THE “*SUPER GREEN PATHWAY*”; WHAT HAVE WE LEARNED SO FAR?

The experience and outcomes of elective urgent and cancer surgery in a District General Hospital in the United Kingdom during COVID-19 Pandemic

Alexander Tam¹, Chea Tze Ong¹, Mohammed Elhadi², Arshad Bhat², Mehmood Akhtar²

¹ Department of General Surgery, Hereford County Hospital, Hereford, United Kingdom.

² Department of Urology, Hereford County Hospital, Hereford, United Kingdom.

Corresponding author: Mr. Mohammed Ehadi, mohdessam1@hotmail.com

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ABSTRACT

Background

The coronavirus disease (COVID-19) had so far claimed more than 600 000 lives worldwide. Many urgent and elective surgeries were postponed to cope with the pandemic, with the latest data found a substantial postoperative mortality risk (25.6%, 18.9%) after an emergency and elective surgery, respectively. Our institution was one of the first few in the country to offer essential elective surgery using a “COVID-free” designated site during the start of the pandemic. This study aims to analyze the clinical outcomes of patients who underwent essential elective procedures during the virus outbreak in the UK.

Methods

Retrospective analysis of outcomes of all patients who had undergone urgent elective and cancer surgery, from 30th March 2020 to 21st May 2020, using an implemented “*Super Green Pathway*.”

The primary endpoints were 30 days mortality and COVID-related morbidities, and the secondary endpoints were surgically related complications and oncological outcomes.

Results

A total of 92 patients (Male: 45%; Female: 55%) across 5 surgical specialties were identified. There was no record of mortality in our cohort. Only 1 patient was tested positive for **SARS-CoV-2**, 18 days after the initial operation without any pulmonary complications. There were 7 postoperative surgical complications managed at the acute hospital site. The waiting time for surgery ranges from 6 to 191 days, mean of 30 days, and a median of 23 days.

Conclusion

It is possible to mitigate the high mortality risk of post-operative complications associated with COVID-19, with no delay to essential surgeries for cancer patients, thus delivering safe practice during the pandemic.

INTRODUCTION

Coronavirus disease 2019 (COVID-19) is the name given to by the World Health Organisation (WHO) for the syndrome caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).¹⁻³

COVID-19 was first described in China in late December 2019, spots of cases around Asia by late January, then a dramatic surge of confirmed cases in Italy by late February. On March 11th, 2020, the WHO declared the SARS-CoV-2 infection a pandemic.⁴ The United Kingdom started seeing a steady exponential increase of cases from the beginning of March 2020, accumulated to a total of 6,650 cases on the 23rd of March 2020,⁵ which is when the prime minister announced the UK lockdown by the end of March, and there were 25,521 cases and 3095 deaths in the UK alone.⁶

Many trusts within the National Health Service (NHS) were forced to shut its routine services to accommodate bed availability and pool resources for the influx of COVID-19 patients while maintaining emergency surgery capabilities.⁷ This was achieved by categorization of surgical procedures into 4 priority levels (**Table 1**), which allowed surgeons to prioritize suspected or confirmed malignancy cases while safely deferring most other elective procedures.⁸

Yet, those patients who were mostly shielded by the government due to their high mortality risk of COVID19 would be subjected to the high-risk hospital environment by undergoing these surgical procedures.⁹ Therefore, an idea of a “COVID-free” site introduced by the government with a historic deal

with the private sector, using their hospital sites for cancer surgery service.¹⁰⁻¹²

To protect these vulnerable patients and to maintain a *COVID-free* zone, patients were initially asked to self-isolate for 14 days before surgery, and adequate risk mitigation were introduced to manage against surgical smoke plume.^{13,14} By late April, polymerase chain reaction (PCR) throat swab was also introduced 72 hours before surgery.¹³

However, data had emerged from an international, multicentre, observational cohort study that shows a substantial risk of increased pulmonary complications and increased mortality in comparison to pre-pandemic baseline rates.¹

We were one of the earliest NHS trusts to provide cancer surgery and other urgent operations through *COVID-free* site after careful planning, scheduling, and organization of clinical activities.

We retrospectively analyzed data on all elective surgeries performed at the *COVID-free* site to compare our findings to the data suggested by the latest findings from international studies. We hypothesized that by using a “Super Green Pathway” there would be fewer post-operative COVID-19 related complications.

MATERIAL AND METHODS

Study Population

Patients sample are either had urgent diagnostics for suspected malignancy or had definitive surgical treatment for cancer.

Patient Selection

A total of 92 patients were identified who had undergone elective surgery under various surgical specialties at a designated *COVID-free* site of a 200-hospital bed rural district hospital in the West Midlands from **30th March 2020 to 21st May 2020**. Patients were selected retrospectively and the researchers who selecting the patients were blind to the outcomes of those patients.

Outcomes

- The primary endpoints were (1) 30-days mortality and (2) COVID-related complications.
- The secondary endpoints were (1) Surgical related morbidities and (2) Oncological outcomes.

TABLE 1. Royal College of Surgeons Categorisation of Surgical Procedures

Priority Level	Time to Surgery
1a	Within 24 hours
1b	Within 72 hours
2	Can be deferred up to 4 weeks
3	Can be delayed up to 3 months
4	Can be delayed for more than 3 months

Data Collection and Analysis

A proforma was used to help collect the data. Hospital intranet online patient record system **IMS Maxims EPR** was used to try and find the relevant data (Figure 1). Using Microsoft Excel spreadsheets, descriptive statistics were used to summarize the data. Univariate analysis was also used to describe the central tendency of the data.

RESULTS

Demographics

A total of 92 patients had elective urgent and cancer-related operations under five different specialties electively at designated **COVID-free** site from 30th March 2020 to 21st May 2020.

The cohort included 41 males (44.6%) and 51 females (55.4%), Male/female ratio was 1:1.2. The

FIG 1. Information collected in the study.

mean age for male patients was 61 and the mean age for female patients was 64 (**Figure 2**).

SARS-CoV-2 Status

The PCR nasal and throat swab tests were not made immediately available for all patients at the start of the COVID pandemic, due to local testing kit pressure and local laboratory capacity. Therefore, the majority of patients who had undergone the elective procedures were not tested pre-operatively. On 14th May 2020, the UK government and public health England published an operating framework for urgent and planned services in hospital settings during COVID-19.¹⁴

The COVID status of 45 out of 92 patients was known (**Figure 3**). Only 1 patient was tested positive for SARS-CoV-2 out of the 45 patients tested. This patient was admitted to the main acute hospital site “COVID-hot site” 18 days after the initial operation with a surgical related complication required to return to theatre. He stayed for 6 nights and was discharged safely. This patient was subsequently tested positive for SARS-CoV-2 as he developed virus symptoms

(11 days after being discharged from the acute site) but did not require hospital admission or treatment.

Surgical Outcomes

Out of 92 operations performed by five surgical specialties (**Figure 4**). A total of 43 procedures were diagnostic (46.8%) and 49 procedures were definitive treatment (52.6%). Length of hospital stay (LOS) was subsequently analyzed (**Table 2**).

There were seven post-operative surgical complications (**Figure 5**), this includes the patient detailed above in section 3.2. No patient died within the first 30 days post-operatively, and no patient was re-admitted with any pulmonary complications.

Oncological Outcomes

23 patients who had diagnostic procedures had a new diagnosis of cancer while 20 patients (21.7%) were found to have benign conditions (**Figure 6**).

Waiting Time for Surgery

the waiting time for surgery ranges from 6 to 191 days, a mean of 30 days, a median of 23 days, and a

FIG 2. Procedures by age group.

FIG 3. Patients swab test and their 30 days outcomes.

mode of 7 days (**Figure 7**), (**Table 3 and Table 4**). The earliest date that can be found on the decision to operate either; MDT outcome, Clinic consultation, or TCI letter. Our data shows no statistically significant difference between waiting times for surgery among the five specialties.

DISCUSSION

When the WHO declared the novel coronavirus outbreak a pandemic, there was an urgent need to address the impact of such a pandemic on cancer patients and those who awaiting urgent surgeries.

TABLE 2. Analysis of Hospital Stay by Each Speciality

LOS	Breast	Colorectal	ENT	Gynecology	Urology
Day case	11	3	6	20	26
1 night	11	0	0	1	2
2 night or more	1	7	0	0	2

ENT = ear, nose, and throat; LOS = length of stay.

FIG 4. Procedures performed by specialties and LOS (in days).

ENT = ear, nose, and throat; LOS = length of stay.

FIG 5. Surgical complications using Clavien Dindo classification.

FIG 6. Oncological outcomes.

FIG 7. Analysis of waiting times in days.

TABLE 3. Analysis of Waiting Times in Days

	Mean	Median	Lower Interquartile	Upper Interquartile	Interquartile range
Overall	30	23	14	38	24
Breast	24	19	11	31.5	20.5
Colorectal	36	25	16	42	26
ENT	30	38	13	42.5	29.5
Gynecology	40	25	14	49	35
Urology	26	23	16	31.5	15.5

TABLE 4. One-Way ANOVA Results that Compared if One Speciality’s Waiting Time was Significantly More Than the Overall Mean

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
Breast	Between Groups	2881.620	16	180.101	.819	.654
	Within Groups	1319.250	6	219.875		
	Total	4200.870	22			
Colorectal	Between Groups	8446.100	7	1206.586	1.777	.407
	Within Groups	1358.000	2	679.000		
	Total	9804.100	9			
ENT	Between Groups	1256.833	4	314.208	.459	.786
	Within Groups	684.500	1	684.500		
	Total	1941.333	5			
Gynaecology	Between Groups	37867.000	15	2524.467	8.854	.012
	Within Groups	1425.667	5	285.133		
	Total	39292.667	20			
Urology	Between Groups	6417.968	21	305.618	4.444	.013
	Within Groups	619.000	9	68.778		
	Total	7036.968	30			

Results show no significant difference($p < 0.05$) between the waiting time of patients in each specialty in comparison to the overall waiting time.

A quick search on PubMed database reveals limited studies internationally and nationally regarding preparedness plans for the care of cancer patients and those who need urgent procedures during an infectious

pandemic exist. Nonetheless, a lack of data remained a common theme during this COVID-19 crisis, and clinical adjudications may be the best available tool that remains.

Our clinical practice in this study has involved:

- Implementing a “Super Green Pathway” which is defined as keeping super green surgical patients in different sites “COVID-free” facilities to help contain the spread of the disease.
- Demarcated areas for donning and doffing of personal protective equipment (PPE) and should be run by dedicated staff who do not work in the main acute hospital.
- A complete ban on hospital visits to the “super green” site.
- Keeping total hospital stay to a minimum, and manage all surgical complications at the acute site. This is an important factor to keep the “super green” site as clean as possible.
- Two weeks of strict self-isolation of the patient’s whole household before and after the operation. These relied totally on the self-discipline of the patient.
- Where possible, most patients who underwent surgery have been for SARS-CoV-2 pre-operatively as advised by Public Health England and RCS.
- Strict adherence to staff appropriate level use of PPE used at the “COVID-free” site seems to be effective in preventing peri-operative SARS-CoV-2 infection.

In this study, our cohort did not suffer long waiting times for cancer surgery and did not suffer any COVID-19 related complications.

Limitations in the study:

- It has not escaped our attention that we had only 92 cases, a relatively small sample size. Also, we have had only 45 patients (48.9 %) with known COVID-19 status pre-operatively. Since 31st May 2020, the UK government increased capacity test to exceed the 200,000 testing/day target which subsequently allowed all patients to be tested pre-operatively.
- Information about medical comorbidities or mode of anesthesia were not gathered. COVIDSurg Collaborative which was published in Lancet on May 29, 2020, concluded that the overall 30-day mortality in the study was and was high across all patient subgroups; **(18.9%)** in elective patients.

CONCLUSION

In this study, we outlined that it is possible to safely carry urgent elective procedures during the COVID-19 pandemic. Our implemented Super Green Pathway which included testing, use of COVID-free hub, and trained staff with appropriate PPE are the main factors to minimize the morbidity and mortality risks.

To our knowledge, we were one of the first few trusts in the United Kingdom which have started to performed elective urgent and cancer surgery using a novel practice at the start of the pandemic as most NHS trusts did not have the capacity and facilities to do it.

REFERENCES

1. COVIDSurg Collaborative. Mortality and pulmonary complications in patients undergoing surgery with perioperative SARS-CoV-2 infection: an international cohort study. *Lancet* 2020 Jul 4;396(10243):27–38. doi: 10.1016/S0140-6736(20)31182-X. Epub 2020 May 29.
2. World Health Organization. [Internet] Naming the Coronavirus Disease (COVID-19) and the Virus that Causes it. Geneva: World Health Organization; 2020. Available at: [https://www.who.int/emergencies/diseases/novel-coronavirus-2019/technical-guidance/naming-the-coronavirus-disease-\(covid-2019\)-and-the-virus-that-causes-it](https://www.who.int/emergencies/diseases/novel-coronavirus-2019/technical-guidance/naming-the-coronavirus-disease-(covid-2019)-and-the-virus-that-causes-it)
3. Huang C, Wang Y, Li X, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet*.2020 Feb 15;395(10223):497–506. doi: 10.1016/S0140-6736(20)30183-5. Epub 2020 Jan 24.
4. World Health Organization. [Internet] WHO Timeline COVID-19. Geneva: World Health Organization; 2020. Available at: <https://www.who.int/news-room/detail/29-06-2020-covidtimeline>
5. GOV.UK N. West, and S. West. [Internet] Number of Coronavirus (COVID-19) Cases and Risk. London: GOV.UK; 2020.
6. GOV.UK. [Internet] Prime Minister’s Statement on Coronavirus. London: GOV.UK; March, 2020. Available at: <https://www.gov.uk/government/speeches/pm-statement-on-coronavirus-12-march-2020>
7. Royal College of Surgeons. [Internet] Guidance for surgeons working during the COVID-19 pandemic from the Surgical Royal Colleges of the United Kingdom and Ireland. London: RCS; 2020. <https://www.rcseng.ac.uk/coronavirus/joint-guidance-for-surgeons-v1/>

8. Federation of Surgical Specialty Association. Clinical Guide to Surgical Prioritisation During the Coronavirus Pandemic. Glasgow, UK: FSSA; 2020. Available at: https://fssa.org.uk/_userfiles/pages/files/covid19/prioritisation_master_240820.pdf
9. Public Health England. [Internet] Guidance on Shielding and Protecting People Who Are Clinically Extremely Vulnerable from COVID-19. London: GOV.UK; 2020. Available at: <https://www.gov.uk/government/publications/guidance-on-shielding-and-protecting-extremely-vulnerable-persons-from-covid-19/guidance-on-shielding-and-protecting-extremely-vulnerable-persons-from-covid-19>
10. Iksal M. No 主観的健康感を中心とした在宅高齢者における 健康関連指標に関する共分散構造分析 Title 2020;21(1)1–9.
11. Goddard B. Nuffield being used to support cancer patients during pandemic. Hereford Times April 2020. Available at: <https://www.herefordtimes.com/news/18389997.nuffield-used-support-cancer-patients-pandemic/>
12. Brennan S. Trusts told to create ‘covid-free hubs’ for cancer patients. HSJ April 2020; Available at: <https://www.hsj.co.uk/acute-care/trusts-told-to-create-covid-free-hubs-for-cancer-patients/7027306.article>
13. Royal College of Surgeons of Edinburgh (RCSEd). [Internet] Updated General Surgery Guidance on COVID-19, 2nd Revision. Edinburgh, UK: RCSEd; May 2020. Available at: <https://www.rcsed.ac.uk/news-public-affairs/news/2020/april/updated-general-surgery-guidance-on-covid-19-2nd-revision-7th-april-2020>
14. National Health Service. Operating Framework for Urgent and Planned Services in Hospital Settings During COVID-19. London: May, 2020. Available at: <https://www.england.nhs.uk/coronavirus/wp-content/uploads/sites/52/2020/05/Operating-framework-for-urgent-and-planned-services-within-hospitals.pdf>