Anesthesia for Embolization from 2003-2004 in Siriraj Hospital: A Retrospective Study

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ABSTRACT

Objective: To report and evaluate the choices and techniques of anesthesia, drug usage and complications at Siriraj Hospital.
Methods: Retrospectively analyzed the patients on whom embolization had been performed during the period of January, 2003 to October, 2004 in Siriraj Hospital. The patients' characteristics, preanesthetic problems, anesthetic techniques, anesthetic agents, embolization agents and complications were assessed.
Results: There were 292 cases and 476 procedures. The age group of 20-29 years was the highest one (27.9%). Most patients had American Society of Anesthesiologist (ASA) class I (60.3%). The diagnoses were brain arteriovenous malformation (30.3%), carotid cavernous sinus fistula (23.5%), other arteriovenous malformations (11.8%), hemangioma (7.8%), venous malformation (3.6%), arteriovenous fistula (2.3%), angiofibroma (2.3%), hemoptysis (2.1%), brain aneurysm (1.7%), gastrointestinal bleeding (1.3%) and others (13.3%). Hematologic disease, hypertension and neurological disease were the most common preanesthetic problems. General anesthesia with endotracheal tube was the anesthetic technique mainly employed (71.0%). Anesthetic agents were mainly administered with propofol, fentanyl and succinylcholine. The mean anesthetic time was 132.5 ± 63.0 minutes. The embolization agents were glue (42.0%), balloon (20.6%), alcohol (13.2%), ivolon (7.1%), coil (6.9%) and gel foam (0.4%). The most frequent anesthetic complication was hypotension.
Conclusion: During anesthetic management for embolization, special techniques or drugs in anesthesia are not routinely required, although the anesthetic personnel had to optimize the patient's condition for safety and there should be an awareness of complications.

Keywords: Anesthetic management; anesthetic technique; complication; embolization

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Despite an increase in the number of patients with cerebrovascular diseases, surgical treatment is limited along with risky outcomes such as bleeding, infection, neurological deficit or improper postoperative pain control[1-3]. Endovascular embolization is another treatment of choice which has some advantages over surgery[1-4]. Although both kinds of treatment have been developed to reduce complications, the risks from anesthetic management still persist.

Siriraj Hospital has performed embolization since 1998 and most of them have been performed by neuroradiologists under anesthesia. The choices and techniques of anesthesia and drug selection vary according to the condition of the patients, familiarity of the anesthesiologists and satisfaction of the neuroradiologists.

To report on and evaluate the choices and techniques of anesthesia, drug usage and complications which occurred during that period of time, a descriptive retrospective study was performed in order to adapt and keep the data for further research in the near future.

MATERIALS AND METHODS

Data from anesthetic procedure records and history charts of patients who underwent embolization in Siriraj Hospital from January 1st, 2003 to October 31st, 2004, were reviewed. The general data included sex, age, ASA physical status, body weight, diagnosis and embolization technique. The anesthetic data encompassed preanesthetic problems, premedications, choice of anesthesia, variety of drug usage, monitoring, time spent and complications which evolved intraoperatively.

Results were reported as mean ± standard deviation (SD) or percentage (%) where appropriate.

RESULTS

There were 476 embolization procedures in 292 cases performed during the study period. The majority of the

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TABLE 1. Anesthesia related data

Data	Number	%
Anesthetic technique		
General anesthesia with endotracheal tube	338	71.0
Total intravenous anesthesia	74	15.6
Monitor anesthesia care	44	9.2
General anesthesia with tracheostomy tube	20	4.2
Sedative agents		
Propofol	274	57.6
Thiopental	113	23.8
Midazolam	105	22.2
Ketamine	16	3.4
Narcotics		
Fentanyl	332	69.8
Pethidine	107	22.5
Muscle relaxants		
Succinylcholine	288	60.5
Pancuronium	184	38.6
Atracurium	116	24.4
Vecuronium	37	7.8
Rocuronium	5	1.1
Local anesthetic		
Bupivacaine	22	4.6
Inhalation agents		
Halothane	164	34.4
Isoflurane	148	31.1
Sevoflurane	46	9.7

patients were male (59.5%), their mean age was 35.2 ± 17.9 years, and ASA physical status I, II (60.3%, 27.5%). The patients that were in the 20-29 year old group were 27.9%.

The diagnoses were brain ateriovenous malformation (30.3%), carotid cavernous sinus fistula (23.5%), other ateriovenous malformations (11.8%), hemangioma (7.8%), venous malformation (3.6%), ateriovenous fistula (2.3%), angiofibroma (2.3%), hemoptysis (2.1%), brain aneurysm (1.7%), gastrointestinal bleeding (1.3%) and others (13.3%).

There were 154 preanesthetic problems in 476 procedures. They involved mainly hematologic disease, hypertension and neurological disease. Other problems were diabetes mellitus, respiratory disease; chronic obstructive pulmonary disease, heart disease; coronary artery disease, liver disease; cirrhosis, renal disease; renal failure and others; including electrolyte imbalance.

Almost all of the procedures were carried out under general anesthesia with either endotracheal tube (71.0%) or tracheostomy tube (4.2%), total intravenous anesthesia (15.5%) and others (9.3%). The details of sedative agents, narcotics, muscle relaxants, local anesthetic and inhalation agents are shown in Table 1.

Clinical monitoring observed by the anesthetic personnel consisted of non-invasive blood pressure, pulse oximetry, electrocardiography, fluid intake and output, tidal volume and airway pressure. End tidal carbon dioxide was recorded 34.2% percent. The anesthetic duration ranged from 20 to 420 minutes. The anesthetic time was 132.5 ± 63.0 minutes.

The embolization agents were glue (42.0%), balloon (20.6%), alcohol (13.2%), ivolon (7.1%), coil (6.9%) and gel foam (0.4%), respectively. The most frequent anesthetic complication was hypotension (25.8%) which was promptly treated by vasopressor and loading of intravascular fluid. The authors noticed that it occurred after rapid protamine injection. Two cases (0.4%) developed bronchospasm but they recovered completely after taking an inhaled bronchodilator. Other complications were bradycardia (1.0%) and hypertension (0.2%).

DISCUSSION

Embolization is an effective treatment with fewer complications than surgery especially for arteriovenous malformation.[2-3,5-7] In Siriraj Hospital, the authors have been employing this technique since 1998. This study was time limited so in certain cases treatment was not completed and further therapy is expected to continue.

The two basic choices of anesthesia which both have advantages and disadvantages are general anesthesia and total intravenous anesthesia.[7-10] With the general anesthesia technique, the control of respiration and cardiovascular systems are more reliable. The authors are able to control patient movement especially when an apnea technique is used for angiogram or MRI examination. While the total intravenous anesthesia and monitored anesthetic care, the authors can detect neurological signs and symptoms directly. However, the control of respiration and cardiovascular systems are limited as well as patient discomfort. In our institute, the authors normally use general anesthesia because of the given reasons in conjunction with the preference of our anesthesiologists.

There are no special anesthetic techniques needed for this kind of anesthesia. The indications for providing general anesthesia were mainly related to the embolization procedures, and underlying diseases, which are frequently treated with complex and difficult procedures, pediatric patients, and refusal of intravenous sedation.[8-10] Cardiopulmonary and other diseases that are more frequent in older patients have been regarded as the major risk factors for complications associated with embolization procedure or sedation. For patients who undergo a short procedure and do not necessarily need controlled ventilation, the authors prefer the intravenous sedation. However, it depends on the experience of the anesthesiologists themselves. In our hospital, the experience of the neuroradiologists is not taken into account in the indication to perform embolization under general anesthesia. However, it is tempting to speculate that those patients in particular may benefit from the general anesthesia technique who undergo embolization with less experienced neuroradiologists.

Sedative agents usually used are either propofol or thiopental because of rapid induction and good recovery. Succinyl choline was the muscle relaxant of choice for intubation and pancuronium and atracurium were the muscle relaxants for maintenance. The narcotics such as fentanyl and pethidine were used more often than the others. The inhalation agents were halothane, isoflurane and sevoflurane.

The anesthetic agent propofol is a phenol derivative approved for induction and maintenance of monitored anesthesia and sedation. Propofol may be ideal for sedation during embolization because of its rapid onset of sedative action, easy titratability, and short duration of effect (7 to 8 minutes).

Anesthetic time and procedure time ranged between 2-3 hours but anesthetic time was expected to be lower because of the time spent in patient positioning and compressing the artery after decanulation of the femoral artery. Hypotension was found in dehydrated patients and after a rapid injection of protamine. The possible causes were directly from vasodilatation and the process after the effect of histamine release.[11]

There was a tendency toward less frequent embolization related complications under the improved conditions

provided by general anesthesia compared to intravenous sedation, since general anesthesia technique offers less patient movement than the prior techniques. However, as the authors evaluate the complications retrospectively from the embolization protocols, the authors believe that the frequency of embolization related complications, especially under intravenous sedation, was probably underestimated and this can only be accurately determined in a prospective evaluation. General anesthesia is, therefore, often used at our institution to protect the airways during time-consuming embolizations. Embolization failure not only causes medical and other serious problems, it can also be assumed that there are additional costs when embolization fails. This could be related to longer hospitalization periods when the procedure has to be repeated, or when surgical interventions become necessary.

Limitations of this study exist. The major limitation was that the authors were unable to compare this study with comparable groups between general anesthesia and intravenous sedation. This was because of both the retrospective nature of the study and the lack of documentation of anesthesia regimens. However, it was also found that inaccurate and incomplete documentation of certain measures, together with many chart reviews, also occurred in this study. Various anesthesiologists define complications differently. Inaccuracy lies in the subjective nature of this definition. For example, instances of brief periods of desaturation to levels more than 90% may not have been documented simply because they were not viewed as a true complication.

CONCLUSION

Embolization is an alternative treatment for abnormal vessels such as arteriovenous malformations, aneurysm and arteriovenous fistula, etc. However, this procedure still needs radiologists, and also anesthetic personnel to observe and take care. Clinical signs should be carefully observed. There were no needs for special techniques or drugs during anesthesia, but anesthetic personnel had to optimize the patients' condition for their safety and there should be an awareness of complications.

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