The study sample included a pediatric age group aged 4 - 16 years. They were complaining of severe nasal obstruction due to nasal septal deviation. All patients were assessed in the outpatient department (OPD) or private clinics. A complete ENT examination, including nasal endoscopy in cooperative patients, was done, and the necessary investigations, including radiology in the form of X-rays of the paranasal sinuses, were requested. The selection of patients was based on the criteria mentioned below. After selection, a full explanation and discussion were done with the child's parents and caregiver about the fundamental goal of doing the operation. Informed consent was obtained from parents and caregivers willing to participate in the study.

Inclusion Criteria

Patients with severe nasal obstruction with or without sleep disturbance in age less than 16 years old with no benefit from medical treatment for at least three months were included. Treatment included topical nasal medication (both saline sprays and topical steroids drops or sprays), antihistamines, anti-interleukins, and repeated courses of antibiotics in cases of repeated infections.

Exclusion Criteria

Patients complaining of nasal obstruction due to adenoid hypertrophy or severe rhinitis without marked septal deviation. A detailed patient history revealed that the most common cause of these deformities was nasal trauma in early childhood (84%). Recent infection or bleeding tendency cases were also excluded from the study.

In this study, the assessment methods adopted to evaluate the severity of symptoms were subjective assessment scales, including Nasal Obstruction Symptom Evaluation Scale (NOSE) and a 10 cm Visual Analogue Scale (VAS). The NOSE scale (Table 1) consists of 5 items; each scored from 0 – 4, where 0=no problem, 1=very mild problem, 2=moderate problem, 3=fairly bad problem, and 4=severe problem. The total raw score range from 0-20, and the total scale score ranges from 0-100 by multiplying the raw score by 5. A score of 5-25 is considered mild; a score of 30-50 is moderate; a score of 55-75 is severe; a score of 80-100 is considered extreme nasal obstruction.

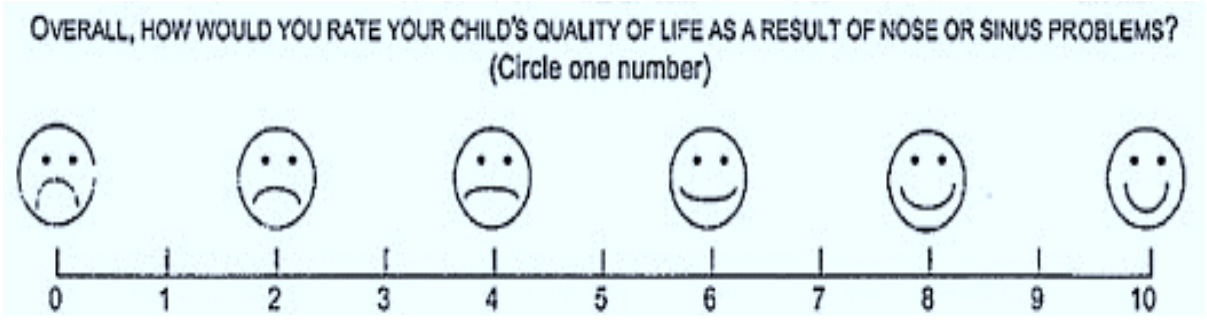
Table(1): Nasal Obstruction Symptom Evaluation (NOSE) scale.[9,10]

Over the past month, how much of a problem were the following conditions for you?

	no problem	very mild problem	moderate problem	fairly bad problem	severe problem
1. Nasal congestion or stuffiness	0	1	2	3	4
2. Nasal blockage or obstruction	0	1	2	3	4
3. Trouble breathing through my nose	0	1	2	3	4
4. Trouble sleeping	0	1	2	3	4
5. Unable to get enough air through my nose during exercise or exertion	0	1	2	3	4

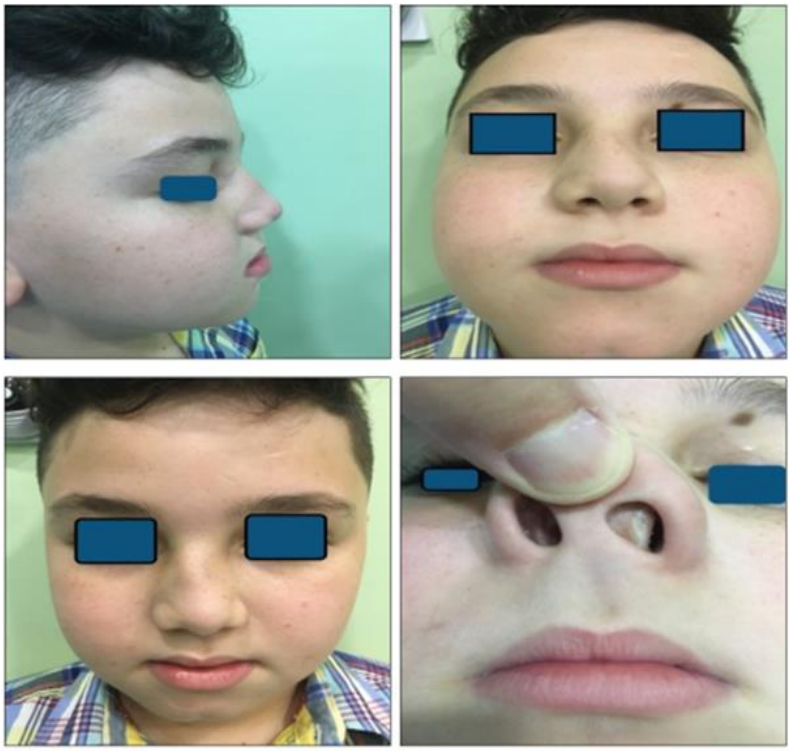
Circle the correct response

Regarding the VAS score, it ranges from 0 (worst possible) to 10 (best possible) satisfaction on a 10 cm line (Figure 1); the VAS score was used to visualize the global and overall satisfaction of patients and their parents with the outcomes of surgery. Both NOSE and VAS scales were used pre-operatively for all patients. Post-operatively, the NOSE scale was done at three months and one year, while the VAS scale was done at 1-year post-operatively.



Figure(1): Visual Analogue Scale of Quality of Life.[11]

Photographic documentations were necessary before doing the operation with the permission of the parents (Figure 2).



Figure(2): 7-year-old patient with severe septal deviation.

The Operative Procedure

Under general anaesthesia, the patient is supine with 45º head elevation supported by a suitable head ring. The endotracheal tube is secured at the midline to avoid facial asymmetry. Infiltration of 1% lidocaine with 1:100000 adrenaline is done at the caudal end of the septum and in the submucoperiosteal/mucoperichondrial plane. A right hemitransfixation incision is done at the mucocutaneous transition at the nasal vestibule. The mucosal elevation is done by a suitable elevator in the subperichondrial/periosteal plane bilaterally. Elevation of the mucosa was continued up to the junction between the quadrilateral cartilage, with the perpendicular plate of ethmoid superiorly and the vomer inferiorly. Elevation of the mucosa inferiorly was done only when indicated to avoid injury to the incisive nerves. If the nasal spine is deviated, it is **corrected to the midline by gentle fracture without complete detachment**.

This was followed by limited excision of the deviated cartilage and bones to avoid unwanted effects on nasal growth. **In most cases, the delivery approach was made; the quadrilateral cartilage was delivered, reconstructed, reshaped, and then repositioned again**.[7,8] In many cases, creating a columellar pocket was necessary, in which the repositioned caudal end of the quadrilateral cartilage was done. A 2-level septocolumellar suture technique in which 4/0 vicryl sutures were used; the upper suture was taken at the anterior septal angle at the upper point, and the lower one sutured at the posterior septal angle at the lower point of the caudal end. Then the upper and lower sutures were sutured to the soft tissue between the medial crura of the lower lateral cartilages. Then the cartilage was fixed to the nasal spine for further support. Transseptal quilting sutures were done, and closure of the hemitransfixation incision using the same suture [Figure 3 (A- F)].

All patients were prescribed broad-spectrum antibiotics for one week post-operatively. In the majority of cases, small anterior vaseline packs were inserted into both nasal cavities. In some cases, this was preceded by the insertion of appropriate size internal nasal splints in older cooperative children (older than 12 years) which were later removed under local anaesthesia.

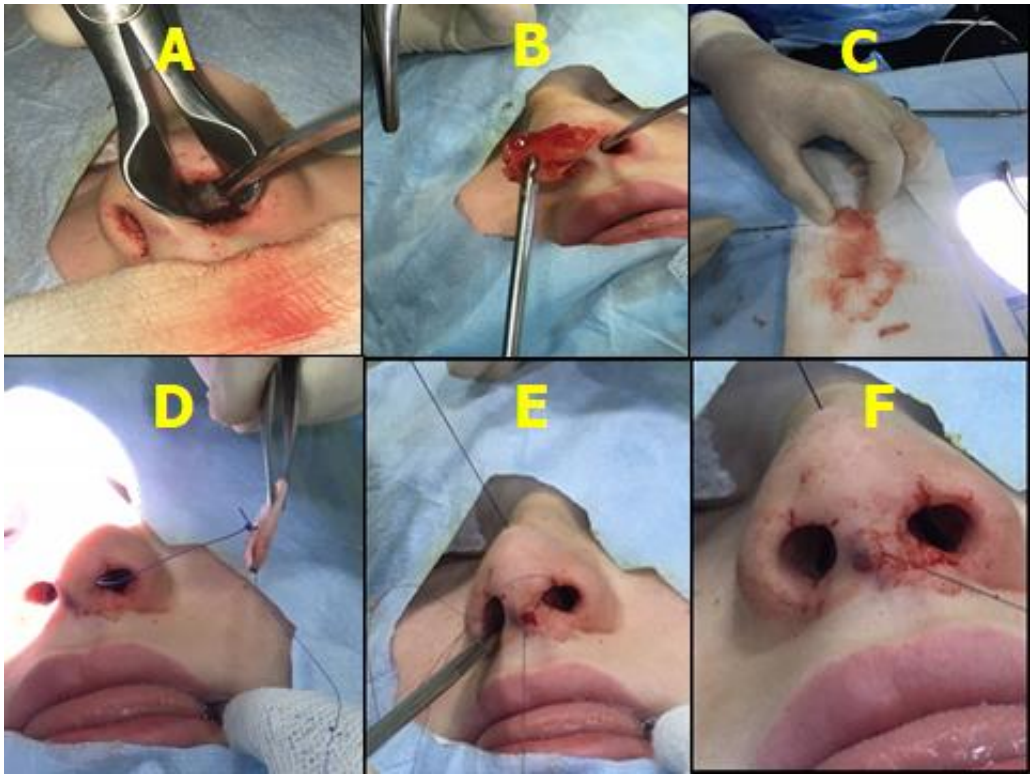


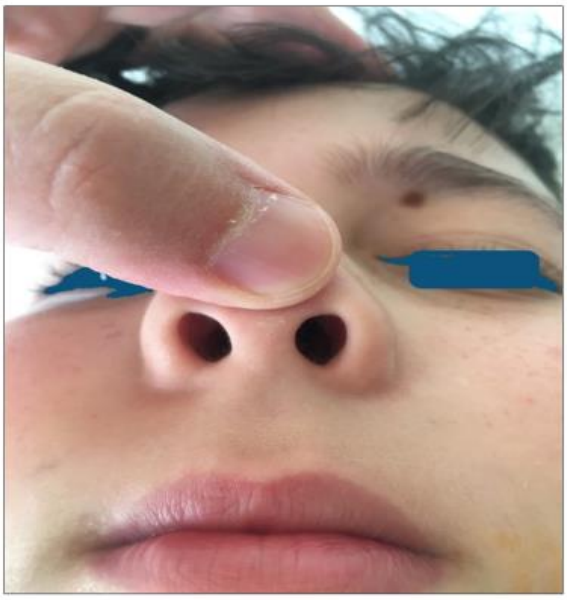
Figure 3 (A-F): Steps of the pediatric septoplasty.

The follow-up:

All patients were prescribed topical nasal decongestant for one week and nasal wash for 2-4 weeks. The first visit was on the first postoperative day to remove the nasal pack if present. The further postoperative visits included: 7 days to remove the internal splints, if present, at 1 and 3 months. Patients were instructed for follow-ups, during which the survey on nasal obstruction and the effect of surgery on quality of life was done.

Generally, the minimum period of follow-up was one year. The VAS was used at the last follow-up at one year for the patients' and their parents' overall satisfaction with the outcome of surgery. Subjective evaluation of patients using the NOSE scale was done at three months and one year. Photographic documentation after surgery was also done (Figure 4).

Nine patients aged five years or less needed a longer follow-up period. This represented 36% of cases, and they were followed for up to 2 years using NOSE and VAS scales. Six patients reached 18 years, representing 24% of cases; they were contacted and examined for the possible need for revision septoplasty or septorhinoplasty, accomplished in 3 patients (12%). The other 3 cases; either refused revision surgery (1 case) or missed follow-up (2 cases).



Figure(4): 1 year after surgery.

RESULTS

In the current study, the parameters were collected from twenty-five (25) patients who underwent septoplasty, and the results were calculated using IBM© SPSS® STATISTICS version 25. The minimum age was four years, and the maximum was 16. The mean age was 8.5±3.8 years. Patients can be grouped according to age into three categories (Table 2), with the maximum number (13 cases) in the age group from 4-8 years.

Table(2): Age groups cluster.

Age group	Frequency	Percentage
4 - 8 years	13	52%
9 - 12 years	8	32%
13 -16 years	4	16%
Total	25	100%

As shown above, the operation rate decreased in the late teenage years. Regarding sex distribution, in the current study, 24 (96.31%) patients were males, and one was female. Regarding the indications of surgery, nasal blockage due to septal deviation was the cause in all patients, including cases with sleep disturbance.

All patients answered the pre-operative NOSE scale before the operation, and the results were multiplied by five, so the range of results of nasal problems will be between (0-100). These results were arranged as follows; mild (5-25), moderate (30-50), severe (55-75), and extreme (80-100).

The pre-operative NOSE scale mean was 82.0±7.9. The value of 3 months postoperative NOSE Scale mean was 21.8±14.05. Finally, the value of the 1-year postoperative NOSE scale mean was 11.0±8.0. These answers were gathered in (Table 3).

Table(3): NOSE scale pre-operative, three months and one year post-operatively.

Pre-operative NOSE scale		Frequency	Three months postoperative NOSE scale		Frequency	1-year postoperative NOSE scale		Frequency
Severe (32%)	70.00	4 (16%)	Mild (68%)	5.00	4 (16%)	Mild (96%)	0.00	4 (16%)
	75.00	4 (16%)		10.00	3 (12%)		5.00	5 (20%)
Extreme (68%)	80.00	4 (16%)		15.00	6 (24%)		10.00	6 (24%)
	85.00	6 (24%)		20.00	2 (8%)		15.00	5 (20%)
	90.00	5 (20%)		25.00	2 (8%)		20.00	3 (12%)
			Moderate (32%)	30.00	2 (8%)		25.00	1 (4%)
				35.00	1 (4%)	Moderate (4%)	30	1 (4%)
	95.00	2 (8%)		40.00	3 (12%)			
				50.00	2 (8%)			
25 (100%)			25 (100%)			25 (100%)		

The pre-operative VAS measures were considered to assess the pre-operative quality of life; the pre-operative VAS score mean 8.1±0.85. After one year of follow-up, a VAS score was presented again. The value of the 1-year postoperative VAS score mean was 2.72±1.42. These results were arranged as shown in (Table 4).

Table(4): VAS scale pre-operatively and 1-year post-operatively.

Pre-operative VAS	Frequency		Postoperative one-year VAS	Frequency	
Moderate (4%)	6.00	1 (4%)	Mild (92%)	0.00	1 (4%)
Severe (96%)	7.00	4 (16%)		1.00	5 (20%)
	8.00	10 (40%)		2.00	4 (16%)
	9.00	10 (40%)		3.00	8 (32%)
				4.00	5 (20%)
			Moderate (8%)	5.00	1 (4%)
				6.00	1 (4%)
25 (100%)			25 (100%)		

The pre-operative and three months postoperative NOSE scale correlations were calculated. The results were significant [mean 60.0±11.85, t (25.38) *P-value* <0.001]. The pre-operative and 1-year postoperative NOSE scale correlations were calculated. The results were substantial [mean 71.0±8.66, t (40.9) *P-value* <0.001]. A paired t-test assessed the correlation between the pre-operative and 1-year postoperative VAS measures. The results were significant [mean 5.44±1.26, t (21.57), *P-value* <0.001].

The two years postoperative NOSE and VAS scale were conducted on 9 (36%) patients who were followed up for two years after the operation (Table 5).

Table(5): Correlation of postoperative NOSE and VAS scales.

	Mean	**Std. Deviation**	***t***	**Significance**
NOSE scale				
Pre & post-op two years	57.3	9.49	21.7	.001
Post-op one year & post-op two years	1.15	2.99	1.38	.190
VAS				
Pre & post-op two years	5.23	1.01	18.6	.001
Post-op one year & post-op two years	3.48	.869	1.59	.137

Note: P-value < 0.001.

If we compare the postoperative NOSE and VAS scales, we didn't find a significant difference between the first and second postoperative years.

The complications that were recorded in our series were classified into early, intermediate, and late complications (Table 6).

Table(6): Distribution of complications among patients.

Complications		Frequency	Percentage	Notes
Early	Epistaxis	0	0.0%	Not reported
	Septal hematoma	0	0.0%	Not reported
Intermediate	Crusting	8	32%	Decrustation was done during follow-up visits
	Vestibulitis	6	24%	Mostly due to crustation
Late	Synechia	12	48%	Most patients are those without silastic cast
	Septal perforation	0	0.0%	Not reported
	Residual deviation	3	12%	Due to limited cartilage removal

Considering the long-term outcomes like nasal dorsum deformity in the current study of patients who need revision septoplasty and/or septorhinoplasty; only 3 patients (12%) had revision surgeries at 18 years.

DISCUSSION

In contrast to adult septoplasty, pediatric septoplasty is still controversial and open discussion, as it is believed that doing surgery in developing centres might lead to some adverse effects on nasal and facial growth.[12] The most crucial point in surgery is conservatively resecting the cartilage and avoiding disrupting the primary nasal and midface growth centres. Excision should be kept to a minimum, and an excised segment should be reinserted after remodelling.[13]

Certain precautions in pediatric septoplasty should be considered to reduce the possible effect on nasal growth and shape. These include avoidance of elevation of the nasal mucosa of the floor to avoid damage to the incisive nerves, avoidance of incision and excision through the growing and supporting zones, especially at the sphenoethmoid dorsal zone, avoidance of separating the septal cartilage from the perpendicular plate, avoidance of transecting the septospinal ligament, avoidance of unilateral or bilateral separation of the upper lateral cartilages from the septum, and to avoid implanting alloplastic or biomaterials in the growing septum.[14]

In the current study, we try to illuminate some points regarding the health-related quality of life and long-term outcomes after surgery. In our study, we used delivery cartilage (extracorporeal) with endonasal approach septoplasty. To reduce the possibility of complications, we remove the cartilage with limited interference to the sphenoethmoid dorsal region and reintroduce it again with suturing to the remaining dorsal L-strut. Although external septoplasty may negatively influence the growth of the nasal dorsum.[8] yet this approach was adopted by several authors, and it was stated that it does not interfere with the normal growing nasal process.[7,8] and performing septoplasty on selected pediatric patients has little risk on long-term facial growth.[6,10]

Whatever the type of nasal surgery in children, the parents and young patients should be informed about long-term follow-up and the need for revision surgery after adolescence.[15] as recurrent septal deviation may occur as the nose is still growing in this age, and this was needed in 3 of our patients.[16]

The mean age in the current study was 8.5±3.8 years. These results correlate with a study by Martins et al. on 40 patients in which his mean age was nine years.[17] On the contrary, our results were contradicted by the results of Manteghi et al., in which the mean age was 15.7±2.1 years.[18]

Regarding gender, the majority were males (96.31%), which agrees with Sabry et al. and Yilmaz et al. (70% & 68.6%).[2,19] The logical explanation for these results is that males are more prone to nasal traumas and their consequences than females.

In the current study, we used NOSE and VAS scales to evaluate the quality of life outcomes. The NOSE scale is a valid and reliable quality-of-life instrument for pediatric patients complaining of nasal obstruction.[9,19] Similarly, the VAS scale is a good tool to show general satisfaction with the operation.[2,19] In the current study, the pre-operative NOSE scale mean was 82.0±7.9, representing severe nasal septal deviation symptoms. These results agree with a study by Yilmaz et al. in which the pre-operative NOSE scale mean was 71.0±18.9, which included only severe septal deviation cases.[19]

In the current study, the three months postoperative NOSE scale mean was 21.8±14.05. One year postoperative NOSE score mean was 11.0±8.0 which shows a significant improvement that is related to the healing process, growth, and age increments [(t=25.38, *P-value* <0.001), (t=40.99, *P-value* <0.001)]. These results are correlated with a study conducted by Resende et al. (3 months postoperative mean was 21.48, *P-value* <0.001 between pre-operative and three months post-operation).[3] This correlates with a study performed by Justicz et al., where severe to extreme septal deviation was the main cause of the operation.[4] Yet, a study conducted by Stewart et al. where patients with mild and moderate septal deviations were also operated on, and even it was combined with turbinate surgery in some cases (pre-operative NOSE score was 69.7±18.7, three months postoperative was 31.2±27.2).[10] In the current study, when we applied the NOSE scale post-operatively, it changed to moderate in 32% and mild in 68% of patients after three months and to moderate in 4% and mild in 96% of patients after one year. This denotes the improvement in quality of life after the operation. Regarding VAS, in our study, the pre-operative VAS score mean was 8.1±0.85. There was a significant improvement from pre to post-septoplasty. The mean subjective satisfaction score between pre- and 1-year post-operation was 5.44±1.26, with the *P-value* <0.001 considered statistically significant. These findings are in agreement with that found by Lee et al., who found that the VAS score significantly improved from pre to post-septoplasty (5.0[4.0, 6.3] to 8.0[8.0, 10.0], *P-value* <0.001).[4] Yilmaz et al. also found that the mean subjective satisfaction score measured with VAS one year post-operatively was 7.9±2.1. The overall subjective satisfaction score measured with VAS was ten from 12 patients at the last follow-up examination.[19]

In addition, we applied the NOSE and VAS scales again two years post-operatively on nine patients (36%) as their age was five years and less as they

are more susceptible to more complications. We found that the mean subjective satisfaction score measured between pre-operative NOSE and VAS scales with 2 years post-operatively was significant (P-value <0.001) and between 1 and 2 years post-operatively was non-significant (P-value >0.001). The non-significant difference in the NOSE and VAS scales between the first and second postoperative years in any of the patients indicates that the effect of pediatric septoplasty can be assessed after one year of operation. In our research in literature, we didn't find research about this topic.

We classified complications into early, intermediate, and late complications. There were no intra-operative complications in any of the patients, including epistaxis. Bishop and Koirala et al. reported that epistaxis occurred in 12.4 and 4% of patients.[15,20] No septal hematoma was found in our study, which agrees with a study performed by Bishop et al.[15] It was reported in 1 patient by Koirala.[20] Regarding intermediate complications, infections in the form of vestibulitis occurred in 6 cases (24%), primarily due to crusting formation, which occurred in 8 patients (32%). It was dealt with by follow-up with meticulous cleaning and instructing patients to use saline wash and local lubricant. Koirala found that almost all children who came for follow-up had crust formation.[20] Regarding synechia, in our study, it occurred in 12 cases (48%). It is higher than that reported by Muhammad et al., who found that its incidence was 7% (14 patients).[21] Synechia happened in those young age groups probably due to opposed raw area, mainly when silastics were not used. Septal perforation was not reported in our study, but it occurred in 0.52% (1 patient) in a study by Bishop et al. at 1-year follow-up. [15]

In our study, the residual septal deviation at 1-year follow-up occurred in 3 cases (12%), comparable to that found by Koirala. in 5 patients (10%).[20] This recurrence of deviation was mainly due to a limited and conservative type of surgery in addition to the memory of cartilage.[20] Concerning the long-term outcomes in the current study, 6 (24%) patients reached 18 years of age. Revision surgery was done in 3 patients (12%); in 2 cases, septorhinoplasty was performed, and one patient had septoplasty. The other 3 cases were either missed from follow-up or refused surgery. In a study by Bishop et al., revision surgery was done in 13 patients (6.7%).[15]

CONCLUSION

The significant improvement in disease-specific quality of life and high patient satisfaction after operation justifies septoplasty in the pediatric age group. The results after cartilage delivery septoplasty are promising if the cartilage is removed conservatively and reintroduced with suturing in place to avoid long-term sequelae. Longer durations and larger sample sizes are needed for future studies on this subject to establish the effects of the procedure in the long term.

Declarations

- **Funding:** No funding was received for conducting this study.
- **Interests to Declare:** The authors have no relevant financial or non-financial interests to disclose.
- **Ethics Approval:** The Collegiate Committee for Medical Research Ethics approved the study with approval code CCMRE-MED-22-1 on 17/01/2022 and is in line with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.
- **Consent to Participate and Consent to Publish:** Written informed consent was obtained from the parents.

Keys to figures

Figure 1	**Visual Analogue Scale of Quality of Life.**
Figure 2	Seven years old patients with severe septal deviation.
Figure 3 (A-F)	Steps of the pediatric septoplasty.
Figure 4	One year after surgery.

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