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Cardiovascular Challenges in Geriatric Anesthesia after Induction of GA

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Abstract

Background: Advanced age is associated with the physiologic process of aging and decreased functional reserve of organs. These patients are often frail and have several comorbid conditions. The physiological changes in the aging cardiovascular system affect the arterial and venous vasculature, myocardium, and autonomic nervous system, making the older person more prone to cardiovascular instability. In addition to the physiological changes, the cardiovascular status of the older person tends to be compromised by associated pathological conditions that are more common with increasing age. This study aimed to analyze cardiovascular challenges in geriatric anesthesia after induction of GA. **Material & Methods:** This prospective study was conducted at the Department of Anesthesia, Combined Military Hospital (CMH), Dhaka, Bangladesh. The study was carried out from April 2016 to September 2016. A total of 60 subjects were selected as per inclusion criteria. Subjects were divided into 2 groups to compare the parameters among the non-elderly and elderly respondents, Group A (age ≤60 years) and Group B (age >60 years). Statistical analysis of the results was obtained by using Statistical Packages for Social Sciences (SPSS-17) software. **Results:** In this study, 30 (50%) patients belonged to group A with ≤60 years of age and 30 (50%) patients belonged to group B with >60 years of age. Among the respondents 20 were male and 10 were female in group A, and 23 were male and 7 were female in group B. Regarding pre-existing cardiovascular co-morbid conditions, most patients (5, 16.67%) suffered from hypertension, followed by atherosclerosis (2, 6.67%) and 1 patient (3.33%) had cardiac arrhythmias in group A. Most of the patients (7, 23.33%) suffered from hypertension followed by congestive heart failure (6, 20.0%), 5 patients (16.67%) had atherosclerosis, 5 patients (16.67%) had coronary artery disease, 4 patients (13.33%) went through cardiac arrhythmias and the rest 3 (10.0%) patients suffered from aortic stenosis. The mean difference of SBP between the groups 20 minutes before and after induction of general anesthesia showed a statistically significant difference at 5,10,15 and 20th-minute follow-ups. (P=<0.05). The mean difference of DBP between the groups 20 minutes before and after giving general anesthesia showed a statistically significant difference at 5, 10, 15, and 20th-minute follow-up. (P=<0.05) The mean difference in heart rate between the groups 20 minutes before and after induction of general anesthesia showed statistically significant differences at 10, 15, and 20th minute follow up. (P=<0.05).

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Conclusion: T This study revealed that elderly patients suffered the most from hypertension followed by heart failure and coronary artery diseases. These pre-existing cardiovascular diseases along with hemodynamic instability during the surgical procedure after general anesthesia pointed towards a great challenge. Thus, care of the elderly patient requires thorough preoperative assessment and planning regarding both anesthetic and surgical techniques and the involvement of a multidisciplinary clinical team knowledgeable about and interested in the management of the elderly surgical patient.

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INTRODUCTION

Several changes in cardiac structures and function occur in elderly patients that contribute to diastolic dysfunction. As myocytes are lost they are replaced with fibroblasts and the heart becomes stiffer and less compliant. Arterial structures and cardiovascular reserves diminish with increasing age, elderly patients are particularly prone to the development of post-induction hypotension.[1] Intraoperative hypotension may have serious effects on postoperative outcomes in terms of vital organ system functions. Even a short duration of intraoperative MAP less than 55 mmHg is associated with acute kidney injury and myocardial injury.[2] The major challenge in anesthesia for the older person with cardiovascular disease is the maintenance of hemodynamic stability, particularly in the face of reduced physiological reserve and the capability to respond to periods of instability.[3] Normal aging of the cardiopulmonary system overlaps with the development of cardiovascular disease. It is characterized by changes that decrease cardiovascular reserve through changes in myocardial function and volumes. These changes are compounded by co-existing cardiovascular disease and multisystem co-morbidities. Anesthesia interferes with each of the components and poses substantial challenges.[4] Probably reduction in vascular resistance by sympathetic nerve blockade, relaxation of the smooth muscle of the vascular system, and vasodilatation is the main reason for hypotension. Relative dominance of the parasympathetic system, activation of Bezold Jarish Re¬flex (BJR), and increased baroreceptor activity may lead to bradycardia and some degree of hypotension.[5] After intravenous induction of general anesthesia, it may result in decreased systemic vascular resistance and depression of cardiac function, which results in arterial hypotension, particularly in elderly patients.[6] Improvements in myocardial protection, extracorporeal circulation, proper anesthesia, and surgical techniques can significantly reduce morbidity and mortality.[7] Cardiovascular diseases, respiratory disorders, endocrinopathies, diminishing hepatic functions, variably impaired renal functions, nutritional deficiencies, gastrointestinal tract dysfunctions, cognitive and neuro-behavioral changes, a common practice of polypharmacy and many other co-morbid diseases largely determine the

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course and impact of surgical interventions in elderly patients.[8] To cope with the challenges, many countries strengthen anesthesia safety by popularizing advanced technology, such as ultrasound and visualization techniques, new airway devices, anesthesia depth, and brain oxygen monitoring facilities.[9] Moreover, balancing the necessity for perfusion of vital organs against the workload imposed on the heart involves a thorough understanding of the patient's medical condition, so that an anesthetic treatment plan may be tailored to the needs of the patient.[10] So, this study aimed to analyze cardiovascular challenges in geriatric anesthesia after induction of GA.

Objective

General Objective

- To analyze the cardiovascular challenges in geriatric anesthesia after induction of general anesthesia.

Specific Objectives

- To analyze post-induction hypotension and bradycardia in elderly patients.
- To assess cardiovascular complications in elderly patients.
- To analyze organ injury due to decreased perfusion of organs.

MATERIAL AND METHODS

This prospective study was conducted at the Department of Anesthesia, Combined Military Hospital (CMH), Dhaka, Bangladesh. The study was carried out from April 2016 to September 2016. A total of 60 subjects were selected as per inclusion criteria. Subjects were divided into 2 groups to compare the parameters among the non-elderly and elderly respondents, Group A (age ≤60 years) and Group B (age >60 years). Evaluation of all patients was done by medical history and physical examination. All necessary investigations were done before applying anesthetic and analgesic medication and surgical procedures. Informed written consent was obtained from all study subjects. Perioperative outcomes were noted routinely. All data were kept confidential and used only for this study purpose. Ethical clearance was obtained from the ethical committee. Statistical analysis of the results was obtained by using Statistical Packages for Social Sciences (SPSS-17) software and the level of significance was measured by using appropriate procedures like chi-square test (X2), relative risk (RR) measurement, t-test, and proportion (d) test and others where applicable. The level of significance (p-value) was set at 0.05 and the confidence interval at 95%.

Inclusion Criteria

- Patients of >25 years of age.
- Patients who had given consent to participate in the study.
- Patients undergoing a surgical procedure under general anesthesia.

Exclusion Criteria

- Patients with mental illness.
- Patients who did not give consent to participate in the study.

RESULTS

In this study, 30 (50%) patients belonged to group A with ≤60 years of age and 30 (50%) patients belonged to group B with >60 years of age. [Table 1] Among the respondents 20 were male and 10 were female in group A, and 23 were male and 7 were female in group B.

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[Figure 1] Regarding pre-existing cardiovascular co-morbid conditions, most patients (5, 16.67%) suffered from hypertension, followed by atherosclerosis (2, 6.67%) and 1 patient (3.33%) had cardiac arrhythmias in group A. Most of the patients (7, 23.33%) suffered from hypertension followed by congestive heart failure (6, 20.0%), 5 patients (16.67%) had atherosclerosis, 5 patients (16.67%) had coronary artery disease, 4 patients (13.33%) went through cardiac arrhythmias and the rest 3 (10.0%) patients suffered from aortic stenosis. [Table 2] The mean difference of SBP between the groups 20 minutes before and after induction of general anesthesia showed a statistically significant difference at 5,10,15 and 20th-minute follow-ups. (P=<0.05). [Table 3] The mean difference of DBP between the groups 20 minutes before and after giving general anesthesia showed a statistically significant difference at 5, 10, 15, and 20th-minute follow-ups. (P=<0.05) [Table 4] The mean difference in heart rate between the groups 20 minutes before and after induction of general anesthesia showed a statistically significant difference at 10, 15, and 20th-minute follow-ups. (P=<0.05) [Table 5]

Table 1: Age distribution of the study respondents (N=60)

Age (in years)	**N**	**%**
≤56 (Group A)	30	50
>56 (Group B)	30	50

Table 2: Distribution of respondents according to pre-existing cardiovascular co-morbidity (N=60)

Comorbid conditions	**Group A n=30 (%)**	**Group B n=30 (%)**
Atherosclerosis	02 (6.67)	5 (16.67)
Coronary artery disease	00 (0.0)	5 (16.67)
Hypertension	05 (16.67)	7 (23.33)
Congestive heart failure	00 (0.0)	6 (20.0)
Cardiac arrhythmias	01 (3.33)	4 (13.33)
Aortic stenosis	00 (0.0)	3 (10.0)

Table 3: Distribution of respondents according to systolic blood pressure (N=60).

Blood pressure	**Group A (n=30)**	**Group B (n=30)**	**P-value**
20 min before induction	125±4.79	127±3.54	0.361^{NS}
Immediate after induction	130±3.67	90±2.19	0.205^{NS}
5 min after induction	125±3.13	86±3.19	0.004^{S}
10 min after induction	118±2.16	84±2.95	0.002^{S}
15 min after induction	120±3.57	90±2.93	0.001^{S}
20 min after induction	120±4.57	90±1.79	0.001^{S}

S= significant, NS= not significant

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Table 4: Mean diastolic blood pressure in both groups before and after induction of GA (N=60)

Diastolic Blood Pressure	Group A (n=30)	Group B (n=30)	P-value
20 min before induction	86±3.16	86±1.32	1.000^{NS}
Immediate after induction	95±2.36	92±2.49	0.115^{NS}
5 min after induction	92±2.19	76±3.71	0.001^{S}
10 min after induction	86±3.47	66±4.57	0.007^{S}
15 min after induction	80±4.77	60±3.73	0.028^{S}
20 min after induction	80±2.89	60±3.77	0.001^{S}

S= significant NS= not significant

Table 5: Mean Heart rate in both groups before and after induction of GA (N=60)

Heart rate	Group A (n=30)	Group B (n=30)	P-value
20 min before induction	76±3.16	74±2.32	1.050^{NS}
Immediate after induction	85±2.36	70±2.49	0.215^{NS}
5 min after induction	82±2.19	66±3.71	0.805^{NS}
10 min after induction	76±3.47	56±4.57	0.004^{S}
15 min after induction	74±4.77	58±3.73	0.048^{S}
20 min after induction	72±2.89	60±3.77	0.005^{S}

DISCUSSION

In this study, 30 (50%) patients belonged to group A with ≤60 years of age and 30 (50%) patients belonged to group B with >60 years of age. According to a study, the elderly (≥60 years) population is the fastest-growing part of the population in many parts of the developed world.[11] Regarding pre-existing cardiovascular co-morbid conditions, most patients (5, 16.67%) suffered from hypertension, followed by atherosclerosis (2, 6.67%), and 1 patient (3.33%) had cardiac arrhythmias in group A. Most of the patients (7, 23.33%) suffered from hypertension followed by congestive heart failure (6, 20.0%), 5 patients (16.67%) had atherosclerosis, 5 patients (16.67%) had coronary artery disease, 4 patients (13.33%) went through cardiac arrhythmias and the rest 3 (10.0%) patients suffered from aortic stenosis. According to another study, achieving adequate BP control preceding an elective surgical procedure is desirable to ensure hemodynamic stability throughout the perioperative period, since labile heart rate, blood pressure, and volume status are associated with adverse cardiovascular events. Risk reduction strategies for the elderly outpatient involve the optimization of coexisting diseases. To minimize perioperative adverse events in the elderly.[12] The mean difference of SBP, DBP, and heart rate between the groups 20 minutes before and after induction of general anesthesia showed a statistically significant difference at 5,10,15, and 20th-minute follow-up in the present study(P=<0.05). Tachycardia during anesthesia could be associated with hypotension, hypovolemia, or an inflammatory response, however, other mechanisms such as negative inotropy of induction agents, BJR, and an increase in baroreflex activity prone patients to bradycardia.[13] Therefore, heart rate may change differently in response to induction

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among patients, which can justify the independence of bradycardia and hypotension in both groups of this study. This is following previous studies, which showed a different chronotropic response in hypotensive elderly patients compared to younger subjects.[14] Activation of the BJR is considered one of the proposed mechanisms for the occurrence of hypotensive events.[15] Hypotension after general anesthesia induction is often encountered by anesthesiologists in routine clinical practice. Various reports demonstrate increased age as a risk factor for hypotension. MBP <80 mmHg sustained >10 min or MBP <70 mmHg for a shorter duration mildly increased the risk of end-organ damage. An assessed MBP <55 mmHg predicted adverse cardiac outcomes and acute kidney injury. Intraoperative hypotension with MBP <55 mmHg in geriatric patients is a risk factor for delirium, associated with declined activities of daily living and postoperative mortality.[16] So, importance should be given to age-related pharmacokinetic and pharmacodynamic considerations, effective pain control, as well as prevention and treatment of hypothermia, fluid, and electrolyte imbalance, and postoperative delirium.[17] Moreover, optimal perioperative care often requires a multidisciplinary approach involving the anesthesiologist, surgeon, primary care physician, and, in selected cases, a geriatrician, subspecialty consultants, nurses, a pharmacist, and various therapists.[18]

Limitations of the Study

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

CONCLUSIONS

This study revealed that elderly patients suffered the most from hypertension followed by heart failure and coronary artery diseases. Pre-existing cardiovascular diseases along with hemodynamic instability during the surgical procedure after general anesthesia pointed towards a great challenge. Thus, care of the elderly patient requires thorough preoperative assessment and planning regarding both anesthetic and surgical techniques and the involvement of a multidisciplinary clinical team knowledgeable about and interested in the management of the elderly surgical patient.

Recommendation

Pharmacokinetic and pharmacodynamic changes must be taken into account when deciding about drug dosing in this age group. Aspects of dose reduction, titration of drugs, dosing intervals, and the pharmacodynamic effects of each class of anesthetic drugs should be considered. Moreover, further studies should be done with a large sample size involving multiple centers should be carried out to get robust data in this regard.

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