



Letter: Comprehensive Neurosurgery Infection Prevention and Control Practice in the COVID-19 “Return to Operate” Era

EDITORIAL

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ABSTRACT

The COVID-19 pandemic has forced neurosurgeons to adapt in the face of an unforeseen crisis, including reevaluating an important aspect of neurosurgical practice: surgical infection control and prevention. Before COVID-19, surgical site infections (SSI) remained a costly and burdensome issue within neurosurgery and the medical field at-large. Furthermore, as options for linking payment to quality of care and mandatory reporting of SSI expands, cranial and spine surgery can expect to face increased oversight and pressure in efforts to reduce SSI. The risk of COVID-19 transmission to both patients and healthcare workers has inspired rigorous attention to inspection control practices. Therefore, at our institution we have applied the momentum gained introducing new infection control practices and procedures to prevent of COVID-19 transmission to the adoption of a surgical infection control bundle. We describe our implementation spanning screening and selection of patients for surgery, intraoperative precautions, postoperative care, and systems for monitoring and feedback.

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KEYWORDS:

Neurosurgery; COVID-19;
pandemic

TO CITE THIS ARTICLE:

Maragos GA, McNeill IT, Kessler R, Xie M, Schaefer S, Patel G, Bederson JB, Shrivastava RK. Letter: Comprehensive Neurosurgery Infection Prevention and Control Practice in the COVID-19 “Return to Operate” Era. *Journal of Scientific Innovation in Medicine*. 2021; 4(2): 33, pp. 1–7. DOI: <https://doi.org/10.29024/jsim.95>

The COVID-19 pandemic has forced neurosurgeons to adapt in the face of an unforeseen crisis. As a community, we have redeployed clinical and administrative resources to meet rapidly changing needs [1–3]. We shifted how we triage surgical cases and altered surgical protocols to protect patients and health care workers (HCWs) [4–10]. We adopted new technology to facilitate use of telemedicine to enable follow-up with our patients [1, 2, 7, 11]. Additionally, we have been forced to evaluate how we engage medical students and train residents in an era where social distancing is the norm [1, 11, 12]. With the transition to a new academic year, we are introducing a new class of students and trainees for whom these adaptations will be their normal. In light of the opportunity to reevaluate how we conduct research, education and patient care amidst the heightened attention to preventing COVID-19 transmission, natural alignment also exists reevaluating another important aspect of neurosurgical practice: surgical infection control and prevention.

Before COVID-19, surgical site infections (SSI) remained a costly and burdensome issue within neurosurgery and the medical field at-large. SSI are associated with significant cost and morbidity, and this burden is increasing in the United States [13]. This is increasingly untenable in a pandemic era amidst increased scarcity of resources and elevated risk to patients associated with every healthcare encounter. Furthermore, as options for linking payment to quality of care and mandatory reporting of SSI expands, cranial and spine surgery can expect to face increased oversight and pressure in efforts to reduce SSI [14, 15].

The risk of COVID-19 transmission to both patients and healthcare workers has inspired rigorous attention to infection control practices. Therefore, at our institution, located in New York City, the United States COVID-19 epicenter, we have applied the momentum gained introducing new infection control practices and procedures to prevent of COVID-19 transmission to the adoption of a surgical infection control bundle (**Table 1**). Implementation of a SSI control bundle has been previously shown to potentially reduce neurosurgery and spine SSI [16–24]. However, this effort requires a multi-disciplinary approach involving OR nurses and staff, anesthesia, infection control, and neurosurgeons. The collaboration and urgency around the protection of patients and health care workers spawned from the COVID experience translates perfectly in the application of system-wide scrutiny of and revision to infection control and prevention processes. We describe our implementation spanning screening and selection of patients for surgery, intraoperative precautions, postoperative care, and systems for monitoring and feedback.

STAGE	COMPONENT	TASK
Preoperative	Mitigation of controllable risk factors (e.g., DM control, smoking cessation)	Patients are advised and encouraged on steps to control modifiable risk factors
	COVID-19	Patients undergo COVID-19 nasopharyngeal swab within 72 hours of surgery
	<i>S. aureus</i> screening and decolonization	Patients are screened via nasal swab for MSSA and MRSA Patients positive for MRSA/MSSA colonization undergo decolonization protocol
	CHG Bath/Shower	Patients are provided written instruction for CHG bathing the night before and day of surgery
Perioperative	Appropriate use of PPE	All OR staff comply with CDC, state and facility guidelines regarding PPE
	Hand hygiene	Faculty, house staff, and OR staff are reeducated on monitored for proper preprocedural hand hygiene and sterile field preparation
	Weight-based antibiotic algorithm	Surgeons, anesthesiologists and OR staff are educated on antibiotic guidelines
Postoperative	Uniform SSI definition	Department adopts definition in line with NHSN guidelines
	Auditing and reporting	SSIs are tracked and reported within 30-day postoperative window

Table 1 Infection Prevention and Control Bundle Components.

DM = diabetes mellitus, MSSA = methicillin-sensitive *S. Aureus*, MRSA = methicillin-resistant *S. Aureus*, CHG = chlorhexidine, PPE = personal protective equipment, CDC = Center for Disease Control, OR = operating room, SSI = surgical site infection.

Many patients have found their elective surgeries significantly postponed or cancelled. Through this time, our institution has used the opportunity to optimize telehealth communication to ensure that patients remained cared for and consistently evaluated in case of progression of symptoms thus changing the urgency of their neurosurgical condition. For those patients who remain stable awaiting surgery, this is an opportune time to address risk factor modification in areas such as smoking and diabetes control which have been shown to impact SSI risk [25–33]. Therefore, prior to surgery we encourage and facilitate smoking cessation or optimization of diabetes control as means to mitigate SSI risk once surgery eventually takes place.

Additionally, prior to surgery all patients undergo COVID-19 screening with a minimum of one SARS-CoV-2 reverse transcriptase polymerase chain reaction (RT-PCR) nasal swab within 72 hours preceding surgery. The results of the COVID-19 screening informs whether we proceed with surgery and the degree of PPE used for patient contact (**Figure 1**). Prior studies have shown an association between Methicillin-resistant Staphylococcus aureus (MRSA) colonization and MRSA SSI [34, 35]. Additionally, studies have shown a potential reduction of SSI with MRSA and Methicillin-sensitive Staphylococcus aureus (MSSA) screening and decolonization initiatives, particularly in other subspecialties such as orthopedics and cardiothoracic [36–41]. Therefore, during the initial screening encounter, we are also implementing universal nasal swab screening for MRSA and MSSA. Inpatients awaiting surgery also undergo nasal swab screening for COVID-19, MRSA, and MSSA. For those patients who test positive for MRSA or MSSA, we perform decolonization treatment with 2% nasal mupirocin ointment twice daily for 5 days and 4% chlorhexidine gluconate (CHG) bathing daily. The MRSA/MSSA screening results also informs perioperative antibiotic selection. Though data regarding the benefit of CHG bathing prior to surgery has been inconsistent, there has been limited attention to cranial or spine surgery specifically in this respect. A recent study demonstrated decreased odds of SSI with CHG showering prior to spinal surgery [42]. Therefore, as part of our bundle we have implemented CHG bathing prior to surgery. For inpatients and outpatients alike, patients are required to undergo chlorhexidine shower or wipes the night prior and the morning of surgery.

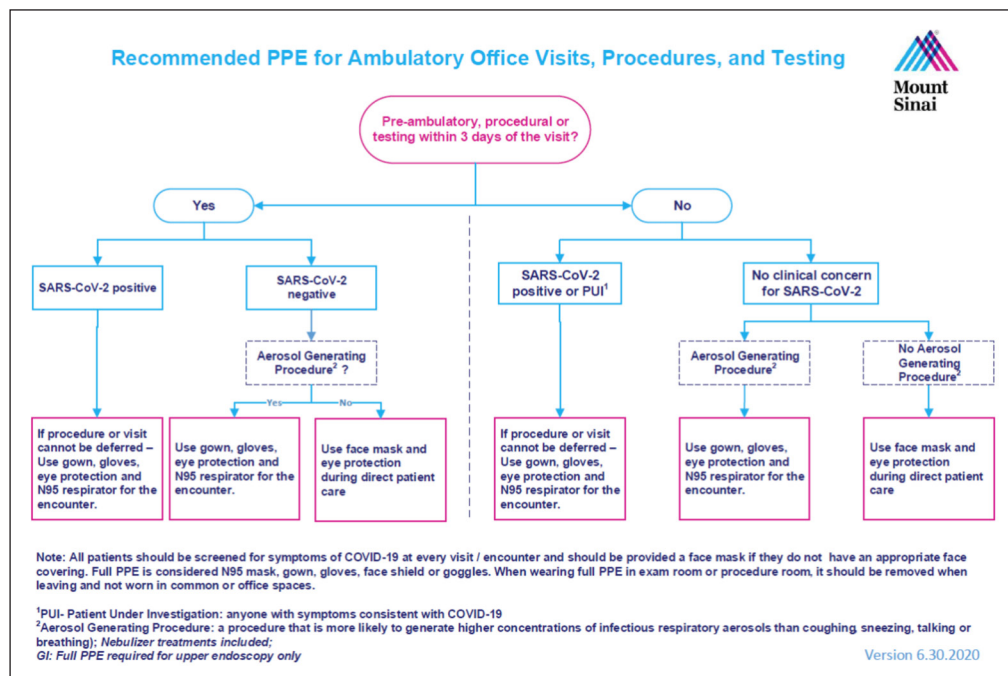


Figure 1 Systemwide PPE recommendations for ambulatory office visits, procedures, and testing.

PERIOPERATIVE CONSIDERATIONS

It has been previously suggested that the most likely transmission of viral particles into the operating room (OR) occurs during routine patient care and the surrounding environment [43]. Therefore, the first line of defense is compliance with Center for Disease Control, state and hospital guidelines regarding universal source control and standard precautions for all patient

care [44]. This focus on basic infection control including hand hygiene, use of personal protective equipment (including gloves), and handling of equipment has opened a window of opportunity for reevaluation of and attention to details that in the pre-COVID era were either taken for granted or often overlooked. For example, while hand hygiene prior to entering the OR is something practitioners learn early in training, bad habits may develop and never be corrected. Given the attention to detail in the COVID-19 era and the start of the new academic year, our institution is using the opportunity to retrain all staff on proper hand-washing technique. Similarly, retraining on technique for sterile surgical site preparation is being conducted for all OR staff using CHG-based prep below the neck and two-step betadine prep for the head (since CHG is not permitted above the neck at our institution due to risk of neurotoxicity, ototoxicity, and fire). Additionally, maintenance of normothermia during the case is a factor that is maintained and audited by anesthesia.

Our institution has instituted system-wide guidelines for weight-based antibiotic prophylaxis guidelines based on surgery type and risk profile. However, historically, surgeons have been accustomed to making antibiotic decisions based on their own experience. We are using the current environment to ensure that all stakeholders, including surgeons, anesthesiologists, and infection control specialists are abide by the current protocols which allow for adherence but still preserve flexibility for clinical judgement.

POSTOPERATIVE CONSIDERATIONS

Postoperatively, COVID-19 transmission prevention efforts center on universal protocols again regarding hand hygiene, use of PPE, social distancing, and minimization of exposure. Given that SSI leads to potential extended length of stay and consumption of resources, SSI prevention postoperatively continues to align with COVID-19 prevention efforts to minimize unnecessary encounters. Therefore, standard outpatient postoperative wound checks are frequently performed via telehealth when possible.

A key component of SSI prevention is continued auditing and reporting to ensure compliance and to enable investigation of new trends. That said, these sort of challenges require continued auditing and monitoring for compliance and results. Surveillance and feedback to staff and surgeons remains a critical component of SSI reduction efforts [13, 45–48]. As part of our initiative, our institution has adopted a SSI definition as described per National Healthcare Safety Network guidelines [49]. Our institution uses an electronic surveillance system to identify patients within a 90-day surveillance window who have undergone neurosurgical procedures and have (1) a positive culture suggestive of infection, (2) a return to the OR for wound exploration and washout, or (3) an ICD-9 diagnosis code associated with infection.

CONCLUSION

The COVID-19 pandemic has presented unprecedented challenges that have required multiple adaptations within neurosurgery practice. In many ways, these adaptations have also levied new opportunities to re-evaluate our practice, break old habits, and adopt a new normal in elements of neurosurgery such communication and education. Similarly, the momentum gained from these changes, the transition of the academic year, and the heightened attention to preventing COVID transmission presents a unique opportunity to revisit, re-evaluate and reform infection control and prevention practices in order to reduce the burden associated with SSI.

COMPETING INTERESTS

The authors have no competing interests to declare.

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Maragkos et al.
*Journal of Scientific
 Innovation in Medicine*
 DOI: 10.29024/jsim.95

TO CITE THIS ARTICLE:
 Maragkos GA, McNeill IT,
 Kessler R, Xie M, Schaefer
 S, Patel G, Bederson JB,
 Shrivastava RK. Letter:
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 Infection Prevention and
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Submitted: 01 May 2021
 Accepted: 27 May 2021
 Published: 16 June 2021

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