The Impact of COVID-19 and Lockdown on Spinal Services at a National Level

Lessons Learned and Areas of Service Improvement for Future Health Care Delivery

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Abstract: The coronavirus disease 2019 (COVID-19) pandemic has had a dramatic impact on the provision of health care worldwide. The delivery of national spinal service for emergent surgery, elective surgery, and outpatient assessment has been incredibly challenging. A variety of innovative measures were undertaken to facilitate the safe provision of acute service and are outlined in this review, along with a number of key learning points which will improve the quality of health care delivered over the coming years. The challenges facing the spinal surgery community with regard the reintroduction of elective surgery is discussed, and a potential roadmap for the safe resumption of services is presented.

Key Words: COVID-19, spine, spinal cord injury, innovation

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The coronavirus disease 2019 (COVID-19) pandemic has had a dramatic impact on the provision of health care worldwide. The delivery of a national spinal service for emergent surgery, elective surgery, and outpatient assessment has been incredibly challenging. A variety of innovative measures were undertaken to facilitate the safe provision of acute service and are outlined in this review, along with a number of key learning points which will improve the quality of health care delivered over the coming years. The challenges facing the spinal surgery community with regard the reintroduction of elective surgery is discussed, and a potential roadmap for the safe resumption of services is presented.

COVID-19 PANDEMIC

The first reported case of the novel coronavirus severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), also known as its disease entity COVID-19, emerged from Wuhan, Hubei Province, China, in December 2019. Since its discovery and rapid global spread, the World Health Organisation (WHO) declared the outbreak a global pandemic and public health emergency on January 30, 2020.[1] As of May 18, 2020, a total of 4,782,539 cases of COVID-19 have been confirmed globally, with 317,566 confirmed deaths.[2]

Ireland's first case of COVID-19 was confirmed on February 29, 2020[3]; however, the country had begun preparing for the arrival of COVID-19 before this with the National Public Health Emergency Team (NPHET) for COVID-19 established on January 27, 2020. Ireland's strategy for tackling the virus was divided into 3 distinct phases; containment, delay, and mitigation.[3] The containment phase aimed to identify as many cases of COVID-19, irrespective of symptom severity, to prevent community transmission. The delay phase focused on slowing the spread of the virus in the community, with the mitigation phase concentrating on identifying the most severe cases of COVID-19 in an effort to reduce mortality. The NPHET advised the Irish government as to the appropriate time to introduce each phase.

New confirmed COVID-19 cases in the Republic of Ireland as of May 15, 2020 (Fig. 1).[4]

Ireland's national lockdown was carried out in stages to reflect these phases. The transition from containment phase to delay phase happened on March 12 and saw the closure of all schools, universities, and childcare facilities. Indoor gatherings of >100 people and outdoor gatherings of >500 people were canceled. All state-run cultural institutions were closed, and all those who could work remotely were encouraged to do so. On March 27, a national lockdown was introduced with citizens ordered to stay at home and limit their outdoor exercise to within a 2 km radius of their place of residence. Only those carrying out a prescribed essential service were permitted to travel to and from their place of work. All those over the age of 70 years were encouraged to "cocoon"; staying at home at all times with limited face-to-face contact.[5]

To increase Ireland's bed capacity during the pandemic, an agreement was made between the Government and the Private Hospital Association that all 19 Private

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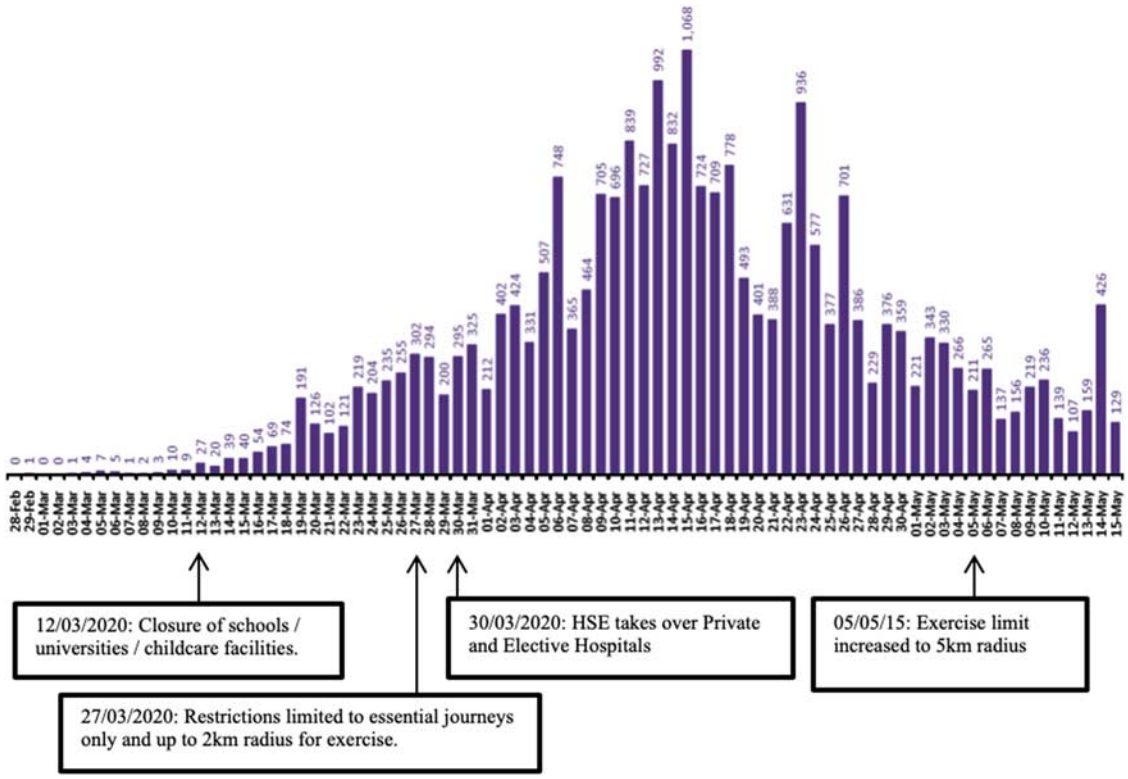

FIGURE 1. New confirmed coronavirus disease 2019 (COVID-19) cases in the Republic of Ireland as of May 15, 2020. HSE indicates Health Service Executive. full color online

Hospitals in Ireland would be leased by the National Health Service, the Health Service Executive, for a duration of 3 months. These hospitals collectively account for just under 2000 inpatient beds, 47 intensive care unit beds, 600-day beds, 194 ventilators, and 9 laboratories, thereby significantly increasing the access to health care facilities during the COVID-19 pandemic.

IMPACT ON TRAUMA AND ORTHOPEDIC SURGERY

The influx of COVID-19 cases and subsequent national lockdown had a catastrophic impact on the delivery of health care services in the Republic of Ireland, with one of the most affected specialties being trauma and orthopedic surgery. The delivery of clinical services at all hospitals was modified to minimize disease spread. Outpatient attendance was significantly reduced, family visitations to hospitals were halted, elective surgery was suspended, and nonoperative management where possible was adopted.[6–8] Resident physician rosters were modified to minimize doctor-patient contact and augment the staffing levels of overwhelmed internal medicine and emergency medicine services. Such was the demand for physician support during the COVID-19 case surge that orthopedic surgery attendings and residents staffed emergency assessment units for suspected COVID-19 cases.

From an organizational perspective, outpatient clinics were delivered off-site from university hospitals where feasible to minimize the risk of COVID-19 exposure for patients and health care staff. Outpatient appointments were limited to urgent cases and immediate postoperative care. Virtual clinics were utilized to provide safe, efficient time-sensitive care to streamline fracture management. All uncomplicated musculoskeletal injuries (ambulatory trauma, minor fractures, soft tissue injuries) in patients not suspected of having COVID-19 were redirected to orthopedic outpatient clinics, which ran extended hours of service, to avoid emergency department attendance at the major university hospitals treating COVID-19 cases. Polytrauma patients and high-risk patients (eg, hip fractures) requiring resuscitation and multidisciplinary medical management continued to be treated at major university hospitals.

IMPACT ON NATIONAL SPINE SERVICE

The COVID-19 pandemic had a dramatic effect on the delivery of spinal care on a national basis. It has been necessary to triage spinal services to protect both patients and clinicians from COVID-19 exposure while continuing to provide timely intervention for emergent or time-sensitive cases. Our institution [National Spinal Injuries Unit (NSIU)] acts as the national tertiary referral center for spinal injuries and complex spine pathology for the Republic of Ireland, with a catchment population of ~5 million. To this end, all elective surgery and elective outpatient clinics were canceled as of March 16 and March

18, respectively, with no elective spinal surgery being performed from March 12 onwards. Where required, telemedicine consultations were performed in place of traditional face-to-face outpatient reviews, and a dedicated monitored email address was created to enable timely communication between patients with urgent clinical queries and their attending surgeon.

Emergent and urgent national spinal referrals continued to be accepted via a long-established web-based referral portal. This system was supplemented by the introduction of a national instant messaging application referral group (Siilo, Amsterdam, The Netherlands) with all orthopedic surgeons in the country invited to join. This application met all the required data protection standards and allowed near real-time clinical decision-making on cases across the country with a median time to the first response by an NSIU surgeon of 15.5 minutes.

Restrictions in access to surgical beds and operating theater capacity, as well as a desire to reduce potential patient exposure to COVID-19, led to a restructuring of the provision of surgical care outside the COVID-19 hospital in which the NSIU is located to other local non–COVID-19 hospitals (Table 1). NSIU surgeons have also traveled to hospitals in other cities to operate on local spine cases, thus avoiding the need to transfer patients between facilities, in a process known colloquially as the "Spine Bus."

Measures to reduce staff contact within the surgical team were introduced including an on-call pod system and the conducting of all departmental meetings via a teleconferencing application (Zoom, San Jose, CA). Training commitments to residents have been maintained, including weekly journal clubs and attending-led spine teaching, all via Zoom. A positive development arising from the transition to a weekly teleconferenced multidisciplinary spinal tumor meeting has been the increased engagement of surgeons and oncologists in regional centers, improving communication, and providing efficient patient-specific treatment plans.

For all operative surgical cases, a COVID-19 risk assessment, including oro/nasopharyngeal swabbing where indicated, were performed preoperatively, and perioperatively management and infection control procedures were applied accordingly. All confirmed or suspected cases had surgery in a dedicated "COVID-19" orthopedic operating room with adherence to national guidelines.[9] While these guidelines have evolved over the course of the pandemic, the core features include minimizing the number of staff in theater, intubation, and extubation in theater, appropriate personal protective equipment (PPE) (surgical gown, gloves, eye protection, and FFP3 mask) and limiting the use of potentially aerosol-generating equipment (power tools, diathermy, etc.) where possible. Anesthetic time and operating theater efficiencies have understandably been severely impacted by additional COVID-19-related precautions; however, our experience is that there is no significant difference in performing the surgical procedure itself. One notable exception has been concerns regarding the ability to satisfactorily decontaminate larger image acquisition machines, such as the O-arm (Medtronic, Minneapolis, MN), precluding navigated spinal surgery for the duration of the pandemic.

The COVID-19 pandemic has resulted in a significant decrease in the NSIU clinical workload, with national spine referrals reduced by 47% (Fig. 2) and surgical cases performed reduced by 61% (Fig. 3) since the introduction of the delay phase on March 12 to the beginning of restrictions being lifted on May 5, when compared with the same period in 2019.

There has also been a shift in the etiology of surgical cases performed in the NSIU during the pandemic (Table 2), with a dramatic reduction in trauma-related cases being performed. This reflects both a reduced incidence of spinal trauma as the general population avoids higher risk activities during the national lockdown but also a shift to a more conservative clinical approach to the management of spinal injuries. Of particular concern has been the increase, in both absolute and relative terms, in the number of suicide attempts leading to spinal injuries. The potential for increased stressors (health and financial concerns, domestic violence, substance misuse, etc.) and reduced social support due to social distancing has mental health professionals alert to the possibility of an increase in suicide attempts as a consequence of the

TABLE 1. Restructuring of Surgical Care

MMUH*	Emergent cases with neurological compromise (CES, acute spinal cord compression) or those requiring critical care
MPH†	Cases without neurological compromise requiring instrumentation, cervical disk pathology
NOHC‡	Lumbar disk pathology other than CES
"Spine Bus"	Cases at risk of COVID-19

*Public University Teaching Hospital (COVID-19 hospital).
†Private Elective Hospital (under control of MMUH during pandemic) (non–COVID-19 hospital).
‡Stand-alone National Orthopedic Elective Hospital (non–COVID-19 hospital).
CES indicates cauda equina syndrome; COVID-19, coronavirus disease 2019; MMUH, Mater Misericordiae University Hospital; MPH, Mater Private Hospital; NOHC, National Orthopaedic Hospital, Cappagh.

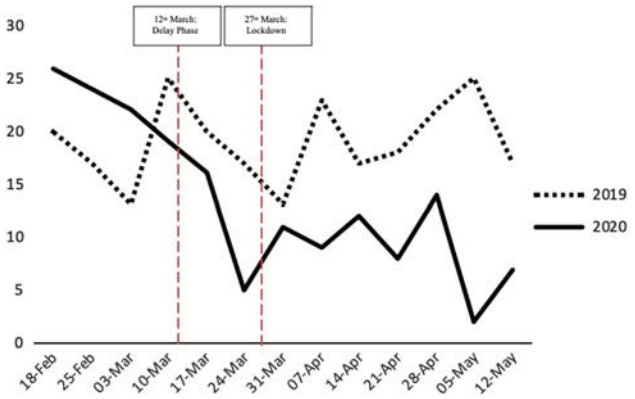

FIGURE 2. National Spinal Injuries Unit (NSIU) portal referrals February 18–May 12 (2019 vs. 2020). full color online

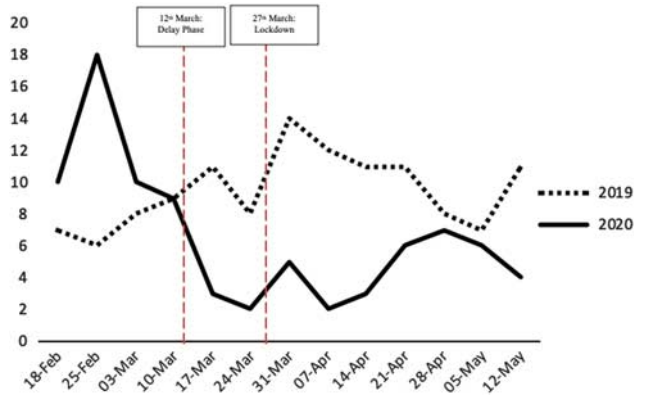

FIGURE 3. National Spinal Injuries Unit (NSIU) surgical cases February 18–May 12 (2019 vs. 2020). full color online

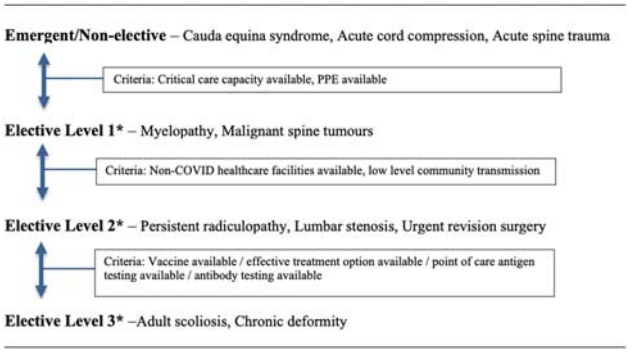

FIGURE 4. Authors suggested a roadmap for graded return of elective spinal surgery. *Exceptions allowable on case-by-case series. COVID-19 indicates coronavirus disease 2019; PPE, personal protective equipment. full color online

COVID-19 pandemic.[10] It is incumbent on us all to be cognizant of the mental health of patients and colleagues during this difficult time.

THE NEW "NORMAL"

As the beneficial effects of the lockdown are being seen and the number of new cases continues to drop, attention is now turning to the next burning question; how to we deliver safe and effective spinal care until such time as a vaccine becomes available? While there are a number of clinical trials of vaccines already underway,[11] it is expected to take at least 12–18 months before a successful vaccine becomes commercially available. During this time, outpatient clinics and surgical waiting lists will continue to grow with patients suffering increasing pain, disability, and deformity. Spine surgery as a subspeciality would particularly suffer if a blanket ban on all elective surgery was implemented given that a not insignificant proportion of "elective" spine surgery, while suitable for a planned admission, is urgent and time-sensitive to prevent neurological deterioration and permanent loss of function. Consideration should be given to the timely reintroduction of elective care in a stepwise controlled fashion (Fig. 4) with due consideration for the urgency of surgery and the potential for negative consequences from delayed treatment, balanced against the risk to patients, clinicians, and society at large of COVID-19. Accurate and timely information regarding factors such as; local and national COVID-19 infection rates, critical care and operating theater capacity, and PPE and staff availability should be communicated effectively within the health care system to allow dynamic adjustment of the level of elective surgical care provided during subsequent infection waves. A number of surgical and orthopedic organizations have published detailed guidance documents to help clinicians and health care institutions navigate the safe return of elective care.[12–14]

Elective clinics would ideally be located away from the main clinical hub with appropriate infection control and social distancing protocols observed. New clinic patients should still be reviewed in person by their surgeon to allow for a formal physical examination. However, subsequent consultations to follow-up on investigations or to discuss management options should utilize the ever-expanding array of telemedicine options. There may be a need for additional capacity, such as extended operating hours or additional clinic sessions to compensate for new practices that impact on traditional working efficiencies. The adoption of a more conservative approach to trauma and elective spine management may result in an increase in complications or treatment failures such as delayed posttraumatic instability, and systems should be implemented to facilitate early review and intervention as required.

Now, more than ever, health services should act in a coordinated fashion to allow for the rapid redeployment of resource in the event of a second wave of COVID-19 infections. This requires dynamic assessment of health care capacity, in particular critical care, accurate diagnostics and modeling of the spread of COVID-19, and the prompt, impartial communication of relevant information to both clinicians and health care administrators.

TABLE 2. National Spinal Injuries Unit (NSIU) Surgical Cases by Classification, March 12–May 12 (2019 vs. 2020)

NSIU Surgical Cases (March 12–May 12)		
Classification	**2019 [n (%)]**	**2020 [n (%)]**
Trauma (excluding suicide attempts)	41 (44)	7 (19.5)
Suicide attempt	1 (1.1)	4 (11)
Malignancy	9 (9.7)	7 (19.5)
Cauda equina syndrome/acute disk pathology	17 (18.3)	7 (19.5)
Spinal stenosis (with acute neurology)	8 (8.6)	8 (22.2)
Infection	6 (6.5)	3 (8.3)
Elective	11 (11.8)	0 (0)
Total	93	36

LESSONS LEARNED

COVID-19 has, out of necessity, been a significant driver of change and innovation across all sections of the health care system in Ireland, and going forward, there

will be efficiencies developed from this time of crisis that are worth keeping in a postvaccine world. New technologies and communication tools such as Zoom and Siilo have been embraced, not only by clinicians but also by elderly patients who may have traditionally been resistant to the concept of telemedicine. In our practice, we have seen that teleconferencing multidisciplinary team meetings or resident teaching sessions has increased both attendance and engagement, and we intend to continue this into the future. The increased utilization of telemedicine is not without some concerns, including issues relating to cyber security and the loss of formal clinical examination. There has also been an increase in access to out-of-hours radiology services at regional centers, in particular magnetic resonance imaging which is of particular benefit when running a national emergency spinal service. Local interval imaging and virtual follow-up are additional tools to decentralize care and will have an expanded role in the future. Strategies to reduce the amount of time patients spend in health care facilities (day-case surgeries, day of surgery admissions, accelerated recovery programs) have been established before COVID-19, but there is now a fresh impetus to progress these strategies and reconfigure services away from health care settings treating patients with COVID-19.

With nearly 30% of confirmed COVID-19 cases in Ireland affecting health care workers,[15] there is a particular focus on infection control procedures and the provision of PPE. It is likely that additional health care staff will need to be recruited to create redundancy in the system to allow for COVID-19-related absences during the second wave of infections. Many questions remain unanswered such as, the role of serial antigen testing of health care workers to identify asymptomatic carriers, the use of antibody testing, and whether infection confers immunity, however, research and innovation relating to COVID-19 is progressing at an astonishing speed, and this should be harnessed to incorporate the most up to evidence and technology to help inform perioperative guidelines and improve patient and clinician safety.

CONCLUSIONS

The COVID-19 pandemic has resulted in unprecedented changes to how health care is delivered worldwide. While devastating on an individual and societal level, it has also helped drive innovation and technological advancement as clinicians strive to maintain and improve the quality of health care delivered to patients. The early adoption of these advancements and the restructuring of care across multiple sites on a stratified risk basis has allowed our national spine service to continue to provide high-quality, efficient care in the most challenging of environments while putting patient and staff safety to the forefront. The spine surgery community will need to learn from the collective experiences of different units as we work towards a degree of normality and continue to advocate on behalf of our patients.

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