Scientific Article

Recall Rates and Caries Experience of Patients Undergoing General Anesthesia for Dental Treatment

William J. Jamieson, DMD[1] • Kaaren Vargas, DDS, PhD[2]

Abstract: ***Purpose:*** *The purpose of this study was to evaluate the recall rate and caries experience of children seen under general anesthesia (GA) at The University of Iowa Hospitals and Clinics.* ***Methods:*** *After a retrospective chart review, information from 217 ASA (American Society of Anesthesiologists) I patients undergoing GA between 1998 and 2002 was gleaned regarding: (1) date of GA; (2) age at time of GA; (3) follow-up (recall) visits; (4) referral status; (5) new caries experience; and (6) treatment of new/recurrent lesions. A 19-question survey was also mailed to parents/legal guardians for satisfaction.* ***Results:*** *Survey data were not reported in this study due to the poor (25%) return rate after several attempts: 41% of the patients were referrals; 54% returned for a 2 week postoperative visit, but only 13% returned for a 6-month recall, with subsequent recalls being even lower; 72% were insured by Medicaid; and 25% had recurrent or new lesions at follow-up appointments.* ***Conclusion:*** *Recall rates after general anesthesia for dental treatment at a university hospital are very low, and new or recurrent caries experience is high. (Pediatr Dent 2007;29:253-7)*

KEYWORDS: GENERAL ANESTHESIA, FOLLOW-UP VISITS, RECALL, CARIES

Dental caries is the most common chronic disease of childhood. It occurs 5 to 8 times more frequently than asthma.[1] Also, national data indicate that 80% of dental caries in the permanent teeth are found in just 25% of child populations.[2] Caries in children can cause: (1) pain; (2) missed days of school; and (3) difficulty in eating, swallowing, and speaking.[3]

Early childhood caries (ECC) is the presence of 1 or more decayed, missing, or filled surfaces in any primary tooth in a child 71 months of age or younger.[4] In children under 3 years of age, if there is any evidence of smooth surface caries it is indicative of severe ECC. From ages 3 to 5, severe ECC is present when there is one or more cavitated, missing, or filled surfaces in primary maxillary anterior teeth, or a decayed, missing, or filled score of greater than 4 (age 3), greater than 5 (age 4), or greater than 6 (age 5).[4] ECC children may need aggressive preventive and therapeutic measures such as:

1. atraumatic restorative technique (ART);
2. regimented topical fluoride;
3. full coverage crowns; and
4. advanced behavior management (depending on the child's development level, comprehension skills, and level of disease) such as:
    a. protective stabilization;
    b. sedation; and/or
    c. general anesthesia.[4]

The indications for general anesthesia (GA) include:

1. patients unable to cooperate due to lack of psychological or emotional maturity;
2. mental, physical, or medical disability;
3. the extremely uncooperative, fearful, anxious, or uncommunicative child or adolescent;
4. when general anesthesia may protect the developing psyche or reduce medical risks;
5. patient requiring immediate, comprehensive dental care;
6. patients for whom local anesthetic is not effective; and
7. patients requiring significant surgical procedures.[4]

Studies have shown that parents do not see the benefits of regular recall visits after a GA event.[5] This is evidenced by studies showing that many patients who undergo GA for dental treatment do not follow-up with 6-month recall exams.[5-10] Occasionally, some patients will need a repeat visit for dental treatment under GA. Some of the reasons for repeat care under GA include:

1. nursing bottle use at time of GA;
2. child responsible for brushing his or her own teeth; and
3. lack of follow-up dental care.[10]

[1]*Dr. Jamieson is in private practice in Atlanta, GA.; at the time the research was done, he was a resident, Department of Pediatric Dentistry, University of Iowa , Iowa City, Iowa; and* [2]*Dr. Vargas is associate professor, Pediatric Dentistry, both at The University of Iowa College of Dentistry, Iowa City, Iowa.*
Correspond with Dr. Vargas at kaaren-g-vargas@uiowa.edu

Berkowitz found that the inability of parents to comply with dental homecare and routine visits may lead to early relapse.[6] Roberts noted that after GA parents did not see the importance of home care prevention and failed to keep visits.[3]

Additionally, Leagault et al found that 39% of all children undergoing GA required subsequent dental treatment, and 11% of these patients needed retreatment under GA.[11] A study by O'Sullivan and Curzon to assess the efficacy of dental treatment under GA, however, found that 80% of the children who needed further dental treatment accepted local anesthesia and treatment in the traditional way.[12]

The purpose of this study was to evaluate the recall rate and caries experience of children seen under general anesthesia (GA) at The University of Iowa Hospitals and Clinics, Iowa City, Iowa. This study hypothesized that children treated under general anesthesia at the University of Iowa Hospital and Clinics had less than optimal recall rates. The authors also wanted to see if low recall rates were associated with higher caries experience and the use of more aggressive forms of behavior management. Furthermore, the authors desired to determine the possible reasons for the low number of routine recalls following general anesthesia.

Methods

Following approval by the Institutional Review Board of the University of Iowa College of Dentistry, Iowa City, Iowa, the Windent data program (Windent Enterprise Edition Appointment Scheduler Application, v. 3.2.54, Richardson, TX) was used to generate a list of patients who received dental treatment under GA between 1998 and 2002. For this study, the patients' ages were limited to between 2 and 7. The program created a list of 380 patients who fit the initial screening criteria of age and GA experience. Of the 380 records, 60 were duplicates and eliminated, reducing the number to 320. A further 103 were eliminated due to medical conditions, since only ASA I individuals were included in the study to eliminate variables associated with health status—leaving a final sample size of 217. The American Society of Anesthesiologists (ASA) defines an ASA Class I patient as being normally healthy with no organic, physiologic, biochemical, or psychiatric disturbance or disease.

Information taken from the clinical notes of these 217 records included:

1. age at GA;
2. if the patient was referred to the clinic;
3. completion of 2-week postoperative visit;
4. frequency of recalls up to 36 months;
5. type of insurance at GA;
6. operative treatment rendered during GA and caries experience; and
7. emergency visits following GA.

A 19-question survey was sent to all the parents/guardians of the patients who had GA for their dental treatment during this time period. The survey included questions regarding:

1. education provided during the GA process, including:
   a. oral hygiene;
   b. diet; and
   c. the importance of frequent recalls;
2. parent/guardian satisfaction related to the overall GA experience;
3. quality of dental care;
4. recalls and operative treatment after GA; and
5. demographics (Table 1).

Statistical analysis was performed using SPSS statistical software version 10 (SPSS, Inc, Chicago, Ill). Analysis was only limited to percentages.

Results

The chart review revealed that there were 320 patients who had treatment under GA between 1998 and 2002 and were between 2 and 7 years old. The records were limited to American Society of Anesthesiologists (ASA) Class I patients—who are normally healthy patients with no organic, physiologic, biochemical, or psychiatric disturbance or disease. These exclusion criteria left the authors with 217 (68%) records that were reviewed.

The average age of the patients who met the inclusion criteria was 3.5 years, with a range of 2 to 7 years old. Additionally, 41% of the patients treated under GA were referrals from outside dentists.

Of the 217 subjects, the most common insurance at the time of GA was Title XIX, Medicaid, and accounted for 73% (158) of the listed insurances. The second most common insurance was privately funded (16%; 35). Eighteen subjects had no insurance (8%), and 3% (6) reported other types of government-assisted insurance.

Slightly over half of the patients 118 (54%) returned for their postoperative visit. Fifty-six (26%) of these patients had further operative needs within 3 years of their GA experience, and 29 (13%) returned to the University of Iowa for an emergency visit during this same time period (Table 1).

The recall rates after GA were surprisingly low compared to prior studies. At each 6-month interval, the percentage of subjects attending recalls decreased, except for the 36-month interval. Of the 217 subjects, 28 (13%) returned at their 6-month recall, 27 (12%) at 12 months, 15 (7%) at 18 months, 14 (6%) at 24 months, 10 (5%) at 30 months, and 11 (5%) at 36 months (Table 2).

Of the 56 (26%) patients who needed operative treatment within 3 years of GA, 41 had recurrent caries (73%) and the other 15 patients (27%) had new carious lesions.

Of the patients who needed operative procedures during the 6 months following GA, there were none that needed

Table 1. FREQUENCY OF POSTOPERATIVE FOLLOW-UP, OPERATIVE VISITS AFTER GENERAL ANESTHESIA, AND EMERGENCIES AFTER GENERAL ANESTHESIA*†

2-WEEK FOLLOW-UP		CARIES WITHIN 3 YEARS OF GENERAL ANESTHESIA		EMERGENCY (OTHER THAN TRAUMA) WITHIN 3 YEARS OF GENERAL ANESTHESIA	
Yes	No	Yes	No	Yes	No
118 (54%)	99 (46%)	56 (26%)	161 (74%)	29 (13%)	188 (87%)

* Sample size=17.
† Percentages have been rounded.

Table 2. RECALL FREQUENCY 36 MONTHS AFTER GENERAL ANESTHESIA*

6 MOS	12 MOS	18 MOS	24 MOS	30 MOS	36 MOS
Yes 28 (13%)	Yes 27 (12%)	Yes 15 (7%)	Yes 14 (6%)	Yes 10 (5%)	Yes 11 (5%)
No 16 (7%)	No 12 (5%)	No 17 (8%)	No 9 (4%)	No 8 (4%)	No 7 (3%)
No record 173 (80%)	No record 178 (82%)	No record 185 (85%)	No record 194 (89%)	No record 199 (92%)	No record 199 (92%)

* Sample size=17.

retreatment under GA. Most patients were able to be treated traditionally in the dental office (64%). In this study, however, some of the subjects were treated with nitrous oxide (9%), sedation (16%), and/or restraint (11%).

Survey results

The response from the mailed survey was much lower than expected. Only 7% (16/217) of the surveys were returned. Additionally, 31 of the parents/guardians were able to be contacted by phone after no response from the first mailing. All 31 parents/guardians verbally agreed to fill out and mail the survey. Only 26% (8/31) of the parents/guardians, however, actually did. Due to this poor response rate, the data from the survey was not included in this study.

Discussion

As evidenced in this study's results, the population of patients receiving dental treatment under GA was very difficult to contact. The records used were from 1998-2002, so several years had passed since the GA event; many families may have changed phone numbers or moved for various reasons. As a result, the survey's response was minimal (16/217, 7%), even after an additional 31 (14%) of the parents/guardians were reached by phone and agreed to participate in the mailed survey—to which only 8 (26%) responded. Thus, even with the correct contact information and verbal agreement, about 75% of parents/guardians failed to complete and mail the survey in a preaddressed, prepaid envelope. There was no incentive offered for completing the survey, which may have influenced the response rate. The survey's low response does reflect the poor recall rates for the 36-month period studied after GA. From this evidence, one can make the assumption that this population may be more likely to attend a one-day GA event, and not make routine recalls a priority.

The data collected for the study were from a postgraduate university pediatric dentistry clinic. Therefore, as expected 41% of the patients treated under GA were referrals from other practitioners. This percentage is most likely much higher than what would have been found had the study been conducted at a private practice or in a larger city. Most of the state of Iowa is rural and, for the most part, does not have convenient access to a hospital or same-day surgery center. Many of these patients continued routine care at the university and did not return to their referring dentist. This finding is contrary to Enger and Mourino, who found that patient's referred from private practice returned to their original dentist after GA.[7] In Iowa, however, there are only 38 private practicing pediatric dentists for a child population under the age of 10 that numbers 391,000,[13,14] making it very probably that the majority of referrals came from general practitioners.

Government-assisted insurance was reported by more than 75% of the parents/guardians at the time of GA. Obst et al showed that pregnant women are twice as likely to have GA than pregnant women not on Medicaid.[15] The same trend could be extrapolated to dental treatment by those on Medicaid.

Slightly over half of the patients (54%) returned for their 2-week postoperative visit, which is in agreement with Primosch et al, who found that 60% of their subjects came back

for the 1-week follow-up.[8] The routine 6-month recall rates after GA, however, were surprisingly low compared to prior studies on recall visits. These recall rates can only be compared to the findings of Berkowitz et al and Primosch et al, who found recall rates of 29% and 31%, respectively.[6,8]

This study found a maximum recall rate of 13% at 6 months and a minimum recall rate of 5% at 30 months. Contrary to these results, Enger and Mourino found that 52% of the patients who received GA returned for routine follow-up care.[7] Also, Sheehy et al found that 77% of the patients treated under GA had regular 6-month follow-up appointments.[9] She did find, however, that return for recall appointments was related to the type of payment.[9] Patients who paid with cash or insurance had a higher attended recall rate when compared to Medicaid patients. The low recall rates found in this study could be partially attributed to the greater than 75% of patients who were on Medicaid at the time of their GA. Other variables that could affect both the recall rate and postoperative visits include:

1. distance traveled;
2. transportation;
3. parent/guardian work schedule;
4. planning on continued care at a referring dentist's practice;
5. satisfaction with dental and GA care at the University of Iowa; and/or
6. maternal psychological well-being.

Kavanaugh et al found that 17% of mothers interviewed had depressive symptoms, with increased rates among women who were poor. Moreover, they found that maternal depression was associated with diminished positive parenting behaviors, including dental care.[16]

Over 25% of the subjects experienced caries and needed operative treatment in the 36 months following GA. Seventy-three percent of these subjects had recurrent caries, and 27% had new carious lesions. These results are in agreement with Leagault et al who found that 39% of all children using GA required subsequent dental treatment.[11] Of the patients who needed operative procedures during the 6 months following GA, none needed retreatment under GA. This differs from Leagault et al, who found that 11% of these patients needed retreatment under GA.[11]

Most subjects were treated in the traditional dental environment, which is in agreement with O'Sullivan and Curzon who found that 80% of children needing additional treatment after GA accepted local anesthesia and treatment in the traditional way.[12] Many children may have first presented in the clinic at age 2 or 3 as precooperative, but may have matured enough by age 4 to 5 to tolerate traditional dental treatment.

As suggested by Sheehy et al, the large number of patients experiencing new or recurrent caries after a GA experience may argue for more aggressive treatment plans to prevent future operative visits.[9] In support of this, Worthen and Mueller advocate full coverage restorations and delaying space maintenance until good compliance is established.[5] Dentists must not, however, limit themselves to the traditional model of dental treatment; prevention must continue to be a strong factor in their decision making. Both Quinonez et al and Chase et al found a high correlation between high levels of mutans streptococci and ECC in high-risk populations.[17,18] Use of prescription toothpastes, xylitol chewing gums, chlorhexidine gels, and varnishes along with more frequent recall rates may lower the number of organisms in these children and reduce the caries risk.

Parents should also be educated on the importance of: (1) regular recalls; (2) good daily oral hygiene; and (3) a healthy, noncariogenic diet. Parents who become proactive in the prevention of oral disease for their children can help avoid another GA event. Accordingly, Bullen found that parental involvement seems to be the key element in preventive dentistry for children.[19] Roberts noted, however, that after GA, parents did not see the importance of homecare prevention and failed to keep visits.[3]

This study's data show that some of the subjects who end up going to GA for dental care continue to struggle with this disease. The parents/guardians of these subjects may have not been properly educated or did not use the education from the dentist to their child's benefit. Some of the subjects appear to have continued the same habits that caused them to go to GA in the first place. Supporting this, Chase et al found that children with recurrent caries following GA had parents who felt that it was "fate" and that there was nothing that they could do about it. On the other hand, children who did not relapse or came more regularly to their recall appointments had parents who felt that they were in control of what happened to their children.[20]

Weinstein et al, however, have been using a promising way of interviewing and educating parents; motivational interviewing (MI).[21] In a recent study, this group compared traditional education to MI in a cohort of South Asian immigrants. Their results showed that, after 1 year, children in the experimental group had a mean of 0.71 carious surfaces while those in the control group had 1.91 carious surfaces.[21] All of these results suggest that the education currently provided to parents/guardians may not be effective enough in changing diet or oral hygiene behaviors. By adequately motivating a parent, however, dentists may be able to modify ingrained dental health behaviors such as:

1. nursing bottle at bedtime;
2. allowing a child to brush his/her own teeth; and
3. lack of follow-up dental care.

There are inherent weaknesses in design whenever a

retrospective chart study is performed. Due to the mobility of our society, it is common for people to move frequently. Therefore, contacting the subject's parent/guardian by mail or phone proved to be a difficult task. It was evident, however, that—even with verbal agreement from parents/guardians to participate in the survey—only 25% actually responded. Further research needs to be done on educating and motivating parents of all pediatric dental patients. Dental caries is a truly preventable disease. Most of the pediatric population, however, does not have the manual dexterity to perform proper oral hygiene, so it is up to the parent to assist. Many parents do not see the need for oral hygiene and are too busy to take an active role in meeting their child's dental needs. These attitudes toward oral hygiene and primary teeth need to be addressed more effectively to prevent the most susceptible patients from continuing in the caries process. Future GA events can be prevented by a change in attitude regarding oral hygiene and prevention from parents, patients, medical practitioners, and dentists.

Conclusions

Based on this study's results, the following conclusions can be made:

1. Recall rates of patients seen under GA for dental treat ment are very low.
2. New or recurrent caries experience is high in this same population.

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