JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

CEFUROXIME ANTIBIOTIC AS A POWERFUL WEAPON AGAINST COVID-19: A REVIEW OF RECENT RESEARCHES

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ABSTRACT:

COVID - 19 Pandemic was the major public threat worldwide that required immediate action. To develop a new successful drug or vaccine was time consuming process that's why drug repurposing was the fastest mean to meet the urgency of situation. The present study was done to identify that which antibiotic was better to control the symptoms of SARS-CoV-2. For this purpose we employed a broad search strategy by systematic review of relevant eligible articles and publications. The data were also extracted from applied treatment results published in authentic media resources worldwide. Cefuroxime the 2nd generation cephalosporine was found to be an efficient and promising tool against COVID-19. One of the basic reasons for cefuroxime being a top ranked potential antibiotic is that it works as a multitarget inhibitor for 3-SARS-cov-2 proteins. It was 5th highest drug with binding energy -54.25 kcal/mal.

Keywords: Cefuroxime, COVID-19, Proteins, Inhibitor, SARS-CoV-2, Repurposing,

INTRODUCTION:

Severe Acute Respiratory Syndrome, Corona virus-2, (SARS-Cov-2), the causative agent of Corona virus disease-19 (COVID-19) is a novel human virus that is responsible for about 4 Million confirmed cases and nearly 3.00.000 deaths in over 200 countries worldwide [JohnsHopkins University 2020]. Till date, there was no confirmed treatment or vaccine prevention strategy against COVID-19. Due to the urgent need for effective treatment, drug repurposing was regarded as the immediate option [Cliberto et.al. 2010 Ekins et. al. 2020].Consequently there has been an explosion of in silico experiments to find out drugs or Investigate anecdotal claims [Ashimiyu et at 2020]. One drug with several anecdotal accounts of benefits was Cefuroxime

and it was identified as a top ranked potential inhibitor drug against SARS-CoV-2 Proteins [Alkhafaji 2020, Almeciga et al 2020, Dar'ya et.al 2020, Galvez et al2020, Koulgi et.al. 2020, wu et.al. 2020]. There have been several anecdotal accounts on social media of SARS-Cov-2 who received oral cefuroxime experiencing often rapid symptomatic improvement. [Aquino.2020, Barreto 2020, Sheathomas 2020, Sur A, 2020, Turneepseed 2020].It has broad spectrum activity and is commonly used for the treatment. of both upper and lower Respiratory Tract infections, Lyme diseases, Genitourinary tract infections etc. It is readily available and affordable drug and it exists in both oral and parenteral forms as cefuroxime axetil and cefuroxime sodium respectively. It has undergone extensive toxicologicalInvestigation and post marketing surveillance and it is known, to have a good safety profile [Emmerson, 1988].

MATERIALS AND METHODS:

We employed a broad search Strategy for peer reviewed data bases by adopting the preferred reporting items for the systematic review. Eligible studies were identified through search of articles published in Medline, Embase, scopus, web of science and Google scholar at the time of severe Infection waves.The full-text publications of potentially relevant articles were retrieved and rescreened. The finally selected articles were reviewed, data were extracted and findings were summarized in this article.

RESULTS:

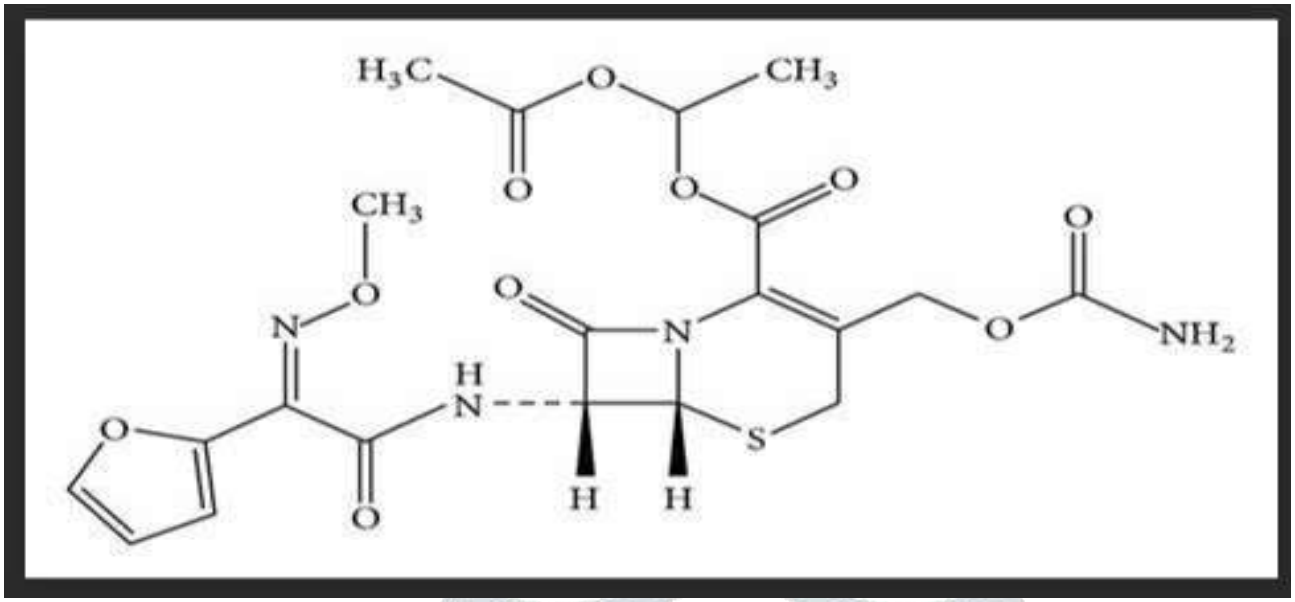
COVID -19 pandemic was a major Public health threat that requires immediate action. Despite the intense efforts to develop a new success full drug or vaccine for controlling SARS-COV-2 this process was time consuming. Therefore the drug repurposing was the fastest way to meet the urgency of situation of COVID-19.

COMPARATIVE STUDY OF VARIOUS DRUGS

By analyzing various reports published we found that Hydroxychloroquine alone or in Combination with Azithromycine can effectively alter the disease course in patients. with severe COVID infection (Taccon et al 2020).Patients who received Remedisivir had a significant four day difference in median time. Lepanavir drug also have good activity as against SARS-Cov-2.Among many drugs applied for COVID-19 Cefuroxime was a powerful weapon to fight against Covid-19. Cefuroxime was the fifth highest drug with a binding energy of -54.25 kcal/mol while Remedisivir ranked 3rd having binding energy. Of - 65.19 Kal/mol [wu et. al,2020, Genheden 2015, Dia et. al 2020, Zhao et.al2008, Rox 2020 Galvez et al 2012]

STRUCTURE AND CLASSIFICATION OF CEFUROXIME:

Beta-lactame antibiotics are the most widely used group of antibiotics [Holten et al. 2000] Cefuroxime belongs to the second generation semisynthetic cephalosporin and beta-lactame antibiotic with bacteriocidal activity[Yaoet al. 2007].The chemistry of cephalosporine has been broadly explored because of their medical applications [Elanders 2003].Cefuroxime [(6R, 7R).-3- (amino carbony), oxy methyl]-7- [1(ZZ-2-(2-Furyl) 2-methoxy imino acetyl) amino] 8 oxo-5-thia-1-aza- bicyclo [4,2,0] oct-2-ene-2-Carboxylic acid (fig. 1) is used to treat a wide variety of bacterial infections.



Chemical structure of cefuroxime

CEFUROXIME : MODE OF ACTION AND POTENCY OF RESISTANCE

Cefuroxime is a bactericidal agent that acts by inhibition of bacterial cell wall synthesis. Cefuroxime has activity in the presence of some beta lactamasse both penicillinases and cephalosporinases, of gram-positive and gram-negative bacteria.SARS-CoV-2 is a positive-sense single stranded RNA virus belonging to the Beta-genus of the corona virus family, The SARS-Cov-2 virion consists of at least four (4) structural proteins: spike(s) protein, membrane (M) protein, Envelop (E) protein and nucleocapsid (N) protein [Li et.al. 2020)] .Crystal structures of 48 pre-screened FDA (United-states food and drug administration) approved drugs and antiviral agents including cefuroximg that was known to bind covalently irreversible bond with cys-145 of the active site of M-Pro protein of SARS-Cov-2. It is the 5th highest drug having high binding energy among all above 48 antiviral agents.More over Cefuroxime is a potential inhibitor of 3-key SARS-CoV-2 proteins. Many studies reported that Cefuroximemay inhibit MPro [Genheden et al 2015, Dia et al. 2010, Zhao et al. 2008, Zhang et al. 2020, Galvez et.al. 2020]. One study reported Cefuroxime may inhibit RdRp. [Elfiky et al. 2020],while another reported cefuroxime may inhibit the ACE-2 spike proteins binding complex [Dar'ya et al.,2020] In this way by reviewing many studies we can suggest that cefuroxime being a multi target inhibitor of SARS-Cov-2 carry the prospect of being more robust antibiotic agent. [Talevi 2015, Xie et al. 2008, Zimmermann et al 2007]

CONCLUSIONS:

COVID-19 was a significant public health emergency. Due to the urgency of health crisis, drug repurposing was the only immediate tool for controlling the severe situation.At that time cefuroxime was found to be the efficient potential antibiotic having activity against SARS-CoV-2.By scientific studies it was findout that it was a multi target inhibitor against three key SARS-CoV-2 Proteins. It was 5th highest drug at that time with high binding energy.Cefuroxime is a broad-spectrum second generation cephalosposin with excellent activity against many respiratory pathogens.

REFERENCES

1. Al-Khafaji K., Al-Duhaida hawi, L. D. & Taskin Tok T. (2020). Using integrated Computational approaches to identify safe and rapid treatment for SARS - Cov-2, Journal of Biomolecular structure and Dynamics.

https://doi.org/10.1080/0791102.2020. 1764392

2. Almeciga-Diaz C. I., Pimental-vera L.N., Caro A., Masquera A., Rojas J.P.M. & Moreno C.A.C. 2020. Virtual screening of Potential inhibitors for SARS-CoV-2 main protease Preprints 2020. .

https://doi.org/10-20944/Preprints 202004.0146v/

3. Aquino. M.C.(2020). Just want to share I have had 3 patients who came from Wuhan, China who had arrived before with flu symptoms Facebook,

https://www.facebook.com/marlene.c.aquino/Post/ 2972999819426807

4. Ashimiyu B., Durojaiye, Johm Ross D., and Can Wang, Repurposing Cefuroxime for Treatment of COVID-19: a scoping reviews of in silico studies, Journal of Biomolecular Structure And Dynamics.

https://doi.org/10.1080/0739112. 2026. 1777904.

5. Barreto. P. (2020), Day 13 of isolation temp is 97.4 without taking Tylenol, trying to Have my body fight with fever. I Just took..--.. Facebook https://www.facebook.com/Peter.barteto.16/posts/1559936 9908 30136.

6. Cillberto, G., & Cardone, L. (2010). Boosting the arsenal against COVID-19 through Computational drug repurposing. Drug Discovery Today https:/ www./doi.org/10.1053/ J.gastro.2020.03.065.

7. Cox M.J., Loman N.,Bogerto D., &0' Grady J. (2020). Co-intections: Potentially lethal and unexplored in COVID-19. The Lancet Michobe, 1(1), e ll, https://doi.org/10.1016/52666-5247 (20)30009-4.

8. Dia W., Zhang B., Su H., Li J., & Bai F. (2020) Structure-based design of antiviral drug Candidates targeting the SARS-COV-2 main protease. Science. https://doi.org/10.1126/science. abb 4489.

9. Darya, S.R., Mackinnon. S.S., Landom M., Windemuth, A., Kurji, N. & Shahani V. (2020) Polypharma DB, a deep learning based resource a quickly identifies repurposing drug candidates for COVID-19 • chem Rxiv. Preprint, https://doi.org/10.26434/ chemvxive. 12071271.VI.

10. Ekins S., Mottin M., Ramos P. R.P.S., Sousa, B.K.P,. Brago R.C., Coffee M. & Andrade C.H. (2020) Déjà Vu Stimulating open drug discovery for SARS-CoV-2. Drug Discovery Today, https://doi.org/10.1016/J drudi2020.03-019

11. Elfiky A.A.(2020). SARS-CoV-2 RNA dependent RNA polymerage (Rdrp) targeting: An In silico Perspective. Journal of Bromolecular Structure anal Dynamices. https://doi.org/10.1080/07391102.2026. 1761882.

12. Emmerson A.M. (1988), Cefuroxime Axetil. The Journal of Antimicrobial chemotherapy, 22(2), 101-104.

https://doi.org/10-1093/jac/ 22.2.101.

13. Galvez J. Zanni R., & Galvez - Liopart M. (2020). Drugs repurposing for coronavirus treatment: computational study based on molecular topology.American Journal of Methods, modelling and Simulation. https://revistas.ucv.es/index/.php/neries/article/view/59.

14. Genheden S. & Ryde V. (2015), The MM/PBSA and MM/GBSA methods to estimate ligand-binding affinities. Expert opinion on Drug Discovery. 10(5), 449-461 https://doi.org/10.1517/17460 441.2015. 1032936.

15. Holten KB, onusko E.M. (2020) Appropriate Prescribing of oral beta-lactam antibiotics. American family physicians 62(3):611-20 PMID -950216 https://Pubmed.ncbi-nlm.nih.gov/ 109550216.

16. Johns Hopkins University (2020). COVID-19 dashboard by the centre for systemsScience and Engineering (csse) at Johns Hopkins university. Retrieved April 27, 2020 from.

https://coronavirus.Jhu.edu/map.html.

17. Koulgi S., Jani V., Uppuladinne M , Sonavane U., Nath A.K., Joshi R., Kumar A. & Darbari H. (2020) Drug repurposing studies targeting SARS-CoV-2, chemRxiv, Preprints, https://doi.org/10. 26434 chemvxiv12228831 -V/

18. Li X., Genge M. & Lu S. (2020). Molecular immune pathogenesis and diagnosis of Covid-19- Journal of Pharmaceutical Analysis. (10)2, 102.108. https://doi.org/10.1016/j.jpha .2020.03.001.

19. Sheathomas. [@shea70317910]. (2020). In Ny, W/ Alot of peeps. Got sick 5 day Later, Days 123 Had Fever and chilles and Full..... [Tweet]. Twitter:

https://twitter.com/shea70317910 status/1242415932/ 657541121.

20. SUR A. (2020) Victory against covid-19, It all started on 17th of April 2020 when I developed mild Fever with dry cough, Soon .....Facebook https:// www.facebook.com/ananda. sur/ posts/ 1818329264970773.

21. Taccone F.S., Gorham J., & Vincet J.L. (2020). Hydrox y chloroquine in the management of critically III patients with COVID-19. The need for an evidence base. The Lancet Resperstory medicine 8(6) 539-541 https://doi.org/10.1016/52213-2600(20)30172-7

22. Talevi A.(2015). Multitarget Pharmacology: Possibilities and limitations of the "skeletal key approach from a medicinal chemist perspective. Frontier in pharmacology. 6, 205. https://doi.org/10.3389/fphar.2015.00205.

23. Turnipseed J.D. (2020) Maris asked me to post an update my update for 4 / 6/ 2020 this Morning my doctor asked me to say.m [Facebook].

https://www.facebook.com/judydavis- turniipseed /posts/ .

24. Wu C, Liu Y., Yang Y.Li. M., & Chen L. (2020) Analysis of therapeutic targets for [SARS-CoV-2] and discovery of Potential drugs by computational methods. Acta Pharmaceutica sinica 10(5).766-788.

https://doi.org/10.1016/japsb .2020.02.008

25. Xie L., Kinning S.L. & Bourne P.E. (2012). Novel computational approach to poly pharmacology as a means to define responses to individual drugs . Annual review of Pharmacology and Toxicology, 52 361-379.

https://doi.org/10.1146/annurevpharmtox. 01811-134630.

26. Y.Zhao, Zhang X.C., Rao.Z. (2008). Structures of two coronavirus main Proteases: Implications for substrate binding and antiviral drug design. Journal of Virology 82 (5) 2515-2527 https://doi.org/10.1128/jvi -02114-07

27. Zhang L, Lin D., Sun X., & Hilgenfield R., (2020) crystal structure of SARS-CoV-2main protease provides a basis for design of improved alpha-keto amide inhibitors, science 368 (6489) y 409-412, https://doi.org/10.1126/science .abb 3405

28. Zimmermann G.R. & Keith L.T. (2007) Multitarget therapeutics when the whole is greater than the sum. Drugs Discovery today. 12.1-2),34-42, https://doi.org/10.1016/jdrudisct. 2006.11.008