

# Return-To-Practice Roadmap In Orthopedic Surgery Of A Spanish Military Hospital After Covid-19 Pandemic

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## Research article

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## Abstract

**Background** The impact of the COVID-19 pandemic In Spain, especially in Madrid, suddenly affected all the activity of the hospital including the suspension of all non-urgent surgical procedures. What's more crucial, the urgent procedures were seriously obstructed by two factors: the mandatory protection measures (individual protection clothes, facemasks, and their initial stockout, etc), the redesigned flow of the patients in and out the operation room specially because the advisable diagnosis study of severe acute respiratory syndrome related Coronavirus 2 in each patient.

**Methods** We review the patients treated in our orthopedic department during the outbreak of Coronavirus disease 19. Based in our early experience and the emergency situation with high contagious rate in Madrid, Spain, we have built a list of considerations and recommendations to guide orthopaedic units in their resumption of their regular activity, focusing at the moment of reintroduce elective surgeries, during the contained epidemic phases.

**Results** The mortality rate in Coronavirus disease 19 patients was 3/9 and in the non Coronavirus disease group 4/23 developed pneumonia by Coronavirus2 (1 dead). There are no guidelines in literature for orthopedic surgeons in the postpandemic phase.

**Conclusion** Coronavirus disease 19 patients have an elevated morbidity and mortality, surgery during this pandemic can facilitate pneumonia by Coronavirus2. The return-to-practice measures in the orthopedic units must take into account this fact. We recommend for each orthopedic surgery department to create a flowchart, as ours, in order to restart surgical activity.

## Introduction

On March 11th, 2020, the World Health Organization declared the disease caused by SARS-CoV-2, Coronavirus Disease 2019 (COVID-19) as a pandemic<sup>1</sup>.

The impact of the pandemic In Spain, especially in Madrid, suddenly affected all the activity of our hospital and quickly forced the adoption of damage control measures at all levels. Among them, hospitalization capacity doubled to 549 beds, the Intensive Care Unit was strengthened quadrupling the number of beds to 32, and emergency beds went from 14 to 73. In addition, non-urgent surgical activity was cancelled following the recommendations of the regional and national health authorities<sup>2,3</sup>. In addition, our Hospital, as a military hospital, has been leading the medical support during the Operation "Balmis", which has consisted of deployment of the Spanish Armed Forces on national territory to confront the health emergency situation caused by the COVID-19 in Spain.

The redaction of this review is preceded by the slowdown in COVID-19 pandemic, there should be a sustained reduction in rate of new COVID-19 cases in the relevant geographic area for at least 14 days before resumption of the normal activity<sup>4</sup>. This trend advises the planning of how to gradually reintroduce the usual activity of the surgical units that have seen their activity decrease drastically and

whose immediate resumption is impossible considering the current situation of the post-emergency pandemic transition phase<sup>5-7</sup>.

There is no evidence in current literature to guide orthopedic services towards the progressive reintroduction of surgical activity<sup>8</sup>. The main scientific societies leave decision-making to each center and the existing guidelines are mainly oriented to activity during the pandemic peak period.

The objective of this publication is to facilitate decision-making roadmap during the contained epidemic phases<sup>9</sup>, focusing at the moment of reintroduce elective surgeries. This information based on our suffered experience could help other Orthopedic departments about how to face up the following phases of these pandemic

Our secondary goal is to confirm if COVID 19 patients who have undergone urgent orthopedic surgery have an increased morbidity and mortality<sup>10,11</sup>.

## **Materials And Methods**

A systematic review was performed based on all relevant recommendations for orthopedic surgeons published up to April 20th, 2020. An electronic database search of Pubmed, Medline, Embase Science Citation Index Expanded, the Web of Science, Google Scholar and scientific societies (keywords: "COVID 19, guidelines"). All electronic databases were searched for articles published using the medical subject headings (MeSH) or entry terms (Supplementary Material) "orthopedics, "surgery" and "diagnosis". The reference lists from the included studies were searched to identify additional studies. The literature search strategy and study selection included 63 publications, of which 19 published articles were systematically analyzed to achieve a summated outcome

Based on it, we have built a roadmap developing the main lines to take into account, thinking about the points of maximum interest for the orthopedic surgery departments: ambulatory orthopedic consultation, trauma emergency department, hospitalization, surgical activity, as well as diagnostic methods.

On the other hand, we reviewed all our surgical activity from March 14 (date of activation of the national alarm state in Spain), to April 30, 2020, registering different variables such as: age, sex, reason for surgery, pre-surgical Polymerase Chain Reaction (PCR) for Severe acute respiratory syndrome-related coronavirus 2 (SARS-CoV-2), post-surgical PCR SARS-CoV-2, perioperative complications and death. We compare all these variables in 2 groups, one COVID diagnostic (-) and the other COVID diagnostic (+) (PCR + or radiological test compatible with pneumonia). We accept only patients older than 60 year. Being small groups, we did not analyze any statistical analysis to detect whether COVID patients have an increased risk of morbidity and mortality. But we describe trends.

## **Results**

We review 19 published articles by 4 members of the orthopedic department of our hospital to achieve a summated outcome and to create a guideline in order to build up our activity in the post pandemic phase.

Between March 14th and April 30th, 32 patients older than 60 years underwent surgery, all of them because of fractures. 9 of the 32 patients had respiratory symptoms and radiological data of pneumonia and/or PCR (+). This was our COVID (+) group. In this group, 3 patients have PCR (+) before surgery and 4 after surgery. Of all the COVID (+) patients, 3 died during the first postoperative month and 1 suffered a pulmonary thromboembolism, that required treatment with low molecular weight heparin. No surgical wound infection was recorded.

In the non-COVID group (23 patients), there were 4 readmissions in hospital during the first month of follow up because of COVID 19 pneumonia and one of them dead. In this group we did not found infections of the surgical wound. There were two postsurgical complications observed: 2 early osteosynthesis failures in hip fractures because hip screw was intraarticular as the screw was too long.

## Discussion

This report, to the best of our knowledge, is the first that focus fractures surgery and describe early mortality in COVID 19 patients older than 60 years. The city of Madrid is one of the tree main and earlier focus of diseases outbreak in Spain. Spain in one of the most affected countries in relative terms in the world. All of the 32 patients included in this study came from Madrid. We choose patients older than 60 years because we wanted to focus on older population as they are the most affected by SARS-CoV-2.

In the COVID group and in non-COVID group, there were no infections of the surgical wound. No differences were found in wound complications. We could no find any study leading with surgical wound and COVID 19.

In the non-COVID 19 group: There were two postsurgical complications observed: 2 early osteosynthesis failures in hip fractures. This fact is unusual as the average of osteosynthesis failure per year in our hospital is 4 failures. We found too high the number of failures in one month and we explain it because the surgical team wore personal protective equipment (N95 mask, face visor mask, 2 pairs of gloves, waterproof gown) that makes physically harder the surgery so it could exhaust the surgeon so choosing incorrect screw length. None of them have symptoms of COVID 19 before surgery. 4 patients developed symptoms of COVID 19 quickly after surgery. We believe that surgical patients may have a higher risk of infection with SARS- CoV-2 or develop the disease. Surgery may not only cause immediate impairment immune function<sup>12</sup> but also induce early systemic inflammatory response.

In the COVID group the mortality rate was unacceptably high during the early follow up (3/9). This leads us to think that COVID 19 patients who undergo surgery need exhaustive follow-up to foresee the possible complications that, with a high incidence in this study, lead to death. Currently, there's no specific treatment for SARS-CoV-2 infection with proven efficacy available, and supportive measures remain the main-stay of COVID-19 treatment. Thus, the patient's immune function is a major determinant of the

disease severity, and populations with low immune function, like older people are more vulnerable and have high mortality after COVID-19 infection<sup>11,12</sup>. Our work coincides with Lei et al<sup>11</sup> in high mortality rate, which should put all surgical services on alert when resuming their usual surgical activity, if their population has not yet achieved immunity against this virus. This fact is our main concern and the reason for developing a roadmap to the normality as follows.

#### **Literature review and roadmap in orthopedic department:**

##### **A. Return to practice in the ambulatory orthopedic consultation.**

In the development of the ambulatory orthopedic consultations it will be convenient to associate the telemedicine with the face-to-face consultation. An overstress is expected on outpatient at the confluence of three patients cited sources from the time the patients be allowed to free movement. Therefore, according to the way that patients have been screened by telephone, the less extra workload it will be involved. Until then, telematic consultations should be prioritized as recommended by the Spanish Society of Orthopedic and Trauma Surgery<sup>13</sup> and the Spanish Society of Preventive Medicine, Public Health and Hygiene<sup>14</sup> in their guidelines, and as it has been included in other international works<sup>15</sup>.

Only oncological patients, follow-up of traumatic injuries and others pathologies whose prognosis may worsen without a correct and close follow-up will be cited for face-to-face consultation. Staff of the receiving ward should be notified in advance of any transfer and must be informed that the patient has possible or confirmed COVID-19<sup>16</sup>.

##### **B. Return to practice in the trauma emergency department.**

During the contained epidemic phase<sup>9</sup>, a progressive rise in the number of admissions to the Emergency Department is to be expected, as the containment measures are withdrawn. During the time deemed appropriate by the health authorities, protection measures against COVID-19 must be taken into account to avoid a possible outbreak and limit a second wave. The protocols of each center will be maintained<sup>17</sup>, ensuring at all times the availability of personal protective equipment for the staff.

The period for avoiding indications for surgical treatment when exists an adequate conservative treatment has not yet been agreed, furthermore, that period will depend on:

- Logistics situation of each center: recovery of medical staff and recovery of resources after the first wave of the epidemic.
- Epidemiological situation in our patients. This is especially important since a high number of complications have been described in COVID-19 patients who underwent surgery with a significant increase in mortality<sup>18,19</sup>.

##### **C. Return to practice in hospitalization.**

Due to the need to avoid contact between COVID-19 and non-infected patients, it would be advisable to ensure the existence of a clean area in the hospital. For this, it is essential to determine the diagnostic tests necessary to be admitted in this area, and protect all patients from hospital-acquired COVID-19 infection throughout the contained period with the use of proper surgical masks and hand hygiene by healthcare personnel and patients<sup>18</sup>. Visitors to all areas of the healthcare facility should be restricted to essential visitors only, such as parents of pediatric patients<sup>16</sup>.

- Clean area of hospitalization: contact precautions should be taken, such as the use of a mask, gloves and proper uniform for all members of the staff, apart from the screening of subclinical infection in healthcare personnel<sup>20,21</sup>. A member of the unit must be designated to carry out surveillance, prevention and control measures, and to act as a liaison with the Epidemiological Surveillance Service<sup>22</sup>. (figure 1)
- COVID-19 area of hospitalization: precaution should be estimated according to each facility. The personnel should be equipped with personal protective equipment and in the daily evaluation of the patients by the orthopedic surgeon; assess that this monitoring can be carried out by non-susceptible professionals (younger staff without comorbidities)<sup>14</sup>.

#### **D. Return to practice in surgical activity.**

Prior resumption of elective surgery, facility shall have appropriate number of intensive care unit and non-ICU beds, personal protective equipment, ventilators, medications, anesthetics and all medical surgical supplies<sup>4</sup>. Four possible scenarios are possible to consider (COVID-19 screening must be done on all of them):

- Emergency Surgery: the surgical treatment of a compartment syndrome or open fractures must be performed without delay in all cases adopting appropriate precaution measures.
- Urgent Surgery: patients with fractures of the long bones can wait until the patient is medically stable, but should generally be done within 2 days, reducing the length of stay in hospital the least number of days required.
- Preferential Elective Surgery: the surgery should not be delayed, and an attempt will be made to schedule at the usual time according to the waiting list, adopting precaution measures depending on the type of patients.
- Elective Surgery: this surgery that is scheduled in advance because it does not involve a medical emergency. In case of elective surgery, it should be delayed until the facility recovers all its logistical and healthcare capabilities.

The change in the epidemiological phase will be dictated by the competent health authority. In all phases, type of surgeries must be adapted to the logistical and human capabilities available (Figure 2).

Following the directions of the 'Disease Outbreak Response System Condition' (DORSCON)<sup>15,19</sup>, that is a colour-coded framework that shows the current disease situation, we could plan elective surgeries, considering its complexity and the estimated length of hospital stay<sup>17,19,23</sup> (Table 1).

In the absence of standards in the recommendations, each center must establish the clinical, analytical and microbiological criteria, imaging tests or epidemiological history that make a patient candidate for elective surgery. Based on the available information, we have developed a specific protocol in our center to reintroduce elective surgeries. We propose, in all elective surgery cases, a COVID-19 screening based on epidemiological, clinical, analytical criteria, imaging tests and microbiological tests (Figure 3). Moreover, we should prioritize the list of previously cancelled and postponed cases.

## Conclusion

We are facing a continuous epidemiological changing situation, in which we cannot yet ensure the reappearance of new outbreaks as aggressive as the one that affected us in March 2020.

This retrospective cohort study showed a 33% mortality rate in the COVID group. Surgery during this pandemic can facilitate pneumonia by CoV-SARS 2. The return-to-practice measures in the orthopedic units must take into account this fact.

The two main scenarios in which we will work in the following months are the COVID-19 patients care and non-infected patients care, which will require great commitment from other hospital services, as Internal Medicine or Microbiology, in the screening and treatment of these patients. Surgical treatment indication will be expanded progressively, reintroducing surgical procedures according to complexity levels, logistics capacity of each facility and the epidemiological situation.

In any case, planning the progressive abandonment of COVID-19 measures and operational structures should allow to resume them all immediately if a new COVID-19 outbreak appears.

## List Of Abbreviations

COVID 19: Coronavirus disease 19

PCR: Polymerase Chain Reaction

SARS-CoV2: Severe acute respiratory syndrome related Coronavirus 2

DORSCON: Disease outbreak response system condition

## Declarations

Ethics approval and consent to participate: The authors declare that this work was exempted of statement of ethics approval by the *ethic committee of Hospital Central de la Defensa (Ceim)*.

Consent for publication: Individual person's data for publication are consent from all authors included in the study.

Availability of data and materials: Data and material are available, please contact authors if applied.

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Authors' contributions: The authors declare that all of them collaborate in this manuscript: DCV analyzed and interpreted the patient data and was the major contributor in writing the manuscript. CRM, JAOG, RGC and MHM reviewed all relevant papers published about Orthopedics surgery and COVID 19, AMH created table and figures. FJAJ translate the manuscript. All authors read and approved the final manuscript.

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## Table

*Table 1. Levels of surgical complexity. Modified from<sup>21</sup>.*

	1	2	3	4
Surgery duration (min)	<30	30-60	60-120	>120
Estimated blood loss (cc)	<100	100-250	250-500	>500
Number of surgeons	2	3	4	>4
Postoperative ICU stay	<1%	1-5%	5-10%	10-25%
Length of hospital stay (hours)	0	<24	24-48	>48

## Figures



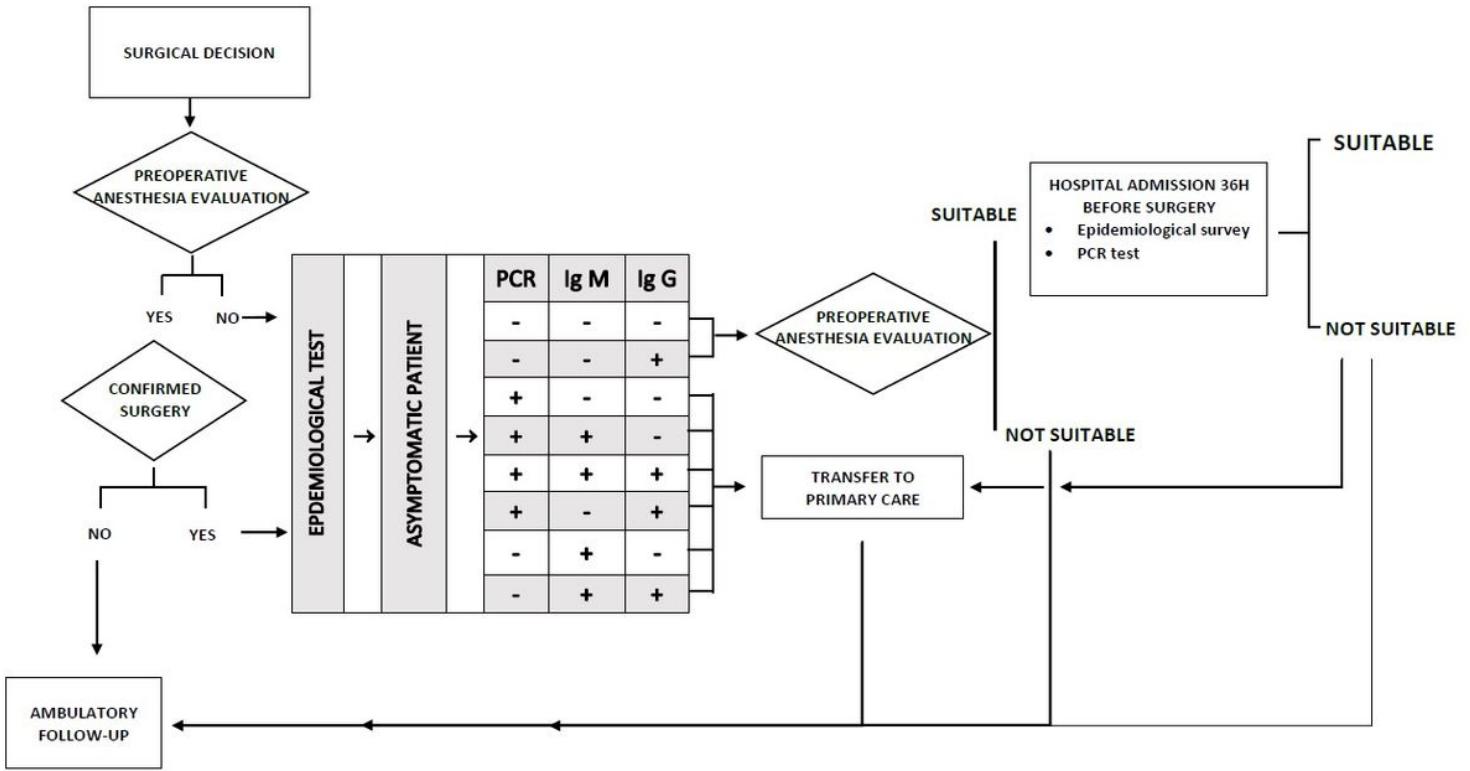
**Figure 1**

Personal protective equipment in ward and consultation.

CONTAINED PHASE	CONTAINED PHASE Low infection rate	CONTAINED PHASE High infection rate	UNCONTAINED PHASE Health emergency
<ul style="list-style-type: none"> <li>• Normal daily surgical activity</li> </ul>	<ul style="list-style-type: none"> <li>• Arthroscopy surgery</li> <li>• Tendon injuries with bad prognosis without surgical treatment</li> </ul>	<ul style="list-style-type: none"> <li>• Displaced articular fractures</li> <li>• Long bone fractures</li> <li>• Musculoskeletal oncology surgery</li> <li>• Sensitive-motor deficits</li> <li>• Vertebral fractures with bad prognosis without surgical treatment</li> </ul>	<ul style="list-style-type: none"> <li>• Fragility fractures requiring surgery</li> <li>• High energy trauma</li> <li>• Compartment syndrome</li> <li>• Vertebral fractures TLICS &gt;4</li> <li>• Incomplete spinal cord injury</li> <li>• Non-reducible joint dislocations</li> <li>• Acute septic arthritis with sepsis</li> <li>• Soft tissue injuries requiring surgery</li> </ul>

**Figure 2**

Types of surgery depending on the epidemiological situation.



**Figure 3**

Preoperative evaluation algorithm for elective surgery in the COVID-19 contained phase.