

ORIGINAL

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## Ambulatory surgery for strabism and its relationship with the different techniques

### Cirugía ambulatoria del estrabismo y su relación con las diferentes técnicas

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#### ABSTRACT

**Objective:** To assess the functionality and usefulness of ambulatory surgery in pediatric patients operated on for strabismus, as well as the incidence of post-operative complications or hospital admission.

**Material and methods:** A descriptive observational retrospective study was carried out with 92 patients operated on at a tertiary hospital between January 2017 and December 2018.

**Results:** Most patients were ASA I. A laryngeal mask was used in 69.6 % of patients with a prevalence of use of sevoflurane (in 94.6 % of patients) and muscle relaxant (rocuronium in 96.7 % of patients).

From the point of view of strabismus surgery, 72.8 % of patients presented with horizontal strabismus, and were esotropias. Most of them with 2 muscles intervened and undergoing surgery for the first time. 21.7 % of patients, presented with other types of strabismus such as IV nerve palsy, Duane or Brown Syndrome. With regard to the results, the admission rate was 4.3 %. In the immediate postoperative period in the Postanesthetic Care Unit (PACU), they did not present with pain and only 6.5 % of the patients suffered Postoperative nausea or vomiting (PONV). Regarding the presence of complications (pain, significant discomfort, tearing, difficulty opening the eyes...), in the ophthalmology consultation on the first postoperative day, they were noted in 2.2 % of the patients.

**Conclusion:** Uniformity criteria such as handling by the same surgeon and the same anesthetic protocol have been essential. Regarding the results, we observed that the number of surgeries performed, the type of strabismus and certain techniques such as Faden, had an effect on the presence of pain. In our study, the low complication rate and low admission rate confirm the success of the ambulatory surgery for this type of surgery.

*Keywords: Ambulatory surgery, ambulatory pediatric surgery, faden technique, endotropia, exotropia, strabismus, alphabet pattern, anesthetic factors in ambulatory pediatric surgery, nausea and vomiting in strabismus surgery, complications associated with strabismus surgery.*

#### RESUMEN

**Objetivo:** Evaluar el funcionamiento y utilidad de la cirugía mayor ambulatoria (CMA) en pacientes pediátricos intervenidos de estrabismo, así como la incidencia de complicaciones postoperatorias o ingreso hospitalario.

**Material y métodos:** Se ha realizado un estudio retrospectivo observacional descriptivo, con 92 pacientes intervenidos en el Hospital Álvaro Cunqueiro de Vigo; entre enero de 2017 y diciembre de 2018.

**Resultados:** La mayor parte de los pacientes eran ASA I. Se utilizó mascarilla laríngea en el 69,6 % con prevalencia de empleo de sevoflurano (94,6 %) y relajante muscular (rocuronio en un 96,7 %).

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Desde el punto de vista de la cirugía estrabológica, el 72,8 % de los pacientes presentaron estrabismo horizontal, tratándose en su mayoría de una primera intervención, endotropias y afectación de hasta dos músculos. El 21,7 % de los pacientes presentaron otros tipos de estrabismo como: paresia IV, síndrome de Duane o Brown, etc. En cuanto a los resultados, la tasa de ingresos fue de un 4,3 %. En el postoperatorio inmediato en la CMA, no presentaron dolor y solo el 6,5% de los pacientes presentaron náuseas o vómitos. En cuanto a la presencia de complicaciones, en la consulta oftalmológica en el primer día postoperatorio (dolor, molestias importantes, lagrimeo, dificultad apertura ocular, etc.), fueron recogidas en un 2,2 % de los pacientes.

**Conclusión:** Han resultado esenciales unos criterios de uniformidad como el manejo por el mismo cirujano y un mismo protocolo anestésico. En cuanto a los resultados, observamos influencia en la presencia de dolor según el número de intervenciones, tipo de estrabismo o técnicas (como Faden). En nuestro estudio, la baja tasa de complicaciones y baja tasa de ingreso confirman el éxito de la CMA para este tipo de intervenciones.

*Palabras clave:* Cirugía mayor ambulatoria, CMA pediátrica, técnica de Faden, endotropia, exotropia, estrabismos, patrón alfabético, factores anestésicos en la CMA, náuseas/vómitos de la cirugía de estrabismo, complicaciones cirugía estrabológica.

## INTRODUCTION

### Background and justification of the project

Ambulatory surgery is an organizational model for surgical assistance that allows for a safe, effective and efficient treatment for patients without the need for hospital admission (1).

This kind of surgery is becoming more widespread in recent years (2). In Spain, it grew from 10.4 % in 1997 to 16.3 % in 2000 3; it accounted for 31 % of all major surgeries performed in Spain in 2005 (4).

Performance of outpatient surgeries (as opposed to the need for surgery with admission) involves carrying out diagnostic or therapeutic procedures in patients under general, locoregional, or local anesthesia who come from their homes and return to them on the same day of the surgery after a period of observation and control (1).

This approach offers many benefits for the patients and their families (5). In outpatient processes, waiting times are significantly reduced, thus diminishing stress and disruption to both the patient and the family (6-8). These surgeries are also of great benefit for the professionals and the health system performing them, as they are more cost efficient (5).

The average cost of each outpatient surgery in the USA is 5,600 dollars, while the cost of surgery with postoperative admission is 28,300 dollars (9).

In ophthalmologic surgery, the main factor associated to anesthetic recovery is the invasiveness of the surgical procedure (10). Preoperative risk factors associated to an extended stay in outpatient surgery include strabologic surgery (11).

By the own surgical procedure, strabismus surgery is very emetizing (12); especially some surgical techniques such as myopexia or Faden technique (13). Furthermore, other

complications from this surgery have been noted, such as anterior segment complications (chemosis, Dellen, exposure of Tenon's capsule), postoperative infection or problems with the muscles operated on (14).

From an anesthetic point of view, we also found other risks and complications coupled with nausea and/or vomit, such as the intraoperative oculocardiac reflex and postoperative pain (15).

Being female and the existence of comorbidities, such as the sleep apnea-hypopnea syndrome among others, are risk factors relevant to a longer anesthesia recovery time (16). These postoperative nausea and vomiting episodes have been found to resolve with antiemetic treatment using dual therapy with dexamethasone and ondansetron. Such treatment reduces their incidence between five and sixteen percent (15).

Major outpatient surgery has become an established practice for numerous procedures, including corrective strabismus surgery. Its aim is to achieve a quick recovery of the patient with regard to the pain, nausea and vomiting parameters (11).

With this study, we seek to assess the functionality and usefulness of ambulatory surgery in pediatric patients undergoing strabismus surgery, as well as the relationship between the incidence of postoperative complications or hospital admission as a result of such complications and various anesthetic, surgical or patient-dependent factors.

## MATERIAL AND METHODS

### Subjects and selection process

A descriptive observational retrospective study was carried out with 92 patients operated on at a tertiary hospital.

Among the criteria for inclusion in this study, the following were considered: patients with horizontal strabismus over 12D

with or without alphabet pattern, IV nerve palsy, nystagmus with torticollis and restrictive strabismus (Brown, Duane).

On the other hand, the following were excluded from the study: congenital strabismus treated with botox, other pediatric surgery (lacrimal duct pathology, annexes, anterior segment surgery (congenital cataract)) or double scheduling with another pediatric surgery. There were non-subsidary of ambulatory surgery, patients with a personal history of respiratory pathologies (such as sleep apnea-hypopnea syndrome (SAHS), dependence on assistive devices (CPAP (continuous positive airway pressure)) or poorly controlled asthma), patients with poorly controlled chronic diseases, congenital heart diseases, BMI (Body Mass Index) above the 95<sup>th</sup> percentile, infections, coagulopathies or craniofacial syndromes (due to higher incidence of difficult airway).

### Protocol

Most surgeries were performed by the same ophthalmologist (95.7 % of patients) with an assistant, who could vary in different surgeries. The anesthesia team consisted of the best-trained anesthesiologists most experienced in pediatric anesthesia. The anesthetic technique and the drugs used by each professional were not protocolized, but differed according to their preferences.

Patients scheduled for a given day were admitted early in the morning from admissions services, accompanied at all times by members of their family.

Prior to surgery, the patients were premedicated with oral midazolam according to their weight and were given a peripheral venous catheter. During surgery, propofol or sevoflurane was administered according to the decision of the anesthesiologist, as well as ondansetron as antiemetic agent. Duration of the surgery varied in accordance with the surgical technique and the number of muscles to operate on.

Once the surgery was finished, patients were carried in their beds to the Postanesthetic Care Unit (PACU). After post-surgical awakening and checking for eventual anesthetic and surgical complications, patients were discharged home with the appropriate treatment and the indications to follow.

Patients were questioned by phone upon discharge about possible post-surgery complications (pain, nausea/vomiting, others) and data obtained were recorded. In addition, patients were checked on the next day by the Ophthalmology Service to assess eventual postsurgical complications.

### Data extraction and analysis

Data from the patients were collected and entered in a spreadsheet by the research team after the persons legally responsible for the minors signed an informed consent.

Information about the patient, surgery performed, and anesthetic technique was included.

The cases in which patients suffered any post-surgery complications (nausea, vomiting, or pain) and/or needed to be admitted to hospital were also recorded.

Statistical analysis was carried out by the statistics department of the “*Fundación Biomédica*” of our region.

A descriptive analysis of the data was carried out. Quantitative variables were described with mean and confidence interval at 95 % (CI 95 %). Qualitative variants are expressed as absolute frequency and percentage.

An univariate analysis was conducted to study the difference among groups. Pearson’s Chi-square test was used for qualitative variables and T-student test or Mann-Whitney U test were applied for independent samples depending on whether the variable followed a normal distribution or not.

Significance level  $\alpha$  accepted for all hypotheses contrasts is 0.05. Data were analyzed using SPSS 19 software.

### Approval of the Ethics Committee and informed consent

The study was approved by the Research Ethics Committee of Galicia and shall be carried out in compliance with the Declaration of Helsinki, the Guidelines for Good Clinical Practice, and the relevant legislation.

### Informed consent

Participants shall be informed about the study to be carried out and shall give their written consent for the use of the data recorded in their medical records which may be necessary for the research.

## RESULTS AND DISCUSSION

A total of 247 pediatric eye surgeries were performed between 2017 and 2018, of which 92 were analyzed after applying the exclusion criteria. No surgeries were suspended or cancelled.

Average age of the patients was 9.5 years (IC 95 % 8.9-10.1). There were no significant differences with regard to the gender of the patients, of whom 50 (54.3 %) were male.

With regard to the ASA (American Society of Anesthesiologists) Physical Status Classification System, 60 (69.9 %) patients were ASA I (low anesthetic risk). A laryngeal mask was used on 64 patients (69.6 %). Eighty-seven patients (94.6 %) were given sevoflurane to maintain anesthesia, as opposed to 5 patients (5.4 %) who were given propofol.

A muscle relaxant (rocuronium) was given to 89 patients (96.7 %).

From the surgical point of view, the average duration of the surgery was 89.5 minutes (IC 95 % 83.3-95.8), including induction and awakening times from anesthesia. Most patients, 76 of them (82.6 %), were operated on two muscles (*versus* more than two) and 67 (72.8 %) underwent their first surgery.

Patients were classified in three groups according to the type of strabismus: a group of patients with horizontal strabismus, made up of 67 patients (72.8 %); a mixed group, consisting of patients with horizontal strabismus with an added vertical component (Dissociated Vertical Deviation [DVD]), made up of 5 patients (5.4 %), and a third group including special strabismus and syndromes (made up of 20 patients [21.7 %]). This last group included IV nerve palsy, Duane Syndrome, Brown Syndrome and DVD without a horizontal component.

Forty-nine of the patients included in the horizontal strabismus group (73.0 %) had pure horizontal strabismus, and 18 patients (26.9 %) presented with associate inferior oblique hyperfunction.

Three patients were operated on (3.3 %), using myopexia or Faden technique.

Four patients had to be admitted to hospital, which is a rate of 4.3 %. One patient was admitted for geographical reasons and the rest of patients for complications from surgery (pain in reoperative surgeries, nausea or vomiting...).

With regard to the early postoperative in PACU, no patients presented with pain (0.0 %). A total of 6 patients (6.5 %) presented with nausea or vomits.

On home discharge, nausea or vomit were not reported. Four patients (4.3 %) presented with pain at home. A statistically significant difference ( $p = 0.014$ ) was observed in the frequency of pain reported at home depending on the use of propofol (2 [40.0 %]) or sevoflurane (2 [2.3 %]).

Results of the eye check-up on the day after the surgery can be found in Tables I and II.

It was noted that:

- 16 patients (17.4 %) presented with pain. Statistically significant differences were observed ( $p = 0.028$ ) according to whether it was a first (9 [13.4 %]), second (4 [20.0 %]), or third surgery (3 [60.0 %]).
- There were observed statistically significant differences ( $p = 0.014$ ) in pain reported among patients operated on for horizontal strabismus, mixed strabismus, or special strabismus: 8 patients (11.9 %) presented with pain in the group of patients operated on for horizontal strabismus.

TABLE I

COMPLICATIONS POSTOPERATIVE DAY ONE:  
PRESENCE OF PAIN

	Postoperative day one		P
	Pain	No pain	
<b>No. of surgeries</b>			
First	9 (13.4 %)	58 (86.6 %)	0.028
Second	4 (20.0 %)	16 (80.0 %)	
Third	3 (60.0 %)	2 (40.0 %)	
<b>No. of muscles</b>			
= 2	11 (14.5 %)	65 (85.5 %)	0.144
> 2	5 (31.5 %)	11 (68.8 %)	> 2
<b>Type of strabismus</b>			
Horizontal	8 (11.9 %)	59 (88.1 %)	0.028
Mixed	3 (60.0 %)	2 (40.0 %)	
Vertical	5 (25.0 %)	15 (75.0 %)	
Alphabet pattern	6 (20.7 %)	23 (79.3 %)	
Inferior oblique surgery	8 (24.2 %)	25 (75.8 %)	0.253
Faden	2 (66.7 %)	1 (33.3 %)	0.077

TABLE II

COMPLICATIONS POSTOPERATIVE DAY ONE:  
OTHER COMPLICATIONS

	Postoperative day one		P
	Other complications	No pain	
<b>No. of surgeries</b>			
First	15 (22.4 %)	52 (77.6 %)	0.251
Second	2 (10.0 %)	18 (90.0 %)	
Third	0 (0.0 %)	5 (100.0 %)	
<b>No. of muscles</b>			
= 2	11 (14.5 %)	65 (85.5 %)	0.069
> 2	6 (37.5 %)	10 (62.5 %)	
Inferior oblique	7 (21.2 %)	26 (78.8 %)	0.780
<b>Type of strabismus</b>			
Horizontal	12 (17.9 %)	55 (82.1 %)	0.425
Mixed	2 (40.0 %)	3 (60.0 %)	
Vertical	3 (15 %)	17 (85 %)	
Alphabet pattern	7 (24.1 %)	22 (75.9 %)	0.391
Faden technique	0 (0.0 %)	3 (100.0 %)	

bismus, 3 patients (60.0 %) reported discomfort in the mixed group, and 5 patients (25.0 %) in the group made of other types of strabismus (Brown Syndrome, Duane Syndrome, Pure DVD).

- The relationship between other complications (hyposphagma, diplopia...) on postoperative day one in patients operated on more than two muscles (6 patients [37.5 %]) as opposed to two muscles or less (11 patients [14.5 %]), as well as the presence of pain in patients operated on using Faden's technique, were very close to statistical significance ( $p = 0.069$  and  $p = 0.077$ , respectively).

In conclusion, 57.83 % of the surgeries performed at the Alvaro Cunqueiro Hospital between January and June 2017 were outpatient surgeries, of which 89.47 % were performed by the Ophthalmology Service (*Doniz Campos, M. et al. Evaluation of quality indicators in pediatric outpatient major surgery. XII National Congress of Pediatric Anesthesia and Resuscitation. Oral Communication*). It is an increasingly common option nowadays.

By the own surgical procedure, strabismus surgery has been found to be very emetizing, especially in the case of some techniques such as myopexia or Faden's technique (13). For this reason, gentle traction and careful handling of the muscles by an experienced surgeon are essential. In our study, 95.7 % of the surgeries were performed by the same surgeon and an anesthetic protocol was followed by an anesthesia team familiar with this kind of surgeries.

In our study, statistically significant differences were observed ( $p = 0.014$ ) in the presence of pain depending on the drug used to maintain anesthesia, either propofol or sevoflurane.

From a surgical point of view, we have observed statistically significant differences in the presence of pain depending on the number of surgeries ( $p = 0.028$ ) or the type of strabismus ( $p = 0.014$ ).

Pain was more frequent in patients operated on using some surgical techniques, such as myopexia or Faden technique, although these differences were not statistically significant.

When analyzing the results of our study, we can see that a low complication rate has been attained (pain, discomfort, nausea/vomiting...). Moreover, the low rate of hospital admissions (4.3 %, as opposed to 100 % in the case of inpatient surgery), added to the costs of hospitalisation in the

case of some postoperatives for inpatient surgery, confirm the success of ambulatory surgery for this type of surgery.

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