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Case Report

INTRA-ABDOMINAL PERFORATION DUE TO CARDIOPULMONARY RESUSCITATION FOLLOWING NON-INVASIVE MECHANICAL VENTILATION IN AN ELDERLY PATIENT

Abstract

Medical treatment with non-invasive mechanical ventilation is the gold standard for elderly patients with acute exacerbation of chronic obstructive pulmonary disease who may develop respiratory failure. However, for geriatric patients needing high-pressure support, non-invasive mechanical ventilation may lead to gastric distension associated with the passage of air into the esophagus and stomach. There are very few cases in literature of gastric perforation developing secondary to gastric distension. In these patients, cardiopulmonary resuscitation increases potential risks by engendering an increase in intra-thoracic and intra-abdominal pressure. After intubation, gastric air decompression with a nasogastric catheter will protect patients from complications such as gastric distension, aspiration and gastric perforation.

In this case report, we present an 84-year-old patient with severe exacerbation of chronic obstructive pulmonary disease, who was treated with non-invasive mechanical ventilation at intermittent high pressures for 6 hours in the emergency department but suffered a cardiac arrest because of respiratory failure. Cardiopulmonary resuscitation was then applied, resulting in the development of pneumomediastinum, pneumoperitoneum and bilateral rectus abdominis rupture associated with gastric perforation.

Due to increased tissue fragility in this age group, complications which may develop from non-invasive mechanical ventilation, which has been applied to avoid the undesired effects of intubation in elderly patients, are of greater importance and should not be ignored.

Key Words: Noninvasive Ventilation; Cardiopulmonary Resuscitation; Perforation; Pulmonary Disease, Chronic Obstructive; Mediastinal Emphysema; Pneumoperitoneum.

Olgu Sunumu

YAŞLI HASTADA NONİNVAZİV MEKANİK VENTİLASYON SONRASINDA UYGULANAN KARDİYOPULMONER RESUSİTASYONA BAĞLI İNTRAABDOMİNAL PERFORASYON

Öz

Akut "kronik obstruktif havayolu hastalığı" alevlenmesine bağlı solunum yetmezliği gelişen yaşlı hastalarda medikal tedavi ile birlikte uygulanan noninvaziv mekanik ventilasyon altın standart olarak belirtilmiştir. Bununla birlikte yüksek basınç gereksinimi olan yaşlı hastalarda noninvaziv mekanik ventilasyon, özefagus ve mideye hava geçişine bağlı olarak gastrik distansiyona neden olabilir. Literatürde çok nadir olarak gastrik distansiyona sekonder gelişen mide ve özefagus perforasyonu bildirilmiştir. Bu yaş grubunda kardiyopulmoner resustasyon uygulaması intratorasik ve intraabdominal basınç artışına yol açarak olası riskleri daha da arttırmaktadır. Entübasyon sonrası nazogastrik sonda yardımı ile gastrik hava dekompresyonu yapılması, hastaları gastrik distansiyon, aspirasyon ve gastrik rüptür gibi komplikasyonlardan koruyabilir.

Biz olgu sunumumuzda ileri derecede kronik obstruktif havayolu hastalığı olan, acil serviste 6 saat aralıklı yüksek basınçlarda noninvaziv mekanik ventilasyon yapılan ancak solunum yetersizliği sebebiyle arrest olup kardiyopulmoner resustasyon uygulanan ve gastrik rüptüre bağlı pnömomediastinyum, pnömoperitonyum, ve bilaretal rektus rüptürü gelişen 84 yaşındaki hastayı sunmayı amaçladık.

Yaşlı hastalarda entubasyonun istenmeyen etkilerinden sakınmak amacıyla uygulanan noninvaziv mekanik ventilasyona bağlı gelişebilen komplikasyonlar, doku frajilitesinin arttığı bu yaş grubunda önem kazanmaktadır ve göz ardı edilmemelidir.

Anahtar Sözcükler: Non-invaziv Mekanik Ventilasyon; Kardiyopulmoner Resustasyon; Perforasyon; Kronik Obstruktif Akciğer Hastalığı; Pnömomediasten; Pnömoperiton.

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Introduction

Geriatric patients with advanced stage chronic obstructive pulmonary disease (COPD) may develop respiratory failure associated with acute exacerbation. For patients presenting at hospital at that age and stage, medical treatment with non-invasive mechanical ventilation (NIMV) is the gold standard. This procedure reduces the need for endotracheal intubation and the length of hospital stay, thereby increasing life expectancy (1,2). For patients needing high-pressure support where there is patient-ventilator incompatibility, air swallowing or ventilations applied at pressures exceeding the esophageal sphincter closing pressure, NIMV may lead to gastric distension associated with the passage of air into the esophagus and stomach (3,4).

In geriatric patients, due to the loss of muscle and connective tissue, there is decreased tissue elasticity, leaving them more vulnerable to traumatic injuries. However, there are very few cases in literature of stomach and esophagus perforation that have developed secondary to gastric distension (5).

Cardiopulmonary resuscitation is the set of methods used to restart the circulatory and respiratory systems. Complications, which may develop during CPR, can usually be treated after successful resuscitation. Even though gastric distension resulting from a very strong and/or fast artificial respiration procedure is frequently seen, very few cases have been reported of massive gastric distension, which will cause gastric perforation and pneumoperitoneum (6,7).

In this study, we present the case of a geriatric patient with severe exacerbation of COPD, who was treated with NIMV at intermittent high pressures for 6 hours in the emergency department (ED) but suffered a cardiac arrest because of respiratory failure. CPR was then applied, resulting in the development of pneumomediastinum, pneumoperitoneum and bilateral rectus abdominis rupture associated with gastric perforation.

Case

An 84-year-old female patient previously diagnosed with COPD and congestive heart failure (CHF) used BIPAP at home and presented at the ED with complaints of respiratory problems. In the room-air test, SpO_2 was 45%; arterial blood gas (ABG) values were pH=7.27, pO_2=55 mmHg and pCO_2=86 mmHg; GCS was 15 and the patient was treated with nebulized bronchodilators (combivent-flixotide) and intravenous steroids by the emergency physicians. With NIMV planned, the patient was monitored for 2 hours attached to a BIPAP device (EPAP=6, IPAP=12). As the hypoxemia, hypercarbia and respiratory acidosis levels had not improved, in the subsequent ABG sample (pH=7.24, pO_2=50 mmHg, pCO_2=99 mmHg, SpO_2=77%), NIMV was continued with a mechanical ventilator (Maquet Servo-I) in continuous positive airway pressure (CPAP) mode (positive end-expiratory pressure (PEEP)=5 cmH_2O, pressure support (PS)=15 cmH_2O). Throughout 4 hours of CPAP application, the general condition did not improve, consciousness gradually lessened (GCS=9), and as there was widespread infiltration on the chest X-ray (Figure 1) and hypoxemia, hypercarbia and respiratory acidosis continued in the ABG (pH=7.19, pO_2=58 mmHg, pCO_2=100 mmHg, SpO_2=88%), it was decided to intubate the patient.

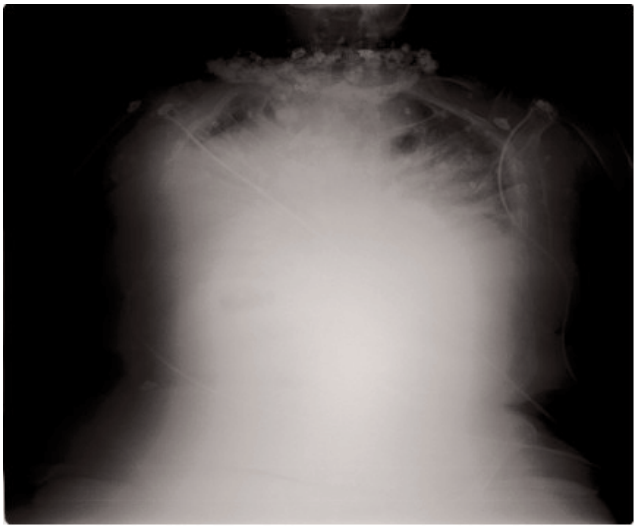

Figure 1— Chest X-Ray before intubation.

To apply intubation, 30 mg rocuronium and 60 mg propofol were administered intravenously. Then 1 mg atropine was administered to the patient, who had bradyarrhythmia. The patient did not respond to atropine and experienced difficulties with bag–valve–mask (BVM) ventilation. As the patient then had a cardiac arrest, crush intubation was applied, and CPR was started immediately. The patient could only be intubated at the second attempt, and at the 5th minute of CPR, normal sinus rhythm was restored. As the development of subcutaneous emphysema and abdominal distension was noticed, tracheal rupture was suspected, resulting from the crush intubation. After ruling out pneumothorax on the bedside ultrasonography (USG), an emergency chest X-ray (Figu-

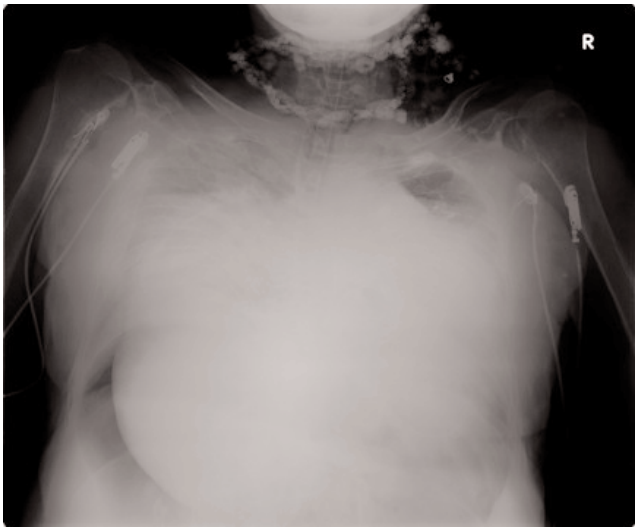

Figure 2— Chest X-Ray after intubation.

Figure 4— Chest X-Ray in the ICU.

re 2) and thoracho-abdominal CT were taken. On the CT images, "an appearance of widespread air in the abdomen (3-4 lts.) and mediastinum" was determined (Figure 3). With a preliminary diagnosis of pneumomediastinum and pneumoperitoneum secondary to tracheobronchial rupture, the patient was admitted for surgery classified as ASA IV E.

Figure 3— CT Scan after intubation.

In the OR, a thoracic surgery specialist performed a diagnostic bronchoscopy, the results of which were normal, and a general surgery specialist performed an upper gastrointestinal system endoscopy. Perforation was determined in the lesser curvature of the stomach and was repaired primarily. During the exploration, a right Morgagni hernia including the transverse colon and omentum was seen and repaired. Both rectus muscles were seen to be ruptured totally from the midportion of the muscle. Throughout the operation, hemodynamics were stable, and the patient was admitted to the intensive care unit (ICU) postoperatively.

The patient was attached to a mechanical ventilator in the ICU and, in the 2nd hour of monitoring, regained consciousness (GCS=E3M6VE). At 48 hours postoperatively, as hemodynamics were stable and ABG levels were pH=7.47, pO_2=81.7 mmHg, pCO_2=55 mmHg, and SpO_2=97%, and spontaneous respiratory effort was sufficient, the patient was extubated (Figures 4 and 5) and spontaneous ventilation was monitored for 2 days with intermittent NIMV support. Gastric decompression with a nasogastric tube was applied with the patient seated upright in bed at 45° during NIMV.

At the end of 2 days, due to continuing hypercarbia and deterioration in her general condition, the patient was re-intubated. Following mechanical ventilation in CPAP mode, extubation was attempted twice during medical treatment, but the respiratory parameters were not sufficient, and re-intubation was required within 30 minutes.

Figure 5— Patient after extubation.

On day 14, a percutaneous tracheotomy was performed, after which the general condition improved and a home-type mechanical ventilator was provided for the mobilized patient, who was then discharged uneventfully.

Discussion

This case report concerns the most feared complication of NIMV which can be seen in emergency patients, as a result of the delayed decision for intubation in a patient who was clearly unsuccessful on NIMV. It had been shown that insisting on a long period of NIMV increases mortality in emergency departments, and non-invasive ventilation must not be regarded as an alternative to intubation.

NIMV is often applied to geriatric patients with advanced-stage COPD in EDs when medical treatment is insufficient for hypercarbic respiratory failure, thus protecting patients from complications associated with intubation (1). The advantages of NIMV are intact airway defense mechanisms, increased patient comfort, physiological air warming and humidification, less need for sedation and easier weaning (9). Intubation should be considered for patients who cannot tolerate NIMV (10).

BIPAP machines are usually preferred at the first stage for NIMV in chronic patients, as they are economical, portable, easy to use and have good leakage compensation, but their use in the ED is limited (11).

In EDs and ICUs, NIMV can be applied with more advanced mechanical ventilators with bedside titration. However, PS and CPAP modes are often preferred, and to overcome auto-PEEP in COPD patients, PEEP application is recommended (1,2).

The application of PEEP results in improved oxygenation as well as reduced risk of lung injury related to the ventilator. However, in the application of PSV-PEEP for NIMV, keeping a high pressure to reach the targeted tidal volume and incompatibility of the patient to the ventilator can cause air swallowing and gastric distension (3,4).

Aspiration may occur due to air swallowing or ventilation at pressures exceeding the upper esophageal sphincter pressure. It can be prevented through proper patient selection, gastric decompression with a nasogastric tube, reduction of respiratory support pressures and intermittent application of NIMV (12).

Complications that may occur during the administration of CPR are generally treatable after successful resuscitation. Postmortem studies have shown thoracic complications in 40% of cases, abdominal-visceral complications in 30% and pulmonary complications in 13%. Life-threatening heart and major vessel injuries or intestinal rupture are extremely rare (0.1 to 5%) (13,14).

As conclusion, in elderly patients requiring high-pressure NIMV, where ventilator-patient compatibility cannot be achieved, complications which may develop associated with gastric distension can be prevented by close monitoring in respect of gastric distension and when necessary, providing decompression with NG tube.

When life-saving protocols such as NIMV or CPR are applied to geriatric patients, it should not be forgotten that in the same way as for evaluation of neonatal patients, complications which may develop, might be related to age just as much as the frequency of the procedure, duration and pressure applied.

Due to increased tissue fragility in this age group, complications which may develop from non-invasive mechanical ventilation, which has been applied to avoid the undesired effects of intubation in elderly patients, are of greater importance and should not be ignored.

Informed Consent

Informed consent was obtained from the patient's next of kin.

References

1. Gursel G, Aydogdu M, Tasyurek S, et al. Factors associated with non-invasive ventilation response in the first day of therapy in patients with hypercapnic respiratory failure. Ann Thorac Med 2012;7:92–7. (PMID:22558014).
2. Hill NS, Brennan J, Garpestad E, Nava S. Non-invasive ventilation in acute respiratory failure. Crit Care Med 2007;35:2402–7. (PMID:17717495).
3. Luria O, Reshef L, Barnea O. Analysis of non-invasive ventilation effects on gastric inflation using a non-linear mathematical model. Resuscitation 2006;71(3):358-64. (PMID:17069955).
4. Solomon AW, Bramall JC, Ball J. Underwater-seal nasogastric tube drainage to relieve gastric distension caused by air swallowing. Anaesthesia 2011;66(2):124-6. (PMID:21128904).
5. Jarry J, Hournau M, Rault A, Collet D. Gastric rupture secondary to non-invasive ventilation. Gastroenterol Clin Biol 2009;33(6):492-3. (PMID:19481386).
6. Grimm G. Gastric rupture-an uncommon complication after successful cardiopulmonary resuscitation: report of two cases. Resuscitation 1997;35(2):175-8. (PMID:9316204)
7. Spoormans I, Hoorenbeecka, KV, Balliu, L, Joren-sa P.G. Gastric perforation after cardiopulmonary resuscitation: Review of the literature. Resuscitation 2010;81(3):272-80. (PMID:20064683).
8. Buschmann C, Tsokos M. Iatrojenic trauma following resuscitation measures. Dtsch Med Wochenschr 2008;133(23):1244-8. (PMID:18509801).
9. Bello G, De Pascale G, Antonelli M. Non-invasive ventilation: practical advice. Curr Opin Crit Care 2013;19(1):1-8. (PMID:23235541).
10. Ucgun I, Metintas M, Moral H, et al. Predictors of hospital outcome and intubation in COPD patients admitted to the respiratory ICU for acute hypercapnic respiratory failure. Respir Med 2006;100(1):66-74. (PMID:15890508).
11. Ferguson GT, Gilmartin M. CO2 rebreathing during BiPAP ventilatory assistance. Am J Respir Crit Care Med 1995;151(4):1126-35. (PMID:7697242).
12. Carron M, Freo U, BaHammam AS, et al. Complications of non-invasive ventilation techniques: a comprehensive qualitative review of randomized trials. Br J Anaesth 2013;110(6):896-914. (PMID:23562934).
13. Hoke RS, Chamberlain D. Skeletal chest injuries secondary to cardiopulmonary resuscitation. Resuscitation 2004;63(3):327-38. (PMID:15582769).
14. Hahn CD, Choi YU, Lee D, Frizzi JD. Pneumoperitoneum due to gastric perforation after cardiopulmonary resuscitation: case report. American Journal of Critical Care 2008;17(4):388-90. (PMID:18593840).