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Regional trauma patterns during the COVID-19 pandemic



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ABSTRACT

Background: The current pandemic has impacted heavily on health systems, making unprecedented demands on resources, and forcing reconfiguration of services. Trauma and orthopaedic units have cancelled elective surgery, moved to virtual based clinics and have been forced to reconsider the provision of trauma. Our national elective orthopaedic centre has been re-designated as a trauma centre to allow tertiary centres re-direct triaged trauma. Many governments, as part of their COVID-19 management, have significantly restricted activity of the general population. We proposed that trauma patterns would change alongside these changes and maintaining existing standards of treatment would require dedicated planning and structures.

Methods: Referrals over a six-week period (March 15th to April 30th) were retrospectively reviewed. Data was collected directly from our referral database and a database populated. Analysis was performed to assess trauma volume, aetiology, and changes in trends.

Results: There were one hundred and fifty-nine referrals from three individual hospitals within the timeframe. Mean age of patient's referred was 55 (range 17–92). Males accounted for 45% of cases. F&A injuries were the most common (32%), followed by H&W (28%), UL (17%), H&F (16%) and K&T (7%). In comparison to the corresponding time-period in 2019, trauma theatre activity reduced by almost one half (45.3%)

Conclusion: The majority of trauma referred to our Dublin based centre during COVID-19 related population restrictions appears to be home based and trauma volumes have decreased. Significant reductions are apparent in work and sport related injuries suggestive of compliance with COVID-19 activity guidelines. Maintaining existing standards of treatment requires dedicated planning.

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Introduction

The current COVID-19 pandemic has impacted on health systems in an unprecedented fashion, producing enormous demands on resources.¹ COVID-19 is an abbreviation of coronavirus disease 2019 and refers to the illness arising from infection with the new viral agent SARS-CoV-2. The outbreak which initiated the pandemic originated in Wuhan in the Hubei province of China.²

Trauma and orthopaedic units, in Ireland amongst others, have cancelled non-urgent elective surgery, moved to virtual based clinics, and made fundamental changes to the provision

of trauma.³ This has been in keeping with national and international guidance.^{4–8} The scope of routine trauma management has changed, with services reconfigured to alleviate pressure caused by these resource demands. Symptomatic of the potential impact on trauma provision, the British Orthopaedic Association have released a pandemic specific BOAST guideline to support practitioners in making difficult treatment decisions during this time.⁴

Furthermore, governments across the world, have placed varying restrictions on the activity of populations to limit the spread of COVID-19.⁹ One by-product of these emergency measures is a likely alteration in the volume and type of

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trauma occurring. The first laboratory confirmed case was recorded in Ireland on February 29th. Schools and cultural institutions were closed from March 12th with non-essential businesses closing from March 24th. A stay-at-home order was issued on March 27th with brief exercise within two kilometres of the home allowed. This specific stay-at-home order was sequentially extended through to May 5th.¹⁰ The country then entered its re-opening phase with graduated reintroduction of non-essential activities over the course of the following six weeks.¹¹

As an example of reconfiguration undertaken, our national elective orthopaedic unit, based in the Dublin metropolitan area, was re-designated as a trauma unit on March 18th of 2020, with the suspension of all non-urgent elective surgery. The intended purpose was to divert pre-triaged low energy trauma in non COVID-19 patients away from tertiary centres within our metropolitan area. We undertook a review of the pattern of injuries referred to our reconfigured unit during this time. Trauma surgery commenced in our unit on March 18th.

Methods

Unit reconfiguration

Our unit acts as a national centre of excellence in adult and paediatric orthopaedic medicine, sports and exercise medicine and rehabilitation medicine, employing over 500 staff and incorporating an on-site radiology service. As a high-volume 159 bed unit, throughput averages 65 overnight cases and 100 day cases per week and more than 1500 primary and revision hip and knee arthroplasties per year. The hospital treats over 24,000 patients annually.

Reconfiguration was designed to facilitate Dublin city wide trauma in the event of existing trauma hospitals becoming overloaded secondary to COVID-19. Same-day and overnight surgery was accommodated. In a phased process ambulatory trauma through to fractures about the hip were accepted. Polytraumatised, medically unwell or patients with a high suspicion of COVID-19 (close contacts) were deemed not suitable.

To ensure clinical governance, all communication links to our unit were established separately with each referring hospital to allow for accurate detailing of referrals and subsequent recording of trauma data. Preliminary COVID-19 questionnaire screening was carried out at site of triage (referring hospital) as part of the referral process. Patients were screened by our unit via telephone questionnaire prior to day of surgery (where possible), with questionnaire screening repeated on the day of surgery. Screening included assessment of symptoms, history of close contacts diagnosed with the disease and travel activities. A full assessment was carried out remote to the clinical area where risk factors for COVID-19 were identified. Swab testing was utilised where appropriate in line with Health Service Executive guidelines. These guidelines evolved overtime but during the study duration patients who exhibited: a fever of 38.5 °C or higher, a dry cough, shortness of breath or were a close contact of a confirmed case warranted swab testing. Patients were deferred when presenting with symptoms of COVID-19 with

appropriate follow up arranged. Cases were allocated to next available lists based on the specialist availability. All patients were followed up post-operatively in our unit under the care of the operating surgeon.

Data acquisition

Retrospective review was conducted of our trauma referral database for the period March 16th to April 30th. Referrals from the three trauma hospitals that had their theatre access most compromised by the need to manage ever increasing numbers of severe and life-threatening cases of COVID-19 were included in this analysis. The time, type, and mechanism of injury as well as anonymised patient demographics were recorded for each referral, populating a database. Charlson comorbidity index was calculated for each patient. Injuries were classified as one of upper limb (UL), hand & wrist (H&W), hip & femur (H&F), knee & tibia (K&T), or foot & ankle (F&A). Time from referral to surgery was recorded in days. Theatre activity data in the three trauma hospitals was collected for the corresponding time-period in 2019 and 2020 to allow for year on year comparison. χ^2 test was performed to analyse the data using Excel.

Results

There were 159 referrals for surgery from the three north of city hospitals for the time-period given. Females accounted for 55% (82/179) of cases. The mean age of patients was 55 (Range 17–92). The mean Charlson Comorbidity Index was 1 (Range 0–8). The mean time to surgery from referral was 3 days (Range 0–17).

F&A injuries were the most common (32%), followed by H&W (28%), UL (17%), H&F (16%) and K&T (7%). In comparison to the month of April in 2019, trauma theatre activity reduced by almost one half (45.3%), when remaining activity and transferred activity was considered, in the three referring hospitals (Table 1).

Injuries were sustained at home in 50% of cases. This varied significantly between pre (33%) and post (59%) 'lockdown'. Falls outside of the home happened in 45% of cases pre lockdown and in 36% of cases post lockdown (Table 2). Of the 159 referrals; in the pre-lockdown period there were 24 at home and 31 outside home; during the post-lockdown phase there were 66 at home and 38 outside of home, see Fig. 1. There was a significant change in the proportion of injuries

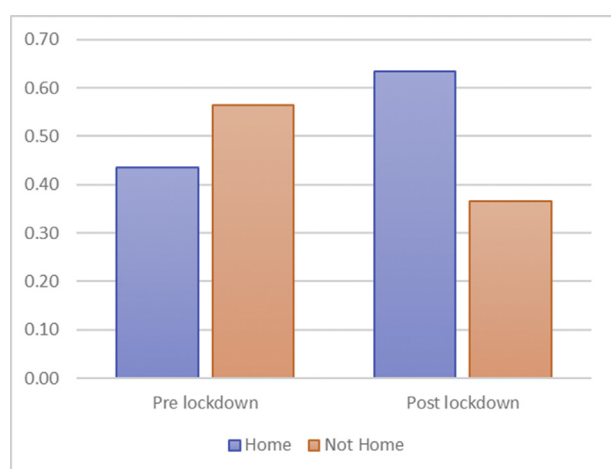
Table 1 – Trauma activity for month of April.

Location	(n = operative cases)		Estimated catchment area
	2019	2020	
Referring hospital 1	87	22	250,000
Referring hospital 2	92	7	331,000
Referring hospital 3	112	9	185,000
COVID trauma centre ^a		121	
Totals	291	159	766,000

^a Including cases referred from Referring Hospitals 1, 2 & 3 only

Table 2 – Aetiology of injuries.

Injury mechanism	As a percentage of overall cases (n/100)			Δ
	Entire period	Pre March 27th	Post March 27th	
Fall at home	0.50	0.33	0.59	↑
Fall outside of home	0.40	0.45	0.37	↑
Fall from a ladder at home	0.06	0.04	0.07	↑
Work related	0.04	0.07	0.03	↓
Formal sports activity	0.11	0.16	0.08	↓
Altercation or alcohol	0.14	0.22	0.10	↓
Personal exercise	0.09	0.05	0.12	↑
Commuting or travel related	0.13	0.13	0.13	↔

**Fig. 1 – Injury location (%) pre and post 'lockdown'.**

that occurred at home using chi-squared test, $p < 0.001$. Two cases of COVID-19 were identified through our screening process, with both deferred. No patient who underwent surgery in our unit during the above timeframe has been diagnosed with COVID-19 post-operatively.

Discussion

The landscape of orthopaedic practice has changed for the foreseeable future. Urgent elective cases and trauma will be prioritised while the pandemic continues. Current restrictions in activity have impacted on the volume of trauma occurring and the type of injuries sustained.¹² Data from our region shows a significant reduction in operative trauma presenting to acute hospitals for this period when compared to 2019. Simple falls at home are the most common mechanism. The data depicts a shift from the pre 'lockdown' period when simple falls outside the home were more common. Compliance with activity restrictions have reduced sporting and work-related injuries while increasing home improvement and personal exercise injuries, reflected by an increase in medium energy injuries around the home. Pilon type ankle

fractures made up 10% of the foot and ankle cases with tri-malleolar fractures making up a further 28%.

While our trauma model, in combination with reduced volumes, has allowed trauma to be treated along existing guidelines the expectation is that volumes will increase as work, leisure, and travel activity increases.¹³ The ability of trauma systems to cope with those increasing volumes under new working environments presents a challenge unique to these times. Safety of theatre staff, theatre turnover times and post-operative care capacity are among the aspects that will alter day to day practice.¹⁴ Fracture management needs to be reconsidered in line with the new BOAST guidelines. COVID positive patients have a significant 30-day peri-operative mortality suggesting that only essential surgeries be undertaken in this group.¹⁵ Knowledge also continues to evolve around associated longer term comorbidities in the form of a post COVID-19 syndrome. The musculoskeletal system, as in most viral illnesses, is affected by COVID-19 with a percentage of patient's experience symptoms in the form of myalgias, arthralgias and fatigue. The mechanisms by which the disease produces these symptoms is unknown and an open mind must be given to the possibility of a post COVID-19 syndrome which includes pathology in the musculoskeletal system.¹⁶ Finding a balance in providing an appropriate level of care at a reasonable level of risk to those involved is hugely challenging and consensus statements and algorithms will aid in the optimisation of care.¹⁷

In the COVID negative cohort, fractures that have a viable delayed treatment, e.g. later corrective osteotomy in extra-articular distal radius fractures,¹⁸ may need to be de-prioritised to maintain adequate service provision. While making a balanced decision to delay treatment may be required in certain cases, another aspect to consider is the delayed presentation of trauma due to anxieties around attending hospital during a pandemic.^{19,20} The discrepancies in our data between 2019 and 2020 are thought to be based on lower trauma volumes but may be at least partially accounted for by 'hidden trauma'. This phenomenon may place unforeseen demands on reconstructive services at a later date. It is important to acknowledge that the situation will likely remain dynamic through to 2021 and a degree of flexibility in management of trauma systems will be required.

Reduction in elective theatre access will create opportunities for units to re-orient rotas directing specific trauma to the care of more freely available specialists. Our centralised unit created dedicated foot and ankle, hand and wrist, upper limb, hip, and knee lists aimed at ensuring injuries were treated by relevant specialists more frequently compared to pre-COVID-19. This highlights that while significant challenges lie ahead, the current environment will also present opportunities for improvement. We believe that we have created an important blueprint for the reallocation of elective orthopaedic resources for trauma in a crisis environment. We are undoubtedly in a better position to deal with any short-term fluctuations in trauma service demands created by the current pandemic. While we will endeavour to re-introduce elective surgery as expeditiously as possible to our centre to the benefit of thousands of patients awaiting orthopaedic procedures, we will continue to provide an overflow trauma service. Incorporating provisions for a second wave and the continued availability of trauma theatre into the medium

term is a key consideration given the short-term unpredictability of the healthcare environment.

Longer term, appropriate foresight around innovations in service provision that are required now can also be used to improve trauma and orthopaedics for the long term.

Conclusion

Trauma and orthopaedic service provision is changing in the face of the COVID-19 pandemic. Consistent with population lockdowns, trauma volumes have dropped and trends in mechanisms have changed. Likewise, volumes and trends will shift once more as countries 're-open'.²¹ Jurisdictions must consider how to provide an adaptable high-quality trauma service immediately while simultaneously planning for the future.

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