

High efficiency endocrine operation protocol: From design to implementation



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Background. We developed a high efficiency endocrine operative protocol based on a mathematical programming approach, process reengineering, and value-stream mapping to increase the number of operations completed per day without increasing operating room time at a tertiary-care, academic center. **Methods.** Using this protocol, a case-control study of 72 patients undergoing endocrine operation during high efficiency days were age, sex, and procedure-matched to 72 patients undergoing operation during standard days. The demographic profile, operative times, and perioperative complications were noted. **Results.** The average number of cases per 8-hour workday in the high efficiency and standard operating rooms were 7 and 5, respectively. Mean procedure times in both groups were similar. The turnaround time (mean \pm standard deviation) in the high efficiency group was 8.5 (\pm 2.7) minutes as compared with 15.4 (\pm 4.9) minutes in the standard group ($P < .001$). Transient postoperative hypocalcemia was 6.9% (5/72) and 8.3% (6/72) for the high efficiency and standard groups, respectively ($P = .99$). **Conclusion.** In this study, patients undergoing high efficiency endocrine operation had similar procedure times and perioperative complications compared with the standard group. The proposed high efficiency protocol seems to better utilize operative time and decrease the backlog of patients waiting for endocrine operation in a country with a universal national health care program. (Surgery 2016;160:1118-24.)

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MOUNTING CONSTRAINTS ON THE CANADIAN HEALTH CARE SYSTEM have brought about management strategies to minimize underutilization and decrease costs in hospitals.¹ One high expenditure area is the operating room (OR). Disruptions in operative flow not only increase costs, but also lead to frustrations for the surgical team, hospital administration, and the patient.² In fact, repetitive

disruptions can contribute to prolonged surgical wait times.²

Various authors have studied the processes related to patient flow in the OR in means of improving efficiency.³⁻⁹ In 2009, the American College of Surgeons launched an initiative to analyze operative flow from booking the operation to discharge from hospital across 3 surgical specialties.⁴ Using the principles of Lean Six Sigma, which minimize process variability and remove non-value added procedures, the authors identified key factors associated with increased efficiency.^{4,10} A notable finding was the benefit of parallel processing of co-workers.⁴ The turnaround time (ie, the time between a patient leaving the OR to the next patient entering) was a commonly used benchmark to gauge the impact of operative efficiency.^{1,2,4}

A transformational change program with the goal of increased process efficiency and improved patient access to services was initiated at the Jewish General Hospital, a university affiliated hospital in Montreal, Canada. The foundation of this research

Preliminary data presented at the Canadian Society of Otolaryngology Annual Meeting in Winnipeg, Canada, June 8, 2015. Final results presented at the Central Surgical Association meeting in Montreal, Canada, March 11, 2016.

Accepted for publication June 23, 2016.

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0039-6060/\$ - see front matter

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<http://dx.doi.org/10.1016/j.surg.2016.06.037>

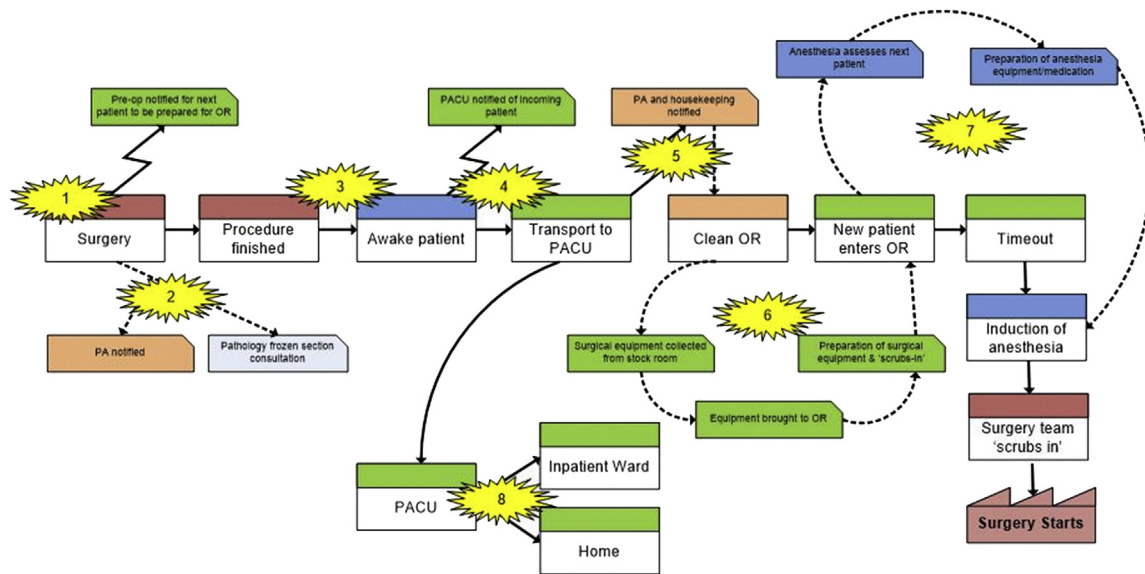


Fig 1. A value stream map of perioperative patient flow. See [Table I](#) for a description of non-value added task and improvement strategies. OR, Operating room; PA, patient attending; PACU, post anesthesia care unit.

was based on operational design, Lean methodology, and process improvement directed towards more strategic management of patient flow in the OR.^{11,12} Despite our preliminary changes which resulted in a more efficient OR, wait times for operation still were problematic, especially for thyroid operation. In this study, we describe a method to analyze the efficiency of OR utilization for thyroidectomy and parathyroidectomy cases and describe a high efficiency protocol for endocrine operation at a Canadian, tertiary care, academic medical center. We compare operative times and complication rates to assess the value and risks associated with a high efficiency protocol.

METHODS

Modeling of the problem. Using a mathematical model, we analyzed the scheduling of endocrine operation cases at our institution. The optimal number of cases per day and sequence of cases was modeled as a knapsack problem. This model uses a combinatorial optimization approach to select the sequence of items (eg, surgical procedures) to be placed together (ie, in any given day) within a series of patients awaiting operation. The goal for this mathematical model was to maximize the number of cases scheduled in the OR per day, considering the expected operative times for each case, turnaround time, and constraints on an 8-hour workday. The results showed that a better case-mix (scheduling of sequential short duration, high volume procedures) would allow for an

additional operation every 4 OR days. The only other way to increase the number of cases would be to decrease the durations of the procedure, anesthesia, or turnaround times. In order to achieve these objectives, we employed process mapping, Lean Six Sigma, methodology, and process reengineering.

High efficiency protocol design and implementation. The first step to design the protocol was to develop a perioperative patient flow value stream map ([Fig 1](#)) with the help of key stakeholders, including leaders from otolaryngology, anesthesia, and nursing as well as health care management, secretarial staff, and housekeeping services. Non-value-added tasks were identified and improvement strategies implemented to enhance flow ([Table I](#)). The high efficiency protocol was refined after multiple roundtable discussions to identify and correct delays in operative flow. The main differences compared to a standard OR protocol were the appropriate selection of cases, organization of teams, efficient turnovers, and facilitation of discharges from the recovery room. Using the high efficiency protocol, up to 8 endocrine operation cases could be performed during regular OR hours (7:30 AM to 3:30 PM) as opposed to 5 cases using the standard protocol. Given the variability in OR time available at our institution which fluctuates on a month-by-month basis, the high efficiency protocol was implemented in 1 of 12 operating rooms 1 day every 4–6 weeks.

Organization of teams with the high efficiency protocol. The surgical team in place for the high

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