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Techniques and Strategies to Optimize Efficiencies in the Office and Operating Room: Getting Through the Patient Backlog and Preserving Hospital Resources



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ABSTRACT

The effects of the coronavirus disease 2019 pandemic are pervasive and have decreased the volume of hip and knee arthroplasty procedures since the mandated cessation of elective surgical procedures at the height of the pandemic in early 2020. Therefore, a backlog of patients in need of these elective procedures is a probable consequence and increased productivity and efficiency in patient care delivery is essential now and into the future. This article outlines multiple strategies and techniques to develop and optimize efficiency in the hip and knee arthroplasty practice. Techniques for increasing surgical efficiency are detailed, along with perioperative strategies in the hospital, ambulatory surgery center, and office settings are outlined and discussed.

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The coronavirus pandemic (COVID-19) of 2020 has brought about change and ushered substantial changes for patients who undergo elective hip and knee arthroplasty and the surgeons, teams, and institutions who provide those services. During the height of the initial COVID pandemic, most institutions in the United States and abroad abruptly halted all elective hip and knee arthroplasty procedures for an approximately 6-week period mid-March through the end of April 2020 to conserve hospital beds and medical equipment such as personal protection equipment needed for the hospitalized patients with COVID-19. Based on a survey of American Association of Hip and Knee Surgeons, 92% of surgeons reported a cessation of inpatient elective hip and knee arthroplasty procedures [1]. In just the first two weeks of the mandatory elective surgery shutdown, an analysis of Medicare claims data revealed a steep decline in total knee arthroplasty (TKA) and total hip arthroplasty (THA) volumes in mid-March of 94% and 92%,

respectively [2]. The total daily hospital Medicare revenue for arthroplasty declined by 87% and surgeon revenue decreased by 85% [2]. While only a small number of orthopedic practices permanently closed due to financial hardship, 68% of those surveyed sought federal funding to offset their loss of revenue due to the mandated cessation of elective surgeries [1].

The mandatory elective surgery shutdowns in the height of the COVID-19 pandemic also have future implications. Surgeons and patients must navigate the complex new health care environment that focuses on identifying asymptomatic COVID-19 patients via preoperative testing and screening but also navigation of societal and patient apprehension with regard to undergoing an elective surgical procedure, such as hip and knee arthroplasty, during a tenuous and anxiety-provoking time in health care. It stands to reason that the incidence of end-stage hip and knee osteoarthritis does not decrease in the event of a year-long viral pandemic. In addition to the need to conserve hospital resources and preserve inpatient beds that has persisted in parallel to the COVID-19 persistence in our communities, it is generally accepted that the demand for hip and knee arthroplasty procedures remains below normal levels. In a recent study on this very topic, investigators used population-level data to estimate monthly THA and TKA procedural volume from 2011 to 2017 and project the “backlog” of THA and TKA monthly procedural volumes for 2020 to 2023 [3]. The projected national volume of delayed cases was 155,293 from

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mid-March to April 2020 at the height of the pandemic and 372,706 to June 2020. Based on this analysis, the projected catch-up time varied between nine and 35 months for the best- and worst-case scenarios. The addition of 20% increased productivity decreased this time to between 3 and 12 months [3]. The increase demand for productivity highlights the relatively urgent need to refocus on strategies within the clinic and operating room to increase the productivity and throughput to accommodate the inevitable backlog of hip and knee arthroplasty patients and maintain appropriate access to care.

Efficiency is defined as “achieving maximum productivity with minimum wasted effort or expense.” This definition emphasizes that efficiency is not simply accomplishing a task or process faster or with more speed, but rather with maximum productivity while minimizing wasted effort, expense, or resources. Surgeons and surgical teams frequently mischaracterize strategies and methods to become efficient as merely trying to move patients through their clinic or perform surgeries at a faster pace, rather than focusing on strategies to remove unwarranted effort or time-consuming, wasteful procedures. Creating and maintaining efficiencies in a hip and knee arthroplasty surgical practice requires time and energy, persistence, focus, discipline, continual education, leadership, and frequent detailed communication between all the stakeholders involved in clinical and surgical patient care. Across the patient clinical care continuum, the stakeholders involved in developing, maintaining, and optimizing efficiency include the hospital administration, orthopedic surgeons, anesthesia team, perioperative medical physicians, advanced providers, operating room staff, industry partners, central sterile supply, the preoperative and postoperative nursing staff, physical therapists and the clinical office nurses, and care providers. An additional stakeholder to consider is the ambulatory surgery center which has been thrust into the forefront in the COVID era due to the limitation of hospital beds and the apprehension of some patients to be hospitalized in the same facility as medically ill COVID-19 patients and the shared staff caring for those patients.

Strategies for Efficiency in Practice and Within the Office

An efficient surgical practice must consider additional resource and time-consuming burdens that have emerged in the COVID era. These include additional clinic screening processes for patients, social distancing limitations that may hamper appropriate clinic throughput, mandatory personal protective equipment management, enhanced patient room and office hygiene cleaning protocols, and diligent preoperative screening COVID-19 testing of surgical patients. When considering strategies to optimize efficiency, it is critical the orthopedic surgeon have an awareness and understanding that one cannot become maximally efficient individually or by oneself. Therefore, it is recommended to build a team of like-minded care providers who are focused and committed to the principals of optimal patient care and efficiency. A team in the office setting will frequently include registered nurses, physician assistance, medical assistants, and front office staff. The orthopedic surgeon should be the leader, facilitator, and torchbearer of value-based and efficient patient care and establish a culture of respect among all team members and empower them to excel at their peak ability. It is also important when building and maintaining a patient care team centered on quality and efficiency that the orthopedic surgeon compensate their staff and team members with “currency” that resonates with each of these valuable individuals. The “currency” may include advocacy for that person within their job and organization, frequent affirmation of outstanding effort, loyalty and success, and acknowledgment of their role and optimal performance in enhancing efficient patient care and even monetary

compensation to incentivize and reward patient care staff for going above and beyond to enhance efficient processes and patient care. As the patient care team leader, it is also critically important that the arthroplasty surgeon hold themselves accountable to continual process improvement, identifying and minimizing wasted time, resources and cost within his or her own behaviors, and practice of medicine.

Hip and knee arthroplasty is an ideal medical specialty for standardizing processes and utilizing process improvement methodologies and strategies to develop efficient patient care. This is achieved in the practice setting by avoiding redundancies and automating where duplication is frequently encountered, such as utilizing clinical templates within the electronic medical record or dictation system to avoid documentation that is repetitive and occurs frequently and repetitively within the patient office encounter. It is important to understand that building these templates to enhance efficiency through automation and reduction of resource duplication requires considerable amount of time initially but will pay dividends in efficiency optimization in the longer term. Further, it is recommended that the surgeon and his or her office staff identify the true essentials in surgical practice that positively affect patient care and outcomes and minimize those standard or potentially historical practices that have minimal bearing on patient outcome or satisfaction. A clinical practice that has been questioned historically has re-emerged as potentially unnecessary in the COVID era of medicine...routine radiographic follow-up of asymptomatic hip and knee arthroplasty patients [4–8]. Multiple peer-reviewed studies over the past decade have demonstrated most asymptomatic patients fail to show up in the arthroplasty surgeon's office and the utility of such annual follow-up appointments is of negligible clinical value [4–8]. These annual or routine radiographic follow-up visits for asymptomatic THA or TKA patients constitute a waste of time and resources and induce an unnecessary cost burden to the health care system [4–8]. Given these studies and data combined with current COVID era practices of social distancing and avoiding unnecessary patient contact to minimize COVID-19 transmission, routine radiographic follow-up of asymptomatic hip or knee arthroplasty patients in clinic represents an unwarranted and inefficient practice during the COVID era and beyond.

Strategies to Optimize Surgical Efficiency

Optimal and enhanced efficiency in the surgical care of hip and knee arthroplasty patients has numerous benefits to the patient, surgeon, and institution. Decreased operative time has been shown to minimize intraoperative blood loss and reduce the incidence of postoperative periprosthetic infection [9–11]. There are a number of successful strategies to enhance the surgical care efficiency of the hip and knee arthroplasty patient in the perioperative and operative environments. First, a partnership with anesthesia is paramount as the collaborative team effort between the anesthesiologist and orthopedic surgeon is a mandatory component of an efficient hip and knee arthroplasty program. In addition, a partnership of mutual respect and trust with your hospital administration or ambulatory surgery center leadership is critical to enable and empower the orthopedic surgeon to cultivate optimal resources and culture within the preoperative and postoperative nursing staff, as well as the operating room assistants and nursing staff. Frequent collaborative educational endeavors in collaboration with industry partners are highly recommended to ensure that the surgical staff anticipate the surgical steps of the surgeon and the associated instrumentation in the highest quality and most efficient manner possible.

When building and maintaining a highly efficient hip and knee arthroplasty surgical program, it is critical that the optimal effort, focus, accountability, and performance of the orthopedic surgeon be paramount and the cornerstone of a successful program. The arthroplasty surgeon must critically and frequently evaluate themselves and continuously evolve to minimize surgical variability and inefficiency and maximize consistency and repetition wherever possible in the procedural steps of a hip and knee arthroplasty procedure. The staff and surgical assistants in the operating room cannot be maximally efficient in an unpredictable environment that can occur if procedural steps are unable to be predicted and anticipated. Another valuable and worthwhile exercise of process improvement is for the surgeon and surgical team to film video of themselves performing a hip or knee arthroplasty procedure and critically evaluate the footage. Particular attention should be paid when reviewing the video footage for any time the surgical field remains idle, and this time should be minimized or completely eliminated whenever possible. This concept of minimizing surgical field idle time emphasizes the previously stated definition of efficiency, where improving surgical efficiency should not be confused as faster movements or the surgeon and team trying to perform the surgical steps more quickly but rather performing the surgical steps safely and consistently while minimizing wasted an unnecessary idle surgical time.

There are strategies to optimizing efficiency in the perioperative time period as well, which enhances the overall efficiency in the arthroplasty program and care delivery model. The anesthesiologist, perioperative medical physician, orthopedic surgeon, physician assistants, and nursing staff should collaboratively develop and optimize standardized protocols that encompass optimal fluid resuscitation, multimodal pain control, and postoperative care pathways. These optimized care pathways combined with efficient and standardize surgical techniques to minimize operative time and blood loss will result in a consistent patient delivery into the postanesthesia recovery unit with minimal fluid shifts, minimal fluctuation in vitals, and adequate pain control that facilitates early ambulation, functional recovery, and safe discharge from either the hospital or the ambulatory surgery center in a timely manner.

As the surgeon and surgical team are able to optimize the efficiencies in the operating room and the perioperative phases as outlined previously, surgical and patient throughput can be enhanced to increase the productivity of hip and knee arthroplasty programs by implementing “jump rooms,” “overlapping surgeries,” or “dual-occupancy” surgery techniques. Numerous publications in peer-reviewed journals have demonstrated patient safety and optimized outcomes through the judicious use of overlapping surgical procedures in appropriate programs with sufficient staff, enhanced surgeon availability and proficiency, and well-trained surgical assistants who enable the surgeon to be present during the critical portions of the surgical procedure [12–14]. This allows maximal efficiency by having one operating room undertaking the preparation of the patient with anesthesia induction, patient positioning, skin preparation, and instrumentation preparation while the surgeon is performing a surgical procedure in an adjacent operating room. While this strategy is highly effective in optimizing efficiency and patient throughput, it is critical that surgeons evaluate their own ability and the ability of their surgical and perioperative team to honestly and transparently ensure the highest level of patient safety.

Conclusion

Strategies to enhance efficiency and hip and knee arthroplasty have once again risen to the forefront due to the anticipated backlog of patients that inevitably will arrive due to the decreased

surgical demand observed within the current COVID pandemic. This need for efficiency will persist beyond the immediate COVID era and a team approach is critical to optimizing the efficient care of the hip and knee arthroplasty patient. Future considerations to enhance efficiency should critically evaluate whether surgical improvements and technology truly add value or decrease efficiency by introducing wasteful time or expense. There are a number of technologies or procedural efficiencies that must be critically assessed in the COVID era. Is the well-documented increase in surgical time associated with robotic assistance during partial and total knee arthroplasty offset with any true clinical value? [15] Is performing a total hip arthroplasty through a direct anterior approach worth the well-documented increased surgical time and inefficiency? [16] Can certain patients undergo total knee arthroplasty with uncemented fixation and obviate the need to “waste” ten minutes per procedure allowing cement to cure? Does every patient require the additional resources and time required to resurface their patella in a routine primary total knee arthroplasty if the native patella tracks perfectly and has intact cartilage with minimal damage? These issues should continue to be studied and evaluated for their true value and may further enhance efficiency in the care of the hip and knee arthroplasty patient.

References

- [1] Stambough JB, Deen JT, Walton SL, Kerr JM, Zarski MJ, Yates Jr AJ, et al. Arthroplasty during COVID-19: surveillance of AAHKS members in the first year of the pandemic. *Arthroplast Today* 2021;7:209.
- [2] Barnes CL, Zhang X, Stronach BM, Haas DA. The initial impact of COVID-19 on total hip and knee arthroplasty. *J Arthroplasty* 2021.
- [3] Wilson JM, Schwartz AM, Farley KX, Roberson JR, Bradbury TL, Guild 3rd GN. Quantifying the backlog of total hip and knee arthroplasty cases: predicting the impact of COVID-19. *HSS J* 2020;1.
- [4] Barrack TN, Abu-Amer W, Schwabe MT, Adelani MA, Clohisey JC, Nunley RM, et al. The burden and utility of routine follow-up at one year after primary arthroplasty. *Bone Joint J* 2020;102-B(Supple_B):85.
- [5] Hendricks TJ, Chong ACM, Cusick RP. The cost of routine follow-up in total joint arthroplasty and the influence of these visits on treatment plans. *Kans J Med* 2018;11:59.
- [6] Jacobs CA, Christensen CP, Karthikeyan T. Assessing the utility of routine first annual follow-up visits after primary total knee arthroplasty. *J Arthroplasty* 2015;30:552.
- [7] Hacking C, Weinrauch P, Whitehouse SL, Crawford RW, Donnelly WJ. Is there a need for routine follow-up after primary total hip arthroplasty? *ANZ J Surg* 2010;80:737.
- [8] Bolz KM, Crawford RW, Donnelly B, Whitehouse SL, Graves N. The cost-effectiveness of routine follow-up after primary total hip arthroplasty. *J Arthroplasty* 2010;25:191.
- [9] Ravi B, Jenkinson R, O'Heireamhoin S, Austin PC, Aktar S, Leroux TS, et al. Surgical duration is associated with an increased risk of periprosthetic infection following total knee arthroplasty: a population-based retrospective cohort study. *EClinicalMedicine* 2019;16:74.
- [10] Teo BJX, Yeo W, Chong HC, Tan AHC. Surgical site infection after primary total knee arthroplasty is associated with a longer duration of surgery. *J Orthop Surg (Hong Kong)* 2018;26. 2309499018785647.
- [11] Badawy M, Espehaug B, Fenstad AM, Indrekvam K, Dale H, Havelin LI, et al. Patient and surgical factors affecting procedure duration and revision risk due to deep infection in primary total knee arthroplasty. *BMC Musculoskelet Disord* 2017;18:544.
- [12] Hamilton WG, Ho H, Parks NL, Strait AV, Hopper Jr RH, McDonald 3rd JF, et al. The Lawrence D. Dorr surgical techniques & technologies award: “running two rooms” does not compromise outcomes or patient safety in joint arthroplasty. *J Arthroplasty* 2018;33:58.
- [13] Waly FJ, Garbuz DS, Greidanus NV, Duncan CP, Masri BA. Safety of a ‘swing room’ surgery model at a high-volume hip and knee arthroplasty centre. *Bone Joint J* 2020;102-B(Supple_B):112.
- [14] Zachwieja E, Yayac M, Wills BW, Wilt Z, Austin MS, Courtney PM. Overlapping surgery increases operating room efficiency without adversely affecting outcomes in total hip and knee arthroplasty. *J Arthroplasty* 2020;35:1529.
- [15] Chin BZ, Tan SSH, Chua KCX, Budiono GR, Syn NL, O'Neill GK. Robot-assisted versus conventional total and unicompartmental knee arthroplasty: a meta-analysis of radiological and functional outcomes. *J Knee Surg* 2020.
- [16] Peng L, Zeng Y, Wu Y, Zeng J, Liu Y, Shen B. Clinical, functional and radiographic outcomes of primary total hip arthroplasty between direct anterior approach and posterior approach: a systematic review and meta-analysis. *BMC Musculoskelet Disord* 2020;21:338.