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Editorial

Kritik bakım ünitesi, bir ya da daha fazla organ veya sisteminde ciddi işlev bozukluğu olan hastaların takip ve tedavi edildiği, fiziksel alt yapısı ve konumu itibariyle hasta bakımı açısından özellik taşıyan, ileri teknolojiye sahip cihazlarla donatılmış, yaşamsal göstergelerin izlendiği, hasta takip ve tedavisinin 24 saat kesintisiz sağlandığı birimlerdir.

Acil servislere çok çeşitli nedenlerle başvuran ve hızlı bir değerlendirme süreci sonrasında kritik bakım ünitesine yatışına karar verilen hastaların enfeksiyon ve deliryum kontrolünden bası yaralarına, hemodinamik stabilizasyondan glisemik, sıvı-elektrolit dengesine, beslenmeye kadar birçok klinik ve laboratuvar parametrelerinin yönetimi çok yönlü, profesyonel bir bakış açısı, yüklü bir bilgi birikimi gerektirir. Kritik bakım sürecinde yer alan öğretim üyesi, uzman, asistan, hemşire ve diğer sağlık personellerinin bu bakış açısı ve bilgi birikiminden nasiplerini almaları elzemdir. Basit gibi görünen bir zaafiyet çok ciddi morbidite, mortalite ve maliyetlere neden olabilir. Takım disiplininin en çok hissedildiği alanların başında gelir kritik bakım üniteleri.

Ülkemiz açısından çok eski sayılmayan kritik bakım üniteleri ve bununla bağlantılı bakım hizmeti kalitesinin gün geçtikçe yaygınlaştığı ve arttığı gözlenmekte. Buralardaki deneyimlerin meslektaşlarımızla paylaşılarak kaliteli bakımın daha da arttırılmasına bir nebze katkı sunmak adına kritik bakım dergimiz hedefine emin adımlarla yürümektedir.

Zorlu bir yaz dönemi sonrası yeni bir eğitim-öğretim döneminin başlangıcına kritik bakıma gönül vermiş sağlık profesyonellerinin gayretleri, alın teriyle birikimlerini kaleme aldığı yazıların yer aldığı yepyeni bir sayı ile huzurunuzdayız. Bu sayımızda acil kritik bakım ünitesi dizaynı ile ilgili derleme yazısını sizlerle buluşturmaktayız. Orjinal makalelerimiz yeni kurulmuş eğitim araştırma hastanesi acil kritik bakım ünitesinin üç aylık deneyimi, zehirlenmiş hastaların kritik bakım ünitesine kabul edilme kriterleri, kronik böbrek yetersizliği olan hastaların değerlendirilmesi, varicella zoster enfeksiyonu, kritik bakım ve ultrason gibi alanı gibi yazılardan oluşmakta. Araştırma makalelerimiz gerçekten ilgi çekici ve alanı için oldukça yenilikçi konuları barındırıyor. Dergimizin bu sayısında ayrıca birbirinden ilginç dört adet olgu sunumu yer almakta.

Yeni dönemin sağlıklı, başarılı ve verimli geçmesini diliyorum, esenlikler.

Tüm editöriyal kurul adına baş editör;
Prof. Dr. Mehmet Gül

Contents

Review Article
Eurasian Journal of Critical Care

A Review of Design Features of Intensive Care Unit in General Terms

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Abstract

Intensive care units (ICU), self-contained places that have special equipment and personnel for following up life threatening diseases, injuries and potentially critical patients. It provides specialty and resource for supporting vital functions. Moreover, it provides opportunity to experienced practitioners and allied health personnel to use their skills. As in the world, different discipliner ICUs are identified and the use of them has become widespread in our country. Beside the ICUs that are incarcerated by department of Anesthesiology and Reanimation, there are ICUs belonging to departments of cardiology, cardiovascular/thoracic surgery, chest diseases, neonatology, neurology, neurosurgery, internal diseases, general surgery and emergency. Good design of ICUs provides comfort and security to patients or personnel and increase the success of treatment. Furthermore, it prevents the deficits that cannot be remedied later, and contribute renewing substructure of ICU in accordance to the current conditions. There is no single ideal geometry for the placement of ICU. The published recommendations suggest units or patient room groups from at least six beds for efficiency and economy, and up to eight to 12 beds for observation reasons.

Keywords: Design,Intensive Care Unıt

Intensive care units (ICU), self-contained places that have special equipment and personnel for following up life threatening diseases, injuries and potentially critical patients. It provides specialty and resource for supporting vital functions. Moreover, it provides opportunity to experienced practitioners and allied health personnel to use their skills[1].

The notion of modern ICU was created by Florence Nightingale in 1852-Crimean War for severely injured soldiers that needed special nursing service in one special area. Otherwise, the commencing of ICUs in United States came into existence with post-operative recovery rooms. In 1923, a unit which comprised of three beds was built for post-operative nursing of neurosurgery patients in The Johns Hopkins Hospital. Second World War, Korean War and Vietnam War led to important developments about cardiopulmonary resuscitation (CPR) and triage of ICU patients. In this period anesthesia and post-operative nursing developed. Furthermore, shock had been started to treat with blood products and intravenous fluids[2]. After a hundred years from Florence Nightingale, in 1952 the epidemia of polio laid the foundations of specialization on intensive care in Copenhagen. In this epidemia the respiratory muscle and/or bulbar paralysis caused respiratory insufficiency in 316 patients, then these patients hospitalized to a special area. In the Blegham Hospital, which is the infectious disease hospital in Copenhagen, the area that provided care to these patients is considered as an ICU in modern sense. The epidemia of polio proved the importance of ICUs and ventilators. In time the roles of these units have expanded and became a multidisciplinary area that all the high-risk patients were accepted. Especially in last 10-15 years the facilities of ICUs have showed rapid improvements. Beside developed facilities, the improvements in variety and number of the patients also led to requirements about physical properties and substructure of ICUs[3]. As in the world, different discipliner ICUs are identified and the use of them has become widespread in our country. Beside the ICUs that are incarcerated by department of Anesthesiology and Reanimation (picture 1), there are ICUs belonging to departments of cardiology, cardiovascular/thoracic surgery, chest diseases, neonatology, neurology, neurosurgery, internal diseases (picture 2), general surgery and emergency (picture 3).

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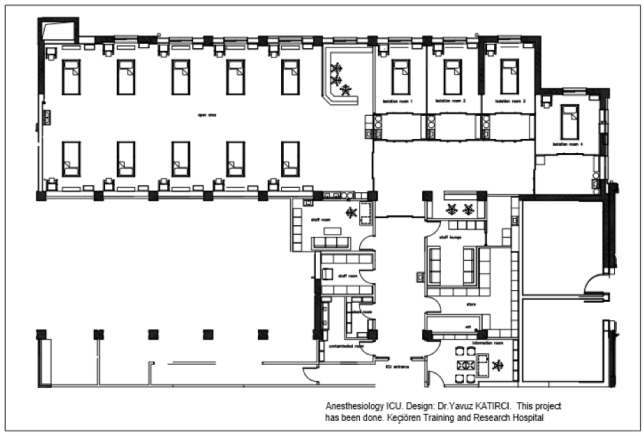
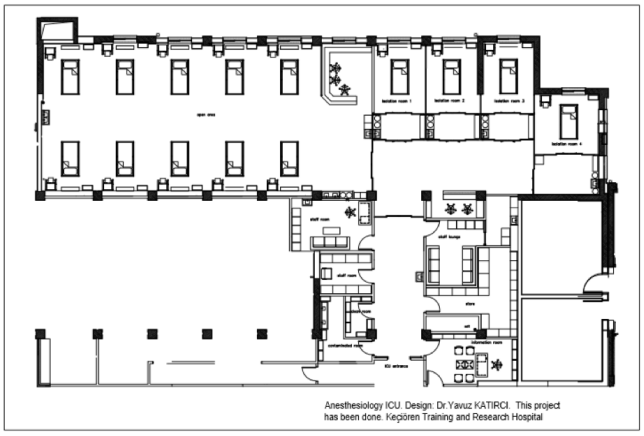
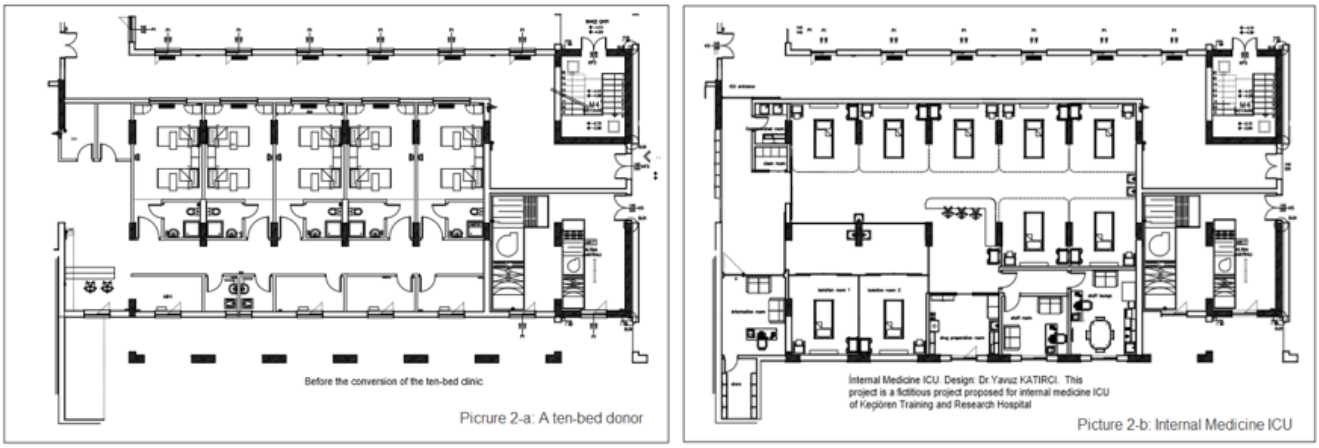


Picture 1. Third Level ICU.



Picture 2. Third Level ICU.



Picture 2. a A ten-bed donor clinic. b: Internal Medicine ıcu (Draft project Od donor clinic conversion to ICU)

GENERAL TERMS FOR INTENSİVE CARE UNITS

Good design of ICUs provides comfort and security to patients or personnel and increase the success of treatment. Furthermore, it prevents the deficits that cannot be remedied later, and contribute renewing substructure of ICU in accordance to the current conditions.

The number of required beds of ICU should be determined according to the properties of the patients that planned to be interned, severity of the diseases, planned treatments to these patients, equipment that these treatments necessitate, substructure of these equipment, settlement of the beds and equipment, use plan, number, properties and comfort of personnel, necessity of other departments, sanitation and security etc[4, 5, 6, 7]. The number of the beds in ICU changes 4 to 50 based on the hospital and/or the service area's level. Large ICUs should be separated to sections that include 8-15 beds (1). According to the legislation of the Turkish Ministry of Health of country, an ICU should confirmed from minimum 4 beds, the ICUs that have under 10 beds should be organized as one service and the ICUs that have over 10 beds should be separated to sections which have 6-10 beds. In addition, each of the ICUs that have 6 beds should have an isolation room[8].

There are limited sources that describe the ICUs physical substructure and architectural design and it is usually difficult to access them. The well accepted source about intensive care design is the suggestions that published by Society of Critical Care Medicine in 1988. The relevant association and many other associations follow the most current edition of the Facility Guidelines Institute (FGI) guidelines for descriptive descriptions of the ICU. Australia and New Zealand have published their own current guidelines in Anesthesiology College.

LEVELS OF INTENSIVE CARE UNITS

ICUs College of Intensive Care Medicine of Australia and New Zealand (CICM) defines three levels of ICUs:

Level 1: This level provides CPR and short-term cardiorespiratory support to critical patients and plays role on preventing and following-up in medical or surgical complications. In this unit patients can be monitored for invasive cardiovascular follow-up and mechanical ventilation for a few hours.

Level 2: This level provides high standard intensive care service including complicated multi-system life support that promotes limited responsibilities of the hospital. This area should be minimum 6 bedded.

Level 3: This level is tertiary admission units for intensive care patients. It can provide comprehensive critical care including complicated multi-system life support for an undetermined time. This area might have over 50 beds which separated 8-15 bedded sections.

Pediatric ICU: This area has same properties as level 3 ICU and reserved for patients under the age of sixteen[1].

In our country, ICU leveling that is defined in "Communiqué on the principles and procedures of intensive care services in inpatient health facilities", is parallel to the definition of CICM[8].

PLANNING OF THE PLACE OF INTENSİVE CARE UNIT

ICUs should be near to emergency department, operating rooms, laboratory, department of radiology and elevators. In contrast, it should be far from the inpatient service visitors and other personnel. Moreover, it should enable to intern patients and perform medical or surgical treatments easily for patients and personnel. There should be extra ways that do not flow into the hospital traffic for easily going to mortuary and medical waste unit. If there should be multiple ICUs in the hospital, organization together of these ICUs as horizontal or vertical layout provides minimizing cost of construction and planning, in addition effective using of the sources like equipment, substructure, laboratory and personnel[8].

DESIGN

ICUs are compromised from 4 main areas that all have one primary function and/or a set of related functions.

1) Patient Care Area is compromised from patient rooms and adjacent areas. Its primary function is patient care.
2) Clinical Support Area is compromised from functions that closely related to directly patient care in all the areas of the unit, not only in patient's room.
3) Unit Support Area is compromised from administration, equipment and personnel support units.
4) Family Support Area is planned for supporting families and visitors[1].

The design of the unit starts with the deep analysis of patient care and support functions, workflow and policy of the hospital (visit times, participation of the families to patient care, etc.). It should be helpful to prepare a current and prospective equipment inventory. Clinical and Unit Support Areas promote clinical and administrative personnel directly. The design should be shortened the walking distance of the personnel and frequently needed area should be as near as possible to equipment or materials. While Family Support Area meets the needs of the visitors, it should not cause delay on patient's care. An efficient area should be small enough to allow caregivers to be fully aware of all the activities in the unit, but large enough to allow efficient staff work. Although a centralized or decentralized design is chosen, caregivers should be able to observe patients from multiple points within the unit.

There is no single ideal geometry for the placement of ICU. The published recommendations suggest units or patient room groups from at least six beds for efficiency and economy, and up to eight to 12 beds for observation reasons[1].

Patient care area: This place is defined as the patient rooms and adjacent areas that provides directly patient care service. Designers should consider needs of patients and visitors, and the care that given to patients directly by the personnel. To integration the families to daily patient care, family needs and care functions should be added to the design of ICU[9].

Single and multiple bedded rooms: researches have shown that single bedded rooms are better than multiple bedded rooms in terms of patient safety. In addition, it provides privacy to patients. Fully protecting rooms increase sleep quality, therefore it contributes to decreasing ICU delirium[1, 9, and 10].

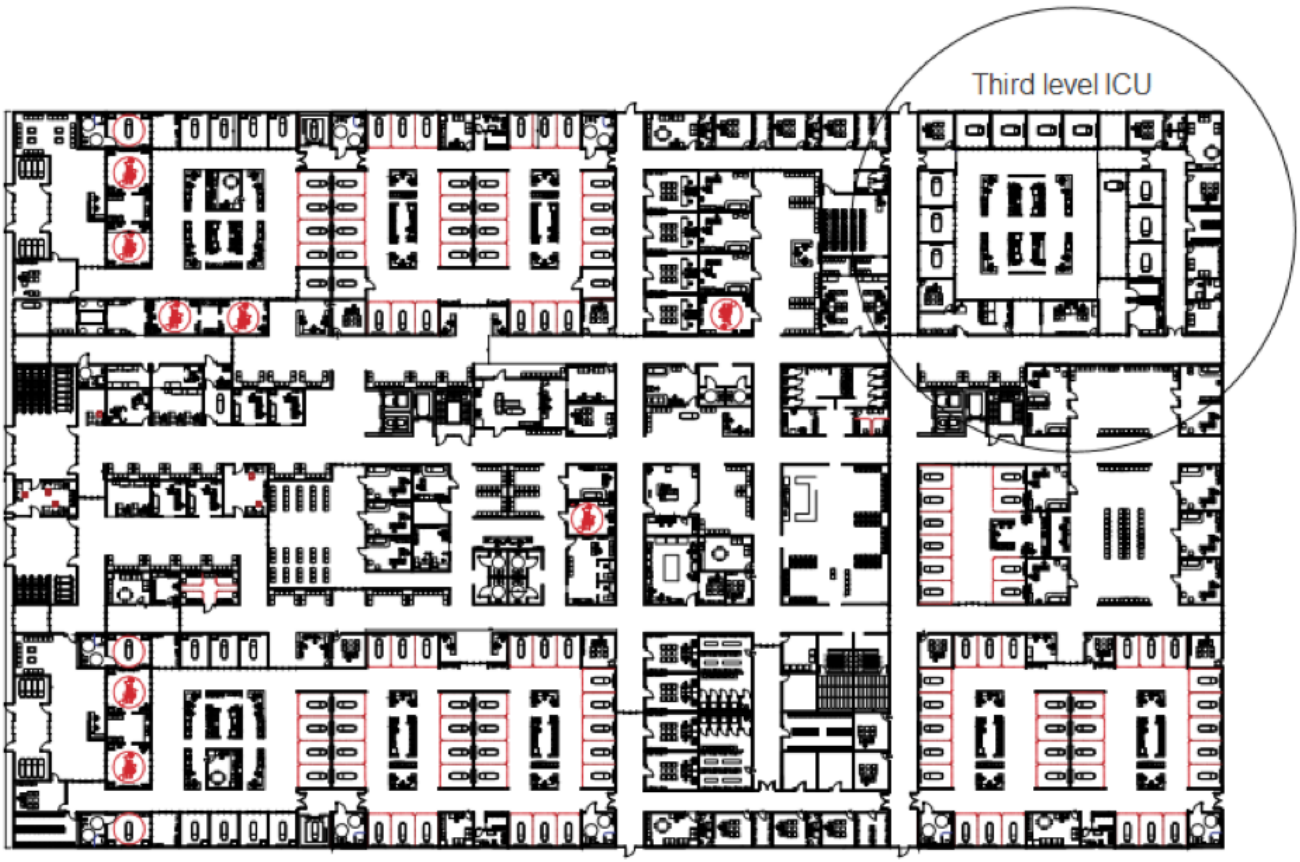
Clean surface areas: clean floor space represents unfilled area by the patient, fixed room furniture and equipment. The size of floor area should be enough for portable radiological imaging devices, echocardiography, electrocardiography (ECG), dialysis devices and more[9].

Patient area: There should be 20 m^2 floor area for each bed in an ICU, except the service areas and walking areas. For single bedded rooms this area should be minimum 25 m^2. In pediatric ICUs might have areas under 20 m^2 for baby cot. Each bed should have enough access (picture 4).

For every two beds there should be washbasin and faucet which can be on by elbow and foot. There should be at least one single room isolation procedure per six beds and each isolation room must have its own washbasin, bathroom and a front room of at least 3 m^2 and suitable facilities for insulation such as air flow control[1]. The Ministry of Health determined different measurements for our country. In adult ICUs, a minimum area of 12 m^2 is required for each bed, with a minimum distance of 1.5 m between the beds, except for support areas. Pediatric ICUs should have at least 12 m^2 of space for each bed so that the distance between the beds is at least 2 m, excluding support areas. Except for support areas, at least 6 m^2 of space should be reserved per neonatal intensive care bed, and for each incubator; 60 cm on the first level, 90 cm on the second level and 120 cm on the third level[8].

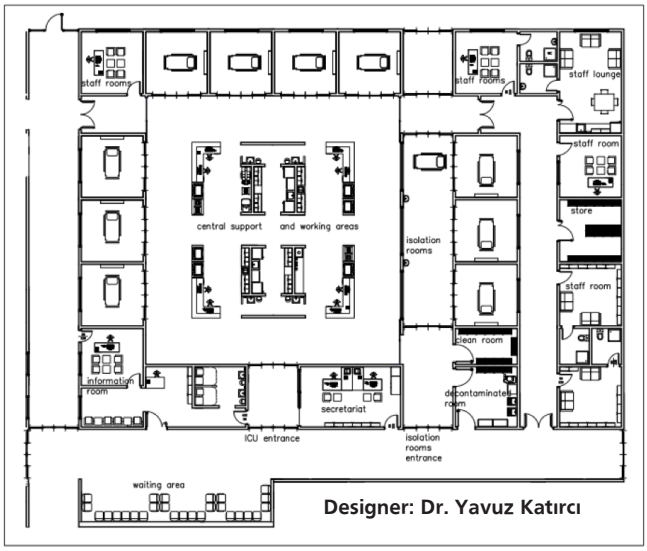
MEDICAL SERVICE DISTRIBUTION

System: The choice of systems for the installation and regulation of electricity, medical gas and other medical service

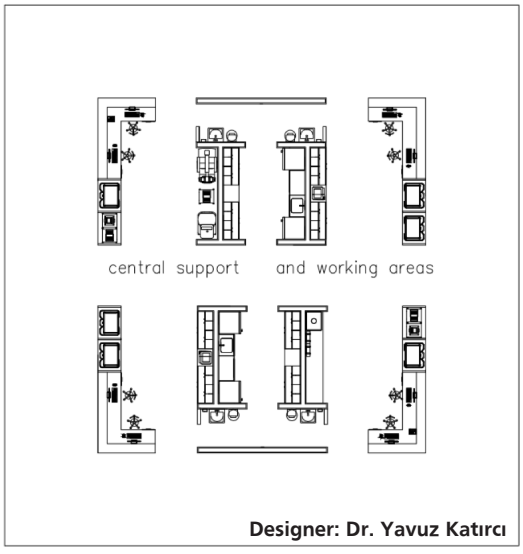


Picture 3. ICU in an experimental emergency room desing

Designer: Dr. Yavuz Katırcı



Picture 4. An experimental desing of third level ICU



Picture 4. An experimental desing of third level ICU working areas

organizations has a major impact on patient and staff satisfaction. Design team should consider patient type, functional plan, staff preferences, technology trends and potential future needs. All options must be considered for the installation and configuration of medical facility outlets. Combinations or hybrids of these systems might be suitable. The medical ancillary delivery system will have an impact on patient room placement and size. The bedside wall-mounted pendant configuration should be mounted on the wall at the head of the bed. This configuration is common, and it allows the outputs to be easily adjusted according to patient needs.

Column Configuration: This configuration should have a series of outlets on a vertical column of immovable attached to the floor and ceiling. The distribution of the outputs might vary depending on the needs of the receiver.

Boom Configuration: This configuration consists of a movable articulated arm(s). Ceiling-mounted booms provide maximum flexibility in positioning and accessing med-

ical gas, electrical and data outlets. In a third-level ICU, at least 4 oxygen, 3 air, 3 vacuum and 4 data outputs and 16 power points are required for each bed area. Accessory racks, brackets and poles can be mounted on these devices, enabling optimal positioning of all support devices such as monitors, computers, communication devices and intravenous (IV) pumps. The use of booms allows for maximum flexibility in beds placement [1, 9].

Medical Gas, Vacuum, Data and Electrical Sockets: These outlets should be accessible from both sides of the patient bed and arranged to provide enough space for multiple procedures at the same time. It is recommended that 50% of the electrical outlets in the patient room be connected to the hospital emergency power system. The oxygen system should be easily accessible during intubation or extubating procedures. In addition, face and aerosol masks should be accessible from both sides of the bed. Because some devices like ventilators use compressed air, enough space is required for additional medical compressed air outlets. There should be at least five vacuum outlets in each room for bronchoscopy, esophagogastroduodenoscopy and other bedside procedures, and for patients with multiple drains (such as chest tubes and wound drainages).

Patient rooms should be designed appropriate for computer terminals and mobile computer solutions. If a wireless system is not accessible, the data ports for the in-room computer terminals should be located so that clinical staff can monitor the patient during documenting or accessing patient information. The placement of computers should protect the confidentiality of patient data.

Adequate electrical outlets and space should be provided for pumps and IV bags to administer IV fluids and medicines. Most pumps are connected electronically to patient monitoring or data acquisition systems.

Drugs that are frequently or urgently needed should be available in or near the patient's rooms. Bedside drug storage should be in safe and keep large or one-dimensional products such as IV bags and large syringes. A computer-controlled distribution system can fulfill this requirement. To reduce staff travel, it should be conceivable to place a small refrigerator in patient rooms for medicines that need to remain cold, or to provide a central refrigerator for staff access to medicines.

Clean utility/workroom: Infection control is an important consideration and storage for clean and dirty products should prevent cross-contamination between the gastrointestinal and pulmonary tracts of visitors and staff and the patient. The design should have enough and suitable space to carry the linens during cleaning and dirty laundry should not be an obstacle. On the other hand, a clean, dry surface to stack clean linens should be added. Separate storage should be provided for clean and used gloves, aprons, hair coverings, shoe covers and eye protection (picture 4)[1, 9].

Doors: The door system should be sized to allow patients, bariatric beds, equipment and personnel to enter and exit patient rooms in the event of a crisis. Sliding glass doors that have opening capacity can provide more visibility to the patient as well as provide useful width.

Windows: Natural light is essential to the well-being of patients and staff and is required for most codes. Each patient care area should have at least one window of appropriate size per patient bed area that provides visual access to outside spaces. Window coverings should be easy to clean in accordance with infection control rules.

Providing patients with an external view - preferably facing the garden, courtyard or other natural environments - can help relieve anxiety and stress, improve care, improve patient comfort, and improve patient orientation. When a patient bed needs to look into the interior of the unit to be closely monitored by staff, an adjustable mirror mounted on the wall or ceiling can give the patient the appearance of the outdoor space.

Patient room furniture: critical care patient rooms should provide a hospital bed designed for a critical patient; a chair suitable for use by the patient and an additional chair for visitors (both cleanable); containers for collecting dirty laundry, garbage and waste products; and containers for collecting hazardous waste products such as needles and syringes.

To create a comfortable environment, rooms should have a clock, a calendar, and similar devices to allow patients and families to personalize the room. Greeting cards and photographs should be provided horizontal surfaces and placed for patients to see them.

The functional design of the unit should allow patient and family education. Therefore, appropriate materials should be provided to serve this purpose and give general information about the organization. Each patient room can be equipped with a television or training / entertainment system that can be controlled by the patient or family to support patient education as well as provide positive distraction and entertainment. In addition, the design should ensure safe storage of patient and family clothing[9].

Lighting system: Natural lighting should be provided as much as possible, and the presence of windows ensure the day-night orientation of the patients. Fire resistant, easy to clean, antibacterial curtain systems are suitable for windows. The parts of the unit without natural lighting should be illuminated at night by using indirect and soft light. According to the standards of the Turkish Ministry of Health, general lighting is preferably set to be 20 fc or 215 lux, spot lighting is 150 fc or 1600 lux[8].

Climatization: In consultation with the care team, patients and families should be able to control the room temperature.

Communication system: The ICU should have in-unit, in-hospital and out-of-hospital telephone facilities, an intercom system to communicate between the sub-units of the ICU, and an in-unit alarm system.

Monitoring system: There should be monitoring resources for measurements of ECG, invasive pressure mea-

surement, direct or indirect arterial oxygen level measurement, pulse oximetry or pO_2, tidal CO_2, transcutaneous pCO_2, temperature, thermodilution cardiac output (CO) measurement, noninvasive CO measurement, mixed venous O_2 saturation measurement, electroencephalography (EEG), mass spectrometry, respiratory mechanics measurement, somatosensory evoked potentials (SEP). Moreover, all these devices' substructure should comply with standards.

Laboratory: ICUs should have access to 24-hour clinical laboratory services. These can be provided by a central hospital laboratory or a satellite laboratory within or near the ICU. If satellite facilities are used, they should provide minimum chemistry and hematology testing, including arterial and mixed venous blood gas analysis. If blood gas analysis is common in the unit, an area for a blood gas analyzer can be included in the overall design. With the increasing prevalence of drug-resistant pathogens, samples should be stored carefully and separately from patients in isolation rooms. Pneumatic tube systems can be used to transport samples quickly to the laboratory[8].

Imaging: Imaging services should be easily accessible by the ICU. The unit should provide enough storage for portable imaging machines. The patient archive communication system and a reading room with digital display with movie display boxes and / or high-resolution displays should be located inside or near the unit[8].

Nurse Desk Unit: The nurse desk, where the central monitoring and monitoring unit is located, should also be designed for intensive care workers and patients to see each other. It is usually made in the middle or side of the area where the patient beds are located. At the nurse desk; central monitors, intensive care data management system, hospital accruals and laboratory connections for computer, printer, telephone, gas and vacuum system pressure indicators and their alarms should be available. Adequate space and systems should be available for the organization and storage of patient follow-up forms, observation of personnel by the ICU supervisor and shift changes (picture 5)[1, 8].

SUPPORT AREAS

Clean and Contaminated Materials Rooms: The ventilation of the contaminated material room should be separated, and the contaminated air must be exhausted. Clean and sterile materials should be stored in the clean room and the ventilation of the room should be provided with sterile air supplied from air conditioning. There should be a enough shelves and / or cupboards and be at a height above the floor. This storage area should be 20 m^2 with washbasins, hot and cold water, buckets for medical waste and special waste bins for sharp-penetrating medical waste (picture 4). In the dirty material room, there should be a drain and washing device for sanitizing the bedpans. If the dirty room is large enough, medical waste should be placed in the waste container or stored in a separate waste room. The waste room should be 2-3 m^2 and designed in accordance with the medical waste instructions.

Personnel Support Room: ICU staff need places to sleep, eat, relax, take care of personal needs and store their belongings. Short sleep or sleep breaks can help medical personnel work better and reduce errors. Telephones or intercom systems should connect these rooms to the ICU and cardiac arrest/emergency alarms should be audible. In addition, computer access to patient medical records and image archiving and communication systems would be ideal. And of course, toilet and shower facilities should be provided.

There should be a common room where ICU employees can relax except sleep. A staff lounge in or near the intensive care unit provides a special, comfortable, spacious and relaxing environment. The lounge should have a comfortable seating area, a table with chairs for meals, and food storage and preparation facilities, including a large fridge, microwave and coffee dispenser or coffee machine. The room must be separated from the common areas. If possible, windows that open outdoors should face nature. The hall should be ventilated to remove food odors from patient care and public areas.

Staff Toilets: Toilets designed to meet clearly defined and accessible requirements for staff should minimize time away from duty but ensure confidentiality. Toilets should not be opened directly to the staff lounge. If the unit is large or contains several capsules, more than one personnel toilet should be considered. Separate men's and women's toilets are recommended, and each toilet should include hand wash basin, dispensers for soap and dehydrated hand cleaner, hand dryers, waste container and mirror. A storage cabinet and shelves should be helpful.

Cabinets: A secure area for lockers for staff items should be found inside or near the staff room. In larger facilities, these areas may be designated for different sections of staff or shared by multiple units. As many nurses or other staff may choose to keep certain items on the workstations, designers should consider providing safe drawers or shelves in these places[8].

Information Desk: There should be a reception area to check visitors' access to the unit, provide information and, if necessary, prevent entry. This zone should preferably be located at a location different from the personnel entrance, connected to the other parts of the intensive care unit with telephone and / or closed-circuit television system.

Visitor Waiting Room: this room should be placed in an area that the receptionist can control check-in and out. There should be 1-2 seats for each patient bed. There should be telephone, television, music and toilet. Indirect lighting should be provided, if possible, there should be windows, and be painted in warm colors. There should be a small space in this room/connected to the room where families can be given special information about their patients[1, 8].

References

1. Minimum standards for intensive care units. IC-1 (2016). College of Intensive Care Medicine of Australia and New Zealand. Available at: https://www.cicm.org.au/CICM_Media/CICMSite/CICM-Website/Resources/Professional%20Documents/IC-1-Minimum-Standards-for-Intensive-Care-Units_1.pdf. Accessed August 5, 2019.
2. Çelikel T. Critical Care Medicine in the World and in Turkey. Turkish Journal of Intensive Care Medicine 2001; 1(1): 5-10.
3. Fiona E Kelly FE, Kevin Fong K, Nicholas Hirsch N and Nolan JP. Intensive care medicine is 60 years old: the history and future of the intensive care unit. Clinical Medicine 2014; 14 (4): 376–9.
4. American College of Critical Care Medicine of the Society of Critical Care Medicine. Critical care services and personnel: Recommendations based on a system of categorization into two levels of care. Crit Care Med 1999; 27:422-6.
5. Faculty of Intensive Care, Australian and New Zeland College of Anesthetists (FICANZCA): Minimum standards for high dependency units seeking accreditation for training in intensive care. IC-13. Australian and New Zeland College of Anesthetists, Melbourne 2000:1-4.
6. Guidelines/Practice Parameters Committee of the American College of Critical Care Medicine, Society of Critical Care Medicine: Guidelines for intensive care design. Crit Care Med, 1995; 23:582-8.
7. Guidelines on critical care services and personnel: Recommendations based on a system of categorization of three levels of care" Crit Care Med 2003; 31:2677-83.
8. Communiqué amending the communiqué on the principles and procedures for the application of intensive care services in inpatient health facilities. Official Gazette of the Republic of Turkey. Number: 30015.Available at: http://www.resmigazete.gov.tr/eskiler/2017/03/20170322-31.htm.Accessed August 5, 2019.
9. Thompson DR, Hamilton DK, Cadenhead CD, Swoboda SM, Schwinde SM, Anderson DC et all. Guidelines for intensive care unit design. Crit Care Med 2012; 40(5): 1586-1600.
10. Morandi A, Brummel NE, Ely EW. Sedation, delirium and mechanical ventilation: the 'ABCDE' approach. Curr Opin Crit Care. 2011; 17(1):43-9..

Orginal Article
Eurasian Journal of Critical Care

The Intensive Care Unit Admission Criteria For Patients With Poisoning

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Abstract

Introduction: Poisoning is an important health problem in Turkey and all over the world. We believe that the creation of ideal scoring systems for patients with poisoning is essential for the determination of intensive care hospitalization necessity, duration of follow-up, mortality and morbidity.

Materials-Method: In our study, we included over-18-year-old 292 patients with poisoning who were urgently hospitalized into the intensive care unit between January 2016 to December 2017. We have identified some criteria which are named as Ankara Poisoning Criterion. Glasgow Coma Score (GCS) (<15); hypotension (systolic blood pressure< 90 mm Hg); bradycardia (<60 beats/min) or tachycardia (> 100 beats/min); lactate level (2.0); and the pH value (< 7.35 or >7.45). OR *The main decisive factor in the selection of these five criteria (Glaskow coma score <15, systolic blood pressure <90 mm Hg, bradycardia (<60 beats / min) or tachycardia (> 100 beats / min), acidosis (pH < 7,359 or alkalosis (pH> 7,45) and serum lactate level> 2.0 mmol / L),* We anticipated that a patient who meets at least one of these criteria is in need of intensive care hospitalization; and that if s/he does not, there is no need for intensive care hospitalization. The patient's scores of Acute Physiology and Chronic Health Evaluation II (Apachell), Sequential Organ Failure Assessment Score (SOFA), Quick Sequential Organ Failure Assessment (QSOFA), Modified Early Warning Score (MEWS), and Systemic Inflammatory Response Syndrome (SIRS), and length of hospital stay (LOS), inotrop, dialysis, mechanical ventilation, special treatment, and antidote needs were recorded and these parameters were compared with the Ankara Poisoning Criteria.

Results: Of the 292 patients included in the Ankara Poisoning Criteria, 45.5% (n = 133) had zero scores; therefore they did not need to remain in intensive care. We statistically revealed that patients with the LOS ≥2, and need of inotrop, dialysis, mechanical ventilation, special treatment, and antidote, meet at least one of the Ankara Toxicity Criteria (p <0.005). Meanwhile, we statistically observed correlations between the Apache II, SOFA, QSOFA, MEWS, and SIRS scores and revealed criteria (p <0.005).

Conclusion: We concluded that the Ankara Poisoning Criteria, which consists of 5 criteria that can be easily and quickly obtained in the emergency services, can prevent unnecessary intensive care hospitalizations and they will be beneficial for the prognosis and mortality-morbidity of patients.

Keywords: Poisoning, intensive care, admission criteria

Introduction

There have been seen many cases of intentional or accidental poisoning with drugs and chemicals in Turkey and in the world. During the evaluation of patients who come with poisoning, after the hospitalization of the patient, the clinician must answer the questions about whether the patient needs medical treatment and if s/he needs such treatment, what the treatment and follow-up duration must be. It should be pointed out that especially the anamnesis of patients taken too many drugs for suicidal purposes is unreliable. For this group of patients, the uncertainty of what medication, how much and when it was taken makes the follow-up and treatment duration uncertain. Therefore, most of the patients are followed up in intensive care and intermediate intensive care units. However, many of these patients are discharged without the need for intensive care interventions. There are currently no internationally accepted criteria for the ICU admission of patients with poisoning. Yet, evaluations with simple clinical criteria of intensive care patients with poisoning hospitalized in the ICU have shown that hospitalizations can be reduced by 40%[5].

Practical scoring systems are not available for the assessment of cases of poisoning in emergency services. Due to this lack of scoring, there is no objective data about patients' need for intensive care and their conditions of mortality and morbidity.

In 1990s, the Poisoning Severity Score (PSS) was developed in Europe to overcome this shortcoming, but its use has not been widespread. In this rarely used scoring system, misinterpretations and modifications come into question. But now, its clinical usefulness is limited[2].

The prognosis and course of patients admitted to the ICU due to poisoning have not been extensively investigated and therefore there is little literature data on the subject[3].

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We believe that the creation of ideal scoring systems for patients with poisoning is essential for the determination of intensive care hospitalization necessity, duration of follow-up, mortality and morbidity. The aim of this study was to reveal objective criteria related to the intensive care follow-up needs of the patients admitted to the emergency services with the diagnosis of poisoning.

Materials and Methods

Patient Group:

Our study was conducted at the University of Health Sciences Medical School Ankara Health Care Center. Our Center is one of the largest training and research hospitals in the region with approximately 10000 outpatients and 1000 emergency service patients admitted per day. Our patient group consists of patients over 18 years old hospitalized between 2016-2017 in the emergency ICU of University of Health Sciences Medical School Ankara Health Care Center with the diagnosis of poisoning with various chemicals (accidentally or intentionally). In addition, patients with more than one admission and hospitalization during this period were included in the study. Our study was conducted retrospectively by scanning patients' files.

Data collection:

We created a database with suitable cases using a Microsoft program. We saved the following data from the database records of the emergency service and ICU: age, gender, vital signs, blood gas, biochemistry and complete blood counts; GCS, Apache II, SOFA, Qsofa, SIRS, MEWS scores; the needs of mechanical ventilator, positive inotrope, antidote, special treatment, dialysis; drugs or chemical substances caused poisoning and their amounts. We identified the groups of the drugs taken by patients by looking at their names, estimated drug dose, anamnesis, and at the drug boxes left in the scene of accident. We could not measure the serum levels of the active substance in all patients due to the causes of poisoning were different and the levels of some substances could not be determined within hospital facilities.

We designed a tool, consisting of 5 parameters, according to which the decision for hospitalization of a patient into intensive care unit is made. We estimated that if a patient meets one of these parameters, his/her hospitalization in the an ICU is required. We have come up with an idea that the patient group, which does not meet any of those parameters, can be followed up in the outpatient or inpatient settings. While introducing these parameters, we have already taken into account the algorithms published in the literature[2,4,5].

When designing this "decision" tool, we opted for simple parameters that could be quickly and easily accessible in the emergency service and we chose the parameters that could determine all vital functions. We determined the cut-off values from national and international guidelines for ICU admission[6]. We named our developed diagnostic tool as "Ankara Poisoning Criteria" (Table 1).

Table 1: Ankara Poisoning Criteria

1) GCS must be <15,
2) Hypotension (systolic blood pressure must be 90 mm Hg),
3) Bradycardia (must be <60 beats/min) or tachycardia (must be > 100 beats/min),
4) Lactate level must be high (> 2.0)
5) The pH value must be acidotic or alkalotic (< 7.35 or > 7.45).

We compared the patients' scores gotten from the Ankara Poisoning Criteria with their LOS, whether they need inotrop or not, whether the dialysis and mechanical ventilation support were provided, and with the specific treatment and antidote needs.

Outcome:

The primary endpoint of the study is the determination of the validity of the Ankara Poisoning Criteria for patients with poisoning hospitalized in the ICU. Therefore, we compared the presence of treatments performed to patients, such as mechanical ventilation, dialysis, inotropic support and special antidote, which are required the ICU conditions, with the Ankara Poisoning Criteria.

Statistical Analysis:

We thought that all the parameters described in Table 1 are equally important for ICU interventions and admission to ICU. Patients who met one or more of the parameters pre-

Table 2: Distribution of scores of patients from scoring systems

qSOFA	0	% 79,8
	≥1	% 20,2
SOFA	≤4	% 91,8
	≥5	%8,2
SIRS	≤1	% 92,1
	≥2	% 7,9
Apache II	≤6	% 68,5
	≥7	% 31,5
MEWS	≤ 2	%91,4
	≥3	% 8,5

sented in Table 1 were considered by us as a group of patients in need of intensive care. The patient who did not meet any of these 5 parameters was considered by us as a patient who does not need an indication for intensive care admission. Patients' general characteristics, intensive care hospital stay durations, mortality and morbidities, GCS, Apache II, SOFA, Qsofa, SIRS, MEWS scores were compared.

The statistical analysis was performed by using the SPSS 22.0 program (Statistical Package for the Social Sciences Inc., Chicago, IL, USA) in the Windows operating system. The patients' scores gotten from the Ankara Poisoning Criteria were compared with the length of stay and needs of inotrop, dialysis, mechanical ventilation, special treatment and antidote by using the Chi-square and Fisher's Exact Tests. We considered the value of $p<0.05$ being statistically significant at the confidence interval 95%.

Results

We included in our study 316 patients aged ≥18 years hospitalized between 01 January 2016 and 31 December 2017 in the emergency intensive care unit of University of Health Sciences Medical School Ankara Health Care Center with the diagnosis of poisoning. 24 of these patients were excluded from the study because all their data could not be reached. The data obtained from 292 patients were evaluated.

The mean age of the patients was 33,35 (min 18, max 90, st dev: 13,953). 65,4% (n = 191) of the patients were female and 34,6% (n = 101) were male. We share distribution of scores of patients from scoring systems in Table 2. In 77.0% of patients (n = 225) the pH value was in the normal range (7,350 ≤ normal pH ≤ 7,450). There was acidosis or alkalosis in 22.9% (n = 67) of patients. In 28.7% of patients (n = 84) we detected lactate as ≥2.0. 91.8% (n = 268) of the patients were discharged after completing treatment in the intensive care unit. 7,2% (n = 21) of patients were transferred to another department for further treatment or referred to another medical center. Three (1%) (n = 3) of patients died. In table 3, we share LOS, tension, pulse rate, GCS, inotropes, mechanic ventilation and dialysis supports. 1 patient was hospitalized in the Department of Psychiatry due to ongoing suicidal thoughts.

When all patients were evaluated within the scope of the Ankara Poisoning Criteria we concluded that 45.5% (n = 133) of patients had a "zero" point. In this study, we compared of the Ankara poisoning criteria with treatment requirements of patients and values of the Ankara poisoning criteria with the criteria values of another intensive care unit (Table 4,5).

Table 3: General characteristics

Length of Hospital Stay	1 day	%11,9
	2≥ day	%88,1
Pulse rate	<60/ min or 100/min≥	%9,5
	60-100/min	% 90,5
Hypotension	+	%3,7
	-	%96,5
GCS	15	%83,9
	≤14	%16,1
Inotropic support	+	%3,4
	-	%96,6
Mechanic Ventilation	+	%4,4
	-	%95,4
Dialysis	+	%1
	-	%99

Discussion

The aim of this clinical trial is to introduce objective and easy-to-reach criteria that can be applied during the ICU admission of patients with poisoning. The results showed that patients who did not meet the criteria, set as the result of our study, did not need inotropic agents, dialysis, mechanical ventilation, special treatment and antidote, and also showed that patients got low points in scoring systems such as APACHE II, SOFA, QSOFA, MEWS and SIRS. Therefore, we have come to the conclusion that an objective clinical evaluation tool that will evaluate blood gas, vital signs, GCS and whether a patient needs intensive care or not, can be created for patients with poisoning.

The main decisive factor in the selection of these five criteria (Glaskow coma score <15, systolic blood pressure <90 mm Hg, bradycardia (<60 beats / min) or tachycardia (> 100 beats / min), acidosis (pH < 7,359 or alkalosis (pH> 7,45) and serum lactate level> 2.0 mmol / L), collected under the name of "Ankara Poisoning Criteria", was that all these criteria were easily accessible. Another factor affecting our choice is the fact that the GCS represents the patient's state of consciousness, systolic blood pressure and heart rates show hemodynamic problems in the patient if there are any, and the patient's pH and lactate values provide information about the patient's metabolic status.

Today, both the national Advisory Center on Toxicology (114) approach and the general approach around the world show that clinicians should provide the follow-up at least 24 hours[3,9] to patients with poisoning, and even this should be done under intensive care settings. However, when there is no need for intensive care, there are some cases of poisoning that are followed up in the intensive care unit for preventive purposes and as the result, limited number of intensive care beds are occupied, which is an important problem in the whole world's medicine. As a result of this study, we have determined that we can overcome this problem with

Table 4: The Comparison of Values of the Ankara Poisoning Criteria with the Criteria Values of Another Intensive Care Unit

	ANKARA CRITERIA		P value	
	NEGATIVE	POSITIVE		
qSOFA	0	128	105	0,000
	≥1	5	54	
SOFA	≤ 4	129	139	0.003
	≥5	4	20	
SIRS	≤ 1	131	138	0,000
	≥2	2	21	
APACHE II	≤6	108	92	0,000
	≥7	25	67	
MEWS	≤2	133	134	0,000
	≥3	0	25	

Table 5: The Comparison of the Ankara Poisoning Criteria with Treatment Requirements of Patients

	ANKARA CRITERIA		P value	
	NEGATIVE	POSITIVE		
Length of hospital stay (days)	1	24	11	0.004
	≥2	109	148	
Need for Mechanical Ventilation	None	133	146	0,000
	Yes	0	13	
Need for inotropic support	None	132	150	0.024
	Yes	1	9	
Need for Dialysis	None	133	156	0.055
	Yes	0	3	
Special Treatment	None	107	102	0.002
	Yes	26	57	
Antidote	None	133	159	0.001
	Yes	0	9	

the Ankara Poisoning Criteria. With the implementation of the Ankara Poisoning Criteria, we concluded that 45.5% of the patients were not in need of hospitalization in the ICU. When we compare scoring systems such as Apache II, SOFA and QSOFA with the patients' scores obtained from the Ankara Poisoning Criteria, we observed that the Ankara Poisoning Criteria were correlated with other scoring systems ($p < 0.005$). When we reviewed the literature, two studies on this topic show that patients with poisoning (having high Apache 2 score) hospitalized in the intensive care unit have higher mortality and require mechanical ventilation[3,7,10]. Moreover, it has also been found that the Apache 2 score is useful in prognosing patients who are followed up due to poisoning in the intensive care unit[8]. Meanwhile, the high Apache 2 scores in our study also correlated with the Ankara Poisoning Criteria. The criteria we use can be a good alternative to the Apache 2 score in clinical practice because they are more practical and easily remembered.

Previous studies have shown that the scoring systems determined for patients could not compare the clinical status of patients (need of ventilator, dialysis and inotropic support). The previously conducted studies focused mostly on the vital signs of the patients[2,3,7]. The Apache scores of the patients with poisoning hospitalized in the ICU in the studies of both Banderas-Bravo and al., and Alizadeh and al. were compared; however, no other patients' findings were reported about the clinical status of the patients. In our study, patients were assessed in terms of the Ankara Poisoning Criteria, while at the same time it was questioned whether it is possible to predict the need for intensive care treatment of patients by using these criteria.

Also in our study, it was found that systems aimed at predicting the severity of intensive care patients are mostly focused on the evaluation of sepsis patients. The clinical use of the poisoning severity score (PSS)[1,11], which is used in the evaluation of patients with poisoning, has not reached the desired prevalence due to the examination of the large number of parameters.

The most important limitation of our study is that it is done in one center and as the result, it could not be possible to examine some types of poisoning. Since the cases with poisoning vary locally, our developed scoring system needs

to be supported by multicenter studies in different geographical regions. The second limitation might be that our patient group relatively consists of more of patients who are not really in need of intensive care. Therefore, we need to carry out different studies and publish the results of these studies using the Ankara Poisoning Criteria in various centers and intensive care units.

Conclusion

The Ankara Poisoning Criteria, introduced in this study, is an appropriate, simple and practical scoring system that can be used in the decision for the indication of intensive care hospitalization and prognosis prediction in cases with poisoning.

References

1. Persson HE, Sjöberg GK, Haines JA, Pronczuk de Garbino J. Poisoning severity score. Grading of acute poisoning. J Toxicol Clin Toxicol. 1998;36(3):205-13.
2. Van den Oever HLA, Van Dam M, Van 't Riet E, Jansman FGA. Clinical parameters that predict the need for medium or intensive care admission in intentional drug overdose patients: A retrospective cohort study. J Crit Care. 2017 Feb;37:156-161. doi: 10.1016/j.jcrc.2016.09.020. Epub 2016 Sep 28.
3. Banderas-Bravo ME, Arias-Verdú MD, Macías-Guarasa I, Aguilar-Alonso E, Castillo-Lorente E, Pérez-Costillas L, Gutierrez-Rodriguez R, Quesada-García G, Rivera-Fernández R. Patients Admitted to Three Spanish Intensive Care Units for Poisoning: Type of Poisoning, Mortality, and Functioning of Prognostic Scores Commonly Used. Biomed Res Int. 2017;2017:5261264. doi: 10.1155/2017/5261264. Epub 2017 Mar 28.
4. Meulendijks CF, Van den Berg EJ, Fortuyn HD, Verkes RJ, Van der Wilt GJ, Kramers C. Predicting the need for hospital admission in patients with intentional drug overdose. Neth J Med. 2003 May;61(5):164-7.
5. Brett AS, Rothschild N, Gray R, Perry M. Predicting the clinical course in intentional drug overdose. Implications for use of the intensive care unit. Arch Intern Med. 1987 Jan;147(1):133-7.
6. Guidelines for intensive care unit admission, discharge, and triage. Task Force of the American College of Critical Care Medicine, Society of Critical Care Medicine. Crit Care Med. 1999 Mar;27(3):633-8.
7. Alizadeh AM, Hassanian-Moghaddam H, Shadnia S, Zamani N, Mehrpour O. Simplified acute physiology score II/acute physiology and chronic health evaluation II and prediction of the mortality and later development of complications in poisoned patients admitted to intensive care unit. Basic Clin. Pharmacol Toxicol. 2014 Sep;115(3):297-300. doi: 10.1111/bcpt.12210. Epub 2014 Mar 6.
8. Eizadi Mood N, Sabzghabaee AM, Khalili-Dehkordi Z. Applicability of different scoring systems in outcome prediction of patients with mixed drug poisoning-induced coma. Indian J Anaesth. 2011 Nov;55(6):599-604. doi:10.4103/0019-5049.90616.
9. Lam SM, Lau AC, Yan WW. Over 8 years experience on severe acute poisoning requiring intensive care in Hong Kong, China. Hum Exp Toxicol. 2010 Sep;29(9):757-65. doi:10.1177/0960327110361753. Epub 2010 Feb 9.
10. McMahon A, Brohan J, Donnelly M, Fitzpatrick GJ. Characteristics of patients admitted to the intensive care unit following self-poisoning and their impact on resource utilisation. Ir J Med Sci. 2014 Sep;183(3):391-5. doi: 10.1007/s11845-013-1026-7. Epub 2013 Oct 8.
11. Novack V, Jotkowitz A, Delgado J, Novack L, Elbaz G, Shleyfer E, Barski L, Porath A. General characteristics of hospitalized patients after deliberate self-poisoning and risk factors for intensive care admission. Eur J Intern Med. 2006 Nov;17(7):485-9.
12. Casey PB, Dexter EM, Michell J, Vale JA. The prospective value of the IPCS/EC/EAPCCT poisoning severity score in cases of poisoning. J Toxicol Clin Toxicol. 1998;36(3):215-7.

Original Article
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The Evaluation of Referance Values for Diaphragmatic Excursion in Turkish Population

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Abstract

Background: The diaphragm is the largest respiratory muscle that contributes to the respiratory work. The aim of this study was to measure the diaphragm excursion, which shows diaphragm function in healthy volunteers, and to determine the reference values in the Turkish population.

Material-Methods: This cross-sectional descriptive study was carried out at a university hospital between 01.01-01.04.2019. Two hundred and thirthy (230) healthy subjects had no history of pulmonar or neuromusculary disease were included in the study. Age, sex and diaphragmatic excursion measurements of subjects were recorded. Measurements were obtained by lung silhouette, anterior and Right Hemidiaphmgm and Left Hemidiaphragm Ultrasonographic Method with M Mode. $p<0.05$ was considered statistically significant.

Results: 230 healthy subjects were included in the study. The male/female ratio was 1.04. No statistically significant difference was found between male and female in terms of age and body mass index. It is concluded that there were statistically significant higher LungSilR, Ant Ax. B Mode R, Ant Ax. B Mode L, Ant. Ax. M Mode R, Ant. Ax. M Mode L of male than female sex. There were a significantly strong positive association between LungSilR and LungSilL, Ant Ax. B Mode R and Ant Ax. B Mode L, Ant. Ax. M Mode R and Ant. Ax. M Mode L.There were a significantly strong positive association between LungSilR and Ant Ax. B Mode R, LungSilL and Ant Ax. B Mode L; significantly weak association between LungSilR and Ant Ax. M Mode R, Ant Ax. B Mode R and Ant. Ax. M Mode R, LungSilL and Ant Ax. M Mode L, Ant Ax. B Mode L and Ant. Ax. M Mode L.

Conclusion: It was concluded that diaphragmatic excursion in theTurkish population was 55.9 - 62 mm in female sex and 67.1 - 71 mm in male sex, since it was found that there was no obstacle in the creation of reference values due to changes in measurement methods and direction, and correlation was found in all methods and right-left measurements for diaphragmatic excursion results.

Keywords: Diaphragm ultrasonography; excursion; healthy subjects; referans values; Turkish population.

Introduction

The diaphragm is the largest respiratory muscle, which contributes to the respiratory effort. Although there is a displacement at a rate of 2-3 cm at resting condition, and the displacement varies according to personal differences and method in deep inspiration, it can reach 7-11 cm[1]. Diaphragmatic dysfunction is faced frequently in muscular dystrophy or in some thoracic and abdominal pathologies. Some conditions like nervous system and phrenic nerve damage may also damagethe diaphragmatic activity. Although bilateral diaphragm damage may cause difficulty in breathing during orthopnea or resting, unilateral diaphragm paralysis is usually asymptomatic[2]. However, there may be suspicion for diaphragmatic paralysis in some conditions like recurrent lung infections, hypoventilation during sleep, limitation in exercise capacity, rapid or frequent breathing, paradoxical activity of abdominal muscles during physical examination, restrictive pattern in pulmonary function tests, and unilateral diaphragm elevation in AC graphics[3]. As a result, since diaphragmatic dysfunction is a common condition that goes undiagnosed when appropriate tests are not carried out upon suspicion, the need for diaphragm evaluation is increasing in both inpatients and especially in outpatients who refer to emergency services.

The function and structure of the diaphragm can be best evaluated with the electrical or magnetic phrenic nerve stimulation. Aside from this, diaphragm paralysis may be evaluated with fluoroscopy; however, fluoroscopy contains both ionized radiation and requires that patients are transported. Another method is Ultrasonography (USG), which is easy, inexpensive and reproducible. Today, although Thorax Ultrasonography is frequently used, diaphragmatic USG is not yet accepted and used widely. The main reason for this is that

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the results of studies conducted in this field are contradictory, and standard measurement methods are not defined yet.

The purpose of the present study was to measure the diaphragm excursion, which shows diaphragm function in healthy volunteers, with some methods, and to determine the reference values in the Turkish population.

Material and Methods

This cross-sectional descriptive study was carried out at a large, tertiary referral, academic institution, after receiving institutional review board approval. All subjects have given verbal consent and signed. Between 01.01-01.04. 2019, two hundred and thirthy (230) healthy subjects had no history of pulmonar or neuromusculary disease and no shortness of breath at rest or with effort and no history of abdominal or thoracic surgery were included in the study. Age, sex and diaphragmatic excursion measurements of subjects were recorded.

***Lungsilhouettemethod**:* Measurement of the upward and downward movement of the lung silhouette in the scapular line. All participants were evaluated in a sitting position. Ultrasound was performed with a Terason Usmart 3200T (77 Terrace Hall Avenue Burlington, MA 01803 United States) and a 3.5-MHz curved probe. The transducer was placed at the lowest part of the lung silhouette in the scapular line. The participant was instructed to exhale as deeply as possible (to RV) and then to inhale deeply to total lung capacity. This maneuver was filmed, and afterward, the distance between the highest and the lowest point of the lung silhouette was measured. This maneuver was performed on the right and the left side. For comparison between this method and the anterior method, only the right side value was used because the anterior method was only used on the right side because of the well-known difficulties on the left side with the anterior method[4, 5, 6, 7,8]**.** The median value was calculated.

***Anteriormethod**:* Measurement of the up- and downward movement of the right diaphragmatic dome from anterior. All participants were evaluated in a lying position. Ultrasound was performed with a **Hitachi ultrasoundsystem (Sono MR, EUB-7500 HV**) using a 3.5 MHz curved probe. The transducer was placed in an area between anterior axillar line and midclavicular line and using the liver as ultrasound window directed toward the diaphragmatic dome. The participant was instructed to exhale as deeply as possible (to RV) and then to inhale deeply to total lung capacity. This maneuver was filmed, and afterward, the distance between the highest and the lowest point of the right hemidiaphragmatic dome was measured. This method was used only on the right side because of the known difficulties with the measurement on the left side with the spleen as ultrasound window[4, 5, 6, 7,8]**.**

Right Hemidiaphmgmand Left Hemidiaphragm Ultrasonographic Method with M Mode

The probe was placled between the midclavicular and anterior axillary lines and intlu- subcostal area, and directed medially, craniallv, and dorsallv, so that the ultrasound beam reached perpendicularlv the posterior third of the right hemidiaphragm Diaphragm movements were recorded in M-mode. Ultrasonographic measurements were performed during quiet breathing (QB) and deep breathing (DB). This maneuver began at the end of normal expiration, and the volunteers were asked to breathe in as deeply as they possibly could.

A subcostal or low intercostal probe position was chosen between the anterior and midaxillary lines to obtain the best imaging of the left hemidiaphragmatic dome. The motion was recorded during the same respiratory maneuvers as for the right hemidiaphragm.

The diaphragm's inspiratory amplitudes (excursions) were measured from the M-mode sonography. For the QB and DB measurements, the first caliper was placed at the foot of the inspiration slope on the diaphragm echoic line and the second caliper was placed at the apex of this slope. Several respiratory cycles were recorded, and measurements were averaged from at least three different cycles.

All evaluations were made by the same rediology spesialist who was blinded to the pulmonary function status of each patient and who has experienced in lung and diaphragmatic ultrasound[8]**.**

Statistical analysis

The data that were obtained in the study were recorded in the SPSS 25.0 Program (Armonk, NY: IBM Corp.). The fitness of the continuous variables to the normal distribution was analyzed with the Kolmogorov-Smirnov test and was recorded as median (quartiles). In this respect, the Mann Whitney U-test was used for the differences between the genders for these parameters that do not show normal distribution. The significance level of the continuous measurements among the four groups was accepted as $P<0.05/6$. The Spearman Test Analysis was used for correlation analyzes among Lung SilR and LungSilL, Ant Ax. B Mode R and Ant Ax. B Mode L, Ant. Ax. M Mode R and Ant. Ax. M Mode L; and $P<0.05$ value was considered to be statistically significant.

Results

A total of 230 healthy participants were included in the present study. A total of 48.9% (n=112) of these were women with a median age of 33.0 (quartile 30.0-36.0); and 51.1% (n=117) were men with a median age of 34.0 (quartile 31.0-

Table 1. Age, body mass index and ultrasonographic measurements of participants of the study and significance level between these results.

	female (n=112)	male (n=117)	P value
Age, median (quartile)	33.0 (30.0- 36.0)	34.0 (31.0-37.0)	0.141
BMI, median (quartile)	23.1 (20.9-26.6)	24.5 (22.7-26.1)	0.095
LungSilR(mm), median (quartile)	55.9 (47.7-64.4)	67.1 (63.8-78.8)	**<0.001**
LungSilL(mm), median (IQR)	57.8 (49.3-66.5)	68.0 (64.1-79.0)	**<0.001**
Ant Ax. B Mode R(mm), median (quartile)	59.1 (49.8-68.5)	69.8 (66.6-80.1)	**<0.001**
Ant Ax. B Mode L(mm), median (quartile)	60.2 (50.6-70.2)	70.1 (67.0-82.1)	**<0.001**
Ant. Ax. MModeR (cm), median (quartile)	6.0 (5.0-7.0)	7.1 (6.5-8.0)	**<0.001**
Ant. Ax. M Mode L (cm), median (quartile)	6.2 (5.2-7.2)	7.1 (6.8-8.5)	<0.001

(Data are expressed as median) (BMI: Body MassIndex)

37.0). The median BMI of the women was 23.1 (quartile 20.9-26.6), and the median BMI of the men was 24.5 (quartile 22.7-26.1). The difference levels of the ultrasonographic findings between the genders are given in **Table 1**. In this respect, it was determined that the Lung SilR (67.1 vs 55.9; p<0.001), LungSilL (68.0 vs 57.8; p<0.001), Ant Ax. B Mode R (69.8 vs 59.1; p<0.001), Ant Ax. B Mode L (70.1 vs 60.2; p<0.001), Ant. Ax. M Mode R (7.1 vs 6.0; p<0.001), Ant. Ax. M Mode L (7.1 vs 6.2; p<0.001) of the men were higher at a significant level compared to the women.

The correlation levels between the right and left ultrasonographic findings of the participants of the study are given in **Table 2**. There was a strong, significant and positive relation between the Lung SilR and LungSilL, Ant Ax. B Mode R and Ant Ax. B Mode L, Ant. Ax. M Mode R and Ant. Ax. M Mode L (r=0.949, P<0.001; r=0.985, P<0.001; r=0.949, P<0.001).

The correlation and significance levels of the ultrasonographic findings with each other are given in **Table 3**. There was a strong positive correlation between Lung SilR and Ant Ax. B Mode R, Lung SilL and Ant Ax. B Mode L(r=0.946, P<0.001; r=0.979, P<0.001; r=0.949, P<0.001). There was a significant and weak relationship between LungSilR and Ant Ax. M Mode R, Ant Ax. B Mode R and Ant. Ax. M Mode R, LungSilL and Ant Ax. M Mode L, Ant Ax. B Mode L and Ant. Ax. M Mode L (r=0.260, P<0.001; r=0.292, P<0.001; r=0.282, P<0.001; r=0.282, P<0.001).

Discussion

The diaphragm excursion measurements differ at significant levels in female or male gender; the changes in the diaphragmatic excursion according to the measurement method; however, this change not reaching a statistical significance level and the lack of statistically significant differences in the right or left side measurements are among the main results of the present study of ours. Based on this, it is possible to argue that the average diaphragm displacement of the male gender in the Turkish population is 67.1-71 mm,

Table 2. The corellation between right and left side of ultrasonographic findings

Variables	Correlationcoefficient	*P value*
LungSilR(mm)and LungSilL(mm)	0.949	**<0.001**
Ant Ax. B Mode R(mm) and Ant Ax. B Mode L(mm)	0.985	**<0.001**
Ant. Ax. M Mode R (mm) and Ant. Ax. M Mode L (mm)	0.949	**<0.001**

Table 3. The corellation between ultrasonographic findings

Variables	Correlationcoefficient	*P value*
LungSilR(mm) and Ant Ax. B Mode R(mm)	0.949	**<0.001**
LungSilR(mm) and Ant. Ax. M Mode R (mm)	0.260	**<0.001**
Ant Ax. B Mode R(mm) andAnt. Ax. M Mode R (mm)	0.292	**<0.001**
LungSilL(mm)and Ant Ax. B Mode L(mm)	0.979	**<0.001**
LungSilL(mm) and Ant. Ax. M Mode L (mm)	0.282	**<0.001**
Ant Ax. B Mode L(mm) andAnt. Ax. M Mode L (mm)	0.282	**<0.001**

and between 55.9-62 mm in female gender regardless of the measurement method and the sides (i.e. right or left).

In previous studies, forced breath excursion values were reported at a wide range; 42±16 to 75±10 mm. At resting condition, on the other hand, the same measurement results were determined to be much lower with 15±2 mm[9]. These differences in the results can be attributed to the parallax error rates, which are observed in lateral approach (both longitudinal and intercostal or subcostal imaging), or in measurements obtained with transverse images[10, 11]. These approaches may cause various transducer positions in the chest or abdomen wall and this might affect the reproducibility preventing maximal diaphragmatic excursion recording because of the oblique orientation in the USI rays, which may cause loss of accuracy in the outcomes[12, 13].

The diaphragm thickness measurements reported in the literature for the male and female gender are limited. Boon et al. reported the diaphragm thickness that was measured in healthy controls as 3.3 mm; however, gender was not reported in this study[14]. Cimşit et al. reported lower diaphragm thickness measurement results in women;however, this difference was not at a statistically significant level[15]. Cohn et al.,on the other hand, reported higher diaphragmatic thickness in males at a statistically significant level[5].The gender differences in these studies, in which diaphragm thickness values were mentioned, are probably stem from the higher muscle mass in males compared to females.

This supports the viewpoint arguing that the thickness is higher in men, not only in the diaphragm muscle, but also in any other muscles in any parts of the body. However, evaluations that are made not only by sex but by body mass index or lean muscle mass will be supportive in this regard to support these findings[16]. All these studies that have been mentioned so far were conducted on the diaphragm thickness. However, the results of the studies conducted on the effect of gender on diaphragm excursion are contradictory. In a study that was published by Testa et al. in 2011, no differences in terms of gender were reported; however other studies reported an increased diaphragm excursion in male gender[7, 13, 9]. In the present study of ours, statistically significant and increased diaphragm excursion values were detected in the male gender, which is consistent with the literature. However, as mentioned above, this may be attributed to the increased lean muscle mass in male gender. Although no significant differences were detected in the Body Mass Indices according to gender in the participants who were included in the study, the fact that lean muscle mass was not measured is one of the limitations of the present study.

The M-Mode and B-Mode Ultrasonography were first identified by Haber et al. in 1975 in evaluating the movements of the diaphragm[17]. In previous studies, it was shown that lung silhouette method was well-correlated with the anterior axillary method, it could be carried out easily in all patients including obese patients, it was easy to apply with US and it was suitable for evaluation of both hemidiaphragms[7,18]. In our study, no significant differences were detected between the techniques in terms of measuring diaphragmatic dysfunction when compared to the anterior method; and the correlation of both techniques was found to be strong. Although there were no significant differences between the right and left evaluations in both methods, it is seen useful to make the evaluations by using the right anterior method especially in patients who cannot be given interscapular image position with point of care US.

Studies that reported right-left correlation have been mentioned in the literature[14]. A difference reaching up to 0.33 cm is acceptable in excursion measurements between the right and left diaphragm halves. However, it is not known which diaphragm half must be thinner, and which one might vary among people. If the displacement in one half of the diaphragm is bigger than this value, the half of the diaphragm of that person might be basically thinner, or that side might have been affected by any disease,which caused muscular atrophy. In such cases, it may help to consider that there is a decrease in the thickening ratio, which must be above 1.2 to detect abnormality[19].

In the present study of ours, although there was a difference that does not exceed normal limitsin the diaphragm halves excursion measurements, which is in line with the literature, the right-left half measurements were found to be correlated with all measurement methods. In this case, the right or left side might be preferred based on the position in which the patient feels comfortable or based on the experience of the practitioner. As it is known, creating the window and capturing the appropriate image may be more difficult on the left side due to gastric gas[20] and right side can be preferred for the convenience of the imaging[21].

Conclusion

The diagnosis methods that involve ionized radiation have increased in our present day, and it is important to useinexpensive, easily applicable and reproducible methods for diagnostic purposes. It was concluded that there is no obstacle in the creation of reference value according tothe changes in the measurement methods and the direction for diaphragmatic excursion results; and since correlation was detected in all methods and in all right-left measurements, the diaphragmatic excursion was 55.9-62 mm in female gender and 67.1-71 mm in male gender in the Turkish population.

References

1. Yamaguti WPS, Paulin E, Shibao S, Kodaira S, Chammas MC, Carvalho CRF. Ultrasound evaluation of diaphragmatic mobility in different postures in healthy subjects. J Bras Pneumol 2007;33: 407–413.

2. Scillia P, Cappello M, De Troyer A. Determinants of diaphragm motion in unilateral diaphragmatic paralysis. J Appl Physiol 2004;96: 96–100. .
3. Hart N, Nickol AH, Cramer D,Ward SP, Lofaso F, Pride NB, Moxham J, Polkey MI. Effect of severe isolated unilateral and bilateral diaphragm weakness on exercise performance. Am J Respir Crit Care Med 2002;165:1265–1270.
4. Ueki J, De Bruin PF, Pride NB. In vivo assessment of diaphragm contraction by ultrasound in normal subjects. Thorax. 1995;50(11):1157–1161. .
5. Cohn D, Benditt JO, Eveloff S, McCool FD. Diaphragm thickening during inspiration. J Appl Physiol. 1997;83(1):291–296.
6. Toledo NS, Kodaira SK, Massarollo PC, Pereira OI, Mies S. Right hemidiaphragmatic mobility: assessment with US measurement of cran¬iocaudal displacement of left branches of portal vein. Radiology. 2003;228(2):389–394.
7. Boussuges A, Gole Y, Blanc P. Diaphragmatic motion studied by m-mode ultrasonography: methods, reproducibility, and normal values. Chest. 2009;135(2):391–400.
8. Houston JG, Morris AD, Howie CA, Reid JL, McMillan N. Technical report: quantitative assessment of diaphragmatic movement – a repro¬ducible method using ultrasound. Clin Radiol. 1992;46(6):405–407.
9. Testa A, Soldati G, Giannuzzi R, Berardi S, Portale G, Gentiloni Silveri N. Ultrasound M-mode assessment of diaphragmatic kinetics by anterior transverse scanning in healthy subjects. Ultrasound Med Biol 2011;37:44–52.
10. Lerolle N, Guerot E, Dimassi S, Zegdi R, Faisy C, Fagon JY, Diehl JL. Ultrasonographic diagnostic criterion for severe diaphragmatic dysfunction after cardiac surgery. Chest 2009;135:401–407.
11. Lloyd T, Tang YM, Benson MD, King S. Diaphragmatic paralysis: The use of M-mode ultrasound for diagnosis in adults. Spinal Cord 2006;44:505–508. .
12. Akiyama N, Ishikawa S, Takeuchi T. Ultrasonographic evaluation of the influence of different postures on diaphragmatic motion in mechanically ventilated patients. Eur J Ultrasound 2000;11:205–211.
13. Kantarci F, Mihmanli I, Demirel MK, Harmanci K, Akman C, Aydogan F, Mihmanli A, Uysal O. Normal diaphragmatic motion and the effects of body composition: Determination with M-mode sonography. J Ultrasound Med 2004;23:255–260. .
14. Boon AJ, Harper CJ, Ghahfarokhi LS, Strommen JA, Watson JC, Sorenson EJ. Two-dimensional ultrasound imaging of the diaphragm: quantitative values in normal subjects. Muscle Nerve. 2013;47(6):884-9.
15. Cimsit C, Bekir M, Karakurt S, Eryüksel E. Ultrasound assessment of diaphragm thickness in COPD. Marmara Medical Journal 2016; 29: 8-13.
16. Smargiassi A, Inchingolo R, Tagliaboschi L et al. Ultrasonographic assessment of the diaphragm in COPD patients: relationships with pulmonary function and the influence of body composition-a pilot study. Respiration 2014; 87: 364-71. .
17. Haber K, Asher M, Freimanis AK. Echographic evaluation of diaphragmatic motion in intra-abdominal diseases. Radiology 1975;114: 141–144.
18. Topeli A , Laghi F , Tobin MJ . The voluntary drive to breathe is not decreased in hypercapnic patients with severe COPD . Eur Respir J . 2001 ; 18 (1): 53 - 60 . .
19. Baria MR, Shahgholi L, Sorenson EJ, Harper CJ, Lim K, Strommen JA, Mottram CD, Boon AJ. B-mode ultrasound assessment of diaphragm structure and function in patients with COPD. Chest 2014; 146: 680-685. .
20. Goligher EC, Laghi F, Detsky M.E. Measuring diaphragm thicknesswith ultrasound in mechanically ventilatedpatients: feasibility, reproducibility and validity. Intensive Care Med. 2015 Apr;41(4):642-9. doi: 10.1007/s00134-015-3687-3. Epub 2015 Feb 19. .
21. Scott S, Fuld JP, Carter R, McEntegart M, MacFarlane NG. Diaphragm ultrasonography as an alternative to whole-body plethysmography in pulmonary function testing. J Ultrasound Med 2006;25:225–232.

Orginal Article
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Evaluation of Patients with Chronic Renal Failure Admitted to the Emergency Department

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Abstract

Objective: The aim of this study is to retrospectively investigate the files of patients with Chronic renal failure (CRF) who have undergone any dialysis program and have been admitted to the emergency department, drawing attention to the preferred treatments with the most common diagnoses, together with demographic and clinical information.

Materials and Method: A total of 683 patients with CRF who were admitted to the emergency department of Meram Medical Faculty, Turkey in the last 5 years were searched and 224 patients, 189 of whom had hemodialysis (HD) and 35 of whom had peritoneal dialysis (PD), were included in the study. The demographic data, complaints and laboratory findings at the time of the admission to the emergency department, diagnoses, treatments and clinical outcomes were analysed.

Results: Sixty nine patients 69 patients had applied to the emergency department more than once. The most common presenting complaint in the HD group was shortness of breath, and for the PD group it was abdominal pain. Fourteen point three percent of all patients (14.3%) died at the end of clinical follow-up. The presence of a history of cerebrovascular disease, antibiotic use in the emergency department, and ventilator use were found to be statistically significant in terms of mortality related factors.

Conclusion: The complaints pattern of patients on routine dialysis is quite wide. In some patients, medical treatment in the emergency department consists only of HD treatment. This shows that some of the dialysis patients need additional dialysis.

Keywords: Emergency department, chronic renal failure, treatment

Introduction

Chronic renal failure (CRF), whose incidence and prevalence is increasing worldwide, has reached a serious level and has become a public health problem[1,2]. CRF, which has high mortality and morbidity rates due to the problems encountered during the disease process or replacement and the complications it develops, decreases both the quality of life of the patient and the cost of diagnosis and treatment[3,4,5,6,7]. In the acute and chronic period of the disease, due to its nature and complications, as well as handicaps developed during the replacement of the deficiency, many patients present to clinicians in emergency conditions[8,9]. In the United States more than half a million hospitalizations are performed each year among patients with end-stage renal disease. The average length of hospital stay of these patients is 11 days[4]. This investigation is to learn about this group of patients more closely, to know and treat problems that threaten their lives, to discover what may reduce their mortality and morbidity, and to know better, when the necessary precautions should be taken. This knowledge will also shed new light on treating clinicians, as it will also cause the breaking of the chain in the pathophysiological process that causes the complaints. For this purpose, chronic renal failure patients who were admitted to the emergency department of Meram Medical Faculty, Turkey and who have continued a regular dialysis program were examined retrospectively; with the aim of drawing attention on the most common diagnoses and the treatments preferred, together with the demographic and clinical information of these patients.

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Materials and Methods

The records of 683 patients with N18.9-Unidentified Chronic Renal Failure according to the ICD-10 diagnostic coding and who were admitted to the emergency department in the last 5 years were reviewed retrospectively. Of these, patients who had undergone hemodialysis (HD) and peritoneal dialysis (PD) for at least 3 months, who were 18 years of age, and who had adequate file records in the emergency department were included in the study. Other patients were excluded from the study. The demographic information, clinical history, complaints at the time of the admission to the emergency department, laboratory findings at the time of admission, the names of the clinical consultations requested on behalf of the patient, the diagnoses they received, the treatments given and the clinical outcome (discharged with full recovery and exitus) were found. The type and number of comorbidity and the number of patients were collected in the light of the information recorded in the files as were the other data.

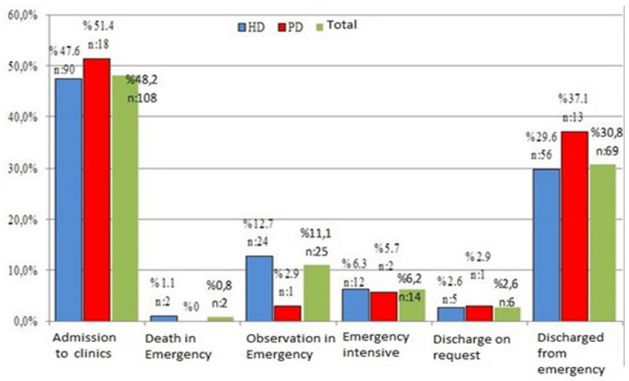
The information received from the files reviewed was entered as data in the SPSS.15 program. The descriptive statistics of numerical data were performed in the SPSS package program. The normal distribution analysis was performed and the normally distributed data were compared with the Student-t test. The data that did not comply with the normal distribution were compared with the Mann-Whitney U test. The Chi-square test was used for the categorical data.

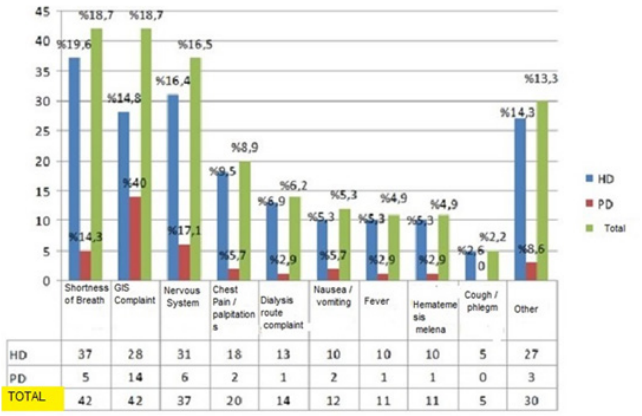
Results

Of the 224 patients included in the study, 189 were undergoing HD and 35 were going into PD. **(Table 1).** The mean HD duration of HD patients admitted to the emergency department was 41.9 months (3–180), 36.8 months (3–138) in PD patients, and 41.1 months (3–180) in the whole patient group. All 224 patients had 388 visits to the emergency department. Sixty nine (69) of the 189 HD patients (36.5%) had applied more than once. In 35 PD patients, this rate was 14 (40%).

Table 1. Gender distribution of dialysis patients admitted to emergency department

	Male	Female	Total
Haemodialysis	102	87	189
Peritoneal dialysis	16	19	35
Total	**118**	**106**	**224**





Of the 224 patients, 192 (85.7%) were treated and discharged from the emergency department or clinic, and 32 **(14.3%)** died in the emergency department or the clinics they were transferred to. The mean age was 60.4 years in the HD group, 53.6 years in PD patients and 59.3 years in the whole group.

It was determined that of the total 224 patients, 33.5% (75 patients) were discharged on the same day from the emergency department after their treatment and care or were discharged due to the patients refusing treatment, **48.2**% (**108 patients**) were hospitalized in the relevant clinics, 0.9% (2 patients) died in the emergency room on the same day, 17.5% (39 patients) were not hospitalized in any clinic but followed up in the emergency department **(Graph 1)**.

The distribution of patients according to the clinics to which they were transferred were as follows: 24.1% (54 patients) of the patients were transferred to the nephrology clinic, 12.5% (28 patients) to ICU (Internal Care Unit), 16.5% (37 patients) to the emergency department observation or intensive care unit, 3.1% (7 patients) to the general surgery clinic, 2.2% (6 patients) to the cardiology service, 1.8% (4 patients) to the gastroenterology service and the remaining 6.3% (14 patients) were taken to to the urology, neurology, cardiovascular surgery clinic, neurosurgery, haematology or gynaecology clinics. When the total number

is considered, 126 (66.7%) of the 189 HD patients and 21 (60%) of the 35 PD patients were taken over by a particular branch for clinical follow-up and treatment.

Of the 39 patients (observation: 25, emergency intensive: 14 patients) admitted to the emergency department, 20 were followed up in the emergency department without any hospitalization. Of these 20 patients, 5 were followed up in the intensive care unit and 4 died. All of the 15 patients who were followed up with emergency observation without any hospital admission were discharged after the completion of their treatment. The duration of emergency observation was 1-5 days. The duration of the emergency stay was 1-7 days.

Thirty one point seven percent of all patients 31.7% of all patients examined were found to have Diabetes Mellitus (DM), 55.8% had Hypertension (HT), 19.2% has Coronery Artery Disease (CAD), 7.1% had HF, 4.5% had Chronic Obstructive Pulmoner Disease (COPD) and 5.4% had a history of Cerebrovasculer Event (CVE).

The frequency of admission complaints of the patients were shortness of breath, Gastrointestinal System (GIS) complaints, neurological system complaints, chest pain and palpitations, dialysis problems, nausea, vomiting, fever, hematemesis and melena, and coughing and phlegm. The frequency of these complaints in HD and PD groups and the number of cases are shown in **Graph 2**.

Fourty eight point six percent of all patients (48.6%) who were admitted to the emergency department and underwent peritoneal dialysis were found to have complaints of GIS (GIS complaint, hematemesis, melena, nausea, or vomiting). This rate was almost twice that of HD patients. When the entire patient population was examined and when the dyspnoea complaint was classified into cardiovascular complaints, 27.6% of the patients had presented with complaints related to the cardiovascular system.

Seventy three percent (73%) of the 189 HD patients (139 patients), 77.1% of the 35 PD patients (27 patients) and 74.1% (166 patients) of all patients were evaluated by internal medicine. The clinics where the consultation was required following internal medicine were monitored by cardiology (13.8%), neurology (7.9%), and general surgery (7.4%) in HD patients while the infectious diseases clinic was the second most commonly consulted branch in PD patients (11.4%)

Eighteen point three percent of all patients (18.3%) were discharged from the emergency department without any diagnosis. An infective status was reported in 27.6%, a respiratory system disease was diagnosed in 22.3%, Cardiovasculer System (CVS) was diagnosed in 13.1%, and hyperkalaemia and acidosis were diagnosed in 12.5%. Diagnosis rates of hyperkalaemia and acidosis were 13.7% in HD patients, whereas the diagnosis of peritonitis, which is more specific for peritoneal dialysis, was 28.5% in PD patients.

When the 224 patients admitted to the emergency department were evaluated in terms of deaths, there were 38 deaths according to clinical observations and treatment. Three of the 38 patients who died had been undergoing PD. The first cause of death in these 3 PD patients was pneumonia after pulmonary embolism, the second was pulmonary edema-hypervolemia, and the third patient's cause of death was not clear.

Of the 224 patients who applied to the emergency department, 99 patients (that is, 66 of 224 patients) (25.5% of all patients) had indications of HD in the emergency department, and the patients were admitted to emergency HD, except for those with routine dialysis programs. As a result of the examination and necessary consultations, 24 (24.4% of HD patients and 6.1% of all admissions) of these 99 admissions were discharged with the consent of the clinician or voluntarily after the HD application was completed.

While 22.7% of the 224 patients admitted to the emergency department did not receive any treatment, 19 (8.5%) underwent blood transfusion for various reasons, 21.4% received antihypertensive treatment, and 13.4% received potassium-lowering fluid. Antibiotic treatment was commenced for 85 patients (37.9%) on the same day. Twenty seven of these patients (27 patients) (31% of those receiving AB) died. Antibiotic use was present in 84.4% of the patients who died after follow-up. A total of 16 examined patients (7.1%) were intubated and ventilated in the emergency department and 13 (81.2%) of them died.

No statistically significant difference was found between HD and PD in terms of mortality ($p > 0.05$).

DM was found in 37.5% of patients, HT in 48.5%, CAD in 20%, CVE in 11.4%, COPD in 2.8% and HF in 8.5%. There were no comorbid diseases in 32.2% (10 patients) who died and 31.7 (60 patients) of the patients who were discharged.

In the above analysis which has been conducted in the light of all these evaluations, mortality-related factors were also examined. The mortality rate was found to be significantly higher in patients with a history of cerebrovascular events ($p: 0.02$), who needed a ventilator, who underwent invasive mechanical ventilation ($p < 0.001$), and for those who had commenced antibiotic therapy ($p < 0.001$).

As a result;

1. Of the 224 patients admitted to the emergency department, 84.4% were undergoing HD and 15.6% were going into PD.
2. A total of 83 patients admitted to the emergency department more than once for various reasons.

3. Thirty five of the 224 patients admitted to the emergency department died. Fifteen point three percent of HD patients (15.3%) and 8.6% of PD patients died. The mortality rate in HD patients was higher than in PD patients.
4. Fourty seven point six percent of HD (47.6%) and 51.4% of PD patients admitted to the emergency department were hospitalized for the continuation of their treatment.
5. Nineteen percent of the patients (19%) (39 patients) were transferred to the emergency observation or intensive care unit.
6. Thirty one point seven percent 31.7% of all patients had DM, 55.8% had HT, and 19.2% had CAD. 24% of the patients had no comorbidity.
7. Among the comorbidities, DM was higher in PD patients than in HD patients.
8. The most common presenting complaint in HD patients was dyspnoea, while the most common presenting complaint in PD patients was GIS symptoms, including abdominal pain.
9. When the consulting clinics were considered, internal medicine was the most frequently requested in both dialysis types (74.1%). The second most frequently requested consultation in HD patients was cardiology, whereas it was internal medicine in PD patients.
10. Considering the diagnoses of the patients, hyperpotassemia was found in 28 patients (14.8%) in the HD patient group and in 2 patients (5.7%) in the PD group. GIS bleeding was found only in 5 HD patients (2.6%). Fistula problems were detected in 10 (5.2%) of the 189 HD patients. Cerebrovascular disease was determined in 9 patients (4.7%) from HD patients and in 3 (8.5%) from PD patients. Hypervolemia was found in 24 (12.6%) of the HD patients. The number of patients with hypervolemia in PD patients was 3 (8.5%). The diagnosis of HT was made in 25 (13.2%) of all HD patients and in 3 (8.5%) of PD patients. Peritonitis was determined in 10 (28.5%) from all PD patients.
11. Diagnosis was not present in 32 (16.9%) of HD patients and in 9 (25.7%) of PD patients.
12. Twenty nine point five percent of all patients (29.5%) had undergone emergency dialysis. The antibiotic treatment was commenced in 37.9% of patients. Blood transfusion was performed in 8.5%, and 7.1% (n: 16) were intubated and connected to the ventilator.
13. When the effect of the number of comorbidity on mortality was examined, no significant difference was found.
14. When the cost of the patients who underwent HD due to the need of HD and were discharged (24 patients) on the same day in the emergency room were considered, the cost (examination + examination and consultation + HD and other medical care) was calculated as 945 Turkish Liras and about 175 dollar .
15. Mortality-related factors were statistically significant in terms of SVO history, ventilator requirement, and antibiotic initiation ($P < 0.001$). When mortality related factors are examined, cardiovasculer history, ventilator requirement and antibiotic initiation were found to be statistically significant ($P < 0.001$).

Discussion

In this study, the complaints of the patients admitted to the emergency department who were still receiving replacement therapy due to chronic renal failure, the laboratory values and the comorbid conditions at the time of admission, the diagnosis and the treatment approaches were evaluated. A descriptive analysis was performed. In this context, this study is important as recognizing the patients and the complications that may develop together with the disease more closely. Furthermore, the treatment planned with an analytical approach will provide advantages in terms of patient and physician satisfaction and cost, and in terms of determining the parameters that emergency physicians should consider while approaching these patients. When the literature was reviewed for the presence of a similar study, few foreign sources were found[10,11,12,13,14]

We found that the dialysis patients had a wide range of complaints and more than one complaint was combined in one patient. Although it is difficult to classify the complaints because of this heterogeneity, similar results were observed in the literature when the main reasons for the admission to emergency services in dialysis patients were considered[10]. In our study, shortness of breath (19.6%) was the most common cause of emergency presentation in HD patients while gastrointestinal complaints (40%) accompanied by abdominal pain were found as the first common cause of complaints in PD patients.

All comorbidities, except diabetes mellitus, were more frequent in HD patients than PD patients, but the difference was not statistically significant. Since it is not known whether CRF or DM has occurred before in PD patients, it is not correct to comment on this issue, although further studies are required to explain this, it may be suggested that glucose dialysate fluids used in this patient group is a predisposing factor for DM.

Considering all 224 patients, 50 (22.3%) of these patients were diagnosed with respiratory system, 30 (13.3%) with cardiac, 12 (5.3%) with neurological system and 73 (32.5%) with other infective conditions including peritonitis. Sixteen

patients patients (16 patients) (7.1%) had a diagnosis of a gastrointestinal origin.

When the performed treatments are considered, although the diagnosis of pneumonia, sepsis and unknown infections were significantly higher in the HD group, the fact that 12 (34.2) of the 35 PD patients had a diagnosis of peritonitis made the PD group superior to the HD patient group[15]. Fourty two percent of PD patients (42%) and 37% of HD patients were found to have antibiotic use while they were in the emergency department.

In the light of the files reviewed in our study, 224 patients had 388 admittances to the emergency department and 96 admittances (24.6%) of 388 with various indications (hypervolemia, pulmonary edema, acidosis, hyperpostasemia, metabolic encephalopathy), were performed with the emergency HD, except for the routine dialysis. In a study by Loran et al., 14% of 351 visits to the emergency department were planned to have HD earlier than routine HD programs (9% urgent dialysis, 5% dialysis earlier than the programme)[12].

The rate of intubation in routine dialysis patients in our emergency department was 7.1%. In the data reported by Sacchetti et al., the rate of intubation in the emergency department was 13% in dialysis patients with congestive heart failure[13]. In another study run by the same person in 1999, the rate of intubation in emergency HD patients was 12% [14]. Despite the increased incidence of CRFs, it is thought that the decrease in the rate of admission to emergency services for more mortal reasons contributes due to the increase in frequency and quality of general care and treatment services. Since there is no similar study conducted in our country previously, it is not correct to make a comparison on behalf of our country but an interpretation similar to the above can be made.

The mean length of hospital stay in HD patients was 5 days. In PD patients, it was 7.1 days.

Considering the need for HD in the emergency department, the cost of the patients (examination + examination and consultation + HD and other medical care) who were discharged (24 patients) on the same day was calculated as 945 Turkish Liras and about 175 dollar . It should be considered that this figure is not a classical cost-effectiveness figure[16]. In other words, except for the examination fee, many other expenses such as personnel and nursing care services, services used to reach the hospital and loss to the workforce of the patient have been ignored.

When the mortality-oriented factors are examined; cardiovasculer history, ventilator requirement and antibiotic initiation were statistically significant ($p < 0.001$)[17].

References

1. Mosenkis A, Kirk D, Berns JS. When chronic kidney disease becomes advanced. Guidelines for care in the emergency department and hospital. Postgrad Med. 2006 Jun-Jul;119(1):83-91, 104.
2. Grassmann A, Gioberge S, Moeller S, Brown G. End-stage renal disease – Global demographics in 2005 and observed trends. Artif Organ. 2006; 308: 95-7.
3. Süleymanlar G, Altıparmak MR, Seyahi N, Trabulus S. Türkiye'de Nefroloji, Diyaliz ve Transplantasyon – Registry 2012. Türk Nefroloji Derneği Yayınları, Ankara, 2013.
4. U. S. Renal Data System, USRDS 2013 Annual Data Report: Atlas of End Stage Renal Disease in the United States. National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases, Bethesda, 2013.
5. Extracellular fluid volume is associated with incident end-stage kidney disease and mortality in patients with chronic kidney disease Anne- LaureFaucon, MartinFlamant et all Nephrology Test Study Group
6. National Kidney Foundation. K/DOQI clinical practice guidelines for chronic kidney disease: evaluation, classification, and stratification. Am J Kidney Dis. 2002;39(2 Suppl 1): S1–266
7. Go AS, Chertow GM, Fan D, et al. Chronic kidney disease and the risks of death, cardiovascular events, and hospitalization. N Engl J Med. 2004; 351:1296-305
8. Long B, Kofman A, Lee CM. Emergency medicine evaluation and management oft he end stage renal disease patient. Am J Emerg Med, 2017 Dec ;35 (12):1946-1955.
9. Kutner NG, Johansen KL, Kaysen GA, et al. The comprehensive dialysis study (CDS): A USRDS special study. Clin J Am Soc Nephrol. 2009;4:645-50.
10. Chronic kidney disease in the emergency centre: A prospective observational study African Journal of Emergency Medicine
11. Sacchetti A, Harris R, Patel K, Attewell R. Emergency department presentation of renal dialysis patients: indications for EMS transport directly to dialysis centers. J Emerg Med. 1991
12. Loran MJ, McErlean M, Eisele G, Raccio-Robak N, Verdile VP. The emergency department care of hemodialysis patients. Clin Nephrol. 2002
13. Sacchetti A, McCabe J, Torres M, Harris RL. ED management of acute congestive heart failure in renal dialysis patients. Am J Emerg Med. 1993.
14. Sacchetti A, Stuccio N, Panebianco P, Torres M. ED hemodialysis for treatment of renal failure emergencies. Am J Emerg Med. 1999.
15. Heaf JG, Løkkegaard H, Madsen M. Initial survival advantage of peritoneal dialysis relative to haemodialysis. Nephrol Dial Transplant. 2002;17:112-7.
16. Peritoneal Dialysis in Renal Replacement Therapies Utaş C. Sunum http://www.tsn.org.tr/folders/file/cengiz%20 utas.pdf ,May 2014
17. Causes of Mortalty in Acute and Chronicc Renal Failure Ferdi Seyyid Taş, Kuddusi Cengiz et all. Fırat Medical Journal 2011.

Original Article
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Three Months Analysis of an Emergency Intensive Care Unit

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Abstract

Objective: The aim of this study was to determine the demographic characteristics of the patients followed in the Emergency Intensive Care Unit (EICU) of Kanuni Sultan Süleyman Training and Research Hospital.

Material and Method: Demographic characteristics such as age, gender and non-invasive mechanical ventilation / invasive mechanical ventilation (NIMV / IMV) requirements, mortality and morbidity rates between 24 November 2018-1March 2019 were examined retrospectively.EICU; is a 5-bed service and managed by an emergency doctor and 2 intensive care nurses for 24 hours. EICU works physically as a level 1 but functionally level 3. It is the first intensive care unit in Istanbul which is in the emergency department and managed by emergency specialists.

Results: A total of 68 patients were included in the study. Of the patients 58.8% (n = 40) were male, 41.2% (n=28) were female and 17.6% (n=12) were foreign nationals.According to the diagnosis of EICU admission, 25.0% (n=17) pneumonia, 17.6% (n=12) cerebrovascular diseases (CVH), 13.2% (n=9) acute renal failure (ARF), 11.8% (n=8) trauma 10.3% (n=7) multiple organ failure syndrome,7.4% (n=5) malignancy, 5.9% (n=4) gastrointestinal bleeding, while 2.9% (n=2) were listed as other reasons. 41.2% (n=28) of the patients were followed as intubated, 58.8% (n=40) were followed as extubated.The mean day of stay of patients in intensive care unit was 5.9 days.

Conclusion: This three-month intensive care experience showed that the rate of complications and mortality was similar to the literature and the quality of patient management was similar to the third level intensive care services.EICU's can be considered as a solution where intensive care is needed.

Keywords: Emergency intensive care unit, emergency medicine, ministry of Health, emergency medical services, mortality

Introduction

The intensive care unit is equipped with advanced technology, which is specially structured in the hospital where close follow-up and treatment of patients is performed and which provides 24 hours support every day of the week[1]. Today, intensive care units have become an integral part of modern medical education hospitals equipped with specialist doctors, nurses, technical personnel and devices[2]. The demand for intensive care beds is increasing in the world and in our country, where the rates of emergency service applications are increasing gradually. The fullness of intensive care beds leads to an increase in the number of outpatients and out-of-hospital referral rates and the waiting period of the patients in emergency services for more than 24 hours.

In order to meet these needs, the Ministry of Health of Turkey changed the communique on the principles and procedures of implementation of emergency services in inpatient health facilities on 20 February 2018 and emergency intensive care units (EICU) are planned to be followed by emergency medical specialists in emergency departments which are suitable for physical and functional conditions[3]. In accordance with the amendment to the communique, the work of the emergency intensive care unit was initiated in İstanbul Kanuni Sultan Süleyman Training and Research Hospital (KSSEAH) as of February 2018.After the approval of the Ministry of Health was taken on 8 November 2018, the first patient was hospitalized on 21 November 2018.

The EICU is a 5-bed service and is managed by an emergency doctor and 2 intensive care nurses for 24 hour which has physically first level,functionally third level intensive care unit features.It is the first intensive care unit in Istanbul which is in the emergency department and directed by emergency specialists. The aim of this study was to determine the demographic characteristics of the patients followed in the Emergency Intensive Care Unit (EICU) of Kanuni Sultan Süleyman Training and Research Hospital.

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Material and Methods

The data of the patients admitted to our emergency department between 24 November 2018 and 1 March 2019 and followed-up in the EICU with the indication of intensive care unit were evaluated retrospectively from the hospital records. Of the 68 patients, 88.2% were patients with severe systemic diseases and 11.8% were trauma patients. Age, gender, nationality, emergency intensive care unit stay, hospitalization, discharge, consultation request, intubation, non-invasive mechanical ventilation / invasive mechanical ventilation (NIMV / IMV) requirement, pressure ulcers development, culture results,mortality and morbidity rates were taken into consideration.

Descriptive statistics were used to analyze the study data.Mean ± standard deviation for numerical variables and number and percentage frequency for categorical data were used in descriptive statistics.

Results

A total of 68 patients were included in the study. Of the patients 58.8% (n = 40) were male, 41.2% (n=28) were female and 17.6% (n=12) were foreign nationals. The mean age of the patients was 64.4 years.

According to the diagnosis of EICU admission, 25.0% (n=17) pneumonia, 17.6% (n=12) cerebrovascular diseases (CVH), 13.2 % (n=9) acute renal failure (ARF), 11.8% (n=8) trauma, 10.3% (n=7) multiple organ failure syndrome,7.4% (n=5) malignancy,5.9% (n=4) gastrointestinal bleeding, while 2.9% (n=2) were listed as other reasons.94.1% (n=64) consultation requests were made and 61.8% (n=42) were multiple departmental consultations.The duration of stay in the EICU was between 1 and 31 days and the median duration of stay was 5.9 days.

When the patients were examined according to their hospitalization status, it was found that 58.8 % (n = 40) of the patients were extubated and 41.2 % (n = 28) of the patients intubated.Discharged from EICU was 35.3% (n=24) referral to another center,26.5% (n=18) to service,13.2% (n=9) with health discharge,25.0% (n=17) patients died.Complications in patients who were hospitalized in the EICU and those requiring medical intervention were 73.5% (n = 50) had no complication, 25.0% (n = 17) had infection, 1.5% (n = 1) acute renal failure (ARF) developed.

In the culture study of the cultures obtained from the patients 73.5% (n=50) culture growth was not detected, 26.5% (n=18) culture growth was detected.According to the results of culture 11.8% (n=8) Candida, 8.8% (n=6) Coagulase negative Staphylococcus spp,1.5% (n=1) Klebsiella,1.5% (n=1) Pseudomonas,%1.5(n=1) E.Coli and 1.5% (n=1) E.coli + Acinetobacter + Coagulase negative Staphylcoccus spp. were identified.The low rate of cultural reproductive results can be attributed to the low rate of intubated patients with a rate of 41.2 % (n = 28)

In the large-scale prevalence studies,11.1% of the patients in intensive care unit developed pressure sores.In our EICU %2.9 (n=2) patients developed new pressure sores and %97.1 (n=66) patients did not develop pressure sores. According to our study, it was found that 57.4% (n = 39) of the hospitalized patients did not need mechanical ventilation and 42.6% (n = 29) required mechanical ventilation.

Discussion

In this study, demographic information, mortality, complications, admission complaints, diagnoses, duration of stay, bed-and-out form of emergency intensive care unit were examined with basic lines.In a study performed by Ozkan and Sahinoglu, 967 patients were examined retrospectively and 627 (64.8%) of the patients were male and 340 (35.3%) were female (4).Of the 68 patients admitted to EICU, 58.8% (n = 40) were male and 41.2% (n = 28) were female.Similar to the findings of our study, in many studies it was found that male patients had higher rates of admission in intensive care units than female patients.

Findlay et al. examined 774 patients admitted to the ICU between January 1993 and December 1994[5].They found that the duration of ICU stay in patients was between 1-68 days and the median duration of their stay in ICU was 2 days[5].In the study of Ozkan and Sahinoglu, the length of stay of 967 patients ranged between 1-77 days. The median duration of stay of the patients was 4 days (4).In our study, the duration of stay in EICU of 68 patients ranged from 1 to 31 days and the median duration of stay was 5.9 days. The reason for the average length of stay was due to the fact that the number of patients with intensive care indications increased and the duration of the referral was increased in the winter months.

Zaren and Bergström found that 47% of the 978 patients admitted to the ICU were in need of mechanical ventilation[6]. In another study, they examined 980 patients and found that those who needed mechanical ventilation in ICU admission were less likely to live than those who breathe spontaneously[7].

In a study conducted by Ozkan and Sahinoglu, 444 of the 967 patients had died and the mortality rate of the ICU was 46%[4]. In our study, the mortality rate of EICU was found to be 25%. Similarly, in our study, the rate of patients with a need for mechanical ventilation was found to be lower with a rate of 42.6%, and the mortality rate of our intensive care unit was lower than that of the patients with a low rate of mechanic ventilation.

Conclusion

This three-month intensive care experience showed that the rate of complications and mortality was similar to the liter-

ature and the quality of patient management was similar to the third level intensive care services.EICU's can be considered as a solution where intensive care is needed.

References

1. Esener Z. Clinical anesthesia, 2nd Edition, Istanbul, 1997: 696-9
2. Şahinoğlu H. Intensive care problems and treatments. 1st Edition. Ankara: Turkey Clinical Publishing House, 1992: 3-8.
3. Ministiry of Health Republic of Turkey Ankara,Turkey.Retrieved from:https://shgm.saglik.gov.tr/TR,32654/yatakli-saglik-tesislerinde-acil-servis-hizmetlerinin-uygulama-usul-ve-esaslari-hakkinda-tebligde-degisiklik-yapilmasina-dair-teblig.html
4. Ozkan F,Sahinoglu H,A retrospective analysis of the 967 patients who admitted to the Ondokuz Mayıs University Faculty of Medicine surgical intensive care unitJournal of Experimental and Clinical Medicine
5. Findlay JY, Plenderleith JL, Schroeder DR. Influence of social deprivation on intensive care outcome. Intensive Care Med. 2000 Jul;26(7):929-33.
6. Zarén B, Bergström R. Survival of intensive care patients. I: Prognostic factors from the patient's medical history. Acta Anaesthesiol Scand. 1988Feb;32(2):93-100.
7. Zarén B, Bergström R. Survival compared to the general population and changes in health status among intensive care patients. Acta Anaesthesiol Scand. 1989 Jan;33(1):6-12.

Orginal Article
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Can the Foot Pain Be the Varicella Zoster (Shingles)?

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Abstract

Shingles is one of the two different clinical presentations of infection of VZV which is a DNA virus. Humans are a known reservoir for the Varicella zoster virus (VZV). It is very contagious. The virus that remains latent after infection in childhood and can be reactive due to various reasons (immune system suppression, old age, stress factors, etc.). It involves various dermatomes after reactivation. Varicella-zoster appears mostly on thoracic, cervical, and ophthalmic dermatomes. Rarely, it is located in the upper and lower extremity dermatomes. In this study; 7 patients with shingles on the foot and sole were examined. It was aimed to emphasize that varicella zoster (zona) may be the cause of foot pain in patients presenting to the emergency department with complaints such as pain, burning and inability to step on standing, and to review the age, gender, underlying factors of the zona cases which are not previously mentioned in the literature.

Keywords: Varicella zozter virüs, foot pain, emergency medicine

Introduction

Shingles is one of the two different clinical presentations of infection of VZV which is a DNA virus. Humans are a known reservoir for the Varicella zoster virus (VZV). It is very contagious. VZV belongs to the herpes virus family[3,4]. In latent infection, reactivation of the virus in the dorsal root ganglion due to a previous varicella-zoster (VZV) infection in childhood causes this clinical presentation[2].Latent varicella-zoster virus (VZV) is a disease which usually involves a single sensory nerve or its dermatome affected by aging, immune suppression, stress, and various triggering factors[1]. A single dermatome and also the adjacent dermatomes can be involved. Varicella-zoster appears mostly on thoracic, cervical, and ophthalmic dermatomes[2]. The lower and upper extremities are rarely involved. The lower extremity dermatomes that can be affected are the legs, feet, and sole. In patients in this study varicella zoster lesions are seen especially in the lower extremity were found to be on foot and sole. The need to considering varicella-zoster (shingles) as a cause of foot pain in patients presenting to the emergency department with complaints such as pain, burning, inability to step on standing.

Methods and Materials

The patients who were admitted to Our Hospital emergency outpatient clinic with complaints such as standing pain, burning, inability to walk between February 2018 and November 2018 were evaluated retrospectively.

Results

Among 526413 patients who admitted between these dates, 93 were diagnosed with varicella zoster. Lesions are located in the lower extremity in 7 of 93 patients. 5 (71.4%) of the 7 patients were male, and 2 (28.6%) of them were female. The mean age of the female patients was 57,25 years (33-72 years). The mean age of male patients was 51 years (35-68). In two patients (28.5%) the lesions were found to be on the plantar side of the foot and in medial section and in 3 patients (42.8%) from the lateral part spreading to the fingers, while in 2 patient (28.5%) the lesions were in the mid-plantar section. The history of the disease was questioned in 5 patients (71.4%). Chronic disease was detected in 5 (71.4%) patients. 3 of the patients had diabetes mellitus and 2 of them had hypertension, and 1 patient had peripheral vascular dis-

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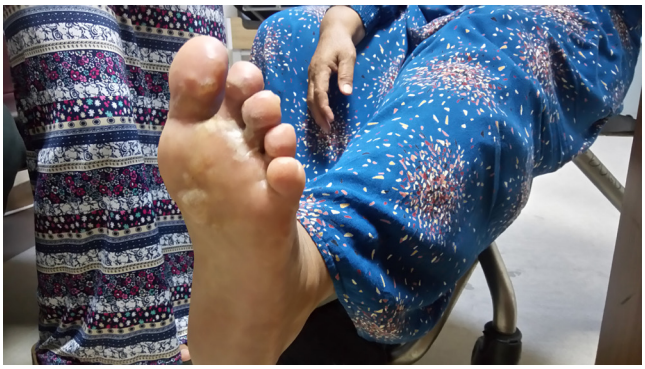

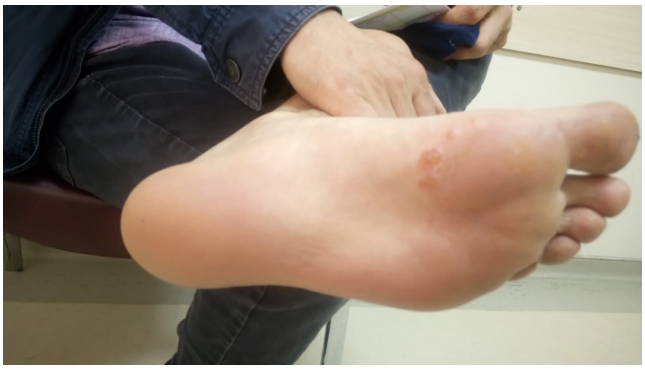

ease and 1 patient had cerebrovascular disease.No additional disease was observed in 2 patients. When stress factors were questioned, work and familial stress factors were described by 6 patients (85.7%). All patients presented vesicular lesions when they admitted to the emergency department. Patients were admitted to the emergency department with complaints of pain (100%), burning sensation (83.3%) and itching (100%) before the lesions were started. Pain (100%), rash (100%), burning sensation (77,7%), itching (83.3%) complaints were described after the lesions occurred. The treatments were arranged following the diagnosis. At the end of the treatment, they were referred to the dermatology polyclinic for the follow-up.

Discussion

HZ (Herpes zoster) is an acute viral infection which is characterized by painful, group tendency of vesicles on one or more adjacent dermatomes with the reactivation of the latent virus in the dorsal root ganglia following a childhood chickenpox infection, in some cases occurs result of a reduction in immune response of the host[13, 14]. Secondary infection of the rash is important in addition to severe pain in shingles[8]. In two of our patients, secondary infection was detected.

The incidence of VZV in healthy people can range from 0.4 to 11 in 1000 per year depending on immune response[2]. Some predisposing factors have been identified in the activation of latent infection. These can be listed as chickenpox, the status of varicella vaccination, being over 50 years old, immunosuppressive conditions and drugs, trauma and psychological stress[12]. In our study, only 2 patients did not have a history of a chronic disease. Besides, in our 5 patients, psychological stress was detected due to various reasons. Shingles show the same rates in male and female sexes[5,6]. In some studies, the rates were found to be different. In our study, there was a difference between genders.

The diagnosis can be made with the presence of prodromal burning sensation-pain, itching, and shingles rashes. Throughout the affected unilateral dermatome, the rash is seen[5]. It can be diagnosed by using cytopathologic evaluation and polymerized chain reaction in atypical rashes[7,8].

A most common symptom of shingles is pain[9]. Pain is presented days or weeks before the rashes occur. The pain usually is described in the form of the burning sensation, tingle and as well as paresthesia, hyperesthesia and also may be in the form of electric shock[2,10]. Local pain of the shingles is severe. Reason for pain is thought to be a result of the stimulation of primary neurons in the skin due to inflammation of the pain receptors as a result of tissue damage[11]. The patients described burning sensation and pain which causes inability to walk on the feet and sole before the lesions were seen. Four of our patients reported that they were admitted to the hospital due to pain several times. But following investigations in the hospital's chronic diseases were thought to be the cause of the pain on the foot. Our patients have presented vesicular lesions additionally to pain, burning sensation, itching symptoms when they admitted to our emergency department.

PATİENT	GENDER	AGE	**CHRONIC DISEASE**	STRESS FAKTOR
Patient1	WOMAN	72	**DİYABETES-HYPERTENSİON**	-
Patient2	MAN	68	**DİYABETES**	+
Patient3	MAN	56	**DİYABETES-CVD**	-
Patient4	MAN	54	**PERİPHERAL VESSEL DISEASE**	+
Patient5	MAN	42	**NO DISEASE**	+
Patient6	MAN	35	**HTPERTENSİON**	+
Patient7	WOMAN	33	**NO DISEASE**	+

Conclusion

Varicella zoster is often seen in advanced age and is mostly a disease that affects the daily lives of patients. Immune insufficiency, malignancies, chronic diseases and stress caused by various factors can lead to reactivation of latent varicella-zoster virus. Diagnosis of shingles on foot which is presenting with pain, burning sensation, inability to walk, is often skipped. It should be kept in mind that there may be shingles on the foot in patients with such complaints.

References

1. Sauve RS, Leung AK. Congenital varicella syndro-me with colonie atresias. Clin Pediatr (Phila) 2003; 42(5): 451-3.(12)
2. Kost RG, Straus SE. Postherpetic neuralgia—pathogenesis, treatment, and prevention. N Engl J Med 1996; 335:32-42. (PMID: 8637540)
3. Gnann JW Jr, Whitley RJ. Clinical practice: herpes zoster. N Engl J Med 2002; 347:340-6.
4. Schmader K. Herpes zoster in older adults. Clin Infect Dis 2001; 32:1481-6.
5. Whitley RJ. Varicella-zoster virus infections. In: Kasper LD, Braunwald E, Fauci SA, Hauser LS, Longo LD, Jameson LJ (eds). Harrison's Principles Internal Medicine.16th ed. United States of America, McGraw-Hill, 2005; pp. 1042-45.
6. Donahue JG, Choo PW, Manson JE, Platt R. The incidence of herpes zoster. Arch Intern Med 1995; 155:1605-9.
7. Weinberg JM. Herpes zoster: epidemiology, natural history, and common complications. J Am Acad Dermatol 2007;57:S130-5.
8. SK. Management of herpes zoster and postherpetic neuralgia. J Am Acad Dermatol 2007; 57:S136-42.
9. Huff JC, Bean B, Balfour HH, Laskin OL, Connor JD, Corey L, Bryson YJ, McGuirt P. Therapy of herpes zoster with oral acyclovir. Am J Med 1988; 85:84-89. (PMID: 3044099)
10. Gilden DH, Dueland AN, Cohrs R, Martin JR, Kleinschmidt-DeMasters BK, Mahalingam R. Preherpetic neuralgia. Neurology 1991; 41:1215-1218. (PMID: 1866008)
11. Bennett GJ. Hypotheses on the pathogenesis of herpes zoster associated pain. Ann Neurol 1994; 35(Suppl):S38-41.
12. Yavaşoğlu İ, Arslan E, Gök M, Kurna M. Erişkin Zona: Olgu Serisi ve Derleme. Uludağ Üniversitesi Tıp Fakültesi Dergisi 2008; 34:123-125.
13. Roxas M. Herpes zoster and postherpetic neuralgia: diagnosis and therapeutic considerations. Altern Med Rev 2006;11:102-13.
14. Sawant SP, Amin AS, Kumar S. Herpes zoster in a healthy immunocompetent two-year-old child. Pediatr Infect Dis J 2012;4:13-4.

Case Report
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A Case Report: Non-Alcoholic Wernicke Encephalopathy

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Abstract

Wernicke encephalopathy (WE) is a life-threatening neurological illness caused by thiamine deficiency. Chronic alcoholism is one of the most important cause of WE, however, WE may develop in other conditions, such as severe malnutrition, hyperemesis gravidarum, prolonged parenteral nutrition, malignancies, bariatric surgery. WE is presenting with classical findings of cerebellar, ocular and confusion. Diagnosis of WE is usually made by history and physical examination. The aim of the treatment is the rapid correction of thiamine deficiency. In this report, we present a patient who with WE had gastrointestinal tract diseases and had undergone gastrointestinal surgeries and discuss predisposing factors as well as diagnostic and therapeutic issues related to this entity.

Keywords: Wernicke encephalopathy, thiamine, delirium, gait ataxia, gastrointestinal tract diseases, emergency room.

Introduction

Wernicke encephalopathy (WE) is a life-threatening neurological illness caused by vitamin B1-thiamine deficiency. WE is an important cause of acute or subacute delirium. Thiamine is a cofactor for several enzymes in the Krebs cycle and the pentose phosphate pathway that plays a central role in cerebral metabolism. Thiamine deficiency can cause metabolic imbalances leading to neuronal cell death. Chronic alcoholism is one of the most important cause of WE, however, WE may develop in other conditions, such as severe malnutrition, hyperemesis gravidarum, prolonged parenteral nutrition, malignancies, bariatric surgery, immunodeficiency syndromes, liver disease, hyperthyroidism, and severe anorexia nervosa, hemodialysis- in patients with end-stage renal disease.[1] In this report, we present a patient who with WE had gastrointestinal tract diseases and had undergone gastrointestinal surgeries and discuss predisposing factors as well as diagnostic and therapeutic issues related to this entity.

Case

A 55-year-old-woman was admitted to the emergency room (ER) with forgetfulness, inability to walk followed by altere mental status. These complaints were started three days ago. Her relatives reported that she admited to general surgery clinic because of abdominal pain, vomiting, poor nutrition and was operated for alkaline reflux, hospitalized in the general surgery intensive care unit for 15 days. It was learned that she received parenteral nutrition while in the intensive care unit. She discharged three days ago. Then the patient was admitted to our emergency room with the above mentioned complaints. When the anamnesis was deepened, it was learned that, he had had two previous gastric surgeries, vomited for a long time and increased for a month, so that he could not eat. There was no other feature in her medical and family history. Her vital signs were stable. General examination was unremarkable except for the operation scar in the abdomen. On neurological examination, her GCS was 14. She was noncooperative and nonorientated. The patient was making nonsensical sentences composed of religious words. There was no significant abnormality in cranial nerve examinations, but horizontal nystagmus was seen on the left eye. Her fundoscopic examination was normal and she had no neck stiffness, obvious motor deficits, side signs, and pathological reflex. Cerebellar examination could not be performed because the patient was noncooperated. The results of her complete blood count, biochemistry panel, thyroid-stimulating hormone arterial blood gas were all within normal limits with the exception of non-hypoxic respiratory alcoholosis. Head computed tomography was negative for acute pathology. Lumbar puncture was performed to exclude central nervous system infection, however, cerebro-

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spinal fluid examination revealed no pathology. The patient was diagnosed as wernicke encephalopathy with anamnesis, physical examination findings. 200 mg thiamine replacement was started immediately. After thiamin replacement, the patient was sent to brain magnetic resonance imaging (MRI) and diffusion MRI. It showed symmetric mild hyperintensities on T2-weighted sequences in bilateral medial thalamus which supported the diagnosis of WE (Figure 1). Thyamine level measurement could not be performed in our hospital. The patient was consulted with the neurology clinic and tansferred to the intensive care unit. 3x200 mg IV thiamine was ordered to the patient. On the 1st day after the treatment, her speech and disorientation improved. She was transferred to the service. The patient who was mobilized on the 3rd day was observed to walk ataxia. Thiamine replacement therapy was continued. The patient, who was discharged on the 10th day, was able to walk with assistance and did not evaluate with mentally detailed neuropsychiatric tests, but there was a great improvement.

Discussion

WE is a clinical diagnosis. Recognition of risk groups, clinical symptoms and findings is of great importance in the prognosis of WE. The incidence of WE, mostly from autopsy studies, is 1-3%, however, this rate is considered to be higher in developing countries due to malnutrition.[2] The causes of WE are alcohol, malignancy, gastrointestinal illness-surgery, hyperemesis gravidarum, starvation, malnutrition, parenteral nutrition, vomiting, dialysis in renal diseases, psychiatric diseases, infections, intoxications, thyroid disease, and many other rare conditions.[3] Possible reasons of WE, in our case was gastrointestinal illness-surgery, vomiting, parenteral nutrition, so they were due to decreased oral intake and thiamine consumption. WE is presenting with classical findings of cerebellar, ocular and confusion as well as findings such as delirium, gait ataxia, delirium tremens, memory disturbance, hypothermia with hypotension.[3] Physical examination including neurological exam with cerebellar testing should be completed. Ataxia is a substantial finding in WE. Ataxia is due to combination of polyneuropathy, cerebellar damage, and vestibular paresis. Altered mental status, sensorium, disorientation, disinterest, inattentiveness, or agitation define encephalopathy. WE rarely can present with coma and death. Ocular abnormalities particularly nystagmus is the typical sign of WE.[4] Conjugate gaze palsies of oculomotor, abducens, and vestibular cranial nerve were also seen in WE. Peripheral neuropathy especially includes the lower extremity may be part of the clinical picture. Hypothermia develops due to thiamine deficiency of the temperature-regulating center in the brain stem and is accompanied by hypotension and coma.[5] Confusion, nystagmus, delirium, memory disturbance were present in our case. Initially, the non-cooperative patient was unable to perform cerebellar tests, but subsequently ataxia was detected.

WE is a clinical diagnosis with the signs and symptoms. Diagnosis of WE is usually made by history and physical examination. A complete blood count, serum glucose levels, the comprehensive metabolic panel, arterial blood gas, toxic drug screening, lumbar puncture, electroencephalogram and imaging study can be completed to exclude other causes of central nervous system abnormalities such as hepatic encephalopathy, stroke, alcohol withdrawal syndrome, delirium tremens, chronic hypoxia, meningitis- encephalitis normal pressure hydrocephalus, psychosis, closed-head injury, nonconvulsive status epilepticus and postictal state. Brain imaging studies such as computed tomography and magnetic resonance imaging (MRI) of patients with WE can

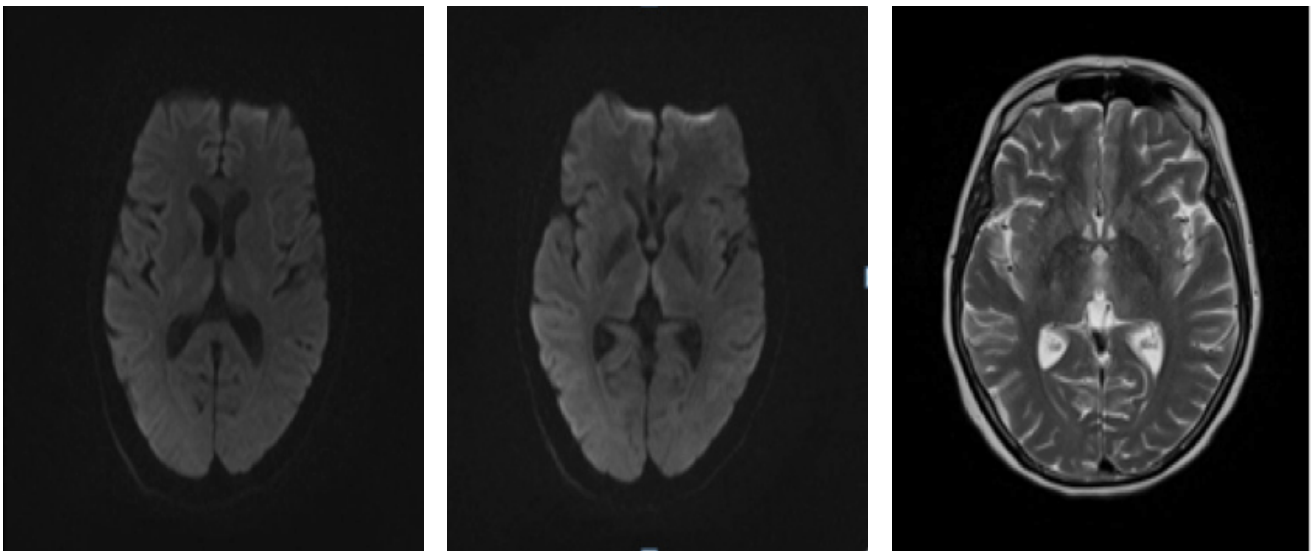

Figura 1. Brain MRI and diffusion MRI showed symmetric mild hyperintensities on T2-weighted sequences in bilateral medial thalamus.

exhibited generally symmetrical lesions in the thalamus with dilated ventricles and volume loss in the mammillary bodies.[6] Normal imaging cannot rule out WE.[5] Biomarkers, including an assay for thiamine, are not used diagnostic purposes, besides, no study has obviously described the sensitivity, specificity, and accuracy of thiamine levels in relation to active disease.[7] Erythrocyte transketolase levels reliably detect thiamine deficiency but are not necessary for the diagnosis of WE.[8] Blood pyruvate and lactate measurements are sensitive and helpful but not specific for thiamine deficiency illnesses. High-Performance Liquid Chromatography for Thiamine Detection is available in many countries. In our case, there was no significant pathology in our laboratory findings except MRI findings that support WE.

WE is one of the medical emergencies that must be noticed immediately. Studies suggest that up to 80% of patients with WE may not be diagnosed, therefore not be treated.[9] The aim of the treatment is the rapid correction of thiamine deficiency. Parenteral replacement of thiamine is most effective the patient's condition to some degree in almost all cases, although, in some cases, neurological deficits may persist despite replacement.[4] Thiamine is indicated for the treatment of suspected or manifest WE. It should be given, before any carbohydrate, 200 mg thrice daily, preferably intravenously (IV).[3] Ataxia, ophthalmoplegia and confusion usually resolve rapidly, within hours, after replacement of thiamine if diagnosed early in the disease course, on the other hand, memory and learning impairment tend to improve slowly as in our patient.[10] Management of WE after emergency diagnosis and thiamine replacement; requires a team approach including neurologist, intensivist, internist, endocrinologist, and psychiatrist. A dietary consult should be done to assess the calorie needs and determine how to provide the food as well as thiamine. Neurological injury, ataxia, Korsakoff syndrome, ophthalmoplegia are complications of WE.

Conclusion

WE is a notably morbid and mortal condition that can be prevented or reversed if diagnosed and treated early. WE should be suspected in any patient with form of malnutrition, feeding with prolonged parenteral nutrition, undergoing gastrointestinal surgery and also presenting with any symptoms and findings such as acute altered mental status, ophthalmoplegia, ataxic gait, delirium.

References

1. Tang L, Alsulaim HA, Canner JK, Prokopowicz GP, Steele KE. Prevalence and predictors of postoperative thiamine deficiency after vertical sleeve gastrectomy. Surg Obes Relat Dis. 2018 Jul;14(7):943-950. doi: 10.1016/j.soard.2018.03.024.
2. Vasan S, Kumar A. Wernicke Encephalopathy. [Updated 2018 Nov 14]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2019 Jan-.Available from: https://www.ncbi.nlm.nih.gov/books/NBK470344/
3. Galvin R, Bråthen G, Ivashynka A, Hillbom M, Tanasescu R, Leone MA EFNS. EFNS guidelines for diagnosis, therapy and prevention of Wernicke encephalopathy. Eur J Neurol. 2010 Dec;17(12):1408-18. doi: 10.1111/j.1468-1331.2010.03153.x.
4. Donnino MW, Vega J, Miller J, Walsh M. Myths and misconceptions of Wernicke's encephalopathy: what every emergency physician should know. Ann Emerg Med. 2007 Dec;50(6):715-21.
5. Antunez E, Estruch R, Cardenal C, Nicolas JM, Fernandez-Sola J, Urbano-Marquez A. Usefulness of CT and MR imaging in the diagnosis of acute Wernicke's encephalopathy. AJR Am J Roentgenol. 1998 Oct;171(4):1131-7.
6. Kim WJ, Kim MM. Wernicke's Encephalopathy Presenting with Bilateral Complete Horizontal and Downward Gaze Palsy in a Malnourished Patient. Korean J Ophthalmol. 2017 Aug;31(4):372-374. doi: 10.3341/kjo.2017.0014.
7. Donnino MW, Miller J, Garcia AJ, McKee E, Walsh M.. Distinctive acid-base pattern in Wernicke's encephalopathy. Ann Emerg Med. 2007 Dec;50(6):722-5.
8. Fattal-Valevski A, Kesler A, Sela BA, Nitzan-Kaluski D, Rotstein M, Mesterman R, et al. Outbreak of life-threatening thiamine deficiency in infants in Israel caused by a defective soy-based formula. Pediatrics. 2005 Feb;115(2):e233-8.
9. Azim W, Walker R. Wernicke's encephalopathy: a frequently missed problem. Hosp Med. 2003 Jun;64(6):326-7.
10. Day E, Bentham PW, Callaghan R, Kuruvilla T, George S. Thiamine for prevention and treatment of Wernicke- Korsakoff Syndrome in people who abuse alcohol. Cochrane Database Syst Rev. 2013 Jul 1;(7):CD004033. doi: 10.1002/14651858.CD004033.pub3.

Case Report
Eurasian Journal of Critical Care

Case of Myasthenia Gravis Admitted With Complaints of Difficulty Swallowing

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Abstract

Myasthenia gravis (MG) is a neuromuscular autoimmune disease that occurs with antibody development against nicotinic acetylcholine receptors. The 19-year-old female patient was admitted to the emergency service with the complaint of difficulty in swallowing for 1 week. There was no history of abnormality in the patient. The uvula sola was deviated in the physical examination of the patient. The obtained brain, cervical and thorax CT and the diffusion MRI of the patient were normal. Consultation was requested for the patient from neurology, and the patient was hospitalized at the neurology clinic with the pre-diagnosis of myasthenia gravis. The case that acutely occurs in myasthenic patients and is characterized by severe loss of strength and respiratory deficiency is known as myasthenic crisis (MC). The diagnosis of MC must be confirmed by considering the patient's history and signs of physical and neurological signs. Myasthenia gravis is an autoimmune disease that is concerned with the neuromuscular junction, and it may lack a diagnosis in the initial periods. We should include myasthenia gravis as a pre-diagnosis in patients with difficulty in swallowing that are admitted to emergency services as a result of upper respiratory infections such as acute pharyngitis and acute tonsillitis.

Keywords: Uvula deviation, emergency medicine, myasthenia gravis

Introduction

Myasthenia gravis (MG) is a neuromuscular autoimmune disease that occurs with antibody development against nicotinic acetylcholine receptors. While its onset is observed the most frequently in the age intervals of 15-30 and 50-75, it maybe seen in every age group.The main clinical finding of myasthenia gravis is muscle weakness that increases in cases of mobility, is fixed partly or completely by resting and shows fluctuations in its severity and distribution in time. Weakness of eye muscles is noticeable in most patients, and this condition is observed with cases of diplopia and ptosis[1]. Its treatment includes anticholinesterases, corticosteroids, plasmaphereses and immune system suppressants[2]. We found it worth reporting a case of a patient that we hospitalized at the neurology service with the pre-diagnosis of myasthenia gravis who came up with complaints of difficulty in swallowing.

Case

The 19-year-old female patient was admitted to the emergency service with the complaint of difficulty in swallowing for 1 week. There was no history of abnormality in the patient. The uvula sola was deviated in the physical examination of the patient (Figure-1). The patient's neurological system examinations and other system examinations were normal. The vital parameters of the patient were as fever: 36.4°C, heart rate: 80/min, BP: 125/80 mmHg, respiratory rate: 20/min. The hemogram and biochemical analyses of the patient were normal. The obtained brain, cervical and

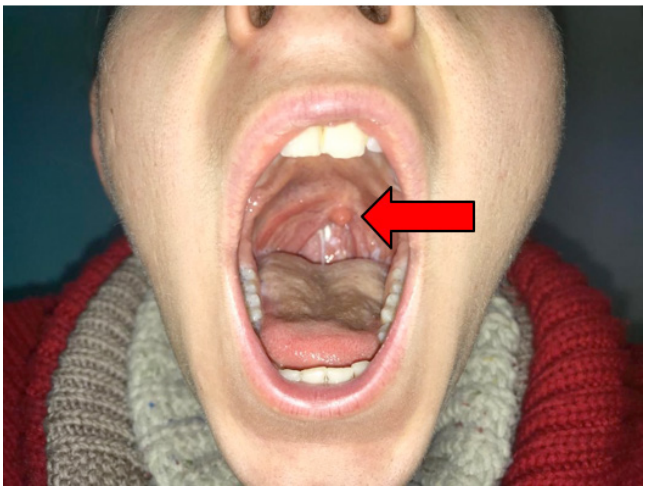

Figure 1. The uvula of the patient deviated to the left.

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thorax CT and the diffusion MRI of the patient were normal. Consultation was requested for the patient from neurology, and the patient was hospitalized at the neurology clinic with the pre-diagnosis ofmyastheniagravis.

Discussion

The case that acutely occurs in myasthenic patients and is characterized by severe loss of strength and respiratory deficiency is known as myasthenic crisis (MC). The most frequent cause of mortality in these patients is MC. MC may develop in the rate of 15-20% in MG patients. Respiratory deficiency that develops as a result of MC frequently required intubation, and these patients usually need to be monitored in intensive care conditions[3].

The diagnosis of MC must be confirmed by considering the patient's history and signs of physical and neurological signs. The causes of crisis should be considered in a case with suspicion of MC, and the possibility of mechanical ventilation should be assessed. Additionally, excessive drug intake may lead to cholinergic crisis. Distinguishing MC from cholinergic crisis is based on the appropriate anamnesis and neurological examination findings. Electrophysiological tests may be required in cases where MG cannot be diagnosed for definitive diagnosis[4].

The most prominent reason of MC is infections by 30-40%. MC may be related to trauma and surgery, changes in the medications that are used (pyridostigmine and corticosteroids), some drugs that are newly started to be used (aminoglycosides, quinidine, beta blockers, macrolides, lithium, chlorpromazine, calcium canal blockers, lidocaine, etc.), irregular usage of medication by the patient[3]. The reason for MC-related acute respiratory failure is the occurrence of alveolar hypoventilation by muscle strength decrease, as well as difficulty in swallowing, development of secondary aspiration as a result of the loss of the coughing reflex and the involvement of oropharyngeal muscles involving aspiration pneumonia. In our case, the patient did not have any complaints besides difficulty of swallowing.

Successful outcomes are achieved by mechanical ventilation support in the treatment of MC patients. While there are studies in terms of the need for intubation, tracheostomy, mortality rates and durations of intensive care and hospitalization in the treatment of respiratory deficiency based on neuromuscular diseases, there are studies that reported that this condition increases these durations[5,6].

While myasthenia agravis patients are previously diagnosed, it is possible to encounter a case that is undiagnosed as in our case, though it is rare.

Conclusion

Myasthenia gravis is an autoimmune disease that is concerned with the neuromuscular junction, and it may lack a diagnosis in the initial periods. We should include myasthenia gravis as a pre-diagnosis in patients with difficulty in swallowing that are admitted to emergency services as a result of upper respiratory infections such as acute pharyngitis and acute tonsillitis.

References

1. Sieb JP. Myasthenia gravis: an update for the clinician. Clin Exp Immunol 2014; 175: 408-18.
2. Erdal H, Ozyurt Y, Arıkan Z. Myastenia gravis ve anestezi: olgu sunumu. Bakırkoy Tıp Dergisi 2006; 2: 141-3.
3. Spillane J, Higham E, Kullmann DM. Myasthenia gravis. BMJ 2012; 345:e8497.
4. Bedlack RS, Sanders DB. How to handle myasthenic crisis. Essential steps in patient care. Postgrad Med 2000; 107: 211-4.
5. Mishra SK, Krishnappa S, Bhat RR, Badhe A. Role of intermittent noninvasiv eventilation in anticholinesterase dose adjustment for myasthenic crisis. Acta Anaesthesiol Taiwan 2010; 48:53-4.
6. Piastra M, Conti G, Caresta E, Tempera A, Chiaret-ti A, Polidori G, et al. Noninvasive ventilation options in pediatric myasthenia gravis. Paediatr Ana-esth 2005; 15:699-702.

Case Report
Eurasian Journal of Critical Care

Central Venous Catheter Malposition: Two Case Reports

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Abstract

Introduction: Unintended vessel advancement during central venous catheter (CVC) insertion is a rare but serious complication. To reduce the complications while CVC placement, the practitioner should be experienced. After the placement it is required to verify correctness.

Case Presentation:

- **Case 1:** A 65-year-old male patient who returned as hypotensive after cardiopulmonary resuscitation was planned with CVC insertion formonitoring central venous pressure, fluid replacement and inotropic support. As the patient's hemostatic parameterswere normal, catheter was placed into the right subclavian vein. Posterior-anterior chest radiograph(CR) was used to confirm catheterization site. It was found that catheter tip was not in normal position, right internal jugular vein(IJV) was directed and twisted in two places.
- **Case 2:** A 64-year-old patient with respiratory distress was conscious of consciousness. The patient's hemostasis parameters were normal and was placed central catheter into right internal jugular vein (IJV). It was seen by the CR that catheter tip was not in the correct position and it was directed to the right subclavian vein.

Discussion: One of the most common complications during CVC placement is malposition of the catheter. Placing a CVC is an invasive procedure and it should be remembered that various complications may develop during or after the placement. Moreover, practitioners should remember that malposition may not be noticed if no imaging and checking methods are used during CVC administration. It is important that the accuracy of the position of the CVC should be confirmed with post-procedure CR. Thus, any complications that require emergent intervention like malposition or pneumothorax can be detected early.

Keywords: Emergency Medicine, Penetrating Thoracic Trauma, Foreign Body.

Introduction

Central venous catheterization plays an important role in medical practice,and usually used in emergency departments, operating rooms and intensive care units for central venous pressure (CVP) monitoring, medications, fluid management, blood transfusion, parenteral nutrition and in complicated cases which require long term follow-up and a wide vein passage. The most common complications of central venous catheter (CVC) insertion are pneumothorax (up to 30%), infection (5% to 26%), and hematoma (2% to 26%)[1].

A less commonly defined yet important complication of CVC placement is malpositioning of the tip of the CVC in another vessel than the superior vena cava (SVC). This complication has been described in approximately 7% of cases of thoracic CVC placement in the literature.Before starting to a catheterization procedure, risk factors that may cause malposition should be well-identified and after inserting a catheter chest radiograph (CR) should be performed to verify the location of the catheter[2]. We aimed to point to the catheter malpositioning by presenting two cases.

Case Presentation:

Case 1:A 65-year-old male patient who returned as hypotensive after cardiopulmonary resuscitation was planned with CVC insertion for monitoring central venous pressure, fluid replacement and inotropic support. As the patient's hemostatic parameters were normal, catheter was placed into the right subclavian vein. After the procedure, blood was seen and detected. Posterior-anterior chest radiograph (CR) was used to confirm catheterization site and it was

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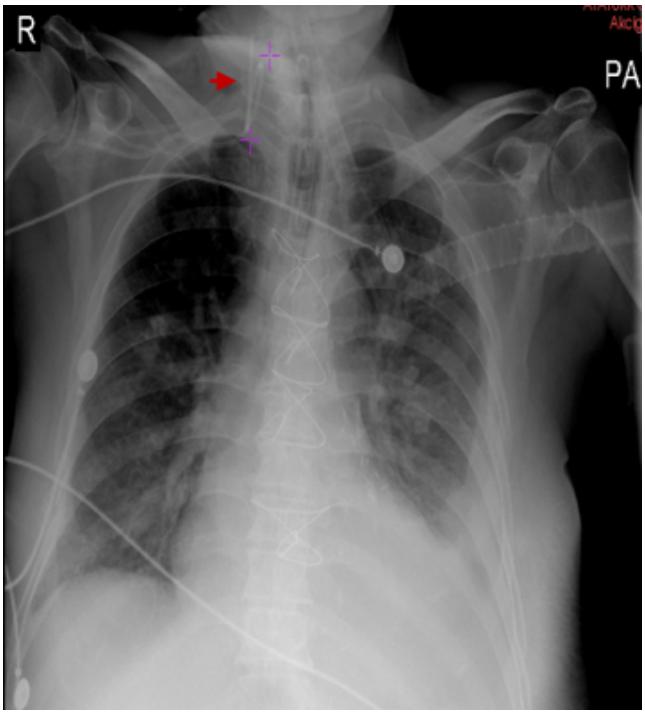

Figure 1: Chest radiograph showing a central line inserted in the right subclavian vein, catheter located at persistent right-internal jugular vein (arrow).

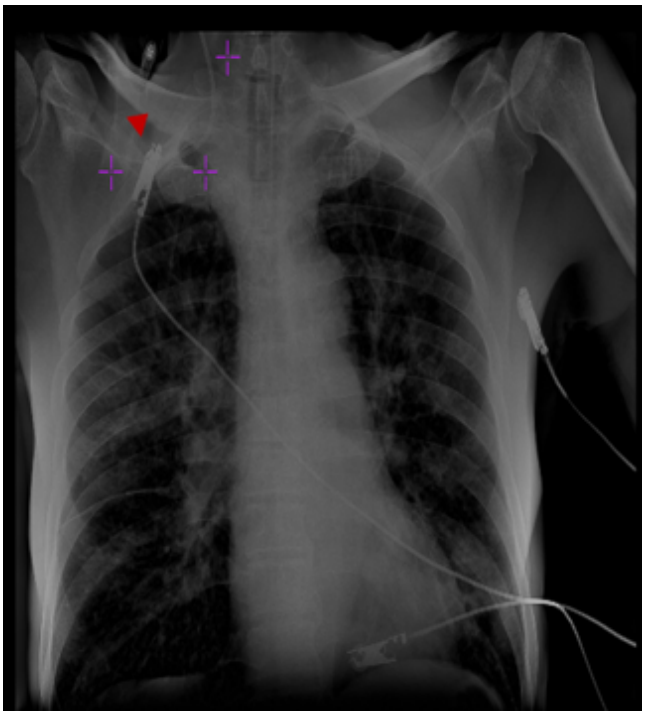

Figure 2: Chest radiograph showing a central line inserted in the right internal jugular vein, catheter located at persistent right subclavian vein (arrow).

seen that the tip of the catheter was not in right position by directing into the right Internal Jugular Vein (IJV) and circling. Therefore, the catheter was removed without any complication andinserted to another localization.

Case 2:A 64-year-old male patient admitted to emergency department with respiratory distress and altered mental status. Respiratory acidosis was seen in arterial blood gas analysis, therefore mechanical ventilation was initiated. As the patient's hemostatic parameters were normal, catheter was placed into the internal jugular vein (IJV). After the procedure, blood was seen and detected. Confirmation of the catheterization site by CR showed that the catheter tip was not in right position (Figure 2) by directinginto the right subclavian vein.For this reason, the catheter was removedand inserted to another localization.

Discussion

The IJV is one ofthe most common sites that anesthesiologists use, and this site is chosen because CVC can be securely inserted in this location.Many of the complications may not be noticed, and many are not reported. Some complications may be life threatening or may cause morbidity, and some may not be recognized as a complication at all[2]. The incidence and occurrence of complications depend on various factors, such as the experience of the operator, the site of insertion, and the placement technique[3].

CVC malpositions may lead to serious complications such as vascular stenosis and thrombosis depending on the location of the catheter. The incidence of catheter malposition varies from 3.3% to 14%. The right IJV is preferred because complications during the procedure and during follow-up are seen less than the other localizations. Left IJV, SCV or femoral vein are also used in cases where the right IJV cannot be used for various reasons[4-6].

Beside some of other certain symptoms, the most common symptom that indicates CVC malpositioning is inefficient catheter function. Chest pain may occur in order to infuse fluid through a malpositioned CVC in small tributaries of large central veins. Pointing the tip of catheter cephalad in the internal jugular vein and/or infusing near the intracranial structures can produce an "ear gurgling" or "water running" feeling and headache. In addition, infusing hypertonic solutions through a brachial vein can produce shoulder or arm pain[7, 8].

While the mechanisms of CVC malpositioning are not well understood, it seems to be multifactorial. Some studies have shown that upon needle insertion, the bevel orientation is helpful for the progression of the guide wire in the intended direction. There have been minor randomized controlled studies demonstrating an effect of slope of the needle orientation

in subclavian catheterizations, with a higher rate of correct placements when the slope of the needle was oriented caudally. Orienting the slope of the needle medially when attempting internal jugular vein insertion may maximize the success rate.True CVC placement should be clinically verified, and additionally confirmed with diagnostic imaging[9].For providing a safe placement of CVC there are many techniques like marking on skin for estimating the length of catheter insertion, ultrasound/electrocardiography/echocardiography-guided localization of the vein. Additionally, it is quite important to confirm the position of the placed catheter by CR to see it located at atri-caval junction. Furthermore, this ensures to rule out the complications associated with the procedure[10].

Conclusion

One of the most common complications during CVC placement is catheter malposition.Placing a CVC is an invasive procedure and it should be remembered that various complications may develop during or after the placement. Moreover, practitioners should remember that malposition may not be noticed if no imaging and checking methods are used during CVC administration. As we have seen in both cases, we performed CR as a routine after the procedure. Thus, we prevented possible complications before they emerged. We believe that X-ray is very useful in preventing possible complications in CVC interventions involving the neck and thorax.Thus, any complication (malposition, pneumothorax, etc.) that may require intervention can be detected early.

References

1. McGee DC and Gould MK. Preventing complications of central venous catheterization. N Engl J Med. 2003;348(12):1123-33.
2. Schummer W, Schummer C, Rose N, et al. Mechanical complications and malposition of central venous cannulations by experienced operators. A prospective study of 1794 catheterizations in critically ill patients. Intensive Care Med. 2007;33(6):1055-1059.
3. C.-C. Chen, P.-N. Tsao, and K.-I. Tsou Yau, "Paraplegia: complication of percutaneous central venous line malposition," Pediatric Neurology, vol. 24, no. 1, pp. 65–68, 2001.
4. Granata A, Figuera M, Castellino S, Logias F, Basile A. Azygos arch cannulation by central venous catheters for hemodialysis. J Vasc Access 2006;7:43-45.
5. Pikwer A, Bååth L, Davidson B, Perstoft I, Akeson J. The incidence and risk of central venous catheter malpositioning: a prospective cohort study in 1619 patients. Anaesth Intensive Care 2008;36:30-7.
6. Patel NH. Percutaneous translumbar placement of a Hickman catheter into the azygous vein. AJR 2000;175:1302-1304.
7. Webb JG, Simmonds SD, Chan-Yan C. Central venous catheter malposition presenting as chest pain. Chest. 1986;89(2):309-312.
8. Gilner LI. The "ear-gurgling" sign. N Engl J Med. 1977;296(22):1301.
9. Tripathi M, Dubey PK, Ambesh SP. Direction of the J-tip of the guidewire, in Seldinger technique, is a significant factor in misplacement of subclavian vein catheter: a randomized, controlled study. Anesth Analg. 2005;100(1):21-24
10. K.-S. Chu, J.-H. Hsu, S.-S. Wang et al., "Accurate central venous port-a catheter placement: intravenous electrocardiography and surface landmark techniques compared by using transesophageal echocardiography," Anesthesia & Analgesia, vol. 98, no. 4, pp. 910–914, 2004.
11. J.-H. Hsu, C.-K. Wang, K.-S. Chu et al., "Comparison of radiographic landmarks and the echocardiographic SVC/RA junction in the positioning of long-term central venous catheters," Acta Anaesthesiologica Scandinavica, vol. 50, no. 6, pp. 731–735, 2006.

Case Report
Eurasian Journal of Critical Care

Glass Foreign Body That Chipped Through the Rib: A Potentially Dangerous Manifestation of Penetrating Thoracic Trauma

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Abstract

Sharp objects of metal and glass nature may cause penetrating injuries to the chest wall. These injuries may cause potential life threatening complications such as pneumothorax, hemothorax, hemoptysis attributable to pleura and lung parenchymal injuries. Sometimes the material that causes the penetrating thoracic trauma may remain in the thorax as a foreign body and cause chronic complications which may lead to possible morbidity and mortality. A case of 12 year old male patient who had a glass foreign body chipped through the left 11th rib who was promptly diagnosed and treated with surgery and recovered without any complication is presented in this report.

Keywords: Emergency Medicine, Penetrating Thoracic Trauma, Foreign Body.

Introduction

Sharp objects of metal and glass nature may cause penetrating injuries to the chest wall. These injuries may cause potential life threatening complications such as pneumothorax, hemothorax, hemoptysis attributable to pleura and lung parenchymal injuries. Sometimes the material that causes the penetrating thoracic trauma may remain in the thorax as a foreign body and cause chronic complications which may lead to possible morbidity and mortality[1]. Although relatively uncommon compared to the blunt thoracic trauma, penetrating thoracic trauma is still a life threatening condition in pediatric age group[2, 3]. A case of 12 year old male patient who had a glass foreign body chipped through the left 11th rib who was promptly diagnosed and treated with surgery and recovered without any complication is presented in this report.

Case Report

A 12 year old male patient admitted to our hospital's emergency department with penetrating wound in the back region. His medical history revealed that a glass door dropped onto him and broken into pieces. Past medical history revealed no prescribed drug use, no chronic illnesses and no allergies. Initial physical examination revealed a blood pressure of 128/79 mm Hg, heart rate of 101/min, fever of 36,3 °C. A 2 cm wide skin laceration on the intersection of 11th rib and mid-scapular line was found upon inspection. Case's lung auscultation was normal. It was a wedge shaped piece of glass measuring about 3.5 cm of length (Figure 1a). A wedge shaped foreign body was identified on the left side with chest x ray (Figure 1b). No parenchymal injury such as hemothorax or pneumothorax was found. A thoracic CT was performed in order to identify the exact location of the foreign body. The foreign body was found at 11th intercostal space (ICS) at its intersection with the mid-scapular line (Figure 1c). Pleural and parenchymal injury was not detected. The foreign body was removed under general anesthesia. Additional exploration revealed that the foreign body struck the left 11th rib first and chipped its inferior end milimetrically and stopped at the 11th ICS without penetrating the parietal pleura. Patient was discharged at the first postoperative day without any complications. His follow up examinations in our outpatient clinics revealed no abnormalities.

Discussion

Penetrating trauma of thorax accounts for nearly 30% of all thoracic trauma cases[4]. Penetrating injuries to the thorax with foreign bodies have been reported to damage lung parenchyma, aorta and heart and thus cause hemo-pneumothorax, hemoptysis and cardiac tamponade[1, 5]. Acute pene-

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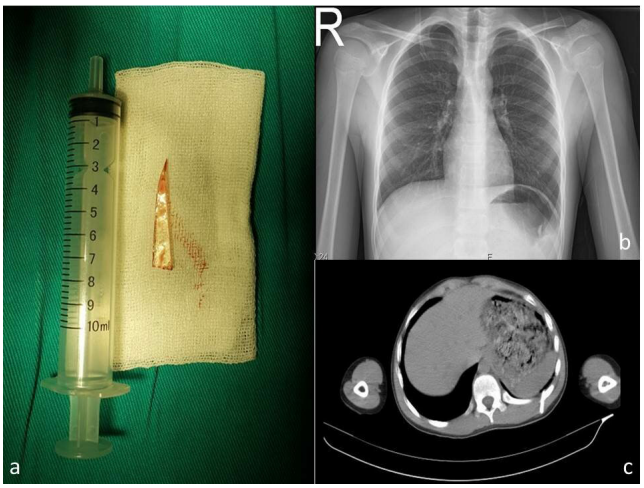

Figure 1a: Glass foreign body that was surgically removed from the patient

Figure 1b: The posterior anterior chest x ray of the patient showing a foreign body on the left lower zone.

Figure 1c: Thorax CT image showing the foreign body localized inferior to the left 11th rib.

trating injuries are usually easily diagnosed and treated on time compatible with our case.

Some penetrating wounds may carry retained foreign bodies in the thoracic region such as broken glass, shrapnel, bullets, bone and cloth fragments[6]. These foreign bodies that are missed may remain dormant for a period of time or migrate through the tissues causing additional late onset injuries. Because of complications that may lead to possible morbidity and mortality such as hemo-pneumothorax, hemoptysis and pyogenic infections, these retained materials generally require immediate surgical removal at the time of diagnosis[5, 6]. Careful history, thorough physical examination and radiological studies such as chest x ray and thoracic computerized tomography have been advocated in the diagnosis of retained foreign bodies in the thoracic region[7]. We believe that these entities should be utilized in a complementary fashion; history may yield information about the nature of the foreign body, inspection during the physical examination and the radiological studies may reveal the injuries and any possible foreign body. Despite all efforts, there are numerous cases of chronic foreign body retention in the thorax with high morbidity rates[1]. We could identify the foreign body in our patient with careful physical examination and radiological studies; and treated our patient with a prompt surgical removal of the object. Thus prevented possible life-threatening complications such as pneumothorax, hemothorax, hemoptysis and infections were prevented.

In conclusion, we believe that all penetrating thoracic trauma should be physically examined carefully and appropriate radiological studies should be undertaken in order to identify any possible retained foreign body. If any foreign body is found in the thoracic wall, immediate surgical removal should be performed in order to prevent any further damage to thoracic viscera, thus preventing possible life-threatening complications in the pediatric population.

Source of Finance

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Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

This study is entirely author's own work and no other author contribution.

References

1. Yurdakul AS, Hoca NT, Gökcek A, Cimen F, Cakaloglu A, Atikcan S. An interesting cause of recurrent haemoptysis: haemoptysis 7 years after a foreign body penetrated the lung parenchyma and aorta. Respirology. 2005;10(2):229-32.
2. Piccolo CL, Ianniello S, Trinci M, Galluzzo M, Tonerini M, Zeccolini M, Guglielmi G, Miele V. Diagnostic Imaging in pediatric thoracic trauma. Radiol Med. 2017;122(11):850-65.
3. Darwish B, Mahfouz MZ, Al-Nosairat S1 Izzat MB. Changing pattern and outcome of pediatric chest injuries in urban Syria. Asian Cardiovasc Thorac Ann. 2018 Jan 1:218492318776565. doi: 10.1177/0218492318776565. [Epub ahead of print]
4. Cakan A, Yuncu G, Olgaç G, et al. Thoracic trauma: analysis of 987 cases. Ulus Travma Derg. 2001;7(4):236–41.
5. Yang X, Shen X. A Piece of Glass in the Heart. Ann Thorac Surg 2006;81(1):335-6.
6. Apiliogullari B, Duzgun N, Kurtipek E, Esme H. Retained foreign body after chest stab wound. BMJ Case Rep. 2014. pii: bcr2014203598. doi: 10.1136/bcr-2014-203598.
7. Ozsarac M, Demircan A, Sener S. Glass foreign body in soft tissue: possibility of high morbidity due to delayed migration. J Emerg Med. 2011;41(6):e125-8. doi: 10.1016/j.jemermed.2008.04.051. Epub 2008 Nov 26.