



Clinical study

The impact of COVID-19 on neurosurgical head trauma referrals and admission at a tertiary neurosurgical centre

Siddharth Sinha^{a,*}, Ko Ko Zayar Toe^b, Edith Wood^b, K. Joshi George^{a,b}^a University of Manchester, Manchester, UK^b Department of Neurosurgery, Salford Royal NHS Foundation Trust, Salford, UK

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ABSTRACT

Background: COVID-19 has greatly impacted surgical specialities throughout the globe leading to a decrease in hospital admissions and referrals. Neurosurgery has seen a great decline in cases including head trauma leading to a negative impact on the development of neurosurgical trainees. The main objective of this study is to identify changes in neurosurgical referrals, admissions and management during the COVID-19 pandemic. We also aim to assess how current practise could be adapted to help manage future pandemic peaks.

Methods: Data was collected for the first 31 days of lockdown during 2020 (23rd March – 22nd April) and compared to the same time period in the years 2016–2019. We assessed the number of referrals, admissions and clinical information of patients during this period with a key emphasis on head trauma.

Results: Neurosurgical head injury referrals and admissions reduced by 57.5% and 48.3% respectively during the first 31 days of lockdown when compared to the mean figures for the same period in the previous 4 years. This was also seen with head trauma with a 21.9% decline in referrals and 39.1% reduction in admissions for the period of interest. A significant decrease in length of stay ($P < 0.001$) was seen between 2020 and the years 2017–19.

Conclusion: The impact of COVID-19 makes it imperative that we plan for future pandemics to lessen the impact on neurosurgery. Special considerations need to be taken so that trainees are sufficiently prepared for completion of training whilst still prioritising patient safety and providing high quality care.

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1. Introduction

During December 2019, a novel coronavirus originated from Wuhan, Hubei province in China. This virus spread rapidly across the world and caused a condition known as coronavirus disease 2019 (COVID-19) [1]. Over the course of 14 months the virus spread to all regions of the globe and as of 9th February 2021, there were 105.4 million cases and 2.3 million deaths [2].

The symptoms of coronavirus can vary greatly with many patients being asymptomatic. The common clinical features include fever, cough, headache, myalgia, nausea, vomiting and diarrhoea [3]. The main complication thus far associated with COVID-19 is acute respiratory distress syndrome resulting from uncontrolled cytokine storm, with multiple organ failure also occurring [1].

The effects of COVID-19 have had an increased impact on acute and critical care medicine. However as a consequence other specialities have seen a reduction in the number of cases, with NHS England reporting a large reduction in the number of patients presenting to the emergency department [4,5]. Surgical specialities have seen a great decrease in the number of operations carried out due to the pandemic with a COVID Surg Collaborative reporting that 72.3% of surgical operations were cancelled over a 12 week period (23rd January 2020 to 8th April 2020) [6]. Neurosurgery is not exempt from the impact of the pandemic with reductions in cases seen across the country. Ahuja et al has reported a reduction of 46.05% in spinal referrals to one tertiary spinal unit [4,6].

The experiences of COVID-19 allow neurosurgical clinicians to gain an insight into how to effectively manage neurosurgery units during a pandemic with government mandated lockdown. In this article, we look to assess the impact of COVID-19 on both trauma and neurosurgery referrals/admissions within our tertiary centre. We particularly look to assess the impact of the pandemic on head injuries during the first 31 days of lockdown within the UK (23rd

Abbreviations: COVID-19, Coronavirus disease 2019.

* Corresponding author.

E-mail address: s.sinha14@alumni.imperial.ac.uk (S. Sinha).

March to 22nd April 2020) and comparing it to the previous 4 years. Using these results, we aim to assess how future pandemic spikes can be managed and how neurosurgeons can contribute to helping on the frontline, while also effectively managing their own patients.

2. Materials and methods

Data was collected from an adult tertiary neurosurgical centre within the UK. The period of interest was between 23rd March to 22nd April, representing the first 31 days of lockdown during the COVID-19 pandemic. Data from 2020 was then compared to the same 31-day period in the previous 4 years (2016–2019). Data was collected for referrals, admissions and patient clinical information. Statistical analysis of the data was carried out where appropriate to determine any difference between variables.

2.1. Referrals, admissions and mechanism of fall

All neurosurgical referrals and head injury admissions were quantified over the selected time periods with head trauma referrals further analysed. All data was collected from the neurosurgical referral database. Head trauma is the main focus of this report, with the type of head trauma categorised into 7 groups (acute subdural haemorrhage, chronic subdural haemorrhage, contusions, depressed skull fracture, diffuse axonal injury, extra dural haemorrhage and other).

With regards to admissions, data was collected from the Trauma and Audit Research Network (TARN) database.

The inclusion criteria for admissions in the TARN database included:

1. Have been an inpatient for more than 3 nights, this includes any previous hospitals or hospitals transferred out to.
2. Have an injury severity score (ISS) of 8> (there will be a number below this score that were entered in error).
3. Have died as an inpatient (this includes if the stay was under 3 nights).
4. Have stayed in a critical care setting (this includes if the stay was under 3 nights).

Mechanism of fall was divided into 6 categories; (blows, fall from under 2 m, falls from over 2 m, stabbings, vehicle incidence/collisions and other).

2.2. Clinical information

Patient GCS was categorised into 3 groups, mild (14–15), moderate (9–13) and severe (3–8). Other areas of clinical information collected were; whether the patient has been operated on, length of stay, 30-day outcome (alive or dead). COVID-19 status was also assessed for patients in the 2020 group.

3. Results

3.1. Neurosurgical referrals

To enable comparison, data from the same period was collected over the previous four years as well. Over the course of 5 years, all neurosurgery on-call referrals were collected between the dates 23rd March – 22nd April. Between 2016 and 2019 the mean total number of referrals was 907.75 (834 to 1084). The number of total referrals reduced to 386 in 2020 during first 31 days of lockdown. 2020 also had the lowest head injury referrals of 132. This drop

however was not as drastic when compared to the preceding years head injury referrals (138 to 197) (Fig. 1).

3.2. Trauma admissions

After the initiation of lockdown on 23rd March 2020, there were 50 general trauma admissions to our tertiary hospital during the first 31 days of lockdown. 2020 had the lowest admissions when compared to preceding years (86 to 107 trauma admissions). The number of head trauma admissions were also reduced to 28 patients from an average of 46 patients (36–57) in previous years (Fig. 2). However, head trauma still ranked highest amongst all trauma admission in all 5 years, this was expected due to the tertiary care offered at our centre (Fig. 3). The mechanism of injury was also analysed, with falls <2 m being the greatest cause of injury across all years (Fig. 4).

3.3. Clinical information

Although there were fewer admissions, no statistically significant difference was seen in GCS or 30-day outcome of patients in 2020 when compared to the previous 4 years. A proportional reduction was seen across mild, moderate and severe cases (Fig. 5, Fig. 6).

2020 when compared to the same timeframe in 2017–19, saw a significant decrease in length of stay in hospital for patients ($p < 0.01$). No significant difference for length of stay was seen between 2020 and 2016 ($p = 0.09$) (Fig. 7). Of the patients admitted, no significant difference was seen in the number of patients operated on during 2020 compared to the previous 4 years (Table 1).

During the first 31 days of lockdown. 21 of the 50 admitted patients were swabbed for COVID-19 due to various clinical suspicions of infection. From which 2 patients tested positive, both of whom were swabbed due to spiked temperature. Subsequently 1 of these patients died 7 days after the result. Current practise dictates that all patient entering the hospital require a COVID-19 swab.

4. Discussion

This study has shown a reduction in both referrals and admissions, to our neurosurgery department during the first month of lockdown when compared to the previous 4 years. This is echoed across several countries around the world with Jean et al reporting that 226 of 494 response recording a greater than 50% drop in

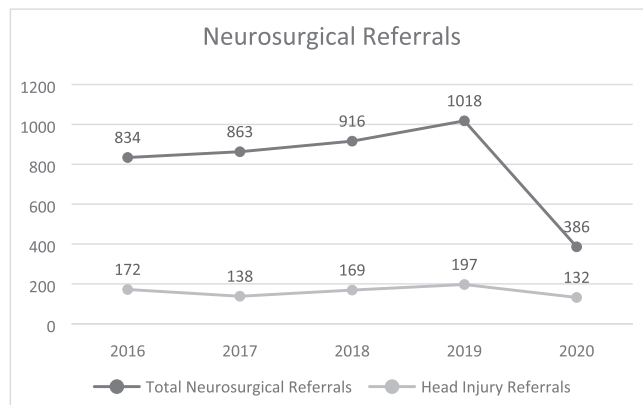


Fig. 1. The total neurosurgical referrals and head trauma referrals between 23rd March and 22nd April (2016–2020).

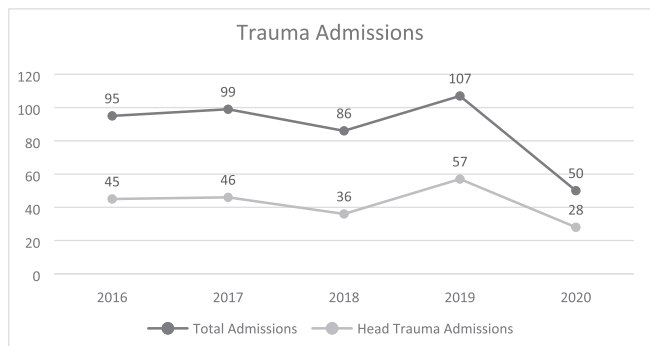


Fig. 2. All trauma and head trauma admissions.

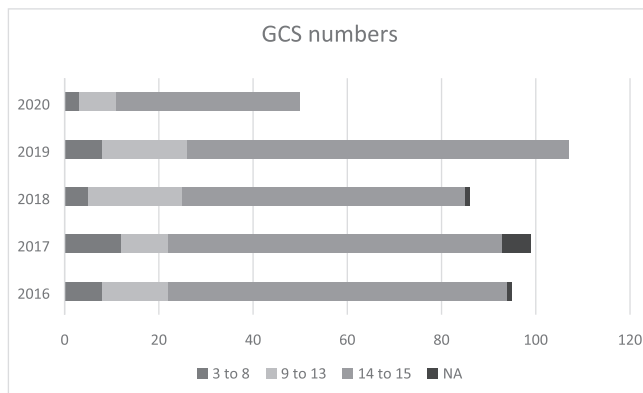


Fig. 5. GCS of admitted patients.

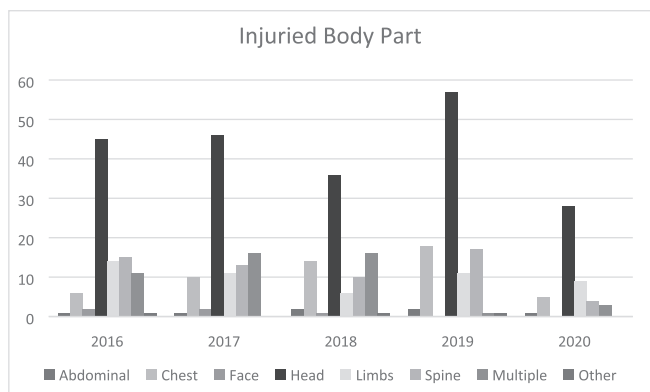


Fig. 3. Main body part injured for all trauma admissions.

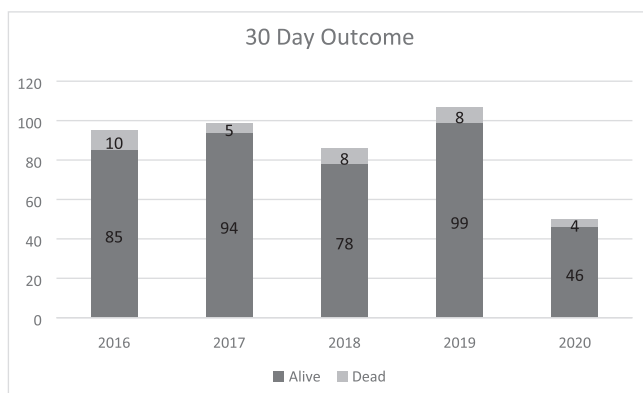


Fig. 6. 30-day outcome of admitted patients. Percentage of patients alive after 30 days – 2016 (89.5%), 2017 (94.9%), 2018 (90.7%), 2019 (92.5%) and 2020 (92%).

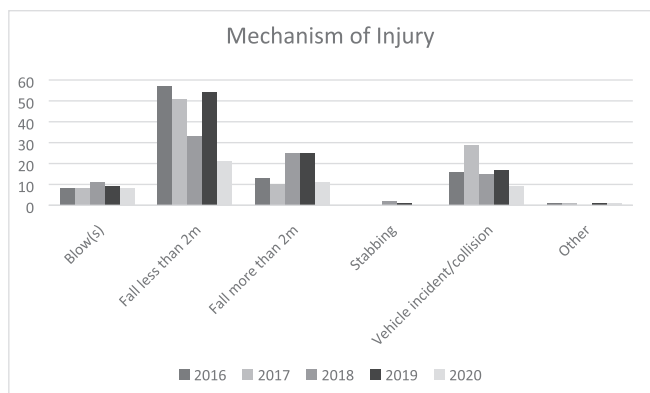


Fig. 4. Mechanism of injury.

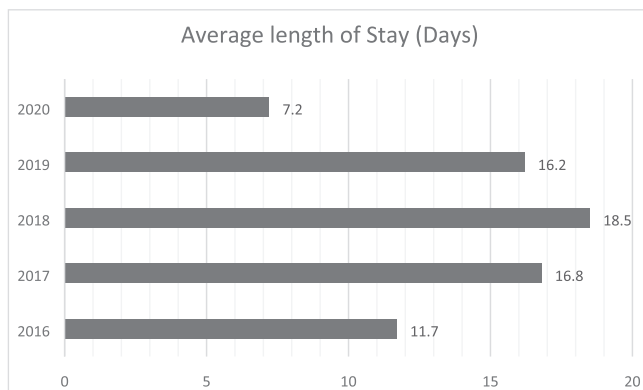


Fig. 7. Average length of stay for admitted patients.

operative volume [7]. This finding is not exclusive to neurosurgery and is evident across all surgical specialities [6]. Here we look to identify the reasons behind the reduction to cases but also possible strategies to optimising neurosurgical patient care in future COVID-19 infection waves or another distinct pandemic.

4.1. Rationale for case reductions

Ahuja et al has attributed patient-based and service-based causes for reduction in cases seen during the pandemic [4]. The effects of lockdown directly saw a reduction in road traffic accidents, with the peak of lockdown showing a 23% drop in motor vehicle traffic when compared to pre-lockdown levels [8]. The reduction in cases likely also stemmed from increased fears of infection with coronavirus and awareness of the pressures on the health

service leading to delayed presentations. Total neurosurgical referrals/admissions reduced during lockdown. The authors personally believe that the threshold for admission by clinicians may have increased to reduce the strain on hospital beds and to reduce the transmission rate of the virus. Several patients were managed remotely where appropriate, a feature which is likely to remain beyond the pandemic.

Head injury referrals and admissions did not see as great a drop when compared to general neurosurgical referrals/admissions. The proportion of patients experiencing blows to the head was proportionally increased in 2020 when compared to previous years, this

Table 1

Number of admitted patients undergoing operations.

	2016	2017	2018	2019	2020
Total Admission	95	99	86	107	50
Number of Operations	34	26	42	45	20
% Operated	35.8	26.3	48.8	42.1	40

may result from the feared increase in domestic violence cases seen during lockdown or increased alcohol intake at home [9,10].

The healthcare service had put in extra resources for enabling faster discharge to create extra capacity in hospitals. This was reflected in our study which showed a significant decrease in the length of stay to 7.2 days for 2020 from an average of 15.8 days for the previous 3 years (Fig. 7).

4.2. Planning for future pandemic

When planning for future infection spikes or pandemics, several factors need to be considered. As the number of referrals were noted to decrease substantially (by half) during the pandemic, one may need a smaller number of people to staff the on-call neurosurgical service. This would free up some members of the neurosurgical staff to help with the COVID response in other specialties. Furthermore, as trauma admissions decrease substantially, a smaller number of ward beds would need to be allocated for major trauma. There were only half the number of trauma operations compared to previous years. So, less theatre resources may be needed for trauma operations.

Interestingly while falls reduced greatly, blows to the head did not, and this information will be useful to emergency services in terms of allocating their resources during future pandemics.

Montemurro & Perrini discussed the role neurosurgical telemedicine may play on consulting and managing a particular set of patients in whom a thorough physical examination is not needed or to establish an initial interaction with a patient prior to inpatient consultation. Unfortunately, telemedicine has its drawbacks, including lacking a universal platform to deliver this approach and physicians would need to ensure that telemedicine services are covered by their medical liability insurance policy [11].

As number of emergency operations for trauma decreases, this has a great influence on junior doctor training. More consultant led surgery occurred during the pandemic with the premise of enabling faster decision making and less time in theatre. This gain in decision making has had a negative on neurosurgical training for juniors. Trainees could be given the opportunity to extend their training if they believe that their learning has been significantly affected by the pandemic [12]. A growing set of evidence would suggest COVID-19 infections may manifest with neurological symptoms [13]. Case studies have reported a possible link between COVID-19 and increased risk of primary and secondary intercranial haemorrhage, suggesting the importance neurosurgery may still play in this pandemic [14–16].

Furthermore, several adaptations have occurred in hospitals such as reorganising of wards, sufficient personal protective equipment and additional staff scheduled to work which could lead to a less dramatic rate of case reduction during future waves.

5. Conclusion

This study adds to the growing literature highlighting the major impact of the COVID-19 pandemic on neurosurgery. Though most specialties have noted decrease in referrals and admissions, this is the first study of the impact of COVID on the on-call neuro-

surgery service with an emphasis on head trauma and trauma related admissions.

The drop-in activity has been quantified and will be helpful in formulating a response for future pandemics with a possible proportionate reduction in the on-call neurosurgical team, trauma ward beds and trauma related theatre resources. Furthermore, telemedicine would need to become an integral part of neurosurgical consultations. Following the conclusion of the recent COVID-19 case surge in the UK in early 2021, the adaptations made to neurosurgical services across the country can be further analysed.

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Conflict of Interest

All authors certify that they have no affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or non-financial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript.

Ethical approval

This article does not contain any studies with human participants performed by any of the authors.

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