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RESEARCH ARTICLE

The impact of COVID-19 on the volume and outcomes of routine and emergency endoscopy within an NHS Trust

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Abstract

***Objective*:** COVID-19 has resulted in increased restrictions around the practice of routine endoscopy. This has had an impact on the number of endoscopies performed and access to training. However, gaps remain in our understanding.

***Methods*:** Patients referred for inpatient endoscopies from March to May 2019 and February to May 2020 were identified. Their electronic notes and endoscopy reports were examined for referral details, endoscopic findings, complications and 30-day mortality. Additional information was collected on patients with upper gastrointestinal bleeds (UGIB) to enable the calculation of pre-oesophagogastroduodenoscopy (OGD) Blatchford scores and post-OGD Rockall scores. Comparisons were made between data obtained from March to May 2019 and 2020 (inter-year comparisons) and between February 2020 (immediately before the British Society of Gastroenterology published advice to restrict routine endoscopies) and March to May 2020 period (intra-year comparisons).

***Results*:** 398 endoscopies were performed from March to May 2019 compared to 183 over the same period in 2020, a 54% reduction. 103 endoscopies were performed in February 2020 compared to the mean monthly value of 61 for the period from March to May 2020, a reduction of 41%. 12% of patients died in 2019 compared to 16% in 2020. For UGIB, 11% of patients died in 2019 compared to 15% in 2020. In 2019, 17% of UGIB OGDs were performed by gastroenterology trainees compared to 26% in 2020.

***Conclusion*:** COVID-19 has led to a marked decrease in the number of endoscopies performed. Despite this trainee endoscopy exposure concerning emergency, UGIB OGDs have been preserved.

Keywords: *Endoscopy*; *Training*; *COVID 19*; *UGIB*

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Key summary

What is already known about this subject?

It is known that with the introduction of more stringent endoscopy vetting criteria in the COVID period, there was a reduction in the number of endoscopies performed. It is also known that these changes have had an adverse impact on endoscopy training. However, relatively few studies have been published in this field, and there remain gaps in our knowledge, particularly concerning: specific inpatient changes in endoscopy provision, mortality, the appropriateness of endoscopy referrals during the COVID period and trainee access to OGDs for upper gastrointestinal bleeds (UGIBs).

What are the key findings?

- There has been a marked reduction in all endoscopies over the COVID period.
- Trainee access to emergency UGIB OGDs has been preserved
- A significantly greater proportion of UGIB OGDs were performed within 24 h of a referral being made during the pandemic compared to the pre-pandemic period

How might it impact clinical practice in the foreseeable future?

This study will help inform clinicians about the impact of COVID-19 on the provision and outcomes of inpatient endoscopy. This will hopefully prompt further studies in

the field and ultimately aid in the development of interventions to mitigate some of the adverse changes observed. Furthermore, should there be a future need for a return to tightened restrictions within healthcare settings an improved understanding of the effects of the pandemic on endoscopy training will help in the development of a training plan to replace the current practice of individualised ad hoc training.

Introduction

The COVID-19 pandemic has given rise to many unprecedented challenges [1]. There was an abrupt reduction in essential diagnostic services, including upper gastrointestinal (UGI) and lower gastrointestinal (LGI) endoscopy, from a United Kingdom (UK) pre-pandemic weekly average of 35,478 to 1,800 [2]. This decrease resulted in a reduction in weekly cancer detection by 58% [2]. This observed UK decrease in endoscopy numbers is mirrored in an international survey performed in 55 countries, which showed a mean 83 % reduction in total endoscopy volume [3].

The reduction in endoscopic services has resulted in a significant backlog. The solution, in the short term, has been to recruit trained endoscopists to perform endoscopies in the private sector [4]. However, this is not a sustainable long-term solution as the capacity of the private sector remains finite, and these measures may lead to a reduction in training opportunities for trainee endoscopists. This has already been seen in a survey measuring the impact of COVID-19 on endoscopy training in the United Kingdom, which shows that the mean percentage reductions for supervised, unsupervised and total trainee-performed procedures were 93.5% (standard deviation [SD] 23.6), 96.3% (SD 12.1) and 96.0% (SD 12.8), respectively, with LGI procedures being more severely impacted [5]. Similarly, a survey of 770 trainees from 63 countries reported a median reduction in total procedures of 99%. This raises concerns about a potential need to extend training, which, in turn, may increase anxiety and burnout among trainees [5].

A single Austrian study demonstrated a 40% reduction in emergency UGI Bleed (UGIB) oesophagogastroduodenoscopies (OGD) after the initial period of lockdown [6]. However, more information is required to build up a comprehensive picture of the impact of COVID-19 on UGIB OGD provision. Furthermore, an evaluation of UGIB OGD-related outcomes is needed.

Aims

We aim to investigate:

- Changes that have occurred in the volume of endoscopies performed during the COVID-19 pandemic by comparing endoscopic data from the period March to May 2019 (pre-COVID-19 period) with data from March to May 2020 (intra-COVID-19 period)
- Changes in endoscopy numbers that occurred within 2020 by comparing data from February 2020, the month before the British Society of Gastroenterology (BSG) issued more stringent guidelines regarding vetting of endoscopies to data from the ensuing March to May time period.
- Changes in mortality that have occurred in the pre and intra-COVID-19 periods.
- UGI bleed performance and outcomes in the pre and intra-COVID-19 periods.

Methods

Patient recruitment

Patients were identified from the referral records of the endoscopy departments within Pennine Acute Hospitals NHS Trust. Hospitals included: The Royal Oldham Hospital (ROH) and Fairfield General Hospital (FGH). All inpatients referred for endoscopy from the 1st of March to the 31st of May 2019 and from the 1st of February to the 31st of May 2019 were included in this study. There were no exclusion criteria provided patients were referred for endoscopy within the two study windows.

Further information regarding the events that transpired during hospital admissions including blood results and endoscopy reports was acquired from the Pennine electronic patient record (Healthviews) and the endoscopy reporting tool 'GI Reporting Tool Live' (Unisoft).

Ethical approval

As this study was retrospective, utilised routinely collected data and was performed for service assessment and improvement, it was approved by the audit department of Pennine Acute Hospitals NHS Trust (26/05/2020 reference number: 2020 188).

Information retrieval

Each patient's electronic patient record was scoured to obtain information pertaining to the endoscopic procedure they were referred for (OGD, colonoscopy, flexible sigmoidoscopy and endoscopic retrograde cholangiopancreatography [ERCP]), the reason for their referral, the date of their endoscopy, their endoscopic findings; the congruency of their endoscopic findings with the reasons for which they were referred, any intra or post-procedural complications that occurred and their 30-day mortality. This data was termed 'general' data by the authors as it pertained to all types of endoscopies performed during the study periods.

Patients referred for OGDs because of suspected UGIB had additional information collected including

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time from referral to endoscopy, blood results, physiological observations, melaena, presence of syncope, co-morbidities and need for repeat endoscopies. These data allowed pre-endoscopic Blatchford scores and post-endoscopic Rockall scores to be calculated for all patients. This was termed 'UGIB data' and in addition to data regarding mortality was used to identify trends in UGIB outcomes.

Definitions

Data pertaining to the reasons for referrals and reported endoscopy findings were used to calculate a 'Hit rate'. This was defined as the percentage of patients who had endoscopic findings in keeping with their initial referrals. For example, if a referral was made for abdominal pain and an ulcer was later seen on endoscopy, this would constitute a positive 'hit' as ulcers can cause abdominal pain. However, if a referral was made for abdominal pain and nothing was found on endoscopy, this would not constitute a 'hit'. The specific type of endoscopic procedure being referred to is stated in the majority of cases. Where the unqualified term endoscopy is used it refers to all types of endoscopic procedures, OGDs, colonoscopies, etc.

Data analysis

General data

The number of endoscopies performed from March to May 2019 was compared to the number of endoscopies performed from March to May 2020. Comparisons were made across the entire study period and month to month between study periods (i.e. March 2019 with March 2020). The number of endoscopies performed in February 2020 was compared to the mean monthly number of endoscopies performed from March to May 2020. This allowed an intra-year comparison of endoscopy numbers to be performed between the immediate pre-pandemic and pandemic periods. Patient demographic data (sex and age) and 30-day mortality were also compared between the study periods.

Means, medians, percentages and standard deviations were calculated for 'general' data using the statistical software package SPSS (IBM, UK). Mortality comparisons between 2019 and 2020 were made using independent sample *T*-tests. Chi-squared tests were used to compare the pre- and post-pandemic: UGIB OGDs performed by gastroenterology trainees, endoscopic hit rates and UGIB OGDs performed within 24 h, 24–48 h and greater than 48 h.

Upper GI bleed data

Once pre-endoscopic Blatchford and post-endoscopic Rockall scores were calculated, comparisons were made between study periods using independent sample *T*-tests.

Results

In 2019, inpatient endoscopies were performed on 398 individuals. Two hundred men and 198 women with a mean age of 63 ± 18 years. In 2020, 183 individuals received inpatient endoscopies; 98 men and 85 women with a mean age of 62 ± 20 years.

General data

Endoscopy

Three hundred and ninety eight inpatient endoscopies of all types were performed from March to May 2019 compared to 183 performed over the same period in 2020 (Fig. 1). This constitutes a 54% decrease in total endoscopy volume (Tables 1 and 2). One hundred and three endoscopies were performed in February 2020 (the immediate pre-COVID-19 period) compared to 86 in

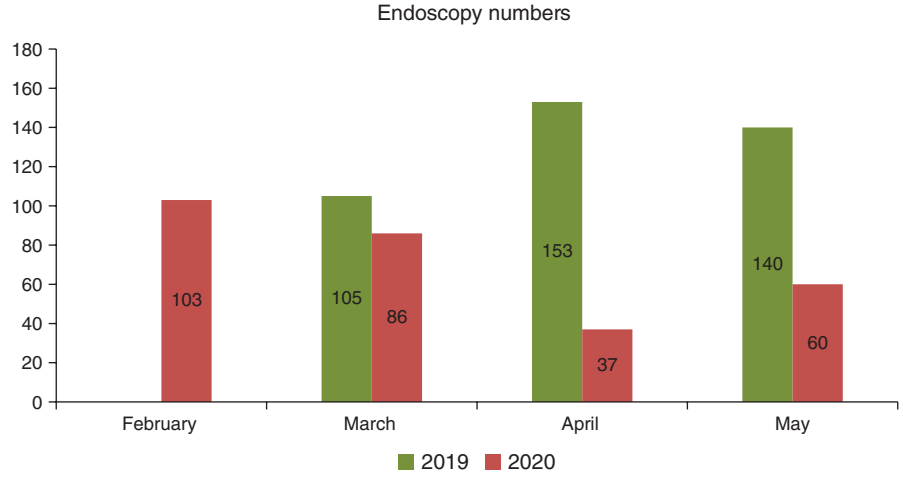

Fig. 1. Monthly endoscopy numbers in the pre- and post-pandemic periods.

March, 37 in April and 60 in May. Comparing the volume of endoscopies in February to the mean monthly value for the period from March to May (61 per month) results in an intra-year reduction of 41%.

In greater detail, in 2019, 262 OGDs were performed compared to 146 in 2020 a decrease of 44%. Ten inpatient colonoscopies were performed in 2019 compared to nine in 2020 a 10% change (Tables 1 and 2). Sixty flexible sigmoidoscopies were performed in 2019 compared to 27 in 2020 a 55% reduction. Finally, 48 ERCPs were performed in 2019 compared to one in 2020 a 98% change.

The endoscopic 'hit rate' for 2019 was 73% compared to 62% in 2020 (X^2 [df = 1, N = 581] = 7.2888, P = 0.007) (Tables 1 and 2). Regarding individual procedures, a significant reduction in hit rate emerged between OGDs performed in 2019 and 2020 (X^2 [df = 1, N = 408] = 13.2346, P = 0.0003). Conversely, a significant increase in hit rate was observed for flexible sigmoidoscopies performed during the pandemic (X^2 [df = 1, N = 87] = 4.4498, P = 0.035). No significant difference was seen in the hit rate for colonoscopies (X^2 [df = 1, N = 19] = 0.0141, P = 0.91) between the two time periods. Thirty endoscopies (7.5%) were complicated for reasons of poor patient tolerance in 2019 compared to two (1.1%) in 2020. No serious complications such as perforation, etc. occurred.

Table 1. Summary of 2019 endoscopy data

2019 total scopes	Hit rate %	M	F	Mean age
398	72.89	200	198	63.10
Scope type	**2019 number**	**Hit rate %**		
OGD	262	76.97		
COLON	10	77.78		
FS	60	77.92		
ERCP	48	89.58		
Elective interventional endoscopies (PEGs + UGI/LGI stents)	*18*	*NA*		
Pathology	**2019 number**	**Hit rate %**		
UGIB	133	77.93		
30-day mortality %				
12.1				

Table 2. Summary of 2020 endoscopy data

2020 total scopes	Hit rate %	M	F	Mean age
183	61.66	98	85	62.03
Scope type	**2019 number**	**Hit rate %**		
OGD	146	61.04		
COLON	9	79.17		
FS	27	94.81		
ERCP	1	100		
Pathology	**2019 number**	**Hit rate %**		
UGIB	77	61.01		
30-day mortality %				
15.8				

Mortality

Forty-eight patients (12%) passed away within 30 days of their endoscopy in 2019 compared to 29 (16%) in 2020 (29). No significant difference in mortality was seen between 2019 and 2020 (T_{10} = −0.15, P = 0.881).

Upper GI bleed data

One hundred and thirty three OGDs for suspected UGIBs were performed in 2019 on 132 patients compared to 77 endoscopies on 75 patients in 2020 a 42 % reduction. Sixty-three men and 69 women received OGDs for UGIBs in 2019 aged 66 ± 16 compared to 53 men and 22 women in 2020 aged 70 ± 14. The 'hit rate' for UGIB OGDs in 2019 was 78% compared to 61% in 2020 (X^2 [df = 1, N = 210] = 7.1054, P = 0.007).

In 2019, 23 OGDs (17%) were performed by gastroenterology trainees. In 2020, 20 OGDs (26%) were performed by trainees (X^2 [df = 1, N = 208] = 2.5693, P = 0.108).

Time to UGIB OGD

In ROH in 2019, 47 (44%) OGDs were performed within 24 h post-referral, 31 (29%) were performed 24 to 48 h post referral and 29 (27%) were performed over 48 h post-referral. In ROH in 2020, 36 (68%) of OGDs were performed within 24 h of referral, six (11%) were performed 24 to 48 h post-referral and 11 (21%) were performed over 48 h post-referral. A significant increase in the proportion of OGDs performed within 24 h was seen during the pandemic period (X^2 [df = 2, N = 160] = 9.282, P = 0.009).

Pre- and post-endoscopy scores

The mean 2019 pre-endoscopic Blatchford score for all patients was 9.02 ± 3.71. In 2020, this was 8.92 ± 3.58. The mean post-endoscopic Rockall score in 2019 was 4.78 ± 1.80 compared to 4.57 ± 1.93 in 2019. There were no significant differences between Blatchford and Rockall scores over the study periods with P values of 0.858 (t −0.180, df 205) and 0.438 (t −0.776, df 205), respectively.

Mortality

Fourteen patients (11%) died within 30 days of their OGDs in 2019 this compares with 11 patients (15%) in 2020. No significant difference was seen between mortality between 2019 and 2020 (T_2 = −0.60, P = 0.609).

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Discussion

This is the first single-centre study that has evaluated the local impact of COVID-19 on endoscopy. It gives an insight into changes in endoscopy provision as inpatient services have been adapted to prevent the inadvertent spread of COVID-19.

We observed a greater than 50% reduction in inter-year 'general' endoscopic data between the pre-pandemic period in 2019 and post-pandemic period in 2020. This observed decrease is most likely because of the increased restrictions put in place during the pandemic to limit endoscopy to patients deemed to be at greatest risk. While unsurprising, it is interesting to note that the reduction in inpatient endoscopy was of a smaller magnitude than the 80% reduction in endoscopy reported in 2020 by Rutter et al. [2]. Potential reasons for this include a difference in the local burden of disease and the fact that in the Rutter study, endoscopy data included both inpatient and outpatient endoscopies.

We also observed a large reduction in the amount of UGIB OGDs performed. While some inter-year variation may be expected, the magnitude of the reduction is potentially indicative of other causes. Such a reduction may be because of fewer people with UGIBs being sent for endoscopy, or fewer people experiencing UGIBs. If the former reason is the cause for the observed decrease, this may be suggestive of conscious a change in the management of hospital inpatients wherein plans are made either by patients or their physicians to treat UGIBs conservatively. However, no evidence of such a process of treatment rationalisation was seen to be present in patient notes. Another, albeit more worrying possibility, is some patients with UGIBs were not referred for endoscopy as they should have been because of actual or perceived COVID-related endoscopic pressures.

Complication rates were seen to be lower during the COVID period in 2020 implying patients were more strictly vetted prior to being sent for endoscopy. This is a potentially positive observation as endoscopic complications are undesirable for patients and endoscopists. They cause distress, delay diagnoses and increase morbidity and mortality [7–9].

Numerically, in-patient mortality was noted to have increased during the COVID period in both the 'general' and UGIB OGD, data compared to the previous year. However, despite the numerical evidence of an increase in mortality, no significant changes in mortality were found. A significant difference may have emerged were the study sample size larger.

A significant reduction in endoscopic hit rate was observed in 2020 in general, for all OGDs and for OGDs performed for UGIBs, while the opposite effect was observed for flexible sigmoidoscopies. These findings were surprising as it was initially assumed that with more stringent vetting of all endoscopies during the COVID period there would be a corresponding increase in the ability of referrals to predict the discovery of pathology. This finding challenges the suggestion that an increase in the quality of vetting led to the observation of lower endoscopic complications in the intra-pandemic period, as any increase in vetting quality may have been expected to increase or at least hold steady the endoscopic hit rate for all, as opposed to some forms of endoscopy. The reasons for these observed changes remain unclear but may suggest that the process of vetting, irrespective of its robustness does not necessarily improve the likelihood of detecting pathology, different standards of vetting for both UGI and LGI endoscopies or differing effects of vetting as regard pathology detection for UGI and LGI endoscopies.

The proportion of patients who had their UGIB OGDs within 24 h was significantly higher during the pandemic compared to the pre-pandemic period. This was surprising. The expectation was there would be a proportionate decrease, reflecting reduced departmental endoscopic capacity because of personal protective equipment (PPE) requirements. That the opposite was observed despite reduced departmental throughput caused by PPE requirements, indicates that during the pandemic, the loss of elective procedures created extra capacity, which was partly filled by performing emergency procedures quicker than would otherwise have been the case. Interestingly, there were no statistically significant changes in the pre-endoscopic Blatchford and post-endoscopic Rockall scores across the study period. This means patients who were similarly unwell were referred for endoscopy during the two time periods and makes it unlikely that observed increases in the promptness of endoscopy or mortality were because of endoscopies being performed on patients who were more unwell.

Trainee access to emergency UGIB endoscopies was preserved during the two time periods. This was unexpected as we initially assumed there would be a reduction in endoscopy access. Within Pennine NHS Trust, formal training lists were reduced and replaced with an ad hoc system put in place wherein trainees attended endoscopy when they did not have duties that required their presence on medical wards or in clinics. Despite this, it appears that the ad hoc system has been able to preserve access to emergency UGIB OGDs. Furthermore, this suggests that the majority of the loss of trainee endoscopy exposure is because of a reduction in routine elective procedures as has been shown in previous studies.

Although this study aimed to provide as comprehensive a picture as possible of endoscopy provision in Pennine Acute Hospitals NHS Trust, it does contain limitations. Firstly, it relied on referrals made to endoscopy departments rather than clinical coding. While it may be argued

that this provides a more accurate picture of endoscopy provision, it is also true to say some patients with pathologies potentially requiring endoscopic investigation may have been overlooked. Secondly, although it was possible to quantify 30-day mortality during the two study periods, the causes of mortality could not be established from the electronic patient records.

As regard Pennine acute hospitals NHS trust, attempts should be made to improve endoscopy training opportunities aiming for a prepandemic level of access as a minimum. However, it is likely that despite this, additional training will have to be provided to allow gastroenterology trainees to 'catch up'.

In conclusion, this study highlights multiple changes that have occurred during the COVID-19 period, including changes in endoscopy numbers, mortality, quality of referrals (encompassed in the hit rate) and trainee access as regards UGIB OGDs. Some of the issues identified will also be present in other areas of the country and potentially further afield. Additional and larger studies should be performed to help provide a more concrete understanding of the impact of the COVID pandemic on endoscopy, especially encompassing the ongoing pandemic recovery period.

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Conflict of interest and funding

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Authors' contributions

AS conceptualised and performed the study, wrote the paper and analysed the data. DL assisted with data collection while SMH helped write the paper. AB helped with data interpretation and writing the manuscript.

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