Original Article

Factors Associated with Perioperative Complications in Geriatric Patients: Experiences from a University Hospital

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Objective: Older patients are at a higher risk of complications and mortality when administered anesthesia. Factors associated with anesthetic complications in elderly patients are limited; particularly in large sample size.

Materials and Methods: The present study retrospectively reviewed all patients 65 years and older who received anesthetic procedures at University Hospital, Khon Kaen University, Thailand. The study period was from January 2010 through December 2011. Data were retrieved from medical charts and anesthetic records. Factors associated with perioperative complications were analyzed by multivariate logistic regression analysis.

Results: There were 3,621 patients aged 65 years and older who received anesthesia during the study period. The average age was 73 years (SD 6.2) and 52% of patients were male. There were 10 factors associated with having perioperative complications including female gender, history of sulfa allergy, history of coronary artery disease, low platelet, history of hypertension, operation time more than 2 hours, combination of general and regional anesthesia, perianal operation, and orthopedic/plastic surgery.

Conclusion: Elderly patients with risk factors for anesthetic complications should be aware during and post anesthetic periods.

Keywords: Complications, Anesthesia, Elderly, Risk factors

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The population of geriatric patients - those patients over 65 years old - is increasing worldwide. The geriatric population may increase up to 20% by 2050 with estimated population of 2.5 billion people particularly in developing countries[1,2]. Elderly people are at risk for several conditions such as infection, delirium, or falls[3-5].

Older patients are also at a higher risk of complications and mortality when administered anesthesia[6]. Patients with age over 80 years had postoperative morbidity of 51% and mortality of 7%[7]. The mortality may occur at 24 hours and as late as 7 days[8]. The incidence of mortality in elderly patients who received anesthesia was 1: 254 at 24 hours and 26.5% at 7 days. Factors associated with anesthetic complications in elderly patients are limited.

Materials and Methods

The present study retrospectively reviewed all patients 65 years and older who received anesthetic procedures at the Department of Anesthesiology, Faculty of Medicine, Khon Kaen University, Thailand. The present study period was from January 2010 through December 2011.

Data were retrieved from medical charts and anesthetic records. Anesthetic records provided information about the patients' conditions during anesthesia and 24 hours after anesthesia. Patients on which data were incomplete were excluded. Data were comprised of 4 parts, including baseline characteristics and American Society of Anaesthesiologists physical status (ASA); operation data such as operative site, operative time, operative procedure, or patient condition during anesthesia; anesthetic data including anesthetic techniques, anesthetic agents, or airway management; and perioperative complications. Severe perioperative complications were defined as cardiac arrest, death, or pulmonary aspiration; while other complications were defined as minor complications.

Statistical analysis

Baseline characteristics of all patients were analyzed using descriptive statistics. The incidence rates of perioperative complications were calculated as events/10,000 anesthetic procedures. Univariate logistic regression analyses were applied to calculate the crude odds ratios of individual variables for having perioperative complications. All variables

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with a *p*-value of less than 0.05 by univariate analysis or clinically significant were included in subsequent forward stepwise multivariate logistic regression analyses. Analytical results were presented as crude odds ratios (OR), adjusted OR, and 95% confidence intervals (CI). All data analyses were performed with STATA software (College station, Texas, USA).

Results

There were 3,621 patients aged 65 years and older who received anesthesia during the study period. The total number of anesthetic events for all patients was 4,595. The average age was 73 years (SD 6.2) and 52% of patients were male. 63% of patients were ASA class 2, 74.7% received an elective surgery, and 70.7% received general anesthesia. Hypertension was the most common co-morbid disease at 42.5%. 24.4% of patients suffered from obesity (Table 1).

There were 395 events of perioperative complications in 384 patients. The incidence rate was 860 events/10,000 anesthetic events. Of those events, 232 events occurred in male patients (58.7%) and 110 events were considered to be severe or critical complications. The three most common severe complications were cardiac arrest, arrhythmia that required treatment, and dental injury with incidence rates of 45.7, 30.5, and 21.8/10,000 anesthetic events, respectively (Table 2).

Table 1. Demographic and anesthetic characteristics of geriatric patients who underwent operation at Khon Kaen University

Factors	Numbers (%)
Female gender	47.2
Age groups	
65 to 70	41.5
71 to 75	27.0
76 to 80	18.1
81 to 85	9.3
86 to 90	3.1
>90	1.0
Body mass index (kg/m^2)	
<18.5	15.8
18.5 to 22.9	42.4
23 to 24.9	17.4
25 to 29.9	20.4
≥30	4.0
ASA classification	
2	63.0
3	31.3
4	5.4
5	0.3
Surgical conditions	
Elective	74.7
Emergency	25.3
Anesthetic technique	
General anesthesia	70.7
Regional anesthesia	16.7
Both	7.4

Univariate analysis showed that there were 7 significant factors associated with perioperative complications in the elderly (Table 3). These factors were being female, having an ASA class of more than 2, comorbid conditions; operative times of more than 2 hours, patient conditions, anesthetic techniques, and the department to which the surgeon belonged.

After the forward stepwise multivariate logistic regression analysis, there were 10 factors associated with having perioperative complications as shown in Table 4. The site of the operation became a significant factor with adjusted OR at 2.1 (95% CI of 1.3 to 3.0), as well as did the department, with the departments of orthopedics and plastic surgery having an adjusted OR at 2.0 (95% CI of 1.6 to 2.6) and 1.5 (95% CI of 1.1 to 2.6), respectively (Table 4).

Discussion

The overall rate of incidence for perioperative complication in the present study was 860 events/10,000 anesthetic events, with occurrences being more common in female patients (58.7%). Previous studies from Thailand have shown that perioperative complications were more common in male patients[9,10]. The difference between the present study and previous studies was in the range of perioperative complications that were analyzed. In the present study, the outcomes were based on overall perioperative complications, while those in other studies only looked at cardiac arrest or death. Male elderly patients are known to be at higher risk for cardiac arrest or death.

The incidence of cardiac arrest, arrhythmia requiring treatment, reintubation, and pulmonary aspiration in the present study were comparable to the previous registration reports from Thailand and Brazil[7,10]. Only dental injury and moderate hypothermia had higher incidence rates in the present study than in a previous study[7]. The mortality rate in the present study was 1: 724, which was somewhat lower than a similar study conducted by Rodanant et al[7]. This result may be explained by a difference in study populations. Subjects in the present study included all patients with minor perioperative complications, resulting in a lower mortality rate.

After controlling for confounding factors, several factors were significantly associated with overall perioperative complications in the elderly patients, including gender, a history of sulfa allergies, a history of coronary artery disease, low platelet count, being on antihypertensive agents, long operating times, the combination of general and regional anesthesia, having a perineal-anal operation, and the operation taking place by surgeons from the department of Orthopedic and Plastic Surgery (Table 4).

Patients with a history of coronary artery disease are at high risk for perioperative myocardial infarction or reinfarction[11-13]. The results of the present study showed that these elderly patients with previous coronary artery diseases had double the risk of overall perioperative complications. Taking antihypertensive agents was shown to be associated with perioperative geriatric death in Thai

Table 2. Perioperative complications in the elderly categorized by incidence rate (per 10,000) and periods

Incident type	Incidence rate	Operative room n (%)	PACU n (%)	2 to 24 hours post operation n (%)
Cardiac arrest	45.7	13 (61.9)	0	8 (38.1)
Arrhythmia needed treatment	30.5	10 (71.4)	2 (14.3)	2 (14.3)
Dental injury	21.8	10 (100.0)	0	0
Reintubation	19.6	3 (33.3)	1 (11.1)	5 (55.6)
Desaturation	15.2	4 (57.1)	1 (14.3)	2 (28.6)
Hypothermia (moderate)	15.2	6 (85.7)	1 (14.3)	0
Death	10.9	1 (25.0)	0	4 (80.0)
Pneumothorax	8.7	2 (50.0)	0	2 (50.0)
Pulmonary edema	8.7	2 (50.0)	1 (25.0)	1 (25.0)

PACU = Post anesthetic care unit

Table 3. Factors associated with perioperative complications in the elderly by univariate logistic regression analysis

Factors	Perioperative complication n (%)	No perioperative complication n (%)	COR	95% CI
Gender				
Male	163 (41.3)	2,261 (53.8)	1.0	Ref
Female	232 (58.7)	1,939 (46.2)	1.7	1.3 to 2.0
ASA Classification				
Class 2	277 (70.1)	2,617 (62.3)	1.0	Ref
Class 3 to 5	118 (29.9)	1,583 (37.7)	0.7	0.6 to 0.9
Underlying conditions				
Sulfa-drug allergy	5 (1.3)	18 (0.4)	3.0	1.1 to 8.1
Coronary artery disease/MI	25 (6.3)	163 (3.9)	1.7	1.1 to 2.6
Platelets <100,000	11 (2.8)	58 (1.4)	2.0	1.1 to 3.9
Taking antihypertensive drug	126 (31.9)	975 (23.2)	1.5	1.2 to 1.9
Operative time				
≤2 hours	185 (46.8)	2,543 (60.6)	1.0	Ref
>2 hour	210 (53.2)	1,657 (39.4)	1.7	1.4 to 2.1
Operation condition				
Non-emergency	318 (80.5)	3,118 (74.2)	1	Ref
Emergency	77 (19.5)	1,082 (25.8)	0.7	0.5 to 0.9
Anesthetic technique				
MAC	6 (1.5)	180 (4.3)	1	Ref
GA	236 (59.8)	3,011 (71.7)	2.4	1.0 to 5.4
Combination of GA with RA	63 (16.0)	325 (7.7)	5.8	2.5 to 13.7
RA	90 (22.8)	684 (16.3)	3.9	1.7 to 9.2
Department				
General surgery	125 (31.7)	1,573 (37.5)	1.0	Ref
Orthopedic	110 (27.9)	678 (16.2)	2.0	1.6 to 2.7
Urological surgery	31 (7.8)	333 (7.9)	1.2	0.8 to 1.8
Plastic surgery	27 (6.8)	222 (5.3)	1.5	0.99 to 2.4
Gynecology	24 (6.1)	117 (2.8)	2.6	1.6 to 4.2

COR = crude odds ratio; CI = confidence interval; ASA = American Society of Anaesthesiologists; MAC = Monitored anesthesia care; GA = General anesthesia; RA = Regional anesthesia; Ref = Reference

patients[8]. Hypertension therefore may be a major warning factor for the occurrence of perioperative complications in the elderly.

Other factors associated with the perioperative complications were duration of operation and bleeding risk. Operations lasting more than 2 hours increased the risk by 60%. Platelet counts of less than 100,000 cells/mm^3, perineal-anal operations, or operations taking place in department of Orthopedics and Plastic surgery were associated with bleeding dyscrasia or long operation times. Even though a

Table 4. Factors associated with perioperative complications in the elderly by multivariate logistic regression analysis

Factors	Numbers (%)	AOR	95% CI
Gender			
Male	163/2,424 (6.7)	1.0	Ref
Female	232/2,171 (10.7)	1.5	1.2 to 1.9
ASA classification			
Class 2	277/2,894 (9.6)	1.0	Ref
Class 3 to 5	118/1,701 (6.9)	0.8	0.5 to 1.0
Underlying conditions			
Sulfa-drug allerg	5/23 (21.7)	3.1	1.1 to 8.9
Coronary artery disease/MI	25/188 (13.3)	2.1	1.3 to 3.4
Platelets <100,000	11/69 (15.9)	3.3	1.7 to 6.6
On antihypertensive drug	126/1,101 (11.4)	1.4	1.1 to 1.8
Operative time			
≤2 hours	185/2,728 (6.8)	1.0	Ref
>2 hour	210/1,867 (11.3)	1.6	1.3 to 2.0
Anesthetic technique			
MAC	6/186 (3.2)	1	Ref
Combination of GA with RA including turning failed RA to GA	63/388 (16.2)	2.5	1.8 to 3.5
Site of operation			
Extremities & joint	92/728 (12.6)	1	Ref
Perineal-anal	28/204 (13.7)	2.0	1.3 to 3.0
Department			
General surgery	125/1,698 (7.4)	1.0	Ref
Orthopedic	110/788 (14.0)	2.0	1.6 to 2.6
Plastic surgery	27/249 (10.8)	1.5	1.1 to 2.6

AOR = adjusted odds ratio; CI = confidence interval; ASA = American Society of Anaesthesiologists physical status; MI: Myocardial infarction; MAC = Monitored anesthesia care; GA = General anesthesia; RA = Regional anesthesia; Ref = Reference

history of sulfa allergies was a significant risk factor, the total number of patients with this condition was small (23 patients). It is necessary to study this factor further. Note that the outcome of the present study was based on overall perioperative complications in the elderly patients. Odds ratios were adjusted for all factors, therefore, and were not specific to any particular types of complications.

Conclusion

Elderly patients with risk factors for anesthetic complications should be aware during and post anesthetic periods.

What is already known on this topic?

An overall perioperative complication prevalence is limited to Thai elderly population.

What this study adds?

Elderly patients with co-morbid diseases or underwent orthopedic/plastic surgery should be aware of perioperative complications.

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Potential conflicts of interest

The authors declare no conflicts of interest.

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