The THAI Anesthesia Incident Monitoring Study (Thai AIMS): Perioperative Arrhythmia

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Background: *The Royal College of Anesthesiologists of Thailand organized the first national sentinel incident reports of anesthesia related adverse events in 2007 on an anonymous and voluntary basis. The aims of the present study were to analyze incidence, risk factors, clinical course and outcome of perioperative arrhythmia and indicate the contributing factors and suggested corrective strategies in the database of the Thai Anesthesia Incidents Monitoring Study (Thai AIMS).*

Material and Method: *This study was a prospective descriptive multicentered study conducted between January 2007 and June 2007. Data was collected from 51 hospitals across Thailand. All cases whose arrhythmia was detected intra-operatively and within 24 hr postoperative period were analyzed by 3 independents anesthesiologists. Any disagreements were discussed to achieve a consensus.*

Results: *Four hundred and eighty-nine cases were enrolled as relevant arrhythmia cases. Bradycardia was the most common type (434 cases; 88.8%). Most of all events occurred intra-operatively (94.7%) and electrocardiography was the most common firstly detected monitoring equipment (95.5%). Arrhythmia occurred frequently in patients with hypertension and pre-operative heart rate < 60 beat per min. Intravenous anesthetics, central neural blockage and vagal reflex were considered to be the 3 most common suspected causes of arrhythmia requiring treatment. Most common outcomes were minor physiologic change with complete recovery physiologic change with complete recovery while 7% of incidents developed fatal outcome. The most common contributing factor was human factor (72.4%) especially in experience. An experienced anesthetic team with high awareness could be the minimizing factors.*

Conclusion: *Arrhythmia accounted for 19.2% of 2,537 incidents of the Thai AIMS database. Bradycardia was the most common type of cardiac arrhythmia. Most arrhythmia was benign but might be fatal. Suggested corrective strategies such as guidelines practice, improvement of supervision and quality assurance activity.*

Keywords: *Anesthesia, Adverse events, Arrhythmia, bradycardia, Multicentered study, Complication*

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Perioperative arrhythmia is one of the most common perioperative complications and required immediate treatment in most cases[1]. The incidence of perioperative arrhythmia were varied from less than 1% to 15%, depending on definitions, group and condition of the patients and data recording source[2-4]. These adverse events are frequently associated with a simultaneous change in other monitored vital signs including hypotension and cardiac arrest[5]. Intra-operative recording of the adverse events is a useful tool for quality assurance and improvement of high safety standard in anesthesia[3,6]. The authors conducted the incident study of perioperative arrhythmia in extensive levels from primary to tertiary

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across Thailand. The purposes of the present study were to identify the incident, frequency distribution, clinical courses, and outcome of overall and subgroup of perioperative arrhythmia. The authors also determined some contributing factors for possible future corrective strategies.

Material and Method

The present study is a part of Thai Anesthesia Incident Monitoring Study (Thai AIMS), which is a prospective descriptive multicentered study in fifty one hospitals in Thailand from January 2007 to the end of June 2007. After being approved by each institutional ethic committee, the specific adverse events during perioperative until 24 hours postoperative period were filled in a standardized incident report form. These critical incidents were reported on an anonymous and voluntary basis. The completed forms were sent to the data management center to be analyzed, and then sent to each group of reviewers to analyze each specific incident. All the details of the study methodology were described previously by Punjasawadwong et al[7].

Five hundred and six completed records of possible perioperative arrhythmia requiring treatment were extracted from 1996 incident reports during the six-month period (January to June 2007)[8]. Perioperative arrhythmia included bradycardia, paroxysmal supra-ventricular tachycardia (PSVT), premature ventricular contraction (PVC) and ventricular tachycardia/ fibrillation (VT/VF). The definition of bradycardia in the present study differed depending on age group (heart rate less than 100 beats/min in age group 0-1 year, less than 80 beats/min in age 1-8 years and less than 60 beats/min in age more than 8 years) PSVT in the present study included supra-ventricular tachycardia, atrial fibrillation and other abnormalities of electricity originated in the atrium. These records were reviewed independently by three peer reviewers. Details regarding patients factors, surgical factors, anesthetic factors, systemic factors, factors contributing to the incident, factors minimizing the incident, and suggested correcting strategies were analyzed. The descriptive statistics were applied to analyze data by using SPSS for windows, version 12.

Results

After reviewing by three peer reviewers, there were a total of 489 cases from 506 suspected cases that met the criteria of arrhythmia requiring treatment. Demographic, surgical and anesthetic data of these patients is shown in Table 1 and Table 2. There were 273 male patients (55.8%) and 216 female patients (44.2%) with an age range from 1 day old to 93 years old in the present study. Most of the patients were elective cases (385 cases or 78.7%) and received general anesthesia (360 cases or 73.6%). The ASA physical status 1, 2 and 3 patients accounted for 24.3%, 45.2% and 24.1% of cases respectively.

Two most common underlying diseases of patients with perioperative arrhythmia were hypertension (128 cases or 26.2%) and baseline heart rate < 60 beat per min (107 cases or 21.9%). The most common arrhythmia in the present study was bradycardia (434 cases, 88.8%). Of these, 396 patients (91.2%) had bradycardia only while 38/434 patients (8.8%) developed bradycardia together with PSVT, PVC or VT/ VF. Fifty five of 489 patients (11.2%) developed PSVT, PVC and/or VT/VF, without bradycardia. Hypotension occurred in 225 of 489 patients with arrhythmia (46%).

In 489 cases most of the arrhythmia occurred in the intra-operative period (463 cases or 94.7%) and occurred one time only (454 cases or 92.8%). Two hundred and three events (41.5%) were detected before surgical incision. Electrocardiogram (ECG) was the most common monitoring for first detection of arrhythmia (467 cases or 95.5%). Pulse oximetry, noninvasive blood pressure and the symptom of patients were the first monitoring of suspected arrhythmia in some patients in PACU or in patients receiving regional anesthesia.

Intravenous anesthesia (49.9%), central neuraxial block (17.0%) and vagal reflex (14.3%) were the three most common suspected causes of arrhythmia especially bradycardia that needed treatment. Electrolyte abnormality (25.5%) was the most common suspected cause of arrhythmia other than bradycardia. Desaturation and vagal reflex, mainly from surgical traction were suspected to produce bradycardia. Other precipitating causes are described in Table 2.

Even though perioperative arrhythmia that needed treatment in 280 patients (57.3%) happened from combined factors, the anesthesia factor was found to be the most common related factor (345 cases or 70.6%), followed by patient factor (331 cases or 67.7%). Surgical factor and system factor involved in 131 (26.8%) and 20 (4.1%) of patients respectively. Perioperative arrhythmia was preventable in 138 patients (28.2%) (Table 3).

The immediate outcomes of perioperative arrhythmia were minor physiologic change (77.9%) and major physiologic change (19.0%), including

Table 1. Demographic and administrative characteristics

Variable		Total 489 cases, n (%)	Bradycardia 434 cases, n (%)	Non-bradycardia 55 cases, n (%)	Death 34 cases, n (%)
Age	Range	1 d-93 yr	1 d-93 yr	6 d-91 yr	2 m-78yr
	Mean ± SD	46.2 ± 23.8	44.9 ± 24.1	56.3 ± 20.2	46.4 ± 23.0
Weight (kg)	Range	1.8-107	1.8-107	3.58-80	1.9-100
	Mean ± SD	53.2 ± 19.9	52.8 ± 20.4	56.9 ± 14.8	52.2 ± 21.6
Height (cm)	Range	50-184	50-184	65-180	50-175
	Mean ± SD	150.9 ± 27.9	150.2 ± 28.9	157.1 ± 16.4	147.7 ± 36.1
Operative time	Range (min)	20-700	20-700	20-425	35-375
	Mean ± SD	139.0 ± 107	137.1 ± 107	154.5 ± 110	130.6 ± 78
Age < 15 yr		74 (15.1)	71 (16.4)	1 (1.8)	4 (11.8)
Gender	Male	273 (55.8)	244 (56.2)	29 (52.7)	24 (70.6)
	Female	216 (44.2)	190 (43.8)	26 (47.3)	10 (29.4)
ASA	Physical status 1	119 (24.3)	110 (25.3)	9 (16.4)	0
	Physical status 2	221 (45.2)	210 (48.4)	11 (20.0)	5 (14.7)
	Physical status 3	118 (24.1)	93 (21.4)	25 (45.5)	8 (23.5)
	Physical status 4	22 (4.4)	13 (3.0)	9 (16.4)	12 (35.3)
	Physical status 5	9 (1.8)	8 (1.8)	1 (1.8)	9 (26.5)
Elective cases		385 (78.7)	351 (80.9)	34 (61.8)	6 (17.6)
Emergency cases		104 (21.3)	83 (19.1)	21 (38.2)	28 (82.4)

Values shown as n (%), mean ± SD and range

Table 2. Anesthetic and surgical characteristics

Variable	Total 489 cases, n (%)	Bradycardia 434 cases, n (%)	Non-bradycardia 55 cases, n (%)	Death 34 cases, n (%)
Anesthetic technique				
General anesthesia	360 (73.6)	318 (73.3)	42 (76.4)	32 (94.1)
Spinal/epidural block	124 (25.4)	112 (25.8)	12 (21.8)	2 (5.9)
Brachial plexus block	1 (0.2)	1 (0.2)	0	0
Combined general anesthesia with regional anesthesia	4 (0.8)	3 (0.7)	1 (1.8)	0
Type of surgery				
General abdominal surgery	120 (24.5)	99 (22.8)	21 (38.2)	17 (50.0)
Orthopedic surgery	107 (21.8)	98 (22.6)	9 (15.4)	0
Obstretic/gynecologic surgery	65 (13.3)	60 (13.8)	5 (9.1)	0
Ear-nose-throat-eye surgery	60 (12.3)	58 (13.4)	2 (3.6)	0
Urology	42 (8.6)	37 (8.5)	5 (9.1)	0
Neurologic surgery	38 (7.8)	36 (8.3)	2 (3.6)	6 (17.6)
Cardiac surgery	19 (3.9)	14 (3.2)	7 (12.7)	4 (11.8)
General nonabdominal surgery	18 (3.7)	14 (3.2)	4 (7.3)	0
Diagnostic procedure	7 (1.4)	7 (1.5)	0	0
Underlying disease				
Hypertension	128 (26.2)	118 (27.2)	10 (18.2)	3 (8.8)
Baseline heart rate < 60	107 (21.9)	106 (24.4)	1 (1.8)	5 (14.7)
Arrhythmia	42 (8.6)	30 (6.9)	12 (21.8)	11 (32.4)
Anemia	40 (8.2)	34 (7.8)	6 (10.9)	16 (47.1)
Diabetes	38 (7.8)	32 (7.4)	6 (10.9)	2 (5.9)
Hypovolemia	35 (7.2)	28 (6.5)	7 (12.7)	22 (64.7)
Electrolyte abnormality	30 (6.1)	18 (4.1)	12 (21.8)	5 (14.7)
Post cardiac arrest	12 (2.5)	10 (2.3)	2 (3.6)	11 (32.4)

Value are shown as n (%)

Table 3. Details of arrhythmia events

Variable	Total 489 cases, n (%)	Bradycardia 434 cases, n (%)	Non-bradycardia 55 cases, n (%)	Death 34 cases, n (%)
Type of arrhythmia				
Bradycardia	434 (88.8)	434 (100)	0	23 (67.6)
PSVT	49 (10.0)	14 (3.2)	35 (63.6)	16 (47.1)
PVC	41 (8.4)	21 (4.8)	20 (36.4)	7 (20.6)
VT/VF	17 (3.5)	7 (1.6)	10 (18.2)	13 (38.2)
Hypotension with arrhythmia	225 (46.0)	197 (45.4)	28 (50.9)	32 (94.1)
Place of first occurrence				
Intraoperative	463 (94.7)	418 (96.8)	46 (83.6)	30 (81.2)
Before surgical incision	203 (41.5)	186 (42.9)	17 (31.0)	12 (35.3)
PACU	21 (4.3)	15 (3.5)	5 (9.1)	2 (5.9)
ICU/ward	5 (1.0)	1 (0.2)	4 (7.3)	2 (5.9)
Episode of occurrence				
One	454 (92.8)	402 (92.6)	52 (94.5)	33 (97.1)
Two	30 (6.1)	27 (6.2)	3 (5.5)	1 (2.9)
Three	4 (0.8)	4 (0.9)	0	0
Firstly detected by				
EKG	467 (95.5)	419 (96.5)	48 (87.3)	32 (94.4)
Pulse oximetry	9 (1.8)	7 (1.6)	3 (5.5)	1 (2.9)
Non invasive blood pressure	4 (0.8)	3 (0.7)	1 (1.8)	1 (2.9)
Clinical symptom	9 (1.8)	5 (1.2)	3 (5.5)	0
Suspected precipitating cause				
Intravenous anesthetic agent	244 (49.9)	238 (54.8)	6 (10.9)	4 (11.8)
Central neuraxial block	83 (17.0)	81 (18.7)	2 (3.6)	0
Vagal reflex	70 (14.3)	70 (16.1)	0	1 (2.9)
Abdominal traction	45 (9.2)	45 (10.4)	0	1 (2.9)
Laryngeal and neck	11 (2.2)	11 (2.5)	0	0
Eye manipulation	8 (1.6)	8 (1.8)	0	0
Carbon dioxide inflation	6 (1.2)	6 (1.4)	0	0
Hypovolemia	43 (8.8)	22 (5.1)	10 (18.2)	24 (70.6)
Anemia	27 (5.5)	33 (7.6)	5 (9.1)	19 (55.9)
Desaturation	24 (4.9)	24 (5.5)	0	0
Electrolyte abnormality	20 (4.1)	6 (1.4)	14 (25.5)	9 (26.5)
Sepsis	10 (2.0)	4 (0.9)	6 (10.9)	6 (17.6)
Local anesthetic/ bone cement	5 (1.0)	3 (0.7)	2 (3.6)	0
Precipitating risk from				
Patient factor	331 (67.7)	281 (64.7)	50 (90.9)	32 (94.1)
Anesthesia factor	345 (70.6)	323 (74.4)	22 (40.0)	10 (29.4)
Surgical factor	131 (26.8)	117 (27.0)	14 (25.5)	15 (44.1)
System factor	20 (4.1)	14 (3.2)	6 (10.9)	8 (23.5)
Preventability				
No	351 (71.8)	313 (72.1)	38 (69.1)	25 (73.5)
Yes	138 (28.2)	121 (27.9)	17 (30.9)	9 (26.5)

Value shown as n (%)
Data is not mutually exclusive

cardiovascular system (16.4%) and respiratory system (3.9%). Twenty patients had unplanned ICU admission (4.1%). The surgery was canceled in two patients (0.4%). For the final outcome, seven patients had prolonged ventilatory support (1.4%) and five patients had prolonged hospital stay (1.0%). Thirty-four patients died (7.0%) while the rest had complete recovery (details are shown in Table 4).

For the 34 mortality cases, 24 were in the non-bradycardia group and 10 were in the non-bradycardia group. Most of the cases were male (70.6%), ASA physical status was 4-5 (61.8%), and underwent

Table 4. Outcomes and management effect. Data shown as number and % of cases

Variable	Total 489 cases	Bradycardia 434 cases	Non-bradycardia 55 cases
Immediate outcome			
Unplanned ICU admission	20 (4.1)	9 (2.1)	11 (20.0)
Unplanned hospital stay	1 (0.2)	1 (0.2)	0
Delay emergence	1 (0.2)	1 (0.2)	0
Postpone/ cancel surgery	2 (0.4)	1 (0.2)	1 (1.8)
Minor physiological change	381 (77.9)	365 (84.1)	16 (29.1)
Major physiological change	93 (19.0)	57 (13.1)	36 (65.5)
Cardiovascular system	80 (16.4)	46 (10.6)	34 (61.8)
Respiratory system	19 (3.9)	17 (3.9)	2 (3.6)
Final outcome			
Prolong ventilatory support	7 (1.4)	2 (0.5)	5 (9.1)
Prolong hospital stay	5 (1.0)	2 (0.5)	3 (5.5)
Complete recovery	455 (93.0)	410 (94.5)	45 (81.8)
Death	34 (7.0)	24 (5.5)	10 (18.2)

Value are shown as n (%)

Table 5. Contributing factors, factors minimizing incident and suggested corrective strategies (n = 489)

	Number	%
Contributing factors		
Human factors		
Inexperience	354	72.4
Poor preoperative evaluation	207	42.3
Improper decision	205	41.9
Lack of knowledge	62	12.7
Communication failure	14	2.9
Hurry	14	2.9
Inadequate preparation	101	20.7
Emergency situation	47	9.6
Monitor/equipment malfunction	4	0.8
Blood bank problem	4	0.8
Factors minimizing incidents		
Prior experienced	471	96.3
High awareness	442	90.4
Experienced assistance	141	28.5
Following guidelines	43	8.8
Good communication	36	7.4
Diagnostic monitor	30	6.1
Consultations	22	4.5
Improve training system	11	2.2
Corrective strategies		
Guideline practice	326	66.7
Improved supervision	301	61.6
Quality assurance activity	258	52.8
Additional training	97	19.8
Improved communication	38	7.8
More manpower	24	4.9

Value are shown as n (%)
Data are not mutually exclusive

emergency surgery (82.4%). The types of surgery included general abdominal surgery (50.0%), neurological surgery (17.6%) and cardiac surgery (11.8%). Hypovolemia, anemia, arrhythmia and post cardiac arrest were found as the underlying disease in 64.7%, 47.1%, 32.4% and 32.4%, respectively (Table 2).

The contributing factors, factors minimizing incident and suggested corrective strategies are summarized and shown in Table 5. The most common contributing factors were human factors such as inexperience (72.4%), poor pre-operative evaluation (42.3%) and improper decision (41.9%). Communication failure (2.9%), monitor/equipment malfunction (0.8%) and blood bank problem (0.8%) were also the part of system factor contributing to adverse events. Three most common factors minimizing incidents involved prior experienced (96.3%), high awareness (90.4%), and experienced assistance (28.5%). Specific guideline development (66.7%), improved supervision (61.6%) and quality assurance activity (52.8%) were the three most common suggested strategies for prevention of perioperative arrhythmia

Discussion

Arrhythmia that needed treatment was a common perioperative adverse event involuntary reported from 51 hospitals across Thailand in the Thai AIMS study[8]. After careful selection, there were 489 incident reports out of 1996 reports that met the criteria for perioperative arrhythmia requiring treatment, which was 24.5% or one-fourth of all adverse incident

reports in 7 months of the study period. This incidence was higher than previous reports since it was calculated on the basis of reported incidents, not all operative cases[2-4].

Bradycardia was the most common perioperative arrhythmia in the present study. The consequences of bradycardia may enhance hemodynamic effect in pediatric patients due to fix stroke volume; however, most of the bradycardia in the present study occurred in patients older than 15 years old. Many studies recommended an intensive beta blocker titration protocol toward a target heart rate of between 55 and 65 beats per minute to reduce myocardial ischemia[9,10]. Even though, slow heart rate is suggested to prevent perioperative cardiac event, bradycardia is often induced by anesthetic agents and sometimes need to be treated[11]. In the present study, many patients were treated when their heart rate was less than 60. So, the authors defined bradycardia in adult patients as heart rate slower than 60 beats per minute which was higher than some previous studies[12,13].

Three major causes of bradycardia included intravenous anesthetic agent, spinal block and visceral traction. Hypertension and slow baseline heart rate were the most common underlying disease in this group. Intravenous anesthetic agents were the most common suspected precipitating cause. Sevoflurane, succinylcholine, fentanyl, propofol, vecuronium and neostigmine were previously reported to occasionally induce bradycardia in all age groups[11,14,15]. Their enhanced effects were demonstrated especially when combined with patient factors such as slow baseline heart rate which was comparable to previous study[12]. Some slow baseline heart rate patients in the present study developed bradycardia more than one episode. Almost half of intra-operative incidents happened before surgical incision. Effects of intravenous anesthetic agents, stress from laryngeal intubation[11,16] and balance between depth of anesthesia and surgical stimuli were important causes of bradycardia in this period.

Spinal block was the second most common precipitating cause of perioperative bradycardia requiring treatment in the present study. Slow baseline heart rate also enhanced bradycardia in patients undergoing neuraxial block[17]. This adverse event was detected as fast as one minute to 135 minutes after intrathecal injection, which was comparable to Lesser et al who found bradycardia at anytime during neuraxial anesthesia[12]. Sympathetic block above T4 produced bradycardia by blockade of cardiac accelerator fibers[12]. The height of sensory blockage in the present study varied from T2-T12, however, most of the blockage height was recorded in the beginning of the cases and may have been changed by the time of the events. Moreover, the level of sympathetic block extended as many as six levels higher than sensory block[17]. Another cause of bradycardia during neuraxial block was vagovagal reflex, which was related to emotional or somatic factor such as fear, anxiety and pain. It mostly occurred in phobia patients and reversible spontaneously. A minority of cases had direct stimulation effect at medulla and developed generalized vasodilatation. This resulted in massive decrease in venous return, hypotension, decreased cerebral blood flow, syncope, bradycardia and may developed asystole[12,18]. The authors found two cases of previously healthy anxious young men who had bradycardia and syncope in the present study. Both of them recovered in a few minutes after atropine treatment and positive pressure ventilation without any sequelae.

The Bezold-Jarisch reflex was also another cause of perioperative bradycardia in patients undergoing neuraxial block. It was initially reported as a bradycardia response to various alkaloid compounds intravenous injection, and later found to be mediated by intracardiac chemoreceptor[19]. This reflex also included bradycardia response to intracardia mechanoreceptor and finally had been used to describe perioperative bradycardia with hypotension[20].

Surgical traction was another most common suspected precipitating cause of perioperative bradycardia[16]. Most of the cases happened due to intra-abdominal visceral organ manipulation which was easily converted to normal by stopping traction and giving intravenous atropine. However, one patient who developed bradycardia during surgical manipulation died from massive uncontrolled surgical bleeding. Bradycardia also happened after eye muscle manipulation, direct laryngoscope, total laryngectomy and manipulation around carotid arteries[16]. Beside the above surgical manipulation, intra-abdominal carbon dioxide inflation during laparoscopic cholecystectomy produced negative effects on venous return and was another cause of bradycardia in the present study[21]. Desaturation occurred together with bradycardia in 24 patients in the bradycardia group (5.5%), which is much less than the study by Watterson et al[22]. Of these 24 incident reports, 17 cases resulted from airway equipment problem while the rest had desaturation from hypoperfusion.

There were many precipitating causes of tachyarrhythmia, especially in patients with underlying heart disease including pain, hypoxemia, hypovolemia, anemia, electrolyte disturbance, drug effect, light anesthesia and sympathetic system stimulation[1]. Electrolyte abnormality and previous cardiac arrhythmia were the most common precipitating factors of the non-bradycardia group. Paroxysmal supraventricular tachycardia was the most common tachyarrhythmia in the present study. Hypokalemia was the most common electrolyte abnormality which precipitated perioperative arrhythmia others than bradycardia. Most of these arrhythmia cases were resolved by medication. Three patients with atrial fibrillation received cardioversion while all of the patients with ventricular tachycardia/ fibrillation received medication together with defibrillation.

Hypotension occurred in half of the patients in either the bradycardia or non-bradycardia group. However, hypotension developed with arrhythmia in most of the mortality cases.

The mortality rate in the present study was 34 cases in 489 reported cases or 7.0% of periope- rative arrhythmia patients. This incidence was calculated on the basis of arrhythmia cases, so the incidence was different from a previous study because of different inclusion criteria[3]. Most cases in this group were male with ASA physical status 4-5 undergoing emergency abdominal, neurological and cardiac surgery. One third of cases had cardiac arrest and received cardiopulmonary resuscitation before arriving in the operative room. Among these fatal cases, 7 cases had bradycardia without tachyarrhyth mia, 16 cases had bradycardia with tachyarrhythmia and 11 cases had tachyarrhythmia without bradycardia. The mortality rate in patients who developed periopertive bradycardia, bradycardia with tachyarrhythmia and tachyarrhythmia were 7 out of 396 (1.7%), 16 out of 38 (42%), and 11 out of 55 (20%) respectively.

Electrocardiogram was the most common, primary monitoring to detect perioperative arrhythmia, especially in the operating room and intensive care unit. It was also the equipment for definite diagnosis. However, less than 5% of arrhythmia cases were primarily detected by suspicious rate and curve on pulse oximetry, palpitation and unexplained hypotension. Nine out of 489 or1.8% of cases were detected primarily from presenting symptoms such as palpitation before being detected by electrocardiogram.

Anesthesia factor was the main precipitating risk for perioperative arrhythmia, followed by patient factors. However, patient factor was the most common risk factor in mortality patients. Surgical factor included surgical traction and uncontrolled bleeding. System factor was uncommon risk factor but was important, since most of these factors were preventable. These system factors involved blood bank problem, equipment failure, improper communication and inadequate preparation and resuscitation prior to surgery.

Besides the 7% mortality of all perioperative arrhythmia cases, the most common outcome of perioperative arrhythmia was minor physiologic change. Major physiologic change mainly involved cardiovascular and respiratory system. The other adverse outcomes including unplanned ICU admission, prolonged ventilatory support and prolonged hospital stay were found in 4.1%, 1.4% and 1.0% respectively. All cases except mortality cases finally resolved to their baseline physical status.

Human factors including inexperience, poor preoperative evaluation and improper decision were the major contributing factors in the present study. All of these factors can be minimized by prior experience and high awareness.

According to our peer reviewers, guideline practices, improved supervision and quality assurance activities were the three most common suggestive strategies to reduce and prevent perioperative arrhythmia adverse events.

Conclusion

Bradycardia was the most common arrhythmia and occurred mainly from intravenous anesthetic agent, central neuraxial block and visceral traction. Electrolyte abnormality and previous cardiac arrhythmia were the important precipitating factors for tachyarrhythmia. Most arrhythmia was benign, but fatal arrhythmia occasionally occurred. There was 7% mortality rate in patients who developed perioperative arrhythmia. Patient factor was the most common cause of these adverse events in the fatal group. Human factors were the major contributing factor and can be minimized by previous experience and high awareness. Corrective strategies such as guidelines practice, improvement of supervision and quality assurance activity were suggested to decrease these adverse events.

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การศึกษาภาวะแทรกซ้อนทางวิสัญญีโดยการรายงานอุบัติการณ์ (Thai AIMS): อุบัติการณ์การเกิดภาวะหัวใจเต้นผิดจังหวะ

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ภูมิหลัง: *ราชวิทยาลัยวิสัญญีแพทย์แห่งประเทศไทยได้ทำโครงการรายงานอุบัติการณ์ภาวะแทรกซ้อนทางวิสัญญีในปี พ.ศ. 2550 ภายใต้หลักการนิรนามและสมัครใจ การศึกษานี้มีวัตถุประสงค์ในการวิเคราะห์อุบัติการณ์ ปัจจัยเสี่ยง และผลลัพธ์ทางคลินิกของการเกิดภาวะหัวใจเต้นผิดจังหวะในช่วงระหว่างและหลังการให้ยาระงับความรู้สึก*

วัสดุและวิธีการ: *เป็นการศึกษาสหสถาบันแบบพรรณนา ชนิดเก็บข้อมูลไปข้างหน้า โดยการรวบรวมรายงานอุบัติการณ์ ในโรงพยาบาลต่าง ๆ 51 แห่ง จากทั่วประเทศ ระหว่างเดือนมกราคม ถึง มิถุนายน พ.ศ. 2550 ข้อมูลการเกิดภาวะหัวใจเต้นผิดปกติที่เกิดระหว่างผ่าตัดตลอดจนหลังการผ่าตัด 24 ชั่วโมงได้รับการทบทวน และวิเคราะห์โดยวิสัญญีแพทย์ 3 คน โดยความคิดเห็นที่ขัดแย้งจะผ่านการอภิปรายจนได้ข้อสรุป*

ผลการศึกษา: *รายงานอุบัติการณ์ 489 รายงาน ซึ่งเข้าได้กับคำจำกัดความ พบว่าภาวะหัวใจเต้นช้าเป็นภาวะหัวใจเต้นผิดปกติที่พบบ่อยที่สุด (ร้อยละ 88.8) โดยร้อยละ 94.7 พบในระหว่างการผ่าตัด และสามารถวินิจฉัยได้ด้วยเครื่องตรวจวัดคลื่นไฟฟ้าหัวใจเป็นส่วนใหญ่ (ร้อยละ 95.5) ภาวะหัวใจเต้นผิดปกติเกิดในผู้ป่วยโรคความดันเลือดสูง และผู้ป่วยที่มีภาวะหัวใจเต้นช้ากว่า 60 ครั้งต่อนาที ยาระงับความรู้สึกชนิดฉีดเข้าหลอดเลือดดำ การให้ยาระงับความรู้สึกโดยการบล็อกหลัง และเวกาลรีเฟลกซ์เกี่ยวข้องกับการเกิดภาวะหัวใจเต้นผิดปกติบ่อยที่สุด ผลกระทบที่เกิดขึ้นส่วนใหญ่เกิดการเปลี่ยนแปลงทางสรีรวิทยาเพียงเล็กน้อย แต่ร้อยละ 7 ของอุบัติการณ์ถึงแก่ชีวิต ร้อยละ 72.4 วิเคราะห์ได้ว่าเป็นสาเหตุจากมนุษย์โดยเฉพาะการขาดประสบการณ์*

สรุป: *ภาวะหัวใจเต้นผิดปกติเกิดขึ้นร้อยละ 19.2 ของอุบัติการณ์ทั้งหมด 2,537 อุบัติการณ์โดยมีภาวะหัวใจเต้นช้าเกิดขึ้นบ่อยที่สุด ส่วนใหญ่แล้วไม่เป็นอันตรายแต่บางรายถึงแก่เสียชีวิตได้ มาตรการที่แนะนำได้แก่ การสร้างแนวทางเวชปฏิบัติ การปรับปรุงระบบให้การปรึกษา และกิจกรรมประกันคุณภาพ*