

Postoperative Treatment of Hypertensives by Epidural Lumbar Anesthesia

Masuichiro OKA

*Oral Surgery, Faculty of Dentistry,
Kyushu University. (Prof. Hiroshi Fujino in Charge)
Anesthesiology, Yamaguchi University School of Medicine
(Prof. Hiroshi Takeshita in Charge)
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INTRODUCTION

With the rapid progress of anesthetic technique most of the operations that were considered infeasible some ten years ago have become workable; thus the number of operations on elderly patients under general anesthesia has been increasing not only in the field of general surgery but also in the dental field.

Since many elderly patients suffer from dehydration and circulatory insufficiencies especially high blood pressure, they often die of circulatory arrest or cerebral hemorrhage due to excessive stimulus provoked by anesthesia, sudden postural change during and after the operation, shivering, hypoxemia and spontaneous pain immediately after the operation. Thus careful observation should be taken for controlling the physical condition of elderly patients during and after the operation.

As one of the measures for the postoperative care of patients with hypertension, epidural lumbar anesthesia was carried out, and the results proved to be very useful.

SUBJECTS AND METHODS

Sixteen patients (TABLE 1) whose blood pressure was more than 180/90 mmHg were selected from the subjects over 55 years of age hospitalized in the Medical and Dental Departments of Kyushu University and operated upon under general anesthesia.

In every case a Teflon catheter (Hakko Shoji Ltd., Japan) was inserted into the epidural cavity prior to the general anesthesia, and 5 to 10 ml of 0.5 % lidocaine hydrochloride or mepivacaine hydrochloride was injected through the catheter just 10 minutes before the end of the operation.

1. Method for epidural lumbar anesthesia:

Expecting an effective result within a certain extent, Moore's method⁷⁾ was adopted using Touhy's needle inserted between the 3rd and 4th lumbar vertebra,

TABLE 1. 16 Cases treated with epidural lumbar anesthesia

	Name	Sex	Age	Weight (kg)	Blood Pressure (mmHg)			
					Before Operation		After Operation	
					Systolic B.P.	Diastolic B.P.	Systolic B.P.	Diastolic B.P.
1	H. N.	M	64	54	200	138	168	78
2	E. K.	F	70	50	210	90	174	70
3	M. Y.	M	75	73	182	90	150	70
4	K. T.	M	68	52	180	92	145	76
5	T. M.	F	58	42.5	180	100	140	90
6	Z. K.	M	68	60	186	100	150	85
7	H. S.	F	58	56.5	206	130	175	80
8	G. K.	M	60	63	196	100	145	75
9	K. K.	F	59	44.5	180	100	160	65
10	U. M.	F	56	66	160	100	140	70
11	T. Y.	M	55	60	166	104	140	80
12	S. M.	F	56	54	160	110	142	75
13	S. A.	M	55	49	156	100	140	70
14	K. S.	M	62	85	180	115	160	80
15	M. H.	M	69	51.5	190	90	170	60
16	G. I.	M	70	60	230	120	160	80
Average value					185.1	104.8	153.7	75.3

with an epidural catheter inserted cephalad about 2 to 3 cm to where the tip of the needle reaches the epidural cavity. The equipment used, drugs, dosage and extent of hypesthesia are shown in FIG. 1. Those cases in which hypesthesia in the cutaneous sensibility zone was proved to extend over the 10th thoracic vertebra were excluded from this study.

2. The determination of blood pressure :

In order to minimize the irregularity of blood pressure, the blood pressure was measured by the indirect method in accordance with what was pointed out by K. Kato⁴⁾.

3. The determination of tidal volume and minute volume :

Tidal volume was determined 5 times and minute volume 3 times with a Wright's respirometer (BOC Ltd., England) and the results are shown in the averaged value.

4. The determination of pH :

An Astrup microequipment AME 1 (Radiometer Ltd., Denmark) was used for the pH determination.

5. The determination of PCO₂, base excess (BE) :

The determination was made with Siggaard-Andersen's curve nomogram (1962) after having obtained 3 different pH values using 2 kinds of mixed gas, 4 % CO₂ and 96 % O₂, 8 % CO₂ and 92 % O₂ (Takachiho Chemicals Ltd., Japan), for which an Astrup microequipment AME 1 was used.

TABLE 2. Variation of blood pressure, tidal volume, minute volume and acid-base balance.
Blood pressure

		Before operation (previous day)	After operation (two hr's later)
Control group (10 cases)	Systolic B. P.	186.0	203.5
	Diastolic B. P.	102.6	132.4
Group receiving epidural anesthesia (16 cases)	Systolic B. P.	185.1	153.7
	Diastolic B. P.	104.8	75.3

Tidal volume and minute volume (ml/min.)

	Before operation		After operation	
	Tidal volume	Minute volume	Tidal volume	Minute volume
Control group (10 cases)	365.4	4260.3	372.3	4116.1
Group receiving epidural anesthesia (14 cases)	382.0	4403.2	394.4	4260.5

pH, PCO₂ (mmHg), BE (mEq/l), PO₂ (mmHg)

	Before operation				After operation			
	pH	PCO ₂	BE	PO ₂	pH	PCO ₂	BE	PO ₂
Control group (10 cases)	7.395	38.4	0	84.0	7.332	37.2	-4.5	65.6
Group receiving epidural anesthesia (14 cases)	7.410	40.3	+1.0	92.0	7.315	39.6	-4.6	62.5

6. The determination of PO₂ :

The determination was made with a PO₂ electrode of an I.L. meter model 113 (I. L. Ltd., USA).

7. Respiration and pulse rates were checked every 5 minutes and the excessively abnormal cases were excluded from this study.

RESULTS

The result of clinical study is shown in TABLE 2. Gradual up-curving of blood pressure was recognized after the operation among those patients older than 55 who suffered from high blood pressure before the operation. As shown in TABLE 3, a strong tendency of high blood pressure was observed in the cases in which

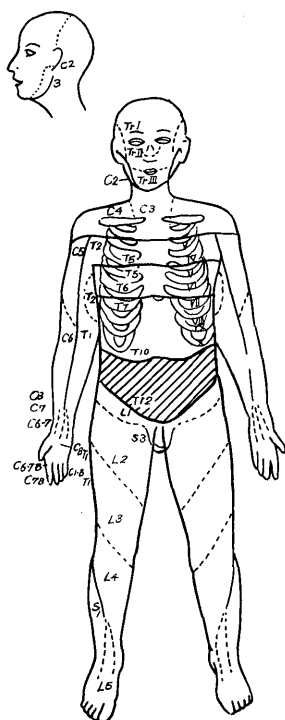
cerebral hemorrhage was anticipated, and a rise of diastolic blood pressure was particularly notable.

In the group receiving epidural lumbar anesthesia, a fall of blood pressure, as much as 30–40 mmHg, was noticed in both systolic and diastolic pressures. However, there was no significant difference between the group receiving epidural anesthesia and the control group as far as respiration, pulse rate, tidal volume, minute volume and artery blood PCO_2 were concerned.

In comparing the postoperation results of the control and subject groups, a decrease of pH, base excess and PO_2 after the operation were recognized, but no difference was noticed between the two groups.

DISCUSSION

The results⁵⁾ of the study which has been conducted on hypertensives at Hisayama-cho, Fukuoka Prefecture by the Second Internal Medicine Department of Kyushu University (TABLES 3, 4 and FIG. 2) show a rapid increase of mortality rate of both male and female patients who are elder than 70 and suffer from high blood pressure.



Extent :

Hypesthesia T_{10} – T_{12} (FIG. on the left)

Drug :

0.5 % Lidocaine hydrochloride

0.5 % Mepivacaine hydrochloride

Dosage :

Single dosage 5–10 c.c. (6.5 c.c. on the average)

Effective period :

30–55 minutes (43 minutes on the average)

FIG. 1. Extent of epidural anesthesia, drug²⁾ and dosage.

TABLE 3. Mortality rate of hypertensives when classified by sex and age (reported by Katsuki)⁵⁾

Mortality rate	Male			Female			Total		
	Death No. of rate subjects	No. of death	Mortality rate (%)	Death No. of rate subjects	No. of death	Mortality rate (%)	Death No. of rate subejcts	No. of death	Mortality rate (%)
40 - 49	31	2	6.5	28	0	0	59	2	3.4
50 - 59	45	7	15.6	44	3	6.8	89	10	11.2
60 - 69	78	3	16.7	67	6	8.9	145	19	13.1
70 - 79	29	14	48.3	56	15	26.8	85	29	34.1
80 -	7	3	42.9	25	18	72.0	32	21	66.7
Total	190	39	20.5	220	42	19.1	410	81	19.8

TABLE 4. Causes of death of hypertensives when classified by age (reported by Katsuki)⁵⁾

	Age			Total	
	40 - 59	60 - 69	70 -		
No. of hypertensives	148	145	117	410	%
No. of death	12	19	50	81	100
Impaired cerebral vascular diseases	9	7	13	29	36
Cerebral hemorrhage	7	3	2		
Cerebromalacia	0	4	8		
Spider membrane hemorrhage	1	0	2		
Bleeding,? Infarction?	1	0	1		
Heart infections			12	12	15
Hypertensive heart disease			6		
Myocardial infarction			1		
Arteriosclerotic heart disease			1		
Malignant tumor	2	5	5	12	15
Bronchopneumonia	1	1	9	11	13
Other natural death		4	9	13	
Urinemia	0	0	0		
Rupture of abdominal aortic aneurysm		1			
Accidental death		2	2	4	

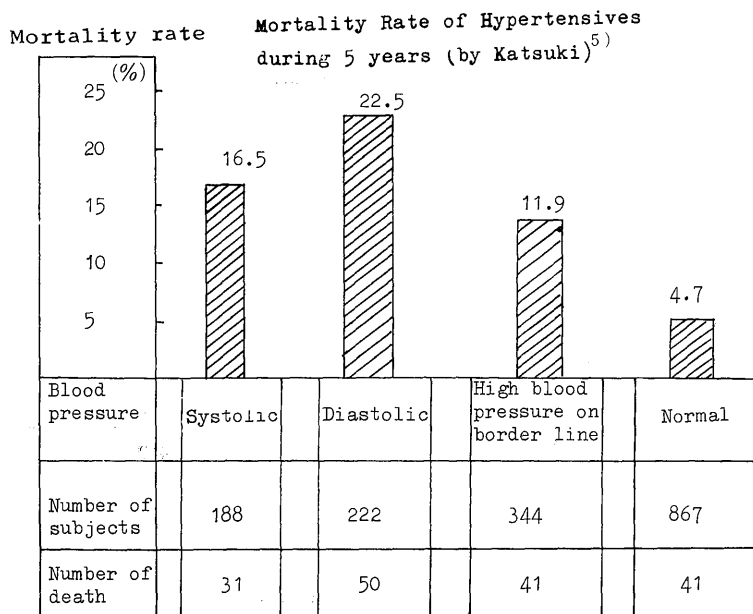


FIG. 2. Prognosis of hypertensives
Cases with higher diastolic pressure are most unfavorable

This study shows a significant result that high blood pressure causes various kinds of complications among middle-aged to elderly patients and often leads to a fatal condition.

Most causes of deaths were proved to be attributable to the cerebrovascular disturbance as shown in TABLE 4. The deaths caused by cerebral hemorrhage were frequent among middle-aged patients (40-50) and those deaths caused by cerebromalacia were frequent among patients over 70 years of age.

As depicted in FIG. 2, the prognosis of those hypertensives, whose high diastolic pressure is conceivably imputable to the rise of peripheral vascular resistance, is more likely unfavorable than the prognosis of those with high systolic blood pressure. Therefore, epidural lumbar anesthesia was applied for the purpose of not only preventing such an unexpected result but also appropriately lowering diastolic blood pressure which can be influenced by the changes of peripheral vascular resistance.

Epidural lumbar anesthesia for hypertensives is generally considered a contraindication since it causes a sudden depression of blood pressure. But it is entirely safe for the patient when vigilant attention is given to the total dose and concentration of drug injected, site of injection, level of hypesthesia, speed of injection, posture of patient and so on.

FIG. 3 and 4 show typical cases of the control group and the group receiving epidural lumbar anesthesia.

Hypertensives described in FIG. 3 showed a gradual rise of blood pressure due

to postoperative shivering, pain and hypoxemia, up-curving of 20–30 mmHg and 30–40 mmHg in systolic and diastolic pressures respectively. No improvement was observed although oxygen was supplied for the purpose of curing postoperative hypoxemia, and the administration of sedatives, urination and thermoregulation were done for the therapy of shivering. Since the clouding of consciousness and the suppression of breathing were noticed approximately 2 hours after the operation, intermittent positive pressure breathing using a Bird's respirator (Bird Ltd., USA) was applied to the patient. The patient was fortunately saved from death but suffered from left hemiplegia from the secondary day. This was conceivably attributable to cerebral hemorrhage caused by the afore-mentioned causes in addition to the hypertensive condition prior to the operation.

On the other hand, the elevation of postoperative blood pressure was successfully prevented by timely epidural anesthesia as shown in FIG. 4. The fall in the systolic and diastolic pressures were recorded 40–50 mmHg and 30–40 mmHg respectively when epidural lumbar anesthesia was administered.

As for the acid-base balance in the patient with spinal anesthesia, Paskin¹⁰⁾ reported that there was no difficulty in gas exchange in such cases where the patients suffered from chronic obstructive pulmonary disease, and anesthetized up to the middle of the thorax or above. Askrog¹⁾ and Jong³⁾ reported that no significant difference was noticed either in PCO_2 or PO_2 when spinal anesthesia was applied for the patient receiving on operation of the hypogastric region. In this clinical study also no abnormalities in gas exchange were recognized during the procedure except a fall of PO_2 immediately after the operation.

However, pH was registered 7.410 to 7.315 and the base excess showed a decrease from +1.0 mEq/l to -4.6 mEq/l after the operation as if metabolic acidosis occurred. As to why such a metabolic abnormality was created, quite a few causes⁶⁾⁸⁾¹¹⁾¹²⁾ can be considered. As reported by Oka⁹⁾, base excess occasionally indicates a lower value as if there exists a hypercapnia status when determined by an Astrup pH meter. Thus postoperative PCO_2 was examined. As a result, there existed no hypercapnia with 37.2 mmHg in the control group and 39.6 mmHg in the group receiving epidural lumbar anesthesia. It can hardly be considered, however, as an error in a method adopted for the determination.

When the nerve block due to epidural lumbar anesthesia reaches an high level, as pointed out by Fukuda²⁾, the blood pressure will decrease because of the cardiac depression due to nerve block and the decrease of venous return due to the dilatation of peripheral vascular bed. This hypotension is said to cause tissue hypoxia and metabolic acidosis.

When I come to think of the fact that the lower value of base excess exists even in the control group in this study, it could be assumed as the particular postoperative phenomenon which occurs when elderly patients were operated upon. In the postoperative conditions which Yamamura¹²⁾ had referred to, there appeared hypoxemia.

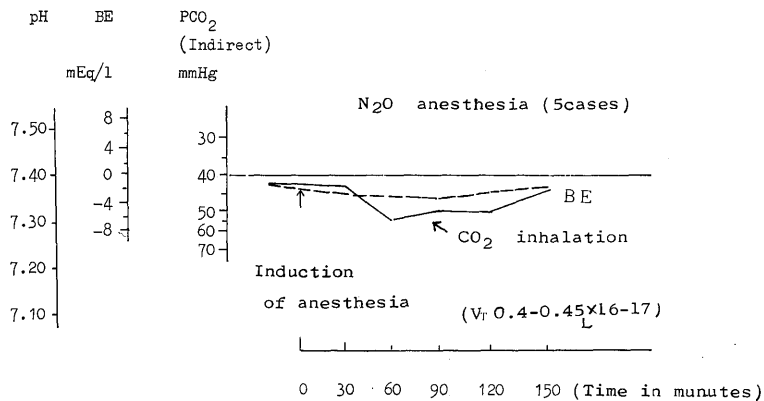


FIG. 5. The base excess does indicate a lower value sometimes should there exist a hypercapnia status when determined by an Astrup pH meter.

The variation⁸⁾ of postoperative electrolyte value is more or less considered to be related to the deterioration of acid-base balance. As a countermeasure against such metabolic acidosis, the variation of postoperative electrolyte value has to be fully studied along with the postoperative treatment of elderly patients in general.

CONCLUSION

Those patients who were hypertensive before the operation often suffer from excessively high blood pressure after the operation, and such an elevation of blood pressure could hardly be prevented in most instances in spite of every therapeutic means for the possible causes.

In those cases, particularly when the patients have high diastolic pressure, they often die of cerebral hemorrhage immediately after the operation if no treatment is made for the patients. Intensive care should, therefore, be taken for the postoperative treatment of hypertensives. In this study, epidural lumbar anesthesia was done for 16 patients over 55 years of age on an operation list whose blood pressure was 180/90 mmHg, aiming at the prevention of their postoperative elevation of blood pressure by decreasing systolic and diastolic pressure by 30–40mmHg respectively. All results were very hopeful and no side effects were recognized. It can be concluded that epidural anesthesia is one of the best postoperative treatments for the hypertensive.

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