Case Report / *Olgu Sunumu*

Acute Radial Nerve Paralysis Related to Use of Automatically Cycled Blood Pressure Cuff During Thoracic Surgery

Göğüs Cerrahisi Sırasında Kullanılan Otomatik Kan Basıncı Ölçer Cihazın Manşon Basısına Bağlı Akut Radial Sinir Paralizisi

Adalet Demir, Saliha Eroğlu Demir*, Mehmet Zeki Gunluoğlu, Hüseyin Melek, Zeynep Nilgün Ulukoz**, Seyyit İbrahim Dinçer

Yedikule Teaching Hospital for Chest Diseases and Thoracic Surgery, Department of Thoracic Surgery, Istanbul, Turkey

**Vakıf Gureba Training and Research Hospital, Department of Physical Medicine and Rehabilitation, Istanbul, Turkey*

***Yedikule Teaching Hospital for Chest Diseases and Thoracic Surgery, Department of Anesthesiology, Istanbul, Turkey*

Abstract

Peripheral nerve paralysis is one of the rare complications following surgical procedures under general anesthesia. We report four cases with acute radial nerve palsy presenting as wrist drop due to compression injury from automatic cycled blood pressure (BP) monitoring during thoracic surgical procedures. The patients were laid supine on the operating table with both of their arms 80-85° abducted, and fixed on arm boards. All patients were cuffed to measure their BP with a large adult cuff. Blood pressure was measured at 5-minute time intervals during the surgery. On postoperative period, patients complained of wrist and finger drop on the side of BP monitoring during surgery. The nerve conduction velocity and electromyography tests revealed a conduction block in the radial nerve above the elbow level. The paralysis in all patients was observed on the side where the cuff was affixed. Rehabilitation was recommended and started immediately. Static splinting, range of motion exercises, strengthening exercises and biofeedback exercises were used. Paralyses resolved within three months in all the patients. Radial nerve paralysis can be seen as a rare complication most likely due to cuff pressure of automatic BP monitor during thoracic procedures. The incidence of peri-operative nerve injuries can be reduced being aware of the problems. Physical therapy is effective in treating this complication. *(The Medical Bulletin of Haseki 2010; 48: 110-2)*

Key Words: Radial nerve paralysis, thoracic surgery, physical therapy

Özet

Periferik sinir paralizisi, genel anestezi altında uygulanan cerrahi girişimler sonrası nadir görülen komplikasyonlardan biridir. Bu sunumda, göğüs cerrahisi operasyonlarından sonra, muhtemelen otomatik kan basıncı ölçüm cihazının (KBÖC) neden olduğu kompresyon yaralanmasına bağlı, düşük el gelişimi ile ortaya çıkan dört akut radial paralizi vakası sunulmaktadır. Hastalar ameliyat masasına supin pozisyonda yatırılmış olup kolları 80-85° abdüksiyona getirilmiş ve bu şekilde kol tahtalarına sabitlenmişti. Tüm hastaların kollarına, kan basıncını takip etmek için yetişkin tip tansiyon manşonu takılmıştı. Cerrahi işlem süresince 5 dakika aralıklarla kan basıncı ölçüldü. Postoperatif dönemde hastaların cerrahi işlem sırasında tansiyon manşonunun takılı olduğu kol tarafında gelişen düşük el ve parmak yakınmaları oldu. Sinir ileti hızı ve elektromiyografi çalışmaları, radial sinirde dirsek hizasından itibaren iletim bloğu olduğunu gösterdi. Tüm hastalarda paralizi, tansiyon manşonunun takılmış olduğu kolda gelişti. Hastalar hemen rehabilitasyon programına alındı. Statik atelleme, hareket açıklığı egzersizleri, germe egzersizleri ve biofeedback egzersizleri uygulandı. Paralizi, tüm hastalarda üç ay içinde geri döndü. Göğüs cerrahisi ameliyatları sonrasında, büyük ihtimalle KBÖC'nın oluşturduğu tansiyon manşonu basıncına bağlı radial sinir paralizisi, nadir bir komplikasyon olarak görülebilir. Peri-operatif sinir hasarı komplikasyon insidansının azaltılması için, bu sorunun farkında olunması gereklidir. Fizik tedavi, bu komplikasyonun giderilmesinde etkindir. *(Haseki Tıp Bülteni 2010; 48: 110-2)*

Anahtar Kelimeler: Radial sinir paralizisi, göğüs cerrahisi, fizik tedavi

Address for Correspondence/Yazışma Adresi: Adalet Demir
Yüzyıl Mah. Kışla Cad. Yeşil Zengibar Sitesi A-3 Blok, D-9 Bagcılar, İstanbul, Türkiye
Phone: +90 212 664 17 00
Fax +90 212 547 22 33 E-mail: dradalet@hotmail.com
Received/Geliş Tarihi: 08 Ocak 2010 **Accepted/Kabul Tarihi:** 15 Şubat 2010

The Medical Bulletin of Haseki Training and Research Hospital, published by Galenos Publishing.
Haseki Tıp Bülteni, Galenos Yayınevi tarafından basılmıştır.

Introduction

Peripheral nerve paralysis is one of the rare complications following procedures performed under general anesthesia (1). Injuries are usually produced by ischemia resulting from excessive stretching or prolonged compression of the nerves (2). The true incidence of perioperative nerve damage remains unclear and, as a complication, it is probably underreported (3). In many of the past reports on radial nerve injuries, there are only a small number of them in which injuries were induced by automatic cycled Blood Pressure (BP) monitoring. We report four cases with acute radial nerve palsy presenting as wrist drop due to compression injury from automatic cycled BP monitoring during thoracic surgical procedures.

In our clinic, four cases following thoracic surgical procedures complained of wrist and finger drop. Two of these patients were admitted to our clinic for correction of pectus excavatus deformity (one patient with primary and the other with recurrent pectus excavatus deformity). They were thin and young. The others were patients who had undergone lung resection for lung cancer. General characteristics of patients are seen in Table 1.

These patients had no particular family history of peripheral nerve paralysis. They had no history of trauma, neuropathy, neurological disease, systemic diseases such as diabetes mellitus (DM), or any history that might have caused nerve paralysis. Their preoperative routine laboratory data and electrocardiograms (ECG) were all within normal limits.

Both arms of all patients were abducted approximately to 80-85 degrees, placed supine on the operating table and their forearms were supinated and fixed on arm boards with central position of the head. Automatic BP monitoring (Drager Medical Systems Inc, Siemens 700, Model No: 5202994E539U, USA) was used for intraoperative BP monitoring. Blood pressure was measured at 5 minute intervals during the surgery. A large adult cuff (length: 50cm, width:14cm) was affixed to the right upper arm in two cases and to the left upper arm in one case. The mean duration of general anesthesia was 175 minutes. There were no particular events such as BP fluctuation during anesthesia. After the operation, patients were sent to the ward. No intramuscular injections were administered and no other manipulations were performed on the upper extremities in the ward.

All patients complained of wrist and finger drop on postoperative early period (Figure 1). Whereas case No.3 (Table 1) had numbness over the dorsum of his hand, the other cases did not complain of paresthesia. In all patients, the symptoms were observed on the side where the cuff was affixed.

Physical examination revealed drastic loss of muscle power to 0/5 on the affected wrist and finger extensor muscles in all patients. Reduced sensation on the radial aspect of the right hand dorsum was also determined in case No.3, while the other two patients had no sensory loss. The biceps and triceps reflexes were normoactive. Acute radial nerve injury was suspected and a neurologist was consulted. A diagnosis of radial nerve injury was made based on nerve conduction velocity and electromyography, which showed a conduction block in the radial nerve above the elbow level. Rehabilitation was recommended and started immediately. Patients continued rehabilitation on an outpatient basis. Static splinting, range of motion exercises, strengthening exercises and biofeedback exercises were used. The strength of the wrist and finger extensor muscles improved to 2/5 one month and to 5/5 three months later.

Discussion

Peripheral nerve injuries following anesthesia have been observed and can occur at any time during the perioperative period (3). The radial nerve is less frequently (3%) affected, whereas the ulnar nerve is the most commonly injured nerve (28%) (2). The mechanisms of nerve damage were attributed to direct damage through nerve block or surgery, pressure damage through a self retractor, a hard operating table or pneumatic tourniquet (1). Because the radial nerve is located deeper than the ulnar nerve, it is topographically better protected by the muscles (2). Three cases with radial nerve damage related to use of automatically cycled BP cuff during thoracic surgery were reported in this study.

The radial nerve exits the brachial plexus from the posterior cord, closely abutting the shaft of the humerus near the spiral groove (4). Lesions of the radial nerve at its origin from the posterior cord in the axilla may be caused by pressure. The triceps is only involved when lesion occurs at this level and is usually spared in the more

Table 1. General characteristics of the patients

Cases	Age (year) /Gender	Underlying disease	Duration of anesthesia (minute)	Arm attached Blood Pressure cuff	Side of paralysis	Outcome
1	17/Male	Pectus excavatum	172	Right	Righ	Complete recovery
2	23/Male	Pectus excavatum	156	Left	Left	Complete recovery
3	69/Male	Lung Cancer	180	Right	Right	Complete recovery
4	51/Male	Lung Cancer	192	Left	Left	Complete recovery

common lesions of the radial nerve in the arm as it lies alongside the spiral groove, where the nerve is commonly affected by fracture of the humerus (5). In our cases, because triceps muscle power was 5/5, a lesion of the radial nerve at the level of the brachial plexus was not considered. The injury probably occurred at that portion of the radial nerve which is located at the lateral aspect of the humerus in the lower third of the upper arm and where the nerve goes from the posterior to the anterior compartment just superior to the lateral epicondyle. In this study, the nerve injuries were confirmed by a conduction block in the radial nerve above the elbow level. This region was the place where the BP cuff was affixed. The normal adult cuff (length:50 cm, width:14 cm) was applied to the arm. This indicates that the injury was produced by the BP measurements.

Radial nerve damage can also occur due to inappropriate positioning of the posterior part of the humerus on the edge of a table or a hard material leading to stretching or compression of the nerves, resulting in ischemia of the vasa nervorum, and therefore, in neuropathy (2). Injury of the brachial plexus is easily seen when the upper arm is overextended, overabducted, and externally rotated, while the head is turned to the other side (1). In our cases, there were no external compressions applied to the shoulder during surgery, arms were not abducted over 90 degree, and the head was not turned to the other side either. Additionally, positioning of the both arms were the same, but paralysis developed only in one arm to which the BP cuff was affixed. Because of these reasons, a partial brachial plexus nerve injury due to malpositioning can be ruled out. The radial nerve can also be injured by trauma during IV injection of drugs, insertion of an arterial catheter, or during a cutdown procedure on an adjacent vein (2). In our cases, no arterial catheter was inserted.

Intraoperative measurement of arterial BP using automatic equipment provides accurate hemodynamic information in a safe and practical way and, therefore, is accepted as a standard procedure in daily anesthesia practice. The human upper extremity usually is able to tolerate prolonged compression; pneumatic tourniquets with pressures to 300 mmHg have been safely applied for a continuous period of 3 hours during hand surgery (2). However, the radial nerve injuries using automatic BP monitors have been reported (2,6,7) and it was assumed that prolonged inflation time caused by artifact movement had caused the damage. If the adjusted time interval while measuring BP is short, the compression can be continuous. We observed that if the cuff of BP monitor is touched or compressed externally, it does not deflate causing prolonged compression to the arm, which therefore, can lead to radial nerve injury. We believe that this was the reason for radial nerve paralysis in our patients.

Figure1. Drop hand deformity in one of our patients

The prognosis and speed of peripheral nerve recovery depend very much on the degree of nerve damage, the level of injury, the surgical intervention and the subsequent rehabilitative process. The neurophysiological investigations can often provide useful diagnostic and prognostic information (8). Once damage to nerves has occurred, it can take several forms, ranging from a mild, reversible neuropraxia to a sensorimotor deficit (3). In our cases, nerve conduction velocity and electromyography revealed a conduction block in the radial nerve above the elbow level, and so the degree of nerve damage was neuropraxia. Neuropraxia describes a mild degree of neural insult that result in impulse conduction failure across the affected segment. It is reversible and recovers in weeks to months (3). During the nerve regeneration period, splinting is one of the most useful modalities to minimize deformities, prevent joint contractures and substitute loss motor control (8). In our patients, static splinting has been used for two months together with range of motion and biofeedback exercises. Our cases recovered within three months after proper physical therapy. The incidence of perioperative nerve injuries can be reduced being aware of the problems associated with operative positions, by careful positioning of the patient with appropriate padding, especially in patients with thin arms, and by applying the pressure cuff higher on the upper arm (2,3).

References

1. Lee HC, Kim HD, Park WK, Rhee HD, Kim KJ. Radial nerve paralysis due to Kent retractor during upper abdominal operation. Yonsei Med J 2003;44:1106-9. [Abstract] / [PDF]
2. Lin CC, Jawan B, de Villa MV, Chen FC, Liu PP. Blood pressure cuff compression injury of the radial nerve. Journal of Clinical Anesthesia 2001;13:306-8. [Abstract] / [Full Text] / [PDF]
3. Sawyer RJ, Richmond MN, Hickey JD, Jarrratt JA. Peripheral nerve injuries associated with anaesthesia. Anaesthesia 2000;55:980-91. [Abstract] / [Full Text] / [PDF]
4. Lowe JB 3rd, Sen SK, Mackinnon SE. Current approach to radial nerve paralysis. Plastic and Reconstuctive Surgery 2002;110:1099-113. [Abstract]
5. Johnson D, Ellis H, Collins. Pectoral girdle and upper limb, Section 5: Chapter 50, Upper arm. Standring S. In: Gray's Anatomy. Thirtyninth edition. Elsevier Ltd. 2005:799-942.
6. Bickler PE, Schapera A, Bainton CR. Acute radial nerve injury from use of an automatic blood pressure monitor. Anesthesiology 1990;73:186-8. [Abstract] / [PDF]
7. Schaer HM, Tschirren B. Radial nerve paresis following automatic measurement of blood pressure. A case report. Anaesthesist 1982;31:151-2. [Abstract]
8. Chan RK. Splinting for peripheral nerve injury in upper limb. Hand Surgery 2002;7:251. [Abstract]