

CURRENT CONCEPTS REVIEW

The Delivery of Orthopaedic Care amidst COVID-19 and Social Distancing

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Abstract

In this paper we present the findings of a literature review covering articles published in the last three decades describing the application of telemedicine in orthopaedics. A review of the PubMed Central and Medline provided 75 articles studying the role of telemedicine, the majority directly examining the application of telemedicine in orthopaedic patients. We report the summarized findings of these studies, the financial and HIPAA considerations of using telemedicine, and provide an example of our single urban level-1 trauma center's strategy for incorporating telemedicine into the clinical practice of orthopaedic surgeons during the COVID-19 pandemic.

Level of evidence: V

Keywords: COVID-19, Orthopedics, Social distancing, Telehealth, Telemedicine

Introduction

The COVID-19 pandemic has placed an unprecedented burden on healthcare systems across the globe (1). In efforts to mitigate transmission and spread of the virus, social distancing, the act of maintaining at least six feet from another individual, has been recommended for all individuals, but the impact of this will take weeks if not months to appear (2). Social distancing efforts have far reaching implications in the delivery of medical care to all patients, both with and without COVID-19. Despite the recommendations for social distancing, patients will still require non-Covid-19 related care in the midst of this pandemic. This has grave implications in terms of stressing the healthcare system and alternative treatment methods need to be explored, especially those that limit direct physician to patient contact whenever possible. Telehealth provides orthopaedic surgeons a viable alternative to in-office visits for patients requiring postoperative follow ups or triage to determine if the patient requires an in-office visit, and in some instances potentially replace routine clinical follow-ups (3–5).

Telehealth is defined as the delivery of preventive, diagnostic, and curative health services over distance

(3). There are three primary forms of telehealth including: video conferencing, telephone calls, and instant messaging including text messages, email, or health system messaging services (5–7). The ideal form of communication is the use of video conferencing with telephone calls a second option. Both of these are readily accessible to many patients in 2020. Studies prior to the global pandemic found that a 75% of patients would prioritize having access to care in place of an in-person office visit (6).

Due to the hands-on nature of orthopaedic practice, telemedicine has not been heavily incorporated into the everyday practice of surgeons until this global pandemic started (7). The most common utilization of telemedicine in delivery orthopaedic care is in teleconsultations, and the results have been favorable with reductions in cost, emergency room visits, and misdiagnoses (8–15). Considering social distancing and the most recent guidelines from the American College of Surgeons (ACS) and Centers for Medicare and Medicaid Services (CMS), orthopaedic practices should move towards delivering care via through telemedicine and virtual clinic.

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Given the current state of the U.S healthcare system, we have provided a review of the most recent recommendations from the ACS and CMS regarding the practice of Orthopedic surgery during the COVID-19 Pandemic (16,17). Furthermore, we have conducted a review of the literature specific to the role of telemedicine in the practice of orthopaedics, and the changes incorporated to deliver care to orthopaedic patients at a single, level-1 urban trauma center.

Materials and Methods

We searched PubMed and the Cochrane databases for studies published from January 1990 to April 1, 2020 for randomized clinical trials, meta-analyses, systematic reviews, observational studies, and retrospectives involving the use of telehealth in the delivery of orthopaedic care. Furthermore, the references of each selected article was reviewed for additional references. Articles were included following review and agreement amongst the authors, with a goal of creating a comprehensive review of the role of telemedicine in orthopedics, and its use during COVID-19 within each orthopaedic subspecialty.

Results

Patient Selection: Emergent, Nonemergent, Elective, and the Undiagnosed Patient

Emergent orthopaedic cases are potentially life or limb threatening emergencies require immediate intervention, including both surgical and medical therapies. Injuries and pathologies qualifying as orthopaedic emergencies include open fractures and traumatic amputations, crush injuries, compartment syndromes and limb ischemia as well as certain nerve and tendon injuries, infection (periprosthetic joint infections, osteomyelitis, septic joints, etc), spinal cord compression, post-traumatic dislocations, hip fractures and unstable or intraarticular fractures (18). Delays in definitive intervention for these injuries can have a dramatic impact on the patient's outcome, resulting in permanent disability, loss of limb, or even death. Inpatient and outpatient evaluation for these patients should be a priority in the acute setting in order fully assess the extent of the injury.

Nonemergent orthopaedic injuries require prompt attention but can often tolerate delayed surgical intervention. These include sprains, strains, certain ligament and tendon injuries, arthritic conditions, biopsy and resection of bone or soft tissue tumors, malunions, some nerve and tendon injuries, mechanical loosening of prosthesis, etc (19–21). While not all of these injuries and pathologies require immediate intervention, delay can lead to increased pain and discomfort, anxiety, and decreased patient satisfaction (21).

Elective procedures can be delayed for weeks, months, or possibly even years in some cases. Common elective procedures in orthopaedics include arthroplasty for painful arthritic conditions, chronic tendon rupture such as rotator cuff pathology, nerve compression (carpal tunnel, cubital tunnel), and many arthroscopic procedures. These procedures alleviate significant pain and can dramatically improve a patient's quality of life.

While not ideal, delay in time to surgery is unlikely to result in irreversible harm to the patient and may be necessary in instances of extreme strain on the healthcare supply chain and system.

In new or undiagnosed patients, the mechanism of injury and history should be utilized to triage patients as emergent, nonemergent, or elective. The initial triage can be performed by incorporating telehealth strategies; telephone calls with new patients can not only appropriately triage the patient, but also increase patient satisfaction as their concerns will still be heard (21).

The need for an in-office evaluation can be difficult to assess even with telemedicine, which depends on the comfort level both the patient and surgeon as important considerations. The current guidelines from the American College of Surgeons (ACS) for the triage of orthopaedic patients details recommendations for each Orthopaedic subspecialty, both for elective and nonelective procedures (17). In broad strokes, patients with emergent and urgent musculoskeletal injuries should be scheduled for an in-office visit. Indications for scheduled office visits include acute joint pain in the setting of an injury, acute traumatic injury, the inability to bear weight, wound drainage or other cause for infection, osteomyelitis, new neurological deficits (cervical myelopathy, acute radiculopathy, scoliosis, weakness of the upper or lower extremities, acute loss of function or change in sensation), acute tendon laceration or rupture, acute loss of function, any dislocation or new fracture, and musculoskeletal oncology patients undergoing chemotherapy or radiation, with impending pathological fracture, or aggressive benign lesions.

The Center for Medicare and Medicaid Services (CMS) has released tiered guidelines for surgical procedures amidst the COVID-19 pandemic: tier 1 – postpone, tier 2 – consider postponing, tier 3 – do not postpone (16). As it relates to orthopaedics, the recommendation is in line with classifying patients as emergent, nonemergent, and elective. Tier 1 procedures are outpatient, low acuity surgeries, for non-life or limb threatening injuries. Examples include trigger finger and carpal tunnel releases. Tier 2 procedures are moderate acuity, requiring in-hospital stay, and performed in healthy patients. Delays in the surgery are non-life threatening in the immediate setting but can increase the mortality and morbidity in the future. These procedures include total hip and total knee arthroplasty, spinal fusions, and laminectomies. Finally, tier 3 procedures are high acuity surgeries in patients where delay would significantly increase the chance of morbidity and mortality. This includes surgical intervention for hip fractures, acute limb ischemia or compartment syndrome, and intervention for spinal cord compression.

Injuries and pathologies not recommended for scheduled in office visits may be appropriate for telemedicine. The experience of using telemedicine can vary greatly depending on the clinical practice, the resources available to the practice, the patient volume, and the financial and legal consideration.

Shoulder and Elbow

In shoulder and elbow patients, the incorporation of

electronic completion of validated scoring indices has been shown to be a simple, yet effective way for patients to be evaluated (22). Furthermore, patient's completing the indices themselves may provide a more accurate score due to the elimination of potential sources of bias (23). In patients undergoing arthroscopic rotator cuff surgery, telehealth provided more efficient postoperative evaluations, with equivocal levels of pain and satisfaction (24). Substantial research has been performed evaluating the effectiveness of telemedicine in measuring range of motion, with studies finding telemedicine measurement comparable to clinical measurements (25–28). In instances where smartphone photography apps are unavailable to the patient, surgeons may be able to use screen-capture to create photographs use in the applications.

Spine

The high rates of complications following spine surgery pose a difficult challenge for surgeons to balance with the current risk of COVID-19 (29). However, several studies have outlined potential navigation of the postoperative care of these patients utilizing telemedicine. A study following patients undergoing lumbar discectomies reduced postoperative visits while retaining the ability to identify postoperative complications through a web based app (30). Clinical evaluation of patients can also be performed via telehealth, with video conferencing allowing for patient interviews, and the existence of standardized procedure for evaluating conditions like scoliosis using photography (31).

Pediatrics

Telemedicine has been utilized in virtually every pediatric specialty with success, but the use in orthopaedics is not well described in the literature. In pediatric orthopaedics, telehealth has been used both for initial evaluations and follow-up/preoperative evaluations, providing to be especially effective in patients with known disabilities or barriers to transportation (32). These patients can often be treated without the need for in person follow up or evaluation (33). Furthermore, as with the evaluation of adult patients suffering traumatic orthopaedic injuries, the evaluation of pediatric fractures and other pediatric orthopaedic problems, can also be performed via telehealth consultation (13,15).

Oncology

Musculoskeletal oncology unique subspecialty, with few fellowship-trained specialists, caring for patients whose survival is greatly impacted by timely treatment (34). More than 40% of patients are referred to another institution for their care after their initial diagnosis, causing significant delays time to treatment (35). The use of telemedicine in orthopaedic oncology was demonstrated as a viable and cost-effective model in first time appointments. Aponte-Tinao et al. performed a cost analysis, utilizing an \$80-dollar charge per telemedicine appointment, and found a decrease in healthcare cost of 12% if appointments were not in-office (36). Furthermore, more than 52% of the patients in the study were

diagnosed during their first visit and did not require any additional orthopaedic oncology care. Other applications of telemedicine in the field of musculoskeletal oncology are limited, but parallels can be drawn to medical and surgical oncology (37–39). Primarily used in follow-up patients, studies have demonstrated significant increase in follow up rates, as high as 1000%, especially in rural settings where patients must travel long distances and may not have access to reliable transportation (40). Telemedicine appointments for preoperative evaluation as well as postoperative follows up have been successful in surgical oncology clinics (41–43). Additionally, tumor boards are a vital component of the multidisciplinary approach to providing comprehensive cancer care, and can be performed virtually using video conferencing and screen sharing for radiographic and histologic images (44). While oncology would, and should, be evaluated in-person, these patients are at increased risk of complications and mortality from COVID-19 due to the severity of their illness and potentially compromised immune systems. Current CMS and ACS guidelines recommend scheduled visits to be maintained, and surgical interventions continue as scheduled in orthopaedic oncology patients (16, 17). However, in low-risk patients or those with benign/stable tumors, telemedicine may be a more appropriate modality for their clinical evaluations.

Trauma

In orthopaedic trauma patients, telemedicine has been used for the routine follow ups of patient sustaining closed fractures (45). Following their 2-week follow up appointments, the remainder of the follow ups were performed via video conference at the 6-, 12- and 24-weeks mark. Patients with both upper and lower extremity fractures, treated operatively and nonoperatively, were included with no difference in complications. Within the hospital, video conferencing orthopaedic consults allowed for patients to be evaluated without increases in adverse outcomes, and provides an opportunity for surgeons to deliver high quality care to patients while minimizing exposure to patients potentially infected with COVID-19 (8–11,46,47). Orthopaedic consults via telemedicine are best accomplished through the use of not only video conferencing with the consulting clinician and patient, but also benefit from the use of teleradiology technology to effectively send clinical and radiographic images (12). Incorporation of readily available technology, such as an iPad, to provide the inclusion of multimedia during point of care consults further reduces resource utilization resulting from orthopaedic consults (13–15). The use of telemedicine has also been shown to reduce unnecessary patient transfers following orthopaedic trauma, fewer unnecessary emergency room visits and fewer missed fractures (48–50).

Hand, Foot and Ankle

In rural settings, telemedicine has been especially effective in the evaluation and management of hand trauma, significantly reducing unnecessary transfers and escalations of care (7). As with other orthopaedic

subspecialties, telehealth and smartphone applications may be a viable alternative to in office range of motion measurements of the wrist, hands foot and ankle, allowing for comparable assessment of the patients function and progress (51,52).

Sports and Adult Reconstruction

In sports and adult reconstruction patients, telemedicine has shown to be an incredibly effective tool, with high rates of patient satisfaction (53). Telemedicine can be used to not only evaluate osteoarthritis in new patients, but also in the postoperative follow up care of patients undergoing TJA (54–56). In sports, the initial follow up period after ACL reconstruction has shown to benefit from telemedicine, allowing surgeons to follow their patients progress remotely with daily updates and identification of possible complications (57,58). The use of telemedicine in TJA patients has been shown to reduce the number of in-clinic visit and calls to the office and improve follow-up efficiency without compromising patient outcomes (59,60). Sharareh et al. found patients with five scheduled skype calls in addition to their in-office visits, found significant time saved due to a decrease in unscheduled appointments and calls (59). A virtual clinical is particularly useful for patients with routine follow up visits. Postoperative follow up visits can be performed via telemedicine without compromising patient care (59). One area of concern with telemedicine is the implementation of imaging modalities in assessing a patient's progress. This is addressed by Wood et al. who had patients undergoing the imaging study, and then have the imaging reviewed electronically by the surgeon. Review of radiographic images in this manner resulted in no increases in complications, with equivocal time spent in the radiology department (60). Furthermore, similar to shoulder and elbow patients, the electronic delivery of validated scoring indices following TJA can eliminate potential sources of biases and provide more accurate scores (23). Regarding the measurement of range of motion following knee surgery, as with other orthopaedic subspecialties, smartphone applications and telehealth have been shown to be comparable to clinical measurements (61,62). Postoperative rehabilitation is another consideration for all orthopaedic patients, especially those undergoing knee surgery (63). Numerous telerehabilitation and at home rehabilitation programs are available to provide patients with the essential therapy they need, without increasing their risk of exposure to COVID-19 and maintain social distancing practices (63,64). Telemedicine provides arthroplasty patients a simple and safe way to communicate with their surgeon in the postoperative period, reducing in-person contact, and the number of unnecessary hospitalizations following TJA (65).

Single Institution Experience

Prior to the onset of the COVID-19 pandemic, telemedicine was not something that was used at our institution. As soon as social distancing recommendations were implemented across the state and region, the institution responded promptly by scheduling

telemedicine visits for patients. Providers were asked to “scrub” their schedules to determine which patients could be offered a telemedicine visit. In general, patients were very receptive to the idea of touching base with their physician over the phone. Furthermore, due to the high level of anxiety within the general public related to exposure to the novel coronavirus, most patients were relieved to “touch base” with their physician or provider over the phone.

In just a brief period of time, the capabilities of our telemedicine visits have expanded from audio to an audiovisual platform, allowing a more interactive visit in which a limited physical exam can be performed, and face-to-face contact can be made. While COVID-19 has no obvious end in sight, we should continue to explore and improve our utilization of telemedicine within the field of orthopaedics. In general, it is an important platform for both patient satisfaction and safety and helps limit resource utilization, especially in times of dire need.

Discussion

The telemedicine model of healthcare delivery has evolved tremendously over the last three decades, with the most dramatic changes occurring in the last fifteen years with the widespread availability and accessibility of smartphones and novel technologies (66). The current global pandemic due to a novel coronavirus strain, COVID-19, has placed an unprecedented burden on the health system as hospitals and clinicians struggle to find balance between flattening the curve and minimizing exposure with the needs of their patients (1,67).

While the role of telemedicine in the field of orthopaedics has slowly grown in recent years, hospitals and orthopaedic groups must dramatically change their practice models to a virtual clinic and telehealth care delivery model. While limited in certain subspecialties, this review of the literature regarding the application of telemedicine in orthopaedics has demonstrated telemedicine to be a more than sufficient care model in the initial, routine, preoperative evaluations, and postoperative follow up visits (4,8,32,36,38,59). Surgeons should be diligent when stratifying patients between in-office and telehealth visits and utilize CMS and ACS guidelines to reduce unnecessary travel and patient exposure, especially in the elderly who are particularly vulnerable (68). As the pandemic continues, patient can still have their orthopaedic needs met high quality and accessible care without diminishing patient satisfaction or causing undo harm (7, 24). In practice, this may allow for physician assistant and nurse practitioners to have play a significant role in telemedicine visits. This advanced practice providers can be effective in assessing a patient's progress postoperatively, or in their initial injury evaluation. The utilization of physician assistants to perform medical screening examinations via telemedicine has gained traction during the COVID-19 pandemic with multiple urban medical centers employing these systems in their emergency rooms(69). Such a practice not only ensures the patient undergoes a thorough screening with a highly trained provider, but also provides the healthcare

worker with an extra degree of protection. This point of care telemedicine screening and triage process can not only identify the appropriate level of care a patient will require, but also if there is any concern over the patient potentially having COVID-19, an exposure that would place all of the healthcare staff at risk.

One of the largest concerns regarding telehealth is physician reimbursement. In a procedure driven specialty, the financial impact of CMS and ACS recommendations to restrict elective surgeries can be crippling. The current payment model codes visits on multiple factors including level of care, time, procedures, and imaging performed. There is simply no feasible way for orthopaedic surgeons to generate equivalent relative value units using telemedicine as with performing total hip and total knee arthroplasties, which with Medicare and Medicaid are approximately \$838 and \$1515 for THA and \$903 and \$1514 for TKA, respectively (70). Telehealth reimbursement is complicated by current CMS and state laws. In California, reimbursement rates for in-office postoperative visits costs \$55 to \$75 dollars per visit, while asynchronous telehealth payment is between \$25 to \$30 per visit (66). However, this is argued to be balanced by increased efficiency allowing more patients to be seen, with multiple studies evaluating the use of telehealth in orthopaedics showing a dramatic reduction in the time spent by the clinician evaluating each patient (45,47,60). While CMS payments for telehealth under normal circumstances is limited to patients with Medicare residing in particular geographic areas and requires real time, interactive, communication between the clinician and patient, the global pandemic has resulted in expansion of telehealth payments (66,71). Among other changes, the expansion has removed the geographic restriction, and will allow for physicians to be reimbursed for Medicare patients regardless of their geographic location (72). Furthermore, state specific changes are being implemented as the pandemic progresses in order to remove barriers to care, optimize delivery of telehealth, and reduce potential exposure of patients to COVID-19 (73).

Another limitation of telemedicine is the medicolegal and HIPAA requirements. Legal guidelines and regulations surrounding telehealth are strict and has previously limited the utility of telemedicine (74). As a result of the COVID-19 pandemic in the United States, the Department of Health and Human Services has relaxed regulations and penalties of HIPAA violations using telehealth, communicating through common products like Facetime and Skype (75). The use of these modes of communication can provide clinicians with easy to use and readily accessible devices, as well as dramatically

decrease the cost of overhead and implementation of telehealth. Currently, there are multiple HIPAA compliant telemedicine platforms that physicians may utilize and incorporate into their practice with relative ease. These platforms include "Zoom", "WebEx", "Healthie", and "Doximity". Other platforms exist, and it is of the utmost importance that physicians evaluate the platform of their choice for both HIPAA compliance and ease of use. While hospitals often opt for HIPAA approved methods of communication (i.e., Webex), there is no citable evidence that their encryption is more secure than that of WhatsApp or Apple's FaceTime. The recent shift to online classrooms and work meetings due to the pandemic has brought up doubts about which software may be most secure as classes have been 'hacked' and disrupted by external parties. Most notably, the videoconference software Zoom, a reportedly HIPAA compliant software, has been hacked numerous times with the intruder taking over the meeting(76,77). Additionally, almost all these programs are easily recordable, meaning encounters and protected health information can be saved or leaked to the internet. The risks and benefits of each software are something that must be decided internally.

With the appropriate precaution and care given to maintaining a patient's privacy, clinicians should feel comfortable using telehealth in its various forms during the COVID-19 pandemic.

Telehealth has the potential to be a crucial mode of care delivery during the COVID-19 pandemic. While historically under-utilized in the field of orthopaedics, telemedicine has proven to be a more than adequate method of providing all levels of outpatient care to orthopaedic patients. While the telemedicine with mitigate the financial impact to a small degree, there is no way for it to make up for the revenue generated by procedures. During this time of global crisis, it is essential for all clinicians, but within and outside of orthopaedics, to feel comfortable with telemedicine and know their patients are still receiving high quality care.

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