

Factors associated with hospitalisation after outpatient anaesthesia in paediatric surgery at the Clermont Ferrand University Hospital Centre

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ABSTRACT

Background: Unplanned hospitalisation of children undergoing outpatient anaesthesia is a major concern for healthcare teams. This study investigated the factors associated with these hospitalisations at the Clermont Ferrand University Hospital Centre.

Methods: This is a single-centre, cross-sectional study conducted from September 1st, 2021 to January 31st, 2022 at the Clermont Ferrand University Hospital, ESTAING site. It involved children aged from 2 to 17 years, of ASA class I, II and III stable, anaesthetised for a scheduled outpatient procedure. Pre-, intra- and postoperative data were collected from patient registers and records and analysed with STATA version 21.0 for $p < 0.05$, in compliance with ethical principles.

Results: Two hundred and two patients were selected and sixteen (7.9%) were hospitalised. There was no significant difference between hospitalised and non-hospitalised children in terms of socio-demographic, clinical and anaesthetic characteristics ($p > 0.5$). The median duration of the procedure for hospitalised patients was 45 minutes compared with 30 minutes for non-hospitalised one, with a significant difference ($p < 0.001$). In multivariate analysis, the regression model showed that 19.9% of hospitalisations could be explained by four included risk factors, $R^2 = 0.173$, $p = 0.003$. Procedure duration of more than 30 minutes adjusted for age, sex and ASA class was positively associated with hospitalisation (OR=17.76 [95% CI, 1.98 - 159.05], $p = 0.010$).

Conclusion: This study infers that only the duration of surgery influences unplanned hospitalisation in outpatient surgery in this hospital.

Key words: associated factors, hospitalization, anaesthesia, ambulatory surgery.

INTRODUCTION

The hospitalisation of patients scheduled for outpatient anaesthesia is a challenge for this type of care. Ambulatory anaesthesia is defined as all anaesthetic procedures programmed and carried out under technical conditions that imperatively require the safety of an operating theatre, under variable-mode anaesthesia and followed by postoperative monitoring that allows the patient to be discharged on the same day as the operation, without increased risk (1). The French National Authority for Health (FNAH) stresses the high standards and excellence required for outpatient surgery, both in terms of medical reasoning and organisation of patients' stays (2).

Using outpatient care presents advantages for patients such as a reduction in the rate of nosocomial infection, a reduction in the risk of thromboembolism and improvement in overall satisfaction, particularly in the pediatric population. It also presents advantages for the community in terms of reduced costs of care, compared to traditional hospitalization (3).

In fact, the use of this type of hospitalization is increasing. In 2009, a survey conducted by the International Association for Ambulatory Surgery (IAAS) concluded that it already concerned 83% of patients operated on in the United States of America (USA), 74% in Denmark, 69% in Sweden, 53% in the United Kingdom (UK), 53% in Holland, 50% in Norway, 49% in Portugal, 43% in Germany and 35% in France (4).

In 2017, a study conducted by the French Ambulatory Surgery Association (FASA) concluded that ambulatory anaesthesia concerned 55.9% of activities, with the aim of reaching 70% by 2022 throughout France (5).

However, despite the precautions taken in the practice of outpatient anaesthesia and surgery, notably careful selection of eligible patients and anticipation and prevention of all kinds of post-operative discomfort, the rate of hospitalisation following outpatient surgery worldwide remains worrying. This rate ranged from 0.26 to 2%, depending on the team and the type of surgery performed. Urological and Ear Nose throat (ENT) surgeries appeared to have the highest risk of unscheduled hospitalization (6).

The study carried out by Tsangu in Kinshasa, taking all surgical specialities together, found that outpatient activities represented 40.5% and the hospitalisation rate was 2.7%, but the factors leading to hospitalisation were not investigated (7).

Factors that may explain hospitalisation include haemorrhage, postoperative pain, postoperative nausea and vomiting, urinary retention, prolonged sedation, and the duration of surgery (8).

Unplanned hospitalisations not only increase the cost of care but also disrupt work organisation. It is therefore important to know the frequency and associated factors for each hospital structure.

However, at the limit of our research modules, we

did not find any studies in the French environment that addressed the factors associated with hospitalisation under outpatient anaesthesia in children, and in particular at the University Hospital Centre (UHC) in Clermont Ferrand. We therefore thought it would be useful to carry out this study to find out what factors are associated with hospitalisation after outpatient anaesthesia in paediatric surgery.

METHODS

Type, setting and period of the study

This was a single-centre cross-sectional study conducted at the ESTAING site of the Clermont Ferrand University Hospital during the period from September 1st, 2021 to January 31st, 2022. The hospital has 86 day hospitalisation places.

Study population and sampling

The study population consisted of children anaesthetised for outpatient surgery at the ESTAING hospital during the study period. We used exhaustive register sampling. All children aged between 2 and 18 years who have undergone anaesthesia for outpatient surgery at the ESTAING hospital and were classified as ASA 1, 2 or ASA 3 stable were included in the study. Children undergoing emergency surgery were excluded.

Data collection

Data were collected using the documentary technique, using patients' medical records and operating theatre registers. A data collection form containing all the study variables was drawn up for this purpose.

The study variables were

- Sociodemographic: age (according to last birthday), gender, parents' level of education (low: less than baccalaureate, medium: with

baccalaureate and higher: baccalaureate plus three at least).

- Clinical variables: surgical speciality, anaesthetic technique and drugs, duration of anaesthesia, postoperative pain management;
- Outcome data: intraoperative complications, postoperative complications, need for hospitalisation, reason for hospitalisation.

Statistical analysis

The data were entered using Epi-info software version 7.2.5.0. They were then exported using a Microsoft® Office Excel® version 2019 file and analysed using STATA version 21.0 software. Continuous variables were presented as medians and categorical variables as proportions or percentages. Karl Pearson's Chi-squared test or Ronald Fisher's exact test was used to compare categorical variables, and Student's t-test was used to compare means. Quantitative variables with an asymmetric distribution were compared using the Kruskal-Wallis test. The logistic regression model was used to assess the association between the explanatory variables. For all tests, the p-value was set at <0.05.

Ethical and regulatory aspects

The hospital management and the hospital's local ethics committee had given their agreement. We have no conflicts of interest in this work.

RESULTS

Patient flow diagram.

Figure 1 shows the patient flow diagram.

During the period from September 1st, 2021 to January 31st, 2022, a total of 217 children were seen in an anaesthetic consultation for outpatient sur-

gery at the ESTAING site of the Clermont Ferrand University Hospital Centre. Two hundred and two were included, fifteen were excluded: seven for ASA 3, five for incomplete data and three for age under 2 years.

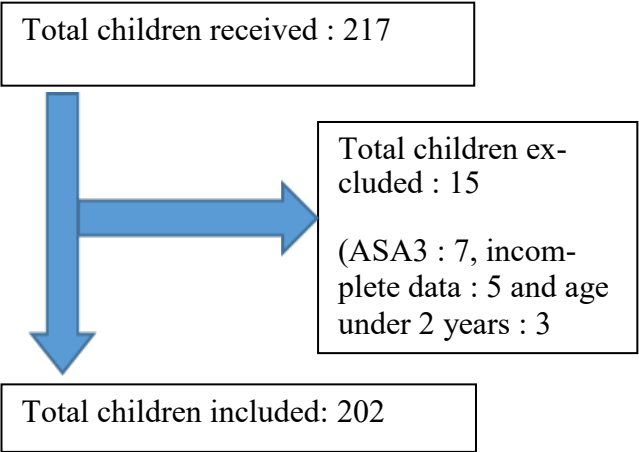


Figure 1: Patient flow diagram

Socio-demographic characteristics of patients

Table 1 shows the socio-demographic characteristics of the patients.

Of the 202 patients, 16 (7.9%) were hospitalised. The median age was 5 years, with 1st and 3rd percentiles of 4 and 8 respectively. The mean age was 6.2 years. Hospitalised patients represented 8.8% of children aged 2 to 5 years, 2% of those aged 6 to 10 years and 13.5% of those aged 10 to 18 years, with no significant difference ($p = 0.388$). Boys accounted for 144 cases (71.3%), compared with 58 girls (28.7%), with a M/F sex ratio of 2.48. Children hospitalised accounted for 9% of boys compared with 5.2% of girls, with no significant difference ($p = 0.565$). Children hospitalised represented 7.4% of parents with a low level of education, 12% of parents with a medium level of education and 0% of parents with a high level of education, with no significant difference ($p = 0.473$).

Table 1. Socio-demographic characteristics of patients

Caracte- ristics	Total n=202	Not hos- pitalised n=186 (92.1%)	Hospi- talised n=16 (7.9%)	<i>p</i>
Age median (IQR)	5(4 - 8)	5(4 - 8)	5(4 - 12)	0.388
2 - 5 years	114 (56.4%)	104 (91.2%)	10 (8.8%)	
6 - 10 years	51 (25.3%)	50(98.0)	1 (2.0%)	
10 - 18 years	37 (18.3%)	32 (86.5%)	5 (13.5%)	
Gender				0.565
Male	144 (71.3%)	131 (91.0%)	13 (9.0%)	
Female	58 (28.7%)	55 (94.8%)	3 (5.2%)	
Level of education				0.473
Low	176 (87.1%)	163 (92.6%)	13 (7.4%)	
Medium	25 (12.4%)	22 (88.0%)	3 (12.0%)	
High	1 (0.5%)	1(100%)	0(0%)	

*IQR: Interquartile range.

Clinical characteristics of patients and duration of procedures

Table 2 presents the clinical characteristics of the patients and the duration of the procedures.

The median duration of the procedure for hospitalised patients was 45 minutes compared with 30 minutes for non-hospitalised children, with a significant difference ($p < 0.001$). Hospitalised children accounted for 10.8% of children classified ASA 2 and 7.3% of those classified ASA 1, with

no significant difference ($p = 0.501$). The surgical specialities were: otorhinolaryngology (Ear, Nose and Throat: ENT) 44 cases (21.8%), urology 43 cases (21.3%), general surgery 35 cases (17.3%), visceral surgery 27 cases (13.4%), gastroenterology 25 cases (12.4%). Children admitted to hospital were operated on for ENT (6 cases), visceral surgery (5 cases), general surgery (2 cases), urology (2 cases) and ophthalmology (one case). However, the difference was not statistically significant ($p = 0.299$). All the children were operated on under general anaesthesia.

Table 2. Clinical characteristics of patients and duration of procedures

Characteristics	Total n=202		Not hospitalised n=186(92.1%)	Hospitalised n=16 (7.9%)	<i>p</i>
<u>Duration of surgery</u> medi-	30(20 – 45)		30(20 – 40)	45(42.5- 55)	<0,001
<or equal 20 minutes	76(37.6%)		75(98.7%)	1(1.3%)	
21 – 30 minutes	48(23.8%)		46(95.8%)	2(4.2%)	
> 30 minutes	78(38.6%)		65(83.3%)	13(16.8%)	
ASA class					0.501
Class 1	165 (81.7%)		153(92.7%)	12(7.3%)	
Class 2	37(18.3%)		33(89.2%)	4(10.8%)	
Surgical specialty					0.299
<u>Gastro-enterology</u>	25(12.4%)		25(100%)	0(0%)	
Gynocology	1(0.5%)		1(100%)	0(0%)	
General surgery	35(17.3%)		33(94.3%)	2(5.7%)	
ENT	44(21.8%)		38(86.4%)	6(13.6%)	
Ophtalmology	10(5%)		9(90%)	1(10%)	
Orthopaedics	2(1%)		2(100%)	0(0%)	
Pneumology	10(5%)		10(100%)	0(0%)	
Stomatology	5(2.5%)		5(100%)	0(0%)	
<u>Urology</u>	43(21.3%)		41(95.4%)	2(4.6%)	
<u>Visceral surgery</u>	27(13.4%)		22(81.5%)	5(18.5%)	
Type of anaesthesia					
General anaesthesia	202(100%)		144(71.3%)	58(28.7%)	-

Legend:*IQR: Interquartile range, ASA = American society of anaesthesiologists, ENT= Ear, Nose Throat.

Anaesthetic drugs

Table 3 shows the anaesthetic agents used.

All children received general anaesthesia. Propofol was used in 95.8% of cases, sevoflurane in 80.2%, sufentanil in 65.8%, rocuronium in 18.8%, ketamine in 14.8%, atracurium in 14.9% and isoflurane in 1.9%. The difference between hospitalised and non-hospitalised patients was significant only for ketamine ($p=0.014$) and atracurium ($p=0.03$).

Table 3. Anaesthetic drugs

Anaesthetic drugs	Total n=202		Not hospitalised n=186(92.1%)	Hospitalised n=16 (7.9%)	<i>p</i>
Propofol	198(95.8%)		182(91.9%)	16(8.1%)	0.488
Sevoflurane	162(80.2%)		147(90.7%)	15(9.3%)	0.068
Sufentanil	133(65.8%)		122(91.7%)	11(8.3%)	0.4

Rocuronium	32(15.8%)		31(96.9%)	1(3.1%)	0.272
Ketamine	30(14.8%)		24(92.5%)	6(7.5%)	0.014
Atracurium	10(4.9%)		7(70%)	3(30%)	0.03
Isoflurane	4(1.9%)		4(100%)	0(0%)	0.73

Complications

Table 4 shows the complications

Complications were present in 19 patients (9.41%) and were represented by: postoperative nausea and vomiting (12 or 5.94%), haemorrhage (4 or 1.98%) and postoperative pain (3 or 1.48%). All the children who presented a complication other than postoperative pain were hospitalised. Three patients (1.61%) who presented a complication (postoperative pain) were not hospitalised.

Table 4. Complications

Complications	Total n=202(100%)	Not hospita- lised n=186(100%)	Hospitalised n=16(100%)	<i>p</i>
No	183(90.59%)	181(97.3%)		
Yes	19(9.41%)	3 (1.61%)	16(100%)	-
Type of complications				
PONV	12 (5.94%)	0 (0%)	12(75%)	-
POP	3(1.48%)	3(1.61%)	0(0%)	-
Haemorrhage	4(1.98%)	0(0%)	4(25%)	-

Legend: PONV= postoperative nausea and vomiting, POP= postoperative pain.

Factors associated with hospitalisation in outpatient anaesthesia

Univariate analysis

Table 5 presents the factors associated with hospitalisation in univariate analysis.

In univariate analysis, the duration of the procedure influenced hospitalisation (OR=1.07 [95% CI, 1.04 - 1.11], $p<0.001$) and the duration of the procedure of more than 30 minutes increased the risk of being hospitalised by a factor of 15 (OR=15 [95% CI, 1.91 - 117.79], $p=0.010$). The other factors had no influence.

Table 5. Univariate analysis of factors associated with hospitalisation

Variables	Hospitalisation OR [95% CI]	<i>p</i>
Duration of surgery	1.07 [1.04 – 1.11]	<0.001
< or equal 20 minutes	Reference	
21-30 minutes	3.3 [0.29 – 36.97]	0.340
> 30 minutes	15.0 [1.91 – 117.79]	0.010
Age group	1.06 [0.94 – 1.21]	0.309
2 - 5 years	Reference	
6 – 10 years	0.20 [0.02 – 1.67]	0.140
10 - 18 years	1.62 [0.51 – 5.10]	0.406
Gender		
Male	Reference	
Female	0.54 [0.15 – 2.00]	0.365
ASA class		
Class 1	Reference	
Class 2	1.54 [0.46 – 5.09]	0.474

Legend: ASA =American society of anaesthesiologists.

Multivariate analysis

Table 6 presents the factors associated with hospitalisation in multivariate analysis.

In multivariate analysis, the regression model showed that 19.9% of hospitalisations could be explained by the four included risk factors, $R^2 = 0.173$, $p=0.003$. Procedure duration of more than 30 minutes adjusted for age, sex and ASA class was positively associated with hospitalisation (OR=17.76 [95% CI, 1.98 - 159.05], $p=0.010$).

Table 6. Factors associated with hospitalisation in multivariate analysis

Variables	Hospitalisation	
	ORa [95% CI]	P
Duration of surgery		
< or equal 20 minutes	Reference	
21-30 minutes	3.67 [0.29 – 45.54]	0.311
> 30 minutes	17.76 [1.98 – 159.05]	0.010
Gender		
Male	Reference	
Female	0.66 [0.10 – 4.16]	0.665
ASA class		
Class 1	Reference	
Class 2	2.23 [0.56 – 8.91]	0.254
Age group		
2 - 5 years	Reference	
6-10 years	0.52 [0.05 – 4.96]	0.575
11-18 years	3.22 [0.71 – 14.58]	0.128

Legend: ASA = American society of anaesthesiologists

Probability of being hospitalised in relation to the duration of the procedure adjusted for age, sex and ASA class.

Table 7 presents the probability of being hospitalised in relation to the duration of the operation adjusted for age, sex and ASA class.

Patients whose procedure lasted longer than 30 minutes had a higher probability of being admitted to hospital than other groups, 0.16 [95% CI, 0.07 - 0.26], $p<0.05$.

Table 7. Evaluation of the probability of being hospitalised in relation to the length of hospitalisation adjusted by age, sex and ASA class

Hospitalisation	Probability	[95% CI]		p
		Lower	Superior	
Duration of surgery				
< ou equal 20 minutes	0.01	-0.01	0.03	0.316
21-30 minutes	0.04	-0.01	0.10	0.167
> 30 minutes	0.16	0.07	0.26	0.001

DISCUSSION

This study was carried out to investigate the factors associated with hospitalisation during paediatric outpatient anaesthesia at the Estaing hospital. It was found that the hospitalisation rate was 7.9% and the only factor associated with hospitalisation was the duration of the procedure exceeding 30 minutes. ENT surgery appeared to be associated with hospitalisation, with no significant difference.

The age range of 2 to 5 years and the male sex were predominant in this study, results similar to those of Dadure who found the age range of one to three years with more boys [9]. Coté CJ [10] considers that outpatient anaesthesia can be used for children from the age of 6 months; in the hospital concerned, the limit is set at 2 years. Males probably predominated because of urological procedures in children and perhaps also ritual circumcision in Jewish and African populations. Some authors have also made the same observation [11, 12, 13]. On the other hand, our study is consistent with that carried out by Marie A et al [14], which found that 70.8% of children aged 4-17 years were circumcised. Dahmani S et al [15] found a mean age of 3.3 years, while Sawhney M [16] found a mean age of 5.2 years. The mean age of our patients was 6.2 years higher than that of the others, probably because of the 2-year limit for eligibility for outpatient anaesthesia in this hospital.

ASA class 1 accounted for 165 patients (81.7%) and ASA class 2 for 37 patients (18.3%), results which are consistent with the literature [17, 18, 19].

The types of surgery most frequently performed in this study were otolaryngology 44(21.8%), urology 43(21.3%), general surgery 35(17.3%), visceral

surgery 27(13.4%) and gastroenterology 25 (12.4%).

ENT and orthopaedic surgery was performed mainly in children aged 4-17, while urological surgery was performed half in 2-3 year olds and half in 4-17 year olds.

Similar results have been reported in the literature [17, 20]. However, Minai F et al [13] found that dental surgery predominated, probably because of the characteristics of the hospital.

The duration of the procedure was significantly associated with hospitalisation (OR=1.07 [CI 95%, 1.04 - 1.11], $p<0.001$) and, when comparing classes of procedure duration, the class of procedure duration greater than 30 minutes was significantly associated with hospitalisation (OR=15.0 [CI 95%, 1.91 - 117.79], $p = 0.010$). Similar results have been reported by other authors [21, 22,23]. They found that patients who developed complications following ENT surgery underwent longer surgical procedures. In our study, out of 16 hospital admissions, 6 had undergone ENT surgery lasting longer than 30 minutes and all were boys. When adjusted for age, sex and ASA class, the duration of the procedure exceeding 30 minutes was positively associated with hospitalisation (OR=17.76 [CI 95%, 1.98 - 159.05], $p=0.010$), with a higher probability of being hospitalised than other groups, i.e. 0.16 [CI 95%, 0.07 - 0.26], $p < 0.05$.

The strength of this study is that it is the first to examine the factors associated with hospitalisation under paediatric outpatient anaesthesia at the Hôpital d'Estaing.

The weaknesses are those of all documentary stud-

ies and the monocentric nature of the study.

CONCLUSION

This study found that the rate of unplanned hospitalisation was 7.9% and that the duration of the procedure exceeding 30 minutes was the only factor associated with hospitalisation. It would seem useful to conduct a study to identify the factors responsible for prolonging the duration of surgery in order to reduce this hospitalisation rate.

Authors' contributions

Jean Claude Mubenga: conception of the study, drafting of the manuscript and data collection.

Wilfrid Mbombo: conception of the study and drafting of the manuscript.

All other authors: reading and correction of the manuscript.

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