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# Overview on Miss Management in Turn over Time in Orthopaedic Operative Room

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## Abstract

**Background:** The operating room (OR) is one of the most important hospital units, but wasted time negatively affects its efficiency. The need to provide timely patient care has prompted this assessment of the time is required to transfer patients to the OR.

**Patients and Methods:** This study examined 382 patients undergoing orthopedic surgery in our orthopedic ward. Patient demographic information, mode of transfer, anesthesia type and surgery site were recorded. The time elapsed during the transfer of patients between stages was measured.

**Results:** Time from the surgical team informing the OR staff about impending surgery and the orthopaedic ward being told to transfer the patient was 3.091±2.804 min. Furthermore, the time spent transferring patients from the orthopaedic ward to the OR was 27.622±17.198 min. The time of preparing the OR, administering anesthesia, patient preparation for surgery, surgical procedure, and transferring to the recovery room were 18.287±16.835 min, 23.785±32.498 min, 48.324±37.9 min, 85.790±61.859 min and 13.738±9.088 min, respectively. The patients spent 32.617±15.88 min in recovery room before transfer back to the ward. The type of anesthesia or surgery site was found not to be associated with the time elapsed at each stage. There was no significant relationship between the time required to transfer patients from the orthopaedic ward to the OR and the mode of transfer (gurney or wheelchair).

**Conclusions:** The presence of trained staff for the proper turn-over of patients in the a department and in the OR, their cooperation, teamwork, interaction and careful monitoring of the staff in the OR and specialized training for the staff can decrease problems in this area.

**Keywords:** Operating room; Patient; Hospital ward; Mode of transfer

## Introduction

The operating room (OR) is the most dynamic ward in a hospital. Factors that decrease the productivity of an OR are the time squandered moving from one stage to another (under-utilized OR time) and personnel being required to work overtime hours (over-utilized OR time). Overtime work beyond regular hours is expensive and results in unplumbed costs resulting from the displeasure and decreased motivation of personnel [1]. A common reason that nurses cite for leaving a job is overtime [2] and scheduling complications. This is a major cause of nursing staff turnover [3]. Effective OR management should aim for maximal use of available OR time while decreasing the amount of overtime the staff is required to work [4].

Delays can arise from human error and system inefficiency [5]. Delay in preoperative treatment can be associated with negative outcomes including increased morbidity and mortality [6-8]. Unlike preoperative delays, which can include a prolonged waiting time or postponement, perioperative delays occur on the planned day of surgery and include delays getting to the OR and during surgery. Perioperative delays prevent maximum patient flow and are a common cause of frustration. They have a negative effect on surgical efficiency and on the working environment. Delays in operative room can be associated with considerable financial burden on health system [9,10]. However, their causes and effects on patient care and resource utilization are not well-defined [9]. Solutions for inefficiency in the OR cannot be managed unless the delays occurring on the day of surgery are sensibly explored. Thus, we aimed to investigate the time required for transferring patients in the OR stratified by the surgery site, type of anesthesia and the mode of transport.

## Materials and Methods

### Study design

All patients undergoing orthopaedic surgery in the orthopaedic ward of a University hospital from July 2017 through March 2018 were entered cross-sectionally into an observational study that identified and recorded all chronological information. Emergency and after-hours cases were excluded. A trained observer was present in the field and entered all chronological data about patient flow in the OR into a standard questionnaire immediately after each case. For this purpose, we determined two rooms and only patients who underwent surgery in these rooms were included. The responsible person followed the patients from admission to OR until they were entered to recovery unit and, then, exited for transferring to the orthopaedic ward. In each stage, the time interval and elapsed time were recorded.

The questionnaire included patient demographic information (sex, age), mode of transfer type to OR (ambulatory, wheelchair, gurney), anesthesia type (sedation with mask (SM), general anesthesia (GA), spinal anesthesia (SA), epidural anesthesia (EA), local anesthesia (LA)) and surgery site (upper or lower extremity)).

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The chronological data about perioperative time frames recorded include the periods of time:

1. Between the moment that the surgical team informs the OR staff about the impending surgery and the orthopaedic ward is asked to transfer the patient.
2. Required to bring the patient to the OR.
3. Required for preparation of the OR (washing, disinfection, equipping).
4. Required for administration of anesthesia.
5. Required for preparation of the patient for surgery (skin preparation, shaving and catheterization).
6. Required for the surgical procedure.
7. Spent waiting to exit the OR after surgery to the recovery room.
8. Spent waiting in the recovery room for transfer to the orthopaedic ward.

All data gathered during this study was kept confidential. Before the study, institutional review board approval was taken. Written informed consent was obtained from all participants.

### Statistical analysis

The data was analyzed using SPSS version 24 software. Kolmogrov-Smirnov test was used to investigate the presence of normal distribution in variables. Independent samples t-test was utilized to compare the time intervals between two groups. Furthermore, one-way ANOVA was used to compare the time interval between groups with different anethesia methods. P<0.05 was significant.

## Results

A total of 382 orthopaedic surgery cases were assessed. The patients aged 38.2±12.7 There were 278 males (73%) and 104 females (27%). 170 and 212 patients underwent upper and lower extremity surgery, respectively Table 1 shows the mean plus standard deviation for time and the minimum and maximum time spent on the different stages.

The results show that there was no significant relationship between time and type of surgery (p>0.05; Table 2).

There was no significant relationship between time required to transfer patients from the orthopaedic ward to the OR and the mode of transfer (gurney or wheelchair) (Table 3). One-way ANOVA showed that the type of anesthesia had no meaningful relationship with the time spent on each task (p>0.05; Table 4).

## Discussion

Delays in the OR reduce OR turnover. This wastes a surgeon's time, which leads to surgeon dissatisfaction. Likewise, delays are stressful and possibly life-threatening for patients, who may be in pain. Although not all delays directly affect patient health, they often negatively effect the patients. Delays in OR turnover are unprofitable and unproductive for hospitals and decrease the return on investment (ROI) and overall productivity [11]. The differences in previous studies in the identification of common causes of delays show the variability between patient systems at different hospitals [9]. The present study measured the mean time taken to transfer patients from the orthopaedic ward to the OR, prepare the OR, administer anesthesia and perform surgery, exit the OR to recovery, time spent in recovery and transfer back to the ward. The results reveal that the types of anesthesia and surgery are not significantly associated with time elapsed at each stage. There was also no significant relationship between the time taken to transfer patients from the orthopaedic ward to the OR and the mode of transfer (gurney or wheelchair).

| Time elapsed in each section | |
|---|---|
| Wa. Time (min) | 3±2.8 (0-10) |
| Trans. OR. Time (min) | 27.6±17.2 (2-95) |
| preparing the OR Time (min) | 18.3±16.8 (2-85) |
| Time of administering anesthesia (min) | 23.8±32.5 (1-225) |
| Time of preparing the patient (min) | 48.3±37.9 (5-240) |
| Time of surgical procedure (min) | 85.8±61.5 (1-265) |
| Time to exit the OR to move to the recovery room (min) | 13.7±9 (0-55) |
| Time in recovery room before transfer back to the ward (min) | 32.6±15.9 (10-100) |

- Wa. time: Time between surgical team informing the OR staff about impending surgery and the orthopaedic ward being told to transfer the patient
- Trans.OR. Time: time of transferring patients from the orthopaedic ward to the OR

**Table 1:** Time elapsed in each section.

Some studies have concluded that saving time in the OR does not necessarily increase efficiency because the time saved is insufficient to allow another case to be completed [12]. However, time management is a common parameter used to evaluate the efficiency of the OR [10]. In addition, correct time management in the OR and the subsequent increase in patient turnover affects a number of performance metrics [13]. Increased patient satisfaction and increased number of patients may be some of these improved metrics. Ghandar [11] showed that the presence of a supervisor who manages the OR significantly increased turnover.

Weinbrown et al. [14] estimated the time wasted to be about 15% of the daily scheduled surgery time. Inappropriately prepared patients (12%), unavailability of surgeons (7%), insufficient nursing staff and anesthesiologists, OR reassignment to emergency surgery (59%), congestion in the post-anesthesia care unit (10%) and delay in transport to the OR (2%) were the main causes of time wasted in the OR. They demonstrated that 10% of time wasted was due to OR preparation. About 8 min was required to clean the OR, irrespective of the department. An average benchmark cleaning time was 10 to 15 min for orthopaedic cases has been previously reported [15]. In the current survey, the time required for preparation was much more than in previous reports, with a mean of 18.287±16.83 min. This could be a reflection of delayed surgical starts and may be caused by the unavailability of the staff responsible for cleaning and equipping the OR. Inappropriate patient preparation included inadequate paperwork, missing laboratory results, lack of an intravenous line, non-performance of required tests, unmarked operative site and consultations performed prior to surgery. This may result in prolonged waiting in the OR or the patient being sent back to the ward [10,14]. Starting on time is essential and is used to evaluate efficiency. Wringff and Roche [10] concluded that the implementation of a targeted program involving several services increased the onset of surgery from 6% to 60%.

| Type of surgery and time spent in each section (min) | | | | | |
|---|---|---|---|---|---|
| | Surgery | | | | P value |
| | upper extremity (N=170) | | lower extremity (N=212) | | |
| | mean | SD | mean | SD | |
| Wa. Time (min) | 3.456 | 2.784 | 2.799 | 2.804 | 0.188 |
| Trans. OR. Time (min) | 28.235 | 18.087 | 27.129 | 16.563 | 0.719 |
| preparing the OR Time (min) | 18.301 | 18.492 | 18.276 | 15.513 | 0.993 |
| Time of administering anesthesia (min) | 22.947 | 27.289 | 24.457 | 36.322 | 0.795 |
| Time of preparing the patient (min) | 53.392 | 40.338 | 44.256 | 35.591 | 0.176 |
| Time of surgical procedure (min) | 81.193 | 61.157 | 89.480 | 62.604 | 0.453 |
| Time to exit the OR to move to the recovery room (min) | 14.175 | 9.028 | 13.386 | 9.184 | 0.627 |
| Time in recovery room before transfer back to the ward (min) | 33.404 | 15.782 | 31.986 | 16.042 | 0.618 |

- Wa. time: Time between surgical team informing the OR staff about impending surgery and the orthopaedic ward being told to transfer the patient
- Trans.OR. Time: time of transferring patients from the orthopaedic ward to the OR

**Table 2:** Type of surgery and time spent in each section (min)

| Transfer style and time spent in each section (min) | | | | | |
|---|---|---|---|---|---|
| | Method of transferring | | | | P value |
| | Litter (N=355) | | Wheelchair (N=27) | | |
| | mean | SD | mean | SD | |
| Wa. Time (min) | 3.233 | 2.803 | 1.222 | 2.167 | 0.038* |
| Trans. OR. Time (min) | 27.677 | 17.542 | 26.889 | 12.484 | 0.896 |

- Wa. time: Time between surgical team informing the OR staff about impending surgery and the orthopaedic ward being told to transfer the patient
- Trans.OR. Time: time of transferring patients from the orthopaedic ward to the OR

**Table 3:** Transfer style and time spent in each section (min).

| Type of anesthesia and time spent in each section (min) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Anesthesia | | | | | | | | P value |
| | Sedation (N=54) | | General anesthesia (N=161) | | Spinal anesthesia (N=42) | | Regional anesthesia (N=125) | | |
| | Mean | SD | mean | SD | mean | SD | mean | SD | |
| Time of administering anesthesia (min) | 26.278 | 31.498 | 20.194 | 22.819 | 14.000 | 11.871 | 30.595 | 45.192 | 0.277 |
| Time of preparing the patient (min) | 40.833 | 24.223 | 49.519 | 40.037 | 52.239 | 39.170 | 48.694 | 40.196 | 0.827 |
| Time of surgical procedure (min) | 64.722 | 62.292 | 80.798 | 65.643 | 84.143 | 61.721 | 101.786 | 54.547 | 0.153 |
| Time to exit the OR to move to the recovery room (min) | 13.611 | 9.977 | 12.600 | 6.495 | 14.500 | 16.677 | 15.000 | 8.264 | 0.629 |
| Time in recovery room before transfer back to the ward (min) | 34.889 | 14.233 | 33.944 | 16.333 | 26.857 | 8.217 | 31.857 | 17.730 | 0.447 |

**Table 4:** Type of anesthesia and time spent in each section (min).

The mean period of time required to administer anesthesia was 23.785±32.49 min and to perform surgery was 85.790±61.859 min. Anesthesia was calculated as the time interval from patient entry to the OR to the end of skin prep. It reflects the induction time as well as the duration from patient entry to the arrival of the anesthesiologist. The results show that this period is significantly longer than in previous reports [11]. Harders et al. reported that administration of anesthesia took about 8.5±11.2 min at a tertiary care academic medical center. They showed that a 3-month multidisciplinary planning program significantly reduces the time required for administration of anesthesia by 27%. The expertise of the surgeons and anesthesiologists and their availability certainly influence the time spent [9,14]. Hence, an improved and simplified communication system could improve availability of staff and cut delays. The time required for preparing the patient, between the onset of administration of anesthesia and the first incision was 48.324±37.9 min on average (range: 5 to 240 min), which is much longer than in previous reports [11]. This reflects the time spent prepping and positioning. Improvement is possible with improved coordination of the OR team.

Weinbrown reported that patients were held in the OR for an average of 7.75 h when the recovery room was full, which constituted 10% wastage of OR time [14]. In the current study, the mean time for waiting to exit the OR was much less, about 0.23 h (13.738±9.08 min), which suggests sufficient space in the recovery room. Additionally, the current results show that the period of time waiting to exit the OR to the recovery room could not be attributed to the type of anesthesia or surgery site. It previously has been shown that unavailability of transport which is related to the mode of transport, is a main reason for such OR delays [14,16]. Surprisingly, the mean time for transfer of patients to the OR (27.622±17.198 min) was not related to the mode of transfer. This may indicate improved equipping of the wards, not the OR, for transfer

services and staff. It has been estimated that patient delays in pre-op is 9 min on average, from the time the circulating nurse sends for the patient until the patient enters the OR [11]. It has been suggested that most lost time is due to the unavailability of a room or staff, which is not easily compensable. Dedicated elevators to the OR would be beneficial to shortening the time required to transfer patients [14].

Issues that increase the time spent in the eight stages of patient turnover in the OR were identified and examined separately. For the time spent from the surgical team informing the OR staff about impending surgery to the orthopaedic ward being told to transfer the patient, factors like the lack of staff in the OR, especially on the evening shifts, and the lack of a dedicated telephone line from the OR to the departments increased the time required in this stage. Because the OR and the orthopedic ward were on separate floors, the lack of a dedicated elevator for the transfer of patients, the absence of a specific individual assigned to transfer patients from the ward, the inaccessibility and lack of adequate supervision of such staff by the ward as well as the lack of coordination of the staff with the OR, time of transferring patients from the ward to the OR was increased. The lack of adequate service personnel and as the inattention of the scrub nurses, surgeons and personnel involved in the previous surgery about maintaining the cleanliness of the OR increase the preparation time for surgical operations. Considering the educational nature of the center in which the current study took place, a slight increase in anesthesia time for educational issues is justified. However, other issues that increase this time include the lack of availability of test results in the patient file, the inability to control existing medical problems such as blood pressure, sugar and hemoglobin levels and availability of blood reserves in patients with underlying problems, the absence of an adequate peripheral vein upon entrance to the OR and the lack of regular pre-operative visits to patients by the surgical group and anesthesiologist in the day before surgery.

The lack of timely availability of surgeons to begin surgery, unavailability of surgical supplies during surgery and the educational nature of the center under study increased the duration of the surgical procedure. The time from completion of surgery to patient transfer to recovery to wake up patients who have been under general anesthesia includes preparation of the patient for release from the OR by the anesthesia staff and the exit of this group from the OR. If the anesthesiology staff not informed in a timely manner by the surgery team about the time required for completion of surgery, this can increase the time spent. However, given that the OR personnel are responsible both for cleaning it and for the transfer of patients, a shortage of such personnel will increase this time. The duration of stay by the patient in recovery until remobilization will also increase because of the lack of staff and of coordination with the OR and the ward and the lack of dedicated personnel for the transfer of patients. This study had several limitations. First, the reasons for the delays were not assessed at the time; only the time spent for each task was recorded. There was no clear criteria on how much time is required to accomplish standard activities such as cleaning the OR in the literature. In addition, the spillover time, wasted time and unavoidable delays were not counted in the calculation of the efficiency of the OR. Furthermore, this was not a randomized study.

## Conclusion

The mean time required for transferring orthopaedic patients to the OR and the duration of tasks stratified by the surgery site, type of anesthesia and mode of transport was defined. It was concluded that the mode of transport was not a major cause of delay in the OR. It also was concluded that the presence of trained staff for proper turnover of patients in the wards and in the OR, their cooperation, teamwork and interaction and careful monitoring and training of the staff in the OR can improve the problems associated with this area.

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