

Evaluating Operation Theatre Metrics - A Focus on Optimum Use of Operation Theatre Time

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Abstract: ***Background and Aim:** The operation theatre metrics is an important quality indicator in a hospital. They indicate optimum utilization of operation theatre time ensuring maximum output. This study evaluated these operation theatre metrics – namely First Case in time, Anaesthesia Time, Case cancellation on the day of surgery, wheel out to Wheel in time and unplanned to Operation Theatre. **Materials and methods:** This prospective observational study was done in 9 operation theatre of tertiary care medical College hospital. The project was done in two parts, where first data was collected regarding the operation theatre metrics (namely First Case in time, Anaesthesia Time, Case cancellation on the day of surgery, wheel out to Wheel in time and unplanned return to Operation Theatre) from 322 patients. The data was analyzed using SPSS software and based on the results corrective measures were implemented. **Results:** There was 16 cases of first case in delay out of 106 cases of 322 cases (3.77%). The most common cause was 'Surgeon being late' (50%), followed by anaesthetist being late (25%). Delay in Anaesthesia Time was noted in 18 patients (5.59%). Spinal Anaesthesia failure leading to need for repeat Spinal Anaesthesia was the most common cause (22.2%). 19 cases got during the period of study, 6 cases were of Orthopaedic Surgery and most common cause was delay in Insurance approval. This was followed by General Surgery department cases (5 cases). Wheel out to Wheel in delay were noted in 4 cases (1.24%). 4 cases in these 322 patients had unplanned return to operation theatre (1.24%) out of which 3 were from General Surgery and 1 was from Spine Surgery. Corrected measures were recommended in the meeting after root cause analysis which included to avoid undue delay by surgeons and anaesthetist, proper coordination of operation theatre manager and surgeons, coordination of Anaesthesia technician and anaesthetist to maintain proper cold chain of anaesthetic drugs and maintenance of temperature of Operation theatre. **Conclusion:** The optimum utilization of Operation theatre is an important quality indicator in health care delivery system, which signifies delivering optimum care to patients with optimum utilization of available resources. Many of the indicators can be improved with constant monitoring of these metrics and better coordination of operation theatre personnel.*

Keywords: Operation theatre metrics, First case in time, Wheel out to wheel in time, Unplanned return, case cancellation

1. Introduction

Efficient management of the operating theatre is crucial, as hospitals face increasing pressure to achieve optimal outcomes with limited resources. Delays in starting the first case have both financial and social consequences, potentially causing last-minute cancellations of scheduled surgeries and extending hospital waiting lists.¹ Operating theatre efficiency is closely linked to reduced theatre turnover time, leading to better patient outcomes, shorter hospital stays, and more cost-effective allocation of healthcare resources².

Preparation of equipment and necessary materials for operating theatre cases should be completed well in advance. Leveraging modern technology facilitates timely booking and efficient scheduling of surgeries.³

Cancellation on the day of surgery and unplanned return to operation theatre is also considered as failure of quality. In this tertiary care center, an average of 40 major surgeries take place on daily basis. A large number of staff are involved in successful completion of all planned surgeries in a day. Reports of few cancellations of surgeries are recorded in a week. These numbers, even if small, lead to patient dissatisfaction, increased financial burden to hospital and extra working hours for staff. Many anecdotal reasons are mentioned in the log for delay and cancellation of surgeries. These are analyzed on case to case basis based on the incident reporting mechanism of the hospital. However, a detailed and structured analysis as well as mitigation plan could help our operation theatre manager to better plan the surgeries in advance by identifying and analysing the reasons for delay and cancellation of surgeries. This study intended to fill this gap, and provide an analysis of delays and cancellations of

surgeries and recommend changes for an efficient operation theatre functioning.

2. Methodology

The study was a prospective observational study, and was conducted in 9 operation theatres of a tertiary care medical college hospital. Inclusion criteria-All elective listed cases done in 9 Operation theatres and Exclusion criteria-Emergency cases including Cardiothoracic surgery, neurosurgery and spine surgery cases. Sample size based on study by Rakesh Garg et al.¹³ was calculated to be 322, undergoing elective surgery. The following operation theatre metrics was recorded manually from the case records on a daily basis on excel sheet-

- 1) **First case on time start-** The first case on time start is the time when the first patient was wheeled into the Operation Theatre (15 minutes or more)
- 2) **Anaesthesia time-** Anaesthesia time refers to the period from anaesthesia start to anaesthesia stop. (from attaching monitors to intubation for general anaesthesia, from attaching monitors to finishing the performance of blocks for regional anaesthesia) (30 minutes or more)
- 3) **Cancellation on the day of surgery-** Cancellation on the day of surgery was the case which was posted in the elective list and is cancelled on the day of surgery.
- 4) **Turn over time (wheel out to wheel in)-** Turn over time (Wheel out to wheel in) was the time from the patient exiting the operation theatre to the next patient entering the operation theatre. (30 minutes or more)
- 5) **Unplanned return to operation theatre-** Unplanned return to operation theatre was, when patient was taken up again for surgery because of surgery or anaesthesia related complications within 48 hours.

Every day, the previous day's data entered in the excel sheet was analyzed and the cause for delay of case or return to operation theatre was noted.

anaesthesiologists to maintain proper cold chain of anaesthetic drugs, maintenance of temperature of Operation theatre.

3. Results and Discussion

The average Anesthesia procedure time was 13.84 minutes. The average time for surgeons to start the case post anaesthesia was 30.40 minutes. There was 16 cases of first case in delay out of 106 cases of 322 cases (3.77%). The most common cause this was 'Surgeon being late' (50%), followed by anaesthetist being late (25%). Delay in Anaesthesia Time was noted in 18 patients (5.59%). Spinal anaesthesia failure leading to need for repeat Spinal Anaesthesia was the most common cause (22.2%). Out of 19 cases got during the period of study, 6 cases were of Orthopaedic Surgery and most common cause was Delay in Insurance approval. This was followed by General Surgery department cases (5 cases).

Wheel out to Wheel in delay were noted in 4 cases (1.24%). 4 cases in these 322 patients had unplanned return to operation theatre (1.24%) out of which 3 were from General Surgery and 1 was from Spine Surgery. Corrected measures were recommended in the meeting after root cause analysis which included to avoid undue by surgeons and Anesthetist, proper coordination of operation theatre manager and surgeons, coordination of Anaesthesia technician and

Table 1: Gender Distribution

Sex	Number
Male	142
Female	179
Total	322

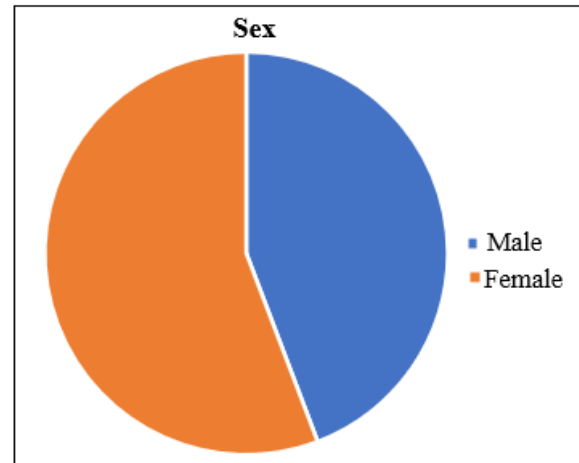
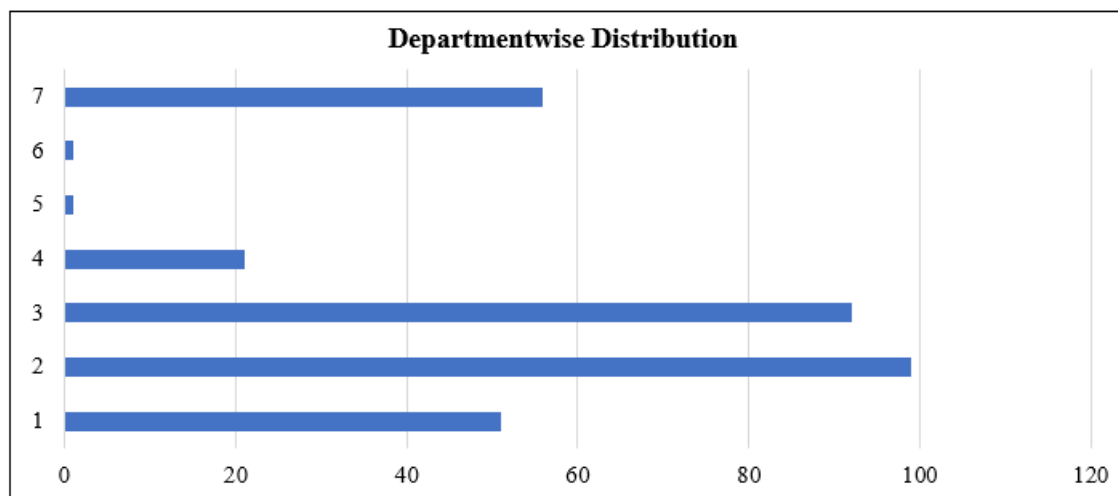


Figure 1: Gender distribution



Legend

- 1) Urology
- 2) General Surgery
- 3) Orthopaedics
- 4) ENT
- 5) OMFS
- 6) Plastic surgery
- 7) OBG

Figure 2: Department wise distribution

Table 2: Department- wise distribution

Department	Number of cases per department
1. Urology	51
2. General Surgery	99
3. Orthopaedics	92
4. ENT	21
5. OMFS	1
6. Plastic Surgery	1
7. OBG	56

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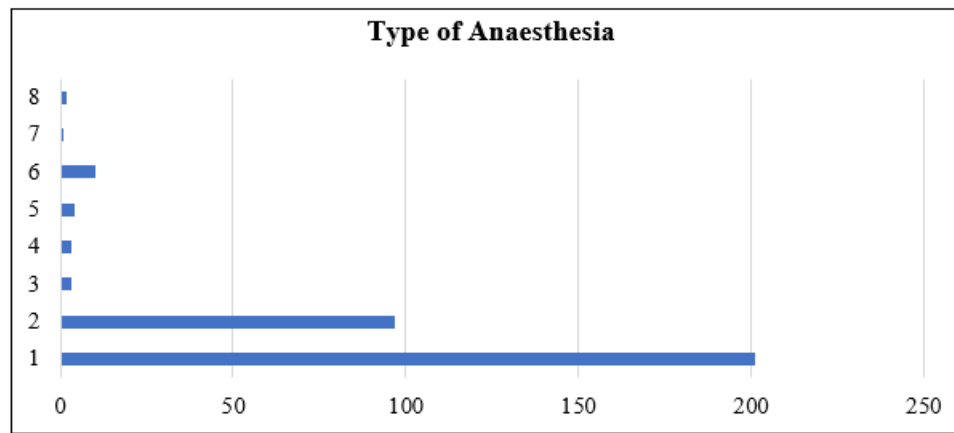


Figure 3: Anaesthesia type

Legend

- 1) SAB
- 2) GA
- 3) GA+Brachial plexus block
- 4) CSE
- 5) SGA
- 6) BPB
- 7) GA+Epidural

Table 3: Anaesthesia type

Type of Anaesthesia	Number of cases
1. SAB	201
2. GA	97
3. GA+Brachial plexus block	3
4. CSE	3
5. SGA	4
6. BPB	10
7. GA+Epidural	1
8. others	2

Table 4: Types of Delay

S No	Type of delay	Number of cases	Percentage
1	First case in delay	26	36
2	Anaesthesia delay	15	21
3	Wheel out to wheel in time	5	7
4	Incision delay	22	28
5	Extubation delay	6	8

Out of 74 cases of delays, 36% was because of first case in delay whereas 28% was because of incision delay and 15% contributed to Anaesthesia delay.

Table 5: First case in delay

Cause of First case in delay	Number of cases	Percentage
Anaesthetist came late	4	25
Arterial cannulation	1	6.25
Difficult to position	1	6.25
Surgeon came late	8	50
One Anaesthetist in 2 OTs	2	12.5

Mohinder Kumar in 2016 remarked that Operation theatre is a very expensive department of the hospital and amounts to almost one third of hospital Budget. The efficient running of operation theatre involves a perfect combination of all concerned staff and is often described as “acronym TEAM, which means together everybody achieves Maximum.”

Establishing a strong rapport, effective communication skills of the OT in charge, a dedicated and professionally trained team, as well as well-structured services, equipment, and layout, are essential for optimizing OT efficiency. Start time delays occur due to process failures or equipment malfunctions.² Delays in commencing the first surgery of the day not only have financial consequences but also social implications, potentially leading to last-minute cancellations of scheduled procedures and extended hospital waiting lists. Since start time delays are largely preventable and minimally affected by external factors, addressing them can significantly enhance OT utilization. The primary cause of OT delays was surgeon-related factors (32%), followed by patient-related issues (18%). Anaesthetist-related factors accounted for 7% of the delays, while hospital administrative reasons contributed to 10%.¹

In an analysis of 100 orthopaedic surgeries, 56% of cases started on time, whereas 44% experienced delays. Among the causes of these delays, hospital-related factors were the most significant (15%), followed by patient-related reasons (14%). Surgeon-related factors accounted for 8%, and anaesthetic-related delays were 7%. The study highlights that reducing morning tardiness and addressing surgeon-related delays in initiating the first surgery could significantly improve OT efficiency.⁴ Most delays stem from system and process-related issues, many of which are correctable—particularly surgeon tardiness. Adopting a proactive approach to minimizing these delays can enhance efficiency and reduce costs. Conducting regular audits is essential for monitoring performance and implementing necessary improvements. In 2022, Blake suggested that surgeon practices and preoperative processes were the primary factors affecting OR inefficiency in a community-based hospital during this project. To enhance daily OR flow in similar institutions, future strategies should focus on ensuring surgeons arrive on time and optimizing the preoperative process to effectively minimize FCOTS (First case on time start) delays. The

median waiting time in the reception room was 42 minutes, with 65% of patients waiting between 25 and 62 minutes. The primary cause of delays in the operating room, occurring in 38% of cases, was the unavailability of the anaesthesiologist. Delays were the most frequent type of error, accounting for 33.6% of cases, with over half (51.4%) of all cases experiencing at least one delay.⁷ The primary cause of these delays was equipment failure. Delays were more common in the first cases of the day and in cranial procedures compared to subsequent cases and spinal procedures. Additionally, a delay in starting the first case was linked to further delays throughout the day.

The on-time start of the first case has long been recognized as a key OR metric, as it can predict overall efficiency throughout the operating day. Studies have shown that it enhances patient satisfaction, reduces unplanned cancellations, minimizes workplace stress, increases hospital capacity for elective surgeries, lowers overtime costs, improves theatre productivity, and shortens patient wait times. Unplanned return rates were higher after unscheduled surgeries (3.2%) compared to scheduled surgeries (1.7%; $P < 0.001$). However, unplanned return rates remained stable over time, with no significant variation across different procedure types over the three-year study period ($P = 0.43$).¹¹ The meta-analysis found that the global prevalence of case cancellations on the scheduled day of surgery was 18% (95% CI: 16–20). It also identified the unavailability of operating theatre facilities as the leading cause of cancellations, followed by the absence of an attendant and changes in the patient's medical condition.⁵

Khan et al did the first systematic review examining the impact of Golden Patient Initiative (GPI) on operating theatre efficiency. Findings from multiple studies indicate improvements in theatre start times and a reduction in case cancellations wherever these metrics were assessed. Additionally, various other parameters, such as theatre finish time, total operating duration, and the number of cases performed, also showed positive changes. Overall, GPI demonstrates significant potential in enhancing theatre efficiency, contributing to improved patient safety and cost savings—critical factors in the post-pandemic era, where waiting lists have surged dramatically.⁸

The most common cause of delays was surgeon-related factors (32%), followed by patient-related factors (18%) and anaesthetist-related factors (7%). Hospital administrative reasons accounted for 10% of the delays. Out of 1,178 surgeries conducted during the study period, 1,170 (99.3%) experienced delays. The average delay time across all cases was 151 minutes, with the first case of the day facing a significantly longer delay than subsequent cases (198.9 minutes vs. 108.5 minutes, $P = 0.000$). Delays in the first cases accounted for 47.5% of all delayed cases. Overall, patient-related factors were the most common cause of delays (31.3%), followed by surgeon-related factors (28.5%) and hospital-related factors (26.2%). Patient-related factors were particularly prominent in first-case delays, contributing to 43.2% of them.⁹ There was a significant relationship between personnel, surgical, equipment, and consumable factors and turnaround time (TAT) ($p < 0.05$). Contributing factors included prolonged nursing handover time ($p = 0.000$), staff

shortages ($p = 0.039$), lack of support from theater managers ($p = 0.020$), urgency of surgery ($p = 0.025$), lack of blood supply ($p = 0.000$), and insufficient availability of drapes and gowns ($p = 0.019$).¹⁰

Conversely, the availability of anaesthesia machines ($p = 0.019$), essential drugs ($p = 0.041$), stretchers, and wheelchairs ($p = 0.022$) helped reduce TAT. Other challenges identified were unreliable electricity ($p = 0.011$) and oxygen supply ($p = 0.023$), as well as difficulty in accessing main theatres from surgical wards and the ICU ($p = 0.000$).¹²

4. Conclusions

The optimum utilization of Operation theatre is an important quality indicator in health care delivery system, which signifies delivering optimum care to patients with optimum utilization of available resources. Many of the indicators can be improved with constant monitoring of these metrics and better coordination of operation theatre personnel.

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