Andrology and fertility

A case of pheochromocytoma crisis with persistent hypotension successfully managed with vasopressin

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ABSTRACT

We report the first case of pheochromocytoma crisis with hypotension that was successfully treated with vasopressin. A 64-year-old patient was diagnosed as pheochromocytoma crisis. Although irregularities in circulating plasma volume were corrected by fluid management, hypotension due to vasodilation persisted. Since it was considered to be desirable to use a vasoconstrictor whose action was not mediated via adrenergic receptors, we administered vasopressin as a non-adrenergic vasopressor. Consequently, sufficient vasoconstriction and pressor effect were achieved without any complications. Finally, the adrenalectomy was performed safely. Vasopressin might be effective and safe treatment for pheochromocytoma crisis with hypotension caused by vasodilation.

Introduction

Pheochromocytoma crisis is characterized by marked hypertension. Rarely, however, hypotension is observed, which is sometimes so difficult to treat that the patient requires mechanical circulatory support. 1 We report that use of vasopressin to treat pheochromocytoma crisis with hypotension, which persisted despite adequate fluid management under cardiorespiratory monitoring.

Case presentation

A 64-year-old patient with a history of hypertension and type 2 diabetes was brought to our hospital due to palpitations and feeling sick. Evaluation showed hypertension alternating with hypotension every 20 minutes (range 230/120 to 50/30). Pulse rate was 133/minute. Urinary and plasma catecholamine levels were abnormally high. Abdominal plain CT revealed an 80 × 50 mm right adrenal tumor. Hence, the patient was diagnosed as right pheochromocytoma with pheochromocytoma crisis. On ICU admission, PiCCO2® (cardiorespiratory monitor, Getinge Group Japan) monitoring was started. PiCCO2® revealed decreased circulating plasma volume and increase in systemic vascular resistance index (SVRI), indicating vasoconstriction. Fluctuations in blood pressure and heart rate subsided on the first in-patient day after fluid management and intravenous infusion of nicardipine 1 mg/hr. The next day, although there were no signs of multiorgan failure that might cause cardiogenic shock, blood pressure decreased to 78/40 mmHg despite an increase in circulating plasma volume based on PiCCO2® monitoring. Considering the decrease in SVRI, we suspected vasodilation as the cause of hypotension and commenced administration of 1 unit/hr vasopressin. As a result, SVRI and blood pressure successfully increased, as shown in Fig. 1. On the fourth in-patient day, PiCCO2® monitoring was terminated because of hemodynamic improvement. Since hypotension still persisted, vasopressin was continued to maintain blood pressure. On the tenth in-patient day, since the patient’s general condition had stabilized without vasopressin, the patient was moved from the ICU to a regular ward and doxazosin 1 mg/day was started as standard preoperative treatment for pheochromocytoma. On the 25th in-patient day, open right adrenalectomy in the supine position was performed, taking all precautions against intraoperative hemodynamic instability. As expected, hypertension and tachycardia were observed intraoperatively, with hypotension after tumor resection. Pathology evaluation of the surgical specimen confirmed the diagnosis and revealed pheochromocytoma of the adrenal gland scaled score (PASS) of 3, indicating a benign tumor. The patient had an uneventful and uncomplicated postoperative course with stable hemodynamics, and was discharged in good condition 15 days postoperatively. The patient’s hypertension and type 2 diabetes improved with no further need for medication.

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Discussion

Pheochromocytoma is a tumor that develops from chromaffin cells in the adrenal medulla. The resultant excessive secretion of catecholamines causes various sympathomimetic symptoms. Pheochromocytoma crisis, due to acute hemodynamic instability caused by excessive catecholamines, can cause multiorgan failure and even death. Control of hemodynamics in patients with pheochromocytoma crisis sometimes requires auxiliary circulatory devices, such as an intra-aortic balloon pump (IABP) and extracorporeal membrane oxygenation (ECMO). Surgical treatment is typically postponed until stabilization of the patient’s general condition.

Vasopressin is a peptide hormone secreted by the posterior pituitary gland that plays a role in maintaining fluid and circulatory homeostasis. There are three subtypes of the vasopressin receptor, V1a, V1b and V2. In particular, V1a and V2 receptors affect hemodynamics. V2 receptors are distributed in the renal collecting duct. Binding of vasopressin to the V2 receptor promotes water reabsorption, resulting in increased fluid volume. In urological practice, desmopressin, which acts selectively on V2 receptors, is used to treat nocturia and nocturnal enuresis associated with polyuria. V1a receptors are distributed on vascular smooth muscle. Binding of vasopressin to V1a receptors causes vasoconstriction and increases vascular resistance. The adverse effects of vasopressin include cardiovascular events and hyponatremia.

Treatment of acute pheochromocytoma crisis includes antihypertensive therapy and fluid management. In this case, although decreased circulating plasma volume was corrected by infusion under monitoring with PiCCO2®, hypotension persisted. Additionally, administration of alpha blockers was contraindicated in this situation. Previous reports suggested that hypovolemia, cardiogenic shock, vasodilation due to beta 2 receptor stimulation, decreased vascular responses due to alpha receptor downregulation, peripheral neuropathy, and decreased baroreceptor responses play a role in hypotension during pheochromocytoma crisis.
Based on the decrease in SVRI, the vasodilation was considered the main cause of hypotension in this case. Since the cause of hypotension was vasodilation rather than cardiogenic shock, we decided to use vasopressin instead of using auxiliary circulatory devices. Further, based on a previous report in which a sympathomimetic drug caused pheochromocytoma crisis, we considered it desirable to use a vasoconstrictor whose action was not mediated via adrenergic receptors, such as vasopressin. This is the first report of use of vasopressin to treat hypotension during pheochromocytoma crisis. Administration of vasopressin resulted in sufficient vasoconstriction and pressor effects, as indicated by the SVRI, with no adverse events. Our experience suggests that vasopressin administration is safe and effective in cases of pheochromocytoma crisis with hypotension due to vasodilation, in which stimulation of the sympathetic nervous system is inappropriate.

Conclusion

We report a case of hypotension during pheochromocytoma crisis. This is the first report of use of vasopressin, a non-adrenergic vasoconstrictor, to stabilize hemodynamics in a patient with hypotensive pheochromocytoma crisis secondary to vasodilation. Vasopressin might be safe and effective in cases of pheochromocytoma crisis with hypotension caused by vasodilation, in whom sympathetic nervous stimulation should be avoided.

Author contributions

Daigo Chiba: Conceptualization, Investigation, Writing - Original Draft.
Yurika Hada: Writing - Review and Editing.
Kenji Numahata: Writing - Review and Editing.
Akihiro Ito: Writing - Review and Editing and Supervision.

Statement of ethics

Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

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Declaration of competing interest

The authors have no conflicts of interest to declare.

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