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Research Article

Risk of Occupational Infections in Orthopedic Surgeons in the Age of COVID-19: Preliminary Study

Loubet Unyendje*, John Mupepa and Jean-Marie Kapoli

Department of Orthopedic Surgery, University of Kindu, Maniema, DRC Medical School, HJ Hospitals, Democratic Republic of the Congo

***Corresponding Author:** Loubet Unyendje, Department of Orthopedic Surgery, University of Kindu, Maniema, DRC Medical School, HJ Hospitals, Democratic Republic of the Congo.

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Abstract

As covid-19 disease is a new threat to humanity, it is a global public health problem. It is transmitted mainly by contact with infected patients, by droplets and airways. In addition to this mode of universal transmission, orthopedic surgeons also run a high significant professional risk of contracting a Covid-19 infection during surgery, through blood, aerosol formation, electro cauterization. Mask ventilation, endotracheal intubation and the use of electrosurgical tools such as power tools for osteotomies, joint replacement surgery, reaming of bones, sawing and drilling, irrigation with saline solutions, are procedures that generate aerosols that can contaminate orthopedic surgeons after surgery.

Consequently, the orthopedic surgeon needs the basic safeguards of universal transmission as well as special methods to mitigate against the virus during surgery. Data is not sufficient to determine which mechanisms have been the sources of transmission so all are suspects requiring considerations.

The purpose of this article is to analyze the peculiarities of COVID-19 contamination on orthopedic practice in the DRC.

Keywords: *Covid-19; Orthopedic Surgeon; Contamination*

Introduction

The 2019 coronavirus disease (COVID-19) was declared a pandemic by the World Health Organization (WHO) on March 11, 2020, after the identification of 118,000 cases in 114 countries [1] which constitutes a new threat like other once-controlled epidemics such as Ebola. Doctors and other healthcare workers are in constant contact and are the most exposed to Covid-19 contamination by the fact that they have to take care of infected people. It would be unacceptable that the deaths of doctors during the COVID-19 pandemic were simply the result of having been exposed in their work to people infected with the disease when, unfortunately, this could have been avoided.

Particular interest was taken to understand certain specific aspects of Covid 19 and the risks of contamination during orthopedic surgical procedures, including the necessary safety measures in the operating theaters of our hospitals. It is widely believed that the COVID-19 virus is transmitted via droplets from the respiratory system of infected patients and contact with contaminated surfaces [2]. In hospitals, the probability of being infected for health workers is three times that of the general population [3,4]. Preserving the safety of providers is essential to ensure complementary care for the general population. In addition to this mode of universal transmission,

orthopedic surgeons on the other hand also run a significant professional risk of contracting a Covid-19 infection during a surgical intervention, through blood, aerosol formation, electro cauterization, mask ventilation, endotracheal intubation and the use of power tools for osteotomies, joint replacement surgery, reaming, sawing and drilling, saline irrigation, are all factors that can expose the orthopedist. Despite a fairly large number of surgeon deaths from covid-19, to our knowledge very few articles in the literature do not demonstrate whether the contamination was during surgery in the operating room. But despite this, we are called upon to demonstrate the different mechanisms of contamination in the operating room and to recall the various protective measures in the operating theaters during this period of Covid-19.

Methodology

Our descriptive cross-sectional and analytical study on the risk run by surgeons in the operating room during this covid-19 pandemic was carried out from a systematic review of the literature using the keywords "COVID-19", "Coronavirus", "Surgeon", "protection", "masks", "gloves", "gowns", "Helmets" and "aerosol" from open access databases such as Pubmed, Cochrane Reviews, Google Scholar during the year 2020-2021, in the orthopedic department of Hj Hospitals of Kinshasa finally to assess all the risk factors of contamination during orthopedic surgical procedures and the various protection methods that we apply.

Results

As there is a huge heterogeneity of articles and studies on COVID-19, but only very few articles deal with the effect of covid-19 on orthopedic practice. Since March 2020, the day of the declaration of the pandemic in the DRC until these days, several surgeons have died of covid-19, which raises questions as to whether they were contaminated during surgery or contamination. universal. In Italy, for example, more than 150 surgeons died between March 11 and April 26, 2020, announced the National Federation of Orders of Surgeons (FNOMCEO) [5], whose covid-19 contamination would it be during the procedures surgical or universal contamination. Since the sources of operating room transmissions were not identified, all potential sources must be addressed.

Discussion and Considerations

Contamination

The basic principle to avoid contamination is to avoid being exposed to the virus, doctors while playing the leading role in the management remain more exposed while it is widely accepted that the COVID-19 virus is transmitted via droplets from the respiratory system of infected patients [2]. For protection against airborne transmission, filter respirator masks should be used as they typically filter more smaller particles (0.3 µm) [6]. Although symptomatic patients are the main source of infection, asymptomatic individuals can also spread the disease and should not be overlooked [7]. The estimated average incubation time of COVID-19 is 5.1 days, but a group of researchers in the *Annals of Internal Medicine* and the *New England Journal of Medicine*, had found that most patients who become symptomatic do so within 11 or 12 days and the vast majority within 14 days [8]. This incubation time of up to two weeks increases the risk of contamination during consultations or evaluation of asymptomatic patients. Therefore, maintaining an interpersonal distance ≥ 1m is essential to minimize the spread of viral particles during social and clinical encounters [9,10]. This is how telemedicine is currently recommended.

SARS-CoV-2 can persist for up to 3 hours in aerosols, 24 hours on cardboard and 2 to 3 days on plastic [11]. The clogs worn by surgeons are made of plastic and can keep germs in for up to 3 days. This is why aeration of closed environments; frequent hand hygiene and surface decontamination are mandatory [12]. In view of this resistance in the operating room, we must remove any unnecessary material and disinfect all surfaces because the surgeon could be in contact with these contaminated surfaces.

Some authors have shown that viral RNA can be detected in blood samples, but the mechanism of blood transmission of SARS-CoV-2 is not yet understood [13]. This mechanism still under study could contaminate the orthopedist by the injuries caused by the exquisite

bones and the splashes during osteotomies, reduction of fractures. Preventive measures should include double gloving with the renewal of outer gloves during risky procedures [14].

Although there is no evidence to date, it is considered possible that SARS-CoV-2 is transmitted to the conjunctiva by aerosol. Preventive measures should therefore include the systematic wearing of glasses covering the eyes and the periocular skin. In a prospective study of conjunctival contamination during routine orthopedic operations, 43 (65%) of 66 glasses worn by surgeons were contaminated [15]. RNA from the COVID-19 virus had been documented in the gastrointestinal tract. Given the potential to aerosolize the intraluminal contents during endoscopy, this was considered high risk [13]. Likewise, due to prolonged contact with potentially high levels of the virus despite a lower risk of aerosol creation, open or laparoscopic surgery on the intestine was also considered high risk [16].

Risky procedures

The use of power tools such as power tools frequently results in contamination of all operating room personnel and contamination of the operating room surface [17,18]. These electrosurgical and high-speed devices (e.g. saw, drill) used during orthopedic surgery are known to generate aerosols [19].

Electrosurgical smoke

"Surgical smoke". Electrocautery generates plumes of smoke, which contain bioaerosols with viable and non-viable cellular material that subsequently poses a risk of infection [20]. Jewett., *et al.* have shown that different surgical power tools such as bone saws or electrocautery in cutting and coagulation mode lead to the generation of aerosols in the operating room [21]. Splashes produced during knee and hip replacements contain aerosols and can even lead to conjunctival injuries. Additionally, exhalation of respiratory secretions during tracheal intubation, ventilation, tracheostomy, cardiopulmonary resuscitation, and bronchoscopy can produce highly virulent airborne particles and increase the risk of aerosolization and droplet transmission [22]. Irrigation with saline solutions or copious lavage during joint replacements also increases aerosol generation and puts surgeons at high risk of contamination [23].

Orthopedic protective measures

The basic principle of avoiding contamination is to avoid being exposed to the virus. There are a variety of different recommendations for the protection of health workers given by each country or hospital. Although there are currently no clear recommendations regarding personal protective equipment (PPE) and surgical safety recommendations such as orthopedics and trauma should be followed before, during and after the operation. To avoid being exposed, several authors recommend telemedicine which has been recognized as an effective tool and thanks to telemedicine, it was possible to considerably reduce waiting times and optimize travel times and expenses [24].

Orthopedic protective measures before the procedure

Preserving the safety of providers is essential to ensure complementary care for the general population. a general consensus all patients undergoing elective surgery should be tested for COVID-19 preoperatively one day before surgery (the RT PCR test). While awaiting results, Contact and Droplet Precautions should be taken in addition to standard measures [25]. For each patient tested negatively, it is advisable to convert as much as possible from general anesthesia, which is an aerosol-generating procedure, to local or locoregional anesthesia, in order to avoid cross-contamination of the anesthesia team and reduce overuse of available resources. Ambulatory or short-term surgery should be encouraged to reduce the risk of nosocomial infection. Patients who test positive should not be operated on overnight but should be delayed for a minimum period of 3 weeks and require two confirmed negative PCR swab tests 24 hours apart.

Orthopedic protective measures during the operation

Suspected or confirmed cases of COVID-19 should be treated in a dedicated space, away from high-traffic areas and deprived of non-essential equipment. Surgery should be performed in negative pressure operating rooms to avoid spreading the virus outside the operating room. However, operating rooms are generally equipped with positive pressure systems to reduce the risk of surgical contamination. If negative pressure cannot be obtained, positive pressure should be turned off and a portable high efficiency particulate air filtration (HEPA) system with frequent air changes should be used [26]. Everyone present during surgery should wear PPE including surgical gloves, a long-sleeved, water-resistant surgical gown, surgical mask and full face protection with a face shield [27] or goggles in prevention conjunctival contamination during an osteotomy disposable plastic cups. Suction devices should always be used to reduce surgical smoke and aerosols generated during powered procedures [28]. The use of absorbable sutures is recommended to decrease the need for additional postoperative visits. For the same reason, the use of a splint rather than a cast to immobilize a limb is preferred [29].

Conclusion

The dynamics of the Covid-19 pandemic will continuously evolve with us, the basic principle to avoid contamination is to avoid being exposed to the virus while doctors are at the forefront in the fight against Covid'19 and are at great risk of being contaminated. They are called upon to master all the contamination mechanisms, the correct use of PPE and strict compliance with recommendations. Today, telemedicine offers incomparable advantages for controlling our patients remotely, although its limitations should not be overlooked. Orthopedic surgeons may require surgical protocols for the operating room specific to COVID which may be similar to AIDS and TJA.

State of Knowledge on the Subject

Our study adds to the knowledge of other new mechanisms of contamination of orthopedic surgeons with Covid-19 during surgical procedures.

Conflicts of Interest

The authors declare no conflict of interest.

Authors' Contribution

All authors have contributed to this study since conception, reading and all have approved the final version of this work.

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