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The Impact of COVID-19 Pandemic on Inpatient Surgical Treatment in Patients with Benign Anorectal Diseases

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Abstract: Background: The reconstruction of anorectal surgery in the context of COVID-19 pandemic is ongoing. Objective: This study aims to examine the impact of COVID-19 pandemic on inpatient surgical treatment in patients with benign anorectal diseases. Design: This was a retrospective, single-center, observational study. Settings: The study was conducted in a hospital affiliated to a provincial medical university in China. Patients: This study included patients admitted from December of the last three years to March of the following year (total 1353). Main outcome measures: The patients' gender, age, first diagnosis, main symptoms and their worse days, pre-admission treatment, date of admission and discharge, length of hospital days, straight-line distance between residence and the hospital, and comorbidities were recorded. Results: Lockdown led to a decline in admissions, a reduction of hospital days ($p<0.001$), and changes in the proportion of different diseases admissions ($p=0.032$). The distance between residence and the hospital was reduced. Each wave of the outbreak was associated with prolonged hospital days. The hospital stay was not significantly affected in patients with colorectal polyps ($p=0.564$), but their number of hospital admissions greatly reduced. Limitations: This study was limited by the limited number of patients during the lockdown period and the lack of data about outpatient and unadmitted patients. Conclusions: The reconstructive process in colorectal surgery remains fraught with difficulties. The determinant of patient admission is the urgency and severity of the symptoms. Pre-admission treatment was not significantly affected. Care should be given to possible adverse outcomes due to reduced admissions for colorectal polyps. Lockdown causes shorter hospital stays over a short time, but the outbreaks still causes longer hospital stays over the relatively long term. To accelerate reconstruction, outpatient treatment should return to normal as soon as possible.

1. Introduction

In the past two years and more, COVID-19 has been changing from generation to pandemic and continuous development of variant strains, the countermeasures were also constantly changing—from maintaining social distancing, doing good personal protection and providing medical treatment, to mass vaccination.[1-3] While the global pandemic is not over yet, many countries are turning to more sustainable and integrated approaches to tackling COVID-19. People's daily life is becoming less and less affected and the needs such as health care have gradually been fully met normally.

At the height of the pandemic, countries and district governments adopted strict restrictions centered on blocking epidemic areas, travel restrictions and social distancing.[4,5] In general, these measures did not include restrictions on medical treatment [6], but people's health care was still greatly affected.[7] Some of these effects were positive, such as that the incidence of many other infectious diseases was significantly reduced compared to previous years, especially in zoonotic, insect-borne, and respiratory infectious diseases.[8,9] Moreover, many studies have shown declines in hospital visits and hospitalizations for chronic and non-communicable diseases during the pandemic [10,11], but the long-term impact of this decline on patient and socioeconomic health costs is unclear.

Targeted the management of colonic, rectal, and anal diseases during the pandemic, the American Society of Colon and Rectal Surgeons (ASCRS), the European Society of Coloproctology (ESCP), the Italian Society of Colorectal surgery (SICCR), the Association of Coloproctology of Great Britainand Ireland (ACPGBI) and colorectal surgical institutions in other countries and regions have issued guidelines accordingly.[12-16] However, most of these guidelines focused on the management of malignant diseases, emphasizing that such diseases should be treated and managed as soon as possible, and that remote diagnosis, conservative treatment and elective surgery were mostly recommended for benign diseases. Therefore, studying the impact of the pandemic for anorectal patients with benign diseases, can help us assess the long-term impact of the pandemic on all colorectal diseases, and studying the changes also provides a reference for social managers to develop more active measures. Medical decision-makers can also learn how to provide more targeted healthcare services to patients with colorectal diseases during the pandemic and in the post-pandemic era.

The wave of epidemic in Xianyang, Shaanxi Province, China, from late 2021 to early 2022, led to a 16-day lockdown from December 25th, 2021 to January 9th, 2022, allowing only places selling daily necessities or medicines. During the period, the number of patients admitted to the department of anorectal surgery had decreased dramatically. It should be emphasized that the outpatient dressing change in this department has been stopped indefinitely since the COVID-19 outbreak was first reported in China at the end of 2019.

2. Materials and Methods

This was a retrospective, single-center, observational study, and the use of all data was approved by the Ethics Committee of the Affiliated Hospital of Shaanxi University of Chinese Medicine. Inclusion criteria were all patients who were hospitalized in the department of anorectal surgery from December 1st to March 31st of the following year in the last three years, and the first diagnosis was mixed hemorrhoids, anal fistula, perianal abscess, colorectal polyps or pilonidal sinus. The operation method of hemorrhoid patients was Miligan-Morgan with or without injection sclerotherapy; the operation methods of anal fistula includes fistulectomy and fistulotomy with or without draining setons; the operation methods of perianal abscess was excision or incision with or

without draining setons; the operation method of colorectal polyps was endoscopic electrocision; the operation method of pilonidal sinus was surgical excision with or without flap-based treatment. Exclusion criteria were no surgical treatment, more than one surgery during hospitalization, inconsistent diagnosis with the operation, once changing the department, and the first diagnosis was colorectal malignancy, colitis, proctitis, intestinal obstruction, necrotizing fasciitis or other diseases.

All information was collected through the ZLHIS Hospital Information Management System (ZLSOFT, Chongqing, China). For the latest wave of outbreak, we collected the gender, age, first diagnosis, main symptoms and their worse days, pre-admission treatment, date of admission and discharge, length of hospital days, straight-line distance between residence and the hospital, and comorbidities of patients who discharged from December 9th, 2021 to January 25th, 2022 (the 16 days before, during and after the lockdown). The straight-line distance (kilometer, km) of residence and the hospital was calculated by using Baidu Map (map.baidu.com), with an error of ± 0.1 km. Patients were divided into Group Previous and Group Later based on the chronological relationship between the date of admission and the start of the lockdown; according to the chronological relationship between the date of discharge and the duration of lockdown, patients were divided into Group Before, Group During and Group After. Patients were divided into two groups according to whether the patient had a systemic disease that may affect the recovery, such as anemia [17], leukopenia [18], liver fibrosis [19], diabetes [20], etc.

On January 9th, 2022, we conducted a questionnaire survey of all the 27 patients in the hospital at that time, and issued and recovered a total of 27 paper questionnaires, of which 24 questionnaires were valid. The questionnaire included some simple questions about the whole hospitalization process. In addition, we collected information on the first diagnosis and hospitalization days of patients admitted from December to March in 2019-2020 (the first wave of outbreak), 2020-2021 (no outbreak) and 2021-2022 (the latest wave of outbreak).

Descriptive statistical analysis was used for all variables, where categorical variables were calculated by frequency, and inferential statistical analysis was used according to different groups. The level of statistical significance was set at $p < 0.05$.

3. Results

3.1. The Latest Wave of Outbreak

A total of 131 patients discharged between December 9th, 2021 and January 25th, 2022 were included. There were no significant differences between the two groups in gender, age, days of worsening symptoms, pre-admission treatment and systemic disease (Table 1). The composition of the first diagnosis is different significantly. The most significant changes were the straight-line distance between residence and the hospital and hospital days.

aPearson $\chi 2$ test; bMann-Whitney U test; cFisher's exact test.Non-normally distributed data are expressed as medians (25th percentile, 75th percentile); categorical data are expressed as counts (%).

Comparing patients at different times of discharge, we found a statistically significant difference only in the straight-line distance between residence and the hospital between the three patient groups (p=0.006). Post-hoc pairwise comparisons for significance levels were corrected using the Bonferroni test and we found that the distribution of distances was significantly different between Group After and Group Before (adjusted p=0.043) and between Group After and Group During (adjusted p=0.005).

Table 1. Comparisons of groups divided by admission date

Characteristics	All patients N=131	Previous N=105	Later N=26	p
Female Sex	54 (41.2%)	45 (42.9%)	9 (34.6%)	0.445[a]
Age	42 (33, 51.5)	42 (32, 52)	42.5 (34, 50)	0.894[b]
First diagnosis				0.032[c]
Mixed hemorrhoid	75 (57.3%)	58 (55.2%)	17 (65.4%)	
Perianal abscess	32 (24.4%)	27 (25.7%)	5 (19.2%)	
Anal fistula	16 (12.2%)	15 (14.3%)	1 (3.8%)	
Polyp	4 (3.1%)	1 (1.0%)	3 (11.5%)	
Pilonidal sinus	4 (3.1%)	4 (3.8%)	0 (0.0%)	
Symptom				
Prolapse	68 (51.9%)	55 (52.4%)	13 (50.0%)	
Pain	78 (59.5%)	63 (60.0%)	15 (57.7%)	
Bleeding	23 (17.6%)	17 (16.2%)	6 (23.1%)	
Festering	18 (13.7%)	17 (16.2%)	1 (3.8%)	
Endless sense of defecation	1 (0.8%)	1 (1.0%)	0 (0.0%)	
Difficult defecation	5 (3.8%)	5 (4.8%)	0 (0.0%)	
Anal falling sensation	6 (4.6%)	6 (5.7%)	0 (0.0%)	
Hypogastralgia	1 (0.8%)	0 (0.0%)	1 (3.8%)	
No symptom	1 (0.8%)	1 (1.0%)	0 (0.0%)	
Days of worsening symptoms				0.400[a]
0~7 days	61 (46.6%)	46 (43.8%)	15 (57.7%)	
8~14 days	15 (11.5%)	12 (11.4%)	3 (11.5%)	
≥15 days	55 (42.0%)	47 (44.8%)	8 (30.8%)	
Pre-admission treatment				0.925[a]
Self-medication	54 (41.2%)	44 (41.9%)	10 (38.5%)	
Outpatient treatment	27 (20.6%)	21 (20.0%)	6 (23.1%)	
No treatment	50 (38.2%)	40 (38.1%)	10 (38.5%)	
Hospital days	17 (13, 21.5)	17 (13, 23)	12.5 (10, 17)	<0.001[b]
Distance	6.5 (2.7, 41.7)	18.1 (3.4, 50.1)	2.75 (2.1, 4.4)	<0.001[b]
Systemic disease	50 (38.2%)	38 (36.2%)	12 (46.2%)	0.349[a]

3.2. Questionnaire

Prior to hospital admission, 68.4% (13 of 19) of the patients had adopted at least one treatment measure. 57.9% (11 of 19) of patients believed that lockdown had delayed their admission. 73.7% (14 of 19) of patients considered disease as their main admission reason. It was worth our attention that the other 26.3% (5 of 19) of the patients used the time and opportunity to choose the hospitalization. 44.4% (8 of 18) of patients thought that the transportation costs to the hospital increased. 80.0% (12 / 15) of patients understood. 80.0 %(12/15) of the patients understood the nucleic acid test and other measures at admission.

Table 2. Comparisons of the number of hospital admissions and hospital days at the same period in the last three years

First diagnosis		All patients	12/2019-03/2020	12/2020-03/2021	12/2021-03/2022	p (first diagnosis)	p (hospital days)
		N=1353	N=361	N=577	N=415		
Mixed hemorrhoid	Count	896 (66.2%)	233 (64.5%)	395 (68.5%)	268 (64.6%)	0.143[a]	<0.001[b]
	Hospital days	14 (12, 15)	15 (12,16)	13 (11,15)	14 (12,15)		
Perianal abscess	Count	235 (17.4%)	68 (18.8%)	96 (16.6%)	71 (17.1%)		0.001[c]
	Hospital days	19.83 (5.767)	20.74 (6.648)	18.20 (4.844)	21.18 (5.543)		
Anal fistula	Count	166 (12.3%)	51 (14.1%)	57 (9.9%)	58 (14.0%)		0.001[b]
	Hospital days	20 (17, 24)	20 (16, 24.5)	18 (16, 21)	22 (19, 27)		
Polyp	Count	56 (4.1%)	9 (2.5%)	29 (5.0%)	18 (4.3%)		0.564[b]
	Hospital days	6 (5, 6)	5 (4, 6)	5 (5, 7)	6 (5, 6)		

aPearson $\chi 2$test; bKruskal-Wallis test; cOne-way ANOVA test. Normally distributed data are expressed as mean (SD); non-normally distributed data are expressed as medians (25th percentile, 75th percentile); categorical data are expressed as counts (%).

The numbers of patients believing that the outbreak and lockdown would prolong (11 of 24, 45.8%) and shorten (10 of 24, 41.7%) their likely length of hospital stay were very close. 70.0% (14 of 20) thought their medical experience would be better without the outbreak and lockdown. 66.6% (16 of 24) of the patients chose either online or offline follow-up. Finally, 70.0% (14 of 20) of the patients believed that traffic to and from the hospital was the most affected. Other aspects that were greatly affected are caregivers (5 of 20, 25.0%), the follow-up visit after discharge (5 of 20, 25.0%) and the extra costs (4 of 20, 20.0%).

3.3. The Admissions in the Recent Three Years

The comparisons of the number of patients admitted for hemorrhoids, perianal abscess, anal fistula and colorectal polyps and the number of hospitalization during December to March in the recent three years are shown in Table 2. There were 361 admissions in the first year, fewer than 415 in the third year and 577 in the second year. There was no statistical difference in the proportion of different diseases during the three periods. Comparing the hospital days for different diseases with Bonferroni test, we found that only patients with colorectal polyps were not significantly affected. The median of hospital days for mixed hemorrhoid patients was the longest in the first year, longer than the third year and the second year. The mean of hospital days for patients with perianal abscess was the shortest in the second year, shorter than that in the first year and that in the third year. The median of hospital days for the anal fistula patients in the second year was shorter than that in the third year.

Figure 1, Figure 2 and Figure 3 show the changes in the number of patients admitted everyday during the three periods and the range between the dashed lines indicates the duration of lockdown. During the lockdown in first and third years, patients admitted for colorectal polyps decreased to 0 and patients with mixed hemorrhoids and anal fistula were also significantly reduced, while the number of patients admitted for perianal abscess decreased only slightly. We noticed that there seems to be an additional increase in admissions for various diseases only after the lockdown in the third year.

4. Discussion

4.1. Admission

The decline in hospital admissions in the context of the COVID-19 pandemic is due to a number of factors, including fears of becoming infected with SARS-CoV-2 by other patients, mobility restriction policies, social isolation, and reduced access to healthcare during the pandemic.[错误!未定义书签。] Moreover, because most of the benign colorectal diseases have high incidence and easily discernible characteristics, and the measures of conservative treatment are various [21,22], coupled with the normal opening of pharmacies makes the normal access to conservative treatment drugs, the hospitalization rate of patients with such diseases is greatly affected.

68.4% of the patients admitted after the start of lockdown took various conservative treatment measures before their admission, and that there was no significant difference between the two groups ($p=0.925$). This result indicates that the lockdown will not limit the conservative treatment of patients with these benign anorectal diseases, but will cause some patients to delay their hospitalization plans. There was no significant difference in the days of worsening symptoms, and we think this was related to that pre-admission treatment was not significantly affected. Because of restrictions on public and private vehicle travel, 33.3% percent of patients had to increase their transportation costs. At the same time, some people chose the ways of short trips, such as walking, which might be responsible for the reduced transportation costs of 11.1% of the patients. This phenomenon was consistent with the significantly shorter straight-line distance to the hospital and the fact that 70.0% of patients believed that traffic to and from the hospital was greatly affected. Although the lockdown led to a reduction in hospital admissions, we noted that 26.3% of the inpatients took advantage of the additional hospital opportunity or time brought about by the outbreak, suggesting that the rate of hospital admission in some special groups may be increased during the lockdown.

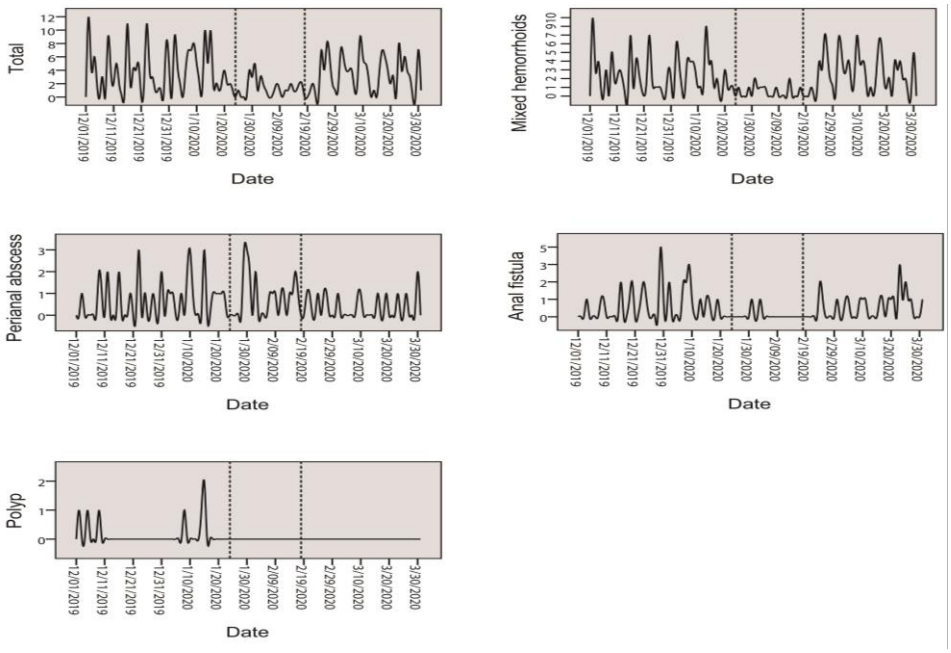

Figure 1. Number of inpatients in the first period

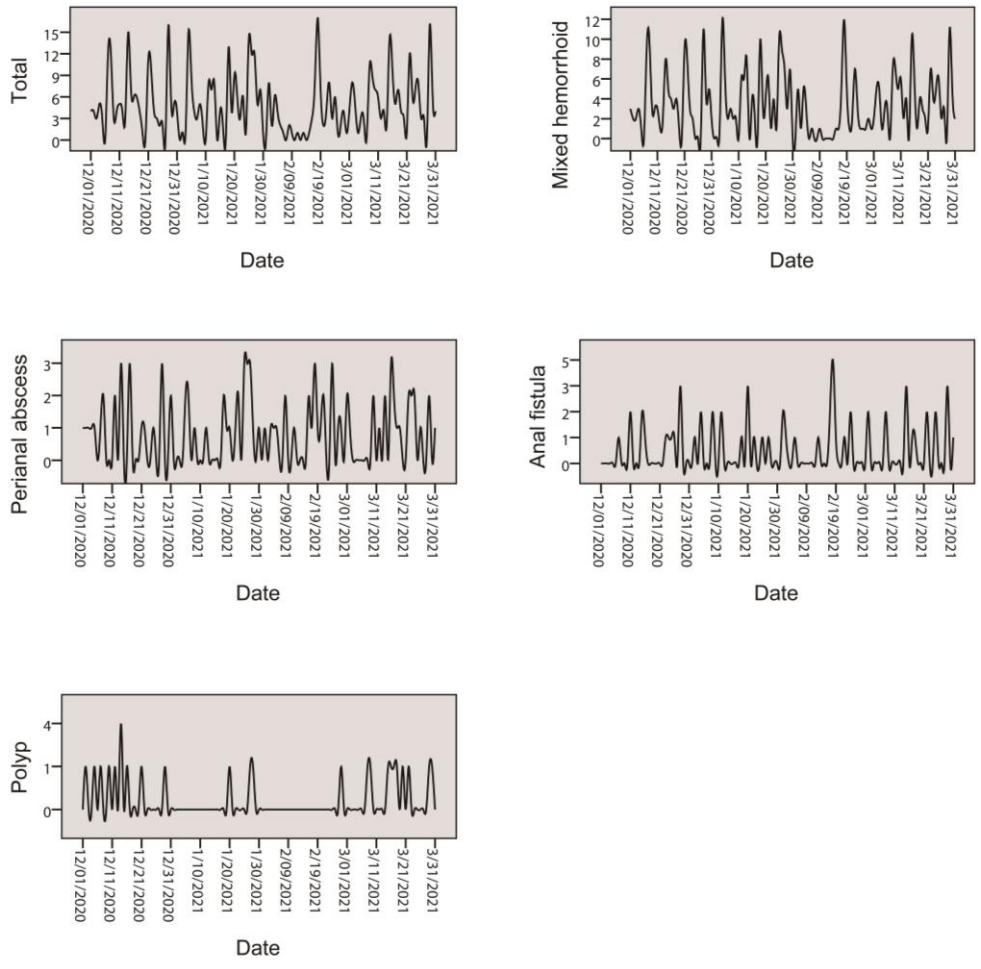

Figure 2. Number of inpatients in the second period

It seemed that only bleeding, which may have serious consequences, increased the likelihood of patient admission, while pain had little impact. In addition, the proportion of patients with non-acute symptoms decreased significantly. Therefore, we believe that many patients will selectively ignore their general symptoms during the lockdown and instead focus only on symptoms that are intolerable or are widely considered to be related to serious consequences. Correspondingly, there were fewer patients admitted with perianal abscess, the anal fistula or philonidal sinus, along with a slight increase in the proportion of patients with mixed hemorrhoids. Although the proportion of patients with colorectal polyps was increased, we noted that patients with colorectal polyps (N=3) were admitted after the lockdown was over. The lockdown had a serious impact on fecal immunochemical testing, colonoscopy services, and colorectal neoplasia detection.] A national study predicted that these delays would lead to future adverse outcomes in colorectal cancer.

The process of admission during the outbreak is more complex than usual. Only a very small number of patients (13.3%) expressed dissatisfaction with the measures, but it was unclear whether the dissatisfaction was a potential factor hindering patient admission.

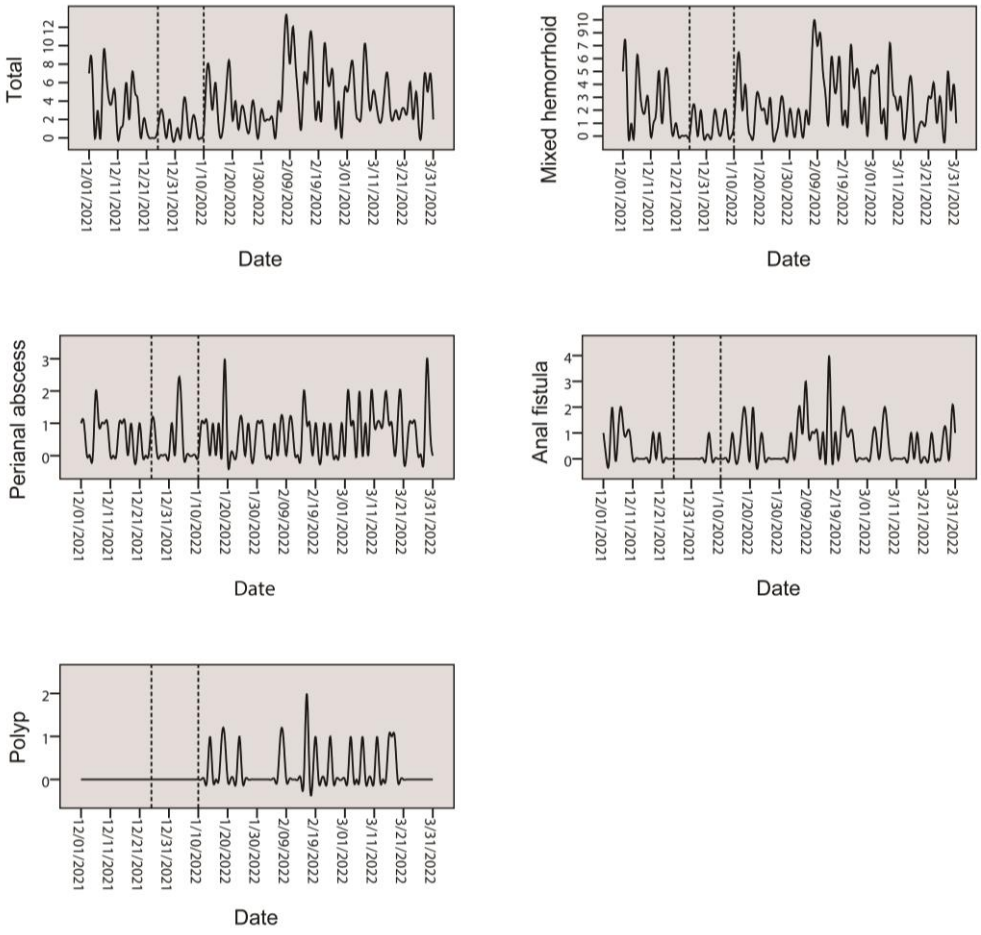

Figure 3. Number of inpatients in the third period

Table 2, Figure 1 and Figure 3 show that the outbreak and lockdown had different effects on patients with different diseases. Polyp patients were the most affected, followed by patients with mixed hemorrhoids and anal fistula, and patients with perianal abscess was the least affected. After the lockdown in the third year, there was an additional rebound in admissions for various diseases (Figure 3), which was not obvious in the first year (Figure 1). The rebound phenomenon was even more obvious in diseases that were severely affected in the short term. Although the proportions of

diseases admitted to the anorectal department would vary in the short term (Table 1), the disease spectrum will not change significantly over a relatively long period of time (Table 2).

4.2. Discharge

As with admission, there were no significant differences in gender, age, or combination of systemic disease between discharged patients during different periods. This result indicates that the effects of lockdown on patients with different gender, age and health status of anorectal diseases are widespread and have no obvious difference. Because of the cancellation of outpatient treatment, the enhanced recovery after surgery (ERAS) program] in this center is almost in a stagnant state, resulting that the current length of stay includes the patient's original outpatient treatment time. The short-term results and long-term results of the changes in hospital days seem to be contradictory except polyp patients, which is a result of the change in the proportion of admitted diseases in the short term and the rebound of some diseases.

Thanks to the popularity of telemedicine in colorectal surgery, 33.3% of patients would have the follow-up by telemedicine. We also need to collect long-term outcomes of the risk of postoperative adverse events for patients who may not have a follow-up. The development of colorectal surgical telemedicine in the last and over two years is one of the outcomes of our response to the COVID-19 pandemic.

Although most of the patients thought their experiences got worse, studies have shown that during the COVID-19 pandemic, the doctor-patient relationship was improved. So the relationship between patients with benign colorectal diseases and physicians will not be negatively affected by the outbreak, despite one patient feeling a change in the doctor's treatment process.

5. Conclusions

Where quarantine measures remain strict, the COVID-19 pandemic still greatly affects people's lives, and the process of rebuilding healthcare services for colorectal diseases is also full of difficulties. The inpatient surgery of patients with benign anorectal diseases are severely hampered by every wave of outbreaks and the biggest influencing factor is traffic restrictions. Social managers should mobilize more forces to ensure the convenient transportation for the groups with medical needs in the face of the new epidemic in the future, rather than just do not restrict medical treatment. There is no significant reduction in the chances of conservative treatment before admission. The determinant of patient admission is the urgency and severity of the disease symptoms, which can lead to changes in the proportion of disease in admissions in the short term, but an additional rebound of admissions after the lockdown will neutralize the changes over a longer time. It cannot be ignored that lockdown increases the possibility of hospitalization for some patients who usually lack hospital opportunities. All these enlighten medical service providers of colorectal diseases that they can respond to the changes in the number and proportion of different diseases in different periods of each outbreak more efficiently and specifically. In addition, we should pay attention to the possible adverse consequences of reduced admissions of colorectal polyps. Lockdown causes shorter hospital days over a short time period, but a outbreak can still prolong hospital days over the relatively long term. To accelerate the reconstruction, the medical institutions should ensure that the outpatient treatment returns to normal as soon as possible, which is both a realistic need and an essential condition for the reconstruction of the anorectal diseases ERAS program.

Due to the small number of admissions during the lockdown and the lack of data about outpatient and unadmitted patients, this study was not able to fully assess the impact of all patients

with benign colorectal diseases, and a large-scale, long-term follow-up is needed to answer this question.

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Data Availability

The datasets used during the current study are available from the corresponding author on reasonable request.

Conflict of Interest

The author states that this article has no conflict of interest.

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