

## Case Report

# Mobitz Type II Atrioventricular Block Followed by Remifentanyl in a Patient with Severe Aortic Stenosis

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Opioids have been considered for their hemodynamic stability. Remifentanyl is an opioid analgesic with rapid metabolism and fast primary effect and recovery. In this paper, a very rare effect of using remifentanyl along with propofol was presented. An 84-year-old male patient with severe aortic stenosis underwent general anesthesia. In order to induce anesthesia and maintain it, fentanyl, pancuronium, and propofol, along with a combination of propofol and remifentanyl, were used, respectively. At beginning of remifentanyl infusion, bradycardia and then Mobitz type II conduction block with a hemodynamic disorder occurred for the patient. The decreased blood pressure responded to injection of atropine and ephedrine; however, dysrhythmia only improved after cessation of remifentanyl. Therefore remifentanyl should be used with caution in aortic stenosis.

## 1. Introduction

Remifentanyl is a congener of fentanyl family of narcotics which is separable from others for the ester structure. Complications of this drug are like those of other opioids and include bradycardia, itching, nausea, vomiting, and muscular rigidity [1]. Aortic stenosis is the most common valvular disorder of heart which is seen in cardiac rheumatic disease and old ages and is divided to slight, moderate, and severe types based on valvular diameter and transvalvular pressure gradient. Anesthesia in these patients could be accompanied by decreased cardiac output, and cardiopulmonary resuscitation is hardly done at this situation.

In this study, a serious complication of remifentanyl was considered during management of anesthesia in a patient with severe aortic stenosis.

## 2. Case Description

The patient was an 84-year-old man, weighting 72 kg, who was hospitalized for open prostate surgery. In records, the patient was only complaining from exertional dyspnea, had no obvious cardiopulmonary problems, and did not mention using any specific drugs. In the conducted examination,

pulmonary auscultation had no problems. Examination of abdomen and organs was normal, and only IV/VI systolic murmur and a thrill were heard in the aortic area. In order to evaluate the patient before the operation, blood tests, electrocardiogram, and echocardiogram were requested. The only positive point in the lab tests was prothrombin time (PT) = 15.6 sec. In the electrocardiogram (ECG), heart rate was 65 beats per minute, and the rhythm was regular; however, left axis deviation and left ventricle hypertrophy were observed. In echo, ejection fraction was 57%, severe hypertrophy of left ventricle, calcified and narrow aortic valve were reported; also, 52 mm Hg was reported for transvalvular aortic gradient; but, no functional and wall motion disorder was seen for left ventricle.

Vital signs of the patient before the induction were blood pressure of 150/90 mm Hg and heart rate of 60 beats per minute. For anesthetic induction with caution and low dose, 100  $\mu$ g of fentanyl, 4 mg of pancuronium, and 80 mg of propofol were used. After tracheal intubation, in order to maintain anesthesia, a combination of propofol and remifentanyl (200 mg + 500  $\mu$ g) along with 50% oxygen and N<sub>2</sub>O was used. The rate of infusion was 0.2  $\mu$ g/kg/min for remifentanyl. After induction and beginning the infusion of remifentanyl and propofol, the patient suffered from decreased heart rate

(35–40 beats per minute) and decreased blood pressure (80/50 mm Hg); after a few moments, he experienced Mobitz II atrioventricular block (Figure 1). To increase heart rate and sinus control, first, 0.5 mg atropine and then 10 mg ephedrine were injected; however, atrioventricular block was not modified (heart rate of about 40 beats per minute) despite increased blood pressure to 110/75 mm Hg. Then, infusion of remifentanyl was stopped and propofol with rate of 50  $\mu\text{g}/\text{kg}/\text{min}$  was used alone. After about 2–3 min, atrioventricular block and bradyarrhythmia were overcome (Figure 2), and the patient's blood pressure was raised to 130/90 mm Hg. The patient had no hemodynamic problem during the operation, and recovery and was completely under control. He had a little restlessness during the recovery and improved after some minutes. Then, he was transferred to the ward in total awareness with blood pressure of 130/80 and heart rate of 62 beats per minute.

### 3. Discussion

Remifentanyl is a narcotic from the fentanyl's family, which has a rapid primary effect and has a short half life (about 3 min) even after long-term usage; therefore, it is a good choice in total intravenous anesthesia (TIVA) and pain relief in ICU [2]. Due to hemodynamic stability, remifentanyl is used in many cardiac diseases such as Eisenmenger [3], coarctation of aorta [4], and severe aortic stenosis [5, 6], cardiomyopathies [7]. In the elderly, the pharmacokinetic and pharmacodynamic of remifentanyl differ, and there is increased sensitivity of brain to remifentanyl. Also, potency of the drug is twice, and it is required to decrease primary dosage of the drug. Central distribution volume and also clearance decrease, and the amount of infusion should be decreased to 1/3 [8, 9]. However, in some cases, this drug could decrease cardiovascular function, and the patient may suffer from bradycardia and hypotension. Sometimes, severe variations are observed in heart rate which has been reported as a result of predominance of parasympathetic over sympathetic tone and is seen in the patients with junctional rhythms and even temporary sinusoidal arrest, which rapidly improves by injection of anticholinergic drug (atropine) [10, 11]. In Fattorini et al.'s study, as a consequence of stimulating sinus node with increased heart rate to less than 140 beats per minute, Wenckebach atrioventricular block was observed in 7 out of 40 patients, which indicated specific increase in refractory period of the atrioventricular node [10].

Aortic stenosis is one of the most common valvular disorders among the elderly. This disorder occurs in children as a result of bicuspid valve and rheumatic diseases, and, in the elderly, it happens mostly because of degenerative disorders, calcification, and fibrous aortic valve. Aortic stenosis is divided to three: slight, moderate, and severe grades according to the difference in transvalvular gradient (left ventricle and aorta). In the severe and fatal type, gradient difference is more than 50 mm Hg and diameter of aortic valve is less than 0.7  $\text{cm}^2$  in this case [6].

In patients with severe aortic stenosis, performing anesthesia has many risks, and, even performing CPR and using defibrillator have a low degree of success. In these patients,



FIGURE 1: After remifentanyl infusion.

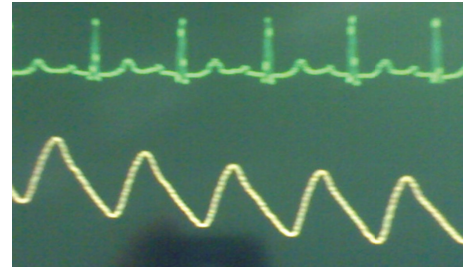


FIGURE 2: After remifentanyl cessation.

due to hypertrophy of left ventricle, the amount of intravascular liquid should be maintained at a desirable and upper normal level; therefore, sometimes, central venous pressure and pulmonary artery pressure are monitored. Increased heart rate could cause ischemia of heart muscle as a result of the decrease in the circulation of coronary blood along with increase in oxygen demand; also, bradycardia causes decrease in cardiac output. Systemic vascular resistance should be also maintained at normal level in order to maintain cardiac output. Increased resistance with increased gradient prevents aortic flow, and decreased resistance of vessels also causes decreased peripheral perfusion and ischemia problems. Decreased blood pressure should be immediately modified by alpha agonists like phenylephrine and metaraminol. Atrial contraction in normal people includes 15–20% of cardiac output; but, in people with severe aortic stenosis, about 40% of cardiac output is caused by atrial contraction, and any nonsinusoidal rhythm decreases cardiac output.

In the surgeries on patients with severe aortic stenosis, regional anesthesia [12] and also general anesthesia could be used; but, regional anesthesia causes sympathectomy and can decrease peripheral vascular resistance. Moreover, bradycardia which follows anesthesia can decrease cardiac output. Thus, in this patient who had 52 mm Hg differences in gradient pressure, general anesthesia was performed. For hemodynamic stability, an opioid base using infusion of remifentanyl was used. Since opioids are not adequately anesthetic by themselves, low dosage of propofol was used for induction, and also remifentanyl was applied for infusion. In order to prevent decreased heart rate, pancuronium was used. In this patient, severe decrease of heart rate was accompanied by Mobitz cardiac block type II, and this variation in heart rate and rhythm caused hemodynamic disorder which did not respond to injection of atropine and ephedrine; only stopping remifentanyl caused improvement.

There have been a limited number of reports on creation of complete heart block following concurrent consumption of propofol, remifentanyl, vecuronium, and sevoflurane [13, 14], but, no case of Mobitz cardiac block type II has been observed. Also, in most of the studies, using anticholinergic before remifentanyl or after the rhythm disorder improves or prevents that signs; however, in this patient, using atropine and also indirect sympathomimetic compound of ephedrine did not solve the rhythm disorder. In the study by Mizuno et al. on a 17-year-old patient, an intermittent bundle branch block followed by bradycardia was reported in the consumption of sevoflurane and remifentanyl, which responded to atropine [15]. In Nishio et al.'s study, a 66-year-old patient with sick sinus syndrome, propofol was used along with sevoflurane and remifentanyl, which did not intensify the disorder in the patient [16]. In Fujii et al.'s investigation (2011), effect of remifentanyl on sinus node and atrial conduction was studied among 60 children, in both of them conduction pathway was inhibited, and no disorder was observed in atrioventricular conduction [17], but, in this paper, the patient suffered from atrioventricular conduction disorder and Mobitz type II block followed by bradycardia.

#### 4. Final Conclusion

In patients with severe aortic stenosis, remifentanyl can be used for hemodynamic stabilization, but, remifentanyl along with propofol could cause conduction disorder and conduction block and should be used with caution in aortic stenosis. In this patient, dysrhythmia and atrioventricular block did not respond to atropine and ephedrine treatment, and only remifentanyl cessation solved the problem.

#### Authors' Contribution

M. T. Gilani contributed to paper preparation and approved the final paper. M. T. Gilani attests to the integrity of the original data and the analysis reported in this paper.

#### Conflict of Interests

The authors declare that they have no conflict of interests.

#### References

- [1] T. D. Egan, "The clinical pharmacology of remifentanyl: a brief review," *Journal of Anesthesia*, vol. 12, no. 4, pp. 195–204, 1998.
- [2] C. L. Westmoreland, J. F. Hoke, P. S. Sebel, C. C. Hug Jr., and K. T. Muir, "Pharmacokinetics of remifentanyl (GI87084B) and its major metabolite (GI90291) in patients undergoing elective inpatient surgery," *Anesthesiology*, vol. 79, no. 5, pp. 893–903, 1993.
- [3] A. Duman, G. Sarkilar, M. Dayioglu, M. Özden, and N. Görmüş, "Use of remifentanyl in a patient with Eisenmenger syndrome requiring urgent cesarean section," *Middle East Journal of Anesthesiology*, vol. 20, no. 4, pp. 577–580, 2010.
- [4] R. Sinha and R. Garg, "Anesthetic management for laparoscopy surgery in a patient with residual coarctation of aorta and mild aortic stenosis," *Journal of Anaesthesiology, Clinical Pharmacology*, vol. 27, no. 3, pp. 412–413, 2011.
- [5] T. T. Lao, M. Sermer, L. MaGee, D. Farine, and J. M. Colman, "Congenital aortic stenosis and pregnancy—a reappraisal," *American Journal of Obstetrics and Gynecology*, vol. 169, no. 3, pp. 540–545, 1993.
- [6] A. M. Ioscovich, E. Goldszmidt, A. V. Fadeev, S. Grisaru-Granovsky, and S. H. Halpern, "Peripartum anesthetic management of patients with aortic valve stenosis: a retrospective study and literature review," *International Journal of Obstetric Anesthesia*, vol. 18, no. 4, pp. 379–386, 2009.
- [7] C. F. Minto, T. W. Schnider, and S. L. Shafer, "Pharmacokinetics and pharmacodynamics of remifentanyl II. Model application," *Anesthesiology*, vol. 86, no. 1, pp. 24–33, 1997.
- [8] C. F. Minto, T. W. Schnider, T. D. Egan et al., "Influence of age and gender on the pharmacokinetics and pharmacodynamics of remifentanyl I. Model development," *Anesthesiology*, vol. 86, no. 1, pp. 10–23, 1997.
- [9] C. P. McCarroll, L. D. Paxton, P. Elliott, and D. B. Wilson, "Use of remifentanyl in a patient with peripartum cardiomyopathy requiring Caesarean section," *British Journal of Anaesthesia*, vol. 86, no. 1, pp. 135–138, 2001.
- [10] F. Fattorini, R. Romano, A. Ciccaglioni et al., "Effects of remifentanyl on human heart electrical system: a transesophageal pacing electrophysiological study," *Minerva Anestesiologica*, vol. 69, no. 9, pp. 673–679, 2003.
- [11] K. Maruyama, Y. Nishikawa, H. Nakagawa, J. Ariyama, A. Kitamura, and M. Hayashida, "Can intravenous atropine prevent bradycardia and hypotension during induction of total intravenous anesthesia with propofol and remifentanyl," *Journal of Anesthesia*, vol. 24, no. 2, pp. 293–296, 2010.
- [12] J. C. Hemming and S. T. Thomas, "Management of patients with valvular heart disease," in *International Practice of Anesthesia*, C. Prys-Roberts and B. R. Thomas Brown, Eds., pp. 3–6, Butterworth Heinemann, Oxford, UK, 1996.
- [13] K. Tanaka, Y. Adachi, S. Suzuki, K. Nishiwaki, and N. Matsuda, "ECG changes after the induction of general anesthesia with remifentanyl: a report of three cases," *Masui*, vol. 61, no. 10, pp. 1128–1132, 2012.
- [14] E. Hamaguchi, H. Kawano, S. Kawahito, H. Kitahata, and S. Oshita, "Torsade de pointes associated with severe bradycardia after induction of general anesthesia," *Masui*, vol. 60, no. 9, pp. 1097–1100, 2011.
- [15] J. Mizuno, S. Kato, K. Ino, T. Yoshimura, S. Yunokawa, and S. Morita, "Intermittent bradycardia-dependent bundle branch block during sevoflurane and remifentanyl anesthesia," *Masui*, vol. 58, no. 8, pp. 976–979, 2009.
- [16] Y. Nishio, K. Hara, G. Obara, and T. Sata, "General anesthesia with remifentanyl for a patient having sinoatrial block and constrictive pulmonary disorder," *Masui*, vol. 57, no. 8, pp. 1002–1004, 2008.
- [17] K. Fujii, H. Iranami, Y. Nakamura, and Y. Hatano, "High-dose remifentanyl suppresses sinoatrial conduction and sinus node automaticity in pediatric patients under propofol-based anesthesia," *Anesthesia and Analgesia*, vol. 112, no. 5, pp. 1169–1173, 2011.