Northwestern Med J.2021;1(3):100-2
doi: 10.5222/NWMJ.2021.41636

Case Report

Supraventricular Tachycardia Induced by Nasal Continuous Positive Airway Pressure

Sürekli Nazal Pozitif Hava Yolu Basıncı ile İndüklenen Supraventriküler Taşikardi

Mervan Bekdas

Cite as: Bekdas M. Supraventricular tachycardia induced by nasal continuous positive airway pressure. Northwestern Med J. 2021;1(3):100-2.

ABSTRACT

The use of noninvasive ventilation in the treatment of respiratory failure has increased in recent years. Nasal continuous positive airway pressure, a noninvasive method of ventilation, is thought to decrease the incidence of arrhythmias, but this case report presents supraventricular tachycardia attacks secondary to nasal continuous positive airway pressure. A 15-month-old boy was admitted to the intensive care unit with diagnoses of sepsis, disseminated intravascular coagulopathy, acute renal failure, and myocarditis. Supraventricular tachycardia attacks started after nasal continuous positive airway pressure but became regular after switching to invasive mechanical ventilation.

Keywords: Respiratory failure, nCPAP, supraventricular tachycardia, child

ÖZ

Solunum yetmezliğinin tedavisinde noninvaziv ventilasyon kullanımı son yıllarda artmıştır. İnvaziv olmayan bir ventilasyon yöntemi olan nazal sürekli pozitif hava yolu basıncının aritmi insidansını azalttığı kabul edilmektedir, ancak bu yazıda sürekli nazal pozitif hava yolu basıncından sonra supraventriküler taşikardi atakları gelişen bir olgu sunulmaktadır. On beş aylık erkek çocuk, yaygın intravasküler koagülopati, akut böbrek yetmezliği ve miyokardit tanıları ile yoğun bakım ünitesine yatırıldı. Supraventriküler taşikardi atakları sürekli nazal pozitif hava yolu basıncı uygulanmasının ardından belirdi, ancak invaziv mekanik ventilasyona geçilince düzeldi.

Anahtar kelimeler: Solunum yetmezliği, nCPAP, supraventriküler taşikardi, çocuk

Received: 12.04.2021
Accepted: 07.07.2021
Publication date: 17.09.2021

Corresponding Author:
Mervan Bekdas
Bolu Abant İzzet Baysal University, Faculty of Medicine, Department of Pediatrics, Turkey
merbek14@yahoo.com
ORCID: 0000-0003-2469-9509

INTRODUCTION

Mechanical ventilation is a life-saving approach in respiratory failure. Noninvasive ventilation (NIV) is considered safer than invasive mechanical ventilation (IMV). It is well known that the use of NIV is associated with shorter ICU stay, lower risk of complications, and mortality rates (1). NIV is effective in reducing respiratory workload, correcting lung complement disorder, or reducing alveolar hypoventilation (2). Nasal continuous positive airway pressure (nCPAP), a NIV method, has been shown to reduce the incidence of arrhythmias (3). However, this case report presents supraventricular tachycardia (SVT) secondary to nCPAP.

CASE REPORT

A fifteen-month-old boy admitted to the hospital with diagnoses of sepsis, disseminated intravascular coagulopathy, acute renal failure, myocarditis, secundum atrial septal defect and bicuspid aorta. It was learned that he was treated with sotalol (2 mg/kg/day) for SVT attacks. His general condition was not good. Therefore, meropenem, teicoplanin, IVIG, (intravenous immunoglobulin) epinephrine (1µg/kg/min) and dopamine (10µg/kg/min) were started. nCPAP (PEEP:5cm$H_2$0) was started when the results of arterial gas analysis were as follows: pH:7.19, pCO_2:73mmHg, and HCO_3:20mmol/L. After nCPAP, he had SVT attack at 25th minute (Figure 1) which was terminated with administration of adenosine. Subsequently, nCPAP was replaced by IMV therapy (PEEP:5cmH_2O, and PIP:15cmH_2O). After 30 minutes, arterial gas analysis revealed pH:7.35, pCO_2:43mmHg, and HCO_3:22.4 mmol/L. On the 7th day of hospitalization, his renal and systolic functions improved, and epinephrine treatment was stopped with tapered dopamine dose. As his blood gas analysis was normal, he was extubated and nCPAP was started after extubation. At the 14th minute, a SVT attack developed again. It was assumed that the first two SVT attacks were due to myocarditis, for this reason the sotalol dose was increased. Blood gas analysis performed on day 20 showed a pH of 7.27 and a pCO_2 of 85 mmHg, and then nCPAP was restarted. On day 20, he had another SVT attack. Finally, it was decided that these attacks were related to nCPAP. Therefore, nCPAP was replaced with IMV therapy. No more SVT attack was observed after this switch.

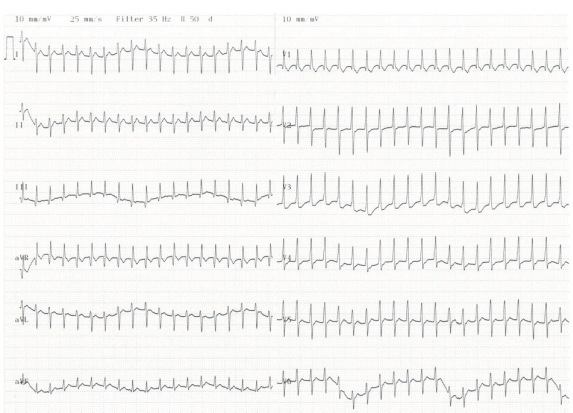

Figure 1. Electrocardiogram of the patient obtained during supraventricular tachycardia

DISCUSSION

It is preferred to use NIV when use of mechanical ventilation support is required in all age groups. NIV can be used in patients who are awake, not agitated, and not in severe respiratory distress while IMV is recommended for individuals who have severe respiratory failure, altered awareness, unstable vital signs, or severe cardiac arrhythmia (4). Sedatives given to these patients can also reduce arrhythmias. However, IMV may also be a cause of arrhythmia in adults (5). NIV is generally accepted to reduce arrhythmias. NIV reduces the frequency and severity of arrhythmias due to decreased sympathetic activity and transmural pressure in the left ventricle (3). On the other hand, it has also been shown that NIV can lead to arrhythmias. There are several reasons for this condition. First, the increased intrathoracic expiratory pressure reduces venous return, these changes lead to a decrease in cardiac output (6). Herewith, NIV is not recommended, especially after cardiac procedures, because it can decrease cardiac output (7). Second, nasal CPAP is known to cause an increase in intrapleural pressure which leads to an increase in right atrial pressure due to a direct mechanical effect (6). Third, CPAP has also been associated with gastric distention in

2% of the patients (8). Gastric distention may lead to increased heart rate due to activation of the sympathetic nervous system while blocking lung expansion (8,9). Finally, nasal skin abrasions, dryness of the nasal mucosa, disruption of nasal mucociliary activity, and inability to tolerate pressure are side effects associated with CPAP therapy (10). These changes cause anxiety in patients. Anxiety can lead to tachyarrhythmia by increasing catecholamines. A decrease in diastolic filling and coronary perfusion during tachycardia causes myocardial hypoxia. This condition increases cardiac irritability (11). The main causes of SVT in this case arose from nCPAP. It should be emphasized that the severe disease state is also an important stressor in this patient (12).

This case shows that NIV can induce SVT in patients with congenital heart disease. Therefore, great care should be taken when using CPAP in these patients.

ACKNOWLEDGEMENTS

Funding source: None

Conflict of Interest: None

REFERENCES

1. Girou E, Schortgen F, Delclaux D, Brun-Buisson C, Blot F, Lefort Y, et al. Association of Noninvasive Ventilation With Nosocomial Infections and Survival in Critically Ill Patients. JAMA 2000;284(18):2361-2367 https://doi.org/10.1001/jama.284.18.2361
2. Ferrer M, Torres A. Pathophysiology of non-invasive ventilation in patients with acute respiratory failure. Minerva Pneumologica 2010;49(3):161-84
3. Dediu GN, Dumitrache-Rujinski S, Lungu R, Frunz-S, Diaconu C, Bartoş D, et al. Positive pressure therapy in patients with cardiac arrhythmias and obstructive sleep apnea. Pneumologia 2015;64(1):18-22
4. Maleh VA, Monadi M, Heidari B, Maleh PA, Bijani A. Efficiency and outcome of non-invasive versus invasive positive pressure ventilation therapy in respiratory failure due to chronic obstructive pulmonary disease. Caspian J Intern Med. 2016;7:99-104
5. Desai R, Patel U, Singh S, Bhuva R, Fong HK, Nunna P, et. Al. The burden and impact of arrhythmia in chronic obstructive pulmonary disease: Insights from the National Inpatient Sample. Int J Cardiol. 2019;281:49-55 https://doi.org/10.1016/j.ijcard.2019.01.074
6. Meurice JC, Mergy J, Rostykus C, Doré P, Paquereau J, Patte F. Atrial arrhythmia as a complication of nasal CPAP. Chest 1992;102(2):640-2 https://doi.org/10.1378/chest.102.2.640
7. Valipour A, Schneider F, Kossler W, Saliba S, Burghuber OC. Heart rate variability and spontaneous baroreflex sequences in supine healthy volunteers subjected to nasal positive airway pressure. J Appl Physiol 2005;99:2137-43 https://doi.org/10.1152/japplphysiol.00003.2005
8. Villanueva AM, Odena MP, Martinon-Torres F, eds. Non-invasive ventilation in pediatrics. 2nd Ed. Madrid:Ergon 2009:81-86
9. Van Orshoven NP, van Schelven LJ, Roelofs JMM, Jansen PAF, Akkermans LMA. Effect of gastric distension on cardiovascular parameters: Gastrovascular reflex is attenuated in the elderly. J Physiol 2004;555(2):573-83. https://doi.org/10.1113/jphysiol.2003.056580
10. Ghadiri M, Grunstein RR. Clinical side effects of continuous positive airway pressure inpatients with obstructive sleep apnoea. Respirology 2020;25:593-602 https://doi.org/10.1111/resp.13808
11. Zile MR, Brutsaert DL. New concepts in diastolic dysfunction and diastolic heart failure: Part II: causal mechanisms and treatment. Circulation 2002;105 1503-8 https://doi.org/10.1161/hc1202.105290
12. Parillo JE. Pathogenetic mechanisms of septic shock. N Engl J Med 1993;328:1471-1477 https://doi.org/10.1056/NEJM199305203282008