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. Objectives: 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% vs 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
**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 surgery.

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 infections.

In surgery, one of the tools proposed as an indicator of quality is the analysis of unplanned return to the operating room (UROR), 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 after the intervention.

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).

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. As a reference, the Clinical Hospital of the University of Chile has an average DRG rate of 0.9929 over a 10-year period. 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 intervention. 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 al.

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 understood.

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%.

There are few published studies on pediatric surgery. Ramirez et al. report a 1.8% of UROR incidence considering only re-interventions after abdominal surgery. Kulaylat et al. 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 re-operation rate in general pediatric surgery of 0.88%. Boo et al. 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. 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

<table>
<thead>
<tr>
<th>Year</th>
<th>Emergency Surgery</th>
<th>Elective Surgery</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 2014</td>
<td>2/827</td>
<td>1/441</td>
<td>3/1.264</td>
</tr>
<tr>
<td>Year 2015</td>
<td>1/441</td>
<td>1/752</td>
<td>2/1.193</td>
</tr>
<tr>
<td>Year 2016</td>
<td>3/434</td>
<td>4/561</td>
<td>7/995</td>
</tr>
<tr>
<td>Year 2017</td>
<td>4/427</td>
<td>1/622</td>
<td>5/1.049</td>
</tr>
<tr>
<td>Year 2018</td>
<td>3/348</td>
<td>3/672</td>
<td>6/1.020</td>
</tr>
<tr>
<td>Total 5 years</td>
<td>12/2069 (0.58%)*</td>
<td>11/3434 (0.32%)</td>
<td>23/5503 (0.42%)</td>
</tr>
</tbody>
</table>

*(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.*
Unplanned reoperation - G. Muranda et al

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

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

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

§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 errors. 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 reoperations. 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.

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 al, 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 surgeons 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.

**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.

**Financial Disclosure**

Authors state that no economic support has been associated with the present study.
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