

Treatment Under Dental General Anesthesia Among Children Younger than 6 Years in Lithuania

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Summary. *Background and Objective.* Dental general anesthesia (DGA) is an efficient treatment modality for young pediatric dental patients. The aim of this study was to identify the reasons for DGA, characteristics of patients receiving treatment under DGA, and treatment performed under DGA for children under school age in Kaunas, Lithuania.

Material and Methods. The study population comprised all patients younger than 6 years treated under GA for dental reasons ($n=144$) at the University Hospital during a 3-year period from 2010 to 2012. The data were collected by means of clinical dental examinations, a survey of the parents, and the patients' dental records and included personal background, reasons for DGA, dental status, and treatment provided.

Results. More than half (54%) of the children were younger than 4 years; 40% of them resided in cities. The dental caries experience was high: the mean dmft and d were 12.9 (SD, 3.5) and 12.1 (SD 3.9), respectively. The majority (81%) of the children had multiple reasons for DGA, with the need for excessive treatment (93%), followed by dental fear and uncooperativeness (66%), being the most common. The extent of treatment increased with age and was greater among patients from rural areas. Of the 1975 primary teeth treated under GA, 50% were restored, 32% extracted, and 18% targeted with preventive procedures.

Conclusions. Young children with very high levels of untreated tooth decay are treated under DGA at the Lithuanian University of Health Sciences Hospital. The need for complex treatment as well as dental fear and uncooperativeness are the major reasons for DGA. Multiple caries treatments and extractions are performed for these patients. This study highlights a great need to develop the healthcare system with regard to the appropriate management of caries among young children and postoperative DGA care.

Introduction

General anesthesia (GA) is utilized for pediatric dental patients to provide comprehensive and high-quality dental care when conventional dental treatment is impossible. Dental general anesthesia (DGA) is an efficient treatment modality, since full-mouth rehabilitation can be performed during a single appointment, and it requires little or no cooperation from the patient. Nevertheless, DGA is considered only as the last option, because GA may pose risk for the patient's overall health (1, 2).

Reports indicate that in the western world, the demand for treatment under DGA in children has been growing (3–5). Children are being referred to dental treatment under GA for various reasons including very young age of a child, fear of a dentist, uncooperative behavior, complex medical/physical/mental conditions, a need for extensive treatment

(e.g., surgical procedures), and others. The child's parents greatly appreciate DGA as a treatment modality (6, 7), as it significantly improves the oral health-related quality of life of young children and has a positive impact on their families (8, 9). Restorative procedures and simple extractions are the most frequent types of treatment modalities. Studies have shown that the quality of restorations carried out under GA is considerably better than under local anesthesia due to more effective moisture control and more accurate placement of planned restorations (10, 11). However, treatment under DGA is a costly method of delivering dental care, and access to it is often limited due to long waiting periods in most hospitals as well as travel costs.

The majority of young children referred to DGA are otherwise healthy and suffer from early childhood caries and its complications. In Lithuania, childhood dental caries is common (12–14). Dental care under GA is provided mostly in the university hospitals in the largest cities and in some private clinics. Although studies have explored risk factors

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for early childhood caries and its prevalence as well as its behavioral, clinical and microbiological characteristics (14, 15), little information is available regarding treatment under DGA among children in Lithuania.

Our aim was to determine the reasons for DGA, characteristics of patients receiving treatment under DGA, and the treatments performed under DGA for children younger than 6 years at the University Hospital in Kaunas, Lithuania.

Material and Methods

Design. This was a prospective cross-sectional clinical study of pediatric patients undergoing treatment under DGA in Kaunas, Lithuania.

Subjects. The study included all the patients younger than 6 years treated under GA for dental reasons at the Hospital of Lithuanian University of Health Sciences (LUHS) in Kaunas, Lithuania, during a 3-year period from 2010 to 2012. All the patients were referred to treatment under DGA from the Clinic of Preventive and Paediatric Dentistry (LUHS) after a consultation with a specialist in pediatric dentistry. A total of 144 patients were enrolled into the study; those with developmental disorders and general diseases (n=26) were excluded.

Data Collection. The study involved clinical dental examinations performed during DGA, a survey of the parents of the children at the time of the treatment, and collection of data from the patients' dental files. The study was voluntary, and the parents provided their written informed consent.

The personal background data included gender, age (in months), parental education (primary, secondary, college, or university), place of residence (village, small town, town, or city), and whether the child had undergone previous treatment under DGA.

Reasons for Dental General Anesthesia. The patient records provided the reasons for referring the child to DGA treatment. The children were treated under DGA due to an inability to accept treatment under local anesthesia. Reasons for referring a healthy child to DGA in the Hospital of LUHS were as follows: immaturity of the child, dental fear and uncooperativeness, and excessive need for treatment (multiple reasons were allowed).

Clinical Examination. A clinical dental examination was performed during the DGA procedure in a standardized manner according to the written instructions. The teeth were first assessed while wet and then after drying with compressed air. A dental mirror and a World Health Organization (WHO) periodontal probe served as visual-tactile aids in assessing the surfaces. The clinical examinations were conducted by 2 examiners with high reproducibility (inter- and intraexaminer kappas, >0.8).

The International Caries Detection and Assessment System (ICDAS) was used for caries assessment (16). The ICDAS includes early enamel caries lesions according to the stage of their progression and categorizes the "obvious" dentine caries lesions according to their progression (17). The ICDAS II codes were used to record the d-component of the dmf index as defined by the WHO (18). The 2-digit ICDAS codes were determined for each tooth surface of the primary dentition. The first digit of the ICDAS code describes the restoration or sealant (if present), and the second digit is the actual caries code (16). Unrupted teeth and teeth missing due to caries or other reasons were also recorded.

Oral hygiene status was assessed with the Silness-Loe plaque index (PLI) (19). The probe was slid over the surface of each tooth, and the findings were recorded in points: 0, no plaque; 1, plaque is located on the gums and the tooth neck area; 2, plaque is visible on the tooth neck area and interdentally; and 3, plaque covers the entire surface of a tooth. The PLI was calculated by adding the scores and dividing them by the number of the teeth assessed. The index was scored as follows: 0, excellent oral hygiene; from 0.1 to 0.9, good; from 1.0 to 1.9, satisfactory; and from 2.0 to 3.0, poor.

Intraoral radiographs before DGA were unavailable because of the poor cooperation of most patients. No intraoral radiographs were possible during DGA due to the limited facilities in the operating room.

Dental Treatment. Full dental rehabilitation was performed in a single DGA session. The data on dental treatment (number of restorations, pulp treatments, extractions, and preventive procedures), diagnoses, and duration of GA were recorded. Glass-ionomer cements and composite resins served as restoration materials. Vital teeth with pulpal involvement underwent pulpotomy and were restored; if bleeding during the pulpotomy procedure persisted for more than 5 minutes, the tooth was extracted. No pulpectomies or pulp capping procedures were performed for primary teeth. The teeth with nonvital pulp were extracted. Preventive procedures included professional tooth cleaning, topical fluoride applications, and fissure sealants if the permanent molars were present; all the procedures were recorded separately.

Data Analysis. Age was categorized into 2 categories based on the maturity and distribution of the children: <4 years and 4–6 years. In the analyses of the caries indices, ICDAS caries codes 1 and 2 were counted as one code being a measure of noncavitated enamel caries (d1-2) and 3, 4, 5, and 6 as obvious caries lesions (d3-6). The dmft index, which represents caries experience, was calculated as the total number of teeth with obvious caries lesions and/or treated caries (ft) and missing teeth (mt) due to car-

ies. DGA treatments were categorized according to the severity of the disease and rated as follows: filling due to caries (score of 1), pulp treatment (score of 2), and extraction (score of 3). The individual treatment index (TI) was calculated as the sum of the scores for fillings, pulp treatments and extractions for each patient. The sum of the scores divided by the number of treated children provided the mean TI.

Ethical Consideration. The Kaunas Regional Biomedical Research Ethics Committee approved the study (No. BE -2-19; April 11, 2009).

Statistical Analysis. The data were analyzed using the Statistical Package for the Social Sciences program for Windows (SPSS, version 17). The chi-square and Mann-Whitney tests as well as logistic regression modelling served for statistical analyses.

Results

A total of 144 children (79 boys and 65 girls) younger than 6 years (range, 25–71 months) were treated under GA for dental reasons at the Hospital of LUHS between 2010 and 2012. Table 1 shows the patients' characteristics by age: more than half (54.2%) of the children were younger than 4 years, and 40% of them resided in cities. Nearly half (47%) of the parents had higher education, and none had education lower than secondary. More than 15% of the children had a history of previous DGA (Table 1).

Reasons for General Anesthesia. Most (81%) of the children had multiple (2 or 3) reasons for DGA (Table 2). DGA due to dental fear and uncooperative behavior as well as the need for complex treatment was indicated in more than half (52.1%) of them. Multivariate logistic regression analysis showed that a history of previous DGA (OR, 6.6; 95% CI, 1.41–31.22; $P=0.017$) and living in a rural area (OR, 2.0; 95% CI, 1.01–4.05; $P=0.046$) were associated with dental fear and uncooperativeness (not shown in tables). No significant differences in the reasons for DGA in relation to gender and parental education were found.

Oral Health. Table 3 shows the dental health status (dmft and its components) of the patients: the level of decay (dmft) was higher in the younger age group. The patients who received treatment under DGA presented mostly with untreated caries (mean d, 12.1) and low numbers of previously filled (mean f, 0.2) or extracted teeth (mean m, 0.6). Most (80%) of the patients had poor oral hygiene (PLI, ≥ 2). The logistic regression analysis revealed that young age (OR, 2.8; 95% CI, 1.06–7.38; $P=0.039$), being a female (OR, 3.1; 95% CI, 1.25–7.67; $P=0.015$), and dental fear and uncooperative behavior (OR, 14.2; 95% CI, 3.53–57.04; $P<0.001$) were significantly associated with a high level of untreated caries ($d=15$ or more) (data not shown in tables).

Treatment Under Dental General Anesthesia. The

Table 1. Characteristics of the Patients Who Received Dental Treatment Under General Anesthesia in 2010–2012 by Age Groups

Characteristic	Total n=144	<4 years n=78	4–6 years n=66	P^*
Gender				
Male	54.9	53.8	56.1	0.79
Female	45.1	46.2	43.9	
Place of residence				
City	39.6	41.0	37.9	<0.001
Town	19.4	20.5	18.2	
Small town	20.1	30.8	7.6	
Village	20.8	7.7	36.4	
Parental education				
University	47.2	52.6	40.9	0.253
College	35.4	29.5	42.4	
Secondary	17.4	17.9	16.7	
Previous general anesthesia	15.3	10.3	21.2	0.069

Values are percentage. *Chi-square test.

Table 2. Reasons for Dental Treatment Under General Anesthesia Among the Patients by Age Groups

Reason for DGA	Total n=144	<4 years n=78	4–6 years n=66	P^*
Immaturity of a child	30.6	56.4	0.0	<0.001
Fear, uncooperativeness	66.0	43.6	92.4	<0.001
Complex treatment	93.1	92.3	93.9	0.701

Values are percentage. *Chi-square test.

For each patient, one or more reasons for referring to DGA were recorded.

Table 3. Dental Health Status (dmft) and its Components Among the Children Treated Under General Anesthesia by Age Groups

	Total n=144	<4 years n=78	4–6 years n=66
dmft	12.9 (3.5)	13.3 (3.7)	12.5 (3.1)
d	12.1 (3.9)	12.7 (4.0)	11.38 (3.7)
m	0.6 (1.5)	0.3 (1.1)	0.9 (1.8)
f	0.2 (0.8)	0.2 (0.5)	0.3 (1.0)

Values are mean (standard deviation).

duration of treatment under DGA ranged from 35 to 180 minutes (mean, 94.3; SD, 30.6). Of the 1975 primary teeth treated under GA, 50% were restored, 32% extracted, and 18% targeted with preventive procedures. Of the restored teeth, 12% were treated endodontically. Fig. summarizes the percentages of children who received each type of treatment. Extractions were more frequent among the 4–6-year-old children than those aged less than 4 years ($P=0.003$). The TI ranged from 3 to 51 (mean TI, 20.3; SD, 9.6). The logistic regression analysis revealed that being older and living in a more rural area were significantly associated with a high extent of DGA treatment (TI, >21) (Table 4). Lower parental educational level tended to be indicative of

Table 4. Patient Background Factors (Age, Parental Education, and Place of Residence) Predicting the Extent of DGA Treatment (TI, >21) Shown by the Logistic Regression Model

Parameter		Estimate	SE	OR	95% CI	P
Age						
<4 years	No					
>4 years	Yes	0.074	0.020	1.077	1.035–1.120	<0.001
Parental education						
High	No					
Other	Yes	0.649	0.364	1.914	0.937–3.907	0.075
Place of residence						
City*	No					
Village**	Yes	0.836	0.374	2.307	1.108–4.804	0.026
Constant		–4.097	0.989	0.017		

*>10 000 inhabitants; **<10 000 inhabitants.

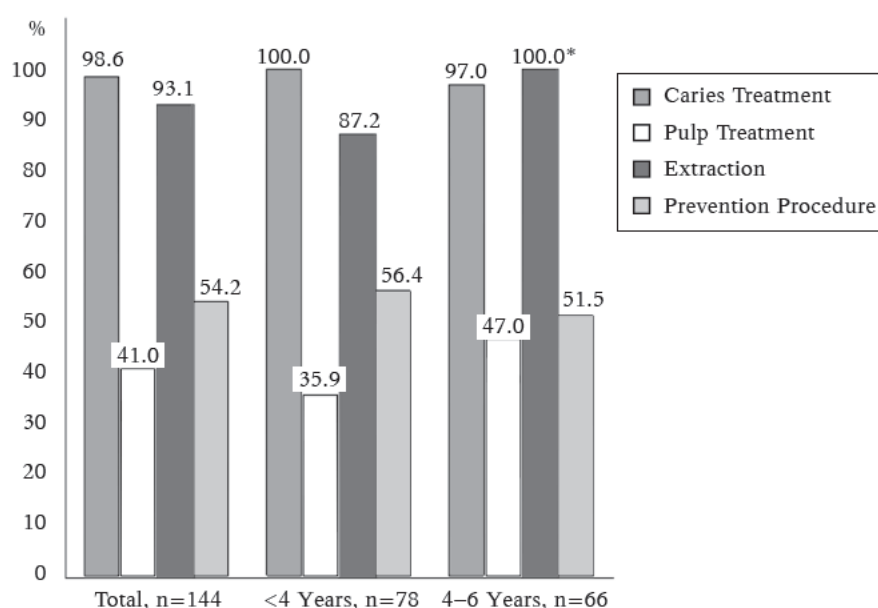


Fig. Percentages of DGA patients receiving various treatments by age

* $P=0.003$ as compared to children younger than 4 years

a higher TI value, although it did not reach significance in the model.

Discussion

This study presents new information about dental treatment under GA among children in Lithuania. Young children with very high levels of tooth decay received treatment under DGA in Kaunas. High dental caries experience together with dental fear and uncooperative behavior were the major reasons for referring a healthy child to DGA.

Country Comparisons. A majority of the children were referred to DGA for multiple reasons, mostly dental fear, uncooperativeness, and the need for extensive dental treatment, as is commonly observed in international studies as well (20, 21).

More than 50% of the treatments were restora-

tions, and this as was the case in a recent study in Finland (20). The mean number of filled teeth was higher than the mean number of extracted teeth, which is in line with the studies performed in Denmark and Belgium (21, 22). The extraction rate of 32% is higher than that reported in the Finnish study (20), but lower than that in other studies (23, 24) in which DGA served primarily for extractions.

As found in our study, dental fear and uncooperativeness are related to a history of previous DGA (20). Our results indicate that children experiencing dental fear tend to have higher dental caries experience than those without fear of the dentist, although the findings of other studies are contradictory (25–27).

National Aspects. The parents of the children treated under DGA were better educated than the

general population (82% with higher and 31% with professional education, respectively). Moreover, no parents in our study had education lower than secondary. Although determining the reasons for this is beyond the aims of our study, the fact that better educated working-age people living in cities have easier access to treatment may explain part of our findings. The socioeconomic status of the educated parents as well as different parental attitudes toward health may also contribute to this (28).

Contrary to the common findings, the younger children among our DGA patients presented with higher dmft and caries scores. This finding may be characteristic of young children in Lithuania and may be related to the considerably higher prevalence and more rapid progression of caries among preschool children in Lithuania than in many other European countries: more than 50% of the 3-year olds had caries, and the dmft among 3-, 4-, and 5-year olds was 2.1, 4.9, and 7.5, respectively (12, 14, 15). Furthermore, severe early childhood caries affected the teeth of 6.5% of the 3-year olds (14). Another possible explanation for the high prevalence of dental caries among the youngest children could be the efforts of pediatric dentists to postpone dental treatment for young children and send those with multiple and severe problems to DGA. Nevertheless, part of very young Lithuanian children seems to have a poor dental status and therefore requires treatment under DGA.

The fact that the numbers of previously filled teeth among our DGA patients were so low highlights the lack of efforts to treat these children. This raises the question of whether other treatment methods involving behavior management techniques and treatment under sedation are ineffective or are simply unused.

At present, no postoperative appointment is being arranged for DGA patients in the Hospital of LUHS; patients are simply referred to their primary care dentists for follow-up dental care. The reason our patients received repeated treatments under DGA was their dental fear, a fact that indicates the need of adequate changes in the health care system, since dental fear after treatment under DGA does not disappear (29). Systematic care for DGA children by a specialist in pediatric dentistry ought to be organized in order to guide such patients toward normal dental care.

The data of this study on treatment under DGA gathered during the 3-year period represent the current situation in the Hospital of LUHS, a tertiary-care treating hospital in Kaunas, the second largest city in Lithuania. The results of this study do not represent those of whole Lithuanian popula-

tion; however, since the Hospital of LUHS serves as the largest medical referral center for all regions in the country and patients may choose this University Hospital when DGA is indicated, the present findings are probably close to those of the whole population.

Strengths and Weaknesses. The fact that all the patients treated under GA within the 3-year period participated in the study, a full dataset was available for every patient, and no changes in the DGA referral process or the treatment protocol during the study period occurred can be considered as the strength of this study. In addition, our findings are based not only on patients' documents and clinical examinations, but also on the survey of parents, which adds valuable information to the patients' background. Furthermore, 2 calibrated dentists performed dental examinations and treatments under GA throughout the study period.

Caries have traditionally been assessed using the WHO criteria including only obvious caries lesions (18). Although previous Lithuanian studies have used these criteria to detect caries, our study is the first to utilize the ICDAS method. The ICDAS, currently being the method recommended globally to assess caries in dental studies (30), provides more information and data on noncavitated caries lesions. Moreover, comparisons with previous surveys are possible (17).

Because oral radiographs for this study were unavailable, the diagnoses and treatment were made based on clinical examinations (referral together with GA). With regard to determining the reasons for GA, dental fear and uncooperative behavior were considered as one reason, since it was difficult to objectively determine which one was the most important reason for young children.

Conclusions

Young children with very high levels of untreated tooth decay are treated under dental general anesthesia in the Lithuanian University of Health Sciences Hospital. The need for complex treatment as well as dental fear and uncooperativeness are the major reasons for dental general anesthesia. Multiple caries treatments and extractions are performed for these patients. Children from rural areas receive more extensive treatment. This study highlights a great need to develop the healthcare system with regard to the appropriate management of caries among young children and postoperative dental general anesthesia care.

Statement of Conflict of Interest

The authors state no conflict of interest.

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