

Unplanned Return to the Operating Room: an analysis of the quality of the health care

Reintervención Quirúrgica No Programada: un análisis de calidad de la atención

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What do we know about the subject matter of this study?

Since 2012 in Chile, unplanned returns to the operating room are an indicator of the surgical quality services. The analysis of them within the treatment team can help improve the quality of care.

What does this study contribute to what is already known?

This study describes unplanned returns to the operating room in a pediatric surgery service during 5 years in both elective and emergency pathology, in addition to the analysis of the causes of these returns and proposes alternatives for optimizing their management.

Abstract

An Unplanned Return to the Operating Room (UROR) is an unplanned surgery performed during the first 30 days as a result of primary surgery. In Chile, the analysis and the UROR rate are quality indicators. **Objective:** to describe and analyze UROR in a pediatrics. **Patients and Method:** Observational cross-sectional study. The clinical records of pediatric patients undergoing UROR at the Hospital Carlos Van Buren over 5 years were reviewed. The incidence, indications, and causes of UROR were analyzed. The causes of UROR were classified as 1) causes attributable to surgical technique, 2) treatment-related causes, 3) the patient pathology, and 4) other causes. In addition, the observance of the case review meetings after an UROR was analyzed. **Results:** 23 UROR out of 5,503 surgeries were performed in 5 years, (0.42%). There were 11 UROR out of 3,434 elective surgeries and 12 UROR out of 2,069 emergency ones (0.32% v/s 0.58% respectively, $p=NS$). There were 2 UROR out of 82 surgeries in newborns, (2.43%, $p<0.01$). After every UROR, a case review meeting was held. In 18 out of the 23 patients who underwent UROR (78%), the cause was attributable to the surgical technique or planning. **Conclusions:** UROR is rare in pediatric surgery, except for the newborn period. Case review meetings are held after every UROR case, according to the national guidelines. The causes of UROR are mostly attributable to the surgical technique or planning.

Keywords:

Unplanned Return to the Operating Room; Quality Indicator; Safe Surgery; Pediatric Surgery

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Introduction

In recent years, the quality of health care has become very important, demanding the best results in health services, which are periodically evaluated. Some quality indicators are hospital stay, rate of re-hospitalization after discharge, patient satisfaction surveys, and morbidity and mortality during the first 30 days after surgery¹.

In Chile, the quality of care and security of the patient is regulated by a ministerial order that came into force in October 2012. This order includes the report of adverse events and sentinel ones, the application of checklists for the surgery security, the analysis of unplanned returns to the operating room, the prevention of thromboembolic disease in surgical patients, the prevention of pressure ulcers in hospitalized patients, the report of falls of hospitalized patients, and the program of prevention of healthcare-related infections².

In surgery, one of the tools proposed as an indicator of quality is the analysis of unplanned return to the operating room (UROR)³, which is an unplanned surgical intervention performed on a patient who has already undergone surgery, as a result of primary surgery, within the first 30 days of post-operative period⁴.

In Chile, the Ministry of Health (MINSAL) requires an analysis of 100% of the UROR within the health team that treated the patient and a UROR rate lower than 2% or a 10% decrease of the baseline (accumulated to December of the previous year)⁴.

The objective of this study is to describe and analyze the URORs in a Pediatric Surgery service for 5 years.

Patients and Method

Design

Cross-sectional observational study that included all patients under 15 years of age who underwent UROR at the *Hospital Carlos Van Buren* in Valparaíso, Chile, between 2014 and 2018. This study was approved by the Scientific Ethical Committee of the Health Service Valparaíso - San Antonio (Ord.: 2690 of 12/28/17).

Definitions

Diagnosis-Related Groups (DRGs) are a system for classifying patients who are discharged based on the information of the clinical record. The use of DRGs allows hospitals to monitor resource utilization and service quality by relating patient demographic data, diagnoses, and procedures to the costs involved in their care^{5,6}. As a reference, the Clinical Hospital of the University of Chile has an average DRG rate of 0.9929 over a 10-year period⁵. The Hospital Carlos Van Buren

is a high complexity hospital with an average DRG rate of 1.0207 to 2018.

A UROR is defined as the performance of an unplanned surgical intervention on a patient already operated on, as a result of primary surgery, within the first 30 days after the intervention⁴. All pediatric patients operated on due to a pathology of general, digestive, neonatal, urology, and plastic surgery, both elective and emergency, were included. All patients who had undergone surgery within the first 30 days after surgery, but such surgery was not performed as a result of a primary one, were excluded as well as those patients operated on due to neurosurgical, otolaryngological, ophthalmological, and traumatological pathology since they are not performed by doctors specialized in pediatric surgery.

Procedures

The clinical records of all patients who met the inclusion criteria, provided by the Quality Unit of our hospital, were reviewed, as well as the minutes of the analysis meetings of these re-interventions carried out in the Pediatric Surgery Service, provided by the head of the Service. With this information, the UROR rate was calculated, the URORs analyzed at the clinical meeting were identified, the primary surgeries were determined and whether they were elective or urgent, the types of re-interventions performed, and the indication for re-intervention.

The causes of the re-interventions were classified into 1) causes attributable to the surgical technique, 2) causes related to the treatment, 3) the patient pathology, and 4) other causes, as proposed by Kroon et al⁷. The proportions were compared using the Chi-square method and the Student T-test, and a significant difference was considered when *p* was lower than 0.05.

Results

Between 2014 and 2018, 9,598 surgeries were performed on children under 15 years of age. Out of them, 838 patients underwent neurological surgeries, 1,822 patients otorhinolaryngological, 351 patients ophthalmological, and 1,084 patients traumatological surgeries. The total number of analyzed patients was 5,503. From this group, 309 patients underwent one or more surgical re-intervention within 30 days after surgery in the studied period. 23 of these patients underwent a UROR (0.42% of all operated on patients).

Surgeons members of the hospital's Pediatric Surgery Service held a meeting to analyze the total number of cases undergoing UROR. Of the total number of surgeries performed, 3,434 were elective surgeries, among which 11 were URORs (0.32%).

There were 2,069 emergency surgeries, where 12 of them were UROR cases (0.58%). Although URORs after emergency surgery almost doubled the number of elective surgeries, these differences were not significant ($p = 0.1475$) (table 1).

As a complement, we calculated an average of the percentages of UROR with a 95% confidence interval for the deviations of the averages and compared the proportion of emergency and elective URORs of the total of the studied period, resulting in a $p = 0.1939$ value. Table 1 shows the UROR cases for each year analyzed, highlighting the low number of URORs in the first two years.

Between 2014 and 2018, 82 newborns were operated on. Out of these, there were 2 URORs (2.43%), which is a significantly higher proportion compared with both the total URORs (0.42%) and the URORs whose primary surgery was an emergency one (0.58%) for the period studied ($p = 0.0069$ and $p = 0.0410$, respectively).

Of the total number of re-operated patients, 4 patients had already been discharged and had to be re-hospitalized for re-intervention.

Tables 2 and 3 show the UROR when the first surgery was elective and emergency, respectively, and detail the age, initial preoperative diagnosis, primary surgery performed, indication for re-operation, re-operation performed, and its causes.

Among the indications for UROR, there were 5 cases of peritonitis/intra-abdominal abscesses, 4 cases of abdominal compartment syndrome, 3 cases of mechanical bowel obstruction, and 2 cases of evisceration.

Regarding the causes of URORs, in some cases, there was more than one cause. Out of the 23 re-operations analyzed, in 18 cases, the main cause of UROR was attributable to the surgical technique or the surgery planning, followed by a cause associated with the treatment (5 cases), the patient's pathology (5 cases), and other causes (2 cases). In 6 cases, there was more than one cause attributable to UROR (tables 2 and 3).

Discussion

A good-quality health indicator should have several qualities such as 1) Importance: the information obtained should be relevant, 2) Reliability: its results should be repeatable, 3) Feasibility: the information provided by the indicator should be obtainable, and 4) Clarity: the results should be easily understood⁸.

According to the above mentioned, the follow-up of UROR is a valuable and useful indicator due to several other reasons, among which, it is more frequent than other indicators, such as mortality; it can occur after practically any surgical procedure, and is, therefore, widely applicable; it is a non-discretionary indicator, that is, the patient will only be re-intervened when really necessary, and it is easily followed-up using administrative data.

The results of our study indicate that the incidence of URORs in our sphere is low, which is lower than the 2% suggested by the MINSAL. In adult surgery, different authors report an incidence ranging from 0.6 to 9.4%^{3,9,10-12}.

There are few published studies on pediatric surgery. Ramirez et al¹³ report a 1.8% of UROR incidence considering only re-interventions after abdominal surgery. Kulaylat et al¹⁴ analyzed data on re-admissions in patients operated on in the National Surgical Quality Improvement Program for Pediatrics (NSQIP-P) of the American College of Surgeons and found a reoperation rate in general pediatric surgery of 0.88%. Boo et al¹⁵ found an incidence rate of UROR of 3.5%. It can be expected that emergency surgery is more likely to become complicated and require re-operation than an elective one, as found by Guevara et al.¹² in an adult cohort study. Our results show that there are no differences in the UROR rates after surgery between emergency surgery and an elective one in pediatric age.

Particularly, in neonatal surgery, newborns are at higher risk for complications because they have a less functional reserve and any surgery is technically more

Table 1. Unplanned Return to the Operating Room. Number and Percentage

	Emergency Surgery	Elective Surgery	Total
Year 2014		2/827	3/1.246
Year 2015	1/441	1/752	2/1.193
Year 2016	3/434	4/561	7/995
Year 2017	4/427	1/622	5/1.049
Year 2018	3/348	3/672	6/1.020
Total 5 years	12/2069 (0.58%)*	11/3434 (0.32%)	23/5503 (0.42%)
	(annual average: 2.4; 95%IC: 1.23-3.57)	(annual average: 2.2; 95%IC: 1.06-3.34)	(annual average: 4.6; 95%IC: 2.78-6.41)

* $p = 0.1475$ (NS) versus the total number of elective surgeries.

Table 2. Total number of patients who underwent an Unplanned Return to the Operating Room (UROR) when the primary surgery was an elective surgery

Case	Age	Preoperative Diagnosis	Primary surgery	Indication for reoperation	UROR	Causes of UROR [§]
1	1 month 11 days	Oropharyngeal dysphagia	Stamm gastrostomy	Gastrostomy disfunction	Gastrostomy tube change	Treatment: Broken balloon due to nursing misuse
2	1 months 14 days	Suspected Hirschsprung Disease	Colostomy + rectal biopsy	Evisceration	Exploratory laparotomy	Technique: Lack of adequate fixation of the colostomy. Treatment: early manipulation of colostomy bag
3	1 year	Hirschsprung Disease	Georgeson endorectal pull-through	Anastomosis dehiscence	Colostomy	Technique: tense mesenterium
4	1 year	Giant Omphalocele	Flap rotation	Flap necrosis	Resection	Planning: inadequate flap design. No drains left
5	1 year	1. Short bowel syndrome 2. Venous thrombosis	Central venous catheter installation in upper cava vein	Massive hydrothorax due to parenteral nutrition	Pleural drainage	Technique: modification of the described technique
6	5 years	Unilateral cryptorchidism	Testicular descent	Testicular evisceration	Resuture	Technique: inadequate suture technique
7	6 years	Bilateral inguinal hernia (female)	Bilateral hernioplasty with a novel laparoscopic technique	Peritonitis secondary to urinary fistula	Exploratory laparotomy	Planning: novel technique and surgeons with little experience in it.
8	10 years	Hirschsprung Disease	Georgeson endorectal pull-through	Anastomosis dehiscence	Ileostomy	Technique: tense mesenterium
9	10 years	Neck lymph node	Biopsy	Surgical wound Infection	drainage	Others: contamination without a clear origin [†]
10	11 years	Medullary thyroid carcinoma	Thyroidectomy + neck lymph node dissection	Bleeding	Drainage	Technique: insufficient bleeding control
11	14 years	1. Intraluminal foreign body 2. Large abdominal scar 3. Treated Hirschsprung disease	Laparotomy: severe adhesive bowel syndrome. Foreign body at the ileocecal valve	Abdominal wound dehiscence	Resuture + seroma drainage	Technique: inadequate access to the abdomen with a bowel perforation on entering the abdomen

[§]When there was more than one cause for the UROR, these were written in the order of importance according to the authors. [†]In case number 9, after a detailed analysis, no clear cause for the contamination was found.

demanding. This is especially critical in preterm infants. In our series, the rate of UROR in neonatal patients significantly exceeds the overall rate and even the emergency one, which is similar to that reported by other authors¹⁵.

It is interesting to observe that the different published series show a wide dispersion of results and, in particular, the series that analyzed the UROR in adults have wider dispersion than the pediatric ones.

When comparing those reports, there are differences in the definition of UROR; authors reported reoperations of different surgical specialties and subspecial-

ties, there are differences in the complexity of the patients seen, the method of detection, and the selection criteria, among other factors.

This disparity of criteria when defining a UROR and the wide range of UROR rates found in them, makes it very complex to carry out comparative studies between different centers^{7,16}. The Chilean regulation establishes that the UROR rate must be lower than 2%, without differentiating whether the original surgery was elective or emergency, and without distinguishing the surgical specialty or the complexity of the patient.

Table 3. Total number of patients who underwent an Unplanned Return to the Operating Room (UROR) when the primary surgery was an emergency surgery

Case	Age	Preoperative diagnosis	Primary surgery	Indication for reoperation	UROR	Causes of UROR [§]
1	0 days	Gastroschisis	Primary closure	Compartment syndrome	Contained laparostomy	Technique: Intraabdominal pressure not measured
2	17 days	NEC	Exploratory laparotomy	Compartment syndrome	Contained laparostomy	Technique: closed abdominal wound instead of contained laparostomy Disease: NEC progression
3	2 months	Intussusception	Exploratory laparotomy	Compartment syndrome	Contained laparostomy	Technique: extensive surgical time Disease: septic shock Treatment: volume overdose during resuscitation
4	2 months	1. Gastroschisis at birth 2. Intestinal obstruction	Exploratory laparotomy Stamm gastrostomy	Peritonitis secondary to gastrostomy dehiscence	Exploratory laparotomy and resuture	Technique: Inadequate fixation of the stomach to the abdominal wall
5	6 months	Complicated appendectomy	Appendectomy	Intestinal obstruction	Exploratory laparotomy and lysis	Planning: insufficient surgical incision Disease: appendiceal mass
6	1 year	NEC	Colon resection, colostomy and Hartmann	Suspected NEC progression	Exploratory laparotomy and resuture	Technique: colostomy with tense mesenterium
7	5 years	Acute appendicitis	Open appendectomy: normal appendix	Acute Peritonitis	Exploratory laparotomy and debridement	<i>Other: E. coli and S. pyogenes infection</i>
8	6 years	Pleuroneumonia	Chest tube insertion	Plugged chest tube	Chest tube change	Treatment: chest drainage system misuse
9	7 years	1. Complicated appendicitis 2. Operated Right CDH	Exploratory laparotomy	Intestinal obstruction	Contained laparostomy: surgical finding was a n intestinal obstruction and not an acute appendicitis	Planning: wrong initial diagnosis promotes a wrong surgical approach
10	9 years	Complicated appendicitis	Exploratory laparotomy	Compartment syndrome	Contained laparostomy	Planning: small surgical incision, inadequate surgeon assistant
11	11 years	Acute appendicitis	Open appendectomy	Intraabdominal abscess	Contained laparostomy	Technique: Inadequate peritoneal lavage (free appendicolith) Treatment: no postoperative antibiotics
12	13 years	Acute appendicitis	Open appendectomy	Intestinal obstruction	Exploratory laparotomy: abscessed appendicular plastron	Disease: acute appendicitis + pancholitis

[§]When there was more than one cause for the UROR, these were written in the order of importance according to the authors. NEC: Necrotizing enterocolitis.

One way to improve the UROR indicator by incorporating these valuable data would be to integrate and relate the UROR rate with the DRG importance of the patient or clinical service in which the patient is treated, in order to estimate the complexity degree of the

patient and, therefore, make the UROR indicator comparable among different clinical services and hospitals.

In our series, in most cases, the causes of UROR were due to either an error in surgical technique or in planning the surgery, which coincides with what was

described by Kroon et al. who showed that 70% of UROR cases are due to technical errors⁷. In addition, no fewer patients presented more than one cause attributable to UROR.

Since October 2012, the detailed analysis of clinical cases, indications, and possible causes of UROR has been gradually implemented in the surgical services of Chilean hospitals. Our study shows that the first two years of implementation of the regulation are those with the lowest number of UROR, a number that stabilizes in the three following years.

In the first years of implementation, the hospital's Quality Unit reported the UROR cases; and, as time goes by, it has been the surgeons themselves who informed their UROR cases. Therefore, it is possible that, during the first years of the study, there has been an under-registration of re-operated patients, as a consequence of the process of implementation and incorporation of the regulations in the clinical services.

The goal of UROR review meetings is for a clinical service to identify the causes of URORs and to propose measures to avoid possible errors and reduce future re-operations. In the period studied, in all registered cases of UROR, an analysis meeting was held in our hospital, fulfilling 100% of the indicator requested by the MIN-SAL. This becomes especially relevant if we consider that most of the UROR causes are attributable to technical errors. We believe that UROR analysis meetings are a valuable tool for learning and continuous improvement for surgical teams, promoting reflective practice, and providing feedback on the work of surgeons that should generate significant improvements in medical practice^{3,17}.

After the five-year retrospective analysis of UROR at our center, what measures do we believe need to be implemented to reduce UROR and promote safer and better quality surgery for our patients? Facing the results of our work and according to Birkmeyer et al¹⁸, the measures to be implemented depending on the baseline risk of the surgery and the frequency with which it is performed. For frequent and low-risk surgeries, it is recommended to implement measures in the process and measure their results. In this sense, it would be advisable to protocolize some surgeries. However, the mere existence of a protocol or clinical guide does not guarantee its proper implementation, so it would also be advisable to carry out periodic training of sur-

geons and measure compliance with protocols or guidelines. On the other hand, in infrequent and high-risk surgeries, it is recommended to implement structural measures, such as centralizing these surgeries in a single center or surgical team, in particular, to increase the volume of surgeries in order to achieve experienced work teams and thus decrease the possibility of complications^{18,19}.

Conclusion

URORs are rare in pediatric surgery, except during the neonatal period. There is full compliance with the regulations of analysis meeting after a UROR that indicate that the causes are mostly attributable to the surgical technique or planning.

Ethical Responsibilities

Human Beings and animals protection: Disclosure the authors state that the procedures were followed according to the Declaration of Helsinki and the World Medical Association regarding human experimentation developed for the medical community.

Data confidentiality: The authors state that they have followed the protocols of their Center and Local regulations on the publication of patient data.

Rights to privacy and informed consent: This study was approved by the respective Research Ethics Committee, which, according to the study's characteristics, has accepted the non-use of Informed Consent.

Conflicts of Interest

Authors declare no conflict of interest regarding the present study.

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