

## Original Article

# The Role of Transforming Growth Factor Beta 1 (TGFβ1) in Nasal and Paranasal Sinuses Polyposis

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### ABSTRACT

**Background and Objectives:** Nasal polyposis is a disease resulting from complex pathogenetic mechanisms. Some studies showed that TGFβ1 had significant role in this pathogenesis. In this study, we investigated the role of cytokines and mediators in polyp development.

**Material and Methods:** In this case-control study, healthy nasal mucosal samples were obtained from 24 people undergoing septoplasty or rhinoplasty and polyp samples were obtained from 15 patients with nasal and paranasal sinuses polyposis undergoing endoscopic sinus surgery. TGFβ1 concentration was measured with ELISA in homogenized polyp and control samples. The difference of the mean concentrations was analyzed with Mann-Whitney test.

**Results:** We detected TGFβ1 in 11 patients' samples and in 22 control samples. There was not significant differentiation between the mean of TGFβ1 levels in two groups.

**Conclusion:** Measuring level of TGFβ1 with ELISA technique in homogenized polyp and control samples have not significant differentiation.

**Key words:** Nasal, Paranasal, TGFβ1, ELISA

### Introduction

Nasal polyposis is thought to develop as a manifestation of a chronic inflammatory process involving the upper airway (1).

Nasal polyps commonly arise from the paranasal sinuses (2). According to the European position

paper on rhinosinusitis and nasal polyposis (EP3OS) document, related recently by the immunology and European Rhinology society, nasal polyposis is considered a subgroup of chronic rhinosinusitis (3). The polypoid disease was generally recurrent despite the medical follow up treatment (4).

The cause of nasal polyposis is still unknown,

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regardless of unknown etiology; nasal polyposis is characterized by extensive inflammatory process associated with local production of several mediators and cytokines by both structural and infiltrating cells.

Activated epithelial cells may be the major source of mediators inducing influx of inflammatory cells mostly eosinophils and proliferation and activation of fibroblasts leading to nasal polyp formation (3).

Accumulation of eosinophils, neutrophils, plasma and mast cells, macrophages and lymphocytes is a frequent finding and there is much evidence to the activity and pathogenic role of these cells (5).

Among the cytokines that have role in nasal polyposis, TGF $\beta$  may play a significant role in this pathogenesis possibly through fibroblast activation (6, 7). TGF $\beta$  may be responsible for recurrent polyposis (8). TGF $\beta$  is a family of dimeric polypeptide growth factors which regulate cell activation, proliferation and differentiation but also embryonic development, wound healing and angiogenesis, play an important role in normal airway morphogenesis and function, and are involved in the pathogenesis of a variety of airway disease (3).

There are three isoforms of TGF $\beta$ , TGF $\beta_1$ , TGF $\beta_2$ , and TGF $\beta_3$ . The first is mainly synthesized by endothelial, hematopoietic and connective tissue cells, the second by epithelial and neuronal cells and third primarily by mesenchymal cells (3).

All three TGF $\beta$  isoforms are expressed at high level during normal airway development, being particularly involved in branching, morphogenesis, and epithelial cell differentiation and surfactant synthesis: small amount of TGF $\beta$  are still present in adult airways, while increases or decreases in the production of three TGF $\beta$  isoforms are linked to a variety of disease states (6). Among its many activities, TGF $\beta$  is able to induce fibroblast proliferation and differentiation into myofibroblast (6, 7).

+TGF $\beta_1$  and TGF $\beta_2$  are strongly expressed in inflammatory nasal mucosa has led to the hypothesis that they may play a significant role in inducing the structural modifications that characterize this disease (6).

Compared with TGF $\beta_2$ , TGF $\beta_1$  appear to be active for a longer period of time and with a wide concentration range on fibroblast functions in cell proliferation (6).

The studies on TGF $\beta$  isoform expression in nasal polyposis so far have yielded different results so in this study; we investigated the role of cytokines and mediators in polyp development.

## Material and Methods

We conducted a case control study on 39 nasal mucosa samples (15 patients and 24 controls) for TGF $\beta$  from September 2006 to October 2007.

Patients were randomly selected from patients with nasal polyposis that proved by CT scan (CT scan need for endoscopic surgery) and controls were selected from healthy persons that were undergoing septoplasty or rhinoplasty. Patients and controls were excluded if they had any of the following: oral or nasal corticosteroid therapy in the preceding 30 days, diseases such as vasculitis, rheumatologic and infections that may affect on nasal mucosa. An informed consent was taken from patients before the study.

Nasal polyp samples (n=15) were obtained during endoscopic sinus surgery and control samples were obtained during septoplasty or rhinoplasty. Samples were taken deeply that including mucosa and lamina propria.

TGF $\beta_1$  concentrations were measured with ELISA technique in homogenized polyp tissue (n=15) and in control mucosa samples (n=24).

### *ELISA measurements:*

Biopsy materials were weighed, chopped in to pieces of 1mm homogenized in 0.9% sodium chloride solution, 1ml solution was added to 100mg tissue. Suspensions were centrifuged at 40c at 3000 rpm for 10 min, and supernatants were stored in refrigerator at -20 °C until used. TGF $\beta_1$  cytokine concentrations were measured by using sandwich ELISA kit (Human TGF $\beta_1$  kit, Bander med system, Austria, Europe) according to the manufacturer's instructions.

**Statistical Analysis:**

The difference of the mean concentrations was analyzed with Mann-Whitney test.

**Results**

A total of 39 patients were enrolled in the study from September 2006 to October 2007 for measuring the TGFβ<sub>1</sub> level in nasal specimens. The patients ages ranged from 19 to 41 years in control group (mean =27) and 19 to 84 in polyp group (mean=38).

There were 24 patients in control group of whom 19 were male, five were female, and 15 in polyp group of whom 10 were male and 5 were female.

TGFβ<sub>1</sub> level were measured in two group and were measurable with ELISA technique in 11 polyp tissue and 22 control samples (Table 1).

**Table1:** patient sample TGFβ1 results

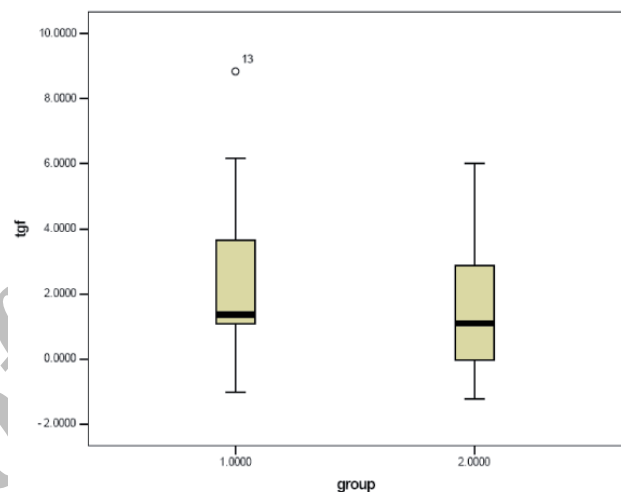
Concentration range	frequency	percent
0	4	26.7
0-1	2	13.3
1-2	4	26.7
2-3	1	6.7
3-4	1	6.7
4-5	1	6.7
5-6	1	6.7
6-7	1	6.7
<b>sum</b>	<b>15</b>	<b>100</b>

**Table 2:** Control sample TGFβ1 results

Concentration range	Percent	Frequency
0	8.3	2
0-1	4.2	1
12-	50	12
23-	8.3	2
34-	12.5	3
45-	0	0
56-	8.3	2
67-	4.2	1
78-	0	0
89-	4.2	1
<b>sum</b>	<b>100</b>	<b>24</b>

The mean TGFβ<sub>1</sub> level in polyp samples was 1.647±0.619 and in control samples was 2.325±0.466 with no statistically significant differences ( $P=0.236$ ).

We did not find significant correlation between mean TGFβ<sub>1</sub> concentration in polyp tissues and control sample by Mann Whitney test ( $P=0.236$ ) [ $P>0.05$  was considered significant] (Fig. 1, and Table 3). In this study, we found TGFβ<sub>1</sub> levels in both patient and control groups but we did not find significant differentiation between these levels.

**Fig. 1:** The mean concentration of TGFβ1 in two groups**Table 3 :**TGFβ1 concentration in two groups

Group	TGFβ1 concentration
<b>Control group</b>	2.325±0.466
<b>Patient group</b>	1.647±0.619
$P= 0.236$	

**Discussion**

Some studies found that TGFβ<sub>1</sub> levels up regulate in nasal polyposis and others found down regulation of TGFβ<sub>1</sub> level in nasal polyps (9, 10).

Beata Rostawaska- Naldoska *et al.* demonstrated that TGFβ<sub>1</sub> mRNA was present at higher levels in all control samples than in polyps (11).

Andre cast *et al.* by using immunohistochemistry

detected no significant difference between TGF $\beta_1$  levels in nasal mucosa from patient polyp samples and control nasal mucosa samples but TGF $\beta_1$  levels was higher in nasal polyp lamina propria and epithelium than controls (12). In our study there was not significant different between the mean level of TGF $\beta_1$  in nasal polyps and normal mucosa sample.

Andre hirshberg *et al.* showed that TGF $\beta_1$  concentration by ELISA measurement significantly higher in control mucosa than in nasal polyps and immunohistochemical analysis revealed TGF $\beta_1$  positivity in the lamina propria of polyp samples but non in control specimens, and they described because there is no immunoreactive TGF $\beta_1$  in control specimens in frozen sections but there is a great amount of that in the homogenized tissue, it seems to be evident that normal nasal mucosa has significant latent TGF $\beta_1$  concentration (5). T. Van zele *et al.* found that TGF $\beta_1$  did not regulate in nasal polyps (13).

Tao *et al.* and lee ch *et al* showed that TGF $\beta_1$  expression in nasal polyps was positive (14, 15). This finding confirms our result that showed there was the level of TGF $\beta_1$  in nasal polyp tissue.

Little SC *et al.* showed that TGF $\beta_1$  expression in polyp tissue could have dual effects. One role is act on anti-inflammatory agent shown by the ability to inhibit production. At the same time, TGF $\beta_1$  expression leads to increases in factors involved in fibrosis and angiogenesis, promoting remodeling and cell growth (10).

As we see in those studies with RT-PCR and ELISA technique TGF $\beta_1$  level measured overlay in homogenized solution. Homogenized solution contains all of mucosa layers (epithelium, mucosa membrane and lamina propria). The results of TGF $\beta_1$  levels in nasal polyposis mucosa measured with ELISA and RT-PCR were in controversy. Controversy in those studies, which used IHC technique for measuring TGF $\beta_1$  levels in tissue layers of nasal mucosa, was low. It seems that the site of concentration of TGF $\beta_1$  has important role in pathogenesis of nasal polyposis. IHC is best method for measuring TGF $\beta_1$  levels in tissue layers of nasal mucosa.

## Conclusion

We recommend further studies on the level of TGF $\beta_1$  in different layers of tissue by IHC because RT-PCR and ELISA technique measured TGF $\beta_1$  levels in homogenized solution not in mucosa layers.

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## References

1. Elovic A, Wong D, Waller P, Matossian K, Gulli S. Expression of transforming growth factors- $\alpha$  and  $\beta_1$  messenger RNA and product by eosinophils in nasal polyps. *J Allergy Clin Immunol* 1993; 93(5):864-70.
2. Claudio M, Lucia R, Koichi N, Atsuko N, Filippo P, Maria P, *et al.* Impact of interanasal budesonide on immune inflammatory response and epithelial remodeling in chornic upper airway inflammation. *J Allergy Clin Immunol* 2003; 37-4.
3. Pawlicza R, Lewandowska A, Kowalski M. Pathogenesis of nasal polyps: An update. *Curr Allergy Asthma Rep* 2005; 5: 463- 471.
4. Meltzer E, Hamilos D, Handley J, Lanza D, Marple B, Nicklas R, *et al.* Rhinosinusitis: Establishing definitions for clinical research and patient care. *J Allergy Clin Immunol* 2004; 114(6):155-212.
5. Hirshberg A, Jkouti A, Darvas Z, Almuy K, Respassy G, Falus A. The Transforming growth Factor-  $\beta_1$ . *Laryngoscope* 2003; 113: 120-124.
6. Serpero L, Petecchia L, Sabatin F, Silvestri M. The effect of transforming growth factor (TGF)-beta 1 and (TGF)- beta 2 on nasal polyp fibroblast activities involved upper airway remodeling: modulation by fluticasone propionate. *Immunol Let* 2006; 105:61-67.
7. pawlicza R, Lewandowska A, Kowalski M. Pathogenesis of nasal polyps Pathogenesis at nasal polyposis by immunoglobulin E & IL5 is completed by: An update. *Curr Allergy Asthma Rep* 2005; 5: 463-471
8. Zhang V, Zele T, Perez- Novo C, Bruaene N, Holtappels G, Deruyck N. Different types of T-effector cells orchestrate mucosal inflammation in chronic sinus disease. *J Allergy Clin Immunol* 2008; 122(5):961-8.

9. Chang C, Chai C, Ho K, Kuo W, Tai C, Lin C, *et al.* Expression of transforming growth factor-beta 1 and alpha-smooth muscle action of myofibroblast in the pathogenesis of nasal polyps. *Kaohsiung J Med Sci.*2001; 17(3):133-8.
10. Eisma RJ, Allen JS, Lafre niere D, Leonard G, Kreuzer DL. Eosinophil expression of transforming growth factor- beta and its receptors in nasal polyposis: role of the cytokines in this disease process. *Am J Otolaryngol* 1997; 18(6):405-11.
11. Naldoska B, Kar pal M, Mazure K U, Gawron w, Pres K. Co- expre Of the TGFβ1 and TGFβ2 isoforms in nasal polyps and in Healthy mucosa. *Postepy Hig Med Dosw* 2004; 61: 702- 7.
12. Caste A, Lefauheur J, Wang Q,P Lespirt E, Poron F, Peynegre R, *et al.* Expression of the transforming growth factor β in inflammatory cells of nasal polyps. *Arch Otolaryngology Head neck surg* 1998;124(12):1367-6.
13. Zele T, Claeys S, Gevaert P, Maele G, Holtappels G, Cauwenberg P, *et al.* Differentiation of chronic sinus disease by measurement of inflammatory medintors. *Allergy* 2006; 61: 1280-89.
14. Little S, Early S, Woodard C, Shonka D, Han J, Borish L, Steinke J. Dual action of TGF-beta 1 on nasal polyp derived fibroblasts. *Laryngoscope* 2008; 118(2):3204-.
15. Lee CH, Rhee CS, Min YG. Cytokine gene expression in nasal polyps. *The Ann Otol Rhinol Laryngol* 1998; 107(8):665-70.

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