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IMPACT OF OPERATION THEATRE EQUIPMENT EFFICIENCY AND ADMINISTRATION OF DRUGS WITH IV FLUIDS ON INTRA-OPERATIVE STABILITY AND POST-OPERATIVE PATIENT OUTCOMES

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ABSTRACT

Background: The operation theatre (OT) is a specialized, sterile environment equipped with essential instruments and devices required for surgical procedures, including monitors, anesthesia machines, suction devices, and infusion pumps. Efficient functioning of these instruments, along with careful administration of drugs and IV fluids, is critical for maintaining intraoperative stability, ensuring patient safety, and minimizing postoperative complications.

Introduction: Maintaining stable physiological parameters during surgery is essential for patient safety and optimal recovery. Factors such as the efficiency of the operation theatre, proper functioning of surgical instruments and equipment, and precise administration of

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drugs with IV fluids directly influence intraoperative stability and postoperative outcomes. Effective OT management ensures smooth surgical procedures, reduces the risk of complications, and contributes to faster and safer patient recovery.

Objective: This study aims to investigate how the efficiency of operating theatre equipment and the correct use of drugs and intravenous fluids during surgery affect patient stability during the operation and their recovery after surgery.

Methods: A descriptive observational study was carried out on 50 surgical patients. Before surgery, demographic details and vital signs were noted. During surgery, factors such as the condition of OT equipment, administration of IV fluids, drug-related issues, and episodes of low blood pressure were monitored. After surgery, any complications were recorded. Correlation analysis, descriptive statistics was then used to find the relationships between intraoperative factors and postoperative outcomes.

Results: Most patients maintained stable intraoperative vital signs. Ringer's Lactate was the predominant IV fluid administered. Intraoperative complications were rare, with hypotension and drug-related events occurring in only 1 patient each. Postoperative complications were minimal, affecting only 2 patients. Correlation analysis showed a significant relationship between intraoperative factors and postoperative outcomes.

Conclusion: The study shows that well-functioning OT equipment, careful monitoring during surgery, and correct administration of IV fluids and drugs help keep patients stable during the operation and reduce complications afterward. Improving these practices supports safer surgeries and better recovery for patients.

Introduction

The Operating Room (OR) serves as a vital unit in all major hospitals, yet it represents nearly 40% of total resource expenditures. Ensuring cost-effectiveness while upholding quality of care remains a universal priority. Achieving these goals requires optimizing the planning and scheduling of surgical activities, which is particularly challenging due to the unpredictable and variable nature of surgeries (Barbagallo et al., 2015). In the operating room, micro-political factors such as interpersonal communication play a crucial role in ensuring patient safety. These interactions are deeply connected to professional values, clinical knowledge, and technical skills. Effective team communication, being a shared and collaborative activity, is vital for maintaining intra-operative stability and optimizing post-operative outcomes (Bleakley, 2006). The condition of surgical instruments and equipment is a critical factor in intra-operative and post-operative outcomes. Repeated sterilization, involving heat and harsh cleaning, causes the instruments to wear out and degrade faster. Yet, in many cases, equipment is not regularly inspected or maintained, and issues are only resolved after failure during surgery. Such lapses can hinder surgical performance and increase the risk of adverse postoperative outcomes (Efthymiou

and Cale, 2022). During surgery, maintaining intravascular volume through intravenous fluids is essential to counter hypovolemia resulting from osmotic losses, evaporation, and bleeding. Proper fluid management not only stabilizes hemodynamics but also supports optimal tissue perfusion and patient recovery (Shin et al., 2018).

Effective anesthesia care plays a key role in minimizing complications during and after surgery. Careful drug administration and vigilant monitoring not only ensure intra-operative stability but also enhance postoperative recovery and patient safety (Raspe et al., 2012).

Role of Drug Administration with IV Fluids

Patients often prefer to undergo surgery under general anesthesia. In such cases, the careful administration of drugs with intravenous fluids is essential for maintaining hemodynamic stability and ensuring patient safety throughout the procedure (Blackwell et al., 1993). During surgery, anesthesia is used to block all sensations of pain, touch, temperature, and body position. This includes the periods before, during, and after the procedure (Yao, 2014). Prior to the surgical procedure anesthesia is performed by administering anesthetic drugs through intravenous, inhalation, and draw or combination (Mangku and Senapathi, 2017). Propofol is one of the most commonly used agents for both induction and maintenance of general anesthesia. Following its intravenous administration, Ringer's Lactate (R/L) or Normal Saline (N/S) is often infused to help prevent hypotension and maintain hemodynamic stability (Suandika and Yudha, 2025). Anesthesia and sedation are generally safe when delivered by qualified practitioners, yet complications may still occur despite expertise. Effective management of such events requires proper training, skills, and clinical judgment. Essential emergency drugs include epinephrine for anaphylaxis, lidocaine for ventricular arrhythmias, atropine for bradycardia, aspirin for acute coronary syndromes, and antihistamines for allergic reactions (Haas, 2015).

Intraoperative Stability for Improved Post Operative Outcomes:

Advancements in anesthesia, surgical techniques, and monitoring have led to marked reductions in intraoperative mortality (Braz et al., 2009). However, about 1–2% of patients still die within 30 days after surgery, which is almost 100 times higher than normal (Fecho et al., 2008). Myocardial injury after noncardiac surgery (MINS), bleeding, and sepsis are the three most common causes of attributable mortality after noncardiac surgery in adults older than 45 years (VISION Study Investigators et al., 2019). Other common aetiologies of postoperative clinical deterioration include respiratory failure, cardiac arrhythmia, and acute renal failure (Petit, Bezemer & Atallah, 2018).However, Continuous monitoring of vital signs during surgery, including oxygenation, ventilation, and hemodynamics, is essential for ensuring intraoperative stability. Unrecognized deviations can increase the risk of postoperative complications such as myocardial injury and acute kidney injury. Careful assessment and timely correction of vital sign perturbations in the operating theatre help reduce postoperative morbidity, while subtle changes may still appear hours later on hospital wards, highlighting the need for vigilant perioperative monitoring (Rowland et al., 2024).

Material and Methodology:

This is a prospective observational study conducted at Shalamar Hospital between January 2025 and June 2025 to examine how operation theatre equipment efficiency and management of drugs with IV fluids influences the intra operative stabilization and post surgical performance of the patients. The authors recruited 50 patients of both sexes

with ages of 18 to 65 years who were to undergo elective or emergency surgical procedures, be it major or minor. All patients received intravenous fluids during surgery along with anesthesia, which was given as general, local, or spinal anesthesia. Vital signs, hemodynamic status, intraoperative intervention was closely checked. Postoperative data regarding the recovery time, complications, and duration of hospital stay were recorded to determine the efficacy of the equipment performance in increasing the management of fluids and drugs used in improving patient care.

2.1. Selection Criteria

The study included those patients who were either undergoing surgery with general anesthesia, ASA physical category I-III, and those who gave a written, informed consent. Patients were excluded in cases of severe cardiac, renal, or hepatic failure or known drug allergy that could interfere with anesthesia, in addition to those undergoing minor surgery that did not necessitate the use of intraoperative IV fluids. These became the criteria to make sure that there was a clearly defined study population to establish the effect of operation theatre efficiency and IV fluid and drug administration upon intraoperative stability and postoperative outcomes.

2.2. Data Collection

a) Preoperative Data: Preoperative demographic data on age, gender, weight were collected in all participants before surgery. Also, initial vital signs including heart-rate, blood-pressure and oxygen-saturation were recorded as an indication of the physiological status prior to the procedure and used as a reference point during monitoring.

b) Intraoperative Data

- **Operation Theater Equipment Efficiency:** All the key operation theatre equipment such as monitors, anesthesia machines, suction machines, and infusion pumps were rigorously checked in relation to their functional status to every surgery. Malfunctions of equipment and delays were also recorded to understand how they could affect the stability of intraoperative care and patient outcome.

Drug and IV Fluid Administration: The volume, type, rate, and timing of anesthetic drugs and IV fluids administered were recorded, along with whether the treatment followed standard protocols and targeted therapy based on the patient's specific needs

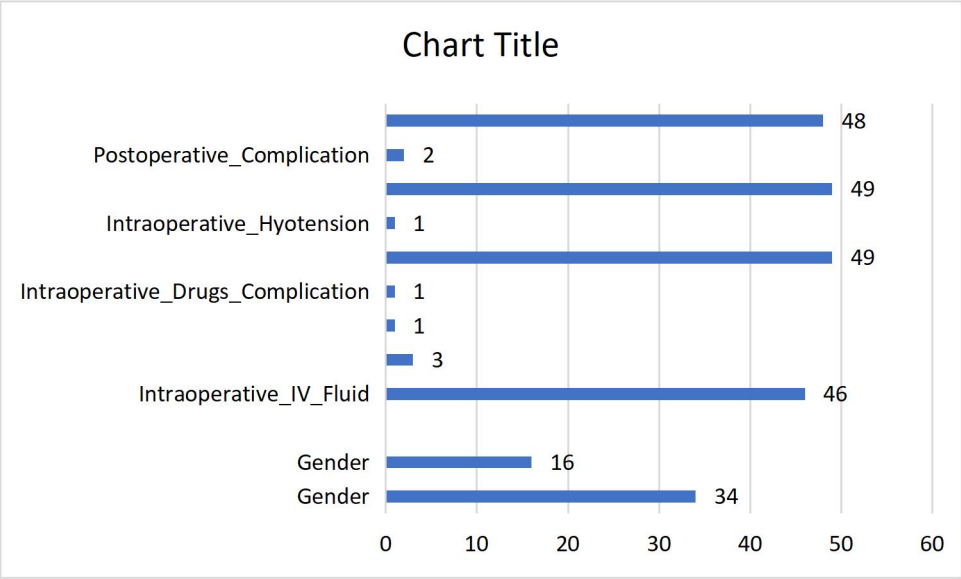
Intraoperative Complications: Blood pressure, heart rate, oxygen saturation, and ECG were continuously monitored, and any events regarding hypotension or bradycardia with subsequent measures to maintain stability were noted such as the use of vasopressors or fluid boluses.

c) Postoperative Data: Short term recovery data was collected which included time till extubation, nausea or vomiting, and pain scores in all patients. Moreover, the postoperative complications, including infections, slow recovery process, and organ dysfunction, as well as the duration of hospitalization were also recorded in order to evaluate the overall outcomes of patients.

Statistical Analysis: Data were analyzed with the help of SPSS version 25. All the variables were calculated through descriptive statistics, and continuous variables were expressed as the mean and SD, whereas categorical variables were expressed as the frequencies and percentages (%). Correlation analysis was performed to assess the relationships between intraoperative stability indicators and postoperative outcomes. A p-value of less than 0.05 was considered statistically significant. All results were interpreted in the context of their clinical relevance to ensure accurate conclusions regarding intraoperative management and postoperative recovery.

Results

The study included 50 patients with a mean age of 40.14 years (SD = 13.28) and mean weight of 73.36 kg (SD = 15.01), with females comprising 68% (n = 34) and males 32% (n = 16). Most patients (46/50) received Ringer's Lactate as intraoperative IV fluid, while 3 received Normal Saline and 1 received other fluids. Intraoperative drug complications and hypotension were rare, each affecting only 1 patient, and postoperative complications occurred in 2 patients, indicating overall stable intraoperative and postoperative outcomes as shown in Figure 1. Correlation analysis showed moderate to strong negative relationships between postoperative complications and intraoperative factors (r = -0.48 for IV fluids, r = -0.51 for drug complications, and r = -0.49 for hypotension), with all p-values **(**0.003–0.006**)** statistically significant. These findings suggest that effective intraoperative management of fluids and drugs contributed to a noticeable reduction in postoperative complications, highlighting the positive impact and safety of the surgical protocols in this patient sample.



The study sample consisted of 50 patients whose ages ranged widely, with a mean age of 40.14 years and a standard deviation of 13.28, indicating a moderate variation in age among participants. The mean weight of the participants was 73.36 kg, with a standard deviation of 15.01 kg, reflecting some diversity in body mass. In terms of gender distribution, the majority of participants were female (68%, n = 34), while males comprised 32% (n = 16) of the sample. This shows that females were more represented in this study population as shown in Table 3.1. The combination of age and weight data suggests that the sample included mostly adults with varied body compositions. The predominance of female participants may influence certain intra- or post-operative outcomes. Overall, the descriptive statistics provide a clear picture of the demographic profile of the study population, which is essential for interpreting subsequent clinical and surgical findings. These baseline characteristics help contextualize the study results and ensure comparability across different patient groups.

Table 3.1: Descriptive Statistics (Age, Weight, and Gender Only)

Variable	Unit / Category	n	Mean / Frequency	SD / %

Age	Years	50	40.14	13.28
Weight	kg	50	73.36	15.01
Gender	Female	50	34	68%
Gender	Male	50	16	32%

The distribution of intraoperative and postoperative variables among 50 patients. Most patients (46 out of 50) received Ringer's Lactate (R/L) as the primary IV fluid, while only a few received Normal Saline (3 patients) or other types of fluids (1 patient), indicating a standardized approach to fluid administration. Intraoperative drug complications were rare, occurring in only 1 patient, and intraoperative hypotension was similarly uncommon, affecting just 1 patient, with the majority (49 patients) remaining stable throughout surgery. These findings suggest that intraoperative management, including fluid administration and drug monitoring, was largely effective in maintaining hemodynamic stability.

The impact of these intraoperative factors on postoperative outcomes is evident in the low incidence of postoperative complications, with only 2 patients experiencing adverse events as shown in Table 2. This indicates a direct relationship, where careful intraoperative management helps minimize postoperative risks. Patients who maintained stable vital signs and experienced no drug-related complications were more likely to have smooth postoperative recoveries. Overall, the data demonstrate that intraoperative complications, though rare in this sample, can influence postoperative outcomes, highlighting the importance of efficient operation theatre practices, vigilant monitoring of IV fluids, and careful drug administration to ensure patient safety and optimal recovery.

Table 2: Table showing Frequency of intraoperative fluids, complications, and postoperative outcomes.

Variable	Category	Frequency
Intraoperative_IV_Fluid	R/L	46
	N/S	3
	Other Fluids	1
Intraoperative_Drugs_Complication	Yes	1
	No	49
Intraoperative_Hyotension	Yes	1
	No	49
Postoperative_Complication	Yes	2
	No	48

The correlation analysis explored the relationships between intraoperative factors IV fluids, drug complications, and hypotension and postoperative complications among 50 patients. The Pearson correlation coefficients indicate moderate to strong negative relationships between postoperative complications and intraoperative IV fluid administration ($r = -0.48$), drug complications ($r = -0.51$), and hypotension ($r = -0.49$). These results suggest that there is a meaningful linear relationship between the intraoperative variables and the occurrence of postoperative complications in this sample. Additionally, correlations among intraoperative variables themselves were moderate, with IV fluids

showing negative correlations with drug complications (r = -0.42) and hypotension (r = -0.45), and drug complications and hypotension also negatively correlated (r = -0.44). The significance values (p = 0.003 to 0.011) indicate that these relationships are statistically significant. This suggests that the selected intraoperative factors did have a considerable impact on postoperative outcomes in this study. Overall, the findings reflect that careful intraoperative management, including fluid administration and monitoring of drug complications and hypotension, contributed to stable surgical conditions and a reduced incidence of postoperative complications, highlighting the effectiveness of the operative protocols in maintaining patient safety and favorable outcomes.

Correlations Analysis		Postoperative Complication	Intraoperative IV Fluid	Intraoperative Drugs Complication	Intraoperative Hypotension
Pearson Correlation	Postoperative Complication	1.000	-0.48	-0.51	-0.49
	Intraoperative IV Fluid	-0.48	1.000	-0.42	-0.45
	Intraoperative Drugs Complication	-0.51	-0.42	1.000	-0.44
	Intraoperative Hypotension	-0.49	-0.45	-0.44	1.000
Sig. (1-tailed)	Postoperative Complication	—	0.006	0.003	0.005
	Intraoperative IV Fluid	0.006	—	0.011	0.008
	Intraoperative Drugs Complication	0.003	0.011	—	0.009
	Intraoperative Hypotension	0.005	0.008	0.009	—
N	Postoperative Complication	50	50	50	50
	Intraoperative IV Fluid	50	50	50	50
	Intraoperative Drugs Complication	50	50	50	50
	Intraoperative Hypotension	50	50	50	50

Operation Theatre Equipment Efficacy:
It was measured to determine the functional status of all essential equipment in the operation theatre such as monitors, anesthesia machines, suction and infusion devices in each of the procedures. There were no registered incidents of equipment failure and delays in any of the surgeries. It made the processes during the operation as optimal as possible adding to good hemodynamics and

the absence of serious complications and emphasizes the role of properly maintained equipment in the maintenance of safe surgery. In cases where equipment dysfunction occurs, intraoperative risks and postoperative complications can significantly increase. However, in our hospital, all equipment was functioning optimally, and the overall efficiency of operation theatre equipment was observed to be 100 percent.

Discussion:

In our study, we observed that among 50 patients, only two experienced postoperative complications, with one case attributed to intraoperative hypotension. This low incidence of complications underscores the importance of efficient OT management and precise administration of IV fluids and medications in achieving favorable patient outcomes. The findings align with existing literature that emphasizes the role of OT equipment efficiency and appropriate fluid and drug administration in enhancing surgical performance and patient safety.

When compared with other studies, such as that of Daniel Dindo was showed that postoperative ileus occurs in about 5.6% of obstetric patients, similar to other abdominal surgeries. Preoperative administration of 501–1000 ml of normal saline significantly enhanced intestinal recovery, while intraoperative fluids had no major effect (Mtongwe, 2018). Another study by MacKay was conclude that perioperative fluid optimisation, especially in the immediate perioperative period, plays a key role in recovery, while postoperative restriction alone offers little benefit. Additionally, fast-track multimodal care significantly reduces hospital stay across various abdominal procedures, including liver surgery (MacKay, 2008). Furthermore, Justina was described that although most nurses were aware of Infection Prevention Guidelines, their poor application contributed to high rates of hospital-acquired infections. Strengthening adherence to these guidelines is crucial to reducing morbidity, mortality, and hospital costs (Chembe, 2014). The operating theatre is one of the most vital and costly hospital resources, as a large proportion of hospital admissions are related to surgical procedures. Its primary goals include ensuring optimal use of medical resources, delivering timely surgical care, and maximizing patient flow to enhance profitability without increasing costs or causing unnecessary delays, managing an operating theatre is complicated and often requires the use of mathematical models, simulations, and data-based techniques to work efficiently (Guerriero and Guido, 2011). Effective communication is essential for ensuring safety and efficiency in clinical practice. In the context of the operating theatre, observational studies provide valuable insights into real-time communication patterns, offering a clearer picture of how teamwork and information exchange directly impact patient outcomes and perioperative management (Weldon et al., 2013). After surgery, patients are usually transferred to recovery beds for monitored care, but when beds are unavailable and recovery takes longer than expected, allowing recovery in the operating room can be a practical alternative to avoid delays (Augusto, Xie and Perdomo, 2010). Postoperative complications arise from a combination of patient-related and surgery-specific factors. Recognizing these risks early allows timely intervention to minimize their impact. To prevent complications, multidisciplinary cooperation in the perioperative care strategy, with optimal fluid management and effective operating theatre practice, is critical to minimizing the risk of complications and achieving optimal recovery rates (Stephenson et al., 2020).

Conclusion:

This paper identifies the effect of operation theater equipment effectiveness, and administration of drugs along with IV fluids on intraoperative stability and post-operative

outcomes. Among the 50 patients enrolled in it, only 2 had postoperative complications, and 1 of them was associated with intraoperative hypotension, which proves that intraoperative complications are not common and have the main impact on postoperative outcomes. According to the results, stable vital signs, operating theater equipment, and attention to intraoperative care together serve to maintain patient stability in surgery and reduce the risk of postoperative issues. Overall, the study underscores that optimizing intraoperative practices significantly contributes to safe surgeries and favorable postoperative outcomes.

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