

Maximizing Efficiency in the Operating Room for Total Joint Arthroplasty

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Developing a high-efficiency operating room (OR) is both a challenging and rewarding goal for any healthcare system. The OR is traditionally a high-cost/high-revenue environment¹ and operative efficacy has been correlated with low complication rates and surgical success.² An efficient OR is one that maximizes utilization while providing safe, reproducible, cost-effective, high-quality care. Total joint arthroplasty (TJA) has occupied the center stage for OR efficiency research, in part due to increasing demands from our aging population³ and economic pressures related to high implant costs, decreased reimbursement, and competition for market shares when OR time and space are limited.

A PubMed search on OR efficiency in TJA shows a disproportionately high focus on surgical technique, such as use of patient-specific instrumentation (PSI), computer-assisted surgery (CAS), minimally invasive surgery, and closure with barbed suture. In a retrospective review of 352 TKA patients who had PSI vs conventional instrumentation, DeHaan and colleagues⁴ found that PSI was associated with significantly decreased operative and room turnover times (20.4 minutes and 6.4 minutes, respectively). In another prospective multicenter study, Mont and colleagues⁵ showed a reduction in surgical time by 8.90 min for navigated total knee arthroplasty (TKA) performed with single-use instruments, cutting blocks, and trials. Other investigators compared PSI to CAS in TKA and found PSI to be 1.45 times more profitable than CAS, with 3 PSI cases performed in an 8-hour OR day compared to 2 CAS cases.⁶

There is no question that improved surgical technique can enhance OR efficiency. However, this model, while promising, is difficult to implement on a wide scale due to surgeon preferenc-

es, vendor limitations, and added costs related to the advanced preoperative imaging studies, manufacturing of the custom guides, and maintenance of navigation equipment. In addition, while interventions such as the use of barbed suture have the potential for speeding closure time, the time saved (4.7 minutes in one randomized trial)⁷ may not be enough to affect major utilization differences per OR per day. These technologies are also frequently employed by high-volume surgeons with high-volume teams and institutions.

Ideally, we need investment in the human capital and a collective change in work cultures to produce high-quality, well-choreographed, easily reproducible routines. An efficient OR requires the synchronous involvement of a large team of individuals, including hospital administrators, surgery schedulers, surgeons, anesthesiologists, preoperative holding area staff, OR nurses, surgical attendants, sterile processing personnel, and recovery room nurses. Case schedulers should match allocated block time with time required for surgery based on the historical performance of the individual surgeon, preferably scheduling similar cases on the same day. Preoperative work-up and medical clearance should be completed prior to scheduling to avoid last-minute cancellations. Patient reminders and accommodations for those traveling from long distances can further minimize late arrivals. Prompt initiation of the perioperative clinical pathway upon a patient's check-in is important. The surgical site should be marked and the anesthesia plan confirmed upon arrival in the preoperative holding area. Necessary products need to be ready and/or administered in time for transfer to the OR. These include prophylactic antibiotics, coagulation factors (eg, tranexamic acid), and blood products as indi-

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cated. Spinal anesthesia, regional nerve blocks, and intravenous (IV) lines should be completed before transfer to the OR. A “block room” close to the OR can allow concurrent induction of anesthesia and has been shown to increase the number of surgical cases performed during a regular workday.⁸ Hair clipping within the surgical site and pre-scrubbing of the operative extremity should also be performed prior to transfer to the OR in order to minimize microorganisms and dispersal of loose hair onto the sterile field.

Upon arrival of the patient to the OR, instrument tables based on the surgeon preference cards should be opened, instrument count and implant templating completed, necessary imaging displayed, and OR staff ready with specific responsibilities assigned to each member. Small and colleagues⁹ showed that using dedicated orthopedic staff familiar with the surgical routine decreased operative time by 19 minutes per procedure, or 1.25 hours for a surgeon performing 4 primary TJAs per day. Practices such as routine placement of a urinary catheter should be seriously scrutinized. In a randomized prospective study of patients undergoing total hip arthroplasty under spinal anesthesia, Miller and colleagues¹⁰ found no benefit for indwelling catheters in preventing urinary retention. In another randomized prospective study, Huang and colleagues¹¹ found the prevalence of urinary tract infections was significantly higher in TJA patients who received indwelling urinary catheters.

A scrub nurse familiar with the instruments, their assembly, and the sequence of events can ensure efficient surgical flow. The scrub nurse needs to anticipate missing or defective tools and call for them, ideally before the incision is made. Direct comparison studies are needed to assess the efficacy of routine intraoperative imaging vs commercially available universal cup alignment guides or clinical examinations in determining acceptable component positioning and limb length. Following component implantation and before wound closure, the circulating nurse should initiate the process of acquisition of a recovery room bed, make sure dressing supplies and necessary equipment are available, and call for surgical attendants. Lack of surgical attendants, delayed transfer from the OR table to hospital bed, and prolonged acquisition of a recovery room bed have been identified as major OR inefficiencies in a retrospective study

by Attarian and colleagues.¹²

In summary, time is the OR’s most valuable resource.¹³ We believe that a consistent, almost automated attitude to the above procedures decreases variability and improves efficiency. By providing clear communication of the surgical needs with the team, having consistent anesthesia and nursing staff, implementing consistent perioperative protocols, and insuring that all necessary instruments and modalities are available prior to starting the procedure, we were able to sustainably increase OR throughput in a large teaching hospital.^{9,14} This process, however, requires constant review to identify and eliminate new gaps, with each member of the team sharing a frank desire to improve. In this regard, hospital administrators share the duty to facilitate the implementation of any necessary changes, allocation of needed resources, and rewarding good effort, which could ultimately increase staff satisfaction and retention. Because efficiency is the ratio of benefits (eg, revenue, safety, etc.) to investment (eg, implant costs, wages, etc.), raises the question: what would be the effect of transitioning from hourly-wage to a salary-based system for key support staff? Unlike hourly-wage personnel, who have no incentive for productivity, a salaried employee assigned to a high-efficiency OR will inherently strive for improvement, employing higher organizational skills to accomplish a common goal. To our knowledge, there is no published data on this topic.

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