

Clinical features of inflammatory bowel disease combined with severe complications: a retrospective study of hospitalized patients

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Research article

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Abstract

Background The population characteristics of Inflammatory Bowel Disease (IBD) in China are different from those of western countries, and this population lacks large sample clinical data. This study aimed to analyze the clinical characteristics of inpatients with severe complications of IBD in our center. **Methods** In this study, medical records of 510 hospitalized IBD patients (excluding pediatrics) were included, digestive tract perforation, massive digestive tract hemorrhage, thrombosis, toxic megacolon, digestive tract fistula, digestive tract stenosis, severe malnutrition, severe infection, and carcinogenesis were defined as severe complications. The clinical process and follow-up were retrospectively analyzed. **Results** The incidence of severe complications in patients with IBD was 39.02%, 71.31%, 23.81% and 50.68% for CD, UC and IBDU, respectively, and the incidence of severe complications in CD was significantly higher than that in UC ($P < 0.005$). The cumulative incidence of serious complications in IBD patients with the course of 0-10 years was 36.99%, which was significantly lower than 48.35% of the course of >10 years ($\chi^2 = 4.054$, $P = 0.044$). The incidence of carcinogenesis in UC patients with the course of 0-10 years was 1.56%, which was significantly lower than 8.47% of UC patients with the course of >10 years ($P < 0.01$). The incidence of severe complications of UC patients with onset age ≥ 50 years old was 37.18%, which was significantly higher than 19.00% of that with onset age 20-49 years ($P = 0.001$). The surgical rate of IBD patients was 10.39%, the surgical rate of CD patients was 27.87%, which was significantly higher than 5.08% of UC patients and 4.11% of IBDU patients ($P < 0.001$), and the mortality rate of IBD patients was 1.57%, that of CD and UC was 3.28% and 1.27%, respectively. **Conclusions** Compared with western countries, IBD patients in China have similar incidence of severe complications, but the surgical rate was lower and the prognosis was better. The onset age ≥ 50 years old may be an independent risk factor for severe complications of UC patients, and the disease course of > for 10 years is an independent risk factor for carcinogenesis of UC patients.

Background

IBD is a kind of chronic non-specific intestinal inflammatory disease, and its etiology is still unclear. It can be divided into CD and UC, also included colonic IBD type-unclassified (IBDU). In most parts of the world, the incidence and prevalence of IBD have steadily increased, which in developed countries are higher than in developing countries, and in urban areas than in rural areas.¹ The rising trend of IBD incidence is almost synchronous with its industrialization. Epidemiological data in China show that the standardized incidence rate of IBD are 1.77/100,000 and 3.14/100,000,²⁻³ although IBD is a rare disease, with the continuous development of economy in our country, and the continuous "westernization" of lifestyle, the incidence of IBD has risen sharply.⁴ It is followed by an increasing number of complications, the loss of patients' labor ability, and a large amount of medical resources investment, which seriously reduces the quality of life of patients. According to the research report from Sweden, nearly one-third of CD patients suffered from the loss of working ability, and the loss of working days was twice that of the control group.⁵ A study from Canada showed that the economic burden of IBD was huge, with an annual total cost of 2.8 billion Canadian dollars in 2012, equivalent to about 12,000 Canadian dollars per patient with

UC or CD.⁶ A study from Europe showed that the total annual cost of CD was as high as 7,835 euros, while that of UC was 3,600 euros.⁷ Chinese scholars have confirmed that economic burden has a significant impact on health-related quality of life (HRQoL) of IBD patients,⁸ and compared with healthy people, CD patients have more symptoms of anxiety, depression and conscious stress, and are accompanied by obvious social functional defects.⁹ Due to differences in social development, living and eating habits, regions, population species and genera, IBD population characteristics in China are different from those in western countries with high incidence of IBD. There is no large sample clinical data on severe complications in IBD population in China, therefore, the aim of this paper was to retrospectively analyze the clinical characteristics of severe complications in hospitalized IBD patients in our center, and preliminarily discuss the influencing factors of IBD-related severe complications.

Methods

General Information

The data of 1835 IBD patients (excluding pediatrics) were collected from January 1, 2010 to December 31, 2018 at the seventh medical center of PLA general hospital, 1325 cases of outpatients (322 cases of CD, 1003 cases of UC), and 510 cases of hospitalized patients (a total of 2231 times of hospitalization, 4.4 times per capita). The hospitalized IBD patients contained 328 males and 182 females, with a male-female ratio of 1.8:1, the age of onset ranged from 7 to 85 years old, and the average age of onset was 37.9 ± 14.9 years old. There were 122 patients with CD, 85 males and 37 females, with a male-female ratio of 2.3:1, the age of onset ranged from 7 to 76 years old, and the average age of onset was 34.8 ± 15.3 years old. There were 315 patients with UC, 194 males and 121 females, with a male-female ratio of 1.6:1, the age of onset ranged from 9 to 85 years old, and the average age of onset was 39.0 ± 14.6 years old. There were 73 patients with IBDU, 49 males and 24 females, with a male-female ratio of 2.0:1, the age of onset ranged from 12 to 68 years old, and the average age of onset was 37.8 ± 15.7 years old. Digestive tract perforation, massive digestive tract hemorrhage, thrombosis, toxic megacolon were defined as acute severe complications, and digestive tract fistula, digestive tract stenosis, severe malnutrition, severe infection and carcinogenesis were defined as chronic severe complications. In this study, all patients with IBD had no family history.

Screening criteria

1. Diagnostic criteria for IBD: According to the consensus opinions on diagnosis and treatment of inflammatory bowel disease in China in 2018 (hereinafter referred to as "consensus opinions"),¹⁰ the hospitalized IBD patients were divided into three groups: CD, UC and IBDU.
2. The course of disease: from the first clinical symptoms to the last follow-up, patients were divided into two groups: the course of 0-10 years and the course of >10 years.
3. Screening criteria for the severe complications: Digestive tract perforation: the lesion penetrates the digestive tract wall and causes the contents of the digestive tract to overflow into the abdominal

cavity. Massive digestive tract hemorrhage: hemoglobin level suddenly drops to $<90\text{g/L}$ or at least 20g/L below baseline, or need to enter at least two units of suspended red blood cells within 24h.¹¹ Thrombosis: any thrombosis occurring in the arterial and venous systems, thrombosis diagnosis time is not earlier than IBD diagnosis time. Toxic megacolon: characterized by segmental or total colonic dilatation, the dilated colon should be $>6\text{cm}$ and accompanied by systemic poisoning. Digestive tract fistula: including digestive tract fistula, external hemorrhoids, abdominal wall hernia, anal fistula. Digestive tract stenosis: inflammatory hyperplasia, fibrosis, scar contracture, intestinal cavity occupying and others cause the lumen stricture of digestive tract. Severe malnutrition: using the Patient-Generated Subjective Global Assessment (PG-SGA), score of ≥ 9 points.¹² Severe infection: gastrointestinal and other organ infections that lead to changes in IBD conditions, including mycobacterium tuberculosis, clostridium difficile, epstein-barr virus, cytomegalovirus, etc. Carcinogenesis: including severe dysplasia, high-grade intraepithelial neoplasia of the colonic mucosa, and other organ tumors.

4. Age grouping criteria for onset: According to the Montreal classification standard,¹³ CD was divided into three groups: ≤ 16 years old, 17-40 years old and >40 years old. According to the peak onset age was 20-49 years old in the "consensus opinions",¹⁰ UC was divided into three groups: <20 years old, 20-49 years old, ≥ 50 years old. The grouping of IBDU was conducted according to the grouping of UC.
5. This study was a retrospective study, and the ethics committee of The Seventh Medical Center, Chinese PLA General Hospital found no ethical approval. Because of the retrospective nature of the study, patient consent for inclusion was waived.

Statistical analysis

Data analysis was performed using SPSS 20.0 statistical software. The count data of hospitalized IBD patients were expressed in terms of number, rate and percentage, etc. The average age was expressed as mean age \pm standard deviation. Differences in gender and differences in incidence of complications between the groups were examined by chi-square test, differences in incidence of complications between different ages of onset were analyzed by $R \times C$ chi-square test. If the theoretical frequency was <5 , Fisher's test would be used. P -value < 0.05 , indicated that the difference was statistically significant.

Results

General information

Among 510 patients with IBD, CD accounted for 23.9%, UC accounted for 61.8%, and IBDU accounted for 14.3%, which showed an overall upward trend. In the past 9 years, the number of inpatients with IBD increased by 3.84 times, CD increased by 14.5 times, UC increased by 1.4 times, IBDU increased by 7.7 times, and the number of newly added patients increased by 3 times. The specific growth trend was shown in Fig. 1. The peak incidence of CD and UC was between 21-30 years old, while IBDU has double

peaks between 21-30 years old and 41-50 years old. The specific age of onset and the distribution of male and female are shown in Fig. 2.

The incidence of severe complications of hospitalized IBD patients was 39.02% (199 cases), among which 71.9% (143 cases) had one severe complication, 19.1% (38 cases) had two severe complications, and 9.0% (18 cases) had three or more severe complications. The incidence of severe complications of CD was 71.31% (87 cases), 23.81% (75 cases) for UC, and 50.68% (37 cases) for IBDU. The differences between CD and UC, CD and IBDU, UC and IBDU in the incidence of severe complications were statistically significant ($P < 0.005$).

The course of IBD patients ranged from 0 to 41 years, with an average duration of 6.4 ± 6.6 years, 419 patients with the course of 0-10 years, and 91 patients with the course of >10 years. The course of CD patients ranged from 0 to 41 years, with an average duration of 4.6 ± 3.1 years, 99 patients with the course of 0-10 years, and 23 patients with the course of >10 years. The course of UC patients ranged from 0 to 33 years, with an average duration of 6.4 ± 6.7 years, 256 patients with the course of 0-10 years, and 59 patients with the course of >10 years. The course of IBDU patients ranged from 0 to 33 years, with an average duration of 4.9 ± 5.8 years, 64 patients with the course of 0-10 years, and 9 patients with the course of >10 years.

Gender factors

Among the 87 CD patients with severe complications, 60 were male and 27 were female, with a male-female ratio of 2.2:1. Among the 75 UC patients with severe complications, 47 were male and 28 were female, with a male-female ratio of 1.7:1. Among the 37 IBDU patients with severe complications, 24 were male and 13 were female, with a male-female ratio of 1.9:1. The gender difference in the incidence of severe complications among the three groups were not statistically significant ($P > 0.05$), as shown in Table 1. However, among the 34 patients with gastrointestinal fistula, 28 were male and 6 were female, the gender difference in the incidence rate was statistically significant ($\chi^2=5.165$, $P=0.023$), as detailed in Table 1.

The factor of disease course

The cumulative incidence of severe complications was 36.99% (155 cases) in IBD patients with the course of 0-10 years, and 48.35% (44 cases) with the course of >10 years, the difference between them was statistically significant ($\chi^2=4.054$, $P=0.044$). The cumulative incidence of severe complications was 67.68% (67 cases) in CD patients with the course of 0-10 years, and 86.96% (20 cases) with the course of >10 years, the difference between them was not statistically significant ($\chi^2=3.391$, $P=0.066$). The cumulative incidence of severe complications was 22.66% (58 cases) in UC patients with the course of 0-10 years, and 28.81% (17 cases) with the course of >10 years, the difference between them was not statistically significant ($\chi^2=1.002$, $P=0.317$). The cumulative incidence of severe complications was 46.88% (30 cases) in IBDU patients with the course of 0-10 years, and 77.78% (7 cases) with the course

of >10 years, the difference between them was not statistically significant ($\chi^2=3.015$, $P=0.083$). The details are reported in Table 2.

The factor of onset age

In CD, 12 patients were diagnosed with ≤ 16 years old, the incidence of severe complications was 66.67% (8 cases). 72 patients were diagnosed with 17-40 years old, the incidence of severe complications was 65.28% (47 cases). 38 patients were diagnosed with >40 years old, the incidence of severe complications was 84.21% (32 cases), the incidence differences between three onset age groups were not statistically significant ($\chi^2=4.498$, $P=0.106$). However, it is worth mentioning that $P=0.036$ (but, $P>0.05/3$) when comparing the incidence of severe complications between group of 17-40 years old and >40 years old, the specific trend is shown in Fig. 3. In UC, 16 patients were diagnosed with <20 years old, the incidence of severe complications was 25.00% (4 cases). 221 patients were diagnosed with 20-49 years old, the incidence of severe complications was 19.00% (42 cases). 78 patients were diagnosed with ≥ 50 years old, the incidence of severe complications was 37.18% (29 cases). The incidence differences between three onset age groups were statistically significant ($\chi^2=10.511$, $P=0.005$), and there was a significant difference between group of 20-49 years old and ≥ 50 years old ($P=0.001$, $P<0.05/3$), the specific trend is shown in Fig. 3. In IBDU, 10 patients were diagnosed with <20 years old, the incidence of severe complications was 70.00% (7 cases). 45 patients were diagnosed with 20-49 years old, the incidence of severe complications was 46.67% (21 cases). 18 patients were diagnosed with ≥ 50 years old, the incidence of severe complications was 50.00% (9 cases). The incidence differences between three onset age groups were not statistically significant ($\chi^2=1.787$, $P=0.409$), the specific trend is shown in Fig. 3.

Nine severe complications

13 patients with digestive tract perforation: the incidence of digestive tract perforation in CD patients was 6.56% (8 cases), UC was 0.32% (1 case), IBDU was 5.48% (4 cases), and the difference in the incidence between CD and UC, IBDU and UC was statistically significant ($P<0.001$). 13 patients with massive digestive tract hemorrhage: the incidence of massive digestive tract hemorrhage in CD patients was 5.36% (6 cases), UC was 1.59% (5 cases), IBDU was 2.74% (2 cases), and the difference in the incidence between CD and UC was statistically significant ($P=0.046$). 7 patients with thrombosis: the incidence of thrombosis in CD patients was 0.82% (1 case), UC was 1.27% (4 cases), IBDU was 2.74% (2 cases), and there was no statistically significant difference in the incidence between the three groups ($P>0.05$). 6 patients with toxic megacolon: the incidence of toxic megacolon in UC patients was 1.58% (5 cases), IBDU was 1.37% (1 case), and the difference in the incidence between two groups was not statistically significant ($P>0.05$). 34 patients with digestive tract fistula: the incidence of digestive tract fistula in CD patients was 13.93% (17 cases), UC was 3.81% (12 cases), IBDU was 6.85% (5 cases). There was a statistically significant difference in the incidence between CD and UC groups ($P< 0.001$). 118 patients with digestive tract stenosis: the incidence of digestive tract stenosis in CD patients was 59.02% (72 cases), UC was 6.67% (21 cases), IBDU was 34.25% (25 cases), and the incidence differences between CD and UC, CD and IBDU, UC and IBDU were statistically significant ($P< 0.001$). 39 patients with severe

malnutrition: the incidence of severe malnutrition in CD patients was 11.48% (14 cases), UC was 6.35% (20 cases), IBDU was 6.85% (5 cases), and there were no statistical differences in incidence between the three groups ($P > 0.05$). 41 patients with severe infection: the incidence of severe infection in CD patients was 10.66% (13 cases), UC was 6.98% (22 cases), IBDU was 8.22% (6 cases), and there were no significant differences in the incidence between the three groups ($P > 0.05$). 11 patients with carcinogenesis: the incidence of Carcinogenesis in CD patients was 1.64% (2 cases) , UC was 2.86% (9 cases), and the difference in the incidence between CD and UC was not statistically significant ($P > 0.05$). The detailed situation is shown in Table 3.

According to the time when severe complications occurred: in the course of 0-10 years, severe complications of CD patients were most common in digestive tract stenosis (65 cases), UC were severe infection (20 cases), and IBDU were digestive tract stenosis (23 cases). In the course of >10 years, severe complications of CD patients were most common in digestive tract stenosis (7 cases), UC were carcinogenesis (5 cases), IBDU were digestive tract stenosis (2 cases). The incidence and distribution of severe complications are shown in Table 4. Between the two groups, the incidence differences of CD patients in digestive tract and digestive tract stenosis were statistically significant ($P < 0.05$), and the incidence difference of UC patients in carcinogenesis was statistically significant ($P < 0.01$), as detailed in Table 5.

In CD patients, the incidence of nine severe complications were no statistically significant difference among different onset age groups ($P > 0.05$). In UC patients, the incidence of toxic megacolon were statistically significant difference among different onset age groups ($\chi^2=6.597$, $P=0.037$), and the difference was significant when compared the group of age <20 years old and 20-49 years old ($P=0.014$, $P < 0.05/3$). The incidence of severe malnutrition were statistically significant difference among different onset age groups ($\chi^2=14.752$, $P < 0.001$), and the difference was significant when compared the group of age 20-49 years old and ≥ 50 years old ($P < 0.001$, $P < 0.05/3$). In IBDU patients, the incidence of nine severe complications were no statistically significant difference among different onset age groups ($P > 0.05$). The incidence and distribution of nine severe complications in IBD patients is shown in Table 6.

Prognosis

53 hospitalized IBD patients (10.39%) received surgical treatment in our center, including 48 patients received one operation, 3 patients received two operations (both CD), and 2 patients received three operations (1 CD and 1 IBDU). The surgical rate of CD patients was 27.87% (34 cases), UC was 5.08% (16 cases), IBDU was 4.11% (3 cases), the surgical rates of IBD patients were shown in Fig. 4, and the differences of operative rate between CD and UC, CD and IBDU were statistically significant ($\chi^2=45.075$, $P < 0.001$). The surgical rate of IBD patients in the course of 0-10 years was 11.22% (47 cases), CD was 31.31% (31 cases), UC was 5.08% (13 cases), IBDU was 4.69% (3 cases). In the course of >10 years, the surgical rate of IBD patients was 6.59% (6 cases), CD was 13.04% (3 cases), UC was 5.08% (3 cases). There were no statistically significant differences in the surgical rate between IBD, CD, UC and IBDU patients at different courses ($P > 0.05$), as detailed in Table 7. The mortality of IBD patients was 1.57% (8

cases), including 4 cases of CD and 4 cases of UC, and there was no statistically significant difference in mortality between the two groups ($P>0.05$), the mortalities of IBD patients were shown in Fig. 4. The causes of death included: postoperative complications (4 cases), toxic megacolon (2 cases), digestive tract perforation (1 case), and colonic malignant tumor metastasis (1 case).

Discussion

IBD is a kind of autoimmune diseases that mainly affect the digestive tract. At present, its pathogenesis is still unclear, and most scholars believe that it is related to various factors such as environment, genetics, dietary, intestinal microecology, et al.¹⁴⁻¹⁶ The incidence and prevalence of IBD are on the rise all over the world, 75% of CD studies and 60% of UC studies had increasing incidence of statistical significance ($P<0.05$) in time-trend analyses.¹ According to IBD epidemiological data in our country, the number of IBD patients nationwide ranges from 25,000-44,000,²⁻³ in the past nine years, the number of IBD patients treated in our center was 1835, and 510 patients were hospitalized with IBD, showing an increasing trend year by year, while the incidence of UC in hospital fluctuated, which was considered to be related to the fact that the general condition of UC population in China was mild and some UC patients were followed up in outpatient clinic. Worldwide, especially in developing countries, number of UC patients are more than that of CD patients, but in countries with high IBD rates such as Europe and North America, there are reports of CD patients more than UC patients or a considerable number of patients.^{1,17} In this study, the ratio of inpatients with UC and patients with CD was 2.58:1, combined with the proportion of IBD patients in outpatient follow-up, the actual UC:CD was 2.97:1. A cohort study based on IBD populations in Europe, the United States, Australia, and New Zealand¹⁸ showed that: Before age 10-14, the CD risk of women is lower, and later the CD risk of women is higher; before the age of 45, the incidence of UC was not significantly different between male and female patients (except for the 5-9 age group), and later the incidence of male UC patients was significantly higher than that of females. The systematic review based on the global IBD population studies showed that: The female to male ratio varied from 0.51 to 1.58 for UC studies and 0.34 to 1.65 for CD studies, suggesting that the diagnosis of IBD was not sex specific.¹ In this study, the male to female ratio of IBD patients was 1.8:1, which was similar to the epidemiological data in China,³ and the ratio of male to female of CD and UC patients was 2.3:1 and 1.6:1, respectively, which were slightly higher than that of CD and UC population in China.¹⁹⁻²² The average onset age of CD patients was slightly less than that of patients with UC, consistent with reports in some Asian regions.^{3,23} The peak incidence of CD patients was basically consistent with some literature reports between 21-30 years old,²⁴⁻²⁶ while UC patients between 21 and 30 years old was different from some literature reports,^{19,20,26} and another small peak incidence between 50-60 years old was not found in this study.¹ The peak incidence of IBDU patients was between 21-30 years old, while there was another peak between 41-50 years old, so far, no similar literature has been reported. Currently, there are few studies on gender difference in incidence of complications of IBD patients, the incidence of severe complications of IBD patients between male and female in our study was no statistically significant difference ($P>0.05$). However, the incidence of digestive tract fistula in male patients was

significantly higher than that in female patients ($P=0.023$), which may suggest that gender plays a role in the occurrence of severe complications, but this needs to be confirmed by further clinical studies.

With the prolongation of the course of IBD patients, the cumulative incidence of severe complications tends to increase, which is related to their biological behaviors. According to reports, the 5-year cumulative complication rate of CD patients was 48% - 52%, and after 10 years was 69% - 70%, about half of patients developed intestinal stenosis,^{27,28} and the cumulative probability of CD patients without complications in 5, 10 and 20 years was 86.3, 66.4 and 52.2%, respectively.²⁹ The incidence of complications of IBD patients in this study was similar to that, and most patients combined with one severe complications, the cumulative incidence of patients with the course of >10 years was 48.35%, which was significantly higher than 36.99% of patients with the course of 0-10 years ($P=0.044$). The cumulative incidence of severe complications in patients with CD, UC, and IBDU also showed upward trends, but the difference of them between the disease course was not statistically significant ($P>0.05$), which may be due to insufficient follow-up time.

The age of onset may be correlated with the incidence of severe complications. It has been reported that in group A1 and A2 (Montreal classification), CD patients presented perianal disease in 75.0% and 57.8% patients, respectively, while in group A3 21.6% ($P<0.001$),²⁹ and the age of >50 years old is a risk factor for IBD infection.³⁰ In this study, the differences among the incidence of severe complications of UC patients at different onset age were statistically significant ($P=0.005$), the incidence of severe complications of patients with onset age ≥ 50 years old was significant higher than that of patients aged 20-49 years old ($P<0.01$), among which the incidence of severe malnutrition was significantly different ($P<0.001$). This may indicate that the onset age ≥ 50 years old may be an independent risk factor for severe complications of UC patients, UC patients with onset of disease in middle and old age are more prone to severe complications. The CD and IBDU patients showed no significant differences in the incidence of severe complications among different onset age groups ($P>0.05$). However, we observed that the incidence trends of severe complications between CD, UC, and IBDU at different ages of onset were "high at both ends and low in the middle". We may infer that the adolescents and middle-aged and elderly IBD patients are more likely to occur severe complications than young patients, which may be related to such factors as the imperfection of immune function, severity of illness, rapid progress, and easy misdiagnosis and poor treatment compliance of adolescent patients, basic diseases, multiple drug use and limited treatment options of middle-aged and elderly patients. In clinical work, the monitoring and screening of severe complications should be carried out according to the characteristics of different onset age groups.

The incidence of severe complications of CD patients was significantly higher than that of UC ($\chi^2=85.060$, $P<0.001$), especially in patients with digestive tract perforation, massive digestive tract hemorrhage, digestive tract fistula, digestive tract stenosis ($P<0.05$), which was determined by the invasive and penetrating biological behavior of CD. The major severe complications of CD patients with the course of 0-10 years were digestive tract stenosis and digestive tract fistula, while patients with the course of >10

years were mainly digestive tract stenosis and severe malnutrition, which were related to CD's involvement in the whole digestive tract and inflammation invading the whole intestinal wall, resulting in inflammatory or fibrous stricture of the intestine and loss of partial intestinal absorption function. Severe infection and malnutrition were the most common diseases in UC patients with a course of 0-10 years, which was considered to be related to the nutritional loss caused by recurrent diarrhea, mucous, pus and blood stools, impaired intestinal mucosal barrier, application of immune modulators and disease activity. However, carcinogenesis and digestive tract stenosis were mainly complications in UC patients with the course of >10 years, which was considered to be caused by repeated inflammatory injury of intestinal mucosa with the prolongation of UC disease course. With the continuous extension of disease course, the cancer risk of UC patients increases significantly, Eaden, et al.³¹ pointed out in a meta-analysis that the risk of cancer increased by 0.5% to 1.0% per year, and the risk of cancer in the 10, 20 and 30 years was 2%, 8% and 18%. A multi-center retrospective epidemiological study in China showed that the colorectal cancer rate of patients with UC was 0.8%.³² Therefore, "consensus opinions" [10] recommends that cancer surveillance should be conducted in remission from 8 to 10 years after the diagnosis of the disease, and in the case of primary sclerosing cholangitis (PSC) every year after the diagnosis of PSC. In this study, the severe infection rate was lower than previous literature reports, infection-related hospitalization accounting for 27.5% of all hospitalized IBD patients,³³ and the incidence of digestive tract stenosis and digestive tract fistula significantly reduced in CD patients after entering the course of >10 years, which may suggest that the incidence of severe complications can be reduced by actively providing nutritional support, standard medical treatment and paying attention to improving patient compliance education in our center.

IBD is a kind of chronic diseases that may require surgical intervention. In recent years, with the development of medical treatment methods for IBD, the surgical risk has gradually declined. A meta-analysis based on IBD population study in 2003 showed that the risk of surgery at 1 year, 5 years, and 10 years after diagnosis of CD were 16.3%, 33.3%, and 46.6%, respectively, the operative risks at 1 year, 5 years, and 10 years after diagnosis of UC were 4.9%, 11.6%, and 15.6%, respectively. The surgical risks at 1 year, 5 years and 10 years after diagnosis of CD and 1 year and 10 years after diagnosis of UC decreased significantly in the past 60 years ($P < 0.05$),³⁴ within 10 years after diagnosis, about half of CD patients will need surgical treatment,¹ and about 1/3 of CD patients will need multiple surgeries.²⁷ The surgical rate and multiple surgical rate of hospitalized patients with IBD in our center are relatively lower, CD patients' surgical rate was significantly higher than that of UC patients ($P < 0.001$), and the surgical rate of patients shows a decrease trend with the extension of the disease course, most patients have undergone surgeries within the course of 0-10 years. In this study, IBD patients had a better prognosis and lower mortality. Studies from the Netherlands showed that the mortality rate of IBD patients was between 3.4% and 11.3%.³⁵ In a record linkage study from England, overall 3-year mortality of hospitalized CD patients with and without colectomy was 9%, and that of UC was 12%.³⁶ This is because our center adopts active and effective nutritional support therapy to improve the basic state of patients; multi-disciplinary cooperation, "individualized" treatment programs such as biological agents, immunomodulators and others; standardize the endoscopic follow-up process to monitor patients'

treatment response and drug side effects, and timely adopt the treatment regimen adjustment and endoscopic intervention; pay attention to patient compliance education and psychological counseling, improving patients' treatment confidence; be alert to "sentinel signs" when the condition changes, and prevent the disease from worsening in time. The association between the treatment and severe complications will be discussed in another article.

Conclusions

The incidence of IBD is increasing year by year, and the cumulative incidence of serious complications increases with the extension of the course of disease. CD is more prone to serious complications than UC, and the surgical rate is also higher. There was no gender difference in the incidence of severe complications, but there was a certain correlation with the onset age. In patients with UC, the onset age ≥ 50 years old may be an independent high risk factor for severe complications, and the onset age < 20 years old may be an independent high risk factor for toxic megacolon, and the course of disease > 10 years was an independent high risk factor for carcinogenesis. In this study, the clinical characteristics of IBD patients were different from those of western countries with high incidence, the incidence of severe complications was similar, but the surgical rate was lower and the prognosis was better. Raise the awareness of early warning and prevent the cascaded reaction in time; based on effective nutrition support and standard medical treatment, the primary disease should be actively controlled and the importance of patient compliance education is emphasized, so as to minimize the rate of severe complications, surgical rate and mortality of patients. At the same time, the advantages of multidisciplinary cooperation should be brought into play to implement individualized treatment, and endoscopic intervention or surgical operation should be conducted in time and according to the condition, so as to improve the treatment effect and improve the quality of life of patients.

Declarations

Ethics approval and consent to participate

This study was a retrospective study, because of the retrospective nature of this study, patient consent for inclusion was waived, and the ethics committee of The Seventh Medical Center, Chinese PLA General Hospital found it no need ethical approval.

Consent to publish

Not applicable.

Availability of data and materials

The datasets used and analyzed in the current study are available from the corresponding author on demand.

Competing interests

The authors declare that they have no competing interests. In addition, they have substantially contributed to this current study and approved the content of the manuscript. All authors have consented to publish in *MBC Gastroenterology*.

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Authors' contributions

SY and LL analyzed data and wrote the manuscript, made equal contributions to this article. SD, LZ, XF, ZK, HS, XL, YF, YT, YJ, XY, RF, YH and SL were responsible for collected data and patients' follow-up, PJ and JS were responsible for endoscopy. JW designed the study and performed scientific edits to the manuscript. All authors read and approved the final manuscript.

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Tables

Table 1 Gender differences in severe complications in hospitalized IBD patients

Diagnosis	Male(case)	Female(case)	c ²	P-value
CD	60	27	0.072	0.789
UC	47	28	0.048	0.826
IBDU	24	13	0.173	0.677
Nine severe complications				
Digestive perforation	10	3	0.942	0.336
Massive gastrointestinal hemorrhage	7	6	0.637	0.425
Thrombosis	4	3	0.159	0.690
Toxic megacolon	3	3	0.542	0.462
Intestinal stenosis	78	40	0.214	0.643
Severe malnutrition	26	13	0.102	0.750
Serious infection	27	14	0.046	0.830
Canceration	5	6	1.742	0.187
Gastrointestinal fistula	28	6	5.165	0.023

Table 2 The difference of incidence of severe complication between the different disease course

Diagnosis	0-10year (%)	>10year (%)	c2	P-value
CD	67.68	86.96	3.391	0.066
UC	22.66	28.81	1.002	0.317
IBDU	46.88	77.78	3.015	0.083
IBD	36.99	48.35	4.054	0.044

Table 3 The distribution of incidence of nine severe complications in hospitalized IBD patients

Diagnosis	CD (%)	UC (%)	IBDU (%)	* P-value
Thrombosis	0.82	1.27	2.74	P > 0.05
Toxic megacolon	0	1.58	1.37	NA
Severe malnutrition	11.48	6.35	6.85	P > 0.05
Severe infection	10.66	6.98	8.22	P > 0.05
Carcinogenesis	1.64	2.86	0	P > 0.05
Digestive tract perforation	6.56	0.32	5.48	P < 0.001
Digestive tract massive hemorrhage	5.36	1.59	2.74	P < 0.05
Digestive tract fistula	13.93	3.81	6.85	P < 0.001
Digestive tract stenosis	59.02	6.67	34.25	P < 0.001

*P: refers to the comparison of incidence of severe complications between patients with CD and patients with UC

Table 4 The distribution of incidence of nine severe complications in IBD patients with different disease course

Diagnosis	CD (%)		UC (%)		IBDU (%)	
	The course 0-10years	The course >10 years	The course 0-10years	The course >10 years	The course 0-10years	The course >10 years
Digestive tract perforation	8.08	0	0.39	0	6.25	0
Digestive tract massive hemorrhage	4.04	8.70	1.56	1.69	3.13	0
Thrombosis	1.01	0	0.78	3.40	3.13	0
Toxic megacolon	0	0	1.56	1.69	1.56	0
Digestive tract fistula	17.17	0	4.68	1.69	6.25	0
Digestive tract stenosis	65.66	30.43	6.64	6.78	35.94	22.22
Severe malnutrition	12.12	8.70	7.81	3.40	7.81	0
Severe infection	12.12	4.35	7.81	3.40	7.81	11.11
Carcinogenesis	10.1	4.35	1.56	8.47	0	0

Table 5 The differences in the distribution of serious complications in different stages

Diagnosis	CD		UC
	Digestive tract fistula	Digestive tract stenosis	Canceration
Course of 0-10 years	17 17.17%	65 65.66%	4 1.56%
Course of > 10 years	0 0%	7 30.43%	5 8.47%
<i>P</i> -value	0.032	0.002	0.004

Table 6 The distribution of nine severe complications in IBD patients with different onset age

Diagnosis	CD (%)			UC (%)			IBDU (%)		
	Age ≤16	Age 17-35	Age ≥36	Age <20	Age 20-49	Age ≥50	Age <20	Age 20-49	Age ≥50
Digestive tract perforation	7.69	11.63	3.03	0	0	1.28	20.00	4.44	0
Digestive tract massive hemorrhage	7.69	9.30	1.52	0	1.81	1.28	10.00	0	5.56
Thrombosis	0	0	1.52	0	0.45	3.85	0	0	11.11
Toxic megacolon	0	0	0	6.25	0.45	3.85	0	0	5.56
Digestive tract fistula	7.69	20.93	10.61	6.25	4.07	3.85	10.00	4.44	5.56
Digestive tract stenosis	46.15	69.77	54.55	6.25	5.88	8.97	30.00	40.00	22.22
Severe malnutrition	15.38	16.28	7.58	12.50	3.17	15.38	20.00	2.22	5.56
Severe infection	15.38	13.95	7.58	6.25	5.43	12.82	0	4.44	11.11
Carcinogenesis	0	2.33	1.52	0	3.17	2.56	0	0	0

Table 7 The surgical status distribution of inpatients with IBD at different course

Diagnosis	IBD %	CD %	UC %	IBDU %
Course 0-10 years	11.22	31.31	5.08	4.69
Course >10 years	6.59	13.04	5.08	0
<i>P</i> -value	0.102	0.078	0.998	0.507

Figures

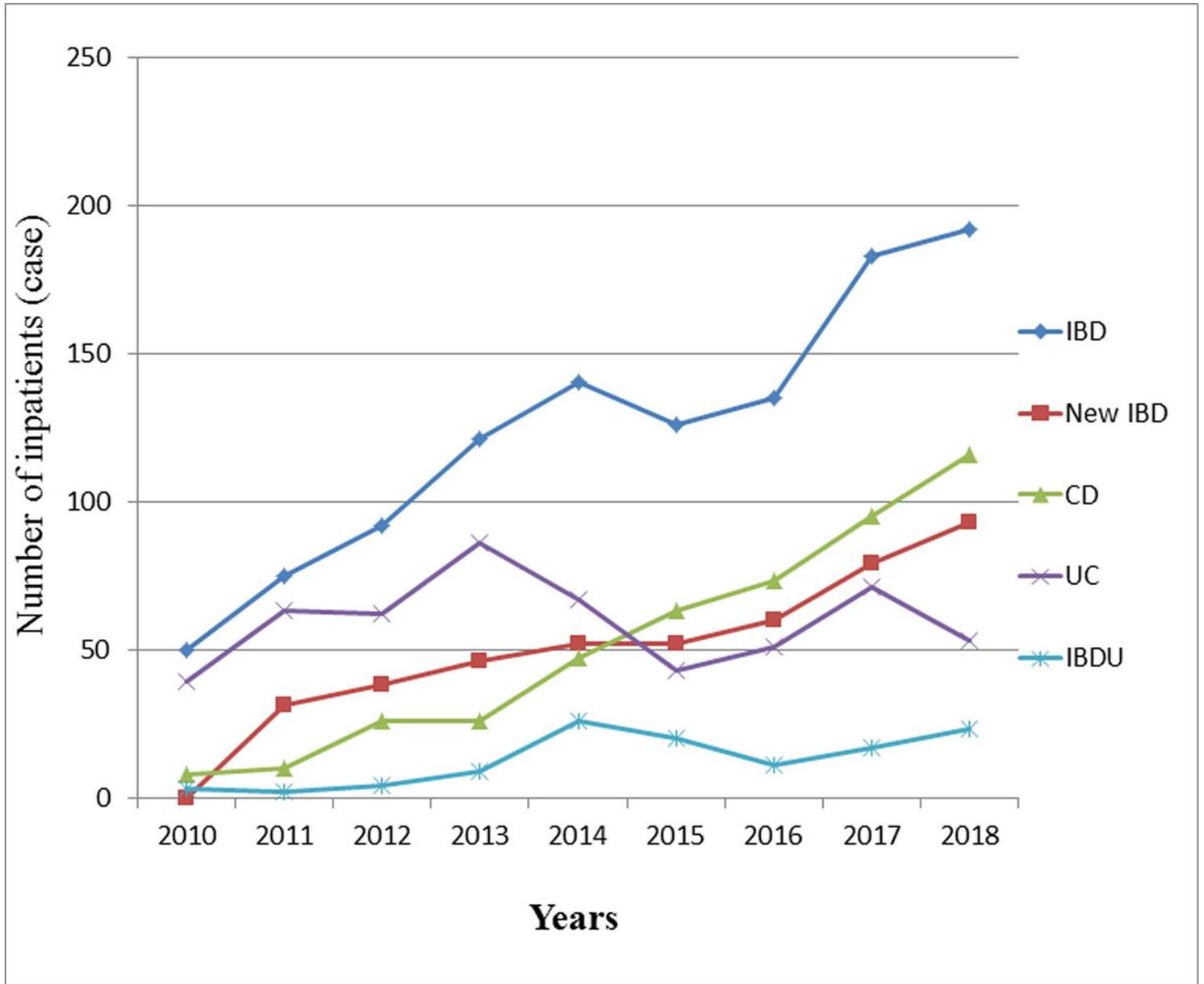


Figure 1

The distribution of hospitalized IBD patients. This figure shows the number of IBD, CD, UC, and IBDU patients hospitalized, newly diagnosed each year from January 2010 to December 2018.

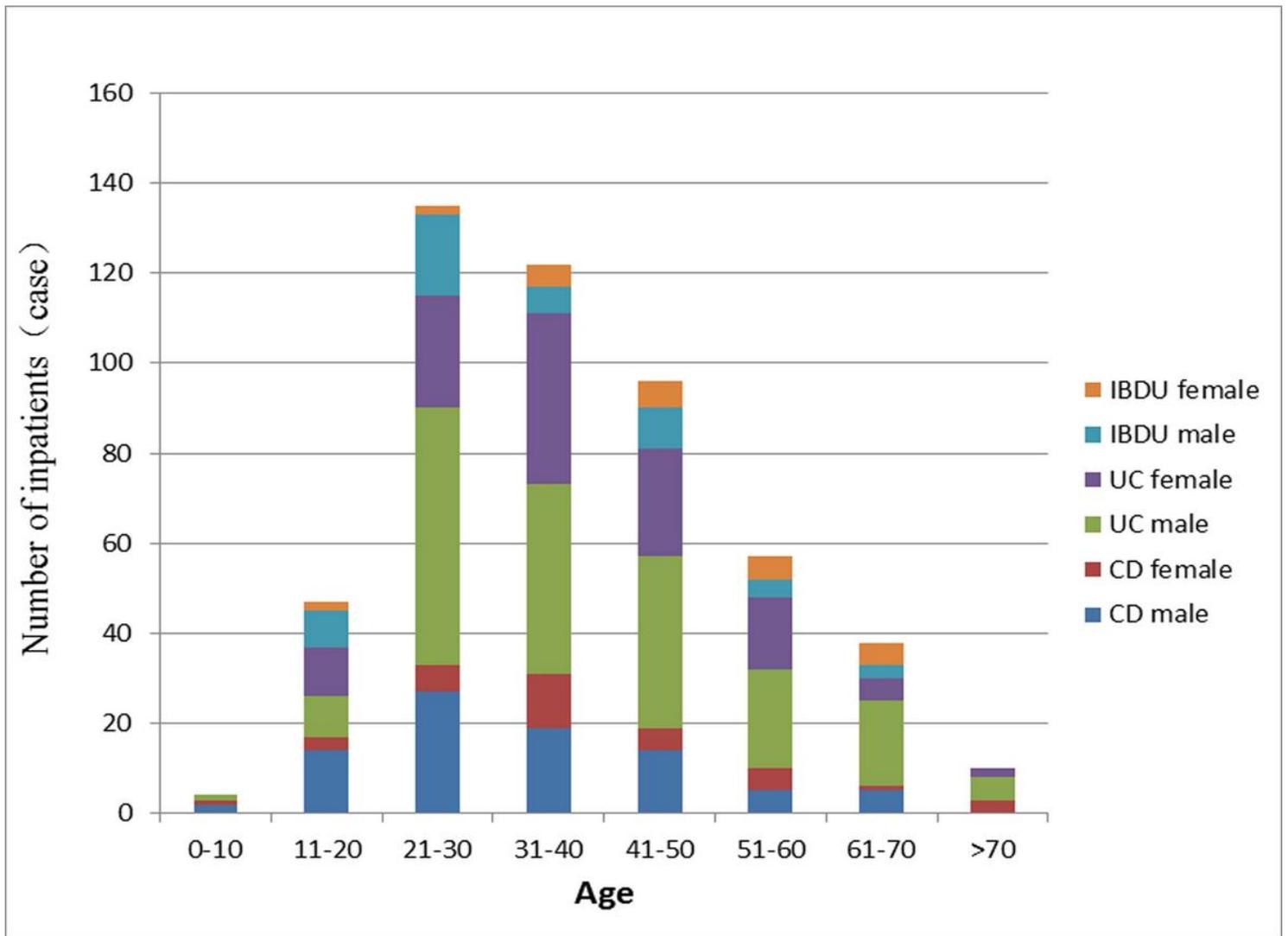


Figure 2

The onset age and gender in IBD patients. This figure shows the distribution of hospitalized patients with CD, UC and IBDU according the onset age and gender.

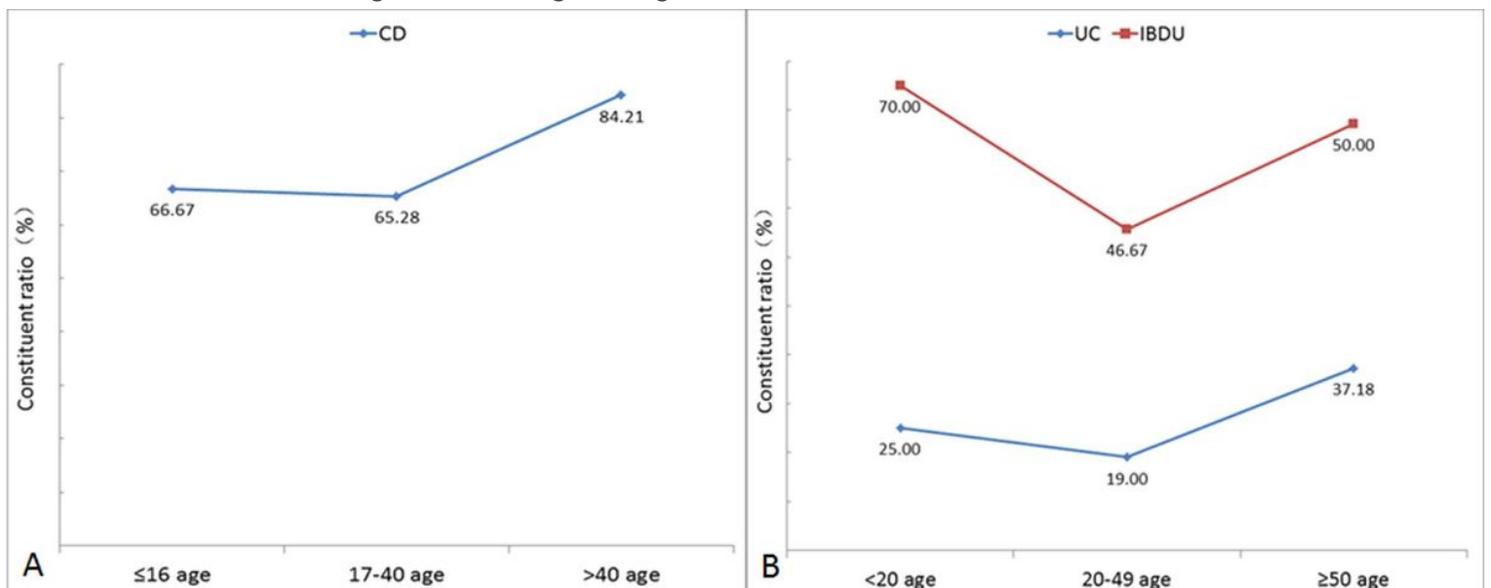


Figure 3

The incidence of severe complications in IBD patients. A: shows the incidence of severe complications in hospitalized CD patients at different onset age. B: shows the incidence of severe complications in hospitalized UC and IBDU patients at different onset age.

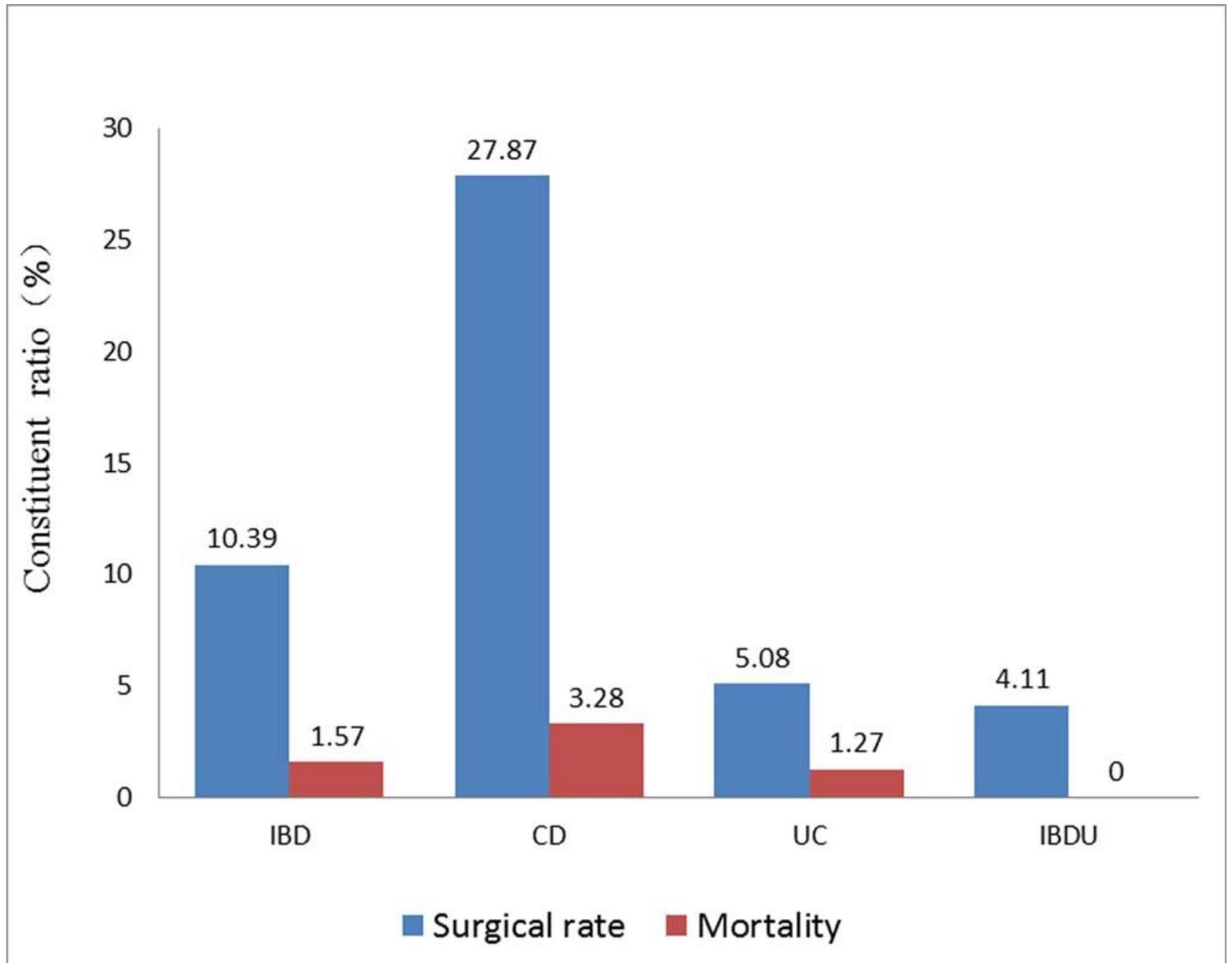


Figure 4

The surgical rate and mortality in IBD patients. This figure shows the distribution of surgical rate and mortality in hospitalized IBD patients.