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의학석사 학위논문

**Crohn's Anal Fistula: How Bad is It
Compared to Ordinary Non-
Crohn's Anal Fistula?**

크론병 항문 치루: 비 크론병 항문
치루와의 비교연구

2015 년 02 월

서울대학교 대학원
의학과 외과학전공
한언철

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2015 년 02 월

서울대학교대학원
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A thesis of the Master's Degree

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크론병항문치루: 비 크론병 항문
치루와의 비교연구

February 2015

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크론병항문치루: 비 크론병 항문

치루와의 비교연구

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**Crohn's Anal Fistula: How Bad is It
Compared to Ordinary Non-
Crohn's Anal Fistula?**

by
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**A thesis submitted to the Department of Surgery in
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for the Master's Degree in Surgery
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ABSTRACT

Introduction: The prevalence of anal fistula in the general population is approximately 0.02%. Crohn's disease, one cause of anal fistula, characterized by a high recurrence rate and a remission-exacerbation cycle. However, there are few studies comparing the treatment outcomes for Crohn's (CD) vs. ordinary non-CD anal fistula. This study aimed to determine whether treatment outcomes of CD anal fistulas are really inferior to those of non-CD anal fistula.

Methods: We included 289 prospectively collected patients with anal fistula (CD, n=65, 107 procedures; non-CD, n= 224, 247 procedures) between August 1998 and December 2012. Data were subjected to a retrospective study through a medical record review. The patients were categorized into CD anal fistula and non-CD anal fistula and further classified into simple fistula and complex fistula.

Results: All CD patients were under medical treatment, including infliximab (n= 17). CD anal fistula were more complex type in nature (69.2% vs. 39.2%, $P < 0.001$). The overall wound healing rates were lower (simple type: 90.6 % vs.

100%, complex type: 56.2% vs. 76.2%, $P < 0.001$), the healing time was longer (simple: 129.6 ± 106.7 vs. 51.3 ± 33.9 days, complex type: 152.9 ± 120.3 vs. 102.9 ± 87.5 days, $P < 0.05$), and recurrence rate was higher (simple type: 10.3% vs. 0.0%, complex type 24.3% vs. 6.5%, $P < 0.001$) in CD anal fistula. In complex type CD fistulas, wounds persisted in 32/73 (43.8%) after conventional surgical procedures. Adipose tissue-derived stem cells (ASCs) were applied to 15 of these patients, and complete healing achieved in 11 (73.3 %).

Conclusions: Despite combined medical treatment, overall outcomes are still poor after conventional surgical procedures for CD fistula. New treatment strategies, such as ASCs treatment, are needed to improve overall outcome.

Keywords: Anal fistula, Crohn's disease, Recurrence, Risk factor, Adipose tissue-derived stem cells

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LIST OF ABBREVIATIONS

| | |
|------|-----------------------------------|
| ASCs | Adipose tissue-derived stem cells |
| BMI | Body Mass Index |
| CD | Crohn's disease |
| CI | Confidence Interval |
| EUS | Endorectal ultrasonography |
| OR | Odds ratio |
| IBD | Inflammatory bowel disease |
| MRI | magnetic resonance imaging |

INTRODUCTION

An anal fistula is a tract connecting the anal canal with the surface of the skin. It is usually lined with granulation tissue, which is often infected, and most often develops from a perianal abscess caused by a cryptoglandular infection (1). The prevalence of anal fistula in the general population is approximately 0.02% (2, 3). Crohn's disease (CD), one cause of anal fistula, is a chronic, nonspecific inflammatory bowel disease (IBD) characterized by a high recurrence rate and a remission-exacerbation cycle. Although the incidence in South Korea is lower than that in Western countries, with 1.34 cases per 100,000 persons, it has been steadily increasing in recent years (4). CD is accompanied by anal fistula, which often requires surgery, in 13–39% of patients; this rate is much higher than that in other IBDs (5–7). Any treatment for anal fistula must prevent recurrence while preserving sphincter function. Surgical treatment options include

conventional methods such as fistulotomy, fistulectomy, the loose seton, the anorectal advancement flap, the fistula plug, and fibrin glue, as well as a recently developed treatment using adipose-derived stem cells (ASCs) (8–11). For anal fistula associated with CD, treatment with biologic agents, including infliximab, has been reported to be effective (12, 13).

Garcia-Aguilar et al. (14) reported recurrence rates of approximately 8% for non-CD-associated anal fistula; another study reported a healing rate of 8–100% and a recurrence rate of 14–41% for CD-associated anal fistula. According to Makowiec et al., there is a 59% chance that a CD-associated anal fistula will recur within 2 years of treatment (15). However, there is a dearth of studies that compare treatment outcomes between CD- and non-CD-associated anal fistulas. The present study compares healing time, recurrence rate, and persistence rate between anal fistula patients with CD and those without,

as well as examining the risk factors that influence the recurrence of CD-associated anal fistula.

MATERIALS AND METHODS

1. Patients

We retrospectively reviewed the medical records of 289 patients at our hospital who were surgically treated for anal fistula by a single surgeon between August 1998 and December 2012. This study was reviewed and approved by the Institutional Review Board of Seoul National University Hospital.

We noted their sex, age, body mass index (BMI), underlying diseases, surgical history, smoking habits, and postoperative healing time, as well as fistula recurrence and persistence. Anal fistula was diagnosed on the basis of symptoms; radiological, endoscopic, or clinical evidence; or physical examination findings typical of the condition. Patients were divided into CD and non-CD groups. For the CD patients, we checked medical records for the date of

the initial CD diagnosis and any pharmacological or surgical treatment prior to diagnosis, including treatment not performed at our institution. All patients underwent a preoperative disease history interview and rectal exam. To preoperatively determine the orientation of the fistula and the extent of CD, we performed colonoscopy, endorectal ultrasonography (EUS), and/or magnetic resonance imaging (MRI) if needed. Patients were considered positive for proctitis (rectal inflammation) if such inflammation was macroscopically visible on endoscopy or surgery. Postoperative outpatient follow-up was performed at intervals of 1 week, 2 weeks, 1 month, and 3 months after surgery, after which regular monthly or bimonthly checkups were performed as needed.

2. Anal fistula classification

An anal fistula is defined as simple if it has one internal and one external opening, is not accompanied by an abscess, and has no connection with nearby structures.

Simple fistulas may have a superficial, intersphincteric, or low transsphincteric origin. An anal fistula is defined as complex if it has more than one internal or external orifice (e.g., a horseshoe fistula, with external openings on both sides of the anus) or is accompanied by a perianal abscess. Complex fistulas may have a high transsphincteric, extrasphincteric, or suprasphincteric origin.

3. Outcome definitions

In the present study, healing was defined as complete closure of the fistula as confirmed by clinical or radiographic (EUS, MRI) examination at follow-up, combined with cessation of any subjective symptoms. Recurrence was defined as reappearance of the fistula or of symptoms in patients previously considered healed. Persistence was defined as portions of the anal fistula tract remaining at follow-up.

4. Statistical analysis

Statistical analysis was performed using the SPSS statistical software package (version 21.0; IBM, Armonk, NY, USA). Comparisons of categorical variables were performed using Pearson's χ^2 -test or Fisher's exact test. Comparisons of continuous variables were performed using Student's t-test and the Mann-Whitney U-test. To determine which factors may influence anal fistula recurrence, we performed a binary logistic regression analysis. We also performed a multivariate analysis of variables found to be significant on univariate analysis. The significance level was set at $P < 0.05$.

RESULTS

Of the 289 patients in our population, the 65 with CD underwent 107 operations for anal fistula, and the 224 without CD underwent 247 operations. The CD group had to be followed up for significantly longer than the non-CD group (CD: median 24.2 months, range 1-155 months; non-CD: median 4.3 months, range 1-53 months; $P < 0.001$). For patients with a fistula of the complex type, median follow-up period was 35.8 months for the CD group (range 1-155) and 7.8 months (range 1-53) for the non-CD group; for those with the simple type, it was 26.2 months (range 1-110) for the CD group and 2.2 months (range 1-8.6) for the non-CD group, which was a significant difference ($P = 0.003$).

Baseline characteristics

The proportion of males was smaller in the CD group than in the non-CD group (70.8% vs. 87.5%, $P = 0.002$).

The CD group was also younger (25.6 ± 7.8 vs. 44.2 ± 13.4 years, $P < 0.001$) and included more cases of the complex type (69.2% vs. 39.2%, $P < 0.001$). In addition, the CD group underwent significantly more surgical procedures than the non-CD group (mean number of procedures per patient: 2.3 ± 1.4 vs. 1.3 ± 0.6 , $P < 0.001$). However, BMI was higher and smoking history more common in the non-CD group. The overall wound healing time of CD group and non-CD group were 150.5 ± 118.9 and 66.2 ± 55.8 days ($P < 0.001$) The CD group exhibited a significantly longer healing time than the non-CD group for both simple (129.6 ± 106.7 vs. 51.3 ± 33.9 days, $P < 0.001$) and complex (152.9 ± 120.3 vs. 102.9 ± 87.5 days, $P = 0.011$) fistula types (Table 1). The mean latency period between CD diagnosis and anal fistula occurrence was 6.2 years (range 1 month to 18 years). In the CD group, proctitis was found during surgery in 14 out of 93 operations for which medical records were available (15.1%); 11 patients (16.9%)

underwent bowel resection as a result of CD exacerbation, and 10 (15.4%) received antituberculosis medication.

Surgical and medical treatment

The CD patients received medical treatment at the time of surgery. Drugs administered, either as monotherapy or in combination, included steroids, mesalamine, metronidazole or ciprofloxacin, immunosuppressants (e.g., azathioprine), and biologic agents (e.g., infliximab); 17 CD patients (26.2%) were administered infliximab. The loose seton (n = 28) was the most commonly used surgical technique in the CD group, followed by fistulotomy (n = 23), incision and drainage (n = 21), ASCs treatment (n = 15), fistulectomy (n = 10), modified Hanley's operation (n = 7), the anorectal advancement flap (n = 2), and colostomy (n = 1). Meanwhile, the most commonly performed surgical procedure in the non-CD group was fistulotomy (n = 113), followed by fistulectomy (n = 102), the loose seton (n = 13), ASCs treatment (n = 7),

modified Hanley' s operation (n = 6), and incision and drainage (n = 3).

Healing, recurrence, and persistence rates

In the CD group, healing was achieved after 29 of 32 operations to treat a fistula of the simple type (90.6%); with 3 unhealed patients, persistence rate was 9.4%. Of the 29 successful operations, the fistula recurred after 3 for a recurrence rate of 10.3%. There were 2 cases of patients being lost to follow-up after surgery to treat a fistula of the complex type; of the remaining 73 operations, 41 resulted in healing (56.2%), but the fistula persisted in 32 (43.8%). Among the 41 healed cases, there were 10 cases of recurrence; thus, the recurrence rate was 24.3%. Of the 32 cases of persistence, the patient underwent another operation in 30 cases (ASCs treatment in 15, conventional surgery in 15), and 2 were lost to follow-up. Healing and persistence rates after the second operation were 11/15 (73.3%) and 4/15 (26.6%), respectively, for

ASCs treatment, but 4/15 (26.6%) and 11/15 (73.3%), respectively, for conventional surgery (Fig. 1). The median follow-up period after the second operation was 34.3 months (range 9.0–60.0) after ASCs treatment and 40.0 months (range 6.9–106.3) after conventional surgery; during this period, there were 2 cases of recurrence (rate 18.2%) among patients who had received ASCs treatment. The 3-year recurrence free survival of patients with stem cell implantation and patients with conventional surgery were 66.7% and 25.0%, respectively (Fig 2).

In the non-CD group, 2 of 144 patients who underwent surgery for a simple anal fistula were lost to follow-up, but the remaining 142 achieved healing (a 100% healing rate), and there were no cases of recurrence. Of 101 operations performed on non-CD patients for a complex fistula, healing was achieved in 77 cases for a 76.2% healing rate and a 23.8% persistence rate; there were 5 cases of recurrence, a rate of 6.5%. The 21 patients exhibiting postoperative persistence underwent a second

operation, either ASCs treatment (n = 7) or conventional surgery (n = 14). Healing and persistence rates after the second operation were 3/7 (42.9%) and 4/7 (57.1%), respectively, after ASCs treatment, but 28.4% (4/14) and 71.5% (10/14), respectively, after conventional surgery (Fig. 3). The median follow-up period after the second operation was 21.1 months (range 6.5–37.9) after ASCs treatment and 14.6 (range 2.1–36.2) months after conventional surgery. There were no cases of recurrence after ASCs treatment.

Overall, the CD group exhibited a significantly lower healing rate than the non-CD group ($P < 0.001$). In addition, the recurrence and persistence rates were significantly higher in the CD group ($P < 0.001$).

Among CD patients, the healing rate was 18/32 (56.3%) with infliximab and 51/71 (71.8%) without ($P = 0.120$); recurrence rate was 4/18 (22.2%) with infliximab and 9/51 (17.6%) without ($P = 0.670$).

Risk factors for anal fistula recurrence in CD

After exclusion of 2 patients lost to follow-up, univariate and multivariate analyses were performed to determine which factors might influence anal fistula recurrence in CD. In the univariate analysis, complex fistula type (odds ratio [OR] 4.55, 95% confidence interval [CI] 1.44–14.39, $P = 0.010$), BMI <18 (OR 0.20, 95% CI 0.08–0.49, $P < 0.001$), and proctitis (OR 6.53, 95% CI 1.81–23.53, $P = 0.004$) were found to be correlated with recurrence. These significant variables were subsequently entered into a multivariate analysis. The results confirmed that complex fistula type (OR 3.54, 95% CI 1.01–12.48, $P = 0.049$) and proctitis (OR 8.81, 95% CI 2.10–38.89, $P = 0.003$) were correlated with recurrence (Table 2).

Table 1. Characteristics of anal fistula patients with and without Crohn' s disease

| | Crohn' s (65 patients, 107 perations) | Non-Crohn' s (224 patients, 247 operations) | <i>P</i> -value |
|-----------------------------------------------------------------------------|---------------------------------------------|---------------------------------------------------|-----------------|
| Gender, n | | | 0.002 |
| Male | 46 (70.8%) | 196 (87.5%) | |
| Female | 19 (29.2%) | 28 (12.6%) | |
| Age | | | <0.001 |
| Mean \pm SD | 25.6 \pm 7.8 | 44.2 \pm 13.4 | |
| Range | (13-47) | (16-76) | |
| Fistula type, n | | | <0.001 |
| Simple | 33 (30.8%) | 146 (60.8%) | |
| Complex | 74 (69.2%) | 101 (39.2%) | |
| Body mass index (kg/m²), mean \pm SD | 19.8 \pm 3.6 | 24.5 \pm 3.5 | <0.001 |
| Smoking history, n (%) | 5 (7.7%) | 69 (31.1%) | <0.001 |
| Current smoker | 5 | 54 | |
| Ex-smoker | 0 | 15 | |
| Operations, n (%) | | | <0.001 |
| 1 | 28 (43.1%) | 180 (81.1%) | |
| 2 | 15 (23.1%) | 31 (13.9%) | |
| 3 | 8 (12.3%) | 8 (3.6%) | |
| 4 | 7 (10.8%) | 3 (1.4%) | |
| 5 | 6 (9.2%) | 1 (0.0%) | |
| 6 | 1 (1.5%) | 1 (0.0%) | |
| Healing time (days), mean \pm SD | 150.5 \pm 118.9 | 66.2 \pm 55.8 | <0.001 |
| Simple | 129.6 \pm 106.7 | 51.3 \pm 33.9 | <0.001 |
| Complex | 152.9 \pm 120.3 | 102.9 \pm 87.5 | 0.011 |

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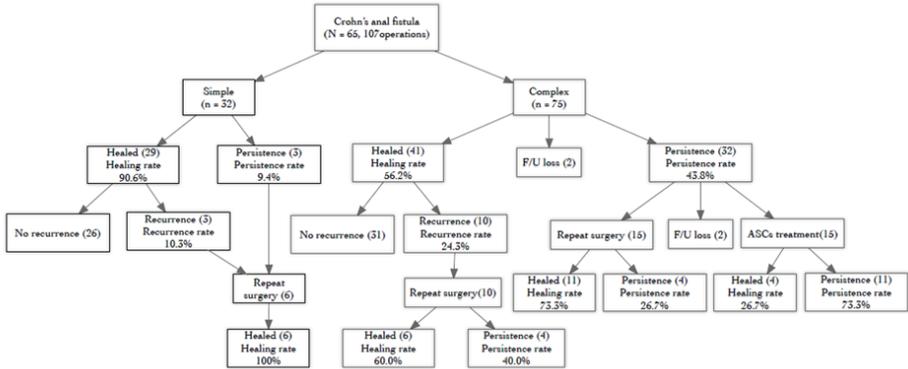


Fig. 1. Postoperative course of anal fistula associated with Crohn' s disease.

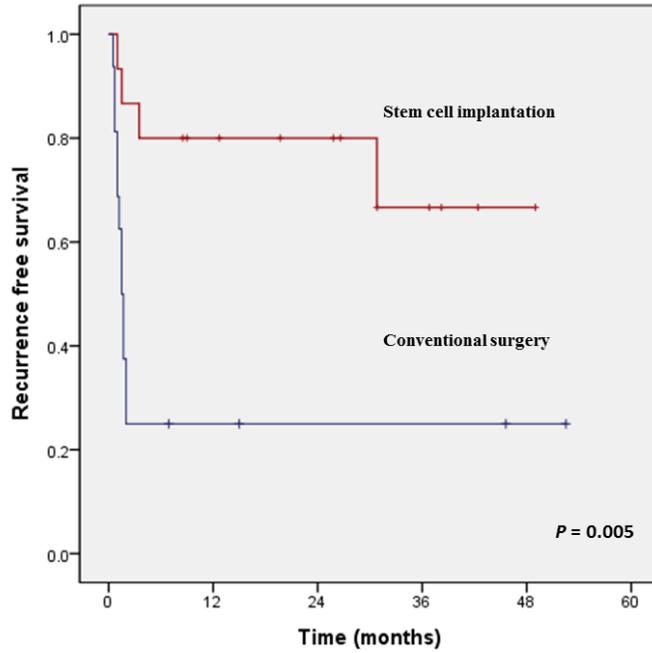


Fig. 2. Recurrence free survival of Adipose tissue-derived stem cells implantation and conventional surgery for patients with persistent fistula in CD group.

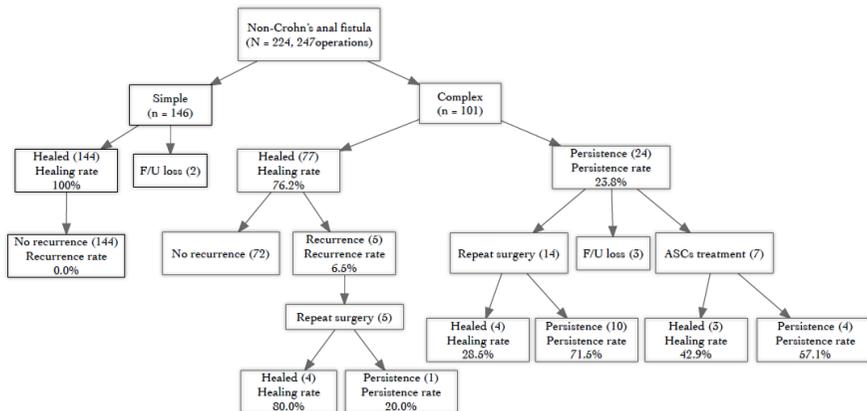


Fig. 3. Postoperative course of anal fistula not associated with Crohn' s disease.

Table 2. Potential risk factors for anal fistula recurrence in Crohn' s disease

| | Univariate analysis | | Multivariate analysis | |
|------------------------------|------------------------|---------------------|------------------------------------|---------------------|
| | Odds ratio (95% CI) | <i>P</i> - value | Adjusted Odds Ratio (95% CI) | <i>P</i> - value |
| Female gender | 3.09 (0.94-10.19) | 0.064 | | |
| Age \geq 20 | 1.38 (0.52-3.71) | 0.519 | | |
| Complex fistula | 4.55 (1.44-14.39) | 0.010 | 3.54 (1.01-12.48) | 0.049 |
| Current or ex-smoker | 1.44 (0.23-9.07) | 0.697 | | |
| No infliximab | 2.13 (0.88-5.10) | 0.090 | | |
| Body mass index \geq 18 | 0.20 (0.08-0.49) | <0.001 | 0.71 (0.25-2.01) | 0.515 |
| Proctitis | 6.53 (1.81-23.53) | 0.004 | 8.81 (2.10-36.89) | 0.003 |

DISCUSSION

This retrospective study assessed the results of surgical treatment of anal fistula in patients with or without CD. In CD patients, simple fistulas required treatment for an average of more than 4 months, and the complex type required more than 5 months. In contrast, in the non-CD group, the simple type required treatment for an approximate average of 1 month, and the complex type required treatment for an approximate average of 3 months. In addition, healing, recurrence, and persistence rates were worse for patients with CD than for those without. Complex fistula type and proctitis were identified as risk factors for fistula recurrence in CD.

Surgical treatment for anal fistula has diverse possible outcomes, ranging from complete healing after one operation to recurrence and repeated operations that reduce quality of life. Many studies have assessed the effectiveness of surgical methods by studying healing and recurrence rates (16–18). Unlike previous studies, this study examined healing time in addition to healing and recurrence rates, as knowing the

expected healing time can help clinicians explain the postsurgical prognosis to patients.

CD-associated anal fistula is well known for its frequent recurrence and chronic nature. However, few studies have compared postsurgical prognosis and treatment outcomes between CD- and non-CD-associated anal fistulas. Buchanan et al., who performed loose seton on patients with complex anal fistula and followed them up for a minimum of 10 years, reported no significant difference in the recurrence rate between patients with CD and those without (CD: 5/6, or 83.3%; non-CD: 11/14, or 78.6%; $P = 1.000$) (19). However, this study found the recurrence and persistence rates of complex anal fistula to be significantly lower in the non-CD group (6.5% and 23.8%, respectively) than in the CD group (24.3% and 43.8%, respectively).

Even with complementary medical treatment, overall outcomes for CD-associated anal fistula are still poor after conventional surgical procedures. New treatment strategies, such as ASCs treatment, which has been assessed for treatment of complex or CD-associated anal fistula in many recent studies, are needed to improve overall outcome. In this study, ASCs

treatment was performed 22 times on patients whose fistula persisted, with healing achieved in 14 cases (63.6%). Garcia-Olmo et al.'s phase II study of ASCs for treatment of complex anal fistula reported a similar healing rate of 71%. but found a higher recurrence rate of 5/12 (41.6%) after 4 years of follow-up (20, 21). However, Garcia-Olmo et al. used a longer follow-up period than we did, which would increase the recurrence rate. Therefore, our results cannot be directly compared with theirs; to enable such comparison, future studies should observe outcomes over a longer term.

In patients with a persistent anal fistula who underwent conventional surgery, the healing rates were similar between the CD and non-CD groups (26.7% and 28.5%, respectively), and the outcome was worse than in patients who received ASCs treatment. Patients with intractable recurring anal fistula, regardless of whether they have CD, may develop complications such as incontinence from repeated surgeries; surgical treatment of such patients requires particular caution and a careful approach.

All CD patients in this study received simultaneous medical and surgical treatment. One of the newest medical treatments,

infliximab, has a response rate of 63–68%, and maintenance infliximab treatment helps prevent anal fistula recurrence (12, 22–24). In addition, a previous study found that a combination of infliximab and surgery resulted in better outcomes than either alone (25). However, we found no difference in healing and recurrence rates between infliximab users and non-users, and our multivariate analysis did not find it to be a significant factor in the outcome. In Korea, infliximab treatment is very expensive, so we used infliximab only in patients with an intractable anal fistula whose insurance could cover it; this may be why healing and recurrence rates in patients who used infliximab were not better than those of patients who did not.

Several studies have attempted to determine significant risk factors for recurrence of anal fistula in CD, but no such factors have been identified consistently, as results have varied among studies (14, 15, 26, 27). Garcia–Aguilar et al. reported that a horseshoe extension, complex fistula type, and a laterally located internal opening were risk factors of recurrence (14). In this study, complex fistula type was likewise found to be a risk factor for recurrence, with horseshoe fistulas categorized as being of complex type for analysis purposes. When

confirmation of the internal opening is difficult or its relationship to the structures around the anus is unclear, recurrence and persistence after surgery are more likely.

The effects of proctitis on surgical outcome have not yet been fully determined. One study has reported that the presence of proctitis had no effect on healing rate and was not a risk factor (27); however, several other studies have reported inferior wound healing and surgical outcome in the presence of proctitis (28–30). In this study, proctitis was identified as a risk factor of recurrence. According to a report by Frøslie et al., patients with CD who showed mucosal healing 1 year after starting medical treatment were less likely to develop an anal fistula (31). Likewise, Baert et al. found a lower incidence of perianal fistula in CD patients who showed mucosal healing after starting medical treatment (4.2%, as compared with 22.7% for no mucosal healing) (32). Another study has reported improvement of surgical outcomes by the use of infliximab as an anti-inflammatory agent to reduce proctitis (33). Thus, many observations have shown proctitis to be associated with slow healing after surgery to repair anal fistula; however, no definitive conclusion has yet been drawn.

In this study, clinical judgment was relied on more often than imaging assessment to determine healing status. Several studies have reported cases in which an anal fistula has persisted after treatment despite improvement of clinical symptoms and been diagnosed using MRI or EUS (34, 35). 35 In addition, a recent assessment has supported the usefulness of MRI and EUS in anal fistula diagnosis (36). Such decreased usefulness of imaging assessment could be the limitation of this study. However, imaging is expensive and is therefore mostly used for clinical trials or in research rather than in routine practice. In future studies, more comprehensive use of imaging should be considered.

In conclusion, for anal fistulas of the simple type, healing rates were similar between the CD and non-CD groups, but healing time was significantly longer in the CD group. For the complex type, there were longer healing time, lower healing rate and higher recurrence rate in the CD group. Factors affecting anal fistula recurrence in CD were complex fistula type and the presence of proctitis. Finally, new treatment strategies are needed for CD patients in whom anal fistula recurs after

conventional surgery, and our results suggest that ASCS treatment could be a good option.

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국문 초록

서론: 일반 인구에서 치루의 발생률은 0.02%로 알려져 있다. 치루의 원인 중 하나인 크론병은 높은 재발률과 호전과 악화를 반복하는 특징을 가진다. 하지만, 크론병 항문 치루와 비 크론병 항문 치루 치료의 결과를 비교한 연구는 많지 않다. 이 연구의 목적은 실제로 크론병 항문 치루가 비 크론병 항문 치루와 비교하여 치료결과가 나쁜지에 대해서 연구하고자 한다.

방법: 1998 년 8 월부터 2012 년 12 월까지 항문 치루로 수술을 시행 받은 전향적으로 수집한 289 명 (크론병 치루, 65 명, 수술 107 레; 비 크론병치루, 224 명, 수술 274 레)의 환자를 대상으로 연구를 시행하였다. 이 자료는 후향적 연구로 의무 기록을 분석하였다. 환자들은 크론병 항문 치루와 비 크론병항문치루로 나누었고 치루를 단순 치루와 복잡 치루로 나누었다.

결과: 모든 크론병 환자들은 내과적 치료를 받았고 17 명의 환자는 infliximab 치료를 시행 받았다. 크론병 항문 치루는 69.2%로 비크론병 항문 치루 (39.2%)에 비해 복잡 치루의 비율이 높았다 ($P<0.001$). 크론병치루의 경우 비 크론병 항문 치루에 비해 전체적으로 치유률이 낮았다 (단순 치루: 90.6% vs. 100%, 복잡 치루: 56.2% vs. 76.2%, $P<0.001$). 크론병 항문 치루는 치유에 걸리는

시간 (simple: 129.6 ± 106.7 vs. 51.3 ± 33.9 days, complex type: 152.9 ± 120.3 vs. 102.9 ± 87.5 days, $p < 0.05$)은 길었고, 재발률 (simple type: 10.3% vs. 0.0%, complex type 24.3% vs. 6.5%, $P < 0.001$)은 높았다. 크론병 항문 복잡 치루의 경우 기존의 수술방법으로 시행했을 경우 치루의 지속적으로 있는 경우는 43.8% (32/73) 이었으나, 지방 조직 유래 줄기세포로 수술을 시행한 15례의 경우는 11 명에 있어서 치유가 되어 73.3%의 치유률을 보였다.

결론: 내과적 치료와 병행함에도 불구하고 전반적인 크론병 항문 치루의 치료결과는 나쁘다. 크론병 항문 치루에 있어서 지방 조직 유래 줄기 세포 치료와 같은 새로운 방법이 필요하다.

주요어 : 항문 치루, 크론병, 재발, 위험인자, 지방조직 유래 줄기세포
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