

Efficiency of Levetiracetam and Gabapentin in the treatment of Epilepsy in a Cavalier King Charles Spaniel Dog with Myxomatous Mitral Valve Heart Disease, a Case Report

Sinan Kandır^{1*}, Cengiz Yüce Kayabek², Bilge Kaan Tekelioğlu³

¹Çukurova University Ceyhan Faculty of Veterinary Medicine Department of Physiology, Adana, TURKEY; sinankandir@cu.edu.tr

²Medical Doctor, Microbiology Specialist, Dog Owner, Antalya, TURKEY

³Çukurova University Ceyhan Faculty of Veterinary Medicine Department of Virology, Adana, TURKEY; ktekioglu@cu.edu.tr, ktekioglu@gmail.com

Abstract

Epilepsy and seizure have a complex physiopathological background and are most common idiopathic or primary neurologic disorders in dogs. Various anticonvulsant (ACDs) and antiepileptic drugs (AEDs) are used for the management of seizures and epilepsy. The use of levetiracetam is limited in the treatment of epilepsy and is used only with expert opinion because of its undesirable side effects and its low therapeutic effect, which are not chemically related to existing AEDs. The Cavalier King Charles Spaniels (CKCSs) are predisposed to numerous inherited neurologic and cardiologic problems due to their high predisposition to genetic pool originated consanguineous diseases. The dog was 3 years old, female, CKCSs breed stud and had been suffered from epileptic seizures almost 3 months. The dog was consulted at Veterinary Faculty Clinics and myxomatous mitral valve heart disease (MMVD) was diagnosed. Phenobarbital (2.5 mg/kg BID, PO) and enalapril (0.5 mg/kg BID, PO) were prescribed for the management of epileptic seizures and medication of the MMVD. However, the dog wasn't reacted the treatment as expected and epileptic seizures were increased dramatically (~7 times per day) in addition with respiratory depression. The treatment protocol was changed to levetiracetam (15 mg/kg BID, PO). The dog was reacted well to levetiracetam treatment and epileptic seizures were disappeared with respiratory depression. Three months later a routine parasitic treatment was done with fipronil (0.067 ml/kg, spot-on). The epileptic attacks were dramatically increased and became more severe just after the fipronil treatment (~7 times per day). Thus, gabapentin (10 mg/kg, TID, PO) was decided to use together with levetiracetam (10 mg/kg BID, PO). Epileptic seizures disappeared with the use of gabapentin over again. In conclusion, the pharmacokinetics and antiepileptic effects of levetiracetam and gabapentin are not fully understood, but the combination of both drugs with a combined drug protocol may help to manage epileptic attacks without causing respiratory depression in CKCS.

Keywords: Anti-epileptic drugs, Canine, Epilepsy, Levetiracetam

1. INTRODUCTION

The Cavalier King Charles Spaniels (CKCSs) are predisposed to numerous inherited neurological and cardiological problems due to their high predisposition to genetic pool originated consanguineous diseases¹⁻³. Mitral valvular heart disease (MMV) is one of the most common inherited disorders in CKCSs. The CKCSs have genetic mutation on the ACE-I gene. This polymorphism is related to lower ACE activity. Moreover, renal and pancreatic diseases are reported with high prevalence on post-mortem examinations 52.2% and 51.9% which have lower clinical signs at ante-mortem examinations 16.7%, 25%, respectively⁴. Epilepsy and seizure have complex physiopathological background, and are

most common idiopathic or primary neurologic disorders in dogs⁵⁻⁷. Various anticonvulsant (ACDs) and antiepileptic drugs (AEDs) are used for the management of seizures and epilepsy. The main goals of treatment, to eliminate epileptic events, to decrease seizure frequency and intensity, to avoid adverse effects such as long term treatment, drug-drug interactions, to decrease seizure-related mortality and morbidity, and to restore abnormal behaviour due to maintenance the life quality. Primarily preferred AEDs, were reported as effective to manage epileptic seizures have high interactions between drugs and undesirable side effects such as hepatotoxic and pancreatotoxic activity on the patients⁸. A water soluble pyrrolidone derivate levetiracetam (LEV) whose chemical structure and molecular charac-

*Corresponding author
Email: sinankandir@cu.edu.tr

teristics and pharmacokinetic properties differs from other AEDs has prominent advantages as fully absorbed after oral administration, minimal protein-binding, lacked of hepatic metabolism, excreted unchanged in the urine, and short half-life⁹. Gabapentin is also safely, tolerable GABA analog second-generation antiepileptic drug which is rapidly absorbed after oral administration. The mechanism of action is not fully elucidated yet but it is not metabolized by the liver as same as levetiracetam. Hereby, gabapentin is not used the cytochrome P oxidase 450 (CYP450) isoenzyme system¹⁰. It seems more effective due to less drug interactions at management of epilepsy. Fipronil is widely used, second-generation phenylpyrazole originated antiparasitic insecticide in veterinary practice and exerted their effects by inhibition of ligand-gated chloride channels of targeted parasites. Blockage of the gamma amino butyric acid (GABA)-gated chloride channels by fipronil are caused to reduce neuronal inhibition and lead to convulsions and hyperexcitation of the central nervous system¹¹. First-line AEDs, especially phenobarbital and potassium bromide, are preferred primarily to manage the epileptic seizures in dogs by veterinarians¹². The pharmacodynamics of first line AEDs and enalapril which is used to cure symptomatic cardiac diseases are metabolized by liver enzymes especially by CYP450 pathway. However, there is not enough information about the physiopathological and pharmacological metabolic mechanisms of the levetiracetam. Additionally, no data on the interaction of levetiracetam and fipronil were found in the reference information. For that reasons, the aim of this case report is to show the successful management of epileptic seizures in a CKCS breed dog with MVD and possible drug to drug interactions by second-generation AEDs.

2. CASE DESCRIPTION

The dog is a 3-year-old female, CKCS breed stud, neutered and has had epileptic seizures for about 3 months. The dog was consulted at Veterinary Faculty Clinics and myxomatous mitral valve heart disease (MMVD) was diagnosed. Diagnosis was based on the patient history, clinical symptoms and status epilepticus formation. MRI was not performed due to owner response based on the side-effects of anaesthesia requirement. Phenobarbital (2.5 mg/kg BID, PO) and enalapril (0.5 mg/kg BID, PO) were prescribed for the management of epileptic seizures and medication of the MMVD. However, the dog was not reacted the treatment as expected and epileptic seizures were increased dramatically (~7 times per day) in addition with respiratory depression. The treatment protocol was changed to levetiracetam (15 mg/kg BID, PO). The dog was reacted well to levetiracetam treatment and epileptic seizures were disappeared with respiratory depression. Three months later a routine parasitic treatment was done with fipronil (0.067 ml/kg, spot-on). The epileptic attacks were dramatically increased and became more severe just after the fipronil treatment (~7 times per day). Thus, gabapentin (10 mg/kg, TID, PO) was decided to use together with levetiracetam (10 mg/kg BID, PO). Epileptic seizures

disappeared with the use of gabapentin over again.

3. DISCUSSION

According to the American College of Veterinary Internal Medicine (ACVIM) consensus statement for seizure management in dogs based on current literature and clinical expertise; phenobarbital, bromide and imepitoin are recommended as primary and more effective monotherapeutic AEDs, than primidone, zonisamide and levetiracetam are less recommended⁸. There is a lack of knowledge about preferred AEDs by Turkish Veterinarians to the management of epilepsy in the dog. Nevertheless, in our experience first-line AEDs are widely used to control the epileptic seizures among clinicians. In this case, myxomatous mitral valve heart disease was diagnosed on an epileptic CKCS breed dog. Phenobarbital was chosen for the first decision to management of the epileptic seizures by veterinarian. Meanwhile, enalapril was preferred to alleviate the cardiac effects of MMVD.

Meurs, et al.⁴ were pioneered in the opinion of the ACE gene polymorphism in CKCSs and they previously were reported that canine ACE gene polymorphism associated with a decrease in ACE activity. According to their results, the CKCS appears to have a high prevalence of the ACE variant which reduces the levels of ACE activity. Therefore, the efficacy of an ACE-I inhibitor enalapril for the treatment of MMVD on CKCs has not been fully established.

CKCSs are brachycephalic breeds, and are predisposed to respiratory disorders related to their genetic characteristics. Summers, et al.¹³ was reported the prevalence of brachycephalic airway obstruction syndrome %16 in a total of 3624 CKCSs. Phenobarbital is a barbituric acid derivate and longest-acting barbiturate that inhibits the calcium channels, resulting in a decrease in excitatory transmitter release thus its caused to CNS and respiratory depression which may progress to Cheyne-Stokes respiration¹⁴ abnormality. The respiratory abnormality forced to reconstruct the management protocol of epileptic seizures. Hence, we decided to use the levetiracetam as a second generation AED which is widely used in human practice, lesser side effects have been reported and chemically unrelated to existing AEDs, also may be more appropriate when it is used with a combined drug protocol. Lynch, et al.¹⁵ reported that LEV's cellular target is synaptic vesicular protein SV2A. Synaptic vesicles are abundant secretor organelles of presynaptic nerve terminals which are divided into two classes based on their functions as transport and trafficking proteins. SVs are accumulated high quantities of neurotransmitters and secrete them by fusion with the presynaptic plasma membrane. One of the family members SV2A's, which is most widely distributed in the central nervous system (CNS), exact role, is still remains unclear. However, it has been proposed to be an integral membrane protein present on all synaptic vesicles. Packer, et al.¹⁶ reported that levetiracetam is a well tolerated, seizure-suppressing drug, and the success rate in 52 epileptic dogs was found %50 reduction, %15 of all the dogs were

completely free from seizures both mono- or add-on therapy. Just, 2 dogs with the levetiracetam monotherapy group were needed to add-on therapy by gabapentin after 168 days of treatment. Nevertheless, there is lack of information about why the researchers were decided to need and choose gabapentin to add-on therapy.

Bharathraj, et al.¹¹ reported the interaction between fipronil and status epilepticus; the blockage of the GABA-gated chloride channels by fipronil reduces neuronal inhibition and leads to convulsions and hyperexcitation of the central nervous system. Fipronil has also been previously reported to trigger hyperexcitability such as tremor, convulsions, seizures and death¹². Even if, fipronil is noncompetitively bound GABA_A-gated chloride channels thereby blocking the inhibitory action of GABA_A in the CNS, the return of the epileptic seizures, after well managed levetiracetam therapy which also act on voltage- or ligand-gated ion channels involved in synaptic transmission¹⁷, could be mediated by unexplained drug-drug interactions in our case.

Govendir, et al.¹⁸ reported that gabapentin treatment as an adjunctive agent to phenobarbital and/or potassium bromide increased the interictal period and shortened the post-seizure recovery and in some dogs seizures were terminated while in others there was an increase in interictal period. Platt, et al.¹⁹ treated 11 dogs with refractory idiopathic epilepsy, they concluded that after 3 months gabapentin therapy lead to reduction in the number of seizures %50 and it should be considered as an adjunctive anticonvulsant treatment. Therefore we decided to add-on therapy with gabapentin to manage to the epileptic seizures after fipronil treatment. Up to now, we were not encountering new attack and still continue applying the gabapentin as an add-on therapy protocol.

4. CONCLUSION

In conclusion, new generation AEDs were reported to have lesser side effects based on the pharmacokinetic data which is indicated that levetiracetam not using the cytochrome P450 liver metabolic pathway. In addition to this advantageous metabolic activity, it may be effective in controlling routine epileptic seizures of CKCSs without causing respiratory depression. Fipronil, phenylpyrazole origin and other antiparasitic drugs should be used very carefully and under veterinary consultant supervision due to their side effects especially in epileptic dogs. Finally, gabapentin could be a good option for the alternative add-on therapy to control epileptic seizures in CKCSs.

5. ACKNOWLEDGEMENT

This oral presentation was supported by University of Cukurova, department of Scientific Research Project (BAP).

6. REFERENCES

- [1] Thomsen B, Garosi L, Skerritt G, et al. Neurological signs in 23 dogs with suspected rostral cerebellar ischaemic stroke. *Acta Vet Scand* 2016;58(1):40. doi: 10.1186/s13028-016-0219-2 [published Online First: 2016/06/09]
- [2] Rusbridge C. Neurological diseases of the Cavalier King Charles spaniel. *J Small Anim Pract* 2005;46(6):265-72. [published Online First: 2005/06/24]
- [3] Lu D, Lamb CR, Pfeiffer DU, et al. Neurological signs and results of magnetic resonance imaging in 40 cavalier King Charles spaniels with Chiari type 1-like malformations. *Vet Rec* 2003;153(9):260-3. [published Online First: 2003/09/17]
- [4] Meurs KM, Olsen LH, Reimann MJ, et al. Angiotensin-converting enzyme activity in Cavalier King Charles Spaniels with an ACE gene polymorphism and myxomatous mitral valve disease. *Pharmacogenet Genomics* 2018;28(2):37-40. doi: 10.1097/FPC.0000000000000322 [published Online First: 2017/12/05]
- [5] Ekenstedt KJ, Oberbauer AM. Inherited epilepsy in dogs. *Top Companion Anim Med* 2013;28(2):51-8. doi: 10.1053/j.tcam.2013.07.001 [published Online First: 2013/09/28]
- [6] Thomas WB. Idiopathic epilepsy in dogs. *Vet Clin North Am Small Anim Pract* 2000;30(1):183-206, vii. [published Online First: 2000/02/19]
- [7] Pakozdy A, Leschnik M, Tichy AG, et al. Retrospective clinical comparison of idiopathic versus symptomatic epilepsy in 240 dogs with seizures. *Acta Vet Hung* 2008;56(4):471-83. doi: 10.1556/AVet.56.2008.4.5 [published Online First: 2009/01/20]
- [8] Podell M, Volk HA, Berendt M, et al. 2015 ACVIM Small Animal Consensus Statement on Seizure Management in Dogs. *J Vet Intern Med* 2016;30(2):477-90. doi: 10.1111/jvim.13841 [published Online First: 2016/02/24]
- [9] Goldenberg MM. Overview of drugs used for epilepsy and seizures: etiology, diagnosis, and treatment. *P T* 2010;35(7):392-415. [published Online First: 2010/08/07]
- [10] Dougherty JA, Rhoney DH. Gabapentin: a unique anti-epileptic agent. *Neurol Res* 2001;23(8):821-9. doi: 10.1179/016164101101199414 [published Online First: 2002/01/05]
- [11] Bharathraj MY, Venugopal K, Jaligheid K, et al. Fipronil Compound Consumption Presenting as Status Epilepticus. *Toxicol Int* 2015;22(1):165-6. doi: 10.4103/0971-6580.172280 [published Online First: 2016/02/11]
- [12] Gesell FK, Hoppe S, Loscher W, et al. Antiepileptic Drug Withdrawal in Dogs with Epilepsy. *Front Vet Sci* 2015;2:23. doi: 10.3389/fvets.2015.00023 [published Online First: 2015/12/15]
- [13] Summers JF, O'Neill DG, Church DB, et al. Prevalence of disorders recorded in Cavalier King Charles Spaniels attending primary-care veterinary practices in England. *Canine Genet Epidemiol* 2015;2:4. doi: 10.1186/s40575-015-0016-7 [published Online First: 2015/09/25]
- [14] Kwan P, Brodie MJ. Phenobarbital for the treatment of epilepsy in the 21st century: a critical review. *Epilepsia* 2004;45(9):1141-9. doi: 10.1111/j.0013-9580.2004.12704.x [published Online First: 2004/08/27]
- [15] Lynch BA, Lambeng N, Nocka K, et al. The synaptic vesicle protein SV2A is the binding site for the antiepileptic drug levetiracetam. *P Natl Acad Sci USA* 2004;101(26):9861-66. doi: 10.1073/pnas.0308208101
- [16] Packer RM, Nye G, Porter SE, et al. Assessment into the usage of levetiracetam in a canine epilepsy clinic. *BMC Vet Res* 2015;11:25. doi: 10.1186/s12917-015-0340-x [published Online First: 2015/04/19]
- [17] Surges R, Volynski KE, Walker MC. Is levetiracetam different from

other antiepileptic drugs? Levetiracetam and its cellular mechanism of action in epilepsy revisited. *Ther Adv Neurol Disord* 2008;1(1):13-24. doi: 10.1177/1756285608094212 [published Online First: 2008/07/01]

- [18] Govendir M, Perkins M, Malik R. Improving seizure control in dogs with refractory epilepsy using gabapentin as an adjunctive agent. *Australian Veterinary Journal* 2005;83(10):602-08. doi: DOI 10.1111/j.1751-0813.2005.tb13269.x
- [19] Platt SR, Adams V, Garosi LS, et al. Treatment with gabapentin of 11 dogs with refractory idiopathic epilepsy. *Veterinary Record* 2006;159(26):881-84.



3rd International Mediterranean SCIENCE AND ENGINEERING CONGRESS
OCTOBER 24-26, 2018
ÇUKUROVA UNIVERSITY, CONGRESS CENTER, ADANA / TURKEY

3. Uluslararası Akdeniz BİLİM VE MÜHENDİSLİK KONGRESİ
24-26 EKİM 2018
ÇUKUROVA ÜNİVERSİTESİ, KONGRE MERKEZİ, ADANA/TÜRKİYE

3rd International Mediterranean SCIENCE AND ENGINEERING CONGRESS

OCTOBER
24-26, 2018

ADANA

TURKEY

Proceedings Book

Organizer of the Congress
Çukurova University



<http://www.imsec.info>



3rd International Mediterranean
SCIENCE AND ENGINEERING CONGRESS
OCTOBER 24-26, 2018
ÇUKUROVA UNIVERSITY, CONGRESS CENTER, ADANA / TURKEY

3. Uluslararası Akdeniz
BİLİM VE MÜHENDİSLİK KONGRESİ
24-26 EKİM 2018
ÇUKUROVA ÜNİVERSİTESİ, KONGRE MERKEZİ, ADANA/TÜRKİYE

3. Uluslararası Akdeniz BİLİM ve MÜHENDİSLİK KONGRESİ

Bildiri Kitabı

Editörler

Doç. Dr. Hasan Serin
Doç. Dr. Mustafa Özcanlı
Dr. Öğretim Üyesi Ahmet Çalık



<http://www.imsec.info>

3. Uluslararası Akdeniz Bilim ve Mühendislik Kongresi (IMSEC-2018) Bildiri Kitabı

Editörler

Doç. Dr. Hasan Serin / Otomotiv Mühendisliği Bölümü, Çukurova Üniversitesi

Doç. Dr. Mustafa Özcanlı / Otomotiv Mühendisliği Bölümü, Çukurova Üniversitesi

Dr. Öğretim Üyesi Ahmet Çalık / Mersin Üniversitesi

© 2018, IMSEC

Bu kitabın yayın hakları IMSEC-2018'e aittir. 5846 Sayılı Fikir ve Sanat Eserleri Yasası uyarınca tamamı ya da bir bölümü, resim, tablo, şekil ve grafikler yazılı izin alınmaksızın elektronik ya da mekanik yöntemlerle kopya edilemez, çoğaltılamaz ve yayınlanamaz. Kaynak olarak gösterilmek koşuluyla alıntı yapılabilir.

Hasan Serin, Mustafa Özcanlı, Ahmet Çalık (Editörler)

3. Uluslararası Akdeniz Bilim ve Mühendislik Kongresi (IMSEC-2018) Bildiri Kitabı

21 x 27 cm, 1 cilt (e-ISBN 978-~~XXX-67XXX-1-4~~)

Mizanpaj / Web Editörü / Dr. Ahmet Çalık

Önemli Uyarı

Bu kitabın içeriğinde yer alan ve yazarlarının güncel bilgi düzeyi çerçevesinde bilimsel zeminde oluşturdukları metinlerde sunulan görüşler sahiplerine aittir ve yayıncı, telif hakkı sahibi ya da sponsor için bağlayıcı değildir. Kitapta adı geçen ticari markalar bilgilendirme dışında bir amaçla sunulmaktadır. Kullanıcıların ilgili üreticilerin ürün bilgi ya da kullanıcı kılavuzlarına bakmaları, şüpheli durumlarda bir uzmana danışmaları önerilir. Editör ekibi, kitabı oluşturan metinlerin hatasız basılması için özen göstermişlerdir.

Honorary Chairman

Prof. Dr. Nejat Vezirođlu (President, International Association for Hydrogen Energy, Florida, USA)
Prof. Dr. Mustafa Kibar (Rector, ukurova University, Turkey)
Prof. Dr. Ahmet Pınarbaşı (Rector, Alanya Alaaddin Keykubat University, Turkey)

Chairman

Assoc. Prof. Mustafa zcanlı (Automotive Engineering, ukurova University, Turkey)
Assoc. Prof. Hasan Serin (Automotive Engineering, ukurova University, Turkey)

Organising Committee

Prof. Dr. Selahattin Serin (Chemistry, Cukurova University, Turkey)
Prof. Dr. Tamio Endo (Faculty of Engineering, Gifu University, Japan)
Prof. Dr. Beşir Şahin (Mechanical Engineering, ukurova University, Turkey)
Prof. Dr. Kadir Aydın (Chairman of Board, Cukurova Technopark)
Assoc. Prof. Dr. Mustafa zcanlı (Automotive Engineering, ukurova University, Turkey)
Assoc. Prof. Dr. Hasan Serin (Automotive Engineering, ukurova University, Turkey)
Assist. Prof. Dr. Ahmet alık (Mechanical Engineering, ukurova University, Turkey)
Assist. Prof. Dr. M. Atakan Akar (Automotive Engineering, ukurova University, Turkey)
Assist. Prof. Dr. Tayfun zgür (Automotive Engineering, ukurova University, Turkey)
Assist. Prof. Dr. Erta Hürdođan (Osmaniye Korkut Ata University, Turkey)
Assist. Prof. Dr. Ercan Avşar (Electrical & Electronics Engineering, ukurova University, Turkey)
Assist. Prof. Sefa Yıldırım (Mechanical Engineering, Alanya Alaaddin Keykubat University, Turkey)
Res. Assist. Erdi Tosun (Mechanical Engineering, ukurova University, Turkey)
Res. Assist. Şafak Yıldızhan (Automotive Engineering, ukurova University, Turkey)

Scientific Secretary

Assist. Prof. Dr. Ahmet alık (Mersin University, Turkey)

Student Members

Aslıhan Bilcan, Habibe Kesmez , Göknuur Hacıođulları, Bengü Badenur Üst, Nursena etin, zlem Bugan, Nesibe Demir , Fırat Demirtaş, Sefa Kuşcu, Kemal Aydın , Abdullah Erođlu , İsmet Atak, Rıdvan Can Karakaya , Ahmet Eşit , Hazal Barbuođlu, Yunus Emre Turhan, Emine Sena Ercan, Metehan Kardelen, Batuhan Şenili, Uđurcan zcan, Tuncer Ergüven, Emre Bulut , Ramazan Safkan, Mehmet Ali Kapıkıran, Muhammed Emin Han, Onur Yücesoy, İlayda Aldatmaz,

INTERNATIONAL SCIENTIFIC COMMITTEE

Nejat Veziroğlu

President, International Association for
Hydrogen Energy
Florida, USA

Adrian Irimescu

Mechanical Engineering
CNR Istituto Motori
Italy

Ahmed H. A. Dabwan

Chemical Engineering
TATi University College
Malaysia

Alireza Karimi

Mechanical Engineering
Kyushu University
Fukuoka, Japan

Alsharifa Hind Mohamad Jasem

Environmental Engineering
Jordan University
Jordan

Christos Douligeris

Department of Informatics
University of Piraeus
Greece

David Studholme

Biosciences
University of Exeter
United Kingdom

Edmond Pasho

Forest Engineering
Agricultural University of Tirana

Elżbieta Piesowicz

West Pomeranian University of Technology
Poland

Esmail Habibi

Electrochemistry
Urmia University
Iran

Hung-Yuan Chung

Electrical Engineering
National Central University
Taiwan

Ismet Gursul

Aerospace Engineering
University of Bath
United Kingdom

Iulian Antoniac

Materials Science and Eng.
University Politecnica of Bucharest
Romania

Iva Petrikova

Head of Applied Mechanics
Technical University of Liberec, Czech Republic

Josip Brnic

Faculty of Engineering
University of Rijeka
Croatia

M. Mehdi Rashidi

Fluid Engineering,
Tongji University
China

Mihaela Diaconu

Biological Science
Universitadedin Bucureşti
Romania

Mohammed Charahgezlou

Civil Engineering
Water Structure Engineering Co. Sari
Iran

Mostafa Eidiani

Electrical Engineering
Khorasan Institute of Higher Education
Iran

Oksana Piven

Institute of Molecular Biology and Genetics
National Academy of Sciences of Ukraine
Ukraine

Ozan Akkus

Case Western Reserve University
USA

Sandra Spaszkievicz

Institute of Materials Science and Eng.
West Pomeranian University of Technology,
Poland

Simona Cavalu

Medical Biophysics,
University of Oradea
Romania

Simona Silvia Merola

Chemical Engineering
CNR Istituto Motori
Italy

Tamio Endo

Faculty of Engineering,
Gifu University
Japan

Tomeh Elias

Vehicles and Engines,
Technical University of Liberec
Czech Republic

Umut Atakan Gurkan

Case Western Reserve University
USA

Viorica Rozina Chifu

Computer Eng.
Universitatii Tehnice din Cluj-Napoc
Romania

Víctor Andrés Acosta Santamaría

Mechanical Eng.
Robust Mechanics & Biomechanics
Spain

Ahmet Akköse

Food Eng.
Atatürk University

Ahmet Alper Babalık

Forest Eng.
Süleyman Demirel University

Ahmet Fertelli

Mechanical Engineering
Cumhuriyet University

Ali Aybek

Agricultural
Kahramanmaraş Sütçü İmam University

Ali İnan

Computer Engineering
Adana Science and Technology University

Alpaslan Turgut

Mechanical Engineering
Dokuz Eylül University

Alper Kamil Demir

Computer Engineering
Adana Science and Technology University

Alper Kuşçu

Food Eng.
Süleyman Demirel University

Aslıhan Karatepe

Chemistry
Nevşehir Hacı Bektaş Veli University

Ayla Uysal

Environmental
Süleyman Demirel University

Aylin Altınbay Bekem

Mechanical
Yildiz Technical University

Burak Ay

Chemistry
Çukurova University

Deniz Çolakkadıoğlu

Landscape architecture
Çukurova University

Ayşegül Demir Yetiş

Environmental
Bitlis Eren University

Cahit Bilim

Civil Engineering
Mersin University

Dinçer Buran

Automotive Engineering
Süleyman Demirel University

Ayşenur Kılıç

Forest
Kahramanmaraş Sütçü İmam University

Cansu Önlén

Medical
Çukurova University

Dinçer Buran

Automotive
Süleyman Demirel University

B. Ahmet Balcı

Biological
Akdeniz University

Cem Çelik

Environmental Engineering
Çukurova University

Durmuş Ali Bircan

Mechanical
Çukurova University

Baki Bağrıaçık

Civil Engineering
Çukurova University

Cemal Kaya

Food Engineering
Gaziosmanpaşa University

Duygu Y. Aydın

Chemical Engineering
Gazi University

Başak Doğru Mert

Energy Systems Engineering
Adana Science and Technology University

Cengiz Duran Atış

Civil
Erciyes University

Emel Yıldız

Chemistry
Çukurova University

Belgin Gözmen Sönmez

Chemistry
Mersin University

Cenk Sahin

Industrial Engineering
Çukurova University

Emine Atalay

Agricultural
Selçuk University

Belkis Zervent Unal

Textile Engineering
Çukurova University

Ceyla Ozgur

Chemistry
Çukurova University

Emine Avsar Aydın

Aerospace Engineering
Adana Science and Technology University

Bengi Kutlu

Textile
Dokuz Eylül University

Cumhur Güngöroğlu

Forestry
Karabük University

Emre Akarşlan

Electrical Engineering
Afyon Kocatepe University

Berrin Gültay

Statistics
Çanakkale Onsekiz Mart University

Cuneyt Bağdatlı

Biological Sci.
Nevşehir Hacı Bektaş Veli University

Erdal Ağçam

Food Engineering
Çukurova University

Bige İncedayı

Food
Uludağ University

Çağatay Bekir Ersü

Environmental
Çukurova University

Erdal Aydemir

Industrial
Süleyman Demirel University

Bilal Şenol

Computer Engineering
İnönü University

Çiğdem Acı

Computer Engineering
Mersin University

Erdinç Avaroğlu

Computer Engineering
Mersin University

Bilgehan Güzel

Chemistry
Çukurova University

Damla Bender Özenç

Agricultural
Ordu University

Erhan Kenan Çeven

Textile Engineering
Uludağ University

Bircan Haspulat

Chemistry
Selçuk University

Demet Özkır

Chemistry
Niğde University

Ersan Turunç

Chemistry
Mersin University

Esra Nurten Yer

Forestry
Kastamonu University

Fatih Karaođlan

Geological Engineering
Çukurova University

Fatih Selimefendigil

Mechanical Engineering
Celal Bayar University

Ferhan Tümer

Chemistry
Kahramanmaraş Sutcu Imam U.

Filiz Karaömerliođlu

Electronics
Mersin University

Filiz Sarı

Electronics Engineering
Aksaray University

Funda Oskay

Forestry Engineering
Çankırı Karatekin University

Füsün Doba Kadem

Textile Engineering
Çukurova University

Gaye Kaya

Textile Engineering
Kahramanmaraş Sütçü İmam University

Gonca Özçelik Kayseri

Textile Engineering
Ege University

Gökhan Erkan

Textile Engineering
Dokuz Eylül University

Gökmen Sığırcık

Chemistry
Çukurova University

Gülesin Sena Daş

Industrial Engineering
Kırıkkale Üniversitesi

Gülizar Atlı

Biological
Çukurova University

Gülsüm Alkan

Agricultural
Adnan Menderes University

Güray Kılınççeker

Chemistry
Çukurova University

Güzide Ertokuş

Chemistry
Süleyman Demirel University

Hakan Arslan

Chemistry
Mersin University

Hakan Çelebi

Environmental Engineering
Aksaray University

Hakan Güneylı

Geological Engineering
Çukurova University

Halil Gürhan Karabulut

Genetics
Ankara University

Halil İbrahim Yumrutaş

Civil Engineering
Karabük University

Hande Baltacıođlu

Food Engineering
Niğde University

Hande Demir

Food Engineering
Osmaniye Korkut Ata University

Harun Cinli

Agricultural Engineering
Çukurova University

Hasan Hüseyin Önder

Industrial Engineering
Süleyman Demirel University

Hasan Serin

Forest and Forest Product
Kahramanmaraş Sütçü İmam University

Haşım Kelebek

Food
Adana Science and Technology University

Ilyas Kacar

Mechatronics Engineering
Niğde Ömer Halisdemir University

İbrahim Halil Mutlu

Materials
Akdeniz University

İlknur Meriç

Fisheries
Ankara University

İrfan Macit

Industrial
Çukurova University

Kadir Çavdar

Mechanical
Uludağ University

Kadir Kaya

Mechanical Engineering
Ondokuz Mayıs University

Levent Şen

Food
Giresun University

M. Nuri Öner

Forestry Engineering
Çankırı Karatekin University

Mehmet Bilgili

Mechanical Engineering
Cukurova University

Mehmet Çađrı Soylu

Biomedical
Erciyes University

Mehmet Çelik

Automotive Engineering
Niğde Omer Halisdemir University

Mehmet Kuruođlu

Civil
Dokuz Eylül University

Melih Yücesan

Industrial Engineering
Munzur University

Meriç Çetin

Computer
Pamukkale University

Muhammet Kose

Chemistry
Kahramanmaraş Sutcu Imam U.

Oğuz Y. Sarıbyık

Chemistry
Gümüşhane University

Pürhan Barbaros Tuncer

Veterinary
Mersin University

Munise Didem Demirbaş

Mechanical
Erciyes University

Oğuzhan Sarıkaya

Forestry
Süleyman Demirel University

Salih Bektaş

Civil Engineering
Aksaray University

Mustafa Bayram

Food Engineering
Gaziosmanpaşa University

Onur Balcı

Textile Engineering
Kahramanmaraş Sütçü İmam University

Selahattin Budak

Materials
Gümüşhane University

Mustafa Guven Gok

Materials Science Engineering
Hakkari University

Onur Güven

Mechanical Engineering
Mersin University

Selçuk Duman

Fisheries and Aquaculture Engineering
Çukurova University

Mustafa Mikail Özçiloğlu

Electric and Electronic Engineering
Kilis 7 Aralık University

Osman Kola

Food Engineering
Adana Science and Technology University

Selçuk Mıstıkoğlu

Automotive Engineering
Iskenderun Technical University

Nalan Kandırmaz

Physics
Mersin University

Ozlem Karagoz

Chemistry
Ataturk University

Selen Deviren Saygın

Agricultural Engineering
Ankara University

Nazmi Sedefoğlu

Physics
Osmaniye Korkut Ata University

Ömer Eker

Forestry
Kahramanmaraş Sütçü İmam University

Sercan Serin

Civil Engineering
Düzce University

Necati Başman

Electrical
Bülent Ecevit University

Ömer Faruk Ertuğrul

Electronics Engineering
Batman University

Serdar Yılmaz

Physics
Mersin University

Necdet Sinan Özbek

Electrical Engineering
Adana Science and Technology University

Ömürden Genç

Mining Engineering
Muğla Sıtkı Koçman University

Serkan Öztürk

Geophysics
Gumushane University

Necmettin Nur

Electrical and Electronics Engineering
Adıyaman University

Özgür Sönmez

Chemistry
Mersin University

Serpil Tangolar

Agricultural Engineering
Çukurova University

Nimet Kara

Agricultural Engineering
Süleyman Demirel University

Özkan Atan

Electronics Engineering
Van Yuzuncuyıl University

Sevim Mazlum

Food Engineering
Cumhuriyet University

Nurettin Üstkoynucu

Electrical Engineering
Erciyes University

Özlem Altuntaş

Agricultural Engineering
İnönü University

Sibel Ozdas

Bioengineering
Adana Science and Technology U.

Nurhan Keskin

Agricultural Engineering
Yüzüncü Yıl University

Öznur Güngör

Chemistry
İnönü University

Sinan Kandır

Veterinary
Çukurova University

Nuşin Uncu

Industrial Engineering
Adana Science and Technology University

Pırıl Tekin

Industrial Engineering
Çukurova University

Suleyman Kilic

Mechanical Engineering
Ahi Evran University

Süleyman Köytepe

Chemistry
İnönü University

Şerife Yurdagül Kumcu

Civil
Necmettin Erbakan University

Tayfun Ozgur

Automotive Engineering
Cukurova University

Tolga Levent

City and Regional Planning
Mersin University

Tolunay Gökçen

Industrial
Adana Science and Technology University

Tuğçe Demirdelen

Electronic Engineering
Adana Science and Technology University

Tülin Güven Gökmen

Veterinary
Çukurova University

Ufuk Coşgun

Forestry
Karabük University

Uğur Eşme

Mechanical Eng.
Mersin University

Ümit Kadiroğlu

Chemistry
Kocaeli University

Vedat Taşdemir

Mechanical Prog
Kahramanmaraş İstiklal U.

Yasemin Coşkun

Biological Science
Süleyman Demirel University

Zekine Pündük

Medicine
Balıkesir University

Zülküf Kaya







Civil Engineering
Erciyes University

Contents

Invited Speakers	1
Thin film transistors: from vacuum deposition to solution processing Mamatimin Abbas	2
Synthesis of crosslinked polymers of poly [<i>p</i> - and <i>m</i> - (N-vinylbenzylidene)] derivative of,4-triazole and their anti-microbial activity studies Mokhtaria Dehar, Seghier Ould-Kada, Zohra Fortas, Soulef Dib-Bellahouel	3
<i>In Silico</i> Science and Engineering Insights Mahmoud Mirzaei	4
Archaeometric Studies on Roman Glass Finds from Romania Roxana Bugoi, Cristina-Georgeta Alexandrescu, Adriana Panaite	5
Synthesis of block Copolymers consists on Vinylidene Chloride and alpha- MethylStyrene by Cationic Polymerization using an Acid Exchanged Motmorillonite Clay as Heterogeneous Catalyst (Algerian MMT) Moukheir Ayat, Naima Bensaada, Yemouna Madaoui, Mohammed Belbachir	6
Thermal properties of TiO ₂ enhanced Myristic Acid as a phase change material Mohammed Ouikhalfan, Ahmet Sarı, Hassan Chehouani	7
Thermal properties of ZnO enhanced polyethylene glycol (PEG) as a phase change material Mohammed Ouikhalfan, Ahmet Sarı, Hassan Chehouani	11
Review on thermal conductivity enhancement of form-stable phase change materials (FSPCMs) Mohammed Ouikhalfan, Ahmet Sarı, Hassan Chehouani	15
Kimlik tanıma sistemlerinde yeni bir model olarak parmak izi okuyuculu kişisel kart tasarımı Hatice Kübra Koç, Ali Yıldız	19
Investigation of Engine Performances with C ₁₀ H ₈ , C ₇ H ₁₆ and C ₁₂ H ₂₆ Fuel in Avds 1790-2A Engine Bilge Albayrak Çeper, Melih Yıldız, Caner Şimşek	22
Passenger Flow Prediction Based on Hybrid Particle Swarm Optimization and Artificial Neural Network Engin Pekel	27
İki Yönlü Fonksiyonel Kademelendirilmiş Plakalarda Yapay Sinir Ağı ile Termal Gerilme Analizi Munise Didem Demirbaş, Didem Çakır	30
Türkiye’de Çeltik Üretimi, Ticareti ve Destekleme Politikaları Ahmet Duran Çelik, Arif Semerci, Aykut Gül	31
Investigation of Toll-Like Receptors 2 and 4 Gene Polymorphisms with PCR-RFLP and DNA Sequencing in Tuberculosis Patients Mahmut Ulger, Pınar Firat Yener Seda Tezcan Ulger Didem Ozgur Gonul Aslan ²	35
Türkiye’nin Tarım Ürünleri Dış Ticareti Arif Semerci, Ahmet Duran Çelik, Aykut Gül	37
Microwave Imaging by Using EBG Grounded Monopole Antenna Integrated Cavity Resonator Fatih Ozkan Alkurt, Olcay Altintas, Emin Unal, Muharrem Karaaslan, Faruk Karadag	43
Effect of Layer Thickness on Surface Properties of 3D Printed Materials Made from Wood Flour/PLA Filament Nadir Ayrılmış	46
Recent Studies in Flame Retardancy of Wood Plastic Composites Nadir Ayrılmış	51

The Effect of Indole Acetic Acid on Some Growth Parameters of Bread Wheat (<i>Triticum aestivum</i> L. cv. <i>Sagittario</i>) Under Salinity Stress Aslı Kılıç, Hande Otu Borlu, Halil Çakan	1231
DiPPM Sinyalinin Üretimi için Yeni Bir Yöntemin Geliştirilmesi ve Uygulaması Mehmet Sönmez	1232
Klorojenik Asit (CGA), Deneysel Oluşturulan Renal İskemi-Reperfüzyon Hasarını Hafifletir Derya Guzel, Ayhan Tanyeli	1234
Synthesis of Mannanase Hybrid Nanocomposite and Investigation of Its Stain Removal Performance Ismail Ocsoy, Vedat Yılmaz, Behzat Cimen, Ayse Demirbas	1239
Efficiency of Levetiracetam and Gabapentin in the treatment of Epilepsy in a Cavalier King Charles Spaniel Dog with Myxomatous Mitral Valve Heart Disease, a Case Report Sinan Kandır, Cengiz Yüce Kayabek, Bilge Kaan Tekelioğlu	1242
Ofset PPM için Yeni Bir Kodlayıcı Yöntemi Mehmet Sönmez	1246
Studying of Potential Biopolymer Production from Municipal Wastewater Treatment Plants Ezgi Bezirhan Arıkan, H. Duygu Bilgen ¹	1248
A Miniaturized Dual Ka/X Band Frequency Selective Surface Esmamutluer, Bora Doken Mesut Kartal	1249
Tekstil Sektöründe İş Sağlığı ve Güvenliği Özlem Kutbay, Uğur Eşme, Mustafa Kemal Külekci	1252
Hafriyat Sahalarında İş Sağlığı ve Güvenliği için Alınması Gereken Önlemler ve Risklerin Değerlendirilmesi Özlem Kutbay, Uğur Eşme, Mustafa Kemal Külekci	1257
İş Sağlığı ve Güvenliği Toplum Kültürü Oluşturulması Özlem Kutbay, Uğur Eşme, Hazel Kaf	1261
Ampisilin Antibiyotikinin Sulu Çözeltilerde Fotokatalitik Oksidasyon Prosesi İle Arıtılabilirliğinin İncelenmesi Gamze Koyuncu Türkay, Halil Kumbur	1266
Folic Acid Directed Organic-Inorganic Hybrid Nanoflowers and Investigation of Their Catalytic and Antimicrobial Activities Vedat Yılmaz, İsmail Öçsoy, Nilay İldız	1271
The Phenolic Compounds and Antioxidant Properties of Some Cornelian Cherry (<i>Cornus mas</i> L.) Genotypes Grown in Turkey Yılmaz Ugur, Isil Yildirim, Selim Erdogan, Tahir Macit, Makbule Yanar	1274
The Effect of Altitude on Fat and Internal Yield of Some Almond Varieties Grown in Turkey Yılmaz Ugur, Tahir Macit, Oktay Turgay Altun, Selim Erdogan, Makbule Yanar, Mehmet Ozelci	1275
Çukurova Koşullarında İkinci Ürün Olarak Yetiştirilebilecek Silajlık Mısır (<i>Zea mays</i> L.) Çeşitlerinin Verim ve Silaj Kalitesi Üzerine Bir Araştırma Yasin Korkmaz, Sait Aykanat, Hatice Yücel, Mustafa Avcı, Rüştü Hatipoğlu	1276
Demonstration of Energy Levels and Transition Energies in Qutrit Systems ($S=, I_1=, I_2=, I_3=1$) Mehpeyker Kocakoç, Recep Tapramaz	1277
Şehir Şebeke Sularındaki Kirleticiler ve Ülkemizde Şebeke Sularında Belirlenen Başlıca Problemler Emine Aksan Aldanmaz	1281
Polimer Donatılı ve Tasarlanmış Çimento Esaslı Kompozit Beton Kirişlerin Eğilme Davranışı ve Fraktal Analizi Ezgi Gürbüz, Savaş Erdem	1286
Yumuşak Çeliğin Klorür Çözeltisindeki Korozyon Davranışlarına Metil Oranjın İnhibitör Etkileri Güray Kılınççeker, Sema ÇELİK, Mustafa Kemal Sangün	1291

Invited Speakers

Invited Speaker	University/Country	Title of oral presentation(s)
<p>1.</p>  <p>Mamatimin Abbas</p>	<p>CNRS, Université de Bordeaux, Lab. IMS, UMR 5218, 33607, Pessac, France</p>	<p><i>Thin film transistors: from vacuum deposition to solution processing</i></p>
<p>2.</p>  <p>Mokhtaria Dehar</p>	<p>Laboratory of Macromolecular Physical Chemistry, Depart- ment of Chemistry, University of Oran1 Ahmed Ben Bella, BP 1524 EL-M'Naouer, Oran 31100, Algeria</p>	<p><i>Synthesis of crosslinked polymers of poly [p- and m- (N-vinylbenzylidene)] derivative of 1,2,4-triazole and their antimicrobial activity studies</i></p>
<p>3.</p>  <p>Mahmoud Mirzaei</p>	<p>Isfahan University of Medical Sciences, Isfahan, Iran</p>	<p><i>In Silico Science and Engineering Insights</i></p>
<p>4.</p>  <p>Roxana Bugoi</p>	<p>Horia Hulubei National Institute for Nuclear Physics and Engi- neering, 30 Reactorului Street, Măgurele 077125, Romania</p>	<p><i>Archaeometric Studies on Roman Glass Finds from Romania</i></p>
<p>5.</p>  <p>Moulkheir Ayat</p>	<p>Moulay Tahar University, De- partment of Chemistry, Faculty of Sciences, BP138 City, Nasr Saida 20000, Algeria</p>	<p><i>Synthesis of block Copolymers consists on Vinylidene Chloride and alpha- MethylStyrene by Cationic Polymerization using an Acid Exchanged Motmorillonite Clay as Heterogeneous Catalyst (Algerian MMT)</i></p>
<p>6.</p>  <p>Mohammed Ouikhalfan</p>	<p>Cadi Ayyad University, Faculty of Sciences and Techniques, Department of Applied Physics, Marrakesh, Morocco</p>	<p><i>Thermal properties of TiO₂ enhanced Myristic Acid as a phase change material</i></p> <p><i>Thermal properties of ZnO enhanced polyethylene glycol (PEG) as a phase change material</i></p> <p><i>Review on thermal conductivity enhancement of form-stable phase change materials (FSPCMs)</i></p>