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**REVISED** Differences in the length of postoperative care of endoscopic endonasal surgery in simple and complex surgical procedure groups [version 2; peer review: 2 approved]

Budi Sutikno, Fuad Fauzi, Diar Mia Ardani, Anna Mailasari

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## RESEARCH ARTICLE

# REVISED Differences in the length of postoperative care of endoscopic endonasal surgery in simple and complex surgical procedure groups [version 2; peer review: 2 approved]

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## Abstract

**Background:** The rapid development of endoscopic endonasal surgery has made the procedure widely used in nasal and sinus surgery. Endoscopic endonasal surgery is a minimally invasive procedure, but the possibility of postoperative damage to the sinonasal mucosa cannot be ruled out. The aim of this study was to analyze the difference in the length of postoperative care between complex and simple endoscopic endonasal surgeries which can be used as a reference in planning postoperative care.







**Methods:** This was a retrospective cross-sectional observational study. The participants were divided into two groups, i.e., simple, and complex surgical procedures groups. The simple procedure group consisted of middle meatal anastomostomy, frontal sinusotomy, sphenoidectomy, uncinctomy, endoscopic septoplasty, and endoscopic turbinoplasty. The complex procedure group included pansinus surgery and or at least total ethmoidectomy. The length of postoperative care between the two groups were measured and analyzed using the Chi-square test.

**Results:** The median length of care in the complex procedure group was significantly longer than that in the simple procedure group ( $p = 0.028$ ), 12 weeks and 9 weeks, respectively. The number of postoperative outpatient visits was significantly less in the simple procedure group compared with the complex procedure group (Median 4 vs. 5;  $p=0.015$ ). There was a significant correlation between length of care and the endonasal endoscopic surgical procedure group ( $p = 0.023$ ).


**Conclusions:** The complex endoscopic endonasal surgery group required a longer length of care and more postoperative outpatient visit than the simple procedure group.

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Approval Status  

	1	2
<b>version 2</b>		
(revision)		
02 Sep 2022	<a href="#">view</a>	<a href="#">view</a>
		
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Any reports and responses or comments on the article can be found at the end of the article.

**Keywords**

endoscopic endonasal surgery, length of care, postoperative, sinus disease

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**REVISED Amendments from Version 1**

1. We redefined the procedures within simple and complex surgical procedure groups thus we deleted last sentence in conclusion mentioned "The limitation of the study is in determining the grouping of the simple and complex surgical procedure groups.
2. We emphasized in the abstract and last paragraph that simple surgical procedure represented a localized disease whereas complex surgical procedure represented a diffuse mucosal disease. The localized disease might take a shorter postoperative care period than the diffuse mucosal disease. The cut-off point was six weeks according to this study. We thank you to reviewers for their enlightening comments.
3. We corrected minor changes: ORL-HNS instead of ENT-HNS, correction of inappropriate capital character (middle meatal antrostomy, chronic rhinosinusitis).

**Any further responses from the reviewers can be found at the end of the article**

**Introduction**

The endoscopic endonasal approach has become one of the technological advances in the otorhinolaryngology head and neck surgery (ORL-HNS) field, used as a supporting examination for diagnosis and therapy. In the 1970s, endoscopic endonasal and intranasal surgical interventions were first introduced by Messerklinger, Stammberger, Draf, and Wigand through transitioning sinus surgery from radical surgery to minimally invasive procedures.<sup>1</sup> Minimally invasive procedures such as endoscopic endonasal surgery are currently widely performed in the ORL-HNS field, including functional endoscopic sinus surgery (FESS), endoscopic turbinoplasty, and endoscopic septoplasty.

In the FESS procedure, ethmoid air cells and sinus ostia are opened by direct visualization aimed at restoring ventilation and mucociliary drainage of the sinus to normal function.<sup>1</sup> In recent decades, FESS has become the standard of care for chronic sinusitis, along with the developments in procedural knowledge.<sup>1</sup> The FESS procedure may include one and/or several different techniques, i.e., uncinectomy, middle meatal antrostomy (MMA), anterior and posterior ethmoidectomy, sphenoidectomy, and frontal sinusotomy.<sup>2</sup>

Based on the level of experience of the ORL-HNS specialist at the Dr. Soetomo Academic Medical Center, Surabaya, endoscopic endonasal surgery is divided into simple and complex surgical procedures. The simple surgical procedure group includes uncinectomy, MMA, frontal sinusotomy, sphenoidectomy, endoscopic turbinoplasty, and endoscopic septoplasty, while the complex surgical procedure group includes pansinus surgery and or at least total (anterior and posterior) ethmoidectomy.

Endoscopic endonasal surgery is a minimally invasive procedure, but postoperative injury such as damage to the sinonasal mucosa remains unavoidable. Proper management and follow-up are essential in a patient's postoperative recovery and wound healing in terms of endoscopic endonasal surgery.<sup>3</sup> Postoperative care in clinical practice differs from one another due to preference based solely on the recommendations or opinions of specialists and the results of randomized controlled trials.<sup>4</sup> The study conducted by Mielcarek-Kutchka *et al.* reported that the length of postoperative care for endoscopic endonasal surgery ranged from six weeks to three months.<sup>5</sup> Studies on the length of postoperative care for endoscopic endonasal surgery are limited. Until recently, there haven't been any studies on the difference in the length of postoperative care for endoscopic endonasal surgery at Dr. Soetomo Academic Medical Center in Surabaya. Thus, the clinicians inadequately provide information to patients who undergo endoscopic endonasal surgery.

Based on this reason, this study attempted to identify the difference in the length of postoperative care for complex and simple endoscopic endonasal surgery so that the results can be used as a reference in the planning of postoperative care.

**Methods**

This was an analytic observational study with a retrospective cross-sectional design. The research data were obtained from medical records to determine the difference in the length of postoperative endoscopic endonasal care in the simple and complex surgical procedure groups.

In total, 60 patients who underwent endoscopic endonasal surgery at Dr. Soetomo Academic Medical Center, Surabaya, from 2015 to 2020, were included (See [underlying data](#)).<sup>6</sup>

The inclusion criteria were male and female patients with minimum age of 18 years. The exclusion criteria were patients that had extended endoscopic sinus surgery (ESS), malignancy, non-standard therapy, and incomplete medical records. The data was collected through a special Data Collection Sheet in the form of tabulations, graphs, and text presentations explaining the graphs.

## Data analysis

Microsoft Excel and SPSS IBM version 22 software were employed to analyze the data with univariate analysis for demographic and clinical characteristics, as well as bivariate analysis of two related variables. For normally distributed data, t-test with free samples was performed. Mann-Whitney test was applied to the non-normal distributions. Meanwhile, the Chi-square test was carried out to identify the correlation between variables.  $P < 0.05$  was considered statistically significant.

## Ethical approval

Ethical approval (Number 0340/LOE/301.4.2/II/2021) was obtained from the Ethics Committee of Dr. Soetomo Academic Medical Center, Surabaya, Indonesia. Oral Informed consent was obtained from all individuals included in this study.

## Results

Although not statistically significant, the mean age in the simple surgical procedure group was lower than that in the complex surgical procedure group, ( $p=0.099$ ). Additionally, statistical significance was also not observed in gender difference between the two groups ( $p=0.315$ ). The results indicate that 56% of the simple surgical procedure group were male, and 57.1% of the complex surgical procedure group were female (Table 1).

In the simple endoscopic endonasal group, 76% of the patients complained about nasal obstruction, while 74.3% of patients that had undergone complex surgical procedures had nasal discharge (Table 2). Additionally, the main risk factors in 28% the patients that underwent the simple surgical procedures included smoking and allergies. On the contrary, allergies and gastroesophageal reflux were discovered in 25.7% of the patients in the simple surgical procedures group. The maximal medical treatment (MMT) history was discovered more in the patients who underwent the complex surgical procedures (37.1%), compared to the simple surgical procedures group, (20.0%).

As much as 28.6% of the patients in the complex surgical procedure group had past surgical history, which was higher than the 24% of the patients in the simple surgical procedures group. In addition, the most surgical history types in the simple surgical procedures group was sinus surgery/nasal irrigation (8.1%), however, in the complex surgical procedure group nasal polypectomy was the main surgical type (11.4%) (Table 2).

The most diagnosed disease was chronic rhinosinusitis (CRS) without polyps in the simple surgical procedures group (45.7%), while CRS with polyps was the most identified in the complex surgical procedures group (40.0%).

The t-test results of the length of postoperative care and the number of visit variables of endoscopic endonasal postoperative patients at ORL-HNS Outpatient Unit at Dr. Soetomo Academic medical center in Surabaya suggested that the number of visits was statistically significant in both groups ( $p=0.015$ ) (Table 3).

Based on the analysis of the receiver operating characteristics (ROC) curve, the obtained cut-off point for the length of postoperative care in both groups was six weeks with an area under the curve of 0.667 (0.528-0.807) and a p-value of 0.028. In accordance with the cut-off-point value, the length of postoperative care was categorized into less than six weeks and more than six weeks, as listed in Table 4.

According to the analysis employing the Chi-square test (Table 4), there was a significant correlation between the endoscopic endonasal surgical procedure groups and the length of postoperative care with a cut-off point of six weeks

**Table 1. Patient's demographic data.**

Variable	Types of surgical procedures in endoscopic endonasal surgery		p-value
	Simple (n=25)	Complex (n=35)	
Age (years), mean±SD	39.64±13.28	46.08±15.62	0.099*
Gender, n (%)			
Male	14 (56.0%)	15 (42.9%)	0.315**
Female	11 (44.0%)	20 (57.1%)	

\*The independent samples t-test; the result would be significant if the p-value was lower than 0.05.

\*\*The Chi-square test; the results would be significant if the p-value was lower than 0.05.

**Table 2. Characteristic of postoperative care patients.**

Variable		Types of surgical procedures in endoscopic endonasal surgery			
		Simple (n=25)		Complex (n=35)	
		n	%	n	%
main complaints	nasal obstruction	19	76.0	25	71.4
	nasal discharge	14	56.0	26	74.3
	facial pain	18	72.0	23	65.7
	reduced smell	6	24.0	15	42.9
risk factors	allergies	7	28.0	9	25.7
	asthma	1	4.0	4	11.4
	gastroesophageal reflux	6	24.0	9	25.7
	smoking	7	28.0	6	17.1
MMT history	yes	5	20.0	13	37.1
past surgical history	yes	6	24.0	10	28.6
types of past surgical	FESS	1	4.0	0	0.0
	sinus surgery	3	12.0	3	8.6
	nasal polypectomy	2	8.0	4	11.4
	septoplasty	0	0.0	1	2.8
diagnosis	chronic Rhinosinusitis with polyp	2	5.7	14	40.0
	chronic rhinosinusitis without polyp	16	45.7	12	34.3
	deviated septum	8	22.9	9	25.7
	Inferior turbinate hypertrophy	6	17.1	3	8.6

**Table 3. Length of care and the number of postoperative visit.**

Variable	Types of surgical procedures				p-value
	Simple (n=25)		Complex (n=35)		
	Median	Range	Median	Range	
length of postoperative care (week)	9	2-34	12	3-81	0.028*
number of visit (times)	4	1-9	5	2-27	0.015*

\*p=0.015.

**Table 4. The t-test of the length of Postoperative care for the endoscopic.**

Types of surgical procedures in endoscopic endonasal surgery	Length of postoperative care		p-value	RR
	≤6 weeks	>6 weeks		
Simple	15 (60.0%)	10 (40.0%)	0.023*	2
Complex	5 (14.3%)	30 (85.7%)		

\*p=0.023.

(p=0.023). The complex endoscopic endonasal surgical procedure group required significantly longer postoperative care, compared to the simple surgical procedure group. The complex endoscopic endonasal surgical procedure group required more than six weeks for postoperative care, which is double the length of care in the simple surgical procedure group.

## Discussion

The median length of postoperative care for the complex surgical procedure group was 12 weeks with a range of 3-81 weeks, while for the simple surgical procedure group it was nine weeks with a range of 2-34 weeks. Additionally, the median length of postoperative care in the complex surgical procedure group was significantly longer than in the simple surgical procedure group. This study indicated a significant correlation between the length of postoperative care and the endoscopic endonasal surgical procedure groups. The complex endoscopic endonasal surgical procedure group required significantly longer postoperative care, approximately more than six weeks, than the simple surgical procedure group.

As reported by other studies, it is most likely that the length of postoperative patient care was influenced by the appropriate management and follow-up of endoscopic endonasal surgery.<sup>7</sup> Mielcarek-Kuchta *et al.* reported that the length of postoperative care for endoscopic endonasal surgery patients ranged from six weeks to three months. Meanwhile, Dursun *et al.* reported that the length of the postoperative care ranged from 2 to 54 months, with an average period of 23 months. Another study stated that postoperative care of 12 endoscopic endonasal surgery patients was conducted for 6 months.<sup>8</sup>

Previous studies also mentioned that the length of postoperative follow-up, which might describe the length of postoperative care and the success of the surgery, was assessed by the percentage of recurrency and symptom resolution.<sup>9</sup> Another study conducted postoperative clinical follow-up on the type of procedure in the complex surgical procedure group based on the patient postoperative clinical condition, the endoscopic and CT scan findings, as well as the presence or absence of complications and revision surgery to assess the healing process and the success of the surgery.<sup>10</sup>

Several studies indicated that the duration of the wound healing process in the simple surgical procedures were relatively shorter than that in the complex surgical procedures. For instance, when studying the uncinectomy procedure, Mekhiemer *et al.* stated that the wound healing process in partial uncinectomy was approximately one or three weeks compared to approximately two or three weeks in total uncinectomy. Also, Byun dan Lee discovered that the wound healing process ranged from 1.18 to 2.36 weeks in partial uncinectomy and from 1.63 to 3.21 weeks in total uncinectomy.<sup>11</sup>

Wound healing in those studies was defined by complete closure of the uncinectomy site by normal mucosa. The aforementioned studies support the results of this study, which indicated that the complex surgical procedure group had a longer healing period than the simple surgical procedure group.

Patients who underwent FESS were monitored for a period of 4 to 14 months, with a median follow-up of nine months. Postoperative outcomes were evaluated subjectively and objectively. The objective evaluation consisted of nasal endoscopy and, if possible, CT evaluation. The objective evaluation criteria consisted of epithelialization of the healthy ethmoid cavity, no sign of pathological secretions, and adequate opening of the natural ostium.<sup>12</sup>

During the primary follow-up, thorough endoscopic cleaning of the cavity and separation of developed adhesions was performed on the 5<sup>th</sup> to 7<sup>th</sup> postoperative days. Endoscopic inspection and removal of the remaining crusts were performed on the 14<sup>th</sup> postoperative day. During the secondary follow-up, which was approximately three months post operation, an endoscopic inspection of the cavity was performed in all patient groups. However, in patients with polypoid disease this took place approximately six months post operation. The primary postoperative follow-up of FESS consisted of three or four visits during the first two or three weeks until the ethmoid healed. Blood clots, crusts, etc., were removed endoscopically, and nasal saline irrigation was administered. Intranasal corticosteroid was applied as previously described.<sup>13</sup>

Frontal sinusotomy surgery patients required a twice-weekly visit for the first two weeks post operation. The frontal recess was cleaned and irrigated sufficiently. The frontal sinuses could also be irrigated during the initial postoperative visit, especially if a stent is placed. Some postoperative patients experience transient frontal pain for a year or more, but they responded well to weekly saline irrigation of the sinuses for two or three weeks.<sup>14</sup>

Simple procedure was applied mostly to localized disease in which the main problem was ventilation and or drainage pathway. Whereas complex procedure was applied on diffuse mucosal disease in which the main problem came from the mucosa itself. In the localized disease, restoring the ventilation problem is the solution, whereas in diffuse mucosal disease, the diseased mucosa is not easily to manage. Post operative care on diffuse mucosal disease is more complex commonly need the systemic treatment aside of intranasal corticosteroid and nasal saline irrigation. On the other hand, localized disease may only require nasal saline irrigation.



## Conclusions

Endoscopic endonasal surgery is a minimally invasive procedure, but the possibility of postoperative damage to the sinonasal mucosa cannot be ruled out. The complex endoscopic endonasal surgery group required a longer length of care and more postoperative outpatient visit than the simple procedure group. The goals of postoperative care are to promote wound healing and early mucosal regeneration, reduce local inflammation, and minimize symptoms in the early postoperative phase. Postoperative care is expected to improve the quality of life that is sustainable in the long term and can minimize the possibility of revision surgery.

## Data availability

### Underlying data

Figshare: Differences in the length of postoperative care of endoscopic endonasal surgery in simple and complex surgical procedure groups [10.6084/m9.figshare.19210806](https://doi.org/10.6084/m9.figshare.19210806)<sup>6</sup>

This project contains the following underlying data:

Data file 1. (Description of data.)

Data file 2. (Description of data.)

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## Author contributions

All author: writing-original draft; BS and FF: conceptualization and Resources

## Ethical approval

The study was approved by the Ethics Committee (Approval number 0340/LOE/301.4.2/II/2021) of Dr Soetomo Academic Medical Center.

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# Open Peer Review

Current Peer Review Status:  

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## Version 2

Reviewer Report 16 December 2022

<https://doi.org/10.5256/f1000research.137567.r149290>

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### Mikiya Asako

Department of Otolaryngology — Head and Neck Surgery, Kansai Medical University Hospital Medical Center, Osaka, Japan

I approved Dr Suktikno B revision version. I think this paper is acceptable.

**Competing Interests:** No competing interests were disclosed.

**Reviewer Expertise:** Rhinology, Endoscopic Surgery, Skull base Surgery, Rhinoplasty, Allegology

**I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.**

Author Response 17 Dec 2022

**Budi Sutikno**, Faculty of Medicine, Universitas Airlangga - Dr. Soetomo Academic Medical Center, Surabaya, Indonesia

Dear Reviewer 2 (Prof. Mikiya Asako),

Thank you very much for your kind review and approval.

**Competing Interests:** No competing interests were disclosed.

Reviewer Report 16 September 2022

<https://doi.org/10.5256/f1000research.137567.r149291>

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**Kachorn Seresirikachorn** 

Department of Otolaryngology, Faculty of Medicine, Chulalongkorn University, Bangkok, Thailand

Thank you for addressing my comment.

**Competing Interests:** No competing interests were disclosed.

**Reviewer Expertise:** Chronic rhinosinusitis, allergic rhinitis, endoscopic sinus and skull base surgery

**I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.**

Author Response 16 Sep 2022

**Budi Sutikno**, Faculty of Medicine, Universitas Airlangga - Dr. Soetomo Academic Medical Center, Surabaya, Indonesia

Dear Reviewer (Dr. Kachorn),

Thank you very much for your kind assistance to this manuscript.

**Competing Interests:** No competing interest were disclosed

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### Version 1

Reviewer Report 01 August 2022

<https://doi.org/10.5256/f1000research.121607.r144481>

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**Kachorn Seresirikachorn** 

Department of Otolaryngology, Faculty of Medicine, Chulalongkorn University, Bangkok, Thailand

I have a question about the rationale for performing this study. The surgery for the different diseases should not be compared. This paper's simple endoscopic endonasal surgery is the surgery for allergic rhinitis or unilateral maxillary sinusitis, whereas complex endoscopic endonasal surgery is the surgery for true sinus disease. The pathophysiology of the disease is different, so I am not convinced that these two categories of surgery should be compared. The definition of postoperative care should be provided. I am not sure that the postoperative care period in this paper means only the debridement and sinonasal toilet or the entire postoperative management, including all medical treatment to normalize the sinonasal mucosa. Postoperative wound healing depends on the surgical technique and the surgeon's expertise. The qualification and standard technique of the surgeon should be provided. Moreover, I am not sure that all patients receive the same postoperative protocol. This point is essential when the objective aim to compare the two surgical categories. The clinical and research applicability and the limitation of the study should be discussed.

**Is the work clearly and accurately presented and does it cite the current literature?**

Partly

**Is the study design appropriate and is the work technically sound?**

Partly

**Are sufficient details of methods and analysis provided to allow replication by others?**

Partly

**If applicable, is the statistical analysis and its interpretation appropriate?**

Partly

**Are all the source data underlying the results available to ensure full reproducibility?**

Yes

**Are the conclusions drawn adequately supported by the results?**

Partly

**Competing Interests:** No competing interests were disclosed.

**Reviewer Expertise:** Chronic rhinosinusitis, allergic rhinitis, endoscopic sinus and skull base surgery

**I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.**

Author Response 14 Aug 2022

**Budi Sutikno**, Faculty of Medicine, Universitas Airlangga - Dr. Soetomo Academic Medical

Center, Surabaya, Indonesia

Dear Reviewer (dr. Kachorn)

Thank you very much for the kind review on my manuscript. This study was intended to give brief difference of post operative care duration for different group procedure which represent group of disease: localized and diffuse mucosal disease. I hope it will be beneficial to clinicians to give advice for their patients on how long the post operative care will take. I would like to have your further review on the revised manuscript I have sent to the publisher.

**Competing Interests:** No competing interests were disclosed.

Reviewer Report 24 June 2022

<https://doi.org/10.5256/f1000research.121607.r139884>

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### Mikiya Asako

Department of Otolaryngology – Head and Neck Surgery, Kansai Medical University Hospital Medical Center, Osaka, Japan

This paper describes appropriate messages for rhinologists of the postoperative care. Their opinion is clear and correct. However, I still have a small unclarified issue about the indication of surgery. I think the inflammation of the complex group is even worse than the simple group. The different profiles of airway inflammation strongly involve results. The simple group might be including non-type 2 CRS or allergic rhinitis, on the other hand, the complex group will be including type2 CRS, because CRS w NP is predominant in central compartments, such as ethmoid and frontal sinus. Type 2 CRS is much more severe inflammatory changes in the epithelial membrane. Please explain the differences of postoperative damage as well as the profiles of airway inflammation.

**Is the work clearly and accurately presented and does it cite the current literature?**

Yes

**Is the study design appropriate and is the work technically sound?**

Partly

**Are sufficient details of methods and analysis provided to allow replication by others?**

Yes

**If applicable, is the statistical analysis and its interpretation appropriate?**

Yes

**Are all the source data underlying the results available to ensure full reproducibility?**

Yes

**Are the conclusions drawn adequately supported by the results?**

Partly

**Competing Interests:** No competing interests were disclosed.

**Reviewer Expertise:** Rhinology, Endoscopic Surgery, Skull base Surgery, Rhinoplasty, Allergy

**I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.**

Author Response 01 Jul 2022

**Budi Sutikno**, Faculty of Medicine, Universitas Airlangga - Dr. Soetomo Academic Medical Center, Surabaya, Indonesia

Dear Prof. Mikiya Asako,

Thank you for kind review. Please allow me to give short explanation for your question. Due to limitation of resources, we lay the endotyping on post operative histopathological report. Most of CRSwNP had non-type 2 endotype and pathological result showed neutrophilic predominant inflammatory polyps. Some cases easily (not so easy) managed with topical intranasal steroid and nasal saline irrigation, but some other difficult cases need systemic treatment of low dose long term macrolide.

Looking forward to having your further respons. Thank you very much.

**Competing Interests:** no conflict of interest

Author Response 14 Aug 2022

**Budi Sutikno**, Faculty of Medicine, Universitas Airlangga - Dr. Soetomo Academic Medical Center, Surabaya, Indonesia

Dear Reviewer (dr. Asako)

I have send the revised manuscript with additional information on the simple and complex group. You are right that simple group represent the localized disease, whereas the complex group represent the diffuse mucosal disease. In regard with the revised manuscript, I would like to have your further review. Thank you very much in advance.

**Competing Interests:** No competing interests were disclosed.

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