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A Comparative Study Investigating the Necessity of Prophylactic 'Systemic Antibiotic and Gentamicin Tunnel Lavage' in Peroral Endoscopic Myotomy (Poem) and Similar Tunneling Procedures (Z-D-G Poem)

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Introduction: Peroral endoscopic myotomy (POEM) and similar procedures (Z-D-G POEM) are one of the most remarkable topics recently in the gastroenterology community. In this paper, we aimed to investigate the necessity of prophylactic 'systemic antibiotic and gentamicin tunnel lavage' in these procedures.
Materials and Methods: From August 2018 to May 2021, we performed Achalasia POEM (35), Zenker's POEM (3), Diverticulum POEM (1), and Gastric POEM (2). Of these, 21 patients received prophylactic 'systemic antibiotic and gentamicin tunnel lavage' and the others (20 patients) nothing. The primary topics of the research were an adverse event, fever, changes in inflammatory markers(c-reactive protein(CRP), white blood cell(WBC), the length of hospital stay, and re-admission rate to the hospital.
Results: The mean age was 46.96±15.44 (21-78) and male/female ratio was 26(67.9%) /15 (32.1%). Comparing groups with and without antibiotics, there was no difference between the two groups as to several adverse events, hospital stay, fever, levels of CRP, and WBC count(all p-values>0.05). The median CRP values on day 1 and day 3 were somewhat high in the antibiotic negative group but were not statistically different (p:0.667 and p:0.839). The median values of WBC of days 1, 3 and 5 were similar in both groups (all p-values>0.05). The mean follow-up days were 396±182.7 and 197.7±18.62 in the antibiotic (+) and antibiotic (-) groups, respectively (p<0.05). Despite such a long follow-up, no patient has been re-administered to the hospital due to infection-related complications.
Conclusion: In this paper, we have shown that the application of prophylactic 'systemic antibiotic and gentamicin tunnel lavage' may not be required in POEM and similar procedures.

Keywords: Peroral endoscopic myotomy, Antibiotic, Gentamicin, Achalasia, Dysphagia, Infection

Introduction

Achalasia is a chronic progressive disease that mainly causes difficulty swallowing both liquid and solid. With the remarkable developments in its diagnosis and treatment, this disease has been the subject of many important studies and articles in recent years (1). Early traditional treatment option for the disease was pneumatic dilatation, botox injection, and Laparoscopic Heller myotomy (LHM) in the past two or three decades, but the success rate was not at the

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desirable level, especially in patients with type 2 and 3 achalasia (1, 2). Because of unmet needs, in 2010, Prof.Inoue launched the first case of tunneling procedure which is to be called as "Peroral endoscopic myotomy (POEM)" in a young achalasia patient (1). POEM is a new minimally invasive and innovative treatment that is basically developed for achalasia a nd subsequently used for the treatment of Zenker's diverticulum (Z-POEM), Epiphrenic diverticulum (D-POEM), and Gastroparesis-gastric-(G-POEM) (3, 4). The main advantages of POEM and similar procedures to traditional surgical treatments are the absence of any skin scars on the body surface, short processing time, chance of long-length myotomy, fast and easy post-operative recovery as well as low complication rates (5). And now, POEM is accepted as one of the most popular and advanced endoscopic procedures in the world.

POEM is like a surgical procedure, performed under general anesthesia without rigor surgical principles. As expected, it can be done after a learning period with a master's doctor. Initially, many endoscopists learned this procedure from Prof. Inoue. The 'gentamicin tunnel lavaging' was the routine procedure of Prof. Inoue's description during POEM, he called it as a 'Holy water', and he always said 'there was no evidence for that application'. Also, there was no evidence about assessing the necessity of this application in the literature (6). Initially, gentamicin tunnel lavage was probably used mainly to prevent serious and fatal infective complications such as mediastinitis, empyema, and abscess (1, 2). During the rapid spread of POEM to the world, the application of 'gentamicin tunnel lavage' was done by many POEM performer doctors without questioning its necessity. Following years, some centers added 'systemic antibiotic using' to gentamicin tunnel lavage. Consequently, dual application (systemic antibiotic and gentamicin tunnel lavaging) was perceived as a routine procedure in POEM without question of need (7, 8). However, we do still not know what kind of clinical practice (systemic prophylactic antibiotic with/without gentamicin tunnel lavage) and which antibiotics are performing by all POEM operators during POEM procedure.

The first human case of POEM was almost made 11years ago and subsequently completed nearly more than 20000 successful procedures all over the world, but only two guidelines for POEM procedure were published (9, 10). In the first guide published in 2018 prepared by Inoue, many detailed issues (detailed procedure descriptions, indications, contraindications, side effects, management of complications and postoperative follow-up) have been addressed, but there is no clear recommendation for 'prophylactic systemic antibiotic using' and 'gentamicin lavaging into the tunnel'(9). European Society of Gastrointestinal Endoscopy (ESGE) guideline recommends a single dose of prophylactic antibiotic injection intravenously before induction of anesthesia when performing POEM, but reference articles given in this manual are very old (from the 1980s and 1990s), and most are them not full-text.Therefore, ESGE recommendations include low-quality evidence (10). This topic is still hot and very controversial for centers performing advanced endoscopic procedures.

In almost all major articles (with a large patient number) published so far, systemic antibiotics and gentamicin tunnel lavaging have been used (5, 7, 11-14). When examined these articles carefully, none of them gives details about why systemic antibiotics and gentamicin tunnel

lavaging are used (3, 11, 15, 16). There are very few articles on this subject, and one of them, Bayer et al., have shown that gentamicin tunnel lavage has no benefit in preventing infection (17). The risk of dangerous infection should be expected to be low with the development of the POEM technique in time and more frequent application by expert (2,5,12). Considering the dangerous changes of unnecessary antibiotics using on microbiota in recent years and the possible harmful effects to other organs, it has become very important for us to question the use of antibiotics in the POEM process (18). We need to talk about that traditional habits should be investigated and revised if there is no evidence about them. In this paper, we investigated the necessity of prophylactic systemic antibiotic using and tunnel lavaging with gentamycin in our case series. with a retrospective manner.

Materials and Methods

Study Design

We retrospectively analyzed our patient's data which were performed between August 2018 and June 2021. All procedures were tunneling process. The case series consisted of 35 Achalasia POEM, 3 Zenker's POEM, 1 Epiphirenic Diverticulum POEM, and 2 Gastric POEM. All patients had a prominent symptom and a clear indication for special procedures to be performed. A high-resolution manometry for the achalasia patients, contrast swallow esophagram for diverticulum disease (Zenker's and Epiphirenic Diverticulum), and a study of gastric emptying time for gastroparesis was performed before the procedure. Except for one patient (Heller myotomy), no treatment attempts before (pneumatic balloon dilatation, injection of botulinum toxin, laparoscopic) had been made. We started tunneling procedures in August 2018, as everyone does, we used systemic antibiotics (ampicillin/sulbactam or ceftriaxone) and tunnel lavaging with gentamicin in all initial POEM procedures. Nearly after completed the 21st procedure, we abandoned both 'systemic antibiotic using' and 'gentamicin tunnel lavaging', and continued others procedures in this way. Most of the first 14 cases (66 %) were done with the help of a more experienced doctor on POEM. Z-D and G-POEM procedures were performed after the 15th Achalasia POEM procedure. The POEM procedure was done traditionally as clearly explained in many previous articles. Antibiotic using and tunnel lavaging with gentamycin were made as follows; ampicillin/sulbactam (intravenous)(2x1gr) or ceftriaxone (intravenous) (2x1gr) was started one day of POEM procedure and continued postoperative five days. The gentamicin tunnel lavaging (2 vials 40 mg gentamicin with 100 cc saline) was applied by administering a spray catheter after myotomy is finished. Almost all procedures were scheduled on Thursday of a week and planned to be discharged the following Monday (5 days for a hospital stay). The primary topics of the research were to investigate adverse event rate, fever pattern, the changes of inflammatory markers [(c-reactive protein (CRP), white blood cell count (WBC)], the length of hospital stay (after operation), and infection-related admission to the hospital during long-term follow-up. The normal range of CRP levels was between 0-5 mg/dl and WBC was 4-10x10^9/L. Fever was accepted if above 37.5^0 Celcius.

Radiological Assessment

A Computed tomography (thorax or abdomen) was performed on all patients on the day after the procedure due to investigate the esophageal leak and minor complications. All

patients were followed up at least 3 months for complications related to infection and others.

Ethical Statement

Local ethic committe of Bülent Ecevit University approved the study (29/04/2019 - 2020/09). The study was carried out following the Declaration of Helsinki. Data analysis was carried out with the SPSS version 18 (Chicago, IL, USA). First, the distribution of variables was examined by Shapiro-Wilk and Kolmogorov-Smirnow tests, and the necessary statistical analysis was determined. Normally distributed and non-distributed variables were expressed as they should be. Mann-Whitney-U and independent t-test were used for the difference between the independent variables depending on whether variables are normally distributed or not. P value<0.05 was considered significant.

Results

A total of 41 patients were included in the study. 35 of them were achalasia POEM, 3 were Zenker's POEM, 1 was Diverticulum POEM and 2 was Gastric POEM. Briefly, the mean age was 46.96±15.44 (21-78) and male/female (ratio) was 26(67.9%)/15(32.1%). The success rate was 97.5%, and one POEM (achalasia) was not completed due to a ventilation problem created by probably over carbon dioxide insufflation during the middle of the procedure. While the median operation time was 102 minutes, the longest operation time was 253 minutes. These 41 patients were divided into two groups according to the condition of antibiotic use status; antibiotic (ATB-group) and non-antibiotic (NATB group). The group of ATB (consisted of 21 patients) identifies taking systemic antibiotic [(ampicillin-sulbactam; 9 (42.9%), ceftriaxone: 12 (57.1%)] and gentamicin tunnel lavage. The group of NATB (consisted of 20 patients) specifies patients who have not taken any systemic antibiotics and gentamicin tunnel lavage. A piece of compact information showing the basic descriptive characteristics of the study patients is summarized in Table-1.

Table 1. Basic descriptive information of the study cohort

Variables	Number, %, std, min-max
Age, *years, std, min-max*	46.96±15.44 (21-78)
Gender *(Male/Female)*	26(67.9%)/15 (32.1%)
Procedures, *n:41, 100%*	
Achalasia Type	21 (51.2%)
Type 1, n, %	10 (24.3%)
Type 2, n, %	4 (9.75%)
Type 3, n, %	3 (7.3%)
Zenker's Diverticulum (Z-POEM)	1 (2.4 %)
Diverticulum POEM (D-POEM)	2 (3.4%)
Gastric POEM (G-POEM)	
Procedure *(POEM=41)*	
Anterior (12 o'clock)	21 (75%)
Lateral (3 o'clock)	17 (25%)
Posterior (5 o'clock)	3 (7.3%)
Antibiotic use	
Antibiotic (+)	21 (51.3%)
Ampicilline / sulbactam	9 (42.9%)
Ceftriaxone	12 (57.1%)
Antibiotic (-)	20 (48.7%)
Success rate	27 (97.5%)
Procedure time, *median(min-max)*	102 min (32-253)
Eckardt score, *median (min-max)*	8.6 (7-11)

The two groups (ATB=21 and NATB=20) were similar in basic data such as mean age, gender, and co-morbid disease. The median procedure time of ATP group [117.5 (85-240)] was longer than [67.5 (32-253)] NATP group (p<0.05). The longest procedure time was 253 minutes in the NATB group. Detailed information about the groups is given in Table 2. The main objective of the study was to compare those groups in terms of inflammatory markers change, fever, stay of the hospital, and any infection-related complications at the time of post-operative period and long-term follow-up. There was no difference between the two groups as to adverse events, fever, c-reactive protein, and white blood cell count (all p-values>0.05).

Table 2: Comparison of two groups of patients who took antibiotic or not in terms of basic demographic data, inflammatory markers, fever, side effects and duration of hospitalization

Variables	ANTIBIOTIC		*P*
	ATB (21)	NATB (20)	
Age (SD)	50.4±14.1	48.5±16.8	0.409
Gender (M/F)	13/8	13/7	0.42
Co-Morbid Disease	10	9	0.899
	Hypertension (4)	Hypertension (4)	
	Diabetes Mellitus (2)	Diabetes Mellitus (1)	
	Hypothyroidism (2)	Hypothyroidism (1)	
	Down's Syndrome (1)	CAD (1), Asthma (1)	
	Arytmia (1)	Chronic Hepatitis B (1)	
		BPH (1)	
Procedure	POEM (21)	POEM (14)	0.719
		Z-POEM (3)	
		G-POEM (2)	
		D-POEM (1)	
Procedure time (min)(min-max)	117.5 (85-240)	67.5 (32-253)	*0.002*
Success rate	20/21 (95.2 %)	20/20 (100%)	
Advers Events	9	6	0.785
Aspiration pneumonia	2	3	0.632
Mucosal tear	1	0	
Capnoperitoneum	4	0	
Emphysema (minimal)	2	3	
Fever			
Subfebrile, C° (37-37.5)	0	1	NS
Febrile, C° (>37.5)	0	0	
Hospital stay (days)	5.46 (4-11)	5.1 (4-6)	0.811
Follow-up (days)(SD)	396±182.7	197.7±18.62	*0.001*
CRP, mg/dl			
CRP Average (mean±std)	33.73±14.94	37.24±24.62	0.652
Operation Day (min-max)	3.15 (0.4-44)	3.1 (0.3-28.3)	0.667
Day 1	38.35 (12.8-89)	41.9 (9.4-143.5)	0.667
Day 3	53.05 (16.5-106)	63.5 (13.1-183)	0.839
Day 5	21.2 (6.8-59)	18.2 (2.4-98.6)	0.91
WBC, 10^9/L			
WBC Average (mean±std)	7.92±3.33	7.58±1.26	0.72
Operation Day (min-max)	9.09 (4.7-13.9)	5.9 (4.5-8.7)	0.663
Day 1	10.15 (5.3-16.5)	9.95 (6.3-13.8)	0.982
Day 3	6.4 (3.2-19.6)	7.15 (5.3-11.8)	0.482
Day 5	5.05 (2.8-12.2)	5.95 (4.1-8.7)	0.227
Hemoglobin, gr/L			
Operation Day (mean±std)	13.05±2.04	13.45±1.71	0.579
Day 1	11.64±3.07	12.72±1.48	0.248
Day 3	12.11±1.79	12.91±1.28	0.185
Day 5	12.40±1.66	12.86±1.4	0.43

ATB: Antibiotic**, NATB:** No-antibiotic **POEM**: peroral endoscopic myotomy, **(Z-D-G) POEM:** Zenker, Diverticulum, Gastric-peroral endoscopic myotomy, **CRP**: C-reactive protein, **BPH**: Benign prostatic hyperplasia, **Min-max**: minimum-maximum, **C^0**: Celcius, **WBC**: White blood cell, **CAD**: coronary artery disease, **NS**:non significance, **SD**: Standart deviation, **Min**: Minute

CRP and WBC values selected as inflammatory markers were examined on the operation day, day 3, and day 5. The median CRP values on day 1 and day 3 were somewhat high in the NATB but were not significantly different (p:0.667 and p:0.839).The mean CRP (operation day, day 1, day 3, day 5) was similar both groups (33.73±14.9 vs 37.2±24.6)(p:0.652)(Figure-1/2).

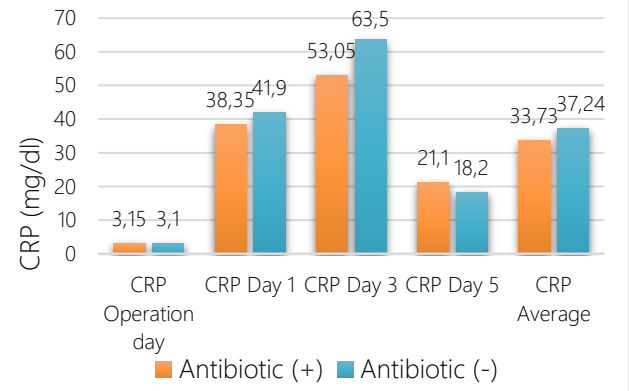

Figure 1. There is no difference between the antibiotic positive and negative groups in terms of mean and median CRP values

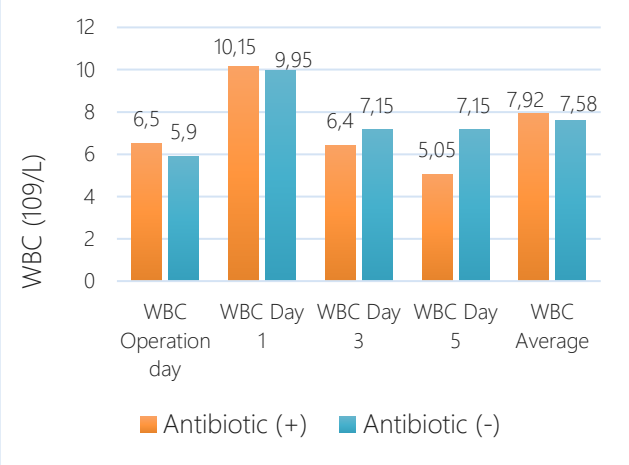

Figure 2. There is no difference between the antibiotic positive and negative groups in terms of mean and median white blood cell count

The median (operation day, days 1,3, and 5) and mean white blood cell counts were similar in both two groups (all p-values >0.05). A total of 15 adverse events were revealed in this period, all of them mild and none of them required a further surgical or interventional operation (Table-2). The number of adverse events was similar in both two groups (9 vs. 6, p:0.532). The mean follow-up was 396±186.7 and 197.7±18.6 in ATP and NATP, respectively (p<0.05)(Table-2). Despite such a long follow-up(almost 1 year), no patient has been re-administered to the hospital due to infection-related complications.

Discussion

While there are many articles in the literature regarding the POEM technique, most ofthem are related to technique, complications, and efficacy, there is little information about the way and duration of antibiotic use in the POEM procedure. This is the first article to investigate the necessity of the use of both prophylactic systemic and in-tunnel antibiotics in POEM procedures and afterward.

Achalasia is a rare, slowly progressive neuro-degenerative disease characterized by difficulty swallowing. Considering the medical history of this disease in the last 15 years, remarkable progress is observed in both diagnosis and treatment (1). In recent years, it has attracted great interest in the medical community, as a shining star, among other gastrointestinal diseases due to the success of a new minimally invasive therapy developed recently. The name of this endoscopic minimally invasive treatment is POEM. The POEM, which is the first 3rd space endoscopy technique, has been developed primarily for Achalasia treatment in 2010 and subsequently used for Zenker's and Epiphrenic Diverticulum, Gastroparesis (Z-D-G POEM) as well as Sub-epithelial tumor resection (STER) (6,19). They are called "digestive endoscopic tunnel techniques" and are the most important innovative and groundbreaking developments in gastroenterology within the last decades (6).

Considering the technical details of the POEM process; unlike LHM, myotomy is performed in the mediastinal region by a 'non-sterile

endoscope' passing through the mouth that contains many bacteria and fungi (20). In some POEM procedures, it is necessary to interrupt and re-enter with an endoscope due to over insufflation of carbon dioxide or cleaning of the endoscopic lens. Every entry and exit with a non-sterile endoscope creates a fear that it may cause bacteria to be transported from the mouth flora to the sterile operation site (21). On the other hand, the second factor, perhaps a more important risk than the first, is problems related to post-operative esophageal leakage whether from the mucosal entrance site due to clip dislocation or ischemia/ damage of esophageal mucosa (22). It is very important to notice at the early stage to keep the patient safe. The leakage usually occurs within the first postoperative following 3 days and it is very important to monitor the patient's clinic, fever, c-reactive protein, and white blood cells for early recognition (5, 22).

The possibility of severe adverse events of POEM and similar procedures is very rare compared to surgery (11, 23). Many adverse events are mild to moderate and occur within the first 48 hours and are commonly managed with no further intervention (14). However, many endoscopists have a serious fear that infective complications are very rare but can be fatal and early recognition infection remains essential (22). Many centers and endoscopists use systemic antibiotics and gentamicin tunnel lavage during POEM and similar tunnel procedures. Most center use systemic antibiotic differently; some centers use only a single perioperative intravenous antibiotic, while other centers use systemic antibiotic both perioperative and post-operative 5 days (7, 8). However, there is still insufficient and very weak evidence for the necessity of this (9, 14). Also, we still do not know what kind of antibiotics (how long and in which way) are using by POEM operators during achalasia treatment. In summary, there is serious debate and complete confusion about "the use of systemic antibiotics and gentamicin tunnel lavage" in POEM and similar tunnel procedures due to the lack of enough evidence (17, 19).

The POEM and similar procedures increase day by day all over the world but there are only a few well-written, clear and detailed guidelines about it (9). The most important deficiency of guidelines is the lack of sufficient data on antibiotic use. There are only two guidelines on this subject and there is no recommendation due to insufficient evidence on this subject (9, 10, 24, 25). In the ESGE guideline, the studies cited in this guide are small samples and not full-text. In a prospective randomized controlled trial by Zhai in 52 POEM patients, it was reported that giving 2 gr of intravenous ceftriaxone sodium preoperatively did not provide any additional clinical benefit in the prevention of infection (26). The second guideline representing Japanese experience, there is no statement regarding the use of antibiotics (9). Briefly, unfortunately, two guidelines do not show a clear direction to endoscopists regarding the use of antibiotics in POEM and similar procedures.

In this study, we conducted a retrospective study to provide evidence for this controversial issue. The main purpose of this article is to question whether prophylactic antibiotic use is required in these procedures. A total of 28 patients were included. Of these, while 14 patients received systemic antibiotics (5 days) and gentamicin tunnel lavage, the other 14 patients did not take any antibiotics. These two were compared in terms of inflammatory

markers (CRP, WBC), length of hospital stay, fever, and adverse event, and no difference was detected (all p>0.05). Unlike other studies, the inflammatory marker levels of the post-operative first 5 days were examined in detail. In terms of CRP, the median CRP levels were slightly low in postoperative days 1 and 3 in patients receiving antibiotics, but it was statistically insignificant (Figure 1).

Potential infection-related complications in POEM and similar procedures are still very rare (21). Possible scenarios can be evaluated as aspiration pneumonia, empyema, and mediastinitis(14). In POE and similar procedures, potential bacterial contamination with a non-sterile endoscope is possible after full-thickness myotomy in the mediastinum and peritoneal cavity. However, there is no clear evidence as to whether this plays a role in infection (21). Unlike other advanced endoscopic way, maintaining the integrity of the mucosa is the most important issue for preventing complications. Mucosal integrity can be impaired in two ways; the first is 'reopening' the mucosal entrance due to clip dislocation, the second is 'delayed mucosal perforation' due to excessive thermal effect of cautery (21). These two main factors that can lead to infection complications are completely related to the experience of the operator performing the POEM procedure. In the research paper published in 2016 by Zang et al, which is included a retrospective analysis of single-center with 1680 patients information about major adverse event rate in 5 years analysis, the adverse event rate was 3.3% and most of them were delayed mucosal barrier insufficiency and pneumothorax, but none of them required surgery (27). In a large and multi-center international study consisted of a well-covered retrospective analysis of 1826 patients written by Haito-Chavez, the adverse event rate was 7.5%, but the severe adverse event rate was (0.5%) (14). The most common of these were inadvertent mucosotomy (2.8%), symptomatic capnoperitoneum (1.2%), and esophageal leak (0.7%). Mild, moderate, and severe adverse event rate was 6.4% (116), 1.7% (31), and 0.5% (9) respectively. The most adverse event was managed conservatively and endoscopically, but only 2.6% required further surgery, and 19.9% required percutaneous drainage (14). In this study, these factors (sigmoid-type esophagus, the endoscopist experience, the use of a Triangular tip knife, and the use of an electrosurgical current different than spray coagulation) are associated with the occurrence of adverse events (14).

Until now, whether published large multicenter study or case series with a large number, the reported adverse event rate rises 72.2%, but inexperienced hands, like Prof Inoue, this rate is only 3.2% (23). Inoue published a paper including information on the first long-term results of a large (500 patients) case series in 2015. In this paper, he did not mention the use of prophylactic antibiotics. However, in 2016, again in a large study involving 200 patients, Ramchandani et al. reported adverse events occurred 10.64% and a prophylactic antibiotic using (5 days) was clearly stated. Again, in a study of POEM involvement of 44 children by the same group (Nabi et al), the adverse event rate was27.9%, while none of them were severe, and the use of prophylactic antibiotics was clearly stated without specifying a reason (8).

This study is the second paper investigating the necessity of antibiotic in POEM procedures. The first publication on this subject is the study of Bayer et al in 2017. In the study, which included 124 patients (60 patients received gentamicin

lavage and 64 patients did not), the levels of CRP and WBC were lower in the gentamicin lavage group [CRP: median 52.7 (IQR 34.9) vs. 69.5 (54.1); p=0.01; WBCs: median 10.9 (IQR 3.3) vs. 12.6 (3.9); p<0.01], but no infectious adverse events was observed in either group.

Consequently, although gentamicin lavage has been shown to reduce systemic inflammatory response, it was emphasized that it has no role in preventing infection-related adverse events (17). This observation was interpreted as clinically negligible. In our study, the number of patients is less than Bayer's study (28 vs 124). Similarly, in our study, inflammatory markers (CRP and WBC) were lower in the group receiving systemic antibiotics and gentamicin, but this was insignificant. We selected C-reactive protein and white blood cell count as a marker of inflammation to early recognition of any adverse event in postoperative 5 days. C-reactive protein and WBC are the most frequently used and followed markers in many inflammatory and severe septic conditions (6). Haito-Chavez et al reported that the adverse event time occurred 57.1% in intraprocedural and 41% during the first 48 hours and only 1.9% revealed after this time (14). In many large case series, esophageal leakage, which is the most potential problem that can cause fatal infection in POEM, usually manifests itself within the first 48 hours a serious clinic problem and fever (14, 22). For this, we followed the first 5 days after the operation for the adverse event. To our best of knowledge, the postoperative course of CRP and WBC has not been studied as detailed information in the previous study. We observed that CRP commonly reached its highest level on the 3rd day and then fell close to the normal level on the 5th day. Moreover, the CRP level was slightly higher in the group of antibiotics negative, but this was not statistically significant.

The major limitations of our study were the low number of patients and retrospective design. Since achalasia is a rare disease and this idea of antibiotic-free POEM is a new scientific concept, it is reasonable not to have a large number of patients in the study. However, apart from other studies, in addition to the classical achalasia POEM, we included different tunnel procedures such as Zenker's and diverticulum POEM and gastric POEM. Moreover, again apart from other papers, we compared the course of the first post-operative 5-day of CRP and WBC (as operation day, day 1,3, and 5) in patients who received and did not receive antibiotics.

Conclusion

To our findings, there is no longer a need to use prophylactic systemic antibiotics and genta micin tunnel lavage in the POEM procedure. Due to the rare incidence of achalasia and the fact that poem procedure can be performed in a limited number of centers around the world, these findings need to be confirmed in well-designed studies with a larger number of patients and prospective design.

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