

# Diagnostic Value of Barium Esophagogram and Bernstein Test in Patients with Esophagitis

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## ABSTRACT

From the 19<sup>th</sup> of July to the 19<sup>th</sup> of October 1999, we conducted a study to evaluate the diagnostic capabilities/benefits of the double contrast barium esophagogram in patients with esophagitis. The sample patients were taken from patients with reflux-type dyspepsia who visited the out patient clinic of the Sub-department of Gastroenterology of the Department of Internal Medicine of the Faculty of Medicine of the University of Indonesia/Cipto Mangunkusumo Hospital, Jakarta. During the duration of study, 32 patients fulfilled the criteria for inclusion, and did not fulfill the criteria for exclusion. All of the subjects underwent double contrast barium esophagogram, Bernstein test, and endoscopy of the upper gastrointestinal tract, as well as biopsy of the lower third esophageal mucosa.

The chief complaints for reflux type dyspepsia were found in the following order: pyrosis/heartburn (56.26%), acid/sour taste in the mouth (12.5%), chest pain (9.38%), swallowing disturbance (6.25%), breathing difficulties (6.25%), belching (6.25%), and palpitation (3.12%).

From the 32 patients with reflux type dyspepsia that underwent double contrast barium esophagogram, 10 patients (31.25%) were found positive for esophagitis, and the remaining 22 patients were found to be negative (68.75%). Bernstein test found 11 patients (34.37%) positive and 21 (65.63%) negative, while endoscopy of the upper gastrointestinal tract showed positive esophagitis in 25 patients (78.13%) and negative in 7 patients (21.87%).

The degree of accordance between double contrast barium esophagogram and the Bernstein test or even a combination of the two was unsatisfactory in diagnosing esophagitis in reflux type dyspepsia.

Based on this, this study concludes that double contrast barium esophagogram and Bernstein are incapable of replacing endoscopic examination in establishing the diagnosis of esophagitis.

**Key Words:** Esophagitis, esophagogram, Bernstein test.

## INTRODUCTION

Esophagitis is an inflammatory condition of the esophageal mucosa.<sup>1</sup> The inflammation can be acute or chronic, seen as various conditions, including motility disturbance. The most common form of esophagitis occurs due to reflux of the gastric acid, often found simultaneously with hiatus hernia. In addition to that, there is also esophagitis caused by candida, especially in patients with low immunity such as AIDS, herpes virus infections, and those receiving certain medications.<sup>2,3</sup>

A severe form of acute esophagitis could occur after ingestion of a strong base or acid. Strong bases are found

in most household cleaning products. These can cause severe lytic necrosis of the mucosa if ingested.<sup>1,2</sup>

Chronic reflux esophagitis is the form of esophagitis most commonly found in clinical practice. This disturbance is caused by a dysfunction of the lower esophageal sphincter and reflux of gastric acid or alkaline intestinal juices into the esophagus over a long period of time. The abnormalities that occur due to reflux include inflammation, ulcer formation, bleeding, formation of scar tissue and stricture.<sup>4</sup>

Esophagitis is influenced by several factors: (a) anti-reflux performance, consisting of factors of the tonus of

the lower esophageal sphincter, crural diaphragm and the gastro-esophageal junction; (b) aggressive factors of gastric contents, consisting of gastric hydro-chloride (HCl), pepsin, as well as bile and pancreatic enzymes; (c) esophageal clearance performance; (d) esophageal epithelial resistance factors; (e) influence of drugs;<sup>5</sup> and (f) infection.<sup>2</sup>

The incidence of esophagitis is estimated to reach 11.5% of the population.<sup>4</sup> According to Goh, in Malaysia and Singapore the incidence rate reached 0.8% (n = 1060) and 4.5% (n = 11943) respectively.<sup>5</sup> Aziz Rani found esophagitis in 22.2% of patients with dyspepsia (n = 50) who underwent endoscopy.<sup>7</sup> Djajapranata found esophagitis in 11.5% of patients with dyspepsia accompanied with gastroesophageal reflux based on endoscopic findings (n = 1063).<sup>8</sup> Daldiyono stated that out of 77 stroke patients with dyspepsia, esophagitis was found in 6 patients (8%) who were considered to have stress ulcer due to stroke.<sup>9</sup> Yung Il Min studied 2795 patients with dyspepsia who visited the Asan hospital in North Korea, he found a prevalence rate of 2.36% for reflux esophagitis<sup>10</sup>. Syafrudin found esophagitis in 22.8% of the 30 subjects of his study.<sup>11</sup> Zubairi Djoerban reported candida esophagitis in 80.8% of 44 AIDS patients in Jakarta.<sup>3</sup>

Even though there is a high prevalence rate of esophagitis, only several clinical studies report the incidence and prevalence rate. Based on epidemiologic evaluation, the diagnosis is established based on specific symptoms in the form of pyrosis/heartburn, regurgitation, water brash, dysphagia, odinophagia and belching.<sup>12</sup>

Esophagitis due to candida in patients with AIDS can be diagnosed presumptively in the presence of retrosternal discomfort when swallowing and oral candidiasis in the form of white spots over a red base or microscopically by the presence of mycelial fungi filaments in specimens taken from the oral mucosa. Definitive diagnosis is established based on endoscopy or autopsy or with the aid of a microscope (histology or cytology) from specimens taken directly from the tissue in question (including mucosa tissue scrapes), and not based on culture.<sup>15</sup>

Histopathologic findings of esophagitis are usually limited to the mucosa layer, in the form of infiltration of inflammatory cells in the squamous epithel, thickening of the basal cell layer, and piling on the surface of epithelial cells.<sup>13</sup> The healing process could develop into stricture. In chronic esophagitis, epithelial cells could undergo transformation into (Barrett's) malignancy.<sup>14</sup>

The radiologic accuracy of barium esophagogram

compared to endoscopy accompanied by biopsy is approximately 24.6% for mild esophagitis, 81.6% for moderate esophagitis, and 98.7% for severe esophagitis.<sup>16</sup> Endoscopy has the advantage of having a direct view and ability to perform biopsy on esophageal tissue. More than 40% of patients that have suffered from histopathologic changes could be diagnosed using endoscopic biopsy.<sup>17</sup>

Another examination used to evaluate destruction of the esophageal mucosa is the Bernstein test. This test evaluates the sensitivity of the mucosa towards acid. This test uses HCl 0.1 N that is poured into the esophagus and NaCl 0.9% as placebo. This test has a sensitivity of 77% and a specificity of 86%.<sup>18,19</sup>

Endoscopic findings of esophagitis are the standard diagnostic criteria for gastroesophageal reflux.<sup>20</sup> Endoscopy and biopsy has a sensitivity of 100%.<sup>21</sup> Histologic evaluation is a standard examination.<sup>22</sup>

Data on esophagitis in Indonesia are still rare. This disorder is presumed to rarely occur. Its presence has not been well studied due to limited knowledge and healthcare facility. Endoscopy, as an important tool to detect this disorder, is still very expensive and is only found in type A and B government hospitals, and private hospitals in the big cities.

Esophagitis could cause mild to severe complications in the form of chronic cough, bronchial asthma, vocal cord disturbance, stricture, or even malignancy. To prevent such complications, esophagitis should be detected as early as possible. Unfortunately, the facility to support the diagnosis is still too expensive and its availability is limited, especially in rural areas. For this reason, we need to find an alternative diagnostic procedure that could replace the standard and expensive diagnostic device (endoscopy).

## MATERIALS AND METHOD

### Study design

The design for this study is cross-sectional study on non-random consecutive samples.

### Sample specification

The sample population include all out-patients with reflux-type dyspepsia that came for medical advise at the Sub-department of Gastroenterology of the Department of Internal Medicine of the Faculty of Medicine of the University of Indonesia/Cipto Mangunkusumo Hospital, Jakarta.

### Study criteria

Criteria for inclusion

- Subjects with clinical symptoms of reflux type dyspepsia
- Subjects are willing to discontinue drinking anti-dyspepsia (antacids, sucralfat, H<sub>2</sub>-agonists, proton-pump inhibitor and prokinetics) for at least 72 hours
- Are willing to voluntarily participate in the study and willing to sign the informed consent form
- Criteria for exclusion
- History of coronary heart disease, chronic lung disease, bronchial asthma, signs of acute infection/under therapy, as well as general weakness
- Clinically unable to undergo endoscopic biopsy, Barium esophagogram and Bernstein test or in a condition of severe complications such as liver or renal failure, respiratory failure, heart failure, hyperpyrexia or coma
- Acute upper gastrointestinal tract obstruction syndrome
- Immunodeficiency

#### Sample size estimate

The population size is determined using the kappa sample size formula as follows:

$$N = \frac{z\alpha^2 \times K}{(1 - K)^2}$$

#### Degree of reliability: 95%

In this study, a degree of significance  $\alpha=0.05$  so that  $z\alpha^2 = (1.96)^2 = 3.84$ . Kappa = 70% (0.70). Sample size thus equals  $n = (3.84 \times 0.70)/(1-0.70) = 29.8$ .<sup>20</sup>

#### Method

A patient with reflux type dyspepsia that fulfills the criteria for inclusion and exclusion is the research subject, performed in the following steps:

1. A questionnaire is used to take a complete history, including symptoms, history of illness and medications
2. Physical examination, including evaluation of optimal physiologic condition
3. Complete laboratory analysis and thoracic x-ray to confirm doubtful clinical conditions
4. Barium esophagogram taken as follows:
  - The patient is asked to fast the night before the examination.
  - At the time of the examination, the patient is asked to drink 200-300 mL of barium mixed with 10 mL fluid containing 4 grams of effervescence.
  - The patient is asked to drink in a supine position

and is asked to turn to the right; spontaneous reflux is evaluated using a fluoroscope.

- If no reflux was observed, the valsava maneuver is performed.
  - The patient lies horizontally on his/her back. The patient is then asked to cough and thrust.
  - The patient is asked to turn from a supine position to a right lateral position.
  - If no reflux is observed, the water siphon test is performed.
  - In a right decubitus position, the patient is asked to drink 60 ml of water using a straw while returning to the supine position with the help of someone else.
  - If no reflux was observed, the patient is placed in a right posterior oblique position while drinking 60 ml of water
  - The esophagogram is used to evaluate signs of esophagitis, such as irregularities of the mucosa (nodular, granular, stricture, narrowing, and malignancy).
5. The patient is asked to fast the night before the Bernstein test is performed. The test is performed using a small, lubricated gastric pipe (flocare) through the nasal openings. The end of the pipe is placed at approximately at the esophagus, 25-30 cm from the nostrils. The gastric pipe is maintained in this position by taping it to the nose. The patient is seated. A neutral fluid (NaCl 0.9%) is slowly dropped into the pipe at a rate of 5-15 mL per minute (100 to 120 drops per minute for 5-10 minutes). Then the same procedure is performed using HCl 0.1 N (the same concentration of chloride acid as that of the gastric acid). If the patient complains of esophageal discomfort or epigastric discomfort the test is considered positive. The painful sensation quickly disappears after administration of a neutral fluid (NaCl 0.9%), and this ensures that the esophageal mucosa is the source of pain due to discontinuity in the tissue of the mucosa.<sup>24</sup> Pain in the Bernstein test is subjective, for that reason a visual analog scale in the form of a line with the number 0-4 is drawn, where the number 0 demonstrates no pain (normal) while the number 4 signifies severe pain.
  6. Endoscopic biopsy is performed by an expert according to the standard operating procedure (SOP) for endoscopy. First, the patient receives an explanation of the aim of the procedure, and then the patient is positioned according to SOP for the endoscopic procedure. The endoscopic device used is the

Olympus P-10 and Pentax EG-3400. Professionally, the scope is inserted through the mouth and hypopharynx to the esophagus. Observation is undertaken from the beginning of insertion until the lower end of the esophagus. The Z line and the appearance of the mucosa is observed and a photograph is taken to be matched with the Savary-Miller classification.<sup>16</sup> Afterwards, a biopsy of the area with esophagitis and the healthy tissue is taken. The biopsy specimen is then sent to the Department of Anatomic Pathology for histopathologic evaluation.

7. Histopathologic examination is conducted by an expert Pathologist without knowledge of the subject's clinical condition
8. The steps mentioned above are performed without knowledge of previous examinations. After a series of examinations is completed, the data are released for further management of the patient.

## RESULTS

In 4 months, from July 19<sup>th</sup> to October 19<sup>th</sup> 1999, there were 32 patients with clinical symptoms of reflux type dyspepsia who underwent double contrast barium esophagogram, Bernstein test, endoscopy and histopathology.

### Sample characteristics

There were 32 patients who fulfilled the criteria for inclusion and did not fulfill the criteria of exclusion for this study. There were 17 women (53.13%) and 15 men (46.87%). The youngest age was 18 years and the oldest was 66 years with an average of 38.53 years with the most frequent age group being 30-39 years of age (28.13%) (Table 1).

The chief complaints of the patients were heartburn/pyrosis in 21 patients (65.54%), and acid/sour taste in the mouth in 4 patients (12.50%).

Based on endoscopic examination, 25 patients (78.13%) suffered from esophagitis and 7 patients (21.87%) were normal. Based on the Savary Miller criteria, from the 25 patients with esophagitis, 18 patients (72%) with first degree esophagitis, 4 patients (16%) with second degree esophagitis, and 3 patients (12%) with third degree esophagitis, and no patients with fourth degree esophagitis.

Based on the Bernstein test on 32 patients, 11 patients (34.37%) turned out positive (there was a sensation of pain) and 21 patients turned out negative (56.63%). From the 11 patients with positive Bernstein findings, based on the visual analog scale, 2 patients were classified as first degree (18.18%), 4 patients as second de-

gree (36.36%) and 3 patients as fourth degree (27.26%).

Based on histopathologic findings of the 32 patients, 31 patients suffered from esophagitis (96.88%) and one turned out to be normal.

### Degree of accordance between combined barium esophagogram and Bernstein using Endoscopy

The degree of accordance between the three examinations was analyzed using kappa Cohen as follows:

Based on the formula above, the kappa (K) value is -0.16. Thus, it can be concluded that the findings of double contrast barium esophagogram do not well parallel endoscopic findings.

Based on the formula above, the kappa (K) value is 0.25. Thus, it can be concluded that the findings of the Bernstein test do not well parallel endoscopic findings.

In the table 4 the results of the analysis of the degree of accordance between combined barium esophagogram and endoscopic has a kappa value of 0.09. This means that the two examinations are not well in accordance.

## DISCUSSION

Based on epidemiologic evaluation, the diagnosis of esophagitis is formulated based on the presence of pyrosis and specific signs such as heartburn/pyrosis, regurgitation, water brash, dysphagia, odinophagia and belching.<sup>12</sup> In this study, heartburn/pyrosis was found in 65.64% of subjects, regurgitation in 12.50% (Table 1). Lelosutan found pyrosis in 80% and regurgitation in 76% of 30 subjects.<sup>10</sup> While Yung Il Min found 77% with pyrosis and 31% with disturbance in swallowing.<sup>10</sup>

After histopathologic analysis, out of the 32 patients with reflux type dyspepsia, 31 (96.88%) turned out to have esophagitis. These data suggest that the chief complaint can be used to diagnose esophagitis.

Compared to endoscopy and biopsy, the barium esophagogram examination has a radiologic accuracy of 24.6% for mild esophagitis, 81.6% for moderate esophagitis, and 98.7% for severe esophagitis.<sup>17</sup> Endoscopy has the advantage of having a direct view and ability to perform biopsy on esophageal tissue. More than 40% of patients that have suffered from histopathologic changes could be diagnosed using endoscopic biopsy.<sup>23</sup>

This study found 31.25% patients with esophagitis and 68.7% normal based on esophagogram (Table 1). This differs from a report by Michael,<sup>28</sup> which found esophagitis in 18.70% of 112 patients with gastroesophageal reflux.

The diagnosis of esophagitis on esophagogram is based on changes in the esophageal mucosa in the form of (a) irregularities due to ulcer; (b) thickness of the esoph-

Table 1. Characteristics of Patients with Reflux-Type Dyspepsia

Characteristics	Frequency	%
<b>Sex</b>		
Male	15	46.87
Female	17	53.13
<b>Age</b>		
<20	1	3.13
20-29	8	25.00
30-39	9	28.30
40-49	8	25.00
50-59	3	9.37
60-69	3	9.37
<b>Chief complaint</b>		
Heartburn	21	65.64
Regurgitation	4	12.50
Dysphagia	2	6.25
Dyspnoe	2	6.25
Belching	1	3.12
Palpitations	2	6.25
<b>Esophagogram</b>		
Esophagitis	10	31.25
Normal	22	68.75
<b>Endoscopy</b>		
Esophagitis	25	78.13
Normal	7	21.87
<b>Degree of esophagitis</b>		
I	18	72
II	4	16
III	3	12
<b>Berstein test</b>		
Positive	11	34.37
Negative	21	65.63
<b>Degree of Bernstein test</b>		
I	2	18.18
II	2	18.18
III	4	36.36
IV	3	27.26
<b>Histopathology</b>		
Esophagitis	31	96.88
Normal	1	3.12

Table 2. Degree of accordance between barium esophagogram and Endoscopy

Esophagogram	Endoscopy		Total
	ESO (+)	ESO (-)	
ESO (+)	7	4	11
ESO (-)	18	3	21
Normal	25	7	32

Kappa = - 0.16 z = 0.35

Note: ESO (+) = positive esophagitis;  
ESO (-) = negative esophagitis

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Table 3. Degree of accordance between barium Bernstein Test and Endoscopy

Bernstein Test	Endoscopy		Total
	ESO (+)	ESO (-)	
ESO (+)	11	-	11
ESO (-)	14	7	21
Total	25	7	32

Kappa = 0.25 z = 0.77

Note: ESO (+) = positive esophagitis;  
ESO (-) = negative esophagitis

Table 4. Degree of accordance between combined barium esophagogram and Bernstein using Endoscopy

Esophagogram and Bernstein	Endoscopy		Total
	ESO (+)	ESO (-)	
ESO (+)	14	3	17
ESO (-)	11	4	15
Total	25	7	32

Kappa = 0.09 z = 0.28

Note:  
ESO (+) = positive esophagitis, if B(+) E(+), B(+) E(-), B(-) E(+); ESO (-) = negative esophagitis, if B(-) E(-)

Table 5. The Relationship between Degree of Pain (Bernstein) and Degree of Esophagitis (Endoscopy)

Spearman's rho		Bernstein degree	Endoscopic degree
Bernstein degree	Correlation coefficient	1.000	0.643*
	Significance (2-tailed)		0.000
	N	32	32
Endoscopic degree	Correlation coefficient	0.643*	1.000
	Significance (2-tailed)	0.000	
	N	32	32

\* correlation is significant at 0.01 (2-tailed)

Table 6. Sensitivity and Specificity of Esophagogram, Bernstein, and Combined Esophagogram and Bernstein Compared to Histopathology

Examination	Sensitivity (%)	Specificity (%)
Esophagogram	28	45
Bernstein test	35.4	100
Combined esophagogram and Bernstein test	43.3	50

ageal fold; (c) thickening of the esophageal wall; and (d) narrowing of the esophageal lumen.<sup>29</sup>

The diagnostic accuracy of esophagogram in this study is unsatisfactory (kappa -0.16), compared to endoscopic examination.

Graziani L reported 39 cases with esophagitis that demonstrated esophagogram sensitivity in almost 90% of the results of endoscopic examination.<sup>30</sup>

Sella RJ compared barium examination using pH monitor for 24 hours in 50 patients and found a sensitivity rate of 71% and specificity rate of 75%.<sup>31</sup>

Bernstein examination to evaluate the sensitivity of esophageal mucosa has an accuracy rate of 86%.<sup>18</sup> This study found 34.37% positive with Bernstein test (Table 1). Compared to endoscopic examination, this examination has an unsatisfactory accuracy (kappa 0.25), thus rendering the Bernstein test not sensitive (Table 3). This has a positive correlation with the degree of esophagitis found using endoscopy (Table 5).

There was a great variation prevalence rate reported from the acid perfusion test that positively caused chest pain. Such variation was caused by a difference in patient selection. Behar achieved a prevalence rate of

100% in 11 patients with chronic chest pain.<sup>32</sup> De Caestecker reported a prevalence rate of 35% in 60 patients with recurrent chest pain referred from cardiologists.<sup>33</sup> Katz evaluated 910 patients with chest pain who were referred, he found 61 (6.7%) positive under the acid perfusion test.<sup>34</sup> Richter compared the acid perfusion test with esophageal pH monitoring for 24 hours in 75 patients with non-cardiac chest pain with a specificity of 90% and sensitivity of 36%.<sup>35</sup>

According to Battle WS, the accuracy of the Bernstein test is better in cases with severe esophagitis.<sup>36</sup> A potential problem that causes a reduced positive outcome in the Bernstein test is if the examination was performed in cases of Barret's esophagus.<sup>37</sup> Another problem is variation in the technique of examination, in which a longer time in pouring chloride acid causes increased sensitivity but reduced specificity.<sup>27</sup>

For establishing esophagitis, Bernstein examination varies in diagnostic value from one researcher to another, as seen in Table 7.

The difference in the results of Bernstein test is due to differences in patient selection, severity of esophagitis, variability in examination technique, and the pres-



Table 7. The Results of Bernstein Examination According to Researcher and Year of Research

Research	Year	Sensitivity (%)	Specificity (%)
Bernstein	1958	77	86
Behar J	1976	100	100
Katz	1987	6.7	-
De Caestecker	1988	35	-
Richter JE	1991	36	90
Author	1999	44	100

ence of Barret cases.

In mild esophagitis that is hard to diagnose radiologically, the diagnosis could be determined accurately from endoscopic examination and biopsy.<sup>39</sup> This study found esophagitis in 78.13% subjects based on endoscopic examination and 96.88% in 32 patients with reflux type dyspepsia.

According to Smout AJPM, endoscopy is the golden standard for the diagnosis of esophagitis.<sup>39</sup> Endoscopy is a well-known examination technique for the diagnosis of esophagitis. Various classification systems have been used to determine the severity of esophagitis based on endoscopic findings in the form of erythema, friability, exudates, ulcer and stricture.<sup>39</sup> The accuracy of endoscopy in diagnosing esophagitis has a specificity rate of 95%.<sup>40</sup> According to Gibbs, endoscopy has a sensitivity rate of 90%.<sup>41</sup>

Establishing the diagnosis of esophagitis by means of endoscopy combined with the distinctive complaint of heartburn and regurgitation has a specificity rate of 95%.<sup>42</sup>

Several cases found to be normal under endoscopic examination turned out with histologic findings distinctive for esophagitis. Even so, biopsy is not recommended as a routine examination for esophagitis.<sup>3</sup> This study found 7 (21.87%) patients normal according to endoscopic findings, but with positive histopathology. Such a condition is called Non-Erosive Reflux Disease (NERD).<sup>42</sup>

Based on Table 4, combination of esophagogram and Bernstein has a kappa value of 0.09 compared to endoscopic examination. This is not a satisfactory degree of accordance.

The sensitivity and specificity rate of the three kinds of examination, compared to histopathology as a golden standard are listed in Table 6.

If the degree of sensitivity and specificity is analysed

using the Receiver Operating Characteristic (ROC) curve, the Bernstein test is more sensitive and specific than the esophagogram, while combined esophagogram and Bernstein has an even higher sensitivity and specificity than the two tests separately, as seen in Figure 1.

In this study, the two tests separately or combined has an unsatisfactory sensitivity and specificity for establishing the diagnosis of esophagitis. The reason for this is that the disturbance of esophageal mucosa in the esophagitis in this study is still very mild. Out of 25 patients positive with esophagitis using endoscopy, 18 patients (72%) suffered from first degree esophagitis, 4 with second degree (16%) and 3 with third degree (12%) (Table 1).

## CONCLUSION AND SUGGESTION

### Conclusion

- Double contrast barium esophagogram and Bernstein examination or the two combined has a low degree of accordance in diagnosing esophagitis. Thus, these examinations cannot replace endoscopic procedure.
- The sensitivity and specificity of the Bernstein test is better than that of the esophagogram.
- A combination of esophagogram and Bernstein has a higher diagnostic sensitivity and specificity than that of each test individually.
- The chief complaint of reflux type dyspepsia obtained from good history taking could be used as a basis for the diagnosis of esophagitis.

### Suggestion

- There needs to be further research with a larger sample and more severe degree of esophagitis on endoscopy to evaluate the sensitivity and specificity of the two tests in question.
- The complaints of reflux type dyspepsia should be studied using correct statistical methods, so that the

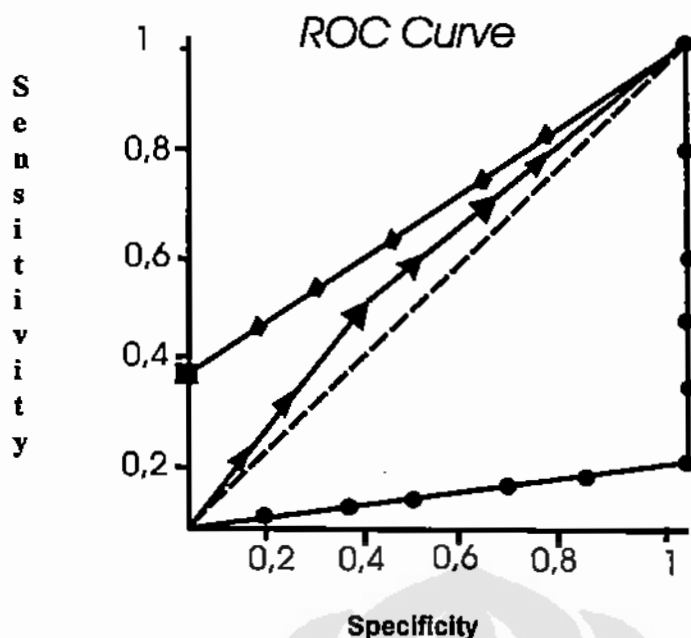


Figure 1. ROC curve of barium esophagogram, Bernstein and combined barium esophagogram and Bernstein

Note:

- — ● = Bernstein
- ◀ — ▶ = Esophagogram
- ◆ — ◆ = Combination of Esophagogram with Bernstein

chief complaint could be used as an alternative for the diagnosis of esophagitis.

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