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The orthopaedic experience of COVID-19: A literature review

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Abstract

This literature review aims to provide an account of the changes to orthopaedics in the era of COVID-19. Herein, the authors explored the use of telemedicine in orthopaedics as well as changes in surgical protocols, screening methods, work priorities and orthopaedic education. There was increased utilisation of telemedicine in orthopaedic training and outpatient cases as a means to provide continuity in education and care. The need to implement social distancing measures, coupled with the reduced availability of staff, has dictated that the practice of orthopaedics shifts to focus on acute care whilst redistributing resources to front-line specialities. This was facilitated by the cancellation of electives and the reduction of outpatient clinics. Thus, it is demonstrated that major changes have been implemented in many aspects of orthopaedic practice in order to address the challenges of the COVID-19 pandemic.

Keywords

Orthopaedics / COVID-19 / Coronavirus / Surgical protocols / Telemedicine / Orthopaedic management

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Introduction

Coronavirus disease-19 (COVID-19) is an infectious disease caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pathogen which originated in the city of Wuhan, China (Li et al 2020). Fever, cough and fatigue were the most common symptoms but severe complications, such as acute respiratory distress syndrome, often resulted in hospitalisation (Fu et al 2020). Over half a million deaths worldwide have been confirmed by the World Health Organization (WHO). Realising the alarming transmissibility and virulence of SARS-CoV-2, it was characterised as a pandemic on 11 March 2020 (WHO 2020). Knowledge of SARS-CoV-2 is limited but growing, although a vaccine has not yet been developed.

Healthcare systems have undergone substantial reorganisation to release capacity, including the reallocation of staff, increasing intensive care unit (ICU) availability and prioritising acute services (Leclerc et al 2020). Healthcare providers have been under immense pressure to protect their staff as well as care for patients, presenting significant fiscal and supply challenges across the world (Rowan & Laffey 2020).

The US Surgeon General has instructed the cessation of elective surgery (Stahel 2020); as have other health authorities. Thus, despite not being considered on the 'front-line', orthopaedic practice has been impacted. COVID-19 has had ramifications for surgical protocols, theatre workflow, patient and staff safety, training and education (Al-Jabir et al 2020, De Simone et al 2020).

In this literature review, we aimed to summarise the impact of COVID-19 on the practice of orthopaedics rather than provide a systematic review or critical analysis. Some aspects such as leadership and communication were critical during the pandemic in all specialties; however, this review focussed on the changes to orthopaedic surgery.

Our findings showed significant changes in orthopaedic practice and adoption of technology.

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Selection criteria

PubMed, Embase, Google Scholar, Medline and Web of Science were searched up to 1 June 2020. Key words included 'Orthopaedic', 'Coronavirus', 'COVID-19' and 'Surgery'. The initial screening of the studies was done by two authors independently, for inclusion, with any discrepancies resolved by a third reviewer. All articles written in English were included if they concerned the management of orthopaedic patients and departments during the COVID-19 pandemic. Case series, research-focused, project reports and descriptive articles were included with the aim of providing a global overview. Forty-five articles were selected.

Patient screening for COVID-19

Three main stages of screening for SARS-CoV-2 infection were described in literature. Epidemiological history and symptoms were investigated at the point of admission as a method of quickly identifying suspected COVID-19 patients (Neradi et al 2020). These patients were sometimes isolated in buffer wards for further testing (Meng et al 2020, Wu et al 2020).

Computed tomography (CT) imaging and blood tests were used to further investigate suspected COVID-19 patients and patients requiring surgery (Keny et al 2020). CT was believed to have high sensitivity for COVID-19 and can be conducted quickly (Ai et al 2020). Few articles expanded on the blood tests required but COVID-19 positive patients had statistically significant differences in white blood cells, C-reactive protein, aspartate transaminase, alanine aminotransferase and lactate dehydrogenase readings (Ferrari et al 2020).

Reverse transcription polymerase chain reaction was considered the diagnostic reference standard and was used as the final confirmatory step; however, the slow turn-around in results made CT more useful in emergency situations (Meng et al 2020). Unscreened patients were strictly managed in isolated rooms with COVID-19 precautions (Wu et al 2020).

Preoperative screening for COVID-19 increased surgery waiting times, which may have increased the risk of complications (Orosz et al 2004, Pincus et al 2017). A Chinese study determined that average waiting times from injury to surgery increased by 4.1 days, and from admission to surgery by 2.0 days, compared with 2019. Patients also waited longer before presenting to hospital (Meng et al 2020).

Elective surgery

The cessation of elective surgery shifted orthopaedic focus towards emergency care (Zagra et al 2020). The cancellations reduced viral spread, preserved bed capacity and personal protective equipment (PPE) and allowed staff to be redeployed to confront the crisis (Iannuzzi et al 2020). More urgent electives were prioritised in the weeks prior to the gradual cessation of most electives (Tadros et al 2020). Furthermore, one paper noted a difficulty in guaranteeing a safe and effective rehabilitation time for patients (Zagra et al 2020). In highly affected regions, such as Lombardy, orthopaedic electives were stopped more abruptly (Giacomo et al 2020).

Most papers excluded urgent electives (such as periprosthetic joint infections and periprosthetic fractures) and orthopaedic oncology cases from cancellation (Giacomo et al 2020, Kenanidis & Tsiridis 2020). In contrast to other articles, one paper from Singapore continued day surgical cases, deeming that the resource-burden and infection risk were reduced by expedient discharge (Liang et al 2020).

The backlog of elective cases will eventually need to be faced (Petrone et al 2020), but reduced resources in some countries may compromise this (Jain & Vaishya 2020).

Emergency surgery

Emergency, urgent elective and oncological orthopaedic services were typically kept operational throughout the crisis (Giacomo et al 2020, Giuntoli et al 2020). Changes in emergency surgery workload varied across the literature reviewed. This was partly due to the fact that some centres were designated as regional trauma centres during the crisis (Meng et al 2020, Zagra et al 2020). Generally, reductions in trauma admissions were seen, with several studies reporting a decrease in trauma workload (Giuntoli et al 2020, Luengo-Alonso et al 2020), likely related to cases of minor trauma. Factors contributing to the reduction are travel restrictions and reduced mobility encouraged by the lock-down measures (Nuñez et al 2020), and a greater fear of coming to hospital during the coronavirus pandemic (Luengo-Alonso et al 2020, Nuñez et al 2020). Some private hospitals in Singapore and the UK offered their services to help public hospitals manage trauma patients (Tadros et al 2020, Tay et al 2020).

Surgical protocol changes

The risk of COVID-19 infection has necessitated the worldwide reduction in the size of surgical teams in the operating room (Lancaster et al 2020, Meraghni et al 2020). This facilitated distancing during surgeries, reduced the likelihood of transmission and allowed scarce PPE to be used elsewhere. The redeployment of staff to the 'front line' also necessitated this reduction. To further reduce infection risk, efforts were made to reduce the duration of surgeries (Neradi et al 2020). However, the additional COVID-19 precautions (discussed below)

have also led to an increase in theatre utilisation per case in some practices (Mathai et al 2020).

The use of PPE during surgeries (such as N95 respirators) was aspired to where possible, in compliance with Centers for Disease Control and Prevention guidelines (CDC 2020, Day et al 2020, Keny et al 2020). During aerosol-generating procedures, FFP3 masks were used alongside eye protection (Tadros et al 2020).

The pandemic necessitated reorganisations of operating theatres and surrounding spaces. Some theatres were dedicated to COVID-19 patients in line with wider segregation efforts in hospitals. Donning and doffing areas were improvised, along with sterile passages between them and theatres (Keny et al 2020). Clean rooms were introduced to facilitate the exchange of materials before surgeries (Mathai et al 2020).

Particulate aerosolisation during surgery was a significant infection risk, particularly during intubation and extubation. Many protocols were employed to address this, including asking the surgical team to step out during intubation and extubation, although this was practiced in many departments before the pandemic (Liu et al 2020, Neradi et al 2020). The use of power tools during surgeries was minimised, and the use of pulsatile jet lavage was avoided (Keny et al 2020). A period of 30 minutes was left before removing patients from the operating room after a surgery to allow aerosolised material to settle before cleaning (Keny et al 2020). The use of negative pressure in operating rooms was adopted by some but not all departments owing to cost and technical challenges. One UK paper stated that their orthopaedic department continued to use positive pressure, citing that little evidence exists for negative pressure in reducing COVID-19 infection risk (Mathai et al 2020). Due to constraints in anaesthetic resources, one department in Singapore converted selected surgeries usually performed under general anaesthesia to local anaesthesia (Hwee et al 2020).

Outpatients

Outpatient clinics have implemented measures to reduce staff and patient contact amidst the pandemic. A total of 23,580 outpatient appointments (93.8%) were cancelled in one Milan centre (Zagra et al 2020). Almost all other papers noted a similar trend. A reduction in referrals was also noted (Askari et al 2020). The duration between non-urgent follow-up appointments was intentionally prolonged, thereby reducing the demand on outpatient services (Liang et al 2020).

All publications discussed the utilisation of telemedicine to conduct clinic appointments, with further details discussed below. However, in-person clinic appointments were still provided to nondeferrable outpatient cases such as plaster removals and some wound examinations (Tadros et al 2020). As a result, rearrangement of the outpatient department was necessary to maintain social distancing and isolation protocols (Mathai et al 2020). Orthopaedic team segregation reduced cross-infection between outpatient and inpatient services. Outpatient appointments were used to review some postponed elective cases, focusing instead on addressing debilitating pain in the early stages of the crisis (Liang et al 2020).

Telemedicine

In this review, 'telemedicine' describes the use of technology to deliver medical services when distance separates the participants. Prior to COVID-19, its adoption had been slow due to cost, staff and patient technology literacy, the inability to physically examine and the reliability of technology. Some barriers to implementation such as lack of awareness (Ayatollahi et al 2015) and regulatory complications were reduced amidst the pandemic; however, others persist such as poor connectivity (Makhni et al 2020). Patient attitudes to telemedicine adoption seemed to be positive, with one report stating that 90% of patients were satisfied with virtual clinics implemented at a UK hospital in line with the NHS Long Term Plan (Gilbert et al 2020). Another paper noted that telemedicine was used in 90% of outpatient clinical evaluations (Luengo-Alonso et al 2020).

Telephone consultations were cheaper than video conferences but failed to provide a solution to the loss of physical examination (Gilbert et al 2020, Meraghni et al 2020). This can present a significant challenge in a speciality like orthopaedics where observing the patient can be critical in diagnosis. Tanaka et al (2020) describes some solutions implemented via video conferencing, such as utilising on-screen measurement tools and objects of known weight to determine length and strength, respectively.

Initial costs included costs of hardware, software, installation and staff training (Makhni et al 2020). Articles noted that long-term cost savings stemming from reduced administration and travel costs, outweighed this initial cost (Ohinmaa et al 2002).

Education

Orthopaedic trainees were redirected to COVID-19 facing areas including ICU and emergency departments, reducing their orthopaedic exposure. Conferences usually attended by orthopaedic departments were preserved by migrating online. Additional online conferences held by industry sponsors, as well as online subspecialty lectures were made available to orthopaedic trainees. The pandemic has also introduced an additional need to train staff in the use of PPE which

was delivered online and in person. Hands-on surgical experience was supplemented with virtual reality simulators used from home in one institution (Schwarzkopf et al 2020). Most institutions implemented simpler virtual teaching solutions like the use of video conferencing apps to facilitate the continuation of 'normal' teaching. Weekly journal clubs allowed for interaction with trainees (Pelt et al 2020).

National guidance in the UK also dictated that surgical exams were either deferred or cancelled (HEE 2020). A paper on the challenges in Singapore and Malaysia (Tay et al 2020) also reported that practical internal exams were postponed due to difficulty in finding patient volunteers during the pandemic.

Staff health

The COVID-19 pandemic has taken its toll on the physical and mental wellbeing of healthcare staff due to frequently changing protocols, shortages in PPE, higher patient mortality and the risk of COVID-19 infection (Walton et al 2020). Caring for infected colleagues compounded the mental and physical health burden. Furthermore, the increased relative risk of infecting family has contributed to the stress and worry of healthcare staff (Guo et al 2020). Measures adopted to curtail COVID-19 spread included changing work rotas and work patterns (Mathai et al 2020) in addition to the strategies outlined previously. Despite this, a small number of healthcare professionals, including orthopaedic staff, have contracted the virus (Guo et al 2020).

An uncertain future and disruption of social support appears to have adversely affected younger staff disproportionately. A survey completed by 611 orthopaedic surgeons from India found a significantly higher level of stress in younger staff (Sahu et al 2020).

Regular praise and acknowledgement of staff, as well as drop-in sessions with psychologists/psychiatrists were recommended based on evidence from previous outbreaks (Walton et al 2020). Conversely, many orthopaedic staff were either mildly stressed or not stressed at all as a result of the marked reduction in elective workload and a reversed work-life balance (Sahu et al 2020).

The future in a COVID-19 world

Expectations of the 'new normal' in a COVID-19 world resemble the changes discussed above. A return to elective surgery is expected, starting with simpler operations and gradually adding complex cases (North et al 2020). The literature indicates an emphasis on precaution and diligence to accompany the resumption of elective surgery, with assessment of COVID-19 patient symptom status on the day of surgery likely to become common. Preoperative patient testing for COVID-19, as well as routine testing of surgical staff has now been implemented due to the risk of asymptomatic transmission. This relies on the availability of fast and cost-effective tests in the future (Meneghini 2020).

Patient fear may remain a hurdle; the risk of COVID-19 infection in hospital discourages patients from electing for surgery, even when medically indicated. This uncertainty extends to life-saving operations (Lancaster et al 2020). An increasing focus on same-day discharge for operations such as hip and knee arthroplasties may help to reduce this risk (Meneghini 2020).

Elective surgery deferrals are likely to greatly impact patients with non-urgent but disabling conditions, reducing their ability to work (COVID Surg Collaborative 2020). This can summate with the already high costs of treatment, leading to impoverishment, particularly in low and middle income countries (Shrime et al 2015). The resulting deterioration in population health during the struggle to 'catch up' with cancelled electives will lead to further societal costs (COVID Surg Collaborative 2020). The world has long to go before resolving the issues associated with COVID-19.

Conclusion

The COVID-19 outbreak has presented a significant challenge to global health systems and the practice of orthopaedics worldwide. To adapt, the orthopaedic community has shifted its treatment priorities to focus on acute care in concert with the efforts of other healthcare specialities. New orthopaedic surgery protocols have reflected the need to both preserve resources and limit infection risks. There has been a significant move towards virtualising both orthopaedic care and training. It remains to be seen how and if these changes will be incorporated into orthopaedic practice beyond the pandemic.

Key Phrases

1. An increased utilisation of telemedicine in the outpatient setting was observed.
2. A shift to focus on acute surgical cases rather than non-urgent surgical procedures was key during the COVID-19 pandemic.
3. A reduction in outpatient and elective cases was intentionally planned as a measure to reduce transmission and divert staff to combat COVID-19.
4. Orthopaedic surgical theatres often reduced staff as part of the response to COVID-19, including students.
5. Orthopaedic training continues in the form of virtual engagements, and attempts were made to maintain practical skills training through technology.

No competing interests declared.

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