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Safe Anesthesia for Radiation Therapy in Pediatric Oncology: the St. Jude Children's Research Hospital Experience, 2004-2006

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Abstract

Purpose—We sought to determine the incidence of anesthesia-related complications in children undergoing radiation therapy and the associated risk factors.

Methods and Materials—We retrospectively investigated the incidence and types of anesthesia-related complications and examined their association with age, weight, oncology diagnosis, type of anesthetic (propofol vs. propofol and adjuncts), total dose of propofol, duration of anesthetic, type of radiotherapy procedure (simulation vs. radiation treatment) and position (prone vs. supine).

Results—Between July 2004 and June 2006, propofol was used in 3833 procedures (3611 radiation sessions and 222 simulations) in 177 patients. Complications occurred during 49 anesthetics (1.3%).

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In univariate analysis, four factors were significantly associated with the risk of complications: procedure duration ($p<0.001$), total dose of propofol ($p<0.001$), use of adjunct agents (vs. propofol alone) ($p=0.029$) and simulation (vs. radiation treatment) ($p=0.014$). Position (prone vs. supine) was not significantly associated with frequency of complications (odds ratio, 0.71, 95% CI, 0.33–1.53; $p=0.38$). In a multivariate analysis, the procedure duration ($p<0.0001$) and total dose of propofol ($p\leq 0.03$) were the most significant risk factors after adjustment for age, weight, type of anesthetic and type of procedure. We found no evidence of development of tolerance to propofol.

Conclusions—The rate of anesthesia-related complications was low (1.3%) in our study. Significant risk factors were procedure duration, total dose of propofol, use of adjunct agents with propofol and simulation (vs. radiation treatment).

Keywords

radiotherapy; pediatric; oncology; anesthesia; propofol

Introduction

Delivery of safe and effective anesthesia for pediatric oncology patients receiving radiation therapy presents several challenges. The procedure is usually brief, and the patient must remain motionless and often prone. Further, the anesthesia provider must continuously monitor the patient's cardiovascular and respiratory status from a remote location. Historically, a variety of anesthetic drugs and techniques have been used to facilitate pediatric radiation therapy, including inhalation anesthesia (1-4); intramuscular and intravenous methohexital (5,6); oral, intramuscular, and intravenous ketamine (3,5,7-9); intravenous thiopental (10); intravenous meperidine; intravenous midazolam; and oral chloral hydrate (11). In recent years, propofol has become the standard of anesthesia care for radiation therapy in children (3,6,11-17). Its merits for use in pediatric external-beam radiation therapy include rapid and predictable induction of anesthesia, easily titratable depth of anesthesia, maintenance of spontaneous ventilation with minimal need for airway manipulation, and rapid recovery (3,6,11-17). These characteristics are important in the context of repetitive daily anesthesia, as required for radiation therapy, and therefore propofol has become the drug of choice at our institution. Our primary objectives were to determine the incidence of anesthesia-related complications at our institution and to identify patient factors or anesthetic techniques associated with the occurrence of anesthetic complications. We are unaware of any previous analysis of the factors associated with the risk of anesthesia-related complications in pediatric patients undergoing radiation therapy. We also characterized the anesthetic techniques used, including the pharmacological regimens, monitoring and positioning for optimal delivery of radiation treatment. Additional research questions addressed the incidence of central venous line infection associated with frequent use of the lines for anesthesia and the development of tolerance to propofol with repeated daily anesthetics.

Methods and materials

The St. Jude Institutional Review Board approved our retrospective review of the records of all patients given anesthetics for radiation therapy between July 2004 and June 2006 at St. Jude, which is a tertiary-care pediatric research facility whose main focus is patient care and research on pediatric cancer. Patients range in age from infancy to young adulthood.

We collected demographic data including age, oncology diagnosis, weight and type of radiotherapy procedure (simulation vs. radiation treatment). Information collected from the anesthesia record included duration of anesthesia (time between first administration of drugs

and completion of the radiotherapy procedure), anesthetic drugs used (selection of drugs, use of adjuvant drugs, total dose [mg/kg]), position and any complications observed.

Anesthesia-related complications were grouped into five categories: oxygen desaturation, apnea, airway obstruction, minor airway complications and hemodynamic complications. Oxygen desaturation was defined as saturation below 90% for any length of time; apnea was defined as absence of respiratory effort for more than 15 seconds; airway obstruction was defined as obstruction that required interventions such as chin lift, jaw thrust, chest roll, or oral airway; minor airway complications were defined as cough, oxygen desaturation between 90% and 99%, partial transient upper airway obstruction that did not require intervention, wheezing, and irregular breathing; hemodynamic complications were defined as any recorded variations in blood pressure or heart rate.

We statistically examined the association of anesthetic complications with the following factors: age, weight, oncology diagnosis, type of anesthetic (propofol vs. propofol and adjuncts), total dose of propofol (mg/kg), duration of anesthetic (minutes), type of radiotherapy procedure (simulation vs. radiation treatment) and position.

Data regarding central line infections in the study patients during the same period were obtained from the hospital quality assurance and infection control databases and verified in the patients' electronic medical records.

Anesthetic Technique, Monitoring, Equipment and Personnel

Anesthetic technique—The technique of choice in our practice is propofol-based total intravenous anesthesia (TIVA). For patients with a history of agitation on emergence from propofol or a source of pain (e.g. recent postoperative status), the propofol-based regimen may be supplemented with benzodiazepines, opioids and/or ketamine. For patients with allergy to propofol or a history of intolerance, a sedation regimen comprising combinations of opioid, benzodiazepine and/or ketamine is used. Propofol anesthesia is induced by administering successive boluses of 1 mg/kg until loss of consciousness occurs. Additional boluses are administered if the child responds to stimulation during positioning for radiation. A propofol infusion is then delivered at rates of 100-250 mcg/kg/min via a Baxter AS50 auto-syringe infusion pump (Deerfield, Illinois). When benzodiazepine and/or opioid are administered as adjuncts, these are given before propofol administration is started.

Airway management—Supplemental oxygen is provided by face mask. The airway position is manipulated by chin lift and placement of a chest roll, as dictated by the clinical situation, and is secured by using the radiation face mask or paper tape under the chin. When the prone position is required, the airway is managed identically, but oxygen tubing alone is used instead of the face mask. In rare cases, when upper airway obstruction cannot be controlled by these measures, placement of an oral airway or laryngeal mask airway is required.

Equipment and monitoring—The standard method of monitoring patients during anesthesia at remote-locations in our institution is by continuous pulse oximetry, heart rate, capnography (via binasal cannulae), blood pressure measurement (every 3 minutes), and if indicated, one-lead ECG. Values are displayed on a Propaq (Welch Allyn, Skaneateles Falls, New York) portable monitor during delivery of the anesthetic, transport to the recovery room and recovery. The patient is visually monitored while in the radiation treatment room via two cameras, one focused on the patient so that chest movement (respiration) can be viewed and the other focused on the portable monitor. The cameras can be repositioned by remote control to allow continuous monitoring as the radiation treatment progresses.

All radiation rooms have suction and two sources of piped oxygen. Self-inflating bags and face masks are available in three sizes in each radiation room. Anesthesia carts in each radiation room contain anesthesia medications and all necessary airway equipment, including intubation equipment. A “crash cart” for emergency resuscitation, including a defibrillator, is also available in the radiation area. During transport to the recovery room, all stretchers are equipped with a portable oxygen tank, self-inflating bag and mask and suction. An anesthesia machine is available in the radiation area, should inhalation induction be indicated.

Personnel—Anesthetics are administered by either a pediatric anesthesiologist–CRNA team or a pediatric anesthesiologist, with the assistance of a sedation nurse. The CRNA or anesthesiologist are continually present during the anesthetic and transport to the recovery room.

Statistical Analysis

Only propofol-based anesthesia courses were used in the risk analysis. Pair-wise relationships among categorical risk factors (oncology diagnosis, type of anesthetic and type of radiotherapy procedure) were analyzed by using the chi-square test. General linear mixed-effect models with a random effect term were used to account for intra-patient correlation between a single categorical risk factor (type of anesthetic, type of radiotherapy procedure) and a single continuous risk factor (age, weight, total dose of propofol, duration of anesthetic) or between two continuous risk factors. Correlation coefficients were computed to test the intra-patient association of two continuous factors (age, weight, total dose of propofol, duration of anesthetic).

The relationship between oncology diagnosis and complications was analyzed by using the chi-square test. The relationships of complications to other risk factors (age, weight, total dose of propofol, duration of anesthesia, type of anesthetic, type of radiotherapy procedure and position) were analyzed by using logistic regression models in which complications were binary dependent variables (yes or no). These models were implemented by using a generalized estimation equation with a random effect to account for intra-patient correlation. We specifically analyzed the group of anesthetics performed in the prone position to determine the rate of complications and types of airway interventions (oral airway, laryngeal mask airway) used.

We further analyzed the risk of anesthesia-related complications for three durations of anesthesia: <30 minutes, 31–60 minutes, and >60 minutes by estimating the odds ratios (i.e., the relative risk) for anesthetic-related complications among the three groups. A p-value <0.05 was considered statistically significant.

To investigate whether patients had developed tolerance to propofol while receiving multiple courses of radiation therapy courses 1–34 were analyzed. A linear mixed model was applied to test the association between the total dose of propofol and course, in which the square root of the total dose (mg/kg) was the dependent variable and the course (radiologic procedure 1, 2, ..., 34) and quadratic term were the independent variables, with a covariance structure of order-1 auto-regression and random effect of intercept and slope. The SAS v.9.1.3 statistical package (Cary, NC) was used for computations. Cases in which patients received more than 34 courses and sessions in which patients received adjunct anesthetics were excluded from this analysis.

Results

Patient Characteristics

One hundred and seventy-seven patients underwent a total of 3850 radiotherapy procedures under anesthesia or sedation. The mean number of procedures per patient was 21.7 (median, 27; range, 1-74), and mean weight at the beginning of radiation treatment was 17.4 kg (median, 15.5; range, 7.0-79). The age, sex, race, diagnosis and weight distributions are presented in Table 1.

Anesthesia Regimens

Anesthesia or sedation was given for 3850 radiotherapy procedures; of these, 3833 (3611 radiation sessions and 222 simulations) in 177 patients were propofol-based and were included in the analysis. The anesthetic techniques and the related complications are summarized in Table 2. In one patient, 17 radiation therapy sessions were performed under sedation (15 sessions with fentanyl and midazolam and 2 with sodium pentothal) and were excluded from the statistical analysis for risk factors.

Anesthesia-Related Complications

Complications were documented in 49 of the 3833 procedures for which propofol-based anesthesia was used (1.3%). Three patients experienced complications of anesthesia during six, four, and three procedures, respectively; nine patients experienced two episodes each, and 18 patients had a single episode. A total of 30 patients had one or more complications. Complications were of five types (Table 3). Minor airway complications were most common. There were no episodes of laryngospasm and no use of advanced airway intervention, such as endotracheal intubation.

Pair-wise relationships among the risk factors

The risk factors analyzed included the type of anesthetic (propofol vs. propofol and adjuncts), type of radiotherapy procedure (simulation vs. radiation treatment), duration of anesthesia (minutes), total dose of propofol (mg/kg), age and weight. Not surprisingly, simulation, duration of procedure and total dose of propofol were all significantly related ($P < 0.0001$). Simulations required higher total doses of propofol and longer anesthesia times than did radiation treatments. Procedures using adjuncts (benzodiazepines, opioids or ketamine) to supplement propofol tended to be longer ($P = 0.01$). The total dose of propofol (mg/kg) decreased as age ($P = 0.006$) and body weight ($P = 0.001$) increased.

Risk factors for complications

Results of univariate analyses are presented in Table 4. We found four factors that were significantly associated with the risk of complications: duration of procedure ($p < 0.001$), total dose of propofol (mg/kg) ($p < 0.001$), anesthesia with propofol plus adjunct agents (as compared to propofol alone) ($p = 0.029$) and simulation (as compared to radiation treatment) ($p = 0.014$). Higher total propofol dose (mg/kg) and longer procedure times (minutes) were associated with higher complication rates. The probability of complications associated with propofol and adjuncts was 2.21 times the probability of complications associated with propofol alone, and the probability of complications during simulation was 2.78 times that during radiation treatment.

Age and weight were not statistically significant risk factors, nor was patient position. The diagnosis of retinoblastoma was significantly more likely to be associated with complications than any other diagnosis ($p = 0.04$).

In a multivariate analysis, the duration of the procedure ($p < 0.0001$) and the total dose of propofol ($p \leq 0.03$) were the most highly significant risk factors, after adjustment for age, weight, type of anesthetic and type of radiotherapy procedure. Age, type of anesthetic (propofol vs. propofol and adjuncts) and type of radiotherapy procedure (simulation vs. radiation treatment) were not independently predictive of risk in multivariate analysis.

Relationship between duration of anesthetic sessions and complications

The number of anesthesia-related complications for three groups of anesthetics based on duration of anesthesia (<30 minutes, 31-60 minutes, and >60 minutes), the respective doses of propofol and the risk of complications are shown in Table 5. We found significant differences between anesthetics >60 minutes and those 31-60 minutes ($p = 0.0001$) and between anesthetics >60 minutes vs. <30 minutes ($p < 0.0001$). The risk of complications during procedures >60 minutes was 3.28 times that in procedures of 30-60 minutes; the odds ratio of 9.85 shows that the risk of complications was 8.85 times greater for procedures >60 minutes than for those <30 minutes (Table 6).

Relationship between patient position and complications

With respect to anesthetics performed in the prone position and the rate of complications and types of airway interventions (oral airway, laryngeal mask airway), we found no association between patient position and the frequency of complications ($p = 0.38$) (Table 7). Complications occurred in 24 (1.07%) of 2249 prone procedures (18 patients) and in 25 (1.58%) of 1584 supine procedures (12 patients). The odds ratio for complications during prone vs. supine position was 0.71 (95% CI, 0.33– 1.53).

In our study group, airway aids (laryngeal mask airways or oral airways) were necessary in a total of 18 anesthetic sessions (11 patients), and in some cases the use of an oral airway was followed by a laryngeal mask airway. More laryngeal mask airways were used for supine patients (6 anesthetics in 3 patients vs. 5 anesthetics in 4 patients) and more oral airways for prone patients (5 anesthetics in 5 patients vs. 2 anesthetics in 2 patients). Endotracheal intubation was not required for any patient in our series.

Tolerance to propofol

We found no evidence of the development of tolerance to propofol; in fact, patients' total doses decreased significantly as time progressed (Figure 1). The estimated model coefficient of the linear course effect was -0.068 ($P < 0.0001$). After reaching its lowest value at approximately the 5th course, the mean total dose increased over time until approximately the 8th course (a quadratic course effect with estimated model coefficient 0.002) ($P < 0.0001$), but did not return to the level of the first course. When the first 10 courses were eliminated from the analysis to control for the initial titration effect, there was still no increase over time in the total dose of propofol.

Frequency of central venous line infection

All patients had central venous catheters that had been placed surgically before the initiation of radiation therapy. One patient (1/177, 0.6%) developed central line-related sepsis, as documented by fever and positive blood cultures drawn from the central line during the course of radiation therapy. The patient was concurrently receiving chemotherapy and continuous opioid infusion (via a patient-controlled analgesia pump) through the central venous line.

Discussion

Our overall complication rate of 1.3% is comparable to or lower than those reported in similar studies (3,11,17,18). A recent study of pediatric sedation from a multi-institution database (18) found an overall complication rate of 5.3% among 30,037 sessions of sedation at 26 institutions, in which a large variety of sedation techniques and providers were used. In a series of pediatric oncology patients undergoing radiation therapy, Fortney et al. reported substantially higher rates of airway obstruction (5.4%), laryngospasm (3.9%), sinus arrhythmia (3.2%) and sepsis (15%). However, this comparison may be limited by differences in the anesthesia and sedation regimens and the methods used to calculate complication rates. Our cumulative rate of respiratory complications was 1.2%; we observed no cases of laryngospasm or sinus arrhythmia, which are complications more likely to be observed with inhalation anesthesia (3).

In a more comparable prospective study of anesthesia for pediatric radiation therapy, the incidence of complications in a group receiving propofol-based anesthesia was 7% (56/837) (11) and included respiratory complications (n=37) (oxygen saturation <90% for more than 15 seconds, respiratory rate <12/minute and apnea), cardiovascular complications (n=13) (pulse >160 per minute, blood pressure <30% baseline), and vomiting (n=6). Our analysis considered only respiratory and cardiovascular complications, as vomiting can have a multifactorial etiology.

Airway and respiratory complications comprised the majority of the problems in our series, therefore it is worth elaborating on the steps that were taken to ensure a safe airway, without endotracheal intubation. Chin lift and jaw thrust may need to be stabilized with application of paper tape under the chin and/or a shoulder roll. The airway position may be challenged by positioning the head and neck in an immobilization device or thermoplastic mask (as indicated by the radiation regimen), which makes monitoring of the airway patency even more critical. Traditional methods of assessing airway patency are supplemented by end tidal carbon dioxide monitoring via binasal cannulae. The cannulae can even be inserted through the thermoplastic mask, and this monitoring may indicate subtle problems not detected by clinical observation. If the airway cannot be optimized by the above management then the addition of an oral airway or laryngeal mask airway may be required. Other factors that may contribute to a low incidence of oxygen desaturation are preoxygenation by face mask before induction and a regimen of successive 1 mg/kg IV boluses of propofol until loss of consciousness, followed by continuous infusion. We have found that this standardized method of administering propofol by practitioners who use it frequently is safe and effective.

We are unaware of any previous analysis of the factors associated with the risk of anesthesia-related complications in pediatric patients undergoing radiation therapy. Not surprisingly, both increased duration of anesthesia and higher total doses of propofol adjusted by weight were associated with a higher risk of complications.

Both simulation sessions and the use of adjuncts to propofol were significantly associated with complications in univariate analysis, but not in multivariate analysis. This result may reflect the confounding effect of the duration of anesthesia and the total dose of propofol. From a clinical standpoint, a higher risk of complications during simulation sessions could result from the necessarily longer time required to manipulate the head to optimize patient positioning for radiation and for airway patency, and the need for additional transportation and repositioning during the simulation sessions. Both of these factors may contribute to airway and respiratory compromise. It is also significant that the simulation session is usually the patient's first anesthetic session, and the individual's airway issues and response to the propofol regimen are better appreciated by the anesthesia team after a few sessions. It is important to take the time

during the simulation session to optimize the quality of airway maintenance, especially when a thermoplastic mask will be used, since the identical position will be reproduced for all subsequent treatment sessions.

The association of anesthesia-related complications with the use of anesthetic adjuncts to propofol, such as opioids, benzodiazepines, and ketamine, may result from the synergistic central nervous system and respiratory depressant effects of such agents. Indeed, most of the complications in our series were respiratory in nature. However, we did not investigate the incidence of emergence agitation; the use of such multiagent total intravenous anesthesia is often driven by a history of emergence delirium with propofol. In our personal experience, the emergence profile has usually improved when low-dose ketamine, opioids, or benzodiazepines are added to propofol.

Regarding the duration of anesthesia, our results demonstrated that a briefer anesthetic session carries less risk. Although, a limit to the duration of anesthesia is unlikely to be feasible in this setting, a heightened awareness of the increased risk during longer procedures may be helpful in anticipating possible complications. It is also worth noting from a clinical perspective that the frequency of complications did not exceed 5% even in anesthetic sessions longer than 60 minutes, and intubation was not required in any of these cases. Observation of multiple episodes of anesthesia-related complications in certain patients (6, 4 and 3 episodes, respectively, in 3 patients and 2 episodes in each of 9 patients) strongly suggests that individual patient factors (such as characteristics of the airway) contribute to the outcome, possibly more than the anesthetic technique itself.

In this study, we did not find that frequent use of the central venous access line increased the risk of sepsis. We encountered only one case (0.6%) of central line-related sepsis, in a patient who was receiving chemotherapy and patient-controlled opioid analgesia concurrently with radiation therapy. Another study reported that 23% of children with central venous lines developed sepsis during the course of radiation therapy (11). Fortney et al reported a 15% incidence of sepsis in a series in which more than half of patients (55%) were receiving propofol-based anesthesia (3). The authors suggested that propofol may support rapid microbial growth at room temperature, before the addition of the antimicrobial disodium EDTA. Our study demonstrated an acceptably low rate of central line-related sepsis during repeated propofol administration, even in immunodepressed patients. However, we were unable to determine whether the low rate reflected the addition of EDTA to propofol or optimal central line care.

We also investigated the phenomenon of tolerance to propofol. We excluded the small number of cases in which patients had undergone more than 34 radiotherapy sessions, which was not representative for our study group. We also excluded sessions in which adjuncts to propofol were used, reasoning that this practice would tend to decrease the dosage of propofol given. Although one case report described tolerance to propofol after repeated anesthesia sessions (12), our study and other prospective evaluations have failed to identify tolerance to propofol, either clinically or through bispectral index monitoring of the level of consciousness during anaesthesia (13,14). We found a negative correlation between the total dose of propofol per session and the number of prior propofol-based anesthesia sessions. Interestingly, we noticed a substantial decrease in the total dose of propofol per session during the first 6 to 10 sessions, which may reflect a gradual “dose-finding” clinical approach in which the dose necessary to ensure a patient’s unconsciousness and lack of movement is identified and used subsequently. When we eliminated the first 10 courses from the analysis to control for this titration effect, there was still no increase over time in the total dose of propofol. However, our interpretation of these data is limited by the fact that the use of adjunct agents was not randomized, and the exclusion of anesthesia sessions in which adjuncts were used may have introduced bias.

In conclusion, our institution has experienced a low incidence of anesthesia-related complications in pediatric oncology patients undergoing radiation therapy. Significant risk factors contributing to the anesthetic risk were: duration of the procedure, total dose of propofol, use of adjunct agents (vs. propofol alone) and simulation (vs. radiation treatment). Factors responsible for the low incidence of anesthesia-related complications may include consistent drug regimens, rigorous monitoring, and delivery of anesthesia by personnel with extensive experience in anesthesia for pediatric radiation therapy.

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Figure 1.
Individual profiles with average trend line for total dose (mg/kg)

Table 1

Patient characteristics (n=177)

Characteristic	n (%)
<i>Age^a</i> (y)	
≤2	38 (21.47)
>2 - ≤4	60 (33.90)
>4	79 (44.63)
Median (range)	3.57 (0.43-21.65)
<i>Sex</i>	
M	106 (59.89)
F	71 (40.11)
<i>Race</i>	
Caucasian	123 (69.49)
Black	31 (17.51)
Other	23 (12.99)
<i>Diagnosis</i>	
Brain tumor	102 (57.63)
Neuroblastoma	21 (11.86)
Retinoblastoma	7 (3.95)
Wilms tumor	14 (7.91)
Rhabdomyosarcoma	13 (7.34)
Other	20 (11.30)
<i>Treatments per patient</i>	
Median (range)	27 (1-74)
<i>Weight^a</i> (Kg)	
Median (range)	15.5 (7.0 -79)

^a At time of first anesthesia/sedation

Table 2

Anesthesia or sedation technique and complications (n=3850)

Type of anesthesia/sedation	Number of anesthetics/sedations (%)	Number of complications (%)
Propofol TIVA	2132 (53.4)	20 (0.94)
Propofol + adjuncts (opioids, benzodiazepines, ketamine)	1701 (44.2)	29 (1.7)
IV sedation (opioids, benzodiazepines, barbiturates)	17 (0.4)	0 (0)
Total	3850	49 (1.28)

Abbreviations: TIVA, total intravenous anesthesia; IV, intravenous

Table 3

Anesthetic-related complications (n=3833)

Type of Complication	Type of anesthetic Complication	Propofol alone	Propofol plus adjuncts	Total	Proportion
Minor airway	Cough, desaturation (90-99%), wheezing, partial obstruction	9	10	19	0.48
Desaturation	Oxygen saturation <90%	4	6	10	0.26
Airway obstruction	Requiring intervention (oral airway, jaw thrust, chin lift, chest rolls)	3	8	11	0.29
Apnea	Apnea >15 seconds	3	3	6	0.16
Hemodynamic changes	Blood pressure or heart rate variations	1	2	3	0.08
Total		20	29	49	1.28

Table 4

Risk factors for anesthesia-related complications (n=49)

Factor	Odds ratio (95% CI)	p
Duration of anesthesia (1-minute increment)	1.02 (1.01 - 1.03)	<0.001
Total dose of propofol (1-mg/kg increment)	1.08 (1.06 - 1.10)	<0.001
Type of radiation (simulation vs radiation treatment)	2.78 (1.23 - 6.28)	0.014
Anesthetic regimen (propofol and adjuncts vs propofol alone)	2.21 (1.08 - 4.5)	0.029
Weight (1-kg increment)	1.02 (0.99 - 1.05)	0.20
Age (1-year increment)	0.98 (0.83 - 1.14)	0.77
Position (prone vs. supine)	0.71 (0.33 - 1.53)	0.38

Table 5
Relationship between duration of anesthetic sessions, total dose of propofol and complications

Duration of anesthetic	Number of anesthetics	Number of complications	Risk of complication (%)	Total dose (mg/kg) mean	Total dose (mg/kg) median (range)
6-30 min	1929	10	0.50	7.51	7.17 (1.61, 44.56)
31-60 min	1438	17	1.13	10.78	10.45 (2.00, 56.75)
>60 min	466	22	4.67	22.2	20.75 (2.20, 74.48)

Table 6

Probability of complications based on duration of anesthetic sessions

Comparison groups	Odds ratio (95% CI)	p
31-60 min vs.<30 min	2.30 (0.78 - 6.73)	0.1292
>60 min vs. 31-60 min	4.28 (2.03 - 9.03)	0.0001
>60 min vs. <30 min	9.85 (4.13 - 23.48)	<0.0001

Table 7

Relationship between patient position and complications

	No	Complications Number of anesthetic sessions Yes	Total (n)
Supine	1559 (98.42%)	25 (1.58%)	1584 (92)
Prone	2225 (98.53%)	24 (1.07%)	2249 (85)
Total	3784	49	3833 (177)