Original Article

Pediatric Unplanned Admission in Specialized Tertiary Children Hospital: A Case-Control Study

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ABSTRACT

Background: Unplanned hospital admissions following surgical procedures are an important quality performance indicator, as they can reflect complications from anesthesia or surgery, in addition to communication issues within the healthcare team. Any patient who undergoes a surgical procedure under general anesthesia but has an unexpected hospital disposition, differing from the pre-operative plan, is considered to have an unplanned admission. These unanticipated admissions can have negative social, economic, and physical consequences for these patients. This study aimed to determine the proportion of unplanned post-operative admissions and to investigate the risk factors that contributed to these unplanned admissions.

Methods: The data on unplanned admissions was collected retrospectively by analyzing the medical records of children aged 14 and younger who underwent non-cardiac surgical procedures under general anesthesia at the King Abdullah Specialized Children's Hospital (KASCH) facility from January 2021 to October 2022.

Results: Out of 15,178 non-cardiac procedures performed, 119 patients (0.78%) experienced unplanned admission. The leading contributing factors were anesthesia-related in 49 patients (41.2%), surgical-related factors in 35 patients (29.4%), and communication failure between the anesthesia, surgical teams, and bed management in 19 cases (16%).

Conclusion: The unplanned admission rate of 0.78% in this facility was lower than the rates reported in the literature. However, these rates may not represent the national practice, and more multi-center studies are needed to gain a more comprehensive understanding of the extent of this problem within the country.

Keyword: Pediatric, Unplanned Admission, Anesthesia, Pediatric Surgery, Tertiary Hospital, Case-control Study, KSA.

Introduction

The increasing use of ERAS (enhanced recovery after surgery) programs and the growth of Day Surgery Units (DSUs) have enabled more surgical, interventional, and diagnostic procedures in the pediatric population to be performed on a day-case basis [1,2].

The shift towards day surgeries has been driven by the negative consequences of unnecessary admissions [3]. However, successful day surgery requires effective coordination between hospital departments to prevent unplanned admissions [4]

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Unplanned admission to a ward, high-dependency unit (HDU), or pediatric intensive care unit (PICU) can have significant negative consequences for the healthcare system, patients, and their families [4]. Unplanned admission is a critical quality performance metric, as it has financial implications for hospitals and families, can reduce bed availability, potentially leading to a crisis, and may cause social issues for patients and families [5, 6]. In the perioperative setting, the unplanned admission rate has been utilized as an indicator of patient safety in the United Kingdom (UK) [7]. A study conducted in Canada reported an unplanned admission rate of 0.97 percent [8]. A multi-institutional study revealed that the rates in the United Kingdom and Ireland was 2.5 percent, while Belgium and New Zealand had rates of 2.89 percent and 1.9 percent, respectively [7-10]. However, there is currently no available data regarding the prevalence of unplanned admissions in Saudi Arabia, which is essential for understanding the magnitude of this issue. Given the differences in population and healthcare systems, it is crucial to investigate the prevalence of unplanned postoperative admissions in King Abdullah Specialized Children's Hospital (KASCH), a governmental tertiary hospital in Saudi Arabia, in addition to determine their contributing risk factors.

Methods

The current study was conducted at KASCH, a specialized tertiary children's hospital in Riyadh, Saudi Arabia. It is accredited by Joint commission of international (JCI). KASCH cares for neonates, premature, former premature, full-term, and pediatric patients in all recognized sub-specialties, pediatric pain management, transplant anesthesia, non-cardiac surgeries for cardiac patients, and conjoined twin's separation. Our research focused on pediatric surgical patients who experienced unplanned admissions, defined as cases where the patient's intended disposition differed from the original plan. KASCH's operating room conducts more than 10,000 surgeries annually. The study encompassed all patients, regardless of nationality, under the age of 14, who underwent surgery at our hospital and were unexpectedly admitted to the ward instead of being discharged home or were admitted to the intensive care unit (ICU) instead of the ward as initially intended. This is a retrospective case control study received approval from the Institutional Review Board (IRB) and Ethical Committee of the King Abdullah International Medical Research Center (KAIMRC) under IRB number IRBC/1393/20. We included all patients who met the criteria for unplanned admission, irrespective of the cause, between January 2021 and October 2022. In addition, we established a matched control group consisting of individuals whose admission plans remained unchanged. The ratio of cases to controls was maintained at 1:2.35, enabling us to investigate potential associations or risk factors that might have contributed to unplanned admissions. Cases were excluded in line with the exclusion criteria: patients over 14 yr of age, procedures under local anaesthesia. Additional exclusions were made for cases who underwent major surgery. Major surgeries constituted intracranial, thoracic, scoliosis correction, bowel and urological (in which disturbance to bowel or bladder function is routinely expected), and orthopaedic with expected major blood loss. We performed an extensive examination of our patients' electronic records utilizing the Best Care System. For the selected patients, we meticulously examined their medical records and extracted various data, including demographic information, medical conditions, medication history, details of surgical procedures, anesthetic events, and admission-related information. Our analysis specifically focused on preoperative, intraoperative, and postoperative details, encompassing surgical and anesthetic plans prior to surgery, in addition to relevant communication notes. Furthermore, we considered the American Society of Anesthesiologists (ASA) physical status [11] and evaluated the surgical complexity according to the classification established by Nasr et al. [8], which categorizes surgical operations into Risk Quartiles (RQ1, RQ2, RQ3, and RQ4) based on their complexity. We collected demographic data, including age and gender, as well as surgical duration, for tracking purposes. We also monitored the timing of the preoperative anesthetic assessment and operation dates to identify any inconsistencies. Potential risk factors contributing to unplanned admissions were documented and categorized as surgical, anesthetic, medical, social, or other factors, social factors include late out of theatre, parents requesting admission, long distance to home or transport issue while medical factors include obstructive sleep apnea, endocrinal problems or new medical conditions that cause complication. The unplanned admission group served as the case group, while the control group was matched from all other cases that adhered to the preoperative discharge plan. The control cases were selected from the total number of surgical cases performed during the same period. Exclusion criteria were applied, excluding patients above the age of 14, those with missing data or incomplete documentation, and the

patients with cardiac surgical procedures. For data analysis, we compared the group of unplanned admissions to a matched control group initially planned for discharge. The primary objective of this study was to estimate the prevalence of unplanned postoperative admissions at KASCH and to identify factors associated with unplanned admissions. We employed a multivariate logistic regression model to identify associations between risk factors and the incidence of unplanned admissions. The occurrence of unplanned admission was considered the dependent variable in the logistic regression model, while all potential risk factors were treated as independent variables. Statistical significance was determined using a significance level less than 0.05. The statistical analysis was performed using SAS 9.4 software (SAS Institute Inc., USA).

Results

During twenty two months, a total of 15,178 non-cardiac procedures were conducted in the operating rooms of KASCH. Among these procedures, 119 patients (0.78%) experienced unplanned admissions (Table 1). Anesthesia-related factors were identified as the primary contributors, accounting for 49 patients (41.2%) who experienced unplanned admissions. Surgical-related factors ranked second, contributing to unplanned admissions in 35 patients (29.4%). The third contributing factor was communication failure, observed in 19 cases (16%). This failure stemmed from inadequate coordination between the anesthesia, surgical teams, and bed management (Table 2). 55.5% of our unplanned admissions were to regular ward, 39.5% were admitted to HDU, and 5% were admitted to PICU (Table 3). When comparing the unplanned admission group (119 patients) to the control group (280 patients), several correlations were observed. Unplanned admissions were significantly associated with patients classified as ASA class II and III, procedures with durations exceeding 1-3 and >3 hour, and surgeries of high complexity, Ear, Nose, and Throat (ENT) and Urology procedures (Table 4).

Discussion

The occurrence of unplanned admissions during a 22-month period from January 2021 to October 2022 was found to be 0.78%. Anesthesia-related factors accounted for the majority of unplanned admissions at 41.2%, followed by surgical factors at 29.4%, and coordination issues at 16%. Among the specialties, ENT and Urology had a higher incidence of unplanned admissions in comparison to others. Unplanned admissions were more likely to occur in cases involving high complexity, surgical procedures lasting longer than one hour, and patients with an ASA scores II and III. It is important to note that unplanned admissions have significant negative implications for both healthcare providers and patients along with their families [12]. In this study, the rate of unplanned admission was determined to be 0.78 percent. Unplanned admissions were found to be more common in studies conducted in the United States, Canada, and Ireland [3]. A study from the United States reported a wide range of incidences of unplanned admissions after ambulatory surgery, ranging from 0.9 percent to 9.4 percent. This variability was attributed to differences in study design, with multicenter studies conducted in seven hospitals on adult populations, potentially explaining the variation in percentages and incidence [13]. Similarly, a Canadian study focusing on unanticipated hospital admissions after plastic surgery reported a rate of 3.55 percent. This study was specific to one department, plastic surgery, and conducted on the adult population [14]. Another multicenter study conducted in a Canadian tertiary center found that 2.67 percent of admissions were unplanned. This study was performed across three tertiary centers and included the adult population [15]. Similarly, studies reported unplanned hospital admission rates of 2.2 percent in Ireland and 0.6 percent in Scotland. The Irish study focused on the pediatric population over 5 years, specifically examining unplanned admissions to the Pediatric Intensive Care Unit (PICU) and High Dependency Unit (HDU). In contrast, The Scottish study encompassed a diverse range of patients, including both adults and children, over a period of three years. [7, 16]. In our study, the primary causes of unplanned admissions were related to anesthesia, with postoperative apnea monitoring in premature patients being the most common reason (22.69%). This differs from studies in the United States and Belgium, where postoperative nausea and vomiting (PONV) were the leading anesthetic cause [9, 10]. Only a small percentage of patients in our study (2.5%) experienced PONV. This lower incidence of PONV at our center may be attributed to our proactive approach of providing prophylaxis to all patients and adhering strictly to PONV prophylaxis guidelines. Additionally, postoperative hypoxia emerged as a significant anesthetic reason, often linked to prolonged narcotic effects or airway obstruction, which posed challenges in meeting hospital discharge criteria [10]. The second most common cause of unplanned admissions in our study was related to surgical factors, including observation of the surgical site and

Table 1: Demographic and Operative Data.

Characteristics	Unplanned admission (n=119)	Control group (n=280)
Age categories, n (%)		
< 2 years	42 (35.3)	68 (24.3)
2 years – 10 years	56 (47.1)	171 (61.1)
>10 years	21 (17.6)	41 (14.6)
Gender, n (%)		
Male	86 (72.3)	168 (60.0)
Female	33 (27.7)	112 (40.0)
ASA, n (%)		
I	31 (26.1)	128 (45.7)
II	49 (41.2)	90 (32.1)
III	31 (26.1)	27 (9.6)
Duration of surgery, n (%)		
<1 h	34 (28.6)	154 (55.0)
1-3 h	64 (53.8)	109 (38.9)
>3 h	21 (17.6)	17 (6.1)
Specialty, n (%)		
ENT	34 (28.6)	83 (29.6)
Urology	23 (19.3)	22 (7.9)
Pediatric surgery	19 (16.0)	57 (20.4)
Ophthalmology	14 (11.8)	18 (6.4)
Other	29 (24.4)	100 (35.7)
Complexity, n (%)		
low complexity	101 (84.9)	268 (95.7)
high complexity	18 (15.1)	12 (4.3)

Data is expressed as numbers (n) and percentages (%).

SD: standard deviation, h: hour, ASA: American society of anesthesiologists, ENT: ear, nose, throat.

Table 2: Factors Contributed to Unplanned Admissions.

Cause of unplanned admission	Number (%)
Anesthetic factors	**49 (41.2)**
▪ Postoperative apnea	27 (22.69)
▪ Postoperative hypoxia	14 (11.76)
▪ Postoperative nausea and vomiting (PONV)	3 (2.5)
▪ Cardiac patient	2 (1.7)
▪ Aspiration	1 (0.85)
▪ Inadequate pain control	2 (1.7)
Surgical factors	**45 (37.8)**
▪ Observation and follow-up by the surgeon	35 (29.4)
▪ Bleeding	5 (4.2)
▪ Change intraoperative surgical plan	3 (2.5)
▪ Prolonged surgery	2 (1.7)
Social factors	**3 (2.5)**
Medical factors	**3 (2.5)**
Coordination factors	**19 (16.0)**

Data are presented as number of cases and percentage (%).

Table 3: Disposition Areas for Unplanned Admission Group.

Area of admission	Number (%)
Ward	66 (55.5)
HDU	47(39.5)
PICU	6 (5.0)

Data are presented as number of cases and percentage.

HDU: High Dependency Unit.

PICU: Pediatric Intensive Care Unit.

Table 4: Risk Factors Association.

Risk factor	Odd's Ratio (95% CI)	P-value
Age Categories		
< 2 years	1.331(0.593-2.988)	0.488
2 years – 10 years	0.687(0.346-1.364)	0.283
>10 years	Reference	
ASA		
I	Reference	
II	2.107(1.164-3.815)	0.014
III	3.809(1.773-8.184)	0.001
Duration of Surgery		
<1 h	Reference	
1-3 h	3.069(1.637-5.754)	0.001
>3 h	5.736(2.227-14.777)	0.001
Specialty		
Pediatric surgery	Reference	
Urology	3.675(1.433-9.423)	0.007
ENT	3.879(1.605-9.378)	0.003
Ophthalmology	2.786(0.981-7.915)	0.054
Other	0.833(0.354-1.965)	0.677
Complexity		
low complexity	Reference	
high complexity	5.877(2.166-15.945)	0.001

Data expressed as odd's ratio, confidence interval, and P value.

ASA: American Society of Anesthesiology physical status

CI: confidence interval

H: hour

ENT: ear, nose, throat

Monitoring of drains that were unexpectedly inserted during surgery. This contrasts with studies in the UK and Canada, where unplanned admissions were due to unexpected surgical complexity and surgical complications, respectively [14, 17]. Additionally, unanticipated postoperative bleeding requiring a return to the operating room and an unplanned admission was also noted [18, 19]. Coordination issues, including social and administrative factors, accounted for 18.5% of unplanned admissions. This is consistent with a study from the United States that found administrative issues at 16%. However, other studies in Belgium and the UK found social issues at 45% and organizational issues at 7%, respectively [9, 14]. Within our hospital, inadequate coordination was evident through subpar communication among surgeons, their coordinators, anesthetists, and bed management. The coordinators need to pay attention to the notes written by anesthesiologists regarding bed arrangements and sometimes direct communication between anesthetists and surgeons is necessary to ensure smooth coordination. In our study, a notable observation was that the most commonly involved cases were from the Ear, Nose, and Throat (ENT) and Urology specialties. This finding can be attributed to the fact that these two specialties contribute significantly to the workload in our hospital. Adenotonsillectomy, commonly performed in patients with sleep apnea, may require post-operative monitoring, which is not always anticipated preoperatively. Similarly, procedures such as circumcisions and hypospadias repairs often involve premature babies who may not meet discharge criteria at the time of surgery due to their postconceptional age. In a study conducted by Green et al. [3] in the United Kingdom and Ireland, similar to our findings, ENT procedures exhibited the highest rate of unplanned admissions, which also included cardiac patients. Additionally, a study conducted in Scotland revealed that ENT and general surgery, followed by dental procedures, accounted for the highest percentage of unplanned admissions [20]. To explore potential correlations and associations, we thoroughly examined the patient details associated with unplanned admissions. Our analysis revealed that various factors, including patient-related factors such as ASA classification and comorbidities, as well as procedure-related factors such as duration, postoperative nausea and vomiting (PONV), and pain, all contributed to the decision to admit patients. Furthermore, we identified a significant association between unplanned admissions and high surgical complexity, with surgical complexity classification referenced from the studies by Desai et al. [21] and Nasr et al. [22]. The resulting burden encompasses various challenges, such as a scarcity of beds, particularly in the High Dependency Unit (HDU) and Pediatric Intensive Care Unit (PICU), the need for additional staff, excessive utilization of equipment and supplies, and inadequate financial resources. However, it is important to recognize that the psychological and economic impacts on patients and their families are equally significant.

Conclusion

The unplanned admission rate in the facility was lower than what we found in the literature. However, more research is needed to throw more light on the parameters revealed by the current study data. Furthermore, the rates do not mirror those of other facilities in the country, and more multi-center studies are needed to reflect national practice.

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Conflict of Interest

None

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