



THE RESEARCH OF BRADYCARDIA AND HYPOTENSION INCIDENTS RATE DURING EPIDURAL ANAESTHESIA IN PATIENTS UNDER THE GENERAL AND ORTHOPEADIC SURGERY

VYTAUTAS MAČIULIS¹, RŪTA PAŠKAUSKAITĖ², AGNĖ ŽUKAITIENĖ², ANDRIUS MACAS^{1,2}

LITHUANIAN UNIVERSITY OF HEALTH SCIENCES, DEPARTMENT OF ANAESTHESIOLOGY, KAUNAS, LITHUANIA

LITHUANIAN UNIVERSITY OF HEALTH SCIENCES, ACADEMY OF MEDICINE, KAUNAS, LITHUANIA

ABSTRACT

Background: it was decided to make a retrospective study about the frequency and value cardiovascular events (hypotension and bradycardia) and correlation between potential relevant risk factors during perioperative period of patients who underwent epidural anaesthesia during general and orthopaedic surgery.

Methods: 48 patient were randomly included in general surgery and 74 patients in orthopaedic surgery groups. General surgery group (GG) received standard general-epidural anaesthesia and orthopaedic surgery group (OG) received standard spinal-epidural anaesthesia. Results were analysed by surgery type. Observed conditions which increase rate of cardiovascular complications: age <65 and ≥65 years, chronic diseases, cardiovascular diseases, ASA physical status.

Results: in GG (48) was 22,9% patients with bradycardia and 12,5% patients with hypotension, in OG (74) was 24,3% patients with bradycardia and 13,5% patients with hypotension ($p>0,05$). In GG was 63,6 % ≥65 age patient with bradycardia, hypotension in GG occurred to 66,7% ≥65 years patient. In GG 81,8% patients with bradycardia had chronic diseases ($p<0,05$). Hypotension data: 83,3% patients had chronic diseases ($p<0,05$). There was 72,7% of those with bradycardia had cardiovascular diseases ($p<0,05$); it was 83,3% of those with hypotension had cardiovascular diseases ($p<0,05$). In OG was 61,1% ≥65 years patient with bradycardia, hypotension in this group occurred to 60% ≥65 years patient. 77,8% patients with bradycardia in this group had no chronic diseases. Hypotension data of OG: 70% patients had no chronic diseases. There was 77,8% of those with bradycardia had no cardiovascular diseases; it was 80% of those with hypotension had no cardiovascular diseases. The most common ASA physical status among patients with both bradycardia and hypotension episodes in GG was ASA-3 (81,8%), while in OG the most common was ASA-2 (66,7%) physical status.

Conclusions: the rate of bradycardia and hypotension in both groups statistically insignificant. The risk factors had significant influence in general surgery group. Patients in the general surgery group who experienced bradycardia and hypotension events often had more severe ASA physical status (ASA 3) than patients in orthopaedic surgery group (the most common was ASA 2) and that could be the reason of greater significant risk factors influence in general surgery group.

Key words: epidural, anaesthesia, bradycardia, hypotension, general, orthopaedic, surgery.

Introduction

In these days epidural anaesthesia is one of the most common anaesthetic and analgesic components of intraoperative and postoperative analgesia. [1] Effect on the sympathetic nervous system of regional anaesthesia may be useful in certain situations such as reducing blood loss during pelvic or lower extremity surgery, reducing the incidence of deep vein thrombosis after orthopaedic surgery, improving graft patency rate after lower extremity revascularization and reducing the stress response during perioperative period. [2, 3] Despite of all the benefits, epidural anaesthesia can cause unpleasant repetitive blood pressure and heart rate variations during and after the surgery. [1] During epidural blockade vasodilatation and decreased venous return occurs and it can result in arterial hypotension. Furthermore decreased venous return and blocking of Th 1-4 sympathetic fibers during thoracic epidural anaesthesia (TEA) can cause bradycardia. [4] In addition, changes in cardiac nerves, arterioles structure and attenuation of the sympathetic nerve system tone during the increasing age can lead to hemodynamic instability. [5] The group of elderly patients are more vulnerable during the TEA, because of the greater sensitivity to volumetric cardiovascular system status as a result of impaired autonomic nervous system control and diastolic function. [6] Although significance of epidural anaesthesia in surgery is increasing, it is necessary to bear in mind that perioperative complications can undesirably aggravate the patient's condition and cause difficult management problem: "the episodes when systolic blood pressure was less than 80 mmHg indicated in 41% of patients and 93% of patients had at least one systolic blood pressure reductions > 20% of the initial level. "[7] In Italy, a survey conducted in hip prosthesis, showed that clinically significant hypotension occurred in 13 patients who had epidural blockade (18%) and 16 patients who had epidural-general anaesthesia (22%). [8] Authors decided to do a retrospective research about one the most common cardiovascular system events (hypotension and bradycardia) during epidural anaesthesia which was used as anaesthetic and analgesic component in perioperative period. In this research were selected patients who underwent major

orthopaedic and general surgery and were observed in the Central Department of Anaesthesiology intensive observation ward in The Hospital of Lithuanian University of Health Sciences Kauno Klinikos in 2015.

Methods

Participants and the main criteria

For a retrospective study there were 48 randomly selected patient who underwent general surgery and 74 who underwent orthopaedic surgery. All patients were adults and had I-IV ASA physical status. General surgery group received standard general-epidural anaesthesia and orthopaedic surgery group received standard spinal-epidural anaesthesia. Results were analysed by surgery type. The main perioperative cardiovascular complications which was observed is bradycardia and hypotension. Value of bradycardia was taken as heart rate <50 beats/min, and value of hypotension was taken as blood pressure <90/60mmHg.

Additional criteria

In each group was observed conditions which can increase rate of cardiovascular complications: age <65 and ≥65 years, chronic diseases, cardiovascular diseases and ASA physical status class. Based on Lee's criteria we considered chronic diseases such as diabetes on insulin, renal insufficiency; the most important cardiovascular diseases was considered myocardial infarction, congestive heart failure, coronary heart disease, cerebrovascular disease. The main perioperative cardiovascular complications which was observed is bradycardia and hypotension.

Statistical analysis

Statistical analysis was performed with SPSS 13.0 program packet. It was used the Independent-Samples T-test and Chi-Square test. Results with values of $p < 0.05$ were considered statistically significant.

Results

There were 48 randomly selected patient who underwent general surgery with epidural-general anaesthesia and 74 who underwent orthopaedic surgery with epidural-spinal anaesthesia. In general surgery group (GG) was 30 (62,5%) males and 18 (37,5%) females. In orthopaedic group (OG) was 30 (40,5%) males and 44 (59,5%) females. There were 23 elderly patients (≥ 65) in GG and 42 patients in OG. Younger than 65 years old were 25 (GG) and 32 (OG) patients. In GG distribution of ASA physical status was: ASA I - 0 patients, ASA II - 21 patients, ASA III - 25 patients and ASA IV - 2 patients. Meanwhile in OG distributions was: ASA I - 7 patients, ASA II - 50 patients, ASA III - 16 patients, ASA IV - 1 patients. [table 1].

Table 1: Demographic data and characteristics of patients.

	GENERAL SURGERY GROUP (GG)	ORTHOPAEDIC GROUP (OG)
Patient	48	74
Gender (M/F)	30/18	30/44
Age (< 65/ ≥ 65) years	25/23	32/42
ASA I/II/III/IV	-/21/25/2	7/50/16/1

In general surgery group (GG) overall was 11 (22,9 %) patients who had bradycardia episode and 6 (12,5%) patients who had hypotension during perioperative period ($p > 0,05$). In orthopaedic surgery group (OG) was 18 (24,3%) patients who had bradycardia episode and 10 (13,5%) patients who had hypotension during perioperative period ($p > 0,05$). [table 2]

Table 2: the surgery groups and cardiovascular events (hypotension, bradycardia) data.

	GENERAL SURGERY GROUP (GG)		ORTHOPAEDIC SURGERY GROUP (OG)	
Bradycardia outcome	11	22,9 %	18	24,3 %
Non-bradycardia outcome	37	77,1 %	56	75,7 %
Hypotension outcome	6	12,5 %	10	13,5 %
Non-hypotension outcome	42	87,5 %	64	86,5 %

In addition in each group was observed conditions which can increase rate of cardiovascular complications: age <65 and ≥65 years, chronic diseases, cardiovascular diseases and ASA class.

In general surgery group was 4 (36,4 %) <65 years old patient who had bradycardia and 7 (63,6 %) who was ≥65 age ($p > 0,05$). Hypotension in this group occurred to 2 (33,3%) <65 years old patient and 4 (66,7%) who was ≥65 age ($p > 0,05$). In orthopaedic surgery group was 7 (38,9%) <65 years old patient who had bradycardia and 11 (61,1%) who was ≥65 age ($p > 0,05$). Hypotension in this group occurred to 4 (40%) <65 years old patient and 6 (60%) who was ≥65 age ($p > 0,05$). [table 3]

Table 3: the surgery groups, age and cardiovascular events (hypotension, bradycardia) data.

	GENERAL SURGERY GROUP (GG)		ORTHOPAEDIC SURGERY GROUP (OG)	
Bradycardia + ≥ 65 years	7	63,6 %	11	61,1 %
Bradycardia + < 65 years	4	36,4 %	7	38,9 %
Hypotension + ≥ 65 years	4	66,7 %	6	60 %
Hypotension + < 65 years	2	33,3 %	4	40 %

In GG 9 (81,8%) patients who experienced bradycardia during perioperative period had chronic diseases ($p < 0,05$) and 2 (18,2%) who had not. Respectively hypotension data was: 5 (83,3%) patients who had chronic diseases ($p < 0,05$) and 1 (16,7%) who had not. In OG 4 (22,2%) patients who experienced bradycardia during perioperative period in this group had chronic diseases ($p > 0,05$) and 14 (77,8%) who had not. Respectively hypotension data of orthopaedic surgery group was: 3 (30%) patients who had chronic diseases ($p > 0,05$) and 7 (70%) who had not. [table 4]

Table 4 : the surgery groups, chronic diseases and cardiovascular events (hypotension, bradycardia). data

	GENERAL SURGERY GROUP (GG)		ORTHOPAEDIC SURGERY GROUP (OG)	
Bradycardia + chronic diseases	9	81,8 %	4	22,2 %
Bradycardia without chronic diseases	2	18,2 %	14	77,8 %
Hypotension + chronic diseases	5	83,3 %	3	30 %
Hypotension without chronic diseases	1	16,7 %	7	70 %

Furthermore there was 8 (72,7%) in GG of those with bradycardia episode had cardiovascular diseases ($p < 0,05$) and 3 (27,3%) had not; and situation with hypotension was 5 (83,3%) of those with hypotension episode had cardiovascular diseases ($p < 0,05$) and 1 (16,7%) had not. In OG were 4 (22,2%) of those with bradycardia episode had cardiovascular diseases ($p > 0,05$) and 14 (77,8%) had not; and situation with hypotension was 2 (20%) of those with hypotension episode had cardiovascular diseases ($p > 0,05$) and 8 (80%) had not. [table 5]

Table 5: the surgery groups, cardiovascular diseases and cardiovascular events (hypotension, bradycardia) data

	GENERAL SURGERY GROUP (GG)		ORTHOPAEDIC SURGERY GROUP (OG)	
Bradycardia + cardiovascular diseases	8	72,7 %	4	22,2 %
Bradycardia without cardiovascular diseases	3	27,3 %	14	77,8 %
Hypotension + cardiovascular diseases	5	83,3 %	2	20 %
Hypotension without cardiovascular diseases	1	16,7 %	8	80 %

Distribution of ASA physical status among patients with bradycardia episode in general surgery group was: ASA-1 0 (0%), ASA-2 2 (18,2%), ASA-3 9 (81,8%), ASA-4 0 (0%); among patients with hypotension episode in general surgery group was: ASA-1 0 (0%), ASA-2 1(16,7%), ASA-3 4 (66,7%), ASA-4 1 (16,6%). ASA physical status among patients with bradycardia episode in orthopaedic surgery group distributed: ASA-1 2 (11,1%), ASA-2 12 (66,7%), ASA-3 4 (22,2%), ASA-4 0 (0%); among patients with hypotension episode in orthopaedic surgery group: ASA-1 0 (0%), ASA-2 6 (60%), ASA-3 3 (30%), ASA-4 1 (10%). [table 6]

Table 6: the surgery groups, ASA physical statuses and cardiovascular events (hypotension, bradycardia) data.

	GENERAL SURGERY GROUP (GG)		ORTHOPAEDIC SURGERY GROUP (OG)	
ASA I/II/III/IV + bradycardia	-/2/9/-	-/18,2 %/81,8 %/-	2/12/4/-	11,1%/66,7%/22,2%/-
ASA I/II/III/IV + hypotension	-/1/4/1	-/16,7%/66,7%/16,6%	-/6/3/1	-/60%/30%/10%

Conclusions

1. In both cohorts the rate of bradycardia and hypotension was slight and statistically insignificant.
2. The investigated factors such as age over 65 years, chronic diseases and cardiovascular diseases had significant influence to bradycardia and hypotension in the general surgery group where patients experienced epidural-general anaesthesia in perioperative period.
3. Among patients in the general surgery group the most common ASA physical status was ASA-3 both in bradycardia and hypotension events. Respectively in the orthopaedic group the most common was ASA-2 both in bradycardia and hypotension.

Discussion

The results of research was common to other performed studies and revealed that epidural anaesthesia as anaesthetic and analgesic component was used safe enough by anaesthesiologists in The Hospital of Lithuanian University of Health Sciences Kauno Klinikos in 2015 and didn't caused severe issues during perioperative period. In authors' opinion the influence of relevant side factors (age over 65 years, chronic diseases and cardiovascular diseases) to investigated cardiovascular events (bradycardia and hypotension) was significantly greater in the general surgery group due to the higher rate of grave ASA physical status. Among general surgery group patients the most common ASA physical status both in bradycardia and hypotension was ASA 3, while in orthopaedic surgery group the most common was ASA 2. In that case we could suggest conclusions that in general surgery group patients were more severe and possibly had more additional factors which could influence frequent relevant side factors. In authors' opinion that could be reasonable to make wider retrospective study and to research other possibly meaningful factors in each surgery-type based group which can influence bradycardia and hypotension appearance during the perioperative period. Those possibly meaningful factors could be preoperative uncorrected severe patient's conditions (severe anaemia, electrolyte imbalance, cachexia, etc.) and surgery technique (laparoscopic or laparotomic, other specific manipulations in abdominal or pelvic cavities).

Funding

Authors research has not received any financial funding from commercial, private, public or non-for-profit sources.

Disclosures

There was no conflict during the research and all of the authors approved the final article.

References

1. Zhu J, Zhang X, Yang H. Effects of combined epidural and general anesthesia on intraoperative hemodynamic responses, postoperative cellular immunity, and prognosis in patients with gallbladder cancer. A randomized controlled trial. *Medicine*. 2017; 96:10 (e6137).
2. Broussard D, Ural K. Cardiovascular problems in the post-anesthesia care unit (PACU). [Internet] March 2017. [cited 2017 March 15] Available from: <https://www.uptodate.com/contents/cardiovascular-problems-in-the-post-anesthesia-care-unit-pacu>
3. Falk SA, Fleisher LA. Overview of anesthesia and anesthetic choices. 2017 March. [cited 2017 March 20] Available from: <https://www.uptodate.com/contents/overview-of-anesthesia-and-anesthetic-choices>
4. Curatolo M, et al. Factors Associated With Hypotension And Bradycardia After Epidural Blockade. *Anesth Analg*. 1996; 83:1033-40.
5. Wink, J. et al. "Upper Thoracic Epidural Anaesthesia: Effects Of Age On Neural Blockade And Cardiovascular Parameters" *Acta Anaesthesiologica Scandinavica*. 2013; 57: 767-775.
6. Wink J, Veering B, Aarts L, Wouters P. Effect of increasing age on the haemodynamic response to thoracic epidural anaesthesia. *European Journal of Anaesthesiology*. 2014;31(11):597-605.
7. Bijker JB, van Klei WA, Kappen TH, van Wolfswinkel L, Moons KG, Kalkman CJ. Incidence of intraoperative hypotension as a function of the chosen definition: literature definitions applied to a retrospective cohort using automated data collection. *Anesthesiology*. 2007; 107(2) : 213-20.
8. Fanelli G, Casati A, Berti M, Rossignoli L. Incidence of hypotension and bradycardia during integrated epidural/general anaesthesia. An epidemiologic observational study on 1200 consecutive patients. Italian Study Group on Integrated Anaesthesia. *Minerva Anesthesiol*. 1998 Jul-Aug;64(7-8):313-9.