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Pediatric ambulatory surgery and wound infection: a review study of 812 operations in a Brazilian university hospital

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Abstract

Introduction: The pediatric ambulatory surgery results in less wound infections, although there is little good evidence for this. *Objective*: To obtain evidence of the influence of ambulatory surgery on the post-operative wound infection results in pediatric day-surgery. *Methods*: A total of 753 patients underwent 812 ambulatory surgery operations; elective general, vascular, and urological minor surgery included. No operations involving infected patients were reviewed in our study, and all operations were performed in the operating room with the patient under general anesthesia at Teresópolis School of Medicine Hospital, Hospital das Clinicas de Teresópolis Constantino Otaviano (HCTCO). Hematoma, wound infection, and recurrence rates were analyzed. *Results*: The wound infection incidence rate was 2.2% in pediatric ambulatory patients. *Conclusion*: Pediatric ambulatory surgery reduces the post-operative morbidity of incidence of wound infection rates, and increases the pediatric quality care.

Keywords: Pediatric ambulatory surgery; Outpatient surgery; Day-hospital; Wound infection; Hospital infection

1. Introduction

Ambulatory surgery is one of those rare socio-economic political movements in which all participants have benefited as demonstrated by public interest and demand, surgeon satisfaction, patient participation and most importantly, payer encouragement and mandate [1].

During the last two decades, many different countries have experienced a dramatic switch from inpatient to day-surgery [2]. To determine the surgical wound infection (WI) incidence rate associated with pediatric day-surgery, a retrospective study of all electively operated pediatric surgery day-cases was carried out, during an 8-year-period from a university hospital in Rio de Janeiro, Brazil, between January 1993 and June 2001. The study included gastroenterological, vascular, and urological surgery.

2. Materials and methods

This study involved the retrospective analysis of all infants admission records treated with day-surgery by our staff consecutively during the period between January 1993 and June 2001. A total of 753 patients underwent 812 operations requiring a skin incision. No operation involving infected patients was reviewed in our study, and all operations were performed in the operating room with the patient under general anesthesia at Teresópolis School of Medicine Hospital, Hospital das Clínicas de Teresópolis Constantino Otaviano (HCTCO). Our method included: (a) a parent or a responsible adult accompany all children following the invitation to go into the operating room with the child; (b) children inhale anesthetic gases as they go to sleep; (c) once the child is asleep, doctors insert an i.v. and begin the surgical procedure; (d) the day-surgery patients generally spent 8–10 h at the pediatric surgery unit (including reception, surgery room visitation with parents, procedure per se and anesthesia recovery); and (e) patients were seen after discharge in both the pediatric surgery hospital unit or a private clinic. Patients were seen 1 week and 2 weeks after discharge, and periodically thereafter, until they were well.

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Table 1
Grøgaard, Kimsas e Ræder criteria

1	Discharge of pus from the wound
2	Microorganisms present in swabs taken from any discharge from the wound
3	Surgical revision and drainage of the wound with positive bacteriology
4	Antibiotic treatment due to clinically suspect infection

The definition of wound infection was based on fulfillment of one from following Grøgaard, Kimsas e Ræder criteria [3] (Table 1). The collection of data included the factors associated with the procedures which were documented for each patient at the time of the operation. Such factors included the name of the surgeon, name of the scrub- and assisting nurse, type and duration of the procedure, location of the incision, and ASA-class of anesthesia risk. Following the Wilson scoring system for WI's [4] in our service, we defined nosocomial infection as any infection acquired in the hospital, i.e. not present or incubating prior to hospitalization. The patients' ages were grouped into: neonates (0–30 days), infants (31 days to 18 months), and children (19 months to 12 years). Patients' nutritional status was assessed using the Marcondes weight-for-height anthropometrical method for protein-energy nutrition state. [5] Additional clinical data included: primary diagnosis, sex, coexisting disease process or anomaly, duration of operative procedure, number of operations for each patient, and time interval in days from operation to onset of infection. A rate of infection was calculated for the entire population as well as for each procedure possible risk-factor. The data were analyzed with Student's *t*-test, and $P < 0.05$ was considered statistically significant.

3. Results

The day-surgery pediatric patients admitted between January 1993 and June 2001 were reviewed. A total of 753 patients underwent 812 operations. The total WI infection rate was 2.2%. In addition 1% of the patients had healing disturbance (usually consisting of transient erythema without any exudate). The median time from operation to diagnosis of WI was 7 days (range 2–7). According to age group (Table 2), the infection rate was higher for neonates (3.6%) than for infants (2.8%) or children (1.1%). When we had a new element in the operative team—a resident or an intern—there was a relative total incidence risk of 15% over procedures performed by experienced surgeon over 3 years.

4. Discussion

Day-surgery is effective and useful [2] and ambulatory surgery is the best for healthy children undergoing minor procedures. It has been claimed that ambulatory surgery results in less wound infections compared with inpatient

Table 2
Wound infections by operation and age

	Neonates	Infants	Children
Operation no.	186/753	211/753	365/753
Inguinal herniorraphy (421)	3	1	2
Umbilical hernioplasty (60)	–	2	–
Testis operation (e.g. orchidopexy) (109)	2	–	–
Orthophalloplasty (different procedures) (38)	–	–	1
Excision of small lipoma (10)	–	–	–
Circumcision (119)	–	1	–
Others (55)	2	2	1
Total no. of patients with WI	7 (3.6%)	6 (2.8%)	4 (1.1%)

treatment [3]. Ambulatory surgery is increasingly accepted and encouraged throughout the world by both government and private agencies [6]. In the long history of surgery, hospital-based operations have been well-accepted in medical and social policy, but as yet, the ambulatory surgery is not accepted everywhere [7,8]. The ambulatory surgery patient may be sent home immediately after an operation and doesn't need a hospital bed [9].

During the last decades, 'quality care' has been used to describe physician–patient relationships evolved into 'cost-effective quality care', and consumers, payers, and providers have differing perspectives [10]. Distribution of health care—mainly "the quality care distribution" according to need—is perhaps the most widely discussed rationing principle in both academic and non-academic debates [11]. In the private hospitals, the situation is totally different. In these hospitals, which prima facie should have an "ambulatory surgery", has taken root exactly in the manner in which it has in developed countries [12].

The medical ethics typically recommend that medico–moral decisions should be guided by four basic philosophical principles [11]—respect for autonomy, beneficence (the patient's interests come first), non-maleficence (above all do no harm), and justice. This position can be referring to as "ambulatory surgery definition". An ambulatory surgery is very safe, with a low incidence of complications, and refers to elective surgery in which people undergoing surgery arrive and return home on the same day [13–15]. The technologic progress related to medical invasive proceedings, diagnostics, and therapeutics conducts a "new" oldest public health problem—nosocomial cost [16]. The virtually absence of cost from post-operative complications has been claimed because ambulatory surgery results less than inpatient treatment [17–19]. This low cost must be include in the absence of post-operative wound infection, ever an important part of the successful outcome of any operative procedure [3]. In Brazil, the epidemiological data on nosocomial infections are little published [20], and it's "hard" to define a right Brazilian rate. Few data exist on post-operative WI in pediatric patients in contrast to numerous reports in adults [21]. Adjustment for variables known to confound rate esti-

Table 3
Wound infection rates reported

Authors	Year	Location	Operations	Wound infection (%)
Davis et al. (31)	1984	Milwaukee, USA	1045	4.2
Sharma and Sharma (40)	1986	Rohtak, India	1325	5.4
Bhattacharya and Koloske (26)	1990	Albuquerque, USA	676	2.5
Davenport and Doig (41)	1993	London, England	1433	16.6
Tiryaki, Baskin, and Bulut (39)	1998	Istanbul, Turkey	1131	1.9
This report	2003	Rio de Janeiro, Brazil	812	2.2

mates is critical if valid comparisons of WI rates are to be made between surgeons or hospitals [22,23] (Table 3).

Our overall WI rate of 2.2% was medium compared to those reported in previous series of pediatric patients (Table 3), and generally accepted as comparable to rates in the United States [21]. However, that study [21] included laparoscopic operations, which generally have a lower risk of WI compared to open operations [24,25]. In our review, when there was a new element in the operative team—a resident or an intern—there was a relative total incidence risk of 15% over procedures performed by 3 years experienced surgeon.

Risk-factor analysis should be used to identify steps to reduce the infection rate, which still occurs despite control practices, including improved sterilization methods and barriers, surgical technique, and availability of personal prophylaxis [26]. The day-surgery at HCTCO is not physically separated from the rest of the hospital. It includes five operating theatres, four post-operative beds, and a step-down area. The unit is located in an old building with no controlled ventilation.

5. Conclusion

The prevention of WIs remains an important aspect of patient care. Educational programs covering both WI prevention and control may increase benefits for the patients, reduce expenses at institutions, and address other underlying issues by improving the working conditions. Pediatric day-surgery provides adequate treatment [27,28], and may improve the quality of hospital care for children in many developing countries. It should be provided not only by public insurance institutes, like SUS (the Brazilian system of public health) but also by both private physicians and services around the world. Our results in pediatric ambulatory surgery support our intents—ambulatory surgery makes sense when it can maintain or improve the quality of care, here defined as the low incidence of WIs [6,28]. The low incidence of wound infections reported here support the safety of ambulatory surgery, and should encourage its continued growth.

References

[1] Rutkow IM. International comparison of ambulatory surgery: status in the United States. Chirurg 1995;66(5):480–6.
[2] Ogg TW, Hitchcock M, Penn S. Day-surgery admissions and complications. Amb Surg 1998;6:101–6.
[3] Grøgaard B, et al. Wound infection in day-surgery. Amb Surg 2001;9:109–12.
[4] Wilson APR, Treasure T, Sturridge MF, et al. A scoring method (ASEPSIS) for postoperative wound infections for use in clinical trials of antibiotic prophylaxis. Lancet 1986;1:311–3.
[5] Marcondes E. Estudo antropométrico de crianças brasileiras de 0 a 12 anos. Anais Nestlé. 1972;84:15–42.
[6] Reis ED, Mosimann F, Vuilleumier H. Implementation of ambulatory surgery in a university hospital: an audit comprising 873 general surgery cases. Amb Surg 1999;7:107–10.
[7] Sadler GP, Richards H, Watkins G, Foster ME. Day-case paediatric surgery: the only choice. Ann R Coll Surg Engl 1992;74:130–3.
[8] Irvin III GL, Sfakianakis G, Yeung L, et al. Ambulatory parathyroidectomy for primary hyperparathyroidism. Arch Surg 1996;131:1074–8.
[9] Loefler IJP. The paradox of ambulatory surgery in the third world. Amb Surg 2000;8:113.
[10] Wetchler BV. Patient focused management: cost versus value (editorial). Amb Surg 2001;9:57–8.
[11] Cookson R, Dolan P. Principles of justice in health care rationing. J Med Ethics 2000;26:323–9.
[12] Evans RG, Robinson GC. Surgical day care: measurements of economic pay-off. Can Med Assoc 1980;123:873–80.
[13] Warner MA, Shields SE, Chute CG. Major morbidity and mortality within 1 month of ambulatory surgery and anesthesia. JAMA 1993;270:1437–41.
[14] Audry G, Johanet S, Achrafi H, Lupold M, Gruner M. The risk of wound infection after inguinal incision in pediatric outpatient surgery. Eur J Pediatr Surg 1994;4:87–9.
[15] Natof HE. Complications associated with ambulatory surgery. JAMA 1980;244:1116–8.
[16] Zoutman D, Pearce P, Mckenzie M, Taylor G. Surgical wound infections occurring in day-surgery patients. Am J Infect Control 1990;18:227–82.
[17] Audry G, Johanet S, Achrafi H, Lupold M, Gruner M. The risk of wound infection after inguinal incision in pediatric outpatient surgery. Eur J Pediatr Surg 1994;4:87–9.
[18] Othersen Jr HE, Clatworthy Jr HW. Outpatient herniorrhaphy for infants. Am J Dis Child 1968;116:78–80.
[19] Steward DJ. Outpatient pediatric anesthesia. Anesthesiology 1975;43:268–76.
[20] Turrini RNT, Santo AH. Nosocomial infection and multiple causes of death. J Pediatr 2002;78(6):485–90.
[21] Bhattacharya N, Koloske AM. Postoperative wound infection in pediatric surgical patients: a study of 676 infants and children. J Pediatr Surg 1990;25:125–9.
[22] Cardo DM, Falk PS, Mayhall CG. Validation of surgical wound surveillance. Infect Control Hosp Epidemiol 1993;14:211–5.
[23] Mangram AJ, Horan TC, Pearson ML, Silver LC, Jarvis WR. Guideline for prevention of surgical site infection. Infect Control Hosp Epidemiol 1999;20:247–78.
[24] Golub R, Siddiqui F, Pohl D. Laparoscopic versus open appendectomy: a meta analysis. J Am Coll Surg 1998;186:545–53.

[25] Centers for Disease Control and Prevention. National Nosocomial Infections Surveillance (NNIS) report, data summary from October 1986–April 1997. Am J Infect Control 1997;25:477–87.
[26] Ehrenkranz NJ, Richter EI, Phillips PM, Shultz JM. An apparent excess of operative site infections: analyses to evaluate false-positive diagnoses. Infect Control Hosp Epidemiol 1995;16:712–6.
[27] Nolan T, Angos P, Cunha AJLA, et al. Quality of hospital care for seriously ill children in less developed countries. Lancet 2001;357:106–10.
[28] Duke T, Tamburlini G. The Paediatric Quality Care Group: Improving the quality of paediatric care in peripheral hospitals in developing countries. Arch Dis Child 2003;88:563–5.