Pediatric Unplanned Admission in Specialized Children Hospital: A Single Center 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, more research is needed to have more understanding for the parameters revealed by the current study data.

Keywords: Pediatric; Unplanned Admission; Anesthesia; Pediatric Surgery; Tertiary Hospital; Case-control Study; KSA

Abbreviations

KASCH: King Abdullah Specialized Children's Hospital; DSU: Day Surgery Units; ICU: Intensive Care Unit; IRB: Institutional Review Board; ASA: American Society of Anesthetists; ENT: Ear, Nose, and Throat.

Introduction

With advancements in healthcare the application of enhanced recovery after surgery (ERAS) programs and the expansion of Day Surgery Units (DSU), surgical, interventional, and diagnostic procedures in the pediatric

population can be performed as a day case [1,2]. The trend toward day surgeries arose because of the adverse effects of unnecessary admissions [3]. However, day surgery requires coordination between hospital departments to avoid unplanned admissions. Unplanned admission to (ward, HDU, PICU) has several negative consequences for the healthcare system, patients, and their families [4].

Unplanned admission is one of the leading quality performance metrics, it has a financial impact on hospitals and families, as well as potential to reduce bed availability that can lead to a crisis at times, as well as social issues for patients and families [5,6].

In the United Kingdom, the unplanned admission rate has been used as a patient safety indicator in the perioperative setting [7]. One study conducted in Canada found an unplanned admission rate of 0.97 percent [8]. According to another multi-institutional study, the rate in the United Kingdom and Ireland is 2.5 percent, while the rate in Belgium and New Zealand is 2.89 percent and 1.9 percent, respectively [7-10]. We don't have similar data in Saudi Arabia that determine the size of the problem of unplanned admission. Determining the size of this problem is the first step to solve it.

These studies already published about the subject were done in Europe and north America, but the population in Saudi Arabia is different. This study aimed to estimate the prevalence of unplanned postoperative admission in King Abdullah specialized children's Hospital (KASCH) and investigate the contributing risk factors.

Methods

This study was conducted in king Abdullah specialized children hospital (KASCH), this is a pediatric hospital that treats mainly children. It has around 500 beds, and pediatric intensive care units, and fourteen operating rooms. 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 over 10,000 surgeries annually. The study included all patients 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 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. Additionally, we established a matched control group consisting of individuals whose admission plans remained unchanged. Exclusion criteria included patients over 14 years of age, those who underwent procedures under local anesthesia, and cases involving major surgeries. Major surgeries were defined as intracranial, thoracic, scoliosis correction, bowel and urological surgeries (where disturbance to bowel or bladder function is routinely expected), and orthopedic procedures with anticipated major blood loss. We conducted an extensive examination of our patients' electronic records utilizing the Best Care System. For the selected patients, we meticulously reviewed their medical records and extracted various data, including demographic information, medical conditions, medication history, details of surgical procedures, anesthetic events, and admission-related information. We reviewed preoperative, intraoperative, and postoperative details. We went back through medical records of the selected patients and extracted demographic data, medical problems, medications, surgical, anesthetic events around the admission, looked for all preoperative, intraoperative, and postoperative information, surgical and anesthetic plans before surgery and communication notes.

We included the ASA physical status according to the American Society of Anesthetists (ASA) physical status and also included the surgical complexity according to the description by Nasr VG, et al [11]. who divided surgical operations into Risk Quartiles based on their complexity (RQ1, RQ2, RQ3, and RQ4) which categorizes surgical operations into Risk Quartiles (RQ1, RQ2, RQ3, and RQ4) based on their complexity. The demographic data, such as age and gender, as well as the surgical time, were all tracked. The timing of the preoperative anesthetic assessment (if performed) and the operation date were tracked to check for any discrepancy. Then we recorded the possible risk factors that might have contributed for the unplanned admission and categorized them into surgical, anesthetic, medical, social, and other factors. 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. 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 patients undergoing 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 these admissions. We employed a multivariate logistic regression model to identify associations between risk factors and the incidence of unplanned admissions. The occurrence of unplanned

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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 of less than 0.05. The statistical analysis was performed using SAS 9.4 software (SAS Institute Inc., USA).

Results

During a 22-month period, 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%), stemming from inadequate coordination between the anesthesia, surgical teams, and bed management (Table 2). Of the unplanned admissions, 55.5% were to the regular ward, 39.5% were admitted to the HDU, and 5% were admitted to the 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 hours and >3 hours, and surgeries of high complexity, particularly Ear, Nose, and Throat (ENT) and Urology procedures (Table 4).

Characteristics	Unplanned Admission (n=119)	Control Group (n=280)
Age in months: mean (SD)	4.9(4.3)	5.4(3.9)
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 1: Demographic and Operative Data.

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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 2: Factors Contributed to Unplanned Admissions.

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 3: Disposition Areas for Unplanned Admission Group.

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
Table 4: Risk Factors Association.

Discussion

The occurrence of unplanned admissions during the 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 compared to others. Unplanned admissions were more likely to occur in cases involving high complexity, surgical procedures lasting longer than one hour, and patients with 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 0.784 percent. Unplanned admission was found to be more common in the United States, Canada, and Ireland, according to their studies. A Study from the United States found that the incidence of unplanned admission after ambulatory surgery ranged from 0.9 percent to 9.4 percent, this wide range and variability was due to the difference in design, these were multicentre studies done in 7 hospitals and on adult population which may explain the variation in percentage and incidence [13].

According to a Canadian study, the unanticipated hospital admission rate after plastic surgery was 3.55 percent and this was also done on adult population and specific to one department only which was plastic surgery [14].

Another study conducted in a Canadian tertiary centre found that 2.67 percent of admissions were unplanned. This was also a multicentre study performed in three tertiary centres and included adult population [15].

Similarly, unplanned hospital admissions were reported to be 2.2 percent in Ireland and 0.6 percent in Scotland,

respectively. The first one was conducted over 5 years on pediatric population and specific to unplanned admission to PICU and HDU, and the second one included adult and pediatric patients over 3 years [7,16].

In our study the leading causes of unplanned admission were anesthetic reasons, the most common reason was postoperative apnea monitoring in premature patients in contrast to a study in the United States and Belgium, where the leading anesthetic cause was postoperative nausea and vomiting (PONV) [9,10]. Only three patients in our study (6.1%) had PONV, this low incidence of PONV in our centre may be explained by the fact that we are using prophylaxis for all patients and very strict in applying the PONV prophylaxis guidelines. Postoperative hypoxia was also a significant anesthetic reason, primarily due to the prolonged narcotic effect or airway obstruction, which made meeting hospital discharge criteria difficult [10].

The second leading group of causes in our study were surgical; observation of surgical site, monitoring of drains that were unexpectedly inserted intraoperatively. 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. Similarly,

in study conducted by Green et al. in the United Kingdom and Ireland, ENT had the highest unplanned admission rate and it also included cardiac patients [3]. In study published in Scotland, ENT together with general surgery followed by dental procedures had the highest percentage of unplanned admission [20].

We looked through the details of the patients involved in unplanned admission to find correlation or association with any of the factors whether it is patients related which include (ASA and comorbidities) or procedure related including (duration, PONV, pain), and we found them all contributing factors to the decision to admit the patients. Also, we found a significant association between unplanned admission and high surgical complexity, and to classify surgical complexity we referred to the study by Desai MM, et al. [21] and Nasr VG, et al. [22].

Shortage of beds, particularly in HDU and PICU, additional staff required, excessive consumption of equipment, supplies, and insufficient funds are examples of the resulting burden. Nevertheless, the psychological and economical effects on patients and their families have equal importance.

Conclusion

The unplanned admission rate in the facility was lower than what we found in the literature. The unplanned admission rate of 0.78% in this facility was lower than the rates reported in the literature. However, more research is needed to have more understanding for the parameters revealed by the current study data.

Consent for Publication

All authors agreed to publish this article once the review was approved.
Availability of data and material: All data and materials are available in the repository upon request.

Competing of Interests

None

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