



Bayes
 (15 , 16)
 (19 , 20)
 가 70
 가
 3
 (likelihood ratio; LR)
 Bayes
 가 (LR=2.65) (LR=2.22)
 (LR=1.94), (LR=1.99), (LR=1.97)
 (LR=3.88) 가 20-29
 (LR=0.53), , S (LR=0.12, 0.19, 0.3, 0.17)
 (LR=0.49) (LR=0.21)
 : Bayes

(1). 가 (prior proba-
 bility) Bayes
 (6, 7).
 (1, 2). 가 (3, 5, 8-10)
 (likelihood ratio; LR)(11) Bayes
 가 (3).
 (4). 1993 1 2003 5 4
 (15 , 16)
 (19 , 20)
 (5). 가 70 (34 ,
 36)

: Bayes

$$P(\bar{D}) : 1 - P(D)$$

$$[1] \quad P(S/\bar{D})P(\bar{D})$$

$$P(D/S) = \frac{\frac{P(S/D) \cdot P(D)}{P(S/D) \cdot P(D) + P(S/\bar{D}) \cdot P(\bar{D})}}{1 + \frac{P(S/D) \cdot P(D)}{P(S/\bar{D}) \cdot P(\bar{D})}} \quad [2]$$

$$P(S/D) = \frac{P(D)/P(\bar{D}) \cdot P(S/D)/P(S/\bar{D})}{P(S/D)}$$

$$(7)$$

$$P(S/D) = P(S_1/D)P(S_2/D) \dots P(S_i/D) \dots P(S_n/D)$$

$$[2]$$

$$P(D/S) = \frac{Odd_{TBC}}{1 + Odd_{TBC}} \quad [3]$$

$$Odd_{TBC} = \frac{P(D) \cdot P(S_1/D) \cdot P(S_2/D) \dots P(S_i/D) \dots P(S_n/D)}{P(\bar{D}) \cdot P(S_1/\bar{D}) \cdot P(S_2/\bar{D}) \dots P(S_i/\bar{D}) \dots P(S_n/\bar{D})}$$

(focal wall thickening) (mesenteric or antimesenteric) (aneurysmal dilatation) (sacculation)

$$\frac{P(S_i/D)}{P(S_i/\bar{D})} \quad S_i \quad [3]$$

Fisher's exact test

$p < 0.05$

Bayes

Bayes

$$P(D/S) = \frac{P(S/D) \cdot P(D)}{P(S/D) \cdot P(D) + P(S/\bar{D}) \cdot P(\bar{D})} \quad [1]$$

$P(D/S)$: S가 D
 $P(S/D)$: D S가 (conditional probability)
 $P(D)$: D (prevalence, prior probability)
 $P(S/\bar{D})$: D가 S가

Table 1

20 - 29

(Table 2),

Table 1. Observed Radiological Findings of Tuberculous Enteritis and Cronh's Disease

Observed Radiological Findings		
Generalized spasm	Fleischner's sign	Stierlin's sign
Rigid narrowing	Mixed ulceration	Polypoid lesions
Shortening	Fistula	Stricture
Continuous involvement	Skip lesion	Obstruction
Shallow ulceration	Extrinsic mass effect	Haustral loss
Deep ulceration	Nodular lymphoid hyperplasia	Fold thickening
Aphthoid ulceration	Asymmetric involvement	Focal wall thickening
Confluent ulceration	Circumferential involvement	Irritability
Longitudinal ulceration	Segmental distribution	Aneurysmal dilatation
Transverse ulceration	Fissure	Thumb printing mucosa
Mixed ulceration	Sacculation	

(LR=2.65, 2.22) 가 가
 , S (LR=0.12, 0.19, 가
 0.3, 0.17) 가
 (Table 3).

(p<0.05)

Table 4

(rigid narrowing, LR=1.94), (shortening of bowel, LR=1.99), (haustral loss, LR=1.97) (sacculation, LR=3.88) 가 (Fig. 1, 2). 가 (skip lesions, LR=0.49) (LR=0.21) (Fig. 3).

Table 2. Age distribution of Tuberculous Enteritis and Crohn's Disease and its Likelihood Ratio of Prevalence

Age (years)	Tuberculous Enteritis (n=34)	Crohn's Disease (n=36)	LR
10 - 19	3	2	1*
20 - 29	8	16	0.53 [†]
30 - 39	6	8	1*
40 - 49	6	4	1*
50 - 59	4	1	1*
60 - 69	3	4	1*
70 - 79	4	1	1*

LR: Likelihood Ratio of Prevalence

1*: Theoretical likelihood ratio because of statistical insignificance
 0.53[†]: Real likelihood ratio because of statistical significance (p < 0.05) = P(Tuberculosis Enteritis) / P(Crohn's Disease); P is prevalence.

Table 3. Distribution of Tuberculous Enteritis and Crohn's Disease and its Likelihood Ratio of Tuberculous Enteritis vs Crohn's Disease

Location	Tuberculous Enteritis	Crohn's Disease	LR
Duodenum	0	1	1*
Jejunum	1	9	0.12 [†]
Terminal ileum	3	16	0.19 [†]
Ileocecal valve	18	14	1*
Cecum	15	6	2.65 [†]
Ascending colon	21	10	2.22 [†]
Transverse colon	12	10	1*
Descending colon	6	9	1*
Sigmoid colon	2	7	0.30 [†]
Rectum	1	6	0.17 [†]

LR: Likelihood Ratio = P(Location/Tuberculous Enteritis)/P(Location/ Crohn's Disease)

1*: Theoretical likelihood ratio because of statistical insignificance
[†]: Real likelihood ratio because of statistical significance (p < 0.05)

) 25 가

$$1 \quad Odd_{TBC} = 0.53 \times 0.12 \times 0.21 = 0.013$$

$$2 \quad \text{Probability of Tuberculous Enteritis} = \frac{0.013}{1+0.013} = 0.012$$

Table 4. Number of Radiological Findings on Barium Study and Small Bowel Series of Tuberculous Enteritis and Crohn's Disease and Likelihood Ratio of Each Findings of Tuberculous Enteritis vs Crohn's Disease

Findings	Tuberculous Enteritis	Crohn's Disease	LR*
Rigid narrowing	22	12	1.94
Shortening of bowel	15	8	1.99
Skip lesions	7	15	0.49
Haustral loss	26	14	1.97
Sacculation	11	3	3.88
Stricture	3	15	0.21
Mixed ulceration	11	12	1
Aneurysmal dilatation	6	3	1

LR: Likelihood Ratio = P(S_i/Tuberculous Enteritis)/P(S_i/Crohn's Disease)

*: Real likelihood ratio because of statistical significance (p < 0.05)



Fig. 1. Tuberculous colitis in a 24-year-old woman. Barium enema demonstrates a haustral loss and antimesenteric border forming sacculation (arrow) in the ascending colon.

Bayes
 3 mm
 3 1.2%
 4 가 1.2%
 가 98.8%
 (13).

(4, 5, 12, 13) 가

가 Bayes
 (cobblestone appearance), (frequency; conditional probability)
 (4, 5, 7). Bayes
 Tandon Praksh 159 10 logistic regression analysis (14)
 (7),
 (15, 16).

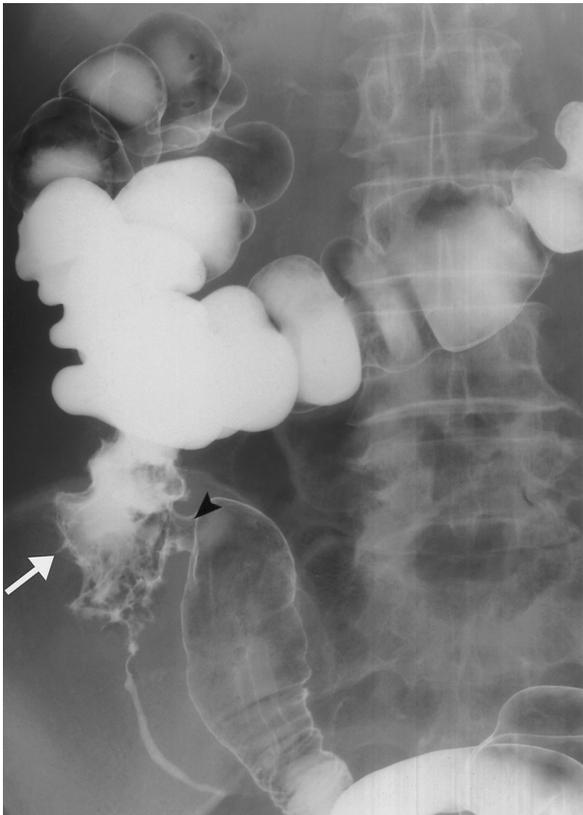


Fig. 2. Tuberculous colitis in a 86-year-old woman. In the ascending colon and cecum, there is rigid narrowing and bowel shortening (arrow). Also widening of ileocecal valve (arrow head) is present.

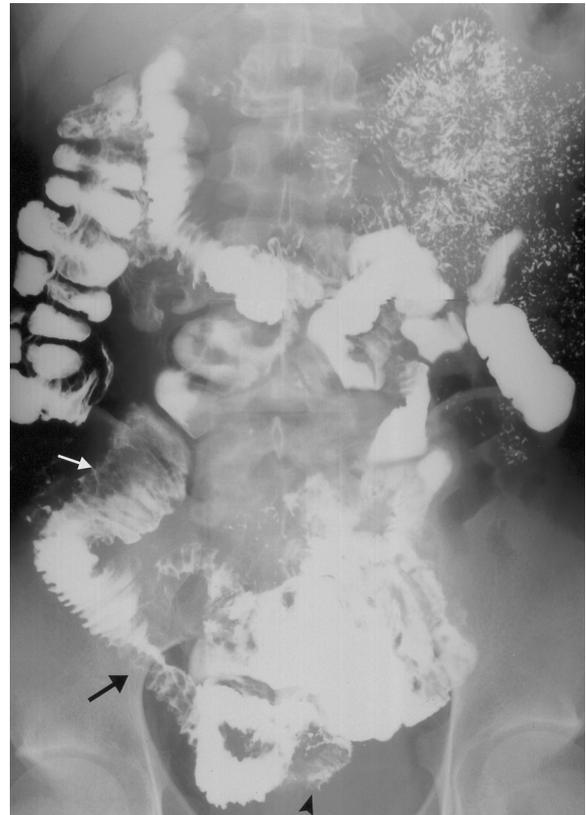


Fig. 3. Crohn's colitis in a 20-year-old man. Small bowel series shows a short segmental stricture (black arrow) in the distal ileum, without significant obstruction. More proximally, ileum also narrowed (arrow head). Cobblestone appearance (white arrow), which is not a finding for differentiation between the two disease, in the terminal ileum is present.

Differentiation of Tuberculous Enteritis and Crohn's Disease with Barium Study Using Bayes Theory¹

Kyoung Ja Lim, M.D., Chul Soon Choi, M.D., Eun Joo Yeun, M.D., Young Lan Seo, M.D.,
IL Sung Lee, M.D., Ik Yang, M.D., Woo Chul Whang, M.D., Sang Hoon Bae, M.D., Ik Won Kang, M.D.

¹Department of Radiology, College of Medicine, Hallym University

Purpose: To differentiate tuberculous enteritis and Crohn's disease with barium study using Bayes theory.

Materials and Methods: The study group consisted of 34 patients with tuberculous enteritis (age range 16 - 86 years, mean age 43.3 years, M:F=19:15) and 36 patients with Crohn's disease (age range 19 - 78 years, mean age 35.2 years, M:F=18:18). These diagnoses were confirmed by therapeutic tests (tuberculous enteritis: 15, Crohn's disease:16) or histopathological examinations (tuberculous enteritis: 19, Crohn's disease: 20) conducted from January 1993 to May 2003. Three radiologists (two abdominal specialists and one trainee) analyzed each radiological finding of tuberculous enteritis and Crohn's disease by means of a barium enema and/or small bowel series. We used Fisher's exact test to verify the statistical significance of each radiological finding and p-values less than 0.05 were considered to be significant. We calculated the likelihood ratio (LR) of tuberculous enteritis versus Crohn's disease for each finding by employing Bayes theory.

Results: The radiological findings associated with a high likelihood ratio for tuberculous enteritis were the involvement of the cecum (LR=2.65) and ascending colon (LR=1.99), rigid narrowing (LR=1.94), shortening of the bowel (LR=1.99), haustral loss (LR=1.97) and sacculation (LR=3.88). The radiological findings associated with a high LR for Crohn's disease (low LR for tuberculous enteritis) were age between 20 and 29 years (LR=0.53), the involvement of the jejunum (LR=0.12), terminal ileum (LR=0.19), sigmoid colon (LR=0.30) or rectum (LR=0.17), and the presence of skip lesions (LR=0.19) or strictures (LR=0.21). With these LRs, the probability of the subject having tuberculous enteritis versus Crohn's disease could be calculated using Bayes theory.

Conclusion: The analysis of a barium study using Bayes theory could provide an objective, easy and fast method of differentiating tuberculous enteritis and Crohn's disease.

Index words : Barium enema examination
Crohn's disease
Small intestine
Tuberculosis, gastrointestinal

Address reprint requests to : Chul Soon Choi, M.D., Department of Radiology, Hallym University, Kangdong Sacred Hospital,
445 Gil-dong, Kangdong-gu, Seoul 134-701, Korea.
Tel. 82-02-2224-2312 Fax. 82-02-488-7370 E-mail: chulsoon@hallym.or.kr