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Pushing the Envelope

New Patients, Procedures, and Personal Protective Equipment in the Ambulatory Surgical Center for the COVID-19 Era

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Keywords

• Patient selection • Ambulatory surgery • Ambulatory anesthesia • PPE • COVID-19 • Cost comparison

Key points

- Patients undergoing ambulatory surgery should have their comorbidities stabilized, COVID-19 status verified; COVID-19 diagnosis, especially with pulmonary complications, has been associated with increased morbidity and mortality after surgery.
- Procedure volume has increased significantly in the ambulatory setting partly due to improved surgical techniques, lower costs (eg, $140 million saved after cervical microdiscectomies moved to ASCs), and reduced complication rates; their selection should be appropriate for the ASC.
- Plans for emergencies, medical and nonmedical, should be established, including the use of emergency manuals and transfer protocols to tertiary care centers.
- PPE availability and training is crucial in the COVID-19 era to protect health care workers and prevent the spread of SARS-CoV-2.
- Positive outcomes from COVID-19 include increased and consistent health care facility hygiene, mask wearing, social distancing, and increased telemedicine usage for preanesthesia consultation that has facilitated case flow.

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INTRODUCTION

The first center dedicated to major ambulatory surgery was opened in Canada in the late 1950s. In the past decades, the number of ambulatory surgery centers (ASCs) has proliferated worldwide. In 2018, more than 23 million ambulatory surgeries were performed in ASCs in the United States [1]. An increasing number of all surgeries at community hospitals are now performed in the ambulatory setting, with a concomitant increase in the share of the hospital outpatient services revenue increasing from 30% in 1995 to 48% in 2016 [2]. This shift to the outpatient setting has been especially pronounced for certain surgeries, including cataract surgeries and hysterectomies [3,4]. The most common ambulatory procedure group was lens and cataract procedures, accounting for 10% of all ambulatory surgeries. Another way to examine these trends is through nonoperating room anesthesia (NORA) cases: from 2010 to 2014, voluntary cases reported to the National Anesthesia Clinical Outcomes Registry (NACOR) listed that NORA cases increased from 28.3% to 35.9% of all cases reported to NACOR [5]. Of these NORA cases, there was an increase in reported outpatient cases from 69.7% to 73.3%. One exception to this has been pediatric surgery cases, which will be discussed later in this section.

Initially, advances in technology and techniques for previously intensive surgeries allowed them to be performed in a less invasive manner, driving the change from inpatient to outpatient settings. However, the main driving factor now for the continued increase in outpatient cases seems to be a combination of lower costs, shorter procedure times, better patient experience, and the potential for increased physician reimbursement as equity owners in the ASCs [5,6]. These factors have also provided an increase in the range of procedures available that can be performed in the ambulatory setting.

As medical technology improves, patients live longer and may have increased comorbidities, careful patient selection is crucial for safe outpatient procedures. Patients may have implanted pacemakers, malignant hyperthermia (MH), implanted drug-eluting or bare-metal stents on dual antiplatelet therapy, diabetes mellitus (DM), hypertension (HTN), morbid obesity, obstructive sleep apnea (OSA), valve replacements, or chronic obstructive pulmonary disease. A previous comprehensive review of the literature, mostly retrospective in nature, has shown similar outcomes in patients undergoing ambulatory surgery, compared to inpatient procedures, if outpatient facilities are accredited, and proceduralists are board-certified [7]. Updated reviews have also shown that complication rates (commonly deep venous thrombosis/pulmonary embolism) were low in the office-based setting (OBS) while establishing patient inclusion and exclusion criteria for those same locations [8–10].

PATIENT POPULATIONS

High-risk conditions for the OBS include a history of MH, active substance abuse, age, OSA, morbid obesity, severe renal or liver insufficiency, myocardial infarction (MI) within the last 6 months, poorly controlled conditions like DM

or HTN, stroke within the last 3 months, and a known difficult airway [10]. In all surgeries, including outpatient surgeries, there have been an increasing trend in age and the American Society of Anesthesiologists (ASA) Physical Status [5].

Patients with OSA are at high risk of intraoperative complications such as difficult intubation and postoperative complications like hypoxia or unplanned hospital admission [9]. They may have accompanying comorbidities like HTN, DM, coronary artery disease, pulmonary HTN, or heart failure, which may not necessarily be optimized. All patients should be screened for OSA with a validated screening tool, like the STOP-BANG questionnaire [11]. If they screen positive, they may benefit from a formal diagnosis and/or treatment of OSA and optimization of their comorbidities before a procedure. However, delaying surgery to diagnose and treat OSA may not necessarily improve perioperative outcomes [12]. Procedures should only occur in this population when the OSA has been managed with continuous positive airway pressure devices, or if they screen positive and have other comorbidities that are optimized [13]. These patients may benefit from narcotic-sparing anesthetic techniques, including regional anesthesia.

Guidelines for performing anesthesia for patients with MH in the outpatient setting have been updated recently by the ASA and Society for Ambulatory Anesthesia (SAMBA) and the North American MH Registry of the MH Association of the United States (MHAUS) [14,15]. MH-susceptible patients can safely undergo procedures if their risk is appropriately identified, treatment for MH is available, or nontriggering anesthetics are used in the sedating or anesthetizing locations. Specific facilities classified as class B, where sedation is via oral or intravenous sedative-hypnotics and/or analgesics, routinely do not stock dantrolene to treat MH because of the lack of MH-triggering agents. However, the ASA and SAMBA in a recent consensus statement suggest having succinylcholine available to treat laryngospasm for emergency airway rescue [16].

When performing surgeries or procedures, emergencies (medical and nonmedical) may occur. In the hospital, many resources are available (eg, equipment, drug, personnel, and intensive care unit [ICU]). In the outpatient setting, these resources might not be as readily available, but these patients are generally healthier, and hence emergencies tend to be less frequent. However, if the patient has comorbidities that may place them at higher risk of perioperative complications, they may require a higher level of care and additional personnel. Having plans to deal with these patients and emergencies, such as using a cognitive aid (emergency manual) and/or having a standardized protocol for transfer to a higher-level facility, is essential [17,18]. Facilities must establish policies, have a communication plan, and ongoing education programs to ensure staff are aware of the latest emergency protocols and qualified to handle emergencies.

During the past year, the selection of patients for ambulatory surgery has added challenges because of the appearance of coronavirus disease 2019 (COVID-19). During the recent pandemic, surgeries continued, and literature

about the effects of COVID-19 on the patient undergoing surgery was published. These data will help inform our understanding of the need to carefully select patients for outpatient procedures and how the unique pathophysiology and transmission pattern of the SARS-CoV-2 impacts surgical outcomes.

AMBULATORY PROCEDURES

The procedures performed in ASCs have continued to change throughout the years. A combination of patient and surgeon desires and an improvement in the surgical equipment and techniques led this shift. Wider acceptance of enhanced recovery after surgery (ERAS) techniques has contributed to an explosion of cases performed in an ambulatory setting. With the continued advancement and complexity of patients and procedures, the challenge remains for the ASC to determine which patients and procedures can or should be done in their facility.

ORTHOPEDIC SURGERY

Orthopedic cases performed in ambulatory settings have traditionally been relatively minor procedures. With the advances in surgical and regional anesthetic techniques, more complex hospital procedures can now be performed in an outpatient setting. One type of high-cost surgical procedure that has been performed in hospital outpatient departments (HOPDs) for several years to commercially insured patients is total joint replacement. As the population ages, there has been a concurrent rise in surgeries for both total knee arthroplasty and total hip arthroplasty in the United States, and recently, ASCs have begun offering these services [19]. In 2017, more than 200 ASCs were providing outpatient joint replacements; more than 25% to 50% of all joint replacements could be performed in an outpatient facility with proper patient selection [20].

In 2020, the Centers for Medicare and Medicaid Services (CMS) revoked the inpatient-only listing on approximately 300 primarily musculoskeletal-related services [21]. CMS's new policy indicates that procedures will migrate to outpatient facilities to the detriment of hospital-based practices. Outpatient facilities may be able to provide a similar level of care without a rise in complications. A matched cohort study demonstrated that with one-compartment knee arthroplasties, there was no statistically significant difference in complication rates between hospitals and ASCs or increased hospital admissions after the procedure [22]. In addition, payment disparity between HOPDs and ASCs ($11,139 vs $18,595) may further drive orthopedic surgeries to ASCs [23]. Thus, the key decision that ASCs will have to make remain that of patient selection.

ENDOSCOPY

In 2019, an estimated 75 million endoscopies were performed in the United States, of which 51.5 million (68%) were gastrointestinal endoscopies [24]. Endoscopic services are primarily delivered in an outpatient setting. The ability to offer a diverse range of endoscopic and specialized services positions the

ASC to take advantage of the well-reimbursed medical model in the United States. The ASC will also be able to provide diagnostic testing, such as laboratory, pathology, and imaging services which may enhance the revenue potential. Nonetheless, the facility should maintain a careful selection process for appropriate patients to be performed in these outpatient facilities. Poor patient or procedure selection can result in unwanted admission to an affiliated hospital [25,26].

PLASTIC SURGERY

The American Society of Plastic Surgery reported in 2019 that plastic surgeons performed more than 27.1 million cosmetic and reconstructive procedures in the United States. Of these, nearly 9 million occurred in ASCs [27]. There is a consistent uptrend over the past decade, representing 25% of reconstructive and 40% of the total cosmetic surgical procedures. Some of this change can be attributed to intense scrutiny of complications because of office-based surgery, whereas some can be attributed to the advances in minimally invasive cosmetic and reconstructive surgical techniques [28,29]. However, the authors maintain that cost, convenience, scheduling, and privacy should also be considered as strong motivators for this change.

A large prospective cohort study of 129,007 patients undergoing plastic surgery in the office showed a lower risk of developing complications if the procedures were performed in an accredited OBS compared with other accredited facilities like ASCs or hospitals [30]. Patients who underwent office-based procedures were more likely to undergo single operations versus combined operations. The continued evolution of the ASC to a place where rapid-onset and rapid-emergence anesthesia in a safe and highly comfortable environment will continue to fuel this move.

NEUROSURGERY

The rising shift to outpatient neurosurgical procedures has been partially due to better surgical techniques and increasing procedural safety [31,32]. Minimally invasive techniques and careful patient selection have allowed neurosurgical procedures to be moved from hospitals to the ambulatory setting. It has been postulated that surgeons desire to minimize health care–related costs because of improved perioperative efficiency and cost reduction [33]. In 1996, the transition of cervical microdiscectomies from hospital-based settings to that of the ASC saved the health care industry approximately $140 million [34]. Factoring in the potential reductions in nosocomial infections and their associated costs, outpatient surgery's potential efficiency could be even greater [35]. Neurosurgeons initially performed single-level anterior cervical discectomy and fusions, but the range of cases has expanded to include posterior cervical foraminotomy, cervical arthroplasty, lumbar laminectomies and discectomies, and lumbar fusions [36]. Numerous studies have demonstrated that the complication rates, hospital transfer rates, and readmission rates for outpatient lumbar decompression surgeries are equivalent to, if not superior

to, that of inpatient ones. Though the patient population needs careful selection to ensure the best outcomes, one study noted that patient satisfaction is increased in ASCs [37].

THORACIC SURGERY

Thoracic surgery would not ordinarily be considered as a possible candidate for inclusion in ambulatory surgery clinics. However, as ERAS techniques continue to improve and be implemented, this patient population might merit re-evaluation. Advances in video-assisted thoracic surgery have demonstrated that ambulatory procedures may be safely performed for mediastinal lymphadenectomy, lung biopsy, and thoracic sympathectomy [38,39]. Studies have demonstrated that a tiny number of these patients require hospital admission postprocedurally. Anesthetic management for these procedures should focus on using ERAS guidelines, emphasizing rapid recovery and minimizing opioids.

The possibility of admittance to a hospital for management of postoperative complications such as the placement of a chest tube might continue to limit the inclusion of this specialty in most ASCs. However, the decreased length of stay from using ERAS techniques will likely lead to cost savings and thus, may be a consideration for some surgeons and anesthesiologists [40].

GYNECOLOGIC SURGERY

Gynecologic procedures have always formed a significant percentage of cases performed in ASCs. With the development of surgical procedures of relatively short duration and suitable for discharge with minimal morbidity or mortality, the pool of possible cases will increase. Improvements in hysteroscopy technique and technology have enabled an increase in the numbers of hysteroscopies performed in the outpatient setting. The utilization of ERAS techniques in the management of gynecologic cases now brings procedures such as hysterectomies as potential candidates for management in ASCs.

Over the past decade, surgical volume has shifted from inpatient to outpatient. For instance, one study found that inpatient rates versus outpatient rates of hysterectomies changed from 26.6 and 13.3 per 10,000 women in 2010, respectively, to 15.4 and 19.6 per 10,000 women in 2013, respectively [41]. Another retrospective cohort study involving 527,974 women who underwent benign hysterectomy (open, laparoscopic, vaginal, or robotic) from 2008 to 2014 found a shift of 44.2% from the inpatient to outpatient setting [42]. A significant contributing factor for increased movement toward outpatient hysteroscopies may be faster patient recovery, adequate pain relief, and equal patient satisfaction in care [43]. Data have shown that careful patient selection could expand the surgical options for an ASC [44].

PEDIATRIC SURGERY

Bucking the trend, pediatric surgery cases continue to show a decline in numbers at ambulatory centers. In 2020, a study found a substantial decrease

in pediatric ambulatory surgery cases between 2010 and 2018 [45]. During this time, there was a concomitant decrease in pediatric cases at general hospitals and increase at pediatric hospitals. This change has been partly driven by the increase in pediatric anesthesiologists, as noted by the expansion of pediatric anesthesia fellowship programs in hospitals dedicated to pediatric care [46]. The increase in the number of specialty trained anesthesiologists will further encourage patients to have their ambulatory procedures managed at nonhospital locations where this high-level care can be delivered.

COVID-19

At the time of writing this article, the United States is still grappling with the effects of the COVID-19 pandemic, with a total of over 30 million cases of infection and over 554,000 dead [47]. This pandemic has had far-reaching implications for all health care workers, including those in ASCs and offices. Multiple medical societies and organizations have released guidelines to assist with the management of precautions in this period. For this article, the United States Centers for Disease Control (CDC) guidelines will be referenced.

SARS-CoV-2 can spread via small aerosols and larger droplets, via coughing, sneezing, speaking, or procedurally [48]. In particular, the concentration of infectious particles is highest in the short distance surrounding the patient vector. There is an incubation period of 4 to 5 days, during which the patient may be asymptomatic or presymptomatic. In particular, patients may be contagious 1 to 3 days before any symptom onset. Symptoms include may fever, cough, myalgias, anosmia, diarrhea, and malaise [49]. Long-term outcomes and complications of COVID-19 remain under investigation and observation [50]. Some of these sequelae include cardiomyopathy and heart failure, persistent decreased pulmonary function, and neuropsychiatric symptoms like brain fog and seizures. Surgeons and proceduralists must now consider the critical role of COVID-19 infection: screening, testing, possible infectious spread, impact on patient outcomes, and personal protective equipment (PPE).

POSTOPERATIVE OUTCOMES IN COVID-19

Multiple studies examined the association of COVID-19 infections in patients and postoperative outcomes [51–54]. In the United Kingdom (UK), 340 COVID-19 negative patients were matched to 82 COVID-19 positive patients, who required hip surgery for fracture. COVID-19 positive patients had a higher risk of death at 30 days, higher risk of postoperative complications, higher rates of postoperative ICU admission, and longer hospital stays [51]. Another multinational observational cohort study in the UK, Spain, USA, and Italy involving 404 patients undergoing a hip fracture surgery found significant differences in mortality at discharge and at 30 days between COVID-19 positive and COVID-19 negative patients: 30 deceased versus 16 deceased and 37 deceased versus 21 deceased, respectively [52]. In New York, USA, one center performed a retrospective cohort study on 432 COVID-19 negative patients and 36 COVID-19 positive patients undergoing urgent and emergent surgeries

in early 2020 [54]. COVID-19 positive patients were at a higher risk of suffering cardiac arrest, having respiratory failure and pneumonia [54]. A multinational study involving 1128 patients and 24 countries examined the presence of COVID-19 infection 7 days before surgery or 30 days after surgery and its impact on postoperative outcomes [53]. Among patients with a COVID-19 diagnosis and pulmonary complications undergoing either emergency or elective surgery, there was a higher mortality rate at 30 days, accounting for 219 (81.7%) deaths, total deaths 268. In adjusted analyses, patients with COVID-19 were more likely to die at 30 days, if they were aged 70 years or older, men, had an ASA grade III to V, undergo emergency surgery and major surgery.

COVID-19 TESTING

The literature published so far points toward relatively higher morbidity and mortality among patients with a COVID-19 diagnosis, especially among those with pulmonary complications. Several studies have documented infection with SARS-CoV-2 in patients who never have had symptoms (asymptomatic) and in patients not yet symptomatic (presymptomatic) [55–57]. SARS-Cov-2 symptomatology presents a significant challenge in appropriate patient selection for health care facilities, as they present a significant risk of spreading COVID-19 within the OR. Our facility (Beth Israel Deaconess Medical Center, Boston, MA) requires all patients undergoing surgery or a procedure to have a negative COVID-19 test 48 to 72 hours prior. The patient is then requested to self-quarantine, and a follow-up screen is performed on the day of the procedure to ensure the patient has no symptoms. Surgeons and proceduralists should not perform elective procedures (especially aerosol-generating procedures like intubation, bronchoscopy, and endoscopy) on patients who have a recent diagnosis of COVID-19 or have been exposed to a COVID-19 patient; in addition, if they have symptoms suspicious for COVID-19, these patients should be rescheduled until they have been self-quarantined for 14 days [48]. Ideally, we recommend that these mildly symptomatic patients have their surgery or procedure delayed for at least 10 days after their symptom onset or after their last fever [58]. If the patient has had a severe COVID-19 illness or is immunocompromised, the timing should be increased to at least 20 days. After the quarantine period, providers should be aware that there may be residual viral shedding beyond those days, and therefore it would not be helpful to retest an asymptomatic patient within 90 days. If there is a possibility of the patient becoming symptomatic and other infectious etiologies are ruled out, then retesting for SARS-CoV-2 would be warranted. If their COVID-19 test is negative after adequate isolation, consider doing the elective procedure while maintaining proper PPE (PPE section).

ASCs are accustomed to performing elective surgeries in patients who have suffered a recent major medical event, such as MI or stroke. These patients should not have elective surgery or procedure until after 8 weeks or 3 months, respectively. Similarly, in the case of symptomatic COVID-19, the authors

recommend that patients ideally should wait a minimum of 8 weeks before elective surgery or procedure [59].

COVID-19 VACCINATION

Several COVID-19 vaccines have received emergency use approval by the Food and Drug Administration (FDA) [60–62]. These vaccines have been shown to be effective in preventing serious complications, hospitalizations, and death from COVID-19. They have also been shown to be well tolerated, with rare but serious allergic reactions noted [63]. However, the long-term data on the vaccines' ability to prevent patients from contracting COVID-19 or spreading COVID-19 are still underway.

Since the vaccine was approved under an emergency use authorization (EUA), it may not be feasible to mandate that all health care workers be immunized to work in a facility. In addition, there is a lack of data on transmission of COVID-19 by a vaccinated person to another individual. For this reason, all vaccinated patients should still undergo COVID-19 testing before surgery, and all vaccinated health care workers should make efforts to ensure they are not exposed to COVID-19 infected individuals. These infectious disease guidelines will evolve as new data emerge regarding the transmissibility of COVID-19 in patients who have received the vaccine and the duration of their immunity. The CDC recommends using additional infection prevention and control practices during the COVID-19 pandemic, along with standard practices recommended as a part of routine health care delivery to all patients. Facilities should develop policies and procedures to ensure recommendations are appropriately applied.

PERSONAL PROTECTIVE EQUIPMENT IN THE AGE OF COVID-19

The CDC has published recommendations on the use of PPE for health care facilities, which is being updated as data are produced regarding their efficacy [64]. Preventing spread involves source-control (preventing others' exposure) measures: using a well-fitting mask to prevent the spread of respiratory secretions and infectious particles when individuals are breathing, talking, sneezing, or coughing. Ensuring a proper fit via multiple modification methods optimizes both source control and infection prevention [65,66]. Because of the potential for asymptomatic and presymptomatic transmission, source control measures are recommended for everyone in a health care facility, even if they do not have symptoms of COVID-19. All patients should be masked unless undergoing a procedure that requires access to the airway while in the health care facility. Facemasks that conform well to cover people's mouth and nose so that air preferentially moves through the material rather than through gaps at the edges are more effective for source control by decreasing particles emitted from the wearer and to which the wearer is exposed [66]. National Institute for Occupational Safety and Health (NIOSH)-approved N95

respirators that are well-fitted offer the highest level of both source control and protection against infectious particles' inhalation [67].

When possible, physical distancing (maintaining at least 6 feet between people) is another crucial strategy to prevent COVID-19 transmission [49]. However, health care delivery often requires close physical contact between patients and health care providers. Methods of implementing social distancing in a health care facility include: limiting visitors to the facility to those essential for the patient's physical or emotional well-being and care, encouraging the use of alternative communication devices (such as video-call applications or telemedicine), digital applications (apps), scheduling appointments to limit the number of patients in waiting rooms, and having patients wait in their vehicles until it is time for their procedure [68]. Telemedicine may improve surgery cancellation rates, reduce the likelihood of miles driven by patients or their family members, reduce the likelihood of patients or their family members missing days of work and wages unnecessarily, reduce unnecessary day of surgery testing, and may improve patient satisfaction and reduce facility expenditures [69–73]. The authors hypothesize that in the future, telemedicine may be further integrated into patient care with preanesthetic evaluations to facilitate the exponential growth of ambulatory procedures.

The potential for health care providers to be exposed to COVID-19 is not limited to direct patient contact. Transmission can also occur through fomites: unprotected exposures to asymptomatic or presymptomatic coworkers in breakrooms, hospital rooms, or other common areas [74]. Ideally, there should be designated areas with protected areas and staggered rest schedules to allow health care staff to take breaks and eat while allowing at least 6 feet of social distancing. All health care employees should wear well-fitted masks in health care facilities; these masks should only be removed after performing CDC recommended hand hygiene guidelines for eating and drinking, at the end of the shift, and for replacing with a clean mask before leaving the facility.

In addition to appropriate source control protocols for patients, ASCs should ensure that appropriate PPE is provided to the health care providers. Appropriate PPE may include NIOSH-approved N95 respirators, gowns, and face shields for procedures that generate aerosols. The PPE should be coupled with training on donning and doffing and demonstrating an understanding of the use of PPE [75].

CASE CANCELLATION IN THE COVID-19 ERA

Owing to the COVID-19 pandemic and resulting waves in hospital and ICU bed occupation, states enacted lockdowns. Elective surgical cases were canceled in ASCs and hospitals as they prepared for surge of COVID-19 hospitalizations. Unfortunately, delaying elective surgery can have serious consequences for patients. Though diagnostic procedures such as screening mammographies and endoscopies may be elective, the consequences of postponing them may contribute toward delayed diagnoses and possibly delayed surgeries and/or treatments. This may lead to acute and emergent presentations in the hospital,

further exacerbating the backlog of cases after the resumption of elective procedures [76]. Furthermore, these delays in diagnosis and treatment may be further exacerbated within certain socioeconomic groups. For instance, reductions in health care services were noted when primary care visits fell drastically during the pandemic. A rise in telehealth failed to make up the difference, especially among certain socioeconomic groups; hence, there continued to be disparities in health care access through adoption of telemedicine [77].

Going forward, as more of the population become infected with and recover from COVID-19, it will be essential to build a framework and approach to treating these previously COVID-19 positive patients [59]. Many of them may have had to delay surgeries because hospitals had canceled elective procedures or because the patient had COVID-19, whether symptomatic or not.

SUMMARY

In 2018, over 23 million ambulatory surgeries were performed in the United States. The trajectory of procedural growth moving from the hospital setting toward ambulatory facilities will likely continue. The primary incentives cited for this change are improved costs, convenience, scheduling, privacy, and patient satisfaction.

The authors anticipate that there will be a continued increase in the number of innovative procedures performed within the ambulatory sphere. These will include procedures such as hysteroscopies, joint replacements, spine surgeries, advanced endoscopies, ophthalmologic procedures, and interventional radiologic, cardiac, vascular, and pain procedures. The onus will be placed upon ASCs to carefully evaluate these patients, procedures, costs, and outcomes to determine their facilities' risk/benefit ratio.

Patients with pre-existing comorbidities must continue to be optimized before their surgery or procedure. However, with the COVID-19 pandemic, surgeons, proceduralists, and anesthesiologists must now pay attention to protocols developed to cope with COVID-19: screening, testing, and PPE [68]. ASCs and office-based practices should consider local, state, and federal regulations and specialty-specific guidelines about COVID-19.

A few positives have resulted from this pandemic: improved and more consistent facility hygiene (alcohol-based and/or gloves), consistent mask usage, and social distancing. The rise of telemedicine in preoperative appointments and preanesthesia screening has facilitated case flow, thereby reducing same-day surgery cancellations while saving the facility and patients time and money.

In summary, tomorrow's ASC should continue to carefully select appropriate patients and procedures in this period of growth. The opportunities for expansion and use of new technologies and techniques in patient management will ensure that this sector of the health care industry continues to thrive.

CARE POINTS

- In addition to traditional concerns of medical optimization of patients in ambulatory surgery centers, clinicians might consider patient COVID-19 status (infection, vaccination, travel, exposures) and social circumstances (immunocompromised, pregnancy, children, housing stability).
- Preventing transmissible, communicable diseases through increased hand hygiene, mask wearing, and social distancing is a positive outcome from the COVID-19 era.
- Given the current situation with fluctuating infection rates and variants of COVID, clinicians should consider being familiar with state and federal COVID-19 guidelines and consider using algorithms for testing patients [68].

Disclosure

The authors have nothing to disclose.

References

[1] Hall MJ, Schwartzman A, Zhang J, et al. Ambulatory surgery data from hospitals and ambulatory surgery centers: United States, 2010. Natl Health Stat Rep 2017;102:1–15.
[2] American Hospital Association. Utilization and volume. In: Trend watch chartbook 2018, trends affecting hospitals and health systems; chapter 4. 2018. Available at: www.aha.org/system/files/2018-07/2018-aha-chartbook.pdf 2018.
[3] Stagg BC, Talwar N, Mattox C, et al. Trends in use of ambulatory surgery centers for cataract surgery in the United States, 2001-2014. JAMA Ophthalmol 2018;136(1):53.
[4] Doll KM, Dusetzina SB, Robinson W. Trends in inpatient and outpatient hysterectomy and oophorectomy rates among commercially insured women in the United States, 2000-2014. JAMA Surg 2016;151(9):876.
[5] Nagrebetsky A, Gabriel RA, Dutton RP, et al. Growth of nonoperating room anesthesia care in the United States. Anesth Analg 2017;124(4):1261–7.
[6] Advisory Board. ASCs are growing even faster than you think. How can hospitals respond?. 2019. Available at: https://www.advisory.com/daily-briefing/2019/03/05/asc-shift. Accessed February 8, 2021.
[7] Shapiro FE, Punwani N, Rosenberg NM, et al. Office-based anesthesia: safety and outcomes. Anesth Analg 2014;119(2):276–85.
[8] Young S, Shapiro FE, Urman RD. Office-based surgery and patient outcomes. Curr Opin Anaesthesiol 2018;31(6):707–12.
[9] De Lima A, Osman BM, Shapiro FE. Safety in office-based anesthesia: an updated review of the literature from 2016 to 2019. Curr Opin Anaesthesiol 2019;32(6):749–55.
[10] Seligson E, Beutler SS, Urman RD. Office-based anesthesia: an update on safety and outcomes (2017-2019). Curr Opin Anaesthesiol 2019;32(6):756–61.
[11] Chung F, Yegneswaran B, Liao P, et al. STOP questionnaire: a tool to screen patients for obstructive sleep apnea. Anesthesiology 2008;108(5):812–21.
[12] Grewal G, Joshi GP. Obesity and obstructive sleep apnea in the ambulatory patient. Anesthesiol Clin 2019;37(2):215–24.
[13] Semelka M, Wilson J, Floyd R. Diagnosis and treatment of obstructive sleep apnea in adults. Am Fam Physician 2016;94(5):355–60.
[14] Urman RD, Rajan N, Belani K, et al. Malignant hyperthermia-susceptible adult patient and ambulatory surgery center: society for ambulatory anesthesia and ambulatory surgical care Committee of the American Society of Anesthesiologists Position Statement. Anesth Analg 2019;129(2):347–9.

[15] Larach MG, Klumpner TT, Brandom BW, et al. Succinylcholine use and dantrolene availability for malignant hyperthermia treatment: database analyses and systematic review. Anesthesiology 2019;130(1):41–54.
[16] Joshi GP, Desai MS, Gayer S, et al. Succinylcholine for emergency airway rescue in class b ambulatory facilities: the society for ambulatory anesthesia position statement. Anesth Analg 2017;124(5):1447–9.
[17] American Society of Anesthesiologists. Guidelines for office-based anesthesia 2019. Available at: https://www.asahq.org/standards-and-guidelines/guidelines-for-office-based-anesthesia. Accessed March 5, 2021.
[18] American Society of Anesthesiologists. Guidelines for ambulatory anesthesia and surgery. 2013. Available at: http://www.asahq.org/quality-and-practice-management/standards-and-guidelines. Accessed February 20, 2021.
[19] Inacio MCS, Paxton EW, Graves SE, et al. Projected increase in total knee arthroplasty in the United States – an alternative projection model. Osteoarthritis Cartilage 2017;25(11):1797–803.
[20] Advisory Board. Hospitals may lose total joint replacements to ambulatory providers. Here's what they're doing about it 2017. Available at: https://www.advisory.com/daily-briefing/2017/08/10/joint-replacement. Accessed March 18, 2021.
[21] Centers for Medicare and Medicaid Services. CY 2021 medicare hospital outpatient prospective payment system and ambulatory surgical center payment system final rule (CMS-1736-FC). 2020. Available at: https://www.cms.gov/newsroom/fact-sheets/cy-2021-medicare-hospital-outpatient-prospective-payment-system-and-ambulatory-surgical-center-0. Accessed March 18, 2021.
[22] Ford MC, Walters JD, Mulligan RP, et al. Safety and cost-effectiveness of outpatient unicompartmental knee arthroplasty in the ambulatory surgery center. Orthop Clin North Am 2020;51(1):1–5.
[23] Carey K, Morgan JR. Payments for outpatient joint replacement surgery: a comparison of hospital outpatient departments and ambulatory surgery centers. Health Serv Res 2020;55(2):218–23.
[24] Beckers Healthcare. 5 trends affecting the gastroenterology specialty 2020. Available at: https://www.beckersasc.com/gastroenterology-and-endoscopy/5-trends-affecting-the-gastroenterology-specialty.html. Accessed March 18, 2021.
[25] Lieber SR, Heller BJ, Martin CF, et al. Complications of anesthesia services in gastrointestinal endoscopic procedures. Clin Gastroenterol Hepatol 2020;18(9):2118–27.e4.
[26] Leffler DA, Kheraj R, Garud S, et al. The incidence and cost of unexpected hospital use after scheduled outpatient endoscopy. Arch Intern Med 2010;170(19):1752–7.
[27] American Society of Plastic Surgeons. Complete plastic surgery statistics report. 2019. Available at: https://www.plasticsurgery.org/documents/News/Statistics/2019/plastic-surgery-statistics-full-report-2019.pdf. Accessed March 21, 2021.
[28] Coldiron BM, Healy C, Bene NI. Office surgery incidents: what seven years of florida data show us. Dermatol Surg 2008;34(3):285–92.
[29] Starling J, Thosani MK, Coldiron BM. Determining the safety of office-based surgery: what 10 years of florida data and 6 years of alabama data reveal. Dermatol Surg 2012;38(2 Part 1):171–7.
[30] Gupta V, Parikh R, Nguyen L, et al. Is office-based surgery safe? comparing outcomes of 183,914 aesthetic surgical procedures across different types of accredited facilities. Aesthet Surg J 2017;37(2):226–35.
[31] Idowu OA, Boyajian HH, Ramos E, et al. Trend of spine surgeries in the outpatient hospital setting versus ambulatory surgical center. Spine (Phila Pa 1976) 2017;42(24):E1429–36.
[32] Best MJ, Buller LT, Eismont FJ. National trends in ambulatory surgery for intervertebral disc disorders and spinal stenosis. Spine (Phila Pa 1976) 2015;40(21):1703–11.

[33] Mummareddy N, Ahluwalia R, Zuckerman SL, et al. Identifying the most appropriate lumbar decompression patients for ambulatory surgery centers – A pilot study using inpatient and outpatient hospital data. J Clin Neurosci 2020;72:206–10.
[34] Silvers HR, Lewis PJ, Suddaby LS, et al. Day surgery for cervical microdiscectomy: is it safe and effective? J Spinal Disord 1996;9(4):287–93.
[35] Adamson T, Godil SS, Mehrlich M, et al. Anterior cervical discectomy and fusion in the outpatient ambulatory surgery setting compared with the inpatient hospital setting: analysis of 1000 consecutive cases. J Neurosurg Spine 2016;24(6):878–84.
[36] Sivaganesan A, Hirsch B, Phillips FM, et al. Spine surgery in the ambulatory surgery center setting: value-based advancement or safety liability? Neurosurgery 2018;83(2):159–65.
[37] Hersht M, Massicotte EM, Bernstein M. Patient satisfaction with outpatient lumbar microsurgical discectomy: a qualitative study. Can J Surg 2007;50(6):445–9.
[38] Souilamas R, D'Attelis N, Nguyen-Roux S, et al. Outpatient video-mediastinoscopy. Interact Cardiovasc Thorac Surg 2004;3(3):486–8.
[39] Iwasaki Y, Shimada J, Kato D, et al. Improvements in thoracic surgery outcomes: a multi-institutional collaboration study. J Cardiothorac Surg 2015;10(1):30.
[40] Zhu S, Qian W, Jiang C, et al. Enhanced recovery after surgery for hip and knee arthroplasty: a systematic review and meta-analysis. Postgrad Med J 2017;93(1106):736–42.
[41] Morgan DM, Kamdar NS, Swenson CW, et al. Nationwide trends in the utilization of and payments for hysterectomy in the United States among commercially insured women. Am J Obstet Gynecol 2018;218(4):425.e1–18.
[42] Moawad G, Liu E, Song C, et al. Movement to outpatient hysterectomy for benign indications in the United States, 2008–2014. PLoS One 2017;12(11):e0188812.
[43] Kremer C. Patient satisfaction with outpatient hysteroscopy versus day case hysteroscopy: randomised controlled trial. BMJ 2000;320(7230):279–82.
[44] Skues MA. High-risk surgical procedures and semi-emergent surgical procedures for ambulatory surgery. Curr Opin Anaesthesiol 2020;33(6):718–23.
[45] Dexter F, Epstein RH, Rodriguez LI. Decline of pediatric ambulatory surgery cases performed at Florida general hospitals between 2010 and 2018: an historical cohort study. Anesth Analg 2020;131(5):1557–65.
[46] Cladis FP, Lockman JL, Lupa MC, et al. Pediatric anesthesiology fellowship positions. Anesth Analg 2019;129(6):1784–6.
[47] Johns Hopkins University. Coronavirus resource center 2021. Available at: https://coronavirus.jhu.edu/. Accessed April 3, 2021.
[48] Gandhi RT, Lynch JB, del Rio C. Mild or moderate Covid-19. N Engl J Med 2020;383(18):1757–66.
[49] Wiersinga WJ, Rhodes A, Cheng AC, et al. Pathophysiology, transmission, diagnosis, and treatment of coronavirus disease 2019 (COVID-19). JAMA 2020;324(8):782.
[50] del Rio C, Collins LF, Malani P. Long-term health consequences of COVID-19. JAMA 2020;324(17):1723.
[51] Kayani B, Onochie E, Patil V, et al. The effects of COVID-19 on perioperative morbidity and mortality in patients with hip fractures. Bone Joint J 2020;102-B(9):1136–45.
[52] Rasidovic D, Ahmed I, Thomas C, et al. Impact of COVID-19 on clinical outcomes for patients with fractured hip. Bone Jt Open 2020;1(11):697–705.
[53] Nepogodiev D, Bhangu A, Glasbey JC, et al. Mortality and pulmonary complications in patients undergoing surgery with perioperative SARS-CoV-2 infection: an international cohort study. Lancet 2020;396(10243):27–38.
[54] Knisely A, Zhou ZN, Wu J, et al. Perioperative morbidity and mortality of patients with COVID-19 who undergo urgent and emergent surgical procedures. Ann Surg 2021;273(1):34–40.
[55] Lu X, Zhang L, Du H, et al. SARS-CoV-2 infection in children. N Engl J Med 2020;382(17):1663–5.

[56] Wei WE, Li Z, Chiew CJ, et al. Presymptomatic Transmission of SARS-CoV-2 — Singapore, January 23–March 16, 2020. MMWR Morb Mortal Wkly Rep 2020;69(14):411–5.
[57] Bai Y, Yao L, Wei T, et al. Presumed asymptomatic carrier transmission of COVID-19. JAMA 2020;323(14):1406.
[58] Centers for Disease Control and Prevention. Interim guidance on duration of isolation and precautions for adults with COVID-19. Centers for Disease Control and Prevention; 2020. Available at: https://www.cdc.gov/coronavirus/2019-ncov/hcp/duration-isolation.html. Accessed March 5, 2021.
[59] Bui N, Coetzer M, Schenning KJ, et al. Preparing previously COVID-19-positive patients for elective surgery: a framework for preoperative evaluation. Perioper Med 2021;10(1):1.
[60] US Food and Drug Administration. Pfizer-BioNTech COVID-19 vaccine. 2020. Available at: https://www.fda.gov/emergency-preparedness-and-response/coronavirus-disease-2019-covid-19/pfizer-biontech-covid-19-vaccine. Accessed March 5, 2021.
[61] US Food and Drug Administration. Moderna COVID-19 vaccine. 2020. Available at: https://www.fda.gov/emergency-preparedness-and-response/coronavirus-disease-2019-covid-19/moderna-covid-19-vaccine. Accessed March 5, 2021.
[62] US Food and Drug Administration. Janssen COVID-19 vaccine. 2021. Available at: https://www.fda.gov/emergency-preparedness-and-response/coronavirus-disease-2019-covid-19/janssen-covid-19-vaccine. Accessed March 5, 2021.
[63] Castells MC, Phillips EJ. Maintaining safety with SARS-CoV-2 vaccines. N Engl J Med 2020;384(7):643–9.
[64] Centers for Disease Control and Prevention. Interim infection prevention and control recommendations for healthcare personnel during the Coronavirus disease 2019 (COVID-19) pandemic 2021. Available at: https://www.cdc.gov/coronavirus/2019-ncov/hcp/infection-control-recommendations.html. Accessed March 5, 2021.
[65] Centers for Disease Control and Prevention. Improve the fit and filtration of your mask to reduce the spread of COVID-19. 2021. Available at: https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/mask-fit-and-filtration.html. Accessed March 5, 2021.
[66] Clapp PW, Sickbert-Bennett EE, Samet JM, et al. Evaluation of cloth masks and modified procedure masks as personal protective equipment for the public during the COVID-19 pandemic. JAMA Intern Med 2020; https://doi.org/10.1001/jamainternmed.2020.8168.
[67] Qian Y, Willeke K, Grinshpun SA, et al. Performance of N95 respirators: filtration efficiency for airborne microbial and inert particles. Am Ind Hyg Assoc J 1998;59(2):128–32.
[68] Young S, Osman BM, Urman RD, et al. Patients, procedures, and PPE: safe office-based anesthesia recommendations in the COVID-19 era. Best Pract Res Clin Anaesthesiol 2020; https://doi.org/10.1016/j.bpa.2020.11.006.
[69] Lee CM, Rodgers C, Oh AK, et al. Reducing surgery cancellations at a pediatric ambulatory surgery center. AORN J 2017;105(4):384–91.
[70] Tait AR, Voepel-Lewis T, Munro HM, et al. Cancellation of pediatric outpatient surgery: economic and emotional implications for patients and their families. J Clin Anesth 1997;9(3):213–9.
[71] Conley C, Facchin M, Gu Q, et al. The virtual pediatric perioperative home, experience at a major metropolitan safety net hospital. Pediatr Anesth 2021;31(6):686–94.
[72] Schoen DC, Prater K. Role of telehealth in pre-anesthetic evaluations. AANA J 2019;87(1):43–9.
[73] Yang Y-L, Wang K-J, Chen W-H, et al. Improved satisfaction of preoperative patients after group video-teaching during interview at preanesthetic evaluation clinic: the experience of a medical center in Taiwan. Acta Anaesthesiol Taiwan 2007;45(3):149–54.
[74] Kim UJ, Lee SY, Lee JY, et al. Air and environmental contamination caused by COVID-19 patients: a multi-center study. J Korean Med Sci 2020;35(35):e332.

[75] Centers for Disease Control and Prevention. Using personal protective equipment (PPE). 2020. Available at: https://www.cdc.gov/coronavirus/2019-ncov/hcp/using-ppe.html. Accessed February 5, 2021.
[76] Fu SJ, George EL, Maggio PM, et al. The consequences of delaying elective surgery: surgical perspective. Ann Surg 2020;272(2):e79–80.
[77] Whaley CM, Pera MF, Cantor J, et al. Changes in health services use among commercially insured US populations during the COVID-19 pandemic. JAMA Netw Open 2020;3(11):e2024984.