SUMMARY OF RECOMMENDATIONS ON REGIONAL ANESTHESIA AND INTERVENTIONAL PAIN PROCEDURES DURING THE COVID-19 PANDEMIC

Jana Hassani,[1] Ghassan Kanazi[1*] and Dina Mouzayen[2]

Abstract

With the global peak of COVID-19 cases earlier this year, hospitals worldwide found themselves adopting specific policies pertinent to this pandemic. These policies include regulating the use of regional anesthesia in the operating room. Regional anesthesia is preferred over general anesthesia, as it carries a smaller risk of transmission to health care workers because it is not an aerosol-generating procedure. In addition, policies regarding interventional pain procedures have also been published. These procedures have been stratified based on urgency, with special considerations pertaining to both patient population and the medications used. This article aims to provide a summary of recommendations on both regional anesthesia and interventional pain procedures amidst COVID-19 pandemic, with a focus on how to proceed with patients in whom the infection is suspected or confirmed.

As of May 2020, there have been more than 5.8 million confirmed cases of corona virus 19 (COVID 19) across 213 countries. As this pandemic peaked, hospitals around the world found themselves overwhelmed with critically-ill patients, resulting in a global shortage of personal protective equipment (PPE). In an effort to preserve PPE and limit the spread of the virus, millions of elective surgeries and other medical services were put on hold. It is estimated that around 28.4 million surgeries have been postponed or cancelled during the 3-month COVID-19 surge, averaging to 2.4 million surgeries a week, approximately 72% of all elective cases.[1] However, as the curve of new COVID-19 cases begins to flatten, health care facilities are now adopting COVID-19 specific policies that allow these organizations to safely resume elective procedures.

The airway manipulation required during general anesthesia (GA) has rendered this technique an aerosol-generating-procedure, thus increasing the risk of transmission of this virus to healthcare workers. As such, the practice of regional anesthesia is preferred over general anesthesia, as it not only eliminates the need for airway manipulation but also decreases the risk of post-operative pulmonary complications, as it has fewer effects on respiratory function compared to GA, with or without muscle paralysis.[2]

The aim of this article is to discuss the risks and advantages of regional anesthesia and chronic

1 MD, Department of Anesthesiology and Pain Medicine, American University of Beirut Medical Center, Beirut, Lebanon.
2 RN, Department of Anesthesiology and Pain Medicine, American University of Beirut Medical Center, Beirut, Lebanon.
* **Mailing address of corresponding author:** Ghassan Kanazi, MD. American University of Beirut Medical Center, Beirut, Lebanon, Phone: +961 1 350 000 Ext: 6380. E-mail: gk05@aub.edu.lb

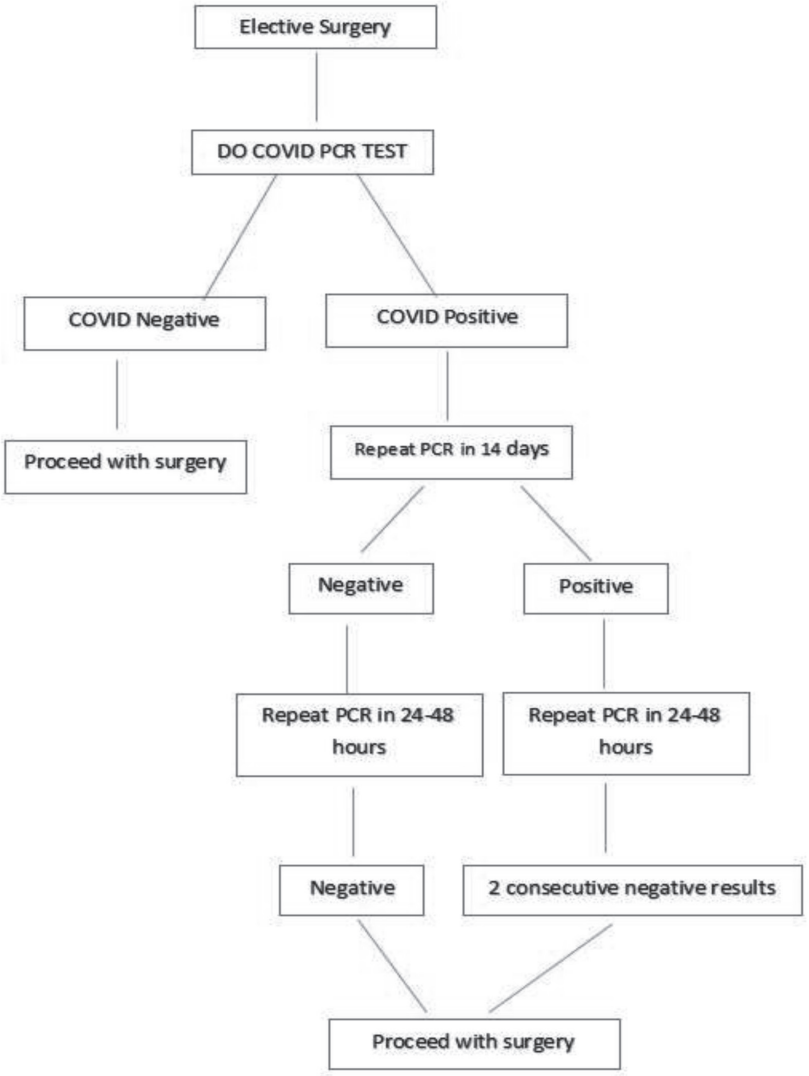
pain procedures in patients with either suspected or confirmed COVID-19 infections, with focus on each of the phases of care implicated. The first part of the article will provide recommendations for performing regional anesthesia, and the second part will address how to proceed with interventional pain procedures during this COVID-19 pandemic. It also assumes that institutions have resumed the practice of elective surgical procedures.

Neuraxial Anesthesia and Peripheral Nerve Blocks

Scheduling and Planning

It has been our practice since March 2020 to screen all patients presenting for elective surgery to determine the COVID-19 status. The test is usually performed in the pre-admission unit (PAU) or the floor should the patient be admitted. If a patient tests positive, the elective surgery is postponed, while if a patient tests negative, then regional anesthesia can be performed following local guidelines without additional restrictions, as before the pandemic. In the event of a life-saving surgery and a pending test result, the community spread of COVID-19 is assumed to be significant, and the patient is treated as positive until proven otherwise. Figures 1 and 2 depicted below clarify a suggested algorithm for proceeding with surgeries, both elective and otherwise. It is especially important to keep in mind the possibility of false-negative test results, owing to the existence of different modalities, the accuracy of which may be operator-dependent. In one systematic review, the sensitivity of

Fig. 1
Suggested Algorithm for Proceeding with Elective Surgeries



the RT-PCR COVID-19 test was estimated at 71-98%, amounting to a false negative rate of 2-29%.[3] The accuracy of the RNA swab was also found to depend on the site of sampling, the degree of viral multiplication, and the stage of the disease.[3] The use of repeat PCR testing, although tempting, would be both impractical and an obvious waste of scarce resources. Thus, the lack of a gold-standard is somewhat a limitation in planning. Regardless, the use of regional anesthesia, be it neuraxial or peripheral nerve blocks, should be the first choice in patients should no contraindication exist.

Operating Theater

In the case of a confirmed or suspected COVID-19 infection, it is preferable that the surgery be performed in a negative pressure room, the purpose of which is to reduce the spread of aerosolized particles to outside the room. The use of a common area, such as the holding area or induction room, is to be avoided. Nevertheless, surgeries have been performed safely in positive pressure rooms, owing to the fact the operating rooms have a higher air exchange rate compared to standard rooms on hospital floors.[4] As such, 99% and 99.9% of airborne contaminants will be removed in 18 and 28 minutes, respectively.[5] It is also preferable that all record-keeping be performed outside the room.

Personal Protective Equipment

In light of the global PPE shortage, it becomes necessary to determine the appropriate PPE that should be donned. Neither neuraxial anesthesia nor

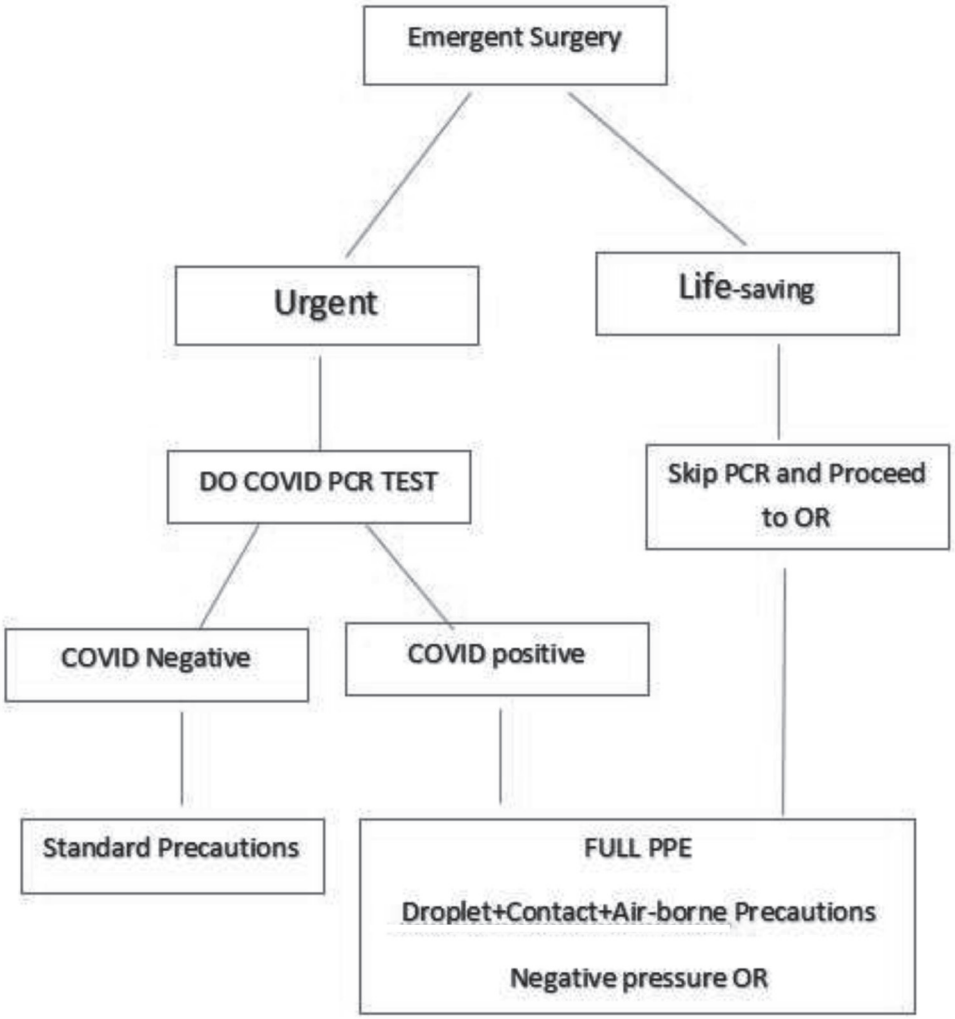


Fig. 2
Suggested Algorithms for Proceeding with Non-Elective Surgeries

peripheral nerve blocks are considered to be aerosol-generating procedures; thus, regular contact and droplet precautions usually suffice. This includes a surgical face mask, eye protection (face shield or goggles), a surgical gown, and two layers of gloves. The use of N95 respirator masks, which implies airborne precautions, is optional and therefore a function of both the availability of these masks and the anesthesiologist's judgment. If close proximity with the patient's face is expected, as would be the case during an upper extremity brachial plexus block, then the use of an N95 mask would be prudent. Relatively longer surgeries might also call for the use of these masks. All protective gear should be worn prior to entering the room, preferably in the presence of trained staff. The block should be performed by the most experienced person available, and patients must wear their surgical facemasks at all times.[6]

Oxygen Supplementation

The safe delivery of oxygen is a key healthcare challenge when dealing with COVID-19 patients. Symptomatic patients often require supplemental oxygen via nasal cannula or face mask, the latter of which may be used to supply oxygen at a rate of up to 10L/minute. Oxygen supplementation, in turn, results in droplet formation, which may travel variable distances depending on both the type of oxygen therapy and the flow rate. In one study by Hui et al, oxygen was provided by nasal cannula at increasing flows of 1-5 L/minute, with subsequent increase in exhalation jets from 0.66 to 1 m.[7] Similarly, the distance traveled by exhaled jets was determined to be 0.4 m when utilizing a face mask at 4L/min.[8] If a patient is receiving high flow nasal oxygen (HFNO), the flow rate must be titrated and gradually reduced to the minimum flow required to maintain an oxygen saturation of >93% as surface contamination of up to 4.5 meters is seen with flows of 60 L/minute.[9] In summary, it seems reasonable and practical to keep oxygen flow to the minimum required to maintain oxygen saturation, with a face mask being preferred over a nasal cannula. Moreover surgical facemasks must also be worn continuously during oxygen supplementation to minimize the spread of droplets.

Equipment

Drugs prepared for use in the case are to be brought into the room inside a plastic bag, with the trolley remaining outside. The ultrasound machine should also be covered in plastic and probe covers used. In addition, it is recommended to use single-use ultrasound gel packets instead of multiuse gel bottle. The number of people inside the room are to be kept at a strict minimum, making use of an assistant or "runner" ready to provide staff with any additional equipment. Once the procedure is over, it is recommended that the ultrasound machine be disinfected once inside the room and once outside and be left to dry each time.[10]

Intra-op Monitoring

Both peripheral nerve blocks and neuraxial anesthesia should be carefully tested before the start of surgery to minimize the risk of emergent conversion to general anesthesia. Generous onset time should be allowed in the case of a peripheral nerve block. Given that patients with COVID-19 generally have respiratory compromise and to avoid the need for airway manipulation, it is best to avoid or minimize sedation. Monitoring end-tidal CO_2 represents yet another challenge, as the carbon dioxide sample line draws contaminated gas without passing through a heat and moisture exchange filter. In the presence of a water trap on the anesthesia machine, the gas passes through a filter and approximately 99.999% of all viruses are eliminated.[10] However with the absence of a filter, measures to prevent contamination of the monitor should be considered. Several mechanisms have been proposed in order to avoid connecting the sampling line directly to the monitor. Lie et al. improvised connecting an ETT connector and a HEPA filter either directly to the face mask or interrupted by a piece of suction tubing, with the CO_2 sampling line then connected to the HEPA filter.[2] Alternatively, respiratory rate may be monitored by impedance plethysmography by the monitor's EKG system. Throughout the whole procedure, it is of utmost importance that the surgical facemask remain on the patient at all times and that unnecessary or prolonged contact be avoided whenever possible.

Recovery

At the end of surgery, patients are monitored in the operating room, as is the practice at our hospital. The length of stay or suitability for discharge is determined by institutional guidelines, and patients are usually deemed fit for discharge when they fulfill certain monitored criteria. Any non-disposable equipment should be thoroughly disinfected both inside and outside the room. Extra time should be allocated to doffing of PPE, as the risk of transmission has been determined to be the highest during this stage.[11]

Special Considerations for Neuraxial Anesthesia

Thrombocytopenia is frequently encountered in patients with COVID-19 and is associated with severe disease and poor prognosis.[12] The pathophysiology of low platelet count is multifactorial and usually suggests severe organ malfunction, which may or may not evolve to DIC.[12] It is therefore best to obtain a platelet count routinely before attempting neuraxial anesthesia in any confirmed or suspected COVID patient. A number of studies have determined 75,000 to be an acceptable threshold for performing spinal/epidural anesthesia.[13] If the decision is to proceed with neuraxial anesthesia despite a low platelet count for fear of respiratory compromise, spinal anesthesia with a small gauge needle is preferred over epidural anesthesia and carries a smaller risk of hematoma.[14] Worth noting is that COVID-19 has been associated with coagulopathy, with one study reporting the incidence of VTE to be as high as 25% in patients not taking thromboprophylaxis.[18] Despite the lack of evidence supporting the use of full-dose anticoagulation, prophylactic anticoagulant therapy using low-weight molecular heparin or low-dose heparin has been associated with decreased mortality and might eventually become the standard of care for these patients.[19] This, in turn, adds another dimension of complexity to the neuraxial technique, and the timing of performing the procedure would then be according to the half-life of the anticoagulant drug being used as per the neuraxial guidelines available. In short, COVID-19 infection by itself is not a contraindication for neuraxial anesthesia, and general indications and contra-indications apply in this patient population.

In case of a relatively short procedure, absolutely no attempts should be made to decrease the duration of the block, as conversion to GA is most undesirable. As such, neither the use of shorter-acting anesthetic agents nor dose reduction is recommended.[2] With regards to hemodynamics, anesthesiologists should be able to manage hypotension following spinal or epidural anesthesia as they would for any other patient. One study examined the hemodynamic effects of neuraxial labor anesthesia in 18 COVID-19 positive women in New York, and hemodynamic instability manifesting as refractory hypotension was never reported.[16] Also, as the virus has been isolated from the CSF of infected patients, the fluid should not be allowed to drip freely after spinal anesthesia.[15]

As of this day, no guidelines exist for the management of post-dural puncture headache, and whether or not an epidural blood patch can safely be performed is still controversial. The theoretical risk of injecting viremic blood into the epidural space is very much there, and as such, it seems wise to postpone the procedure until negative viral titers are obtained. However, an epidural blood patch might be considered if the headache is refractory or debilitating, the patient is clinically well, and no contraindication exists, most conspicuous of which is thrombocytopenia.[10]

Special Considerations for Peripheral Nerve Blocks

The American and European Societies of Regional Anesthesia have recently published a joint recommendation for performing peripheral nerve blocks in COVID-19 positive or suspected patients. In general, peripheral nerve blocks have less hemodynamic side-effects than neuraxial anesthesia does, as most nerve blocks do not cause hypotension from sympathectomy. The block should be given adequate time to take effect, and it should be tested systematically and vigilantly prior to incision to ensure its efficacy and to avoid emergent conversion to GA. Attempts should also be made to avoid blocks that might interfere with respiratory function and to substitute them with safer blocks whenever applicable. The interscalene block, for example, is notorious for causing ipsilateral

phrenic nerve block and diaphragmatic paresis, and as such, should be substituted for a superior trunk block. A supraclavicular block carries a relatively higher risk of pneumothorax, and should also be substituted with an infraclavicular or axillary block.

To avoid the need for airway manipulation, sedation should intuitively be kept at a minimum. The use of adjuvants should be weighed carefully against potential risks. Dexmedetomidine, is a commonly used adjuvant and carries the risk of sedation, hypotension, and bradycardia.[17] It might thus seem prudent to exclude the use of such adjuvants altogether. Peri-neural catheters may also be utilized in an attempt to decrease post-operative pain and opioid consumption. Because use of ultrasound during peripheral nerve blocks decrease the risk of local anesthetic toxicity and enhances the success of the technique, all peripheral nerve blocks must be done under ultrasound guidance.

Interventional Pain Procedures

Special Considerations in Chronic Pain Patients

Given that chronic pain conditions are usually musculoskeletal in nature, they most often occur in the elderly, who are in turn more likely to suffer from co-existing conditions.[20] In one large cross-sectional study by Barnett et. Al involving more than 1.7 million people, COPD, coronary artery disease, diabetes, and cancer were found to be the four most common comorbidities in patients with chronic pain.[21] Furthermore chronic pain impedes the immune system and immunosuppression is not a rare occurrence. Chronic pain patients are consequently labelled as "high-risk". Therefore, prioritizing interventional pain procedures is essential, and any procedure that does not fall under the urgent or emergent category must be postponed. A joint statement recently published by ASRA and ESRA societies has classified procedures into elective, semi-urgent, and urgent.[22] and examples or semi-urgent and urgent scenarios are depicted in Table 1.

Despite this seemingly-simple grouping, it is important to note that classification of pain procedures is, in fact, very subjective, and withholding even an elective pain-related procedure might lead to significant anxiety or distress. Thus, it might be more prudent to consider patients on a case-by-case basis and to reconsider regulations regarding elective procedures based on the local prevalence and incidence of COVID-19 at the time. Moreover, with the recent progress in containment of the COVID-19 contagion and the easing of lockdown restrictions, more elective interventional procedures cases are scheduled. Hence, these patients should undergo the proper screening and be stratified as high or low risk, and prior testing

Table 1
Classification of procedures

Semi-Urgent Scenarios	Urgent Scenarios
Acute cluster headaches and other intractable headache conditions	Intrathecal pump refills and malfunction
Refractory cancer pain	Neurostimulator infection and malfunction
Acute herpes zoster or subacute intractable post-herpetic neuralgia	
Intractable trigeminal neuralgia	
Acute herniated disc and/or worsening lumbar radiculopathy	
Early complex regional pain syndrome	

for SARS-CoV- 2 may be a good practice in high risk patients.

The Use of Steroids in Chronic Pain

The use of steroids in epidural and intraarticular injections is well known to cause hypothalamic-pituitary axis suppression, the magnitude and duration of which depends on the dose, half-life of the steroid utilized and site of injection. A number of studies in the literature have shown that the oral steroids compromise the immune system and increase the risk of infection. In one study, the relative risk (RR) for infection increased from 1.6 with a daily dose of 10 mg of prednisone to a RR> 8 with doses above 40 mg of prednisone.[23,24] Moreover, intraarticular corticosteroid use is associated with an increased risk of influenza infection, as demonstrated by Sytsma et al.[25] There has been no study to date, however, examining the risk of contracting COVID-19 after epidural steroids administration. Because immunosuppression is dose-dependent, one option might be to reduce the dose in high-risk patients. Cortisol suppression is also more prominent with longer-acting agents such as triamcinolone and methylprednisolone compared to more soluble agents such as dexamethasone or betamethasone.[26] As such, the use of dexamethasone is preferred over methylprednisolone due to its shorter systemic effect. All patients must be counseled on the possible risks of immunosuppression resulting from these procedures and the risks and benefits of using these drugs must be weighed on a case-by-case basis in the setting of the COVID-19 pandemic.

Procedural Conduct

As is the case of regional anesthesia techniques, interventional pain procedures are not aerosol-generating; however, precautions should be taken based on whether or not the patient has been tested or is high-risk. In all cases, patients should be asked to wear surgical masks and gloves, have their temperature checked, and limit their exposure to live-in family members to reduce the risk of infection. Also, patients should not wait in a common area for a prolonged periods and practice proper social distancing.

In low-risk patients with no history of exposure or travel or if patients have tested negative within 72 hours, standard contact and droplet precautions suffice, and routine aseptic technique are to be followed. Similar to regional anesthesia techniques in the OR, patients must keep their surgical facemasks on at all times.

On the other hand, if a patient either tests positive or is deemed to be high-risk, then, if and only if the procedure is determined to be strictly urgent, more stringent regulations apply. The procedure must be performed in an area designated for COVID-19 patients, as this will avoid contact with COVID-19 negative patients and ensures that the appropriate PPE is readily available.[22] The use of N-95 masks should be strongly considered if a patient is actively coughing or sneezing. Any equipment used should be protected using plastic covers, and the use of sedation is to be avoided. Once the procedure is over, the equipment should be disinfected immediately, and the patient should be monitored in the same room until he/she can be either discharged from the hospital or taken to a separate isolation room. Disinfection of the room between cases is a must.

Conclusion

Regional anesthesia is the preferred anesthetic technique in suspected or confirmed COVID-19 patients since it is not an aerosol-generating procedure and does not involve airway manipulation. In addition to decreasing the incidence of post-operative pulmonary complications, it also decreases both post-operative opioid consumption and nausea/vomiting. Whenever applicable, regional anesthesia seems to be the safest anesthetic approach for both the patients and the healthcare team involved. Many regional anesthesia guidelines also apply to interventional pain procedures, with a few additional special considerations in this population. In the coming few months, one of the most challenging physician tasks in response to COVID-19 will be minimizing the risk of transmission and exposure but preserving healthcare function and improving quality of life at the same time.

References

1- Millions Of Surgeries Have Been Canceled Worldwide Due To Covid-19. *Here's How Long Patients Can Expect to Wait*. 2020. Available from: https://www.forbes.com/sites/jacquelyncorley/2020/05/21/millions-of-surgeries-have-been-canceled-worldwide-due-to-covid-19-heres-how-long-patients-can-expect-to-wait/#578bb5727ece

2- Lie SA, Wong SW, Wong LT, Wong TGL, Chong SY, et al. Practical considerations for performing regional anesthesia: lessons learned from the COVID-19 pandemic. *Canadian Journal of Anesthesia/ Journal canadien d'anesthésie* 2020;1-8.

3- Watson, Jessica. Interpreting a COVID-19 test result. BMJ 2020;369:m1808.

4- Liu EH, Koh KF, Chen FG. Outbreak of severe acute respiratory syndrome in Singapore and modifications in the anesthesia service. Anesthesiology 2004; 100: 1629–30.

5- Centers for Disease Prevention. Guidelines for environmental infection control in health-care facilities. 2003. Available from: https://www.cdc.gov/infectioncontrol/guideline

6- Cook TM. Personal protective equipment during the COVID-19 pandemic - a narrative review. Anaesthesia 2020;75:920-7

7- Hui DS, Chow BK, Chu L, Ng SS, Lai S-T, Gin T, et al. Exhaled air dispersion and removal is influenced by isolation room size and ventilation settings during oxygen delivery via nasal cannula. Respirology 2011:1005-13.

8- Hui, DS, Ip M, Tang JW, Wong ALN, Chan MTV, Hall SD, et al. Airflows around oxygen masks: A potential source of infection. Chest 2006;130:822-826.

9- Lyons C, Callaghan M. The use of high-flow nasal oxygen in COVID-19. Anaesthesia 2020;75:843-7

10- Uppal V, Sondekoppam RV, Landau R, El-Boghdadly K, Narouze S, Kalagara HKP. Neuraxial anaesthesia and peripheral nerve blocks during the COVID-19 pandemic: a literature review and practice recommendations. [published online ahead of print]. Anaesthesia 2020.

11- Chughtai AA, Chen X, Macintyre CR. Risk of self-contamination during doffing of personal protective equipment. American Journal of Infection Control 2018;46:1329-34

12- Lippi G, Plebani M, Henry BM. Thrombocytopenia is associated with severe coronavirus disease 2019 (COVID-19) infections: A meta-analysis. Clinica Chimica Acta 2020;506:145-8

13- Bernstein J, Betty H, Madelyn K, Naum S, Simon Y, Davila-Velazquez J. Neuraxial anesthesia in parturients with low platelet counts. Anesthesia & Analgesia 2016;123:165-7

14- Practice guidelines for obstetric anesthesia: an updated report by the American Society of Anesthesiologists Task Force on Obstetric Anesthesia. American Society of Anesthesiologists Task Force on Obstetric Anesthesia. Anesthesiology 2007; 106:843-63.

15- Filatov A, Sharma P, Hindi F, Espinosa PS. Neurological complications of coronavirus disease (covid19): encephalopathy. Cureus 2020;12(3):e7352. doi:10.7759/cureus.7352.

16- Breslin N, Baptiste C, Gyamfi-Bannerman C, Miller R, Martinez R, Bernstein K, et al. COVID-19 infection among asymptomatic and symptomatic pregnant women: two weeks of confirmed presentations to an affiliated pair of New York City hospitals [published online ahead of print]. American Journal of Obstetrics and Gynecology MFM 2020;2:100118

17- Shanthanna H, Strand NH, Provenzano DA, Lobo CA, Eldabe S, Bhatia A, et al. Caring for patients with pain during the COVID-19 pandemic: consensus recommendations from an international expert panel. Anaesthesia 2020;75:935-44

18- Cui S, Chen S, Li X, Liu S, Wang F. Prevalence of venous thromboembolism in patients with severe novel coronavirus pneumonia. J Thromb Haemost 2020;18:1421-4

19- Kollias A, Kyriakoulis KG, Dimakakos E, Poulakou G, Stergiou GS, Syrigos K. Thromboembolic risk and anticoagulant therapy in COVID-19 patients: Emerging evidence and call for action. British Journal of Haematology 2020;189:846-7

20- Russell CD, Jonathan EM, Baillie JK. Clinical evidence does not support corticosteroid treatment for 2019-nCoV lung injury. The Lancet 2020;395:473-5

21- Breivik H, Collett B, Ventafridda V, Cohen R, Gallacher D. Survey of chronic pain in Europe: prevalence, impact on daily life, and treatment. European Journal of Pain 2006;10:287–333.

22- Barnett K, Mercer SW, Norbury M, Watt G, Wyke S, Guthrie B. Epidemiology of multimorbidity and implications for health care, research, and medical education: a cross-sectional study. Lancet 2012;380:37–43

23- Shanthanna H, Cohen SP, Strand N, Lobo C, Eldabe S, Bhatia A, et al. Recommendations on Chronic Pain Practice during the COVID-19 Pandemic. A Joint Statement by American Society of Regional Anesthesia and Pain Medicine (ASRA) and European Society of Regional Anesthesia and Pain Therapy (ESRA). 2020.

24- Stuck AE, Minder CE, Frey FJ. Risk of infectious complications in patients taking glucocorticosteroids. Revnfect Dis 1989;11:954-63.

25- Ginzler E, Diamond H, Kaplan D, Weiner M, Schlesinger M, Seleznick M. Computer analysis of factors influencing frequency of infections in systemic lupus erythematosus. Arthritis Rheum 1978;21:37-44.

26- Sytsma, TT, Lindsey KG, Laura SG. Joint Corticosteroid Injection Associated With Increased Influenza Risk. Mayo Clinic Proceedings: Innovations, Quality & Outcomes 2018;2:194-8.

27- Miller DC, Patel J, Gill J, Mattie R, Saffarian M, Schneider BJ, et al. Corticosteroid Injections and COVID-19 Infection Risk. Spine Intervention society (Factfinders for Patient Safety). 2020.