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ORIGINAL ARTICLE / ÖZGÜN ARAŞTIRMA MAKALESİ

FOCUS in Emergency Room For Dyspnea: Bedside Diagnosis is Now Possible For Pulmonary Embolism

Nefes Darlığı için Acil Serviste FOCUS: Pulmoner Emboli için Yatak Başı Teşhis Artık Mümkün

Halil İbrahim Atalay[1], Serhad Ömercikoğlu[2], Murat Doğanay[3], Çiğdem Özpolat[2], Erkman Sanrı[2], Özge Ecmel Onur[2], Arzu Denizbaşı Altınok[2]

ABSTRACT

Aim: It's known that computed tomographic pulmonary angiography (CTPA) is the gold standard in imaging techniques for pulmonary embolism (PE). Echocardiography and focused cardiac ultrasonography (FOCUS) are the most beneficial bedside diagnostic and treatment tools for unstable patients. Our aim was to determine the value of FOCUS in the diagnostic algorithm of pulmonary embolism.

Material and Methods: This study was designed prospectively in a tertiary medical center's emergency medicine department. All the patients which were presented with dyspnea triaged with Emergency Severity Index triage criteria 1-2, after that if PE was involved in differential diagnosis and the patients whose had Wells score as moderate or high risk randomized for whether to carry out FOCUS or not. The patients who underwent CTPA were included to study. FOCUS protocol consisted of the views of parasternal long axis, parasternal short axis, subxiphoid and apical four chamber views. The ratio of right ventricle to the left ventricle, right ventricular dilatation, septal flattening, septal paradoxal movement, right atrial and ventricular thrombus, vena cava inferior (VCI) and ejection fraction (EF) were evaluated from these views. Final diagnoses of patients and the statistical significance of FOCUS parameters in the diagnosis of pulmonary embolism were examined.

Results: 102 patients were included in the study, of which 45 (44,1%) were women. Patients mean age was 63,8 -+ 15. PE was found as final diagnosis at the 60(%58,8) patients. The FOCUS parameters which were the ratio of right ventricle to the left ventricle over 0,9[sensitivity %45(%32,12-%58,39) and specificity %80,95(%65,88-%91,40)(p=0,0069)], septal paradoxal movement [sensitivity %21,67(%12,07-%34,20) and specificity %95,24(%83,84-%99,42)(p=0,0182)], full VCI(>21 mm, <%50 collapsibility) and hyperdynamic EF(>%70) relation [sensitivity %28.33(%17.45-%41.44) and specificity %97.62(%87.43-%99.94) (p=0,0004)] were found as the most valuable.

Conclusion: FOCUS could be a valuable diagnostic tool that saves lives in unstable patients by making early diagnosis.

Keywords: FOCUS, Pulmonary embolism, Echocardiography

ÖZ

Amaç: Pulmoner Emboli(PE)'de altın standart görüntüleme yöntemi Pulmoner Anjiyografik Bilgisayarlı Tomografi (PABT) olarak bilinmektedir. Anstabil hastalarda yatak başı ekokardiyografi ve odaklanmış kardiyak ultrasonografi (FOCUS) en yararlı tanı ve tedavi araçlarındandır. Amacımız FOCUS'un akut PE tanı algoritmasındaki değerliliğini saptamak olacaktır.

Gereç ve Yöntemler: Bu çalışma 3.basamak bir acil servis kliniğinde prospektif olarak dizayn edilmiştir. Acil Servise solunum sıkıntısı ile başvuran hastalar ESI triaj kriterlerine göre (kriter 1-2) triaj yapılmıştır ve bundan sonra ayırıcı tanısında PE varsa ve Well's Skoru orta ve yüksek risk grubunda olanlara randomizasyon yapılarak yatak başı FOCUS yapılıp yapılmayacağına karar verilmiştir. PABT görüntülemesi yapılmış olan hastalar çalışmaya dâhil edilmiştir. FOCUS protokolü parasternal uzun aks penceresini, parasternal kısa aks penceresini, subksifoid pencereyi ve apikal 4 odacık penceresini içermiştir. Bu pencerelerden sol ventrikül fonksiyonu, sağ/sol ventrikül oranları, sağ ventrikülün dilatasyonu, septal düzleşme, septal paradoksal hareket, sağ atrial ve ventriküler trombüs varlığı ve inferior vena kava ve sol ventrikül ejeksiyon fraksiyonunun birlikteliği değerlendirilmiştir. Hastaların son tanıları ve FOCUS'ta bulunan parametrelerin pulmoner emboli tanısında istatistiksel olarak anlamlılıkları incelenmiştir.

Bulgular: Çalışmaya 102 hasta dâhil edilmiş olup, bunların 45 tanesi (%44,1) kadındır. Hastaların ortalama yaşı 63,8-+15 yıldır. PABT çekilen 102 hastanın 60 (%58,8)'ında son tanı olarak PE saptanmıştır. FOCUS parametrelerinden; sağ/sol ventriküle oranı >0,9 [duyarlılığı %45 (%32,12-%58,39) ve özgüllüğü %80,95 (%65,88-%91,40)(p=0,0069)], septal paradoksal hareket [duyarlılığı %21,67 (%12,07-%34,20) ve özgüllüğü %95,24 (%83,84-%99,42)(p=0,0182)], dolu VCI (>21 mm, <%50 kollabilite) ve hiperdinamik EF (>%70) ilişkisi [duyarlılığı %28.33 (%17.45-%41.44) ve özgüllüğü %97.62 (%87.43-%99.94)(p=0,0004)], en değerli olarak görülmüştür.

Sonuç: FOCUS erken tanıyı mümkün kılabilen ve anstabil hastada hayat kurtaran değerli bir tanı aracıdır.

Anahtar Kelimeler: FOCUS, Pulmoner emboli, Ekokardiyografi

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[1] Kırsehir Ahi Evran University Research and Training Hospital, Department of Emergency Medicine, Kırsehir, Turkey

[2] Marmara University Faculty of Medicine Pendik Research and Training Hospital, Department of Emergency Medicine, Istanbul, Turkey

[3] Buyukcekmece Mimar Sinan State Hospital, Department of Emergency Medicine, Istanbul, Turkey

Corresponding Author: Halil İbrahim Atalay, MD **Address:** Kırsehir Ahi Evran University Research and Training Hospital, Department of Emergency Medicine, Kervansaray Mah. 2019. Sok. No:1, Kırsehir, Turkey. **Phone:** +905313635049 **e-mail**: iboatalay@gmail.com

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Introduction

Pulmonary Embolism (PE) is one of the main and most mortal causes of dyspnea (1). Patients who is suspected of PE should be evaluated by clinical gestalt and then it is important to remember that Wells or Geneva score have to be calculated (2, 3). Computed tomographic pulmonary angiography (CTPA) is the gold standard imaging technique of PE (4).

For unstable patients bedside echocardiography and Focused Cardiac Ultrasonography (FOCUS) can be used for diagnosis (5). Objectives of FOCUS in symptomatic patients are; evaluation of the presence of pericardial effusion and global cardiac systolic function, describing right and left ventricular enlargement, assessment of internal vascular volume and measuring inferior vena cava (VCI) size and it's changes under spontaneous respiration (6). FOCUS has a good correlation with consultative echocardiography, even when it is performed by physicians who are not very experienced (7). The role of FOCUS in suspected PE patients is to make differential diagnosis before further investigations and to help treatment in critical care patients (8).

In this study our primary aim was to determine the value of FOCUS protocol for PE. Our secondary aim was to find out if vital parameters (blood pressure, heart rate, respiration rate, blood oxygen saturation) are related with PE.

Material and Methods

2.1. Study design, setting and population

This study was designed as a single center prospective observational study. The study was executed after approval of the ethics committee (ethics committee document number: *09.2016.082/70737436-050.06.04).* The patients who admit to emergency department of Marmara University Hospital; were enrolled as a convenience sample from February 2016 to December 2016. All the patients which were presented with dyspnea triaged with Emergency Severity Index triage criteria 1-2, after that if PE was involved in differential diagnosis and the patients whose had Wells score as moderate or high risk randomized for whether to carry out FOCUS or not and the patients who underwent CTPA were included to study. The written consent was obtained from the patients who had received the FOCUS protocol.

Patients who had diagnosed other cardiac emergency by ECG, required urgent non-invasive or invasive airway, refused to give consent were excluded.

The physician who performed FOCUS was 4th year resident in emergency medicine training program and who had basic and advanced ultrasonography (USG) certificate, was capable of performing cardiac and thoracic USG's and spent 8 hours observing FOCUS in the echocardiography laboratory and did not take part in the treatment of the patients. The practitioner was supervised by an experienced emergency medicine specialist who have advanced ultrasonography and echocardiography certificate.

2.2 Study Protocol

After a detailed history, examination and 12-lead ECG, if the primary physician thought that the patient was preliminary diagnosed for PE, patient was evaluated according to the pulmonary embolism Kline Algorithm (Figure 1)(9). Wells score was calculated in order to determine the risk of PE while the evaluation of the patients was continuing (5, 6). Wells score contains; clinical symptoms of Deep Vein Thrombosis 3 points, other diagnosis less likely than DVT 3 points, heart rate greater than 100 beats per minute 1,5 points, immobilization or surgery within past 4 weeks 1,5 points, previous DVT or PE, hemoptysis 1 point, malignancy 1 point. Risk score interpretation (probability of PE) was made as follows: > 6 = high risk, 2-6 = moderate risk, <2 = low risk

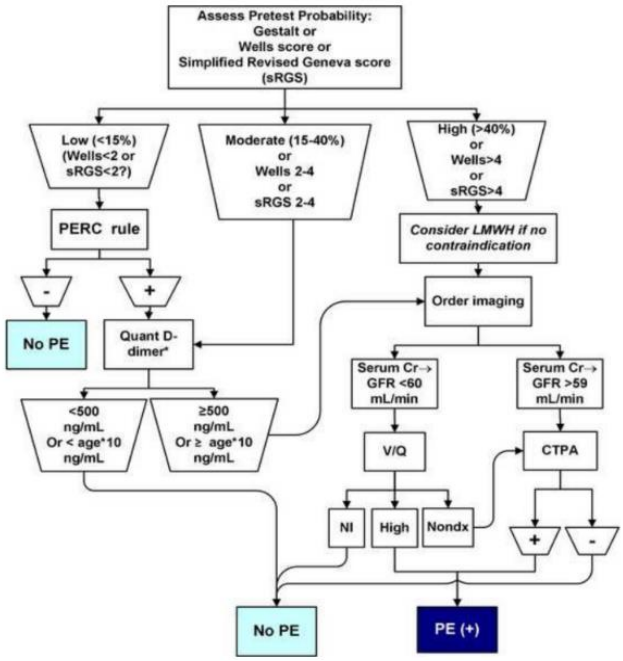


Figure 1. Pulmonary Embolism Kline Algorithm

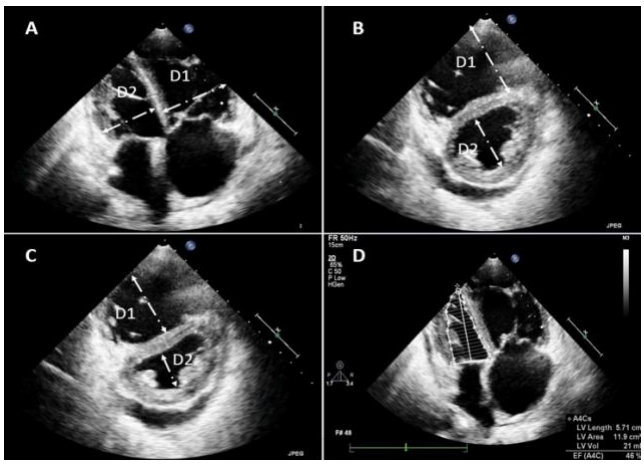
Coin flip (heads or tails) was performed to determine whether or not apply FOCUS in patients with moderate or high risk. The parameters measured in the FOCUS were recorded in the patient's data collection form.

2.3 FOCUS Protocol

The views used for FOCUS are similar to echocardiography. These views are parasternal long axis view (PSLAV), parasternal short axis view (PSSAV), apical 4 chamber view (A4CV) and subxiphoid view (SXV)(Figure 2). FOCUS was performed with 1-5 MHz phased array transducer of CHISON i3 USG device in the PSLAV view, PSSAV, SXV and A4CV while lying on their back (semi-recumbent position) and left. Left ventricular function, right/left ventricular ratios, dilatation of right ventricle, septal flattening, septal paradoxical movement, and measurement of inferior vena cava and

ejection fraction were examined from these windows and it was noted if there was visible thrombus.

Ratio of right ventricle to left ventricle above 0.9 supports PE. It can be visualized at A4CV and PSSAV on papillary muscle level. It is calculated by proportioning measurements derived from the basal portion of the ventricles (10). Dilatation of the right ventricle means that having 3 cm or above size right ventricular end diastolic diameter) (Figure 2) (11).



A: A4CV, Ratio of right ventricle to left ventricle above 0.9 (D1/D2>0.9)
B: PSSAV on papillary muscle level (D1/D2>0.9)
C: Septal paradoxical movement
D: Left ventricular EF, 2-plane Simpson method
Figure 2. FOCUS views and FOCUS parameters

Septal flattening: The ratio of the axial diameter of the left ventricle to the horizontal (perpendicular to the septum) diameter> 1 is significant for septal flattening. It means the shortening of the horizontal diameter and the displacement of the septum towards the left ventricle (12).

Septal paradoxical movement can be visualized from parasternal short axis at the papillary muscle level of the right ventricle. It is the detection of the displacement of the septum towards the left ventricle at the end of the systole due to excessive pressure in the right ventricle (Figure 2)(12).

After visualization of the right atrium from the SXV, the VCI is visualized by a 90-degree rotation over the axis of the right atrium and a diameter measurement is made on the junction of the distal VCI and hepatic vein (Figure 3). After switching USG to M-mode, the collapse of VCI resulted from the pressure change during spontaneous inspiration and expiration is examined. VCI value of more than 2.1 cm and collapse of less than 50% is associated with overvolemia and PE (6).

The left ventricular EF is measured using the 2-plane Simpson method. For the calculation of EF, the left ventricular end-systolic and end-diastolic measurements are made by the Simpson method. EF is calculated by subtracting the end-systolic area from the end-diastolic area and dividing the value by the end-diastolic area (Figure 2)(13).

After the FOCUS findings were recorded, CTPA was performed to the patient if there was no contraindication. The researcher was blind to results. The final diagnoses of the patients with an official CT report were obtained. The statistical significance of FOCUS parameters for PE was analyzed.

A: SXV, Dilatation of the right ventricle
B: SXV and M-mode, VCI>2,1 cm, collapse <50%

Figure 3. FOCUS views and FOCUS parameters

Results

102 patients who performed FOCUS protocol and CTPA between February 2016 and December 2016 were included in the study. The mean age was 63,8 years, %55,9 of them were male. Demographic and clinical information are listed in Table 1. According to CTPA results, there was no statistical significance between vital parameters.

In the evaluation of the preliminary diagnoses (Table 2) top three places were taken by; pulmonary embolism with 102 (100%) patients, acute decompensated heart failure with 72 (70.6%) patients, pneumonia with 68 (66.7%) patients.

As a result of evaluation and imaging, the final diagnosis were found as below (Table-2), pulmonary embolism took 1st place in the table with 60 (58.8%) patients.

Discussion

Echocardiography is one of the first place tools in the ESC PE management guide published in 2014 in the management of unstable patients (14). Again, in this guideline, it is mentioned that it is not appropriate for the patients to leave the critical care area and if echocardiography shows signs supporting right ventricular strain, treatment for PE may be applied to the patient. In the diagnosis, bedside POCUS and its component FOCUS, come to prominence.

In this study, we aimed to see the value of FOCUS in the diagnosis of PE in patients with dyspnea. There are many congestive heart failure studies in the literature with POCUS. Russell et al.(15) and Anderson et al.(16) investigated the importance of lung and cardiac USG in the diagnosis of CHF in patients presenting with undifferentiated dyspnea.

It is known that with adequate education, the FOCUS performed by the emergency physician can provide sufficient correlation with echocardiography. Rutz et al.(17)showed similar results between right ventricular dilatation in detailed echocardiography and FOCUS performed by the emergency physician.

	CTPA Result				
	PE (-) (n=42)		PE (+) (n=60)		
	Median	IQR	Median	IQR	P[1]
Age (years)	66,0	52,0 - 76,0	63,5	55,0 - 73,0	0,6535
Body Temperature (°C)	37,0	36,6 - 37,4	36,9	36,5 - 37,1	0,3237
SBP (mmHg)	115,0	91,0 - 149,0	114,0	100,0 - 138,0	0,9241
DBP (mmHg)	70,5	55,0 - 80,0	70,0	52,5 - 80,0	0,9919
MAP (mmHg)	86,5	68,0 - 100,0	86,5	67,5 - 100,0	0,9593
Heart Rate(/min)	116,0	110,0 - 126,0	116,0	109,0 - 124,5	0,4646
SpO_2 (%)	88,0	80,0 - 89,0	87,0	80,5 - 89,5	0,7624
RR(/min)	30,0	25,0 - 36,0	30,0	26,0 - 33,0	0,6969
Wells Score					
Moderate	41(%97,6)		59(%98,3)		
High	1(%1,7)		1(%1,7)		

Table 1. Age, vital signs and Wells score of patients according to CTPA results

Demonstrating right ventricular strain could be a good tool to predict mortality (18). In a study conducted by Dresden et al.(19), the role of right ventricular dilatation in bedside echocardiography performed by an emergency physician in the diagnosis of PE was investigated. The sensitivity and specificity of the Right ventricular dilatation on echocardiography was found 50% (95% CI 32% to 68%), specificity 98% (95% CI 95% to 100%) respectively. The sensitivity and specificity of septal paradoxical movement were in turn 27% (11% - 43%) and 100% (96.65% - 100%)(19). We found similar results but some of them were slightly lower in our study. If we expanded our sample size we probably could find closer results to the literature data.

In our study, sensitivity and a specificity of coexistence of greater than 21 mm VCI, less than 50% VCI collapse rate and more than 70%, left ventricular EF were found 28.33% (17.45%-41.44%), 97.62% (87.43%-99.94) respectively. In clinical practice, full VCI and hyperdynamic left ventricle can contribute diagnosis of PE, but the absence of these findings does not exclude PE (6).

All of the FOCUS parameters were found to be consistent with the echocardiographic data in the literature. It could be said that it is strong in diagnosis and weak in exclusion. In other words, it could be used in dyspnea cases that the underlying causes unclear for differential diagnosis. Combining the data, we found in our study with the practical advantage of FOCUS, we can see that FOCUS can replace echocardiography soon in diagnosis and treatment of PE.

Limitations

The study was organized as a single center and USG's were made by a single practitioner. If more patients were enrolled to the study it could have made closer our results to literature. It would have been better if pulmonary ultrasound had been performed as well as cardiac ultrasound. Our study protocol did not contain McConnell finding. Adding McConnell finding to FOCUS parameters would make more valuable studies in future researches. Advanced echocardiography could have been performed to understand whether right ventricle strain was acute or chronic.

Pre-diagnosis	%	Final diagnosis	%
PE	102(%100)	**PE**	60(%58,8)
ADHF	72(%70,6)	**ADHF**	26(%25,5)
Pneumonia	68(%66,7)	**Pneumonia**	17(%16,7)
COPD exacerbation	27(%26,5)	**COPD exacerbation**	20(%19,6)
Other Causes (Lung Cancer, Acute coronary syndrome, Vena cava superior syndrome)	7 (6,8%)	**Other Causes** (Lung cancer, Acute coronary syndrome, Vena cava superior syndrome, Chronic thromboembolic pulmonary hypertension, Pericardial effusion, Acute respiratory distress syndrome, Cardiogenic Shock)	15 (14,8%)

Table 2. Pre-diagnosis and final diagnosis list

	Sensitivity (95% CI)	Specificity (95% CI)	AUC (95% CI)	+LR (95% CI)	-LR (95% CI)	P
Right ventricle to the left ventricle ratio over 0.9	45,00 (8,39 - 32,12)	80,95 (65,88 - 91,40)	0,63 (0,53 - 0,72)	2,36 (1,19 - 4,68)	0,68 (0,52 - 0,89)	**0,0069**
Right ventricular dilatation	65,0 (51,60 - 76,87)	71,43 (55,42 - 84,28)	0,68 (0,58 - 0,77)	2,28 (1,36 - 3,80)	0,49 (0,33 - 0,73)	**0,0003**
Detection of septal flattening	43,33 (30,59 - 56,76)	78,57 (63,19 - 89,70)	0,61 (0,51 - 0,70)	2,02 (1,06 - 3,86)	0,72 (0,55 - 0,95)	**0,0225**
Septal paradoxical movement	21,67 (12,07 - 34,20)	95,24 (83,84 - 99,42)	0,58 (0,48 - 0,68)	4,55 (1,08 - 19,12)	0,82 (0,71 - 0,95)	**0,0182**
Presence of thrombus in the right atrium or right ventricle	3,33 (0,41 - 11,53)	100,00 (91,59 - 100,00)	0,52 (0,42 - 0,62)	-	0,97 (0,92 -1,01)	0,2344
Hyperdynamic left ventricle (EF> 70%) with full inferior vena cava (VCI value> 21 mm collapse <50%)	%28,33 (%17,45 - 41,44)	%97,62 (%87,43 - 99,94)	-	11,90 (1,65 - 86,01)	0,73 (0,62 - 0,87)	**0,0004**

Table 3. Comparison of clinical value of FOCUS parameters

Conclusion

From the FOCUS parameter data we found in our study, the right / left ventricular ratio, septal paradoxical motion, and detection of hyperdynamic EF with full VCI were found correlate with the echocardiographic data in the literature.
In the diagnosis of PE; it can be seen that FOCUS is highly specific. However, its sensitivity is quite poor. The possibility of bedside use and its ability to be performed successfully by non-cardiologist physicians even with a short education are important for FOCUS in examination and evaluation of undifferentiated dyspnea patients in emergency and intensive care units. When our study is compared to recent studies, it can be understood that FOCUS and POCUS must be involved in routine evaluation of acute dyspnea.

Conflict of Interest: The authors declare no any conflict of interest regarding this study.

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Authors' Contribution: Conceptualization, Data curation, Project administration, Resources, Supervision, Roles/Writing - original draft, Writing - review & editing (HİA, SO, MD, CO) Formal analysis, Methodology, Validation, Visualization (SO, CO, ES, ÖO, ADA) Funding acquisition, Investigation, Methodology, Project administration, Software (HİA, ES, CO, AD)

Ethical Statement: The study was approved by the Clinical Research Ethics Committee of a tertiary hospital with the decision number 09.2016.082/70737436-050.06.04.
All authors declared that they follow the rules of Research and Publication Ethics.

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ORIGINAL ARTICLE / ÖZGÜN ARAŞTIRMA MAKALESİ

Evaluation of The Relationship Between Minor Head Trauma and Attention Deficit and Hyperactivity Disorder in Children

Çocuklarda Dikkat Eksikliği ve Hiperaktivite Bozukluğu ile Minör Kafa Travmasının İlişkisi

Suna Eraybar[1], Serhat Atmaca[1], Yasemin Nennicioğlu[1], İbrahim Taymur[2], Melih Yüksel[1], Halil Kaya[1], Erol Armağan[3]

ABSTRACT

Aim: Multiple injuries, such as poisoning, limb and tooth injuries, increase in children with attention-deficit and hyperactivity disorder (ADHD). Our study aimed to investigate the possible relationship between ADHD and head trauma in children.

Material and Methods: 200 children (Group 1) and 131 healthy children (control group) who presented with minor head injury were included in the study. After the initial evaluation and examination phase of the patients, the risk level of ADHD was determined by filling in the Conner's Parent Rating Scale (CPRS) with a descriptive form containing trauma mechanism, information about the child, and primary complaints.

Results: Of the 200 pediatric patients who were evaluated with minor head trauma, 125 were male (62.5%) and 75 were girls (37.5%). The average age was 7, and the most common occurrence mechanism was np: 79 patients (39.5%) falling from the same level. Subdural hematoma in 2 (1%) patients and linear cranial fracture in 8 (4%) patients were detected as a result of the imaging performed by patients with minor head trauma. ADHD rates were found as 15% according to the Conner's Parent Rating Scale. According to the ADHD subgroup analysis in our study population 59 (28.5%) attention deficit, 21 (% 10.5) antagonism, 63 (%31.5) hyperactivity and 62 (%31) behavioral disorder were detected.

Conclusion: Pediatric head trauma, as a significant public health problem all over the world, is usually due to preventable causes. A detailed evaluation of ADHD cases as they are evaluated due to trauma can initiate the diagnostic processes and enable follow-up and treatment.

Keywords: Minor head trauma, pediatric trauma, attention deficit and hyperactivity disorder

ÖZ

Amaç: Dikkat eksikliği ve hiperaktivite bozukluğu (DEHB) olan çocuklarda zehirlenme, ekstremite ve dental yaralanmaları gibi çoklu yaralanmaları artar. Çalışmamız, çocuklarda DEHB ile kafa travması arasındaki olası ilişkiyi araştırmayı amaçlamaktadır.

Gereç ve Yöntemler: Çalışmaya hafif kafa travması ile başvuran 200 çocuk (Grup 1) ve 131 sağlıklı çocuk (kontrol grubu) dâhil edildi. Hastaların ilk değerlendirme ve muayene aşamasından sonra, travma mekanizması, çocuk hakkında bilgiler ve birincil şikayetleri içeren tanımlayıcı bir form ile DEHB risk düzeyini belirlemek için Conner Ebeveyn Derecelendirme Ölçeği (CPRS) dolduruldu.

Bulgular: Minör kafa travması ile değerlendirilen 200 pediatrik hastanın 125'i erkek (% 62,5), 75'i kızdı (% 37,5). Ortalama yaş 7 idi ve en yaygın oluşum mekanizması n: 79 (% 39,5) hasta ile aynı seviyeden düşmeydi. Minör kafa travmalı hastalarda yapılan görüntüleme sonucunda 2 (% 1) hastada subdural hematom ve 8 (% 4) hastada lineer fraktür tespit edildi. Conner Ebeveyn Değerlendirme Ölçeği'ne göre DEHB oranları % 15 olarak bulundu. DEHB alt grup analizine göre çalışma popülasyonumuzda 59 (% 28,5) dikkat eksikliği, 21 (% 10,5) antagonizm, 63 (% 31,5) hiperaktivite ve 62 (% 31) davranış bozukluğu saptandı.

Sonuç: Tüm dünyada önemli bir halk sağlığı sorunu olan pediatrik kafa travması genellikle önlenebilir nedenlere bağlıdır. DEHB vakalarının travma nedeniyle olan başvurularında detaylı bir şekilde değerlendirilmesi, tanısal süreçleri başlatabilir, takip ve tedaviye olanak sağlayabilir.

Anahtar Kelimeler: Minör kafa travması, pediatrik travma, dikkat eksikliği ve hiperaktivite bozukluğu

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[1] Science Health University, Yuksek Ihtisas Research and Education Hospital, Emergency Department

[2] Science Health University, Yuksek Ihtisas Research and Education Hospital, Psychiatry Department

[3] Uludag University Faculty of Medicine, Emergency Department

Corresponding Author: Suna Eraybar; MD **Address:** Yuksek Ihtisas Education and Research Hospital, Emergency Department, Mimar Sinan Mah. Emniyet Cad. Polis Okulu Karşısı Yildirim / BURSA **Phone:** +905325782903 **e-mail**: sunaeraybar@gmail.com

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Introduction

Head trauma is one of the essential socio-economic problems that are common today with forensic and medical aspects. Despite efforts to reduce the incidence, it is still a significant problem in the pediatric population. Approximately 634,000 head traumas are reported each year in the United States, and most of them are children under the age of 15 (1). Head trauma is a frequent referral cause to emergency services in childhood, although clinically serious injuries are rare. On the other hand, delayed or missed diagnoses can lead to a fatal outcome. Routine physical examination at the initial evaluation does not always provide information about the severity of the injury. In the pediatric age group, the assessment may be inaccurate due to lack of communication and inadequacy of cognitive functions. A careful history should be taken from the parents about the mechanism of injury and the psychological condition of the child due to the underlying attention deficit and hyperactivity disorder. The use of criteria as PECARN (pediatric head injury/trauma algorithm) including the presence of an injury mechanism or accompanying symptoms can determine the need for imaging in the pediatric age group. According to the trauma mechanism falls from 0.9 m (3 feet) level is essential for the severe mechanism of injury and evaluated as a limit of fall from high. In this respect, clinically significant injuries can be detected, and also unnecessary exposure to radiation can be avoided (2).

ADHD, characterized by problems in attention, concentration, mobility and impulse control, is the most common psychiatric disorder of childhood. The onset is usually around the age of three, but the diagnosis is made during the school years required for regular attention and the development of concentration (3).

It has been reported that ADHD is seen in 3-10% of childhood (3,4). If it is not diagnosed on time, and appropriate treatment and education services are not arranged, it is observed to turn into a critical problem that causes many dysfunctions in school, at home and other social environments, which makes the life of the individual and family difficult. In many studies, ADHD is associated with poisonings, limb and tooth injuries, and penetration of foreign bodies into the nose and the ear (5-7).Some researchers noted a significant association between the incidence of untreated ADHD and the severity of injuries associated with traffic accidents and head traumas during adolescence (8).

Our study aims to evaluate the possible relationship between ADHD and head trauma by assessing children's ADHD scores concurrently with the trauma mechanism in children with minor head injuries admitted to the emergency department.

Material and Methods

Sampling:

Our study was carried out within one month from August 15th to September 15th. Ethical committee approval was obtained from Yüksek İhtisas Research and Education Hospital Clinical Research Ethics Committee (2011-KAEK- 25 2015/15-10) during the study planning phase. A total of 200 children aged five years and older who were evaluated for minor head trauma were included in the study. Patients with mild or moderate head trauma, children under five years old and patients who have not received a written consent form excluded from the study. The families of the cases involved have signed an informed consent form. A descriptive form included trauma mechanism, child information, and parents filled primary complaints in the monitoring process after the initial assessment and screening of the patients, and also ADHD risk status was evaluated by filling CPRS. Intracranial injury, hospitalization follow-up or operation necessity were prospectively recorded after initial treatment.

Simultaneously, the CPRS was filled in for 131 school children aged >5 years who had no history of head trauma, as a control group for establishing the frequency of ADHD in individuals without head trauma.

Evaluation of ADHD:

Multiple approaches are used in the evaluation of ADHD. Diagnosis is based on standard diagnostic criteria such as a diagnostic and statistical manual of mental disorders fifth edition (DSM-V) (9).In addition to DSM-V, other methods such as interview, observation, and rating scales are often used to help diagnose. When the clinical evaluation is insufficient, rating scales are handy tools to identify individuals who need treatment and education. Rating scales can provide valuable information about the individual from different sources of information, such as parents, teachers, peers, and the individual himself. Conner's rating scales are one of the most recognized and most used tools among them. Conner has developed a set of measurement tools to help clinical diagnoses and to determine the effects of treatment and/or training in children and adolescents primarily in ADHD (10).

CPRS was used in our study. The scale consists of forty-eight questions and has four subscales. The questions are answered on the quartile Likert scale (0: Never, 1: Rarely, 2: Frequently, 3: Always). Eleven items are scanning the behavioral disorder, five items attention deficit, four items the hyperactivity, and five items the antagonism.

When the total scores on the attention deficit subscale are 5, the scores on the hyperactivity subscale are 6, the scores on the antagonism subscale are 7, and the score on the subscale of the behavioral disorder is 18, it means that the child has ADHD or subgroup pathologies (10,11).

Statistical analysis:

Recording of all data for the study was recorded using IBM SPSS for windows 21.0 (Armonk, NY). In continuous variables ± standard deviation calculated as descriptive values and in categorical variables n and % values were given. Kolmogorov-Smirnov test was used to analyze whether the data were in a normal distribution. Student's t-test was used for parametric data, and Mann Whitney U test was used for non-parametric data. Categorical data were compared with the chi-square test. P<0.05 was considered statistically significant.

With an alpha = .05 and power = 0.95, the projected sample size needed with this effect size (G Power 3.1 or other software) is approximately N = 88 for group 1 and N:88 for group 2 for this most straightforward between-group comparison. Thus, our proposed sample size will be more than adequate for the main objective of this study and should also allow for expected attrition and our additional purposes of controlling for possible subgroup analysis.

Results

A total of 200 minor head trauma patients (group 1) and 131 healthy controls (control group) were included in the study. The mean age in group 1 was 7.2 (min: 5-max: 13 standard giant 2.15) and 8.4 (min: 6-max 11 giant: 1.312) in the control group. N: 125 male and n: 75 girls were in group 1 while n: 86 male and n: 45 girls were in the control group. The mechanisms of head trauma are summarized in Table 1. The most common cause was falling from the same level 79 (%39, 5), was followed by collision with hard objects 43 (% 21.5). Injuries occurred in 110 (%55) cases at the playground and the street outside the home, and 79 (%39.5) occurred at home (Table: 2). 28 (%14) children had a previous head trauma history. After the initial evaluation by an emergency physician, 180 (% 90) patient needs further imaging studies. 96 (%48) patients had cranial X-ray, and 74 patients (%18.5) had cranial computed tomography. Ten patients (%5) underwent computed tomography (CT) scanning after initial cranial X-ray, because of the need for detailed examination. According to the mechanisms of trauma, the examination requests are summarized in Table 3.

	Frequency (N)	Percent (%)
Fall from the same level	79	39,5
Toy-induced injury	27	13,5
Fall from high	23	11,5
Collision with a fixed object	43	21,5
Fall from the bike	28	14,0
Total	200	100,0

Table 1: The mechanisms of head trauma

Ten (%5) pathologies were detected, with 2 (%1) subdural haemorrhage and 8 (%4) linear fracture. The distribution of the pathologies determined by imaging methods is summarized in Table 4. After the initial assessment, 10 (%5) patients admitted to hospital, 8 (%4) to neurosurgery clinic and 2 (%1) to pediatric intensive care unit respectively. None of them needs a surgical procedure. The whole cases were followed by an average four hour in emergency department observation room.

	Frequency (N)	Percent (%)
Home	79	39,5
School	8	4,0
Garden	26	13.0
Street	84	42,0
Other	3	1,5
TOTAL	200	100,0

Table 2: Distribution of the places where the trauma has occurred

CPRS scale was calculated across all cases and control group, and subgroup analyzes as attention deficit, antagonism, hyperactivity, and behavioral disorder subgroups calculated. Conner's scale evaluation of patients is summarized in Table 5.

Analysis of sub-parameters according to CPRS showed that 59 (%28.5) attention deficit was detected in 200 patients evaluated with head trauma; antagonism, hyperactivity and behavioral disorder rates were 21 (%10.5), 63 (%31.5) and 62 (%31) respectively. There was a statistically significant difference in hyperactivity and behavioral disorder groups in terms of head trauma (p= 0.026, p=0.006) (Table 5).

Discussion

Pediatric head trauma is a significant public health problem all over the world and usually occur due to preventable causes. Therefore, the education of families and child care providers can prevent such accidents as indoor and outdoor. Thus the frequency of trauma reduce.

Brain CT in head trauma is the "gold standard" imaging method (12,13).Indications for withdrawal of CT in patients presenting with emergency trauma are controversial[14]. Haydell et al. reported that %8 of 175 patients with mild head trauma had had an intracranial injury or depressed skull fracture detected in CT (15). In our study, 106 (%53) of the patients were required for CT, whereas only 10 (%5) of them have pathologies on imaging modalities. These rates show that the rate of requesting CT from patients who present with head trauma is quite high in our emergency service.

Overuse of imaging methods may be in question in children who are evaluated for head trauma due to the intense patient admissions of emergency services. The lack of team and material to meet this intensity, the follow-up times of

		Imaging studies				
Trauma mechanism		**X-ray**	**Cranial CT**	**None**	**X-ray+CT**	**Total**
Fall from the same level	*Frequency(n)*	44	27	7	1	79
	Percentage (%)	45,80%	36,50%	35,00%	10,00%	39,50%
Toy-induced injury	*Frequency (n)*	11	8	6	2	27
	Percentage (%)	11,50%	10,80%	30,00%	20,00%	13,50%
Fall from high	*Frequency (n)*	3	17	1	2	23
	Percentage (%)	3,10%	23,00%	5,00%	20,00%	11,50%
Collision with a fixed object	*Frequency (n)*	24	11	5	3	43
	Percentage (%)	25,00%	14,90%	25,00%	30,00%	21,50%
Fall from bike	*Frequency (n)*	14	11	1	2	28
	Percentage (%)	14,60%	14,90%	5,00%	20,00%	14,00%
Total	*Frequency (n)*	96	74	20	10	200
	Percentage (%)	100,00%	100,00%	100,00%	100,00%	100,00%

CT: Computed tomography

Table 3. Trauma mechanisms and imaging studies

the patients are being shortened. And this increases the demand for unnecessary head CT. The limited time allocated to patients, the anxiety of encountering medicolegal events related to the patient, the desire to reduce the suspicion of skipping diagnoses or being late may lead the physician to use imaging methods. In our study, few pathologies were determined compared to the number of views required. In conclusion, it is useful for physicians to observe the indications of head CT again.

In many studies, there has been an increased risk in the frequency of multiple injuries, including head trauma in ADHD. In the Komurcu et all reported that extremity fractures were found in the ADHD group, and diagnostic measurements were made using the Wender Utah Rating Scale (WURS) and the Adult Self-Report Scale (ASRS) (6). In another study, Avsar et al. examined the relationship between ADHD and dental injuries (16). Discala and colleagues have identified an increased risk of head trauma and different body parts. In particular, ADHD has increased risk for the presence of hyperactivity, inattention, and behavioral impairment (17,18). In our study, hyperactivity and behavioral disorder rates were found high, especially in head trauma group. In our study, hyperactivity and behavioral disorder rates were found high, especially in head trauma group.

		Pathology			
Imaging Modality		**Linear fracture**	**Subdural hematoma**	**None**	**Total**
X-ray	*Frequency(n)*	2	0	94	96
	Percentage (%)	25,00%	0,00%	49,50%	48,00%
Cranial CT	*Frequency (n)*	6	2	66	74
	Percentage (%)	75,00%	100,00%	34,70%	37,00%
None	*Frequency (n)*	0	0	20	20
	Percentage (%)	0,00%	0,00%	10,50%	10,00%
X-ray+ CT	*Frequency (n)*	0	0	10	10
	Percentage (%)	0,00%	0,00%	5,30%	5,00%
Total	*Frequency (n)*	8	2	190	200
	Percentage (%)	100,00%	100,00%	100,00%	100,00%

CT: Computed tomography

Table 4: The imaging and detecting pathologies

Score received		Head trauma		Total (N)	X^2 and p value
		Have(N)	*No(N)*		
Attention deficit	0-4	141	95	236	X^2 :0.158
	5-15	59	36	95	p=0.691
Antagosim	0-6	179	121	300	X^2 :0.766
	7-15	21	10	31	p=0.381
Hyperactivity	0-6	137	74	211	X^2 :4.491
	7-12	63	58	120	**p= 0.026**
Behavioral	0-7	138	108	246	X^2 :7.495
Disorder	8-33	62	23	85	**p= 0.006**
Total		200	131	331	

Table 5: Conner's rating scale subgroup analyzes

In our study, the 48 items Likert type CPRS was used in the evaluation of ADHD. Dereboy et al. examine the validity of the Conners Short Form Teacher and Parent Rating Scales and found that the construct validity of the scales and the factor analysis of the children with healthy development for CPRS-48 data, the scales support the validity of the structure (19).

The paediatrician or emergency physician often assesses ADHD associated with high-risk behaviours for different reasons before child psychiatrists. With careful evaluation, it can provide proper follow-up and appropriate orientation for the patient. According to Culpepper, the primary care physician should be aware of ADHD and should be able to guide the patient while solving the referral problem[20]. Faber et al. studied the frequency of ADHD in children and adolescents under 16 years of age, and initial diagnosis and treatment unit found that diagnosis by the paediatrician was 32% and the rate of determination by the primary care physician was 61%, with 51% of the patients being followed by the child psychiatrists (21).

The American Academy of Pediatrics and the American Academy of Emergency Specialists have emphasized that early detection of ADHD in emergency services has a significant impact on this group with a high risk of trauma (22). When a pediatric patient is admitted with head trauma, initial assessment and imaging are followed by observation and monitoring during the observation period in emergency service. During this period taking a more detailed history from the child and parents may indicate an underlying psychological problem in the current injury, as well as the appropriate orientation, may prevent future injuries.

In many studies, the relationship between ADHD and increased use of health facilities and multiple hospital applications has shown as most of them can be solved in the first step health unit instead of emergency services (23,24). Early diagnosis of ADHD in children can help to eliminate additional problems that may arise during adulthood, and can help to recognize comorbid conditions such as bipolar disorder and major depression (25).

Limitations

This study has potential limitations. First, the low number of patients and the fact that the study was performed in a single department. Second, all patient information was obtained from their parents since the patients were in childhood, and parents may have acted incorrectly while filling out the form. However, we think that these limitations can be overcome since there may be a relationship between minor head trauma and ADHD. We believe that this issue can be better elucidated by other multicenter studies to be conducted with a higher number of patients

Conclusion

Pediatric trauma is an essential reason for referral to emergency services. ADHD is one of the most common psychiatric disorders of childhood. Many studies show that children with ADHD have a higher risk of trauma than the healthy population. Detailed evaluation during admission to emergency services due to trauma can initiate the diagnostic processes of these cases and enable follow-up and treatment. We think that evaluating pediatric trauma patients among this aspect and informing parents can prevent both future injuries and prevent recurrent emergency department visits.

Conflict of Interest: The authors declare no any conflict of interest regarding this study.

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Authors' Contribution: Conceptualization, Data curation, Project administration, Resources, Supervision, Roles/Writing - original draft, Writing - review & editing (SE, SA, YN, IT) Formal analysis, Methodology, Validation, Visualization (MY,HK,EA) Funding acquisition, Investigation, Methodology, Project administration, Software (SE, SA, YN, EA)

Ethical Statement: The study was approved by the Clinical Research Ethics Committee of a tertiary hospital with the decision number 2011-KAEK- 25 2015/15-10.
All authors declared that they follow the rules of Research and Publication Ethics.

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ORIGINAL ARTICLE / ÖZGÜN ARAŞTIRMA MAKALESİ

Relationship Between Modifiable Risk Factors and Blood Cell Types in Acute Coronary Syndrome and Estimation of Mortality in Emergency Department

Akut Koroner Sendromda Değiştirilebilir Risk Faktörleri ile Kan Hücresi Tipleri Arasındaki İlişki ve Acil Serviste Mortalite Tahmini

Habip Emrah Leylek[1], Vahide Aslıhan Durak[2], Özlem Köksal[2]

ABSTRACT

Aim: Inflammatory mediators such as leukocyte count (WBC), neutrophil / lymphocyte ratio (NLR), platelet / lymphocyte ratio(PLR), platelet distribution width (PDW) and C reactive protein (CRP) are used for the prediction of ischemic vascular events such as acute coronary syndrome (ACS).In this study, the relationship between inflammatory mediators and modifiable risk factors in the diagnosis of ACS and mortality was examined.

Material and methods: A total of 100 patients with ST elevation myocardial infarction (STEMI) and non-ST elevation myocardial infarction (NSTEMI) were included in the study. Blood samples for WBC, neutrophil count, NLR, PLR, PDW and CRP and routine blood laboratory studies were taken at the time of admission of the patients.

Results: Of the patients diagnosed with ACS,49% was STEMI and 51% was NSTEMI. Female gender was found to be higher in the NSTEMI group than in the STEMI group and also the hypertension ratio was found to be higher in the NSTEMI group than in the STEMI group and it was found to be statistically significant. The NLR median value between the STEMI and NSTEMI diagnostic groups was found to be higher in the NSTEMI group and statistically more significant.

Conclusions: In conclusion; troponin, control troponin, lymphocyte and NLR ratio were found to be statistically significant between STEMI and NSTEMI diagnostic groups.In addition to this; age was found as an effective parameter on mortality.

Keywords: Acute coronary syndrome, leukocyte count, platelet distribution width

ÖZ

Amaç: Lökosit sayısı (WBC), nötrofil / lenfosit oranı (NLR), trombosit / lenfosit oranı (PLR), trombosit dağılım genişliği (PDW) ve C reaktif protein (CRP) gibi inflamatuar medyatörler; akut koroner sendrom (AKS) gibi iskemik olayların tahmininde kullanılmaktadır. Çalışmamızda , AKS tanısında inflamatuar mediatörler , çeşitli risk faktörleri ve mortalite arasındaki ilişki incelenmiştir.

Gereç ve Yöntem: Çalışmaya ST elevasyonlu miyokard enfarktüsü (STEMI) ve ST elevasyonu olmayan miyokard enfarktüsü (NSTEMI) tanısı olan toplam 100 hasta dahil edildi. Hastaların acile başvuru anındaki sırasında WBC, nötrofil sayımı, NLR, PLR, PDW,CRP değerleri ve diğer biokimyasal belirteçler için kan örnekleri alındı.

Bulgular: AKS tanısı konan hastaların% 49'u STEMI ve% 51'i NSTEMI idi. Kadın cinsiyetin NSTEMI grubunda STEMI grubuna göre daha yüksek olduğu ve hipertansiyon oranının NSTEMI grubunda STEMI grubuna göre daha yüksek olduğu ve istatistiksel olarak anlamlı olduğu saptandı. STEMI ve NSTEMI tanı grupları arasındaki NLR medyan değeri, NSTEMI grubunda daha yüksek ve istatistiksel olarak daha anlamlı bulundu.

Sonuç: Sonuç olarak; STEMI ve NSTEMI tanı grupları arasında troponin, kontrol troponin, lenfosit ve NLR oranının anlamlı farklılık gösterdiği bulunurken yaşın mortalite üzerinde etkili bir parametre olduğu görülmektedir.

Anahtar Kelimeler: Akut koroner sendrom, löosit sayısı, trombosit dağılım aralığı

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[1] Balikesir State Hospital

[2] Uludag University Faculty of Medicine, Emergency Department

Corresponding Author: Vahide Aslıhan Durak; MD **Address:** Uludag University Faculty of Medicine, Emergency Department, BURSA **Phone:** +902242953239 **e-mail**: aslidurakis@hotmail.com

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Introduction

While the underlying cause of atherosclerotic heart disease (ASHD) is thought to be endothelial damage dependent cellular proliferation, recent studies have also shown that inflammatory mechanisms play an important role in the pathogenesis of ASHD (1,2). After these developments, inflammatory mechanisms in many cardiac and non-cardiac diseases have begun to be investigated. It has been shown that inflammatory mechanisms are important in the development and prognosis of acute coronary syndrome (ACS) (1,2). It has been shown that inflammatory mediators are associated with ASHD, thrombus formation is induced, and plaque rupture risk increased. For this purpose, many inflammatory mediators such as Leukocyte and C Reactive Protein (CRP) are used in asymptomatic patients to foresee ischemic vascular events (3).

An ACS is a life-threatening table that develops after vessel erosion in the coronary arteries or after a plaque rupture and requires immediate intervention. ACS is divided into three different clinical classes: ST segment elevation MI (STEMI), usually occurring in full occlusion of coronary arteries and seen on at least two consecutive derivations of the electrocardiogram (ECG), non-ST segment elevation MI (NSTEMI) and unstable angina pectoris without enzyme elevation (USAP) (4). Chest pain is one of the frequent referrals to emergency services. However, it is not always possible to diagnose ACS in these patients. For this reason, the diagnosis and differential diagnosis of these patients is gaining importance. The ECG should be the first assessment of these patients. STEMI is often diagnosed based upon the patient's clinic and ECG findings. However, in diagnosis of NSTEMI and USAP, it is very important to use ECG findings and clinical evaluation, ECG and especially cardiac specific troponin in combination (5). In order for the level of troponin to be measurable, i.e being able to be positive, the myocardium must be damaged in significant quantities, which causes the increase in circulation level to be delayed. Because the level of troponin is measurable after 3-6 hours, 6-12 hours of sampling may be required to exclude ACS in patients with suspected ACS and those with NSTEMI (5,6). Therefore, research for new biomarkers in the diagnosis of ACS and mortality has become widespread in recent years.

In this study, the role of blood parameters such as leukocyte count (WBC), neutrophil count, neutrophil lymphocyte ratio (NLR), platelet lymphocyte ratio (PLR), platelet distribution width (PDW) and C reactive protein (CRP) in ACS diagnosis and mortality prediction were investigated in patients presented with chest pain to the emergency department (ED) with STEMI and NSTEMI diagnosis. The role of modifiable risk factors in predicting mortality after ACS was also investigated.

Material and Methods

A total of 100 patients with STEMI and NSTEMI who were referred to Bursa Uludag University Medical Faculty ED for 6 months were included in this prospective study. The study was approved by the Clinical Research Ethics Committee of a tertiary hospital with the decision number 2016-18/30. All patients were included in the study, including patients aged 18 years and older diagnosed with ACS who agreed to participate in this study, also patients with chest pain complaints and patients with ACS and those who met inclusion criteria were included.

Patients who were younger and who were not oriented-cooperated, who had diseases which may impair cognitive functions such as dementia, those who refused to participate in the work, pregnant women, those had a diagnosis of malignancy, those with kidney and liver disease, those with multiple organ trauma, those with active infection with fever of 38 degrees and above, those with known deep vein thrombosis (DVT) and thromboembolic disease and the patients with sepsis were excluded from the study.

In addition to the demographic information of the patients participating in the study, additional information such as history of chest pain or complaint and its characteristics, diabetes, hypercholesterolemia, hypertension, family history, smoking history, obesity, alcohol intake, previous ACS story were obtained, and additional diseases and additional complaints were questioned and recorded.

Patient's data such as; age, blood pressure(systolic and diasyolic), oxygen saturation as well as ; AST- AST levels, creatinine, CRP, CK, CK-MB, troponin levels (in the first admission time) , control troponin levels (6 hours later after the first admission), WBC, neutrophile, lymphocyte, thrombocyte, PDW, NLR, PLR were obtained in the first admission time and included in our study.

Statistical Analysis

Statistical analysis of the data was done in SPSS 23.0 statistical package program. Whether data showed normal distribution or not was examined by the Shapiro-Wilk test. T-test was used to compare two groups with normal distribution, and Mann-Whitney U test was used to compare the data without normal distribution. Pearson Chi-square test, Fisher's exact Chi-square test and Fisher-Freeman-Halton test were used in the analysis of the categorical data. The logistic regression method was used in examining the risk factors that affect mortality. Significance level was determined as $p<0.05$.

Results

Of the 100 patients included in the study, 18% were female and 82% were male. The mean age of the patients (± SD) was 58.83 ± 11.36 years. The mean age of the male patients (± SD) was 56.49 ± 10.18, while the mean age of the female patients was (± SD) 69.50 ± 10.58. There was a statistically

significant difference between the mean age of males and females and the mean age of male patients was lower than females (p <0.001). When the patients were examined according to the risk factors, smoking in 43%, hypertension (HT) in 52%, diabetes mellitus (DM) in 24%, myocardial infarction (MI) history in 24%, family history in 16% and dyslipidemia in 7% were detected. 49% of patients were diagnosed with STEMI, while 51% were diagnosed with NSTEMI. The mortality rate was determined as 7% according to the results obtained by the 4-week follow-up of the patients.

When the characteristics of the chest pain of the patients participating in the study were examined; 89% had classic anginal character, while 11% had non-classical anginal character of chest pain. When the periods of onset of chest pain of the patients participating in the study were compared, it was found that 85% of the patients had a chest pain in the first 24 hours and 15% of the patients applied to the hospital with a complaint of a chest pain lasting longer than 24 hours.

Vital findings and blood parameters were compared between the STEMI and NSTEMI diagnostic groups of the patients included in the study (Table-1). Accordingly, troponin, control troponin, lymphocyte and NLR ratio were found to be statistically significant between STEMI and NSTEMI diagnostic groups (p values: 0.004, 0.000, 0.006 and 0.049 respectively).

History parameters, admission and referral status, and mortality parameters after four weeks were compared between the diagnosis groups (Table-2). While 25.5% of the NSTEMI group were females, the rate of females in the STEMI group was lower by 10.2%. Between the diagnostic groups, there was a significant difference in females in terms of gender (p: 0.047). In the NSTEMI group, the percentage of those with HT was 62.7%, while in the STEMI group it was found to be 51%. There was a statistically significant difference between the diagnostic groups in terms of HT (p: 0.028).

When risk factors affecting mortality were examined with univariate analysis, those with significance level p <0.250 included in multivariate analysis. As a result, age, diagnosis groups and smoking were included in the model. When the risk factors affecting the four-week mortality were examined, only age was found to be statistically significant. One unit increase in the age increased the risk of death by 1.096-fold. No statistically significant difference was found in the analysis of other risk factors in terms of affecting mortality.

The statistical study we conducted on HT, smoking and DM risk groups as the main risk group for the patients included in the study; the patients without these three risk factors accounted for 16% of the total patients. According to this, 84% of the patients had at least one of these three basic risk factors. Basic blood parameters were compared in patient groups with and without these three basic risk factors. When HT, DM, and smoking were considered as the three major risk factors among the patient groups included in the study, it was found that 13 of the 16 patients in whom these risk factors were not found were male (13%) and 3 of them were female (3%) (Table 3).

According to this, there was no statistical significance between the blood parameters of patient groups with and without risk factors between male and female gender.

	NSTEMI	STEMI	p
	Median (Min-Max)	**Median (Min-Max)**	**value**
Age	58 (40-85)	57 (39-76)	0.141
Systolic BP	120 (90-200)	120 (60-170)	0.336
Diastolic BP	70 (50-100)	70 (30-100)	0.419
NDS	80 (60-120)	80 (46-105)	0.104
sO_2	95 (90-100)	96 (83-99)	0.410
AST	22 (11-155)	25 (10-226)	0.160
ALT	20 (8-85)	21(6-57)	0.505
Creatinine	0.85 (0.65-1.56)	0.9 (0.58-1.56)	0.279
CRP	0.5 (0.1-16)	0.4 (0.1-31.3)	0.639
CK	116 (21-1224)	116 (20-2853)	0.844
CK- MB	30 (10.6-219)	30 (8-226)	0.508
Troponin	120 (3.8-33312)	29.61 (1.7-50000)	**0.004***
Control Troponin	1401(43.9-50000)	36008 (2.3-116200)	**0.000***
WBC	9.9 (3.1-18.8)	11.1 (5.7-20.9)	0.068
Neutrophile	5.73 (1.7-13.1)	6.03 (2.24-13.5)	0.759
Lymphocyte	2.86 (0.002-8.15)	3.55 (0.51-8.92)	**0.006***
Thrombocyte	238 (30-378)	235 (80-359)	0.697
PDW	18.2 (15.1-20.2)	17.7 (15.2-22.9)	0.576
NLR	2.17(0.75-7.1)	1.66(0.61-12.2)	**0.049***
PLR	82000(64.16-700000)	72000(35.4-315000)	0.083

Table-1: Comparison of vital signs and some parameters among the diagnostic groups.

Discussion

Cardiovascular diseases are one of the most preeminent cause of death in the world in our age, and it is expected to be in this way for many years. Acute MI may be the first sign of coronary artery disease or may recur in people with known diseases (7,8). Many risk factors affect mortality in ACS; age, sex, previous MI history, DM, kidney failure, smoking, HT, obesity, hyperlipidemia are the main ones. Reduction of coronary artery disease risk factors along with

		NSTEMI		STEMI		
		Number (n)	Percentage (%)	Number (n)	Percentage (%)	p value
Gender	Female	13	(%25.5)	5	(%10.2)	**0.047***
	Male	38	(%74.5)	44	(%89.8)	
Characteristics	typical	47	(%92.2)	42	(%87.5)	0.517
	atypical	4	(%7.8)	7	(%12.5)	
When to start	0-5 hours	36	(%70.6)	33	(%67.3)	0.432
	6-11 hours	7	(%13.7)	6	(%12.2)	
	12-23 hours	0	(%0.0)	3	(%6.2)	
	24 hours	8	(%15.7)	7	(%14.3)	
Hypertension	No	19	(%37.3)	29	(%59.2)	**0.028***
	Yes	32	(%62.7)	20	(%40.8)	
DM	No	36	(%70.6)	40	(%81.6)	0.196
	Yes	15	(%29.4)	9	(%18.4)	
Smoking	No	32	(%62.7)	25	(%51.0)	0.236
	Yes	19	(%37.3)	24	(%49.0)	
Obesity	No	45	(%88.2)	48	(%98.0)	0.057
	Yes	6	(%11.8)	1	(% 2.0)	
Hyperlipidemia	No	46	(%90.2)	47	(%95.9)	0.437
	Yes	5	(%9.8)	2	(%4.1)	
Family History	No	41	(%80.4)	43	(%87.8)	0.315
	Yes	10	(%19.6)	6	(%12.2)	
Result	Coronary ICU hospitalization	30	(%58.8)	46	(%93.9)	**0.000***
	Referred to the hospital	21	(%41.2)	3	(%6.1)	
Mortality After 4 Weeks	Alive	48	(%94.1)	45	(%91.8)	0.712
	Exitus	3	(%5.9)	4	(%8.2)	

Table-2: Comparison of history parameters, admission and referral status, and mortality parameters after four weeks among the diagnostic groups.

suggestions such as lifestyle changes, smoking cessation, diet and weight control and strict blood pressure follow-up is also very important in reducing mortality and morbidity (9).

The mean age of the patients in this study was (± SD) 58.83 ± 11.3, 82% was male and 12% was female. In the study in which Ozel et al investigated the socio-demographic and clinical characteristics of patients with ACS who were admitted to emergency department, the mean age of the patients (± SD) was 52.4 ± 9.4, and 72.1% was male (10). In the OPERA study of Montalescot et al. investigating the differences between STEMI and NSTEMI, the mean age (± SD) was 64.63 ± 12.24, and 76% of the patients were male (11). Similar to the literature, age and male gender were found to be the most important risk factors in our study.

When the literature is reviewed, age is the most important risk factor for CAD (12,13). The mean age of the male patients (± SD) was 56.49 ± 10.18, while the mean age of the female patients was found to be (± SD) 69.50 ± 10.58. The mean age of male patients was significantly lower than that of females ($p < 0.001$), and it is consistent with the literature. Studies have shown that ACS develops in women about 5-10 years later than males and symptoms occur later (14-16). In our study, 25.5% of the NSTEMI group was female whereas the female ratio of STEMI group was found to be as lower as 10.2%. There was a significant gender difference between the diagnostic groups in terms of female gender. The number of female patients with NSTEMI was more than the number of female patients with STEMI, and this is found to be statistically significant.

When classified the ACS diagnosed patients as STEMI and NSTEMI in our study, NSTEMI was 51% while STEMI was found to be 49%, and this rate was different from the literature. In GRACE records, NSTEM were detected in 30% of the cases and STEMI were detected in 34% of the cases (17). Studies conducted in recent years show that there is a significant increase in the rate of NSTEMI in all societies and genders. In a study conducted by Bugiardini et al, NSTEMI and USAP were observed in about two thirds of patients with ACS, and STEMI was detected in one third (18). It is a fact that evaluation of patients using cardiac-specific troponin follow-up and ACS subtype classification and using some risk

scores is effective in the increase of NSTEMI rate in recent years (19). Due to the fact that the follow-up of troponin and ACS subtype in patients suspected of having ACS has been done more strictly in the emergency department of our hospital in recent years, we think that the rate of NSTEMI patients is high in our study.

Similar to other studies, HT was the most significant risk factor in this study, with a rate of 52%. Unlike other studies, it attracts the attention that smoking (43%) is in the second place in this study (11,14,20). Patients with diabetes were found to have a similar ratio (%24) with other studies. The family history and the coronary artery disease history of the person accounted for 40% of the major risk factors. The frequency of hyperlipidemia in the study was 7% which is lower than other studies. In the Opera study, the risk factors are hyperlipidemia with 49.7%, HT with 47.1%, smoking with 36%, and DM with 15.6% (11).In the studies in which Yazici et al examined the compliance of the guidelines and mortality of NSTEMI patients' treatments, HT, DM, smoking and family history were reported as 71.4%, 35.8%, 26.4% and 24.4%, respectively (20). Among the risk factors, HT is one of the most common chronic diseases in the world, and in all studies, it is ranked as one of the firsts of risk factors (14,20). In this study, HT was found high in accordance with the literature. In the NSTEMI group, the rate of HT was 62.7%, whereas in the STEMI group this rate was found to be as low as 51% and a significant difference was detected between the diagnostic groups (p: 0.028). We think that this may be due to the fact that the patients diagnosed with STEMI first applied to the hospital in the form of MI, and that they did not know they were HT patients due to the lack of routine blood pressure follow-ups. It can be said that the rate of hyperlipidemia in our study was as low as 7%, due to the fact that the lipid profile in our emergency department could not be studied, or it was not routinely studied for every patient at hospitalization.

Leukocytes and subtypes are also known as markers of inflammation in cardiovascular diseases (21). NLR is more valuable than neutrophil and lymphocyte values alone, and has been shown to be a long-term mortality marker, especially in patients with STEMI (22-24). Leukocytosis is usually associated with necrosis size, glucocorticoid level, and inflammation in coronary arteries as a result of STEMI/NSTEMI (22,25). Neutrophils are the first leukocytes to reach the damaged site in STEMI/NSTEMI, producing large quantities of inflammatory mediators regulating neutrophil inflammatory response (22). There are publications in which increased numbers of neutrophils are associated with infarct size, mechanical complications, and mortality (26,27). In this study, the median value in the NSTEMI group was found to be higher than the median value in the STEMI group in terms of change in NLR between the STEMI and NSTEMI diagnostic groups, and it was statistically significant. In general, there are many studies that high level of NLR is widespread in STEMI and NSTEMI cases. However, the number of studies examining the mean value of the NLR variable between the STEMI and NSTEMI diagnostic groups is rather limited. In a study conducted by Azab et al. (28), NLR had significant predictive value in short and long term in patients with NSTEMI. As is known, neutrophils have a short life span of about 7 hours in the circulation. Contrary to expectations, Azab et al found that there was a significant relationship between mortality and all NLR values measured at different times in the study.

The mortality rate after 4 weeks of follow-up of 100 patients evaluated in the study was found to be 7%, and it is in accordance with the literature. When the risk factors affecting the 4-week mortality in the study were analyzed univariately, only age was found statistically significant when the affecting risk factors were examined. One unit increase in the age increased the risk of death by 1.096 fold. This shows that age is one of the most important risk factors as well as an effective parameter on mortality. There was no statistically significant difference in terms of affecting mortality in the analysis of other risk factors and biochemical parameters in our study.

Conclusion

In conclusion; troponin, control troponin, lymphocyte and NLR ratio were found to be statistically significant between STEMI and NSTEMI diagnostic groups. In addition to this; age was found as an effective parameter on mortality.

Conflict of Interest: The authors declare no any conflict of interest regarding this study.

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Authors' Contribution: Conceptualization, Data curation, Project administration, Resources, Supervision, Roles/Writing - original draft, Writing - review & editing (HEL, VAD) Formal analysis, Methodology, Validation, Visualization (VAD, OK) Funding acquisition, Investigation, Methodology, Project administration, Software (HEL, VAD, OK)

Ethical Statement: The study was approved by the Clinical Research Ethics Committee of a tertiary hospital with the decision number 2016-18/30.

All authors declared that they follow the rules of Research and Publication Ethics.

	Total patients (n:100) (mean± SD)	Non-risk factor (n:16) (mean± SD)	Risk factor (n:84) (mean± SD)	p value	Non-risk factor (n:16) (mean± SD)	Hypertension (n:52) (mean± SD)	Diabetes mellitus (n:24) (mean± SD)	Smoking (n:43) (mean± SD)	Non-risk factor Male (n:13) (mean± SD)	Risk factor Male (n:49) (mean± SD)	p value	Non-risk factorFemale (n:3) (mean± SD)	Risk factor female (n:15) (mean± SD)	p value
WBC*	10.67 ± 3.17	10.73 ± 2.59	10.66 ± 3.28	0.796	10.73 ± 2.59	10.32 ± 3.07	10.44 ± 2.45	11.50 ± 3.35	11.03±2.58	11.07 ± 3.30	0.899	9.43 ± 2.65	8.79 ± 2.55	0.824
Neutrophile	6.28 ± 2.46	6.38 ± 1.96	6.26 ± 2.55	0.550	6.38 ± 1.96	6.03 ± 2.13	6.23 ± 1.81	6.50 ± 2.80	6.18 ± 1.99	6.44 ± 2.59	0.919	7.24 ± 1.90	5.48 ± 2.24	0.250
Lymphocyte	3.31 ± 1.60	3.33 ± 1.42	3.31 ± 1.64	0.703	3.33 ± 1.42	3.18 ± 1.60	3.18 ± 1.67	3.77 ± 1.57	3.76 ± 1.15	3.49 ± 1.69	0.446	1.49 ± 0.97	2.46 ± 1.03	0.446
NLR*	2.38 ± 1.84	2.67 ± 2.70	2.33 ± 1.64	0.676	2.67 ± 2.70	2.32 ± 1.53	2.27±1.21	2.20 ± 1.74	1.74 ± 0.64	2.36 ± 1.76	0.689	6.67 ± 4.78	2.17 ± 0.92	0.689
Platelets (10^3)	237 ± 62	247 ± 66	235 ± 61	0.400	247 ± 66	232 ± 69	230 ± 69	2400 ± 60	254 ± 56	232 ± 62	0.182	216 ± 108	245 ± 59	0.426
PLR*	92128 ± 78955	97044 ± 65062	91192 ± 81640	0.573	97044 ± 65062	86096 ± 44688	106982 ± 134014	7777 ± 4540	722209±13558	80081 ± 47718	0.919	204666 ± 96241	142300±158265	0.919
PDW*	18.11 ± 1.34	18.36 ± 1.44	18.06 ± 1.32	0.369	18.36 ± 1.44	18.02 ± 1.16	18.63 ± 0.98	17.87 ± 1.46	18.34±1.54	17.91 ± 1.32	0.291	18.43 ± 1.15	18.76 ± 1.10	0.574

Table-3: Investigation of basic hemogram parameters according to patient groups in the presence/absence of risk factors.

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ORIGINAL ARTICLE / ÖZGÜN ARAŞTIRMA MAKALESİ

Bibliometric Analysis for Researches On Emergency Care: 30-Year Thematic Development Mapping with SciMAT

Acil Bakım Konulu Araştırmalar İçin Bibliyometrik Analiz: SciMAT İle 30 Yıllık Tematik Gelişim Haritalaması

Ayhan Tabur[1]

ABSTRACT

Aim: This study aims to reveal the change in trends of the themes discussed in the scientific studies conducted in the field of Emergency Medicine by years.

Material and Methods: In this study, 2112 articles published in the Web of Science Core Collection database covering the last 30 years (1990-2019) and containing the term "emergency care" in the title tab in the Web of Science Core Collection database, which is the most accepted in the academic world, were examined using bibliometric scientific mapping method. In these analyses conducted with SciMAT software, which is one of modern science mapping techniques, articles were evaluated in the periods of 1990-1999, 2000-2009 and 2010-2019 years. The findings were examined with the number of articles, total citations, strategic diagrams, cluster networks, thematic development maps and comparative analyzes.

Results: It was observed that the studies carried out in the field of emergency medicine since 1990 have increased in quantity over time, the thematic change is significant in terms of periods and new themes have been evaluated in studies while some themes have declined over time. In emergency medicine, “medicine”, “departments” and “emergency medicine” in 1990-1999, “management”, “satisfaction” and “diabetic ketoacidosis” in 2000-2009 and “practitioner”, “risk” and “geriatrics” in 2010-2019 were found as motor themes.

Conclusion: When the cluster networks and thematic development maps on emergency care are examined, it can be said that the general subject fields and definitions have evolved towards more specific and specific subject fields over the years.

Keywords: Emergency medicine, bibliometric, scientific mapping, thematic development, SciMAT

ÖZ

Amaç: Acil Tıp alanında yapılan bilimsel çalışmalarda ele alınan temaların yıllara göre değişim eğilimlerini ortaya koymaktır.

Gereç ve Yöntemler: Bu çalışmada akademik dünyada en fazla kabul gören Web of Science Core Collection veri tabanında son 30 yılı kapsayacak şekilde (1990-2019) yayımlanan ve başlık sekmesinde “emergency care” terimini içeren 2112 makale bibliyometrik bilimsel haritalama yöntemi kullanılarak incelemiştir. Modern bilim haritalama tekniklerinden SciMAT yazılımı ile yapılan analizlerde makaleler 1990-1999, 2000-2009 ve 2010-2019 dönemleri halinde ele alınmıştır. Bulgular makale sayısı, toplam atıf sayısı, stratejik diyagramlar, küme ağları, tematik gelişim haritaları ve karşılaştırmalı analizler ile incelenmiştir.

Bulgular: Acil Tıp alanında 1990 yılından itibaren gerçekleştirilen çalışmaların zaman içerisinde nicelik olarak artış gösterdiği, dönemler bazında ele alındığında tematik değişimin belirgin olduğu, zaman içerisinde bazı temalar gerileme gösterirken yeni temalarında araştırmalarda ele alındığı görülmüştür. Acil Tıp alanında 1990-1999 döneminde “medicine”, “departments” ve “emergency medicine”, 2000-2009 döneminde “management”, “satisfaction” ve “diabetic ketoacidosis”, 2010-2019 döneminde “practitioner”, “risk” ve “geriatrics” temalarının motor temalar olduğu belirlenmiştir. Temalara ait h-index ve toplam atıf sayıları gibi veriler tablolarda sunulmuştur.

Sonuç: Acil bakım konusundaki otuz yıllık yayın küme ağları ve tematik gelişim haritaları incelendiğinde genel konu alanları ve tanımlamalarının, yıllar geçtikçe daha spesifik ve özel konu alanlarına doğru evrildiği söylenebilir.

Anahtar Kelimeler: Acil tıp, bibliyometri, bilimsel haritalama, tematik gelişim, SciMAT

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[1] Diyarbakır Gazi Yasargil Training and Research Hospital, Diyarbakir, Turkey.

Corresponding Author: Ayhan Tabur; MD **Address:** Diyarbakır Gazi Yasargil Training and Research Hospital,, Diyarbakir, Turkey **Phone:** +90 532 4453803 **e-mail**: ayhantabur@yaani.com

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Introduction

In recent years, tremendous change and growth have been seen in the healthcare industry including the field of emergency medicine along with the progress of other branches of science and technology.

Themes addressed in scientific studies are also among those affected by this change. Studies that increased quantifiably in the field of Emergency Medicine were examined using the bibliometric scientific mapping method in this study to see changing themes.

Emergency medicine refers to a medical specialty in which physicians care for patients with acute illnesses or injuries that require immediate medical attention (1).

The goal of emergency medicine is to improve health while preventing and treating disease and illness in patients seeking emergency medical care. Improvements in emergency medical care and the delivery of this care can be achieved through credible and meaningful research efforts. Improved delivery of emergency medical care through research requires careful planning and the wise use of limited resources (2).

Emergency medicine research's goal is to extend knowledge and advance technology in ways that will ultimately improve the health of patients through enhancing the emergency medical care they receive. Emergency medical care is both an important community responsibility and a vital community resource. It is the only medical care resource that offers both immediacy and universality of service (2).

Despite a consensus on the need for more research, little is known about the current state of research in EM. Although anecdotal information suggests that the volume of EM publications is increasing, data to support this conclusion are scarce (3).

To the best of our knowledge, no investigation has characterized the type and quantity of worldwide EM research publications (1).

This study is the first analysis conducted in Emergency Medicine with SciMAT software (A free java-based scientific mapping program that builds network analysis at a longitudinal level), one of which is modern bibliometric science mapping technique.

Bibliometric measures and indicators can be employed to carry out a performance analysis of the generated maps (4). This kind of analysis allows us to quantify and measure the performance, quality, and impact of the generated maps and their components, as shown in (5).

Science mapping, or bibliometric mapping, is an important research topic in the field of bibliometrics (6). It is focused on monitoring a scientific field and delimiting research areas to determine its cognitive structure and its evolution (7).

Science mapping aims at displaying the structural and dynamic aspects of scientific research (8).

In this article, we used an open-source science mapping software tool called SciMAT (Science Mapping Analysis Software Tool) which incorporates methods, algorithms, and measures for all the steps in the general science mapping workflow, from preprocessing to the visualization of the results.

SciMAT allows the user to carry out studies based on several bibliometric networks (co-word, cocitation, author cocitation, journal cocitation, coauthor, bibliographic coupling, journal bibliographic coupling, and author bibliographic coupling). Different normalization and similarity measures can be used over the data (association strength, Equivalence Index, Inclusion Index, Jaccard Index, and Salton's cosine). Several clustering algorithms can be chosen to cut up the data. In the visualization module, three representations (strategic diagrams, cluster networks, and evolution areas) are jointly used, which allows the user to better understand the results (9).

SciMAT also uses advanced bibliometric indexes such as the h-index (10-14).

Material and Methods

The bibliometric scientific mapping method was used in this study whose aim is to reveal the tendency of change of the themes discussed in the scientific studies conducted in the field of emergency medicine. The data obtained from the Wos (Web of Science) database were analyzed with SciMAT software, which allows the evaluation of bibliometric sources (5). This study examines 30 years of research in the field of emergency medicine. For this reason the ethics committee approval was not obtained.

Data Analysis

Web of Science Core Collection database covering the last 30 years (1990-2019) and containing the term "emergency care" in the title tab in the Web of Science Core Collection database. The data related to 2658 articles from 1980-2019 period which were obtained from WoS database were uploaded to SciMAT program for analysis and necessary arrangements were made. Of the 2658 articles uploaded to the SciMAT program, 546 articles belonging to the period 1980-1989 were excluded from the analysis due to lack of data. It was determined that the publication year data of 3 of the 2112 articles to be used in the analysis were missing and the missing data were introduced to the program manually. The data were divided into 10-year periods as "1990-1999", "2000-2009" and "2010-2019" in order to see thematic change. "Words" were used as an analysis unit, groups of similar and synonyms were made, very general meaningful words were excluded from the analysis, and threshold values were determined for data reduction by taking into account the word frequencies for each period. Accordingly, the threshold values of 2 for the "1990-1999" period, 3 for the "2000-2009" period, and 8 for the "2010-

2019" period were used in the data reduction. "Co-occurrence" for network inference, "Equality index" for network normalization, "simple centers algorithm" for clustering algorithm, "core mapper" for mapping, "h-index" and "sum citations" for the quality measure, "inclusion index" for development map and overlap map were used in the analyses.

Overlap map, strategic diagrams, thematic networks, and thematic development map were used in the evaluation of SciMAT analysis findings. The overlap map shows the number of themes in the relevant period, the number and percentage of themes from the previous period and the next period. Strategic diagrams were examined in four areas based on the concepts of centrality and density (15). The concept of centrality shows the degree of strength of the relationship of a theme with other themes and this relationship increases with the right approach in the diagram. The concept of density shows the working density of a theme, i.e. the number of publications, and this density increases with the upward approach in the diagram. According to this; The themes in the upper right area of the diagram are motor themes with high centrality and density, the themes in the lower right area are essential and transformational themes that are important for the research area but not studied enough, the themes in the upper left area are highly developed and isolated themes that are very studied but have a weak relationship with other themes, the themes in the lower left area refers to themes that have just emerged or begun to disappear (4,16).

Thematic network maps show the degree of strength of the relationship between the themes in the map and the thickness of the lines shows that the relationship is strong. The thematic development map shows the periodic development of the themes, with straight lines expressing coexistence in the same publication, and dashed lines expressing the frequency of sharing common words, and the thickness of the lines indicating that the relationship is strong (16).

The aim of this study is to provide a scientific and macroscopic perspective to those who are interested in the subject by making bibliometric analysis of articles on emergency care with science mapping method.

Results

The number of articles for the periods examined has increased significantly over time. Findings related to the ten most frequently mentioned keywords in publications in the period of 1990-2019 are Emergency-care, Management, Mortality, Children Services, Emergency-medical-services, Health-care, Emergency-department, Medicine and Health respectively. The most frequently used keywords are "Emergency-care" (n: 127), "Management" (n: 111) and "Mortality" (n: 103).

The use of keywords used in the research publications in the periods "1990-1999", "2000-2009" and "2010-2019" are as follows,

114 (39%) of the 292 words used in the period 1990-1999 continued to be used in the period 2000-2009 and 1003 new words began to be used.

512 (46%) of the 1117 words used in the period 2000-2009 continued to be used in the period 2010-2019 and 2792 new words began to be used.

The strategic diagram for the 1990-1999 period is shown in Figure 1. The findings related to the themes are given in Table 1. During the period 11 themes emerged. The themes of "Medicine", "Departments" and "Emergency-medicine" are motor themes whose relation to other themes in the field is high and intensively studied. The themes of "Medicine" and "Departments" were the main themes of this period, while the theme of "Emergency-medicine" was more numerous in publication.

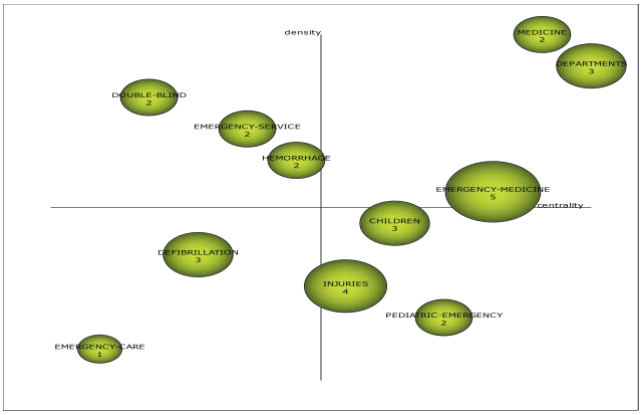

Figure 1: Strategic Diagram of the Period 1990-1999

The themes "Children", "Injuries" and "Pediatric-emergency" are fundamental and transformational themes that have a high relation to other themes in the field but a lower intensity of study. The themes "double-blind", "Emergency-service" and "Hemorrhage" are highly developed and isolated themes with low relation to other themes in the field but with high intensity of work. The themes of "Defibrillation" and "Emergency-care" are newly emerging or beginning to disappear, with a low intensity of study and relationship to other themes in the field. The h-index values and total citation numbers of the articles are as shown in Table 1.

According to the thematic network map for the theme "Medicine", which is one of the prominent themes in terms of centrality and intensity in the period 1990-1999, and the thematic network map weight values the themes to which the "Medicine" theme is highly associated with "Predictive-instrument", "Public-hospital-emergency" and "Visits" themes.

The strategic diagram for the "2000-2009" period is shown in Figure 2, the findings related to the themes are given in Table 1. During the period 2000-2009, 15 themes emerged.

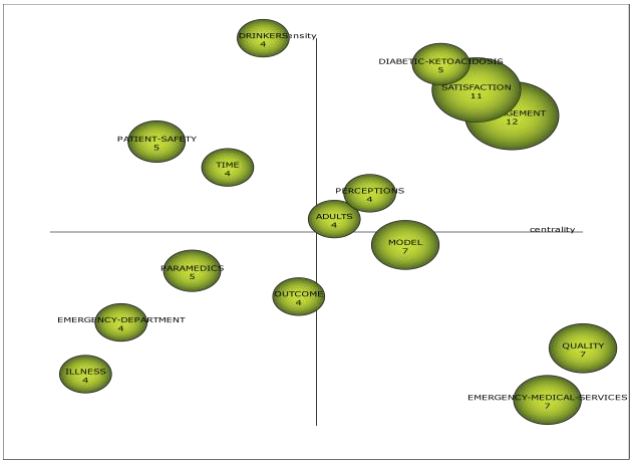

Figure 2: Strategic Diagram For The Period 2000-2009

The themes of “Management”, “Satisfaction” and “Diabetic-ketoacidosis” are the leading motor themes whose relation to other themes in the field is high and intensively studied. “Diabetic-ketoacidosis” theme has a high intensity, “Management” and “Satisfaction” themes have a higher number of publications. “Quality”, “Emergency-medical-services” and “Model” themes are fundamental and transformational themes that have a high relation to other themes in the field but a lower intensity of work. The themes of “Drinkers”, “Patient-safety” and “Time" are highly developed and isolated themes with low relation to other themes in the field but with high intensity of study. The themes of “Illness”, “Emergency-department”, “Paramedics” and “Outcome" are newly emerging or beginning to disappear, with low relation to other themes in the field and intensity of work. The h-index values and total citation numbers of the articles are as shown in Table 1.

According to the thematic network map for the theme “Management”, which is one of the prominent themes in terms of centrality and intensity in the period 2000-2009, the “Management” theme is most highly associated with “Guidelines”, “Head-injury”, “Relief” and “Acute-abdominal-pain" themes.

The strategic diagram for the "2010-2019" period is shown in Figure 3, the findings related to the themes are given in Table 1. During the period 23 themes appeared. The themes of “practicer”, “Risk” and “Geriatrics " are high in relation to other themes in the field and are the leading motor themes studied extensively. Of these themes, the intensity of the “Geriatrics” theme, the centrality of the “practicer” theme is high, while the number of publications of the “Risk" theme is higher. Besides, “Mortality”, “Emergency-medical-services” and “Death” themes are also included as motor themes during this period, and “mortality” and “Emergency-medical-services” themes are seen to have a high number of publications.

The “Departments” and “Management” themes are fundamental and transformational themes that have a high relation to other themes in the field but a lower intensity of study. The themes of “Department-visits“, “Performance”, “Patient” and “Burden” are also included as fundamental

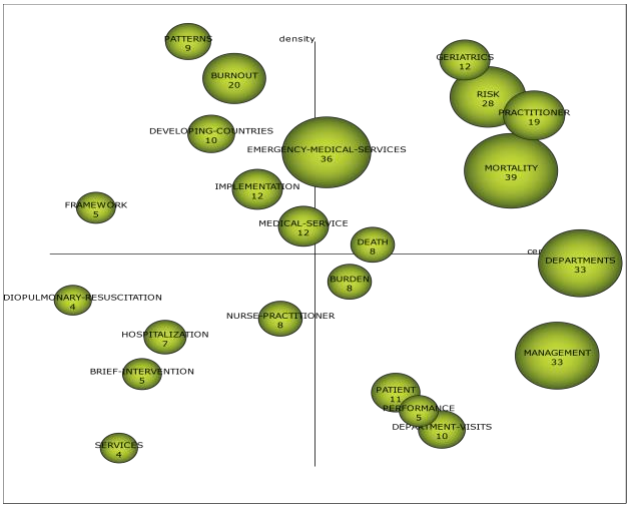

Figure 3: Strategic Diagram For The 2010-2019 Period

and transformational themes in this period. The themes of “Patterns”, “Burnout” and “Developing-countries” are highly developed and isolated themes that are not related to other themes in the field but have a high intensity of work. The themes of” Services“, “Brief-intervention”, and” Hospitalization " are newly emerging or beginning to disappear, with a low intensity of study and relationship to other themes in the field. The h-index values and total citation numbers of the articles are as shown in Table 1.

According to the thematic network map for the theme “practicer”, which is one of the prominent themes in terms of centrality and intensity in the period 2010-2019İ; practicer theme is most highly associated with “Community”, “Impact” and “Quality-of-care" themes. The highest level relationship between the other themes in the thematic network map is between the themes “Accident” and “Impact”.

The thematic development map, which shows the conceptual and structural development of the themes that stand out in the period of 1990-2019, is shown in Figure 4.

When the straight lines showing coexistence between the themes of the “1990-1999” period and the themes of the “2000-2009” period are examined in the same publication, the highest relationship is between “Emergency-care” and “Satisfaction" and similar relations “Department” and “Quality”, “Injuries” and “emergency-medical-service” is observed. When the dashed lines showing the frequency of sharing common words between “1990-1999 theme and “2000-2009 themes” are examined, it is seen that there are high levels of relationships between “Medicine” and “Time”, “Hemorrhage” and “Management”, “hemorrhage” and “Illness”.

When the straight lines showing the coexistence between the themes “2000-2009” and “2010-2019” are examined, the highest relationship is between “Emergency-

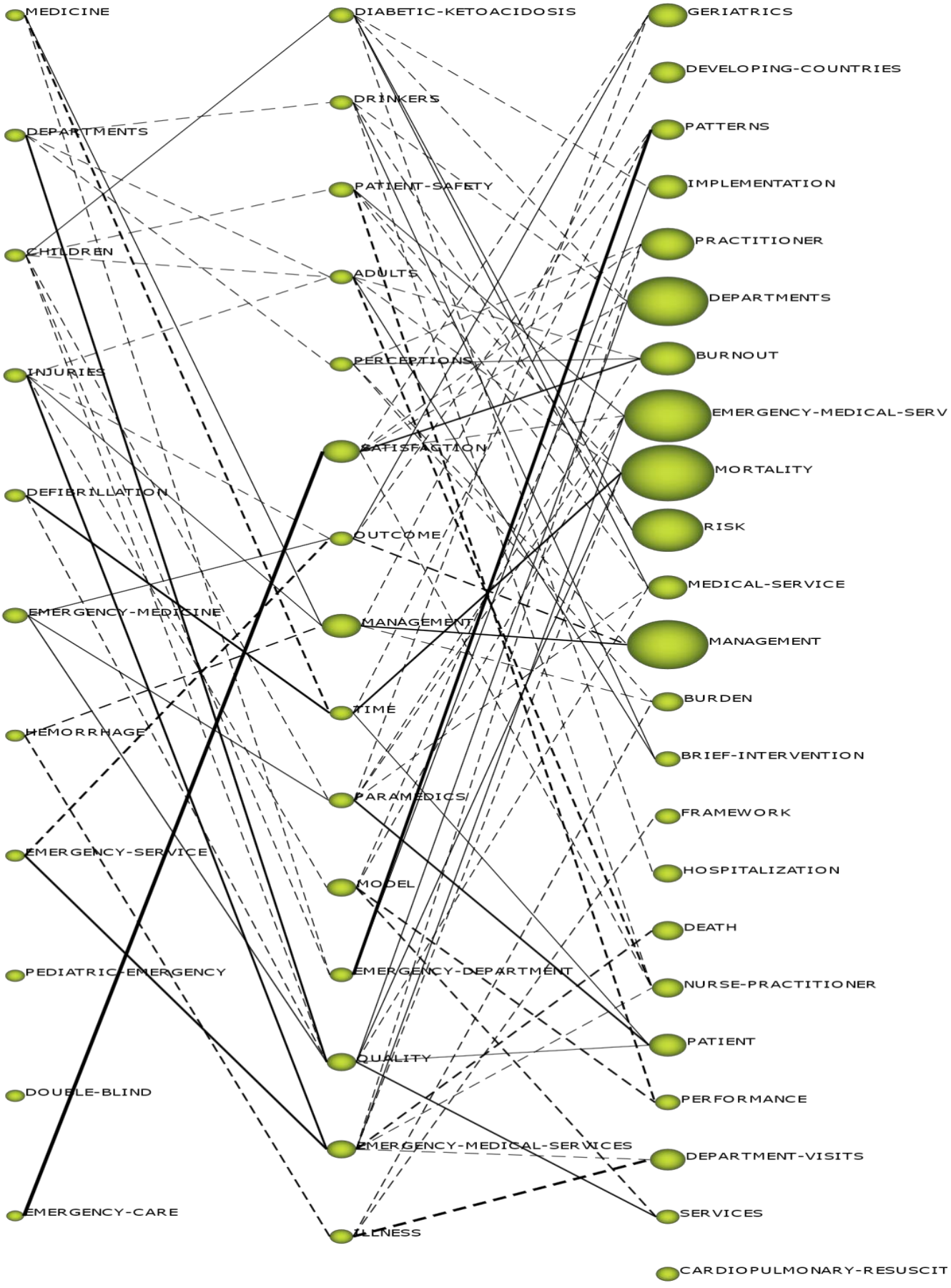

Figure 4: Thematic Development Map (1990-2019)

1990-1999						
Name	**Centrality**	**Centrality range**	**Density**	**Density range**	**h-index**	**Sum Citiations**
Departments	55.00	1.00	71.43	0.91	3	71
Medicine	47.89	0.91	144.05	1.00	2	41
Emergency medicine	46.78	0.82	39.03	0.55	2	39
Pediatric-emergency	36.94	0.73	11.11	0.18	2	41
Children	29.72	0.64	36.11	0.45	3	72
2000-2009						
Name	**Centrality**	**Centrality range**	**Density**	**Density range**	**h-index**	**Sum Citiations**
Emergency-medical-services	38.75	0.93	1.29	0.07	5	148
Management	36.86	0.87	26.74	0.80	7	176
Satisfaction	36.58	0.80	28.28	0.87	8	198
Diabetic-ketoacidosis	35.03	0.73	44.62	0.93	5	150
Model	32.76	0.67	9.66	0.47	6	180
2010-2020						
Name	**Centrality**	**Centrality range**	**Density**	**Density range**	**h-index**	**Sum Citiations**
Departments	25.36	1.00	2.55	0.48	11	331
Practitioner	21.07	0.91	4.20	0.83	7	120
Mortality	20.74	0.87	3.23	0.70	11	382
Risk	20.01	0.83	4.24	0.87	7	171
Geriatrics	19.33	0.78	5.82	0.96	6	98

Table 1: Themes of the Periods 1990-1999, 2000-2009 and 2010-2020 (First five themes)

department" and "Pattern" similar relationships are found at high levels between "Satisfaction" and "Burnout", "Management" and "Management". When the dashed lines showing the frequency of sharing common words between "2000-2009" themes and "2010-2019 "themes are examined, it is seen that there are high levels of relationships between "Patient safety" and "performance", "Adults" and "Nurse-practitioner", "Outcome" and "Management".

Although "children" and "Pediatric-emergency" themes were found in "1990-1999" period," "adults" in "2000-2009" period, "Geriatrics" themes appeared in "2010-2019" period, the theme "Management" in the period "2000-2009" takes place in the next period and its intensity increases (Figure 4).

Discussion

The increase in the number of articles in the years determined in our research is thought to be an expected result. The speed of publishing academic articles in the world and the volume of the literature from different disciplines are increasing. Among the disciplines with the highest number of publications in recent years academic publication statistics, there is no emergency medicine discipline. Nevertheless, the fact that emergency medicine is a relatively new discipline within the medical disciplines and the continuing research on emergency medicine issues are thought to be a factor that supports the increase in the number of articles. (17).

In this research, articles on emergency care were examined. Naturally, the most frequently used keywords are such as emergency-care, mortality, emergency medical services, health care, and emergency department. Management is one of the most used keywords. There is also "management" in emergency services. Examples such as airway management and difficult patient management can be given. Emergency medicine is a new discipline among the disciplines of medicine. Emergency Medicine was accepted as a branch of science in 1979 with the effect of wars in the past century. In the following years, legal regulations related to Emergency Health Services, Administrative/administrative application principles, training programs for personnel, and similar regulations were implemented within the authorized institutions and organizations of countries. In this context, research, examination, analysis, and evaluations on issues related to Emergency Health Services have been carried out over the past years and continue. Therefore, there are numerous articles in the literature containing the word "management" (18).

Keywords increased at a similar rate in the periods 1990-1999, 2000-2009, and 2010-2019. It is close to each other in the proportions of the numbers of words that have been abandoned and newly used. These increases give clues about the necessity of bibliometric methods which are the subject of our research. Continuity in scientific development has brought a striking increase in the number of scientific publications. With this increase, the follow-up, examination, and control of academic and scientific progress have become difficult. It is important to be able to follow the developments in various disciplines and the changes in

existing practices. Scientists demand constant updates and access to scientific data at any time to stay integrated with their worldwide counterparts. All these needs increased the need for bibliometric methods and the use of the methods, which are also the subject of this article (18,19).

The themes “Medicine”, “Departments” and “Emergency-medicine” are motor themes between 1990-1999 that have a high relationship with other themes. "Departments" stand out among themes. In this period, there are many articles in the literature with the title "emergency department". In these articles, topics such as the effectiveness of the emergency services, frequency of use, and quality level were examined. The reason for the research to focus on this issue may be to identify possible disruptions and possible contributions to the operation of the emergency services, which were recently implemented and are still under development at that time. The fact that “Departments” is one of the most cited themes among the themes in the same period supports this.

Epidemiologists are evaluating evidence to determine whether exposure is responsible for a direct outcome. Studies follow a hierarchy in terms of the quality of the evidence they can provide, and randomized double-blind studies are considered the "gold standard" of epidemiological studies. Randomized double-blind studies started to be used by scientists in the 60s, these studies became much more valuable in the 90s. It is thought that this situation will explain the determination of the “Double-blind” theme as a highly developed and isolated theme with high working intensity (20).

Among themes from the same period, the most cited theme is “Defibrillation”. The reason why this theme stands out in terms of attribution compared to other themes is the periodical intensity in the scientific debate on the use of Automatic External Defibrillators (OED) and its reflection in academic papers. In the early 90s, it was reported that OEDs were used successfully by first aid teams. In the same period, the use of OED of non-healthcare personnel was approved, the legal legislation on the subject was soon written and OED training was included in the basic CPR course. Increasing the number of researches in which academic circles examine this new device led to an increase in the number of articles on the OED. This increase, together with the citation increase, caused this theme to stand out among others (21).

"Management" and "Satisfaction" are the motor themes that stand out in 2000-2009 period. This is likely to be since emergency medicine, as stated in the paragraphs above, is a new discipline among the disciplines of Medicine. Legal arrangements, administrative/administrative implementation principles, training programs for personnel, and similar arrangements regarding Emergency Health Services were implemented in the 80s and 90s. The research and analysis of the results obtained from these regulations and practices were carried out during the same period and continues. As an expected result, the data obtained from these researches and studies have been shared with the scientific world in academic articles, and many articles have been published titled “Management of emergency health services and satisfaction with these services” (22).

“Drinkers”, which is one of the themes in the strategic diagram of the same period, attracts attention as the most cited theme. This may be since when applying to the emergency room with a trauma complaint, it is quite common for the applicant to be drunk. This situation is frequently encountered especially in adolescent applications in the USA. There are numerous articles on “drinkers” from the period studied in the literature (23).

Patterns, practicer, Departments Mortality, Management themes are some of the themes that emerged during 2010-2019. These indicate that research and investigations into Emergency Health Services continued during this period as well. The fact that Departments and Management themes have the highest citation level among other themes supports this.

The themes of “Practitioner” and “Nurse-practitioner” which appeared in the same period indicate that, unlike previous periods, the issue of examining the results of education related to emergency health services gained weight in this period, and the articles related to it came to the fore. Following the establishment of the Emergency Medicine Departments, training programs for the personnel who would work in this field in the 80s and 90s and training topics related to the Emergency Health Services were determined and documents related to this were written. Afterward, the results obtained from these trainings were analyzed and examined. This may explain the issues related to education to come to the fore. Besides, the recent increase in various disasters, immigration, epidemics, and conflicts in the world has accelerated the work of developing training programs. This issue is also thought to contribute to highlighting educational issues.

In the thematic development map of the 1990-2019 period obtained in our study, the themes of the period of 1990-1999 and the themes of 2000-2009 period, "Emergency-care" and "Satisfaction", "Department" and "Quality" and "Injuries" and "Emergency -Medical-Service are found in many articles together. The intensity of the articles that share the results of the researches examining the emergency and emergency health services in a way to support the issues stated in the paragraphs above can be accepted as the reason for this cooperation.

There is a strong relationship between the "Emergency-department" and "Pattern" between the themes of the period 2000-2009 and 2010-2019, as discussed in the above paragraph. In the literature, there are articles examining the numerous features of emergency departments: patient and

admission patterns, bleeding, and diurnal patterns of treatments. This situation is thought to explain the strong relationship between “Emergency-department” and “Pattern”.

The strong relationship "Emergency-department" and "Pattern" is similar to that between "Satisfaction" and "Burnout". Burnout refers to a state of emotional, mental, and physical exhaustion caused by extreme and long-term stress. Emergency physicians have a higher level of burnout compared to other physicians. This situation arises from the characteristics of the medical discipline they belong to, such as working hours, need for intensive professional development, and non-clinical tasks. Satisfaction is used in relation to job satisfaction and has been investigated with burnout in emergency physicians. This explains the strong relationship between themes (24,25).

Conflict of Interest: The author declares no any conflict of interest regarding this study.

Financial Disclosure: The author declared that this study received no financial support.

Authors’ Contribution: The manuscript was written by one author.

Ethical Statement: This study examines 30 years of research in the field of emergency care. For this reason, it is declared that the ethics committee approval was not obtained by the author. Author declared that he follows the rules of Research and Publication Ethics.

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CASE REPORT / OLGU SUNUMU

Successful Treatment of a Heroin Package in the Stomach by Endoscopic Method: A Case Report

Midede Bir Eroin Paketinin Başarılı Olarak Endoskopik Yöntemle Tedavisi: Olgu Sunumu

Fevzi Yılmaz[1], Ömer Faruk Karakoyun[1], Hüseyin Uzunay[1], Fatih Selvi[1], İhsan Ulusoy[1]

ABSTRACT

Aim: The term “Body packing” refers to a method that is commonly used for carrying illegal drugs in the body of a carrier. The drug is typically prepared in small plastic packages and either ingested via oral route or inserted into body cavities including the rectum and the vagina. Another term, “body stuffing,” is used for instances when a drug package is quickly swallowed to avoid an imminent police arrest.

Case Report: Herein, we report the endoscopic removal of heroin packages in a 25-year-old male patient carrying multiple such packages in his stomach and intestines, which could not be removed by medical treatment in the emergency department (ED).

Conclusion: Upper gastrointestinal endoscopy (UGIE) is a safe alternative to surgical removal of selected cases of body packing.

Keywords: Foreing body, heroin, upper gastrointestinal system endoscopy

ÖZ

Amaç: "Vücut paketleme" terimi, bir taşıyıcının vücudunda yasadışı uyuşturucuları taşımak için yaygın olarak kullanılan bir yöntemi ifade eder. İlaç tipik olarak küçük plastik paketler içinde hazırlanır ve ya oral yolla alınır ya da rektum ve vajina dahil vücut boşluklarına sokulur. Başka bir terim olan "vücut doldurma", bir uyuşturucu paketinin polisin yakında tutuklanmasını önlemek için hızla yutulduğu durumlar için kullanılır.

Olgu Sunumu: Bu olguda Midesinde ve bağırsaklarında çok sayıda eroin paketi olan 25 yaşındaki erkek hastanın acil serviste medikal tedavi ile takip sonunda çıkmayan eroin paketinin endoskopik yolla çıkarılmasını sunuyoruz.

Sonuç: Üst gastrointestinal endoskopi, seçilmiş vakalarda vücuttaki paketlerin cerrahi olarak çıkarılmasına güvenli bir alternatiftir.

Anahtar Kelimeler: Yabancı cisim, eroin, üst gastrointestinal sistem endoskopi

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[1] Antalya Training and Research Hospital, Department of Emergency Medicine, Antalya/TURKEY

Corresponding Author: Fevzi Yilmaz, M.D. **Address:** Antalya Training and Research Hospital, Department of Emergency Medicine, Antalya/TURKEY **Phone:** +905055907307 **e-mail**: fevzi_yilmaz2002@yahoo.com

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Introduction

Drug and narcotic substance addiction is an important social and medical problem. The supply and trafficking of narcotic substances are international crimes. Despite the measures taken by the states in this regard, drug traffickers attempt to continue this trade with illegal and unconventional methods. The most frequently trafficked products are cannabis, cocaine, and heroin (1).

The "body packing" method was first reported in the medical literature in 1973 (2). The transport process is planned by placing the illegal substances in the body cavities after preparing them in small plastic packages of 8-10 grams (3). Carriers usually carry between 50 and 100 packages on their bodies, but this number may increase; often, packages can be transported in the gastrointestinal system by swallowing them or inserting them into the rectal or vaginal cavities (1). Patients who are brought to the ED should be definitely asked about the type of material packaged, the way the packages are wrapped, and the amount of the packaged materials. Although the carrier's statements on this matter are often unreliable, it is essential to carefully evaluate the responses given by the carrier. Carriers may often apply to the ED without symptoms. In this regard, physicians should identify possible complications that may occur in the carrier and plan their examinations accordingly. A patient history should include questions about abdominal pain, vomiting, inability to pass gas or stool, and the patient should be examined for serious complications such as gastrointestinal perforation and ileus (4). In addition, it should not be forgotten that as a result of a possible rupture of the packages, severe toxicological symptoms such as agitation, hypertension, tachycardia, mydriasis may occur, even culminating in the death of a carrier (5).

The diagnosis of body packages is usually made by plain abdominal radiography and computed tomography (CT) (1). Carriers can be followed conservatively as long as they are asymptomatic, or discharge of the packages can be induced with laxatives. Surgery is the treatment of choice for removal of ingested drug packages, especially in cases where drug leak and resultant intoxication is a concern (5). Removal of swallowed drug packages from the gastric lumen by an upper gastrointestinal endoscopic procedure can also be applied, although reported data on this technique is rare (4). In this report, we present a patient who was brought to the ED and claimed that he was carrying heroin packages in his body, which could not be discharged naturally and were removed by the endoscopic method.

Case Report

A 25-year-old male patient was detained by the narcotic branch police teams at the airport and brought to the ED on suspicion that he was transporting drugs in capsules. The patient stated that he was a drug dealer and that he sloppily packed and swallowed the heroin, the amount of which he did not know exactly. He was concerned about the leakage of the package contents due to poor packaging and asked for their removal.

He was asymptomatic and appeared healthy upon his arrival at the ED. He had an arterial blood pressure of 124/73 mmHg, pulse rate of 76/min, body temperature of 36.7°C, and respiration rate of 14/min. Upon examination his abdomen was soft; bowel sounds were increased; there were no signs of abdominal guarding or rebound tenderness; digital rectal examination revealed stool contamination. Other system examinations were normal. His admission complete blood count was normal, as was his initial routine serum chemistry including renal and hepatic functions, as well as serum electrolytes. An upright plain abdominal radiogram (UPAR) taken to evaluate the foreign bodies swallowed by the patient revealed multiple foreign bodies in the abdomen, but it did not give a clear idea about the location and amount of the packages (figure 1). Intravenous contrast-enhanced abdominal CT imaging was planned to clarify the diagnosis. It showed foreign bodies that may belong to multiple smooth-contoured and specially prepared packages at the level of the stomach, intestines and colon (figure 2).

Figure 1. Suspected foreign bodies seen in UPAR

The general surgery and gastroenterology departments were consulted for follow-up and monitoring possible complications. In the ED, treatment for shortening the gastrointestinal transit time was administered via oral and rectal routes until all packages were removed naturally against the risk of opening the packages in the gastrointestinal system. The patient was followed in the ED for 4 days, and most of the heroin packages were discharged naturally from the rectum. However, a heroin capsule was retained in the gastric body and the patient complained of nausea and vomiting despite medical treatment; thus, UGIE was planned. The patient was informed about the possible complications of the ingested heroin package, and

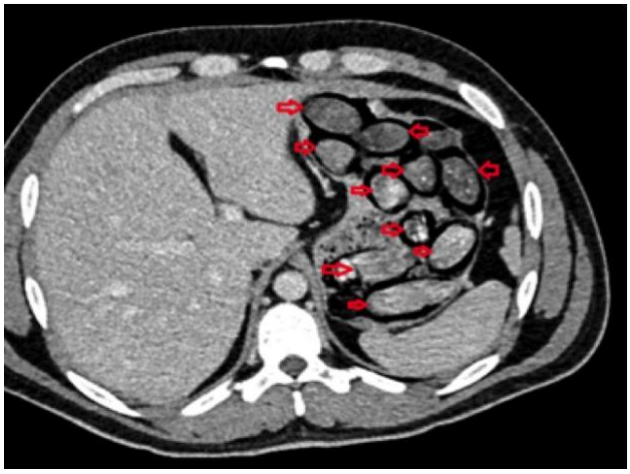

Figure 2. The abdominal CT shows multiple foreign bodies that may belong to smooth-contoured packages at the level of stomach, intestines and colon.

treatment options were discussed. The package removed by UGIE looked intact. The patient, who did not develop any complications during the endoscopy and during the follow-up, was discharged under the supervision of the police. Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

Discussion

Body-packing refers to the act of hiding illicit drugs in various compartments, anatomical spaces, or external orifices of the human body. Cocaine is the most commonly smuggled narcotic substance worldwide, which is followed by heroin, methamphetamines, and cannabinoids. A “carrier” can usually transport approximately 1 kg of any smuggled drug, in a divided form into 50–100 packages (6). Our patient was also carrying multiple heroin packages.

Most of the carriers are usually asymptomatic at the time of presentation. Although body packers may be an unreliable source of information, they should be questioned whether they carry packages, the wrapping technique used for the packages, the number of packages carried, and the presence of gastrointestinal symptoms suggestive of ileus or GIS perforation. Packages are sometimes felt during an abdominal, vaginal, or rectal examination. The advances in the packaging system developed by the carriers have currently reduced the chance of package rupture to as low as 5%. The presence of "toxic syndrome" or "toxidrome" in a patient suggests leakage from the drug package. Patients with signs and symptoms suggestive of cocaine toxicity such as agitation, hypertension, tachycardia, mydriatic pupils, and diaphoresis should be assumed to be carrying large doses of deadly heroin packages (3-5).

The packages could not be seen on plain radiogram of the abdomen taken on admission. It has been reported that plain radiograms have a sensitivity ranging between 40% and 90% for detection of drug packages. This creates a need for performing advanced imaging studies such as such as abdominal ultrasonography, CT, and contrast passage radiograms for individuals suspected to carry body packages. It is sufficient for diagnosis to see foreign bodies with smooth contours within the luminal organs of the gastrointestinal system in CT (7). In our patient, a large number of packaged foreign bodies was visualized in the abdomen by a plain radiogram, but the latter did not give a clear idea about the location and quantity of the packages. Therefore, an abdominal CT was taken to clarify the diagnosis, which showed a large number of smooth-contoured, specially prepared foreign bodies at the level of the stomach, intestines, and colon.

Urine toxicology has an unclear role in making the diagnosis of body packages. Several large studies have reported that it has a wide range of sensitivities, ranging from more than 90 to less than 40%. Hence, owing to inconsistent sensitivity values reported in the literature, we believe that urine toxicology is not suitable as a screening test to detect body packers (8). Blood or urine toxicological tests were not performed in our patient, either.

Asymptomatic patients should be closely monitored in the intensive care setting until the passage of all packages is complete. In the conservative method, intestinal irrigation and laxatives can be of benefit in case of reduced intestinal motility to the foreign body (3). Patients presenting with sympathomimetic toxicity should be evaluated urgently and taken to the operating room for surgical decontamination. Although there are opinions that the use of endoscopic methods for removing the packages in asymptomatic patients is not preferred due to the risk of piercing the latex dressing of the packages, there are publications in which the removal of the packages was successfully performed in selected cases (9,10).

UGIE can be used to remove packages in cases with a small number of packages, a shorter time from swallowing packages to hospital presentation, and packages that has not passed beyond the pylorus. Only a small number of reports in the medical literature have reported successful removal of drug packages using UGIE. To our opinion, this results from migration of swallowed packages past the pylorus during the time spent in police custody in an asymptomatic carrier or until the carrier becomes symptomatic in complicated cases. Additionally, UGIE has a potential of harming the patient by causing the packages to burst or punctured and their contents to spill over into the gastrointestinal system at endoscopic package removal. Endoscopic retrieval is particularly challenging when a body packer has swallowed a large number of packages. Nevertheless, several case reports have reported that UGIE procedure could successfully remove drug packages (4). Our patient also swallowed many heroin packages, and he was administered oral and rectal treatment to shorten the gastrointestinal

transit time in the ED. Most of these heroin packages came out of the patient's rectum during his 4-day follow-up in the ED. However, UGIE was used for successful removal of a heroin capsule that was retained in the gastric body despite medical treatment during follow-up. The patient, who did not develop any complications during the endoscopy and during the follow-up, was discharged with full recovery and delivered to the police forces.

Conclusion

Difficulties are still encountered in the management of patients with body packages containing drugs. Although surgical method is the preferred treatment method in symptomatic cases, UGIE is considered as a minimally invasive treatment option that may be appropriate in selected cases where there are no signs of toxicity, the time between swallowing body packages and arrival to the hospital is short, and the number of swallowed packages is small.

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Authors' Contribution: FY conceived the case report. FY, MFA contributed reagents, materials, analysis tools or data. FY, MFA, EDA, OA drafted the manuscript and all authors contributed substantially to its revision.

Informed Consent Statement: Written informed consent was obtained from the patient for publication of this case report and any accompanying images. A copy of the written consent is available for review in this journal.

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CASE REPORT / OLGU SUNUMU

A Rare Case of Chemical Pneumonia Caused by Hydrocarbon Ingestion

Hidrokarbon Yutulmasının Neden Olduğu Nadir Bir Kimyasal Pnömoni Vakası

Fevzi Yılmaz[1], Muhammed Furkan Albayrak[1], Engin Deniz Arslan[1], Önder Acar[1]

ABSTRACT

Aim: Hydrocarbon compounds that are ingested orally show their effects by tissue hypoxia, pulmonary irritation, and systemic toxicity. Chemical pneumonia is one of the most serious complications of hydrocarbon poisoning. The clinical and radiological detection of chemical pneumonia is important in terms of treatment and prognosis. In this article, a 54-year-old patient diagnosed with chemical pneumonia due to kerosene drinking is presented.

Case Report: A 54-year-old man was admitted to the Emergency Department with complaints of cough, shortness of breath, and epigastric pain. On admission, his vital signs were as follows: BP: 150/95 mmHg, SPO2: % 97, the pulse rate: 97/min, body temperature: 36.5 C. His medical history was notable for drinking approximately 100 ccs of kerosene accidentally while cleaning his house about 5 days ago. The patient was found to have chemical pneumonia and hospitalized.

Conclusion: Chemical pneumonia should be remembered in patients admitted to the emergency department after drinking hydrocarbons. In addition, most of these poisoning episodes are preventable.

Keywords: Hydrocarbon toxicity, chemical pneumonia, lamp oil

ÖZ

Amaç: Ağızdan yutulan hidrokarbonlu bileşikler doku hipoksisi, pulmoner irritasyon vesistemik toksisite ile etkilerini gösterirler. Kimyasal pnömoni hidrokarbon zehirlenmesinin en ciddi görülen komplikasyonlardan biridir. Kimyasal pnömoninin klinik ve radyolojik olarak saptanması tedavi ve prognoz açısından önemlidir. Bu yazıda gazyağı içmeye bağlı şimik pnömoni teşhisi konulan 54 yaşında bir hasta sunuldu.

Olgu Sunumu: 54 yaşında erkek hasta Acil Servis'e öksürük, nefes darlığı ve epigastrik ağrı şikayetleri ile başvurdu. Kabulde vital bulguları; TA: 150/95 mmHg, SPO2: % 97, nabız: 97/dk, ateş: 36,5 C idi. Hastanın öyküsünde yaklaşık 5 gün önce evini temizlerken yanlışlıkla yaklaşık 100 cc kadar gaz yağı içtiği öğrenildi. Yapılan tetkiklerinde şimik pnömoni saptanan hasta hastaneye yatırıldı.

Sonuç: Acil servise hidrokarbon içilmesi sonucu getirilen hastalarda şimik pnömoni unutulmamalıdır. Ayrıca bu tür zehirlenmelerin büyük çoğunluğu önlenebilir

Anahtar Kelimeler: Hidrokarbon toksisitesi, kimyasal pnömoni, gaz yağı

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[1] Antalya Training and Research Hospital, Department of Emergency Medicine, Antalya/TURKEY

Corresponding Author: Fevzi Yilmaz, M.D. **Address:** Antalya Training and Research Hospital, Department of Emergency Medicine, Antalya/TURKEY **Phone:** +905055907307 **e-mail**: fevzi_yilmaz2002@yahoo.com

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Introduction

In excess of 28,000 cases of hydrocarbon, exposure is reported to United States regional poison control centers each year, and these intoxications are among the leading poisoning types across the globe. Accidental intakes constitute some 85% of all hydrocarbon exposures. Most of the approximately 14,000 annual pediatric cases affect children aged 5 years or younger (1). Despite a very low death rate, moderately severe intoxications particularly with hydrocarbon ingestion are common and require supportive care. Hydrocarbon ingestion ranks first in the frequency list of exposures affecting this age group, being responsible for some 75 percent of cases (2). Young children (≤5 years of age) are usually tempted by their exploratory behavior and get intoxicated by ingesting hydrocarbons. Hydrocarbons are usually insecurely and improperly stored in drinking containers such as soda or water bottles. On the other hand, adolescents and adults are typically exposed to inhaled hydrocarbons through recreational abuse of these substances (3).

The route of intake, type of chemical compound, and amount of substance taken are important determinants of the toxicity of a given substance. Despite the fact that hydrocarbons injure nearly all systems in the human body, the lungs, brain, and heart are the most severely affected organs (4-6). Animal studies suggest that severe necrotizing pneumonia represents the principle pathologic change (7). Direct severe injury to the airway epithelium, alveolar septae, and pulmonary capillaries are among other findings, which also include the dissolution of the lipid surfactant layer. Atelectasis, interstitial inflammation, and hyaline membrane formation are secondary pathological findings.

Ingestion of hydrocarbon-containing substances primarily causes aspiration and chemical pneumonia, leading to morbidity and mortality through lung injury and subsequent complications. Acute hydrocarbon exposure is diagnosed by a clinical evaluation with patient history and physical examination findings. Symptoms vary according to chemical class and route of exposure. Most of the time, exposure and type of substance are identifiable in the patient's history (5). With this case report, we aimed to draw attention to hydrocarbon poisoning, which mostly occurs as a result of home accidents and causes preventable lung complications.

Case Report

A 54-year-old man was admitted to the Emergency Department with complaints of cough, shortness of breath, and epigastric pain. On admission his vital signs were as follows: BP: 150/95 mmHg, SPO2: % 97, the pulse rate: 97/min, body temperature: 36.5 C. His medical history was remarkable for accidental drinking of approximately 100 ccs of kerosene while cleaning his house about 5 days ago (figure 1). The patient had no smoking history or known

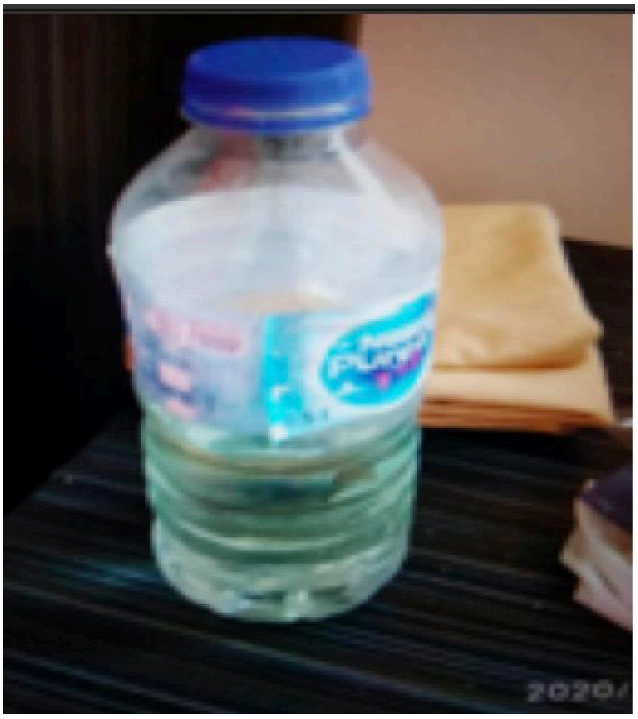

Figure 1. The kerosene bottle from which that the patient drank kerosene and which he brought to the emergency department

comorbidity. His physical examination revealed a normal oropharynx, reduced lung sounds, and ronchus localized to the right hemithorax on pulmonary auscultation. His other organ systems showed normal examination findings.

In the radiological examinations, a posteroanterior chest X-Ray showed an infiltrative image consisting of a large number of small, irregular densities with ill-defined borders in the right upper lung (figure 2). In chest CT, there were cystic bronchectasic areas, opacities compatible with secretion in dilated bronchi (pneumatocele), parenchymal glass ground densities, and centrilobular opacities in the upper lobe of the right lung (figure 3).

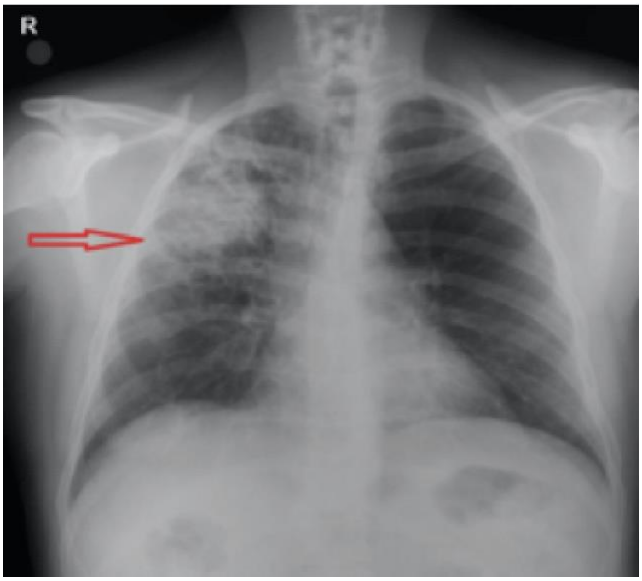

Figure 2. An area of infiltration in the upper zone of the right lung on PA chest X-Ray.

The laboratory test results were as the following: Hb: 11.7 g/dL, HTC: 34.8%, Glucose 117 mg/dL, BUN:10 mg/dL,

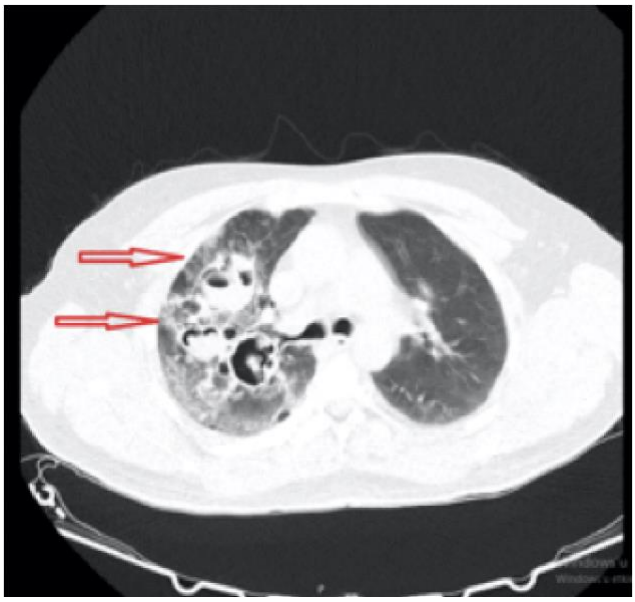

Figure 3. Chest CT findings compatible with chemical pneumonia in the upper zone of the right lung.

Creatinine: 0.89 mg/dL, Sodium:133 mmol/L, Alanine aminotransferase (ALT): 132 U/L, Aspartate transaminase (AST): 56 U/L; in arterial blood gas analysis, pH: 7.42, PO2:83 mmHg, PCO2: 42 mmHg, and HCO3: 25 mmol/L. A 12-lead electrocardiogram (ECG) was recorded, and continuous cardiac monitoring was initiated to monitor ventricular arrhythmias.

Based on the above findings, the patient was consulted with the department of pulmonary diseases with a preliminary diagnosis of chemical pneumonia and hospitalized for further diagnostic workup and treatment. He was treated with O2, bronchodilators, nebulizers, and administered Piperacillin-Tazobactam against superinfections. Having recovered both clinically and radiologically the patient was discharged with full recovery 12 days later.

Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

Discussion

The aliphatic hydrocarbons are straight-chain compounds, which include butane, propane, kerosene, and mineral seal oil. They are used in furniture polishes, lamp oil, and lighter fluid. Gasoline and naphtha are composed of mixtures of aliphatic hydrocarbons which additionally contain other substances such as xylene, toluene, benzene, naphthalene, and tetraethyl lead that is added to enhance octane. Petroleum distillates are produced by processing crude oil; their contents include gasoline, naphtha, mineral spirits, kerosene, paraffin wax, and tar. Terpene hydrocarbons, a family of cyclic hydrocarbons, include turpentine (commonly utilized as paint thinner) and pine oil (incorporated into a variety of cleaning products enriched with pine odor). Aromatic hydrocarbons are cyclic compounds that incorporate a benzene ring such as benzene, toluene, and xylene. Their main area of use is the production of solvents, glues, nail polishes, paints, and paint removers (4,5).

Clinical manifestations of hydrocarbon intoxications depend on the type of hydrocarbon and the route and amount of hydrocarbon intake. The primary mechanism of toxicity of aromatic hydrocarbons, halogenated hydrocarbons (e.g., trichloroethylene), and pine oil is systemic absorption from the gastrointestinal tract or the pulmonary tree. Pulmonary aspiration and chemical pneumonitis, however, may also develop by vomiting the compounds. Central nervous system (CNS), the liver, kidney, myocardium, and bone marrow may also be damaged (6). Aliphatic hydrocarbons damage the respiratory system. Lung findings depend on aspiration occurring during drinking or vomiting of these substances (7). Our patient has also been forced to vomit by their relatives after drinking a toxic agent. We think that these practices cause pulmonary complications due to a high risk of aspiration.

Among these substances, intoxications due to drinking kerosene are the most common ones in our country (8). Severe fatal pneumonia can occur by aspirating a few drops of these substances into the lungs. The main symptoms of aspiration are cough, dyspnea, cyanosis, and rales. In severe cases, massive pulmonary edema, pulmonary bleeding, secondary infection, and sometimes pneumothorax and pleurisy may develop (9). Our patient drank approximately 100 ccs of kerosene, and the history and physical examination were taken at the admission to the emergency department showed findings suggesting respiratory system damage.

Hydrocarbons may also injure the central nervous system (CNS) and the cardiovascular system, with the latter mainly occurring via arrhythmias and myocardial dysfunction. Especially solvent hydrocarbons (e.g., halogenated hydrocarbons) cause fatal ventricular arrhythmias by making the myocardium susceptible to the effects of endogenous and exogenous catecholamines. A variety of hydrocarbons depress the central nervous system (CNS) through some compounds' direct neuronal effects and/or hypoxia caused by profound lung damage. Patients may suffer restlessness, confusion, sleepiness, and rarely, convulsions. They are lost from a coma or respiratory arrest. Cardiomegaly, heart failure, hepatosplenomegaly, and proteinuria are also signs of severe intoxication (5). In our patient, an ECG taken at admission and cardiac enzymes measured during follow-up were normal. In addition, except for the respiratory system, no abnormalities of the CNS or other systems were detected.

When ingested, hydrocarbons irritate the pharynx, esophagus, stomach, and small intestine by direct contact and cause edema and mucosal ulceration of the affected sites. Orogastric and intestinal irritation may result in nausea, vomiting, and hematemesis, which are typical of mild severity and do not usually require care (4,5,10). Our patient also had epigastric complaints, but he did not have signs or symptoms such as nausea-vomiting, hematemesis, and melena, and his physical examination showed no irritative lesions in the oropharynx. However, superficial ulceration was detected at the esophagogastric junction in upper gastrointestinal endoscopy while he was hospitalized, and H2 blockers and proton pump inhibitors (PPIs) were initiated accordingly.

Plain films of the chest usually suffice for the determination of hydrocarbon-induced chemical pneumonitis. The radiograms initially manifest pulmonary aspiration/chemical pneumonitis by a large number of small densities with indiscernible borders that are scattered all over the lungs. Progressive cases tend to develop larger lesions as individual lesions congregate (4,11). In our patient, a chest X-Ray showed an infiltrative lesion consisting of multiple, small, irregular densities with unclear borders in the right upper lung. Subsequent thorax CT revealed radiological findings compatible with chemical pneumonia in the upper zone of the right lung (figures 2, 3).

As with all patients visiting the ED, airway, breathing, and circulation should be secured in these cases. Gastric lavage is risky in these patients and may lead to aspiration. Antidotes such as activated carbon should not be used either, as they will also cause vomiting. Oxygen, nebule therapy, bronchodilators as needed, as well as antibiotics if there are signs of superinfection, are administered to patients with pulmonary symptoms. Corticosteroids are not used. Treatment of CNS symptoms is symptomatic. Oxygen, hydration and, if necessary, sedation is applied.

Conclusion

Even if fluids containing hydrocarbons are taken orally, they can lead mainly to pulmonary complications, as well as cardiac and neurological complications. These poisonings are largely preventable by taking appropriate measures. Among the measures to be taken for this purpose, raising the awareness of family members about not keeping such substances in places where children can easily reach, particularly in water containers, is of utmost importance. We are of the opinion that regular training of emergency physicians is necessary for the diagnosis and treatment of patients who present after ingesting these substances.

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LETTER TO THE EDITOR / EDİTÖRE MEKTUP

Rare Presentation Form of Pulmonary Embolism: Right Upper Quadrant Pain

Pulmoner Embolinin Nadir Bir Başvuru Şekli: Sağ Üst Kadran Ağrısı

İbrahim Toker[1], Nilüfer Kahraman[2], Tanzer Korkmaz[2]

To the Editor,

Pulmonary embolism (PE) is a life-threatening condition with many different clinic manifestations, including, although rarely, abdominal pain. Potential mechanisms behind this abdominal pain include diaphragmatic pleurisy originating from a pulmonary infarction at the lungs' base and secondary passive hepatic congestion with acute right ventricular dysfunction (1).

A 24-year-old woman admitted to our emergency department (ED) due to right upper abdominal pain that had started two days earlier and had worsened on the day of admission. Abdominal pain was increased in supine position and with deep inspiration. Before admission to ED, she examined by a general surgeon and an infectious disease doctor; an abdominal ultrasonographic examination had been performed but showed no abnormalities. The patient was diagnosed with a urinary tract infection, and treatment had started. There was no prior history of significant diseases. She has been using oral contraceptives for the last one year. The patient's vital signs on admission were a temperature of 36.6°C, blood pressure of 160/100 mmHg, heart rate of 130 beats per minute, and respiratory rate of 24 breaths per minute, and her oxygen saturation was 98% while breathing room air. On abdominal examination, she had right upper quadrant tenderness and voluntary guarding without rebound tenderness on palpation. She had tachycardia, but heart sounds were normal with no rubs, murmurs, or gallops. Lung sounds were bilaterally equal and normal with no rales, rhonchi, or wheezes. In the blood gas analysis administered while the patient was breathing room air, pH was 7.46, pCO2 29.3 mmHg, pO2 106 mmHg, bicarbonate was 22.6 mmol/L and base excess was -3.2 mmol/L. Laboratory findings on admission were white blood cell count 16,4x10^3, hemoglobin 12,7 g/dL, C-reactive protein level 15.6 mg/dL. The serum electrolytes, glucose, blood urea nitrogen, creatinine, liver function tests, bilirubin, and amylase (lipase not available) were normal. The patient's Wells's score was 1,5 points and had a low pretest probability. The D-dimer level determined was 640 ng/mL (D-dimer normal range was ≤ 500 ng/mL). A chest x-ray (CXR) at the ED showed a wedge-shaped opacity in the right lower lobe (Figure 1), and a subsequent chest computer tomography (CT) angiography was performed and revealed an acute PE (Figure 2). The patient was admitted to the pulmonology ward for observation. After one week of anticoagulation therapy, she was discharged without any problems.

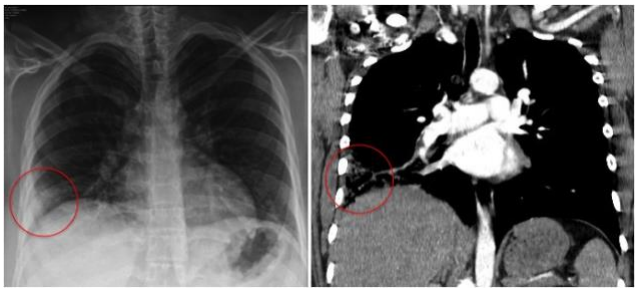

Figure 1(a) CXR reveals Hampton's hump sign (red circle) (b) Chest CT angiography (coronal section) shows a filling defect in right lower lobe segmental branch complicated by wedge-shaped infarction (red circle) along right and diaphragmatic surface of pleura.

PE has a wide range of clinical features, from no symptoms to shock or sudden death. The most common presenting symptom is shortness of breath and chest pain and cough. However, many patients have mild or nonspecific symptoms or are asymptomatic. A meta-analysis of clinical signs alone found a sensitivity of 85 percent and specificity of 51 percent, respectively, for the diagnosis of PE. Abdominal pain is a rare complaint about PE, and previous studies show an incidence of 6.7%(2). Therefore, maintaining a high level of suspicion is critical so that clinically relevant cases are not overlooked.

CXR is neither a sensitive nor a specific tool to diagnose PE, but it can be used for the differential diagnosis of chest pain and abdominal pain. Indications of PE, including Hampton's hump, the Westermark, and Palla's signs, pleural effusion, and elevated diaphragm, can all be observed by CXR (3,4). The Hampton's hump, a wedge-shaped opacity with the base along the pleural surface, may be particularly useful to

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[1] Kayseri City Hospital, Emergency Department, Kayseri, Turkey

[2] Tire State Hospital, Emergency Service, İzmir, Turkey

Corresponding Author: İbrahim Toker, M.D. **Address:** Kayseri City Hospital, Emergency Department, Kayseri, Turkey **Phone:** +90 232 512 15 22 **e-mail:** ibrahimtoker9@gmail.com

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emergency physicians in indicating a pulmonary infarction resulting from PE (4).

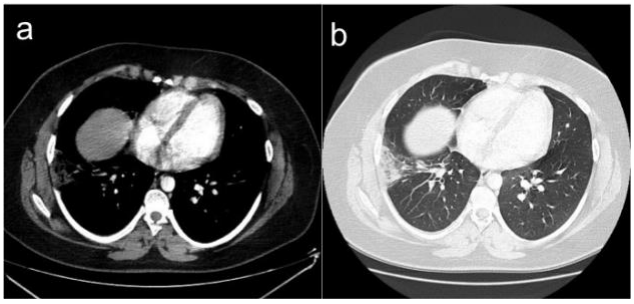

Figure 2 (a and b) Chest CT angiography (axial section) shows a wedge-shaped infarction along right pleural surface.

Here, we describe an interesting PE case that can be easily overlooked. Emergency physicians should maintain a systematic approach and be aware of the various signs, symptoms, and radiographic signs. A PE can masquerade as a variety of other diseases.

Keywords: Pulmonary embolism, abdominal pain, emergency medicine

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REVIEW / DERLEME

Changes in Blood Gases in Hypothermia and Respiratory Treatment Goals: Alpha-STAT and pH-STAT Approaches

Hipotermide Kan Gazlarında Gözlenen Değişiklikler Ve Solunumsal Tedavi Hedefleri: Alfa-STAT Ve pH-STAT Yaklaşımları

Tuğba Cimilli Öztürk[1], Fatma Sarı Doğan[1], Ebru Ünal Akoğlu[1]

ABSTRACT

In Emergency Medicine practice, hypothermia cases are generally seen with environmental accidents related to cold injuries. The body temperatures of the cases differ and the ultimate goal in treatment is to reach normal body temperature. Therapeutic Hypothermia, or "Targeted Temperature Management", is a neuroprotective treatment method that is thought to increase neurological functions and survival rate after cardiac arrest. Although the target values and duration of therapy after cardiac arrest have not been clarified, it is known that better neurological outcome is observed compared to those who received standard therapy in the first hours. Therefore, it will be inevitable to apply "Targeted Temperature Management" more widely in emergency services in the coming days. Interpretation of changes in blood gases observed in patients with hypothermia and respiratory therapy strategies that should be applied to carry out cellular physiological processes in a normal course are important problems that have been discussed for many years and there is still no consensus. In this review, physiological processes occurring in the human body in hypothermia and their reflections on blood gases are evaluated and at the same time, 'Alpha-Stat' and pH-Stat' respiratory treatment strategies, which have completely opposite goals are discussed.

Keywords: Hypothermia, blood gases, alpha stat, pH stat, targeted temprature management

ÖZ

Acil Tıp pratiğinde hipotermi vakaları genellikle soğuk ile ilişkili çevresel kazalar ile birlikte görülür. Vakaların vücut ısıları farklılık gösterir ve tedavide nihai hedef normal vücut sıcaklığına ulaşmaktır. Terapötik hipotermi veya daha çok kabul gören ismi ile 'Hedeflenmiş Sıcaklık Yönetimi' ise kardiyak arrest sonrası nörolojik fonksiyonlarda ve hayatta kalma oranında artış sağlayabildiği düşünülen nöroprotektif bir tedavi yöntemidir. Kardiyak arrest sonrası her ne kadar hedef değerler ve uygulama süresi netlik kazanmamış olsa da ilk saatlerde uygulanmaya başlayan hastalarda standart tedavi uygulananlara göre daha iyi nörolojik sonlanımın gözlendiği bilinmektedir. Dolayısıyla önümüzdeki günlerde acil servislerde 'Hedeflenmiş Sıcaklık Yönetimi'nin daha yaygın uygulanması kaçınılmaz olacaktır. Hipotermi uygulanan hastalarda kan gazlarında gözlenen değişikliklerin yorumlanması ve hücresel fizyolojik süreçleri normal seyrinde yürütmek için uygulanması gereken solunumsal tedavi stratejileri ise uzun yıllardır tartışılmaya devam eden ve üzerinde bir konsensüse varılamamış önemli sorunlardır. Bu derlemede, hipotermide insan vücudunda ortaya çıkan fizyolojik süreçler ve bunun kan gazlarına olan yansımaları değerlendirilmiş ve aynı zamanda bu hasta grubunda uygulanan ve birbirine tamamen zıt hedefleri olan 'Alfa-Stat' ve pH-Stat' solunumsal tedavi yöntemleri tartışılmıştır.

Anahtar kelimeler: Hipotermi, alfa-stat, pH-stat, kan gazı, hedeflenmiş sıcaklık yönetimi

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[1] Sağlık Bilimleri Üniversitesi, Fatih Sultan Mehmet Eğitim ve Araştırma Hastanesi, Acil Tıp Kliniği, İstanbul/ Türkiye.

Sorumlu Yazar: Tuğba Cimilli Öztürk MD **Adres:** Sağlık Bilimleri Üniversitesi, Fatih Sultan Mehmet Eğitim ve Araştırma Hastanesi, Acil Tıp Kliniği, İstanbul/ Türkiye **Phone:** +90532 5140485 **e-mail:** tcimillioztürk@gmail.com

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Hipotermi Tanımı

Hipotermi, vücut iç sıcaklığının 35^{0}C'nin altında olması olarak tanımlanmaktadır. Vücut iç sıcaklığının ölçülebildiği koşullarda sıcaklığa göre evreleme birçok kaynakta; hafif hipotermi: 32-35^{0}C, orta derecede hipotermi: 28-32^{0}C ve ağır hipotermi: <28^{0}C olarak tanımlanmaktadır. 20-24^{0}C'nin altındaki değerler ise bariz hipotermi olarak kabul edilmektedir. Hafif hipotermide kişi uyanıktır ancak bilinç değişikliği gözlenebilir. Titreme vardır ancak kişi öz bakımını sağlayamaz. Orta derecede hipotermide; bilinç etkilenmiştir, titreme olabilir de olmayabilir de. Ağır hipotermide; bilinç kaybolmuştur, titreme gözlenmez. 20-24 ^{0}C'lerin altında ise koma tablosu görülür (1,2,3).

Hedeflenmiş Sıcaklık Yönetimi

'Hedeflenmiş Sıcaklık Yönetimi' kardiyak arrest sonrası nörolojik fonksiyonlarda ve hayatta kalma oranında artış sağlayabildiği düşünülen nöroprotektif bir tedavi yöntemidir. Optimal fonksiyonel ve nörolojik sonucu sağlamak için spontan dolaşımın dönüşünden sonra komutlara uymayan tüm hastalar için hedeflenen sıcaklık yönetiminin hızlı bir şekilde başlatılması gerekliliği yüksek kanıt değerine sahip öneriyle güncel resusitasyon kılavuzlarında yerini almıştır (4,5). Hem hastane içi ve hem de hastane dışı kardiyak arrestlerde mevcut verilere göre en az 24 saat 32-36^{0}C'lik hipotermi uygulaması önerilmektedir. Kardiyak arrest sonrası bakımın dışında hem erişkinlerde hem de çocuklarda kardiyak by-pass cerrahisi sırasında ve sonrasında ve diğer konjenital kalp hastalıklarının cerrahilerinde ve yenidoğanlarda farklı klinik durumlarda hali hazırda uygulanan bir tedavidir (6,7). Travmatik ve travmatik olmayan serebrovasküler iskemik olaylarda da nöroprotektif etkileri için çalışmalar yapılmaktadır (8).

Hipotermide insan vücudunda gözlenen fizyolojik yanıtlar

İnsan vücudunda hücrelerin normal işlevlerini sürdürebilmesi için iç sıcaklığın 37$\pm$0.5^{0}C'de stabil tutulması gereklidir. İnsan vücudu, çevresel koşullara tepki olarak ısı kaybını ve kazancını düzenlemek için otonom mekanizmalar kullanarak bu sıcaklığı mümkün olduğunca korur. Ancak insan vücudunun soğuk çevre koşullarına yanıt verme konusunda sınırlı fizyolojik kapasitesi vardır. Bu nedenle, giyim ve barınma gibi davranışsal adaptasyonlar, hipotermiye karşı savunmada kritik öneme sahiptir. Isı dengesinin ana kontrol merkezi hipotalamustur. Hipotalamus, merkezi ve çevresel termal reseptörlerden soğuk stresi yönünde uyarı alınca tiroid, katekolamin ve adrenal aktivite uyarılır, titreme başlar ve ısı üretimi artar. Sempatik uyarı ile vazokonstriksiyon soğumanın en yüksek olduğu periferik dokulara kan akışını azaltılır ve ısı kaybı en aza indirilir. Vücut ısısının düşmeye başlamasıyla doku metabolizması azalır ve nöronal aktivite inhibe olmaya başlar (1,3,9). Başlangıçta, cildin soğumasına tepki olarak vücut titreme ile ısı üretir ve metabolizmayı, ventilasyonu ve kalp debisini artırmaya çalışır. Nörolojik fonksiyon, 35°C'lik iç sıcaklığın üzerinde iken bile azalmaya başlar. İç sıcaklık 32^{0}C'ye ulaştığında, metabolizma, ventilasyon ve kalp debisi azalmaya başlar. Titreme, iç sıcaklık düşmeye devam ettikçe etkisini kaybeder ve nihayetinde durur. Hipotermide başlangıçta solunum uyarılır. Ardından ilerleyen dakikalarda solunum hacminde azalma gözlenir. Sıcaklık 8^{0}C düştüğünde CO_2 üretimi yaklaşık olarak %50 azalır. Ciddi ağır hipotermide solunum kontrolü kaybolur. Respiratuvar asidoz ile birlikte CO_2 retansiyonu görülür (1,9).

Kan Gazı Analizi

Kan gazı (KG), arteriyel veya venöz kandaki parsiyel oksijen basıncını (PaO_2), parsiyel karbondioksit basıncını ($PaCO_2$), asit-baz dengesini (pH), oksihemoglobin doygunluğunu (SaO_2) ve bikarbonat (HCO_3) konsantrasyonunu ölçen bir laboratuar testtir. Kan gazı analizinin standardizasyonu için teknik detaylar önemlidir. Alınan numunenin laboratuvara taşınması sırasında buz aküsü kullanılması ve olabildiğince hızlı nakledilmesi istenmekteydi. Bu uygulamanın platelet ve lökositlerin O_2'yi kullanmalarını en aza indireceği düşünülmektedir. Aksi halde PaO_2 olduğundan daha düşük gözükebilir. Bu durum özellikle lökositoz ve trombositoz hastalarında göz önünde bulundurulmalıdır. Farklı bir görüş de pvc enjektörlerin soğuğa maruz kalmaları sonucunda geçirgenliklerinin artacağı ve olası gaz kaçaklarından dolayı da olduğundan fazla $PaCO_2$ ve olduğundan daha az PaO_2 ile düşük pH tespit edilebileceği yönündedir. Bu nedenle soğuk transfer yerine 15 içerisinde transfer artık daha çok önerilmektedir. Enjektör içerisinde kalan hava kabarcıkları ve enjektörün fazlaca sallanması da değerler üzerine etki edebilecek diğer bir nedenlerdir. Solunan havada CO_2 neredeyse sıfır olduğu için $PaCO_2$ transfer sırasındaki oluşabilecek difüzyon ile ilgili sorunlardan PaO_2'ye göre daha az etkilenecektir (10,11,12).

Laboratuvar sonucu olarak kan gazı analizlerinde O_2 ve CO_2 'parsiyel basınç' olarak bildirilir. İngiliz kimyager William Henry tarafından 19. yüzyılın başlarında formüle edilen, su ile emilen gazların miktarı ile ilgili gaz yasasına göre yani bilindik ismi ile 'Henry Yasası'na göre; sabit bir sıcaklıkta, belirli bir sıvı hacmi ve türünde çözünen belirli bir gazın miktarı, o sıvı ile denge halindeki gazın kısmi basıncı ile doğru orantılıdır. Esasen kan gazı analizi cihazlarının temel çalışma prensipleri bu gaz yasası üzerine kurulmuştur. Ancak sıcaklık düştükçe bu gazların kanda ve diğer sıvılarda çözünürlüklerinin artması ve dolayısıyla da vücuttaki total miktarları ile olan ilişkilerinde değişikliklerin olacağı kaçınılmazdır. Genelde ölçüm yöntemlerinin ve çıkan sonuçların komplike hale gelmesi de bundan dolayıdır (13,14).

Otomatize cihazlar analiz öncesinde örneği yeniden 37^0C'ye ısıtır. Teorik olarak numunenin ısısı düştüğünde pH artarken $PaCO_2$ ve PaO_2 düşer. Hipertermi durumları için de tersi geçerli olacaktır. Bununla ilgili bazı oranlar da bildirilmiştir ve modern cihazlar istendiği takdirde 37^0C'deki değerler ile hastanın kendi vücut sıcaklığındaki değerleri de hesaplayıp verebilecek kapasiteye ulaşmıştır. Vücut ısısında her 1^0C'lik düşüşte PaO_2 5mmHg, $PaCO_2$ 2mmHg düşer, pH ise 0.012 artar. Düzeltilememiş değerlerle hastalar hipokarbik, hipoksik ve alkelemik görülür. Hipertermide ise tam tersine, arteriyel $PaCO_2$ her 1^0C artış için $PaCO_2$ %4.6 artar (13). Hastalar düzeltilmemiş değerlerle hiperkarbik hiperoksik ve asidemik bulunacaktır.

Isıyla beraber önemli denecek farklı parsiyel basınç ölçümlerinin gözlenmiş olması gerçekte sıcaklık düzeltmeli sonuçlarla mı hastayı değerlendirmeli yoksa hastanın vücut sıcaklığına göre düzeltilmiş değerlerle mi hasta yönetilmeli tartışmasını ortaya çıkarmıştır. Teknik olarak biyokimya camiasının genel olarak 37^0C'de standardize edilen sonuçların klinisyenlere sunulması yönünde fikir birliğinde oldukları söylenebilir. Bunun nedenleri ise şöyle sıralanmaktadır: Birincisi kan gazı analizi yorumlama kılavuzlarının ve algoritmaların mevcut 37^0C'deki standart sonuçlara göre hazırlanmış olmasıdır. İkinci önemli neden ise klinisyenlerin hastanın gerçek vücut sıcaklığını her defasında laboratuvara doğru bir şekilde bildirebilmesinin güçlüğü ve transfer sırasında da olası sorunlardan kaynaklanabilecek ısı farklılıklarının görülebileceğidir. Bunların yanında yine düzeltilmiş değerlerin bildirildiği raporlarda kaç derece için geçerli olduğu bilgisinin gözden kaçabilme ihtimali ve hastanın vücut ısısının doğru ölçülmeme ihtimalleri de düzeltilmeden sonuç verilmesinin yani 37^0C de ölçülen sonuçların raporlandırılmasının daha doğru olacağını desteklemektedir. Sonuç olarak biyokimya otörleri, çok özel durumlarda tüm sorumluluk klinisyende olmak koşuluyla ve özel olarak laboratuvara bildirim yapıldığı takdirde sonuçların ısıya göre düzenlenmesini önermektedirler (11,14-17).

Hipotermide Solunumsal Tedavi Yönetimi

Kan Gazı ölçümlerin sadece numunenin ısısındaki farklılıklardan kaynaklanacağını söylemek insan vücudundaki kompleks metabolik süreçler ve kompanzasyon mekanizmaları göz önünde bulundurulduğunda ne derece doğrudur? Hipotermi karşısında vücutta gözlenen fizyolojik yanıtların kan gazlarına yansıması komplike bir durumdur. Üzerinde halen bir konsensusa varılamayan önemli noktalardan biri budur. Yani hipotermide vücudun metabolik hızındaki düşmeye bağlı CO_2 üretme hızındaki artışı 37^0C'deki normal kabul edilen değerlere çekmeye çalışmalı mıyız yoksa ısıya göre düzeltilmemiş kan gazı değerlerine göre mi hastayı izlemeliyiz? Bu durumda vücudun normal fizyolojik kompansatuar mekanizmalarına müdahale etmiş olur muyuz? Benzer sorunlar en uygun O_2 ve pH değerlerini belirlemek için de geçerlidir. Hatta O_2'de durum biraz daha karışıktır. Metabolik hızdaki azalmaya bağlı O_2 kullanımının azalmasının yanında hemoglobinin O_2'ye bağlanma afinitesi de vücut ısısından etkilenir. Oksihemoglobin eğrisinde sola doğru kayma gözlenir. Teorik olarak hipotermide dokulara daha az oksijen dağılımı söz konusudur. Hipertermide ise O_2 tüketimi artar (2,3).

Bu önemli sorular kazara olan hipotermilerden ziyade terapötik hipotermi uygulanan ve belli bir süre belli bir sıcaklı altında tutulmak istenen hastalarda asit-baz dengesini sağlamaya çalışan klinisyenler tarafından tartışılmaktadır. Literatürde halen 'hipotez' statüsünde olan neredeyse birbirine zıt iki görüşün 'Alfa-Stat ve pH-Stat' savunulduğu kaynaklar mevcuttur (18). Ancak halen bir konsensusa varılamadığını da belirtmekte fayda vardır.

Alfa-Stat Hipotezi

Alfa-Stat yaklaşımında homeostazın, hastanın vücut ısısına göre düzeltilmemiş sonuçları 37^0C'deki değerler hedeflenerek gerekirse mekanik cihazlar ile sağlanması gerektiğini savunulmaktadır. Buradaki "Alfa", protein molekülleri arasında protonlanmış histidin kalıntılarının toplam imidazolüne oranıdır. Histidin, proteinlerin biyosentezinde kullanılan bir α-amino asittir. Bir α-amino grubu, bir karboksilik asit grubu ve bir imidazol yan zinciri içerir. Alfa-Stat yaklaşımına göre 37 ^{0}C'de ve 6.8'lik hücre içi pH'da, alfa yaklaşık olarak 0.55'tir ve bu değer intrasellüler enzimatik süreçler için optimal düzeydir. Bu değerlerin hedeflenmesinin daha fizyolojik olacağı düşünülmektedir (20,21).

Bu görüşe göre, hastanın ventilasyonu $PaCO_2$ 40mmHg, pH, 7.40, PaO_2 60mmHg'yı yakalayacak şekilde ayarlanmalıdır. Aslında, alfa-stat yönetimi kullanıldığında, $PaCO_2$ azalır (ve çözünürlük artar); dolayısıyla 7.40 pH ve 40mmHg arteriyel $PaCO_2$ (37°C'de ölçülmüştür) olan hipotermik bir hasta gerçekte daha düşük bir $PaCO_2$'ye sahip olacaktır (yaklaşık 32mmHg) ve bu azalmış serebral kan akışı ile birlikte göreceli bir solunum alkalozu olarak ortaya çıkacaktır görüşü savunulmaktadır. Yani eğer değerler düzeltilmiş olsaydı düşük bulunacak olan $PaCO_2$ göz önünde bulundurulduğunda bu yaklaşıma göre dolaylı olarak daha yüksek $PaCO_2$ değerlerine ulaşmak hedeflenmektedir. Alfa-stat yönetiminin savunucuları hipotermi sırasında alkaliye eğilimin olduğu, bunun serebral oto-regülasyonun devam etmesine izin verdiğini ve hücresel transmembran pH gradyanlarının ve protein fonksiyonlarının böylelikle korunacağını düşünmektedirler. Ancak aksi görüşte olanlar, yüksek $PaCO_2$ hedefinin serebral vazodilatasyona yol açabileceği ve bu yöntemin sadece serebral perfüzyon düşmesine eğilimi olan hastalarda tedaviyi yönlendirmede seçilmesinin daha uygun olabileceğini savunmaktadır (21,22).

pH-Stat Hipotezi

pH-Stat hipotezine göre yani vücut ısısına göre düzeltilmiş kan gazı değerleri ile hasta değerlendirilecek olursa hipotermi hastasında pH'nın düşük olduğunu ve $PaCO_2$ ve O_2'nin yükseldiğini göreceğiz. Dolayısıyla pH-Stat yaklaşımını benimseyen görüşe göre düşük $PaCO_2$ değerleri hedeflenmelidir. pH-Stat yönetiminin yani hastanın gerçek sıcaklığında 40 mm Hg'lik bir $PaCO_2$ basıncını ve 7.40'lık pH'ı hedefleyen yaklaşımın savunucuları ortaya çıkan daha yüksek CO_2'nin serebral vazodilatasyona ve daha hızlı ve daha homojen soğutmayı sağlayabileceğini iddia etmektedirler. Ayrıca, bu yönteme göre uygulanacak olan asidotik protokolünün, oksijen disosiyasyon eğrisinde hipotermik hastalarda olan sola kaymayı dengeleyerek oksijenin hemoglobinden ayrılmasını kolaylaştırabileceğini öne sürerler (Bohr Etkisi: Hemoglobinin oksijen bağlama afinitesi, asidite ve karbondioksit konsantrasyonu ile ters orantılıdır). Aksi görüşte olanlar ise düşük $PaCO_2$ ile arteriyel vazokonstriksiyona sebep olunarak beyine giden kan akımın düşme ve dolayısıyla intraserebral basınçta azalma olabileceğini iddia etmektedirler. Bundan dolayı yöntemin sadece intrakraniyal basınç artışı eğilimi olan hastalar için daha uygun olabileceğini savunmaktadırlar (21,22,23).

Alfa-Stat mı pH-Stat mı?

Literatürde bu iki yöntemin karşılaştırıldığı düşünüldüğünden daha az sayıda çalışma mevcuttur ve farklı sonuçlar gözlenmiştir. Priestley ve ark. ve Li ve ark. domuzlar üzerinde yaptıkları iki ayrı hayvan çalışmasında derin hipotermi uygulananlarda pH-Stat yaklaşımının nörolojik sonlanım açısından daha iyi olduğunu göstermiştir. Ancak hafif hipotermide Li ve ark. alfa-Stat'ın daha iyi olduğunu belirtmektedir (24,25). İnsan çalışmaları genellikle kardiovasküler cerrahi sırasında ve sonrasında çocuk ve erişkinlerde hipotermi yapılan hastalarda yapılmıştır. Literatürde pH-Stat yaklaşımının daha iyi olduğu yönünde sonuçların yoğunlaştığını görsek de Alfa-Stat yönteminin daha iyi olduğunu bildiren çalışmaların az olduğunu söylemek mümkün değildir (26,27,28). Bildiğimiz kadarıyla yöntemleri karşılaştıran bir meta analiz bulunmamakla birlikte Abdul Aziz ve ark. konu ile ilgili on altı çalışmayı incelediklerini ve bu çalışmalara çocuklarda pH-Stat yönteminin daha uygun olabileceği erişkinlerde ise Alfa-Stat yaklaşımı ile daha iyi sonuçlar alınabileceği yorumunu yapmışlardır (19).

Kardiyak arrest sonrası hangi stratejinin daha iyi olacağını araştıran çalışmalar daha da kısıtlıdır. Voicu ve ark. yirmi bir vakalık hastane dışı kardiyak arrest vakasında iki yöntemi karşılaştırdıklarında Alfa-Stat'ın daha iyi olduğunu göstermişler (29). Konu ile ilgili belki de en kapsamlı ve yakın zamanlı çalışmalardan biri 2018 yılında Jakkular ve ark.'ın kardiyak arrest sonrası 36 saat hipotermi uygulanan 123 hasta üzerinde yapmış oldukları çalışmadır. İki yöntemi, yani düşük CO_2 ve yüksek CO_2 yaklaşımını karşılaştırdıkları randomize kontrollü çalışmada nöron spesifik enolaz değerleri ve nörolojik iyi sonlanım karşılaştırmışlar. İki grup arasında belirgin bir fark gözlemediklerini bildirmişlerdir (30).

Sonuç

'Hedeflenmiş Sıcaklık Yönetimi' Türkiye'deki sağlık sisteminde acil servislerin misyonu göz önünde bulundurulduğunda önümüzdeki yıllarda Acil Tıp Hekimleri'nin daha hakim olmalarını gerektirecek bir tedavi yöntemi olacaktır. Bu tedaviyi uygularken seçilecek solunumsal tedavi yönetimi için literatürde halen bir fikir birliği olmadığı görülmektedir. Araştırma sonuçların oldukça değişken olduğu bu konu için hangi tedavi yöntemini kullanmanın daha doğru olacağı önerisini yapmak mevcut verilerle mümkün değildir. Daha güçlü kanıtlar sunulana kadar hemen her koşulda olduğu gibi hasta özelinde karar vermek en doğru strateji olacaktır.

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Etik Beyan: Yazarlarlar araştırma ve yayın etiğine uyduklarını beyan ederler.

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