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## Functional endoscopic sinus surgery improves the quality of life in children suffering from chronic rhinosinusitis with nasal polyps

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## ABSTRACT

**Objective:** To evaluate the impact of FESS in children with chronic rhinosinusitis with nasal polyps, regarding their overall postoperative quality-of-life (QoL) and constituent QoL domains. Potential differences between cystic fibrosis (CF) sufferers and non-sufferers, or cases with recurrent sinonasal polyposis versus single-operations were also explored.

**Methods:** 39 children were studied. The mean patient age was 10.9 years; four children suffered from cystic fibrosis. The children (or parents) completed the Glasgow Benefit Inventory for Children (GCBI) at least six months after their operation. The Mann-Whitney test compared the GCBI scores between non- and CF sufferers, as well as children with and without recurrent polyposis.

**Results:** The median overall QoL score was 98. There were no statistically significant differences between CF sufferers and non-sufferers regarding their overall QoL, or the respective individual QoL domains, apart from their physical postoperative activity ( $p = 0.04$ ). Twelve children demonstrated recurrent polyposis (30.7%); among them three were cystic fibrosis sufferers. No statistically significant differences were identified in the overall QoL score, or individual GCBI subscale scores between children with recurrent polyposis versus single-operations. Children with recurrent polyposis but not CF performed better regarding their overall QoL ( $p = 0.021$ ) and medical status ( $p = 0.015$ ), compared to their CF counterparts.

**Conclusion:** FESS performed for chronic rhinosinusitis with nasal polyps in children is associated with improved postoperative QoL, irrespective of the presence of CF (although the latter needs to be confirmed in larger patient cohorts). The absence of appreciable differences in the overall QoL, or its constituent domains, between single and re-operated children, indicate that the positive effect of FESS outweighed the burden of re-operation. Appropriate preoperative informed consent in cases of recurrent sinonasal polyposis necessitates acknowledging worse respective outcomes in CF sufferers.

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## 1. Introduction

In the era of endoscopy and imaging, it has become clear that rhinitis and adenoid hypertrophy are not the only reasons of a runny nose in children, as the paranasal sinuses can be frequently involved as well [1]. Indeed, children experience an average of six to

eight colds per year, with 0.5–5% of them being complicated by acute sinusitis [2]. In addition, chronic rhinosinusitis may also cause significant morbidity to children, and affect their everyday quality of life [3].

Sinonasal polyposis represents a rare pathology in children [4], and may accompany a variety of diseases, most commonly cystic fibrosis (CF). However, the presence of nasal polyps seems to have a major impact on the quality of life (QoL) of pediatric patients and their parents [5,6]. Thus, due to the physical and psychological consequences of sinonasal polyposis and any underlying disease, comprehensive treatment is necessary [5].

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Functional endoscopic sinus surgery (FESS) is the treatment of choice in adults with chronic rhinosinusitis (CRS) with nasal polyps, when maximal medical therapy has been unsuccessful [7]. In addition, a recent meta-analysis had shown that FESS is effective in children with CRS, when optimal medical treatment proves unsuccessful, and is associated with improvement in the children's QoL. FESS also seemed to improve the sinusitis-associated symptoms and QoL in children with CF [3].

The aim of the present study was to evaluate the impact of FESS performed in children with CRS with nasal polyps, not only with regard to their overall postoperative QoL, but also to the constituent QoL domains. Potential differences between CF sufferers and non-sufferers, as well as between cases with recurrent sinonasal polyposis versus single operations were also explored.

### 1.1. Patients & methods

Thirty nine children who underwent FESS due to CRS with nasal polyps between the years 2011 and 2015 were included in the study. Among them, 20 were boys and 19 girls, with a mean age of 10.9 years old (range 7–14). CF was present in four children.

All patients underwent FESS under general anesthesia, following maximal conservative medical treatment. The operation consisted of bilateral middle meatal antrostomies, anterior ethmoidectomies, and endoscopic polypectomy with the use of a microdebrider. A pre-operative CT scan of the sinuses had been performed in all children. The patients were postoperatively packed and were discharged the next day. No major or minor complications were encountered in any patient. The children were postoperatively encouraged to perform normal saline nasal douches, and use a steroid nasal spray. They were also followed up regularly by the first author in a dedicated Rhinology clinic.

During their clinical appointment the children (or their parents) were invited to fill in the Glasgow Benefit Inventory for Children (GCBI) at least six months after their operation. The GCBI is a validated questionnaire focusing on quality of life after a surgical intervention, appropriately adapted from the respective adult questionnaire (GBI). The questionnaire was first used in a study involving tonsillectomy and ventilation tube insertion in children [8]. The GCBI comprises 24 questions covering five domains; the general postoperative status of the child (4 items), the medical status (3 items), the postoperative physical (3 items), and school activity (5 items), and the psychological domain (9 items). Each item receives a 1–5 score at a Likert scale, with 5 representing a significantly improved situation postoperatively, and 1 no change at all. The overall postoperative QoL score was also noted.

The non-parametric Mann-Whitney test was used to compare the GCBI scores between non- and CF sufferers, as well as children with and without polyp recurrence. All analyses were performed using SPSS version 23.0. Statistical importance was accepted at a level of 0.05.

The research protocol was submitted, and received ethical approval by the Ethics Committee of the University of Athens, prior to commencing data collection. All parents were asked to sign an informed consent form before being enrolled in the study.

## 2. Results

FESS performed for CRS with nasal polyps in children is associated with a marked improvement in their postoperative QoL (Table 1). Indeed, the median value for the overall QoL score was 98. The respective scores for the GCBI subscales were also high, with a median value of 18 for the general postoperative status, 13 for the medical status, 13 for physical activity, 19 for school activity, and 35 for the psychological domain. This marked postoperative

**Table 1**

Overall postoperative QoL score and individual GCBI domain scores in children undergoing FESS for CRS with nasal polyps.

	Median value	Maximum score	Maximum potential	Minimum score	Minimum potential
Overall quality of life	98	112	120	79	24
General status	18	20	20	16	4
Medical status	13	15	15	7	3
Psychological domain	35	42	45	27	9
School activity	19	25	25	15	5
Physical activity	13	15	15	9	3

improvement involved not only children without CF, but also their counterparts suffering from CF (Table 2).

Indeed, the median value for the overall QoL score was 99 in the former and 90 in the latter patient group ( $p = 0.0195$ ), whereas the respective median values for the GCBI subscales were 18 in both groups for the general postoperative status, 13 in both groups for the medical status, 19 versus 18 for school activity ( $p = 0.467$ ), and 35 in both groups for the psychological domain. Only the physical activity domain scores differed between non- and CF sufferers (13 vs. 11,  $p = 0.04$ ), which was not surprising as a result, due to the involvement of various organs in the latter patient category.

Twelve children demonstrated polyp recurrence (30.7%); among them three were suffering from CF. Nevertheless, no statistically significant differences were identified either in the overall postoperative QoL score, or in the individual GCBI subscale scores between children who had a single operation, and children who were re-operated because of polyp recurrence, indicating that the positive effect of the operation outweighed the burden of one or more additional procedures (Table 2). By contrast, the comparison between children with polyp recurrence and CF versus their non-CF counterparts with polyp recurrence showed improved overall QoL ( $p = 0.021$ ) and medical postoperative status ( $p = 0.015$ ) in the latter patient category, whereas the remaining individual QoL domains were similar (Table 2).

## 3. Discussion

CRS with nasal polyps in children represents a significant chronic illness [6]. Indeed, the nasal congestion, the persistent nasal discharge, the postnasal drainage, and the recurring headache inevitably affect the children's physical and emotional well-being, and thus their QoL [3].

The evolution of pediatric medicine from the diagnosis and management of infectious diseases to the prevention and control of chronic conditions [9] has rendered issues of QoL in children too important to be disregarded. QoL, however, is generally a multidimensional construct encompassing several domains [10]. Some of them i.e. the psychological aspect of QoL, are inherently different than others, which measure more physical domains; yet contemporary views tend to acknowledge the critical link between physical and psychological health.

In this context, the present study investigated the effect of pediatric FESS in children with CRS with nasal polyps using the GCBI, a validated questionnaire focusing on QoL. The advantage of this specific questionnaire is two-fold. Firstly, it can only be completed postoperatively, hence not many patients are lost in follow up, at least in dedicated outpatient clinics. Secondly, it is completed at least six months after the operation, hence, there is enough time for the patient (or his/her parent) to appreciate the impact of the surgical intervention on the patient's QoL, but not too long time interval, to render the responses susceptible to recall bias.

**Table 2**

Comparison of the overall and subscale postoperative GCBI scoring in children with cystic fibrosis and/or polyp recurrence versus non-cystic fibrosis sufferers and/or children undergoing single FESS surgery for CRS with nasal polyps (median values and 95% confidence intervals/numbers in bold indicate statistically significant results).

	Non-CF sufferers	CF sufferers	p-value	Single operations	Recurrent polyposis	p-value	Non-CF sufferers with polyp recurrence	CF sufferers with polyp recurrence	p-value
Overall QoL	99 (95, 102)	90 (88, 105)	0.019	99 (93, 102)	96,5 (89, 105)	0.922	99 (94, 102)	96 (83, 98)	<b>0.021</b>
General status	18 (18, 19)	18 (16, 19)	0.164	18 (18, 19)	18 (16, 20)	0.844	18 (17, 20)	16 (16, 18)	0.108
Medical status	13 (13, 14)	13 (10, 14)	0.494	14 (13, 14)	13 (10, 15)	0.631	13,5 (13, 14)	10 (10, 13)	<b>0.015</b>
Psychological domain	35 (34, 37)	35 (30, 37)	0.634	35 (31, 37)	35 (34, 38)	0.336	27,5 (24, 28)	27 (22, 28)	0.488
School activity	19 (17, 21)	18 (15, 25)	0.467	19 (18, 21)	17 (15, 21)	0.159	27,5 (27, 30)	24 (23, 27)	0.789
Physical activity	13 (12, 13)	11 (10, 13)	<b>0.040</b>	13 (12, 13)	12,5 (11, 13)	0.473	9,5 (9, 10)	8 (8, 9)	0.061

Abbreviations: CF: cystic fibrosis, QoL: quality of life.

The results of the present study suggest that FESS performed for CRS with nasal polyps in children is associated with a marked improvement in their postoperative QoL with close to the maximum possible scores in almost all aspects of QoL. These findings are important, as chronic rhinosinusitis in children has been associated with heavier impact on their school-related activities and perception of discomfort or pain, compared to other, and perhaps more prominent, chronic diseases in childhood, such as asthma, epilepsy or juvenile rheumatoid arthritis [6]. Hence, the observed postoperative improvement in children's QoL seems to justify FESS as the primary therapeutic option in the treatment of nasal polyps in this patient group, taking also into account that in contrast to adults, there is little place for the systemic use of steroids in children. Similar results were also reported by Cornet et al., who found 78% of their operated children and adolescents suffering from CRS with nasal polyps to report an overall improvement in their sinus-related symptoms after FESS [5]. The satisfactory score in the psychological domain, albeit not as close to the maximum possible as the other domains of postoperative QoL, could be attributed to the impact that the diagnosis of a chronic disease exerts upon children or their parents, or even the concern that the recurrence of nasal polyps might lead to a similar to the preoperative state of QoL.

The improvement in the postoperative QoL following FESS for CRS with nasal polyps in children also applies for CF sufferers. Indeed, no statistically significant difference between these children and their non-CF counterparts was noted either regarding their overall QoL, or concerning the respective individual QoL domains, apart from their physical postoperative activity ( $p = 0.04$ ). The finding that the medical postoperative status of non-CF children with nasal polyps is similar to their CF counterparts, who suffer from a systemic disease with multiple organ involvement, is novel and undoubtedly important, as it confirms the positive impact that FESS has on the overall medical status of children with CF. That being said, it is also important to note that CF patients are thought to demonstrate more widespread sinonasal inflammatory changes and more advanced disease for each sinus [11–13], compared to patients without CF, who most commonly display inflammatory changes limited to the maxillary and ethmoid sinuses [14].

Our findings differ to some extent from the results of Albritton and Kingdom, who reported that the improvement which CF sufferers demonstrate after FESS is less good compared to their non-CF counterparts, albeit still remaining significant in 50% of children in the two-year follow up [15]. However, in addition to alleviating sinonasal symptoms, FESS may very well reduce the seeding of bacteria to the lower airways [14], thus contributing to the observed improvement in the medical postoperative status of patients with CF. By contrast, the lower scores that the latter children reached postoperatively with regard to their physical activity were not unexpected, due to the pulmonary involvement which accompanies this disorder.

The polyp recurrence rate was 30.7% in the overall patient cohort, but reached 75% in children suffering from CF. These rates were higher than the rates reported by Cornet et al. (14% and 33%, respectively) [5], yet close to historical data [16–18]. They do confirm, however, the importance of CF as a predictor for revision surgery in children suffering from CRS with nasal polyps [5].

Drawing on the surgical aspect of pediatric FESS, which may to some extent be associated with polyp recurrence, our surgical approach always included an anterior ethmoidectomy, as the anterior ethmoidal cells can be considered the central point for ventilation and drainage of the paranasal sinuses [4]. However, it should be mentioned that the mechanism of polyp formation which accompanies chronic sinusitis in CF patients, hence their recurrence also, is not fully understood. Nasal polyp histology in these patients seems to differ in comparison with the typical non-CF allergic patient [19]. In addition, the keystone in the pathogenesis of chronic sinusitis in CF patients seems to be the increased mucus viscosity, which results in poor mucociliary clearance, obstruction of the sinus ostia, and impairment of the drainage routes [14].

Interestingly, the comparison between children who had a single operation, and children who were re-operated because of polyp recurrence did not identify any statistically significant differences either in the overall postoperative QoL score, or in the individual GCBI subscale scores, thus demonstrating that the positive effect of the operation outweighed the burden of one or more additional procedures. However, the comparison between CF sufferers with polyp recurrence with children not suffering from CF but also having nasal polyp recurrence yielded somehow different results. The former children had worse postoperative medical status ( $p = 0.015$ ), suggesting that the recurrence of their polyps may have represented one of the many facets of exacerbation of CF. It may, hence, be unsurprising that their overall QoL was also poorer ( $p = 0.021$ ).

The latter finding, however, may be important for providing realistic expectations to patients and their parents, and could be included in the preoperative informed consent in cases of polyp recurrence. By contrast, no intra-operative complications were encountered in the patients of the present study, and this applied not only in primary but also in revision cases.

The present study is not without limitations. Firstly, the number of participants is relatively small, especially regarding the CF group, which has an impact in the power of the obtained results. Nevertheless, pediatric FESS is not routinely performed, and most prospective studies on this subject included similar or smaller overall numbers of operated patients [5,6,18,20,21]. In addition, non-parametric statistics were used for comparisons involving the CF sufferers, acknowledging the fact that the results obtained could be considered less statistically powerful.

Furthermore, apart from CF, various predisposing factors have been associated either with pediatric CRS, such as passive or active smoking [22,23], gastro-esophageal reflux disease [24], adenoidal

hypertrophy [25], environmental pollution [26], or especially with pediatric sino-nasal polyposis, i.e. chronic obstructive pulmonary disease, aspirin intolerance, allergy, or Woake's syndrome [17]. These factors were not examined in the present study.

Finally, appreciable differences between parental and child reporting do exist [6], and need to be considered, when the results pertaining the effect of a surgical intervention in the children's QoL are analyzed. Nonetheless, it has been suggested that children older than 8 years of age can accurately report on subjective issues [27]. Taking into account that the mean age of our study sample was 10.9 years, the aforementioned discrepancy is not likely to have influenced our results.

#### 4. Conclusion

FESS performed for CRS with nasal polyps in children is associated with a marked improvement in their postoperative QoL, irrespective of the presence of CF (although the latter needs to be confirmed in larger patient cohorts). Moreover, no statistically significant differences exist either in the overall postoperative QoL score, or in its constituent domains between children who had a single operation, and children who were re-operated because of polyp recurrence, indicating that the positive effect of the operation outweighed the burden of one or more additional procedures. By contrast, children with polyp recurrence but not CF seem to perform better regarding their overall QoL and medical post-operative status, in comparison with their CF counterparts with polyp recurrence. It may prove prudent for the latter findings to be included in the preoperative informed consent in cases of polyp recurrence, in order to provide realistic expectations to patients and their parents.

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#### Conflicts of interest

None declared.

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