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Felipe Fregni, Allan Stensballe, Georgia Levidou and Serafino Fazio

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contributing to improved patient management and, thus, avoiding repetitive procedures and optimizing the overall efficiency and cost-effectiveness of diagnostic practices.

3.7. Unveiling Natural Inhibitors for ABCC1 (MRP1) Membrane Transporter Through Molecular Docking and Molecular Dynamics Simulations

Roya Rahimivaghar [1,2], Seyed Shahriar Arab [1], Justin Tze-Yang Ng [2], Yaw Sing Tan [2]

1. Department of Biophysics, Faculty of Biological Sciences, Tarbiat Modares University, Tehran, Iran
2. Bioinformatics Institute, Agency for Science, Technology and Research (A*STAR), 30 Biopolis Street, #07-01 Matrix, Singapore 138671, Singapore

ABC transporters are fascinating proteins responsible for transporting a variety of substrates through the hydrolysis of ATP. Some ABC transporters are multidrug-resistant (MDR), a trait commonly associated with human cancers and pathogenic microbes. Their ability to transport toxic substances and drugs across membranes, even against the concentration gradient, leads to a reduced concentration of drugs inside cells, which diminishes the drug's effectiveness. Natural compounds, such as polyphenols and flavonoids, have anticancer properties. By inhibiting ATP hydrolysis, they can potentially inhibit MDRs in cancer cells, reduce the activity of these proteins, and enhance the therapeutic effects of anticancer drugs. In this study, we investigate the inhibitory effects of 77 of these compounds on the nucleotide-binding domains (NBDs) of ABCC1 (MRP1) by using molecular docking and molecular dynamics (MD) simulation. The results indicate that five compounds, namely (-)-catechingallat, limonin, naringin, rhoifolin, and robinin, had high binding affinities, with values of -7.8, -8.5, -8.3, -8.3, and -8.5 in NBD1 and -7.1, -7.9, -8.2, -7.9, and -7.7 in NBD2, respectively; in comparison, ATP showed binding affinities of -6.8 and -7.1 in NBD1 and NBD 2, respectively; all the compounds occupied the same binding sites as ATP, namely Asp793 and Tyr831 in NBD1 and Arg1445 in NBD2. A molecular dynamics trajectory analysis of the NBDs and ligands revealed these domains were stable throughout 200 ns MD simulations. The MD simulations confirm the stability of the complex formed by the interaction of five ligands with NBD, characterized by structural compactness and minimal to no fluctuations. This in silico study offers key information for developing potential ATP inhibitors, suggesting that NBDs could be suitable binding sites for the flavonoid family. The discovery of novel MDR-inhibiting compounds has the potential to make cancer treatment more effective for all types of cancers, making it a comprehensive solution to drug resistance.

4. Immune System, Tumor Immunology, and Autoimmune Disease

4.1. Efficacy and Safety of Tocilizumab in the Treatment of Rheumatoid Arthritis: An Umbrella Review

David Silva [1], Fernando Moreira [2], Marlene Santos [2]

1. Escola Superior de Saúde, Instituto Politécnico do Porto, Rua Dr. António Bernardino de Almeida, 4200-072, Porto, Portugal
2. REQUIMTE/LAQV, Escola Superior de Saúde, Instituto Politécnico do Porto, Rua Dr. António Bernardino de Almeida, 4200-072, Porto, Portugal

Introduction: Tocilizumab (TCZ) is a humanized immunoglobulin G1 monoclonal antibody that targets and inhibits the interleukin-6 (IL-6) receptor. As a selective inhibitor of this cytokine, TCZ offers a targeted approach in managing inflammatory conditions. Given its specificity and potential therapeutic benefits, this article aims to provide a comprehensive summary of the efficacy and safety of TCZ in the treatment of RA.

Methods: This study adhered to the structure of an Umbrella Review, which synthesizes multiple systematic reviews and clinical studies to provide a broad understanding of the subject matter. The review was conducted between October 2023 and August 2024, with a focus on patients diagnosed with rheumatoid arthritis. A thorough search was performed using the PubMed and Cochrane databases to identify relevant studies. The inclusion criteria were based on systematic reviews, while exclusion was applied to studies based on the article type and the publication date.

Results: Seventeen studies were included in the analysis. These studies utilized the American College of Radiology (ACR) criteria to assess the efficacy of TCZ in comparison to other conventional and biologic DMARDs, as well as a placebo. The results revealed that TCZ monotherapy demonstrated superior efficacy in reducing disease activity and improving physical function when compared to alternative treatments. Safety was evaluated by reviewing adverse reactions and infections associated with TCZ. Overall, the incidence of adverse events was similar to that observed with other biologic therapies, suggesting that TCZ does not pose an increased risk in this regard.

Conclusions: Tocilizumab has proven to be an effective and safe option in the treatment of rheumatoid arthritis, offering distinct advantages in both efficacy and safety compared to other conventional and biological DMARDs. The findings from this review support its continued use, including as adjunctive therapy in managing RA, particularly for patients who do not respond adequately to traditional treatments.

4.2. Anti-Arthritic Potential of Artemisia Herba-Alba in Carrageenan- and Complete Freund's Adjuvant-Induced Arthritis Models in Rats

Hicham Wahnou [1], Zaynab Ouadghiri [2], Martin Ndayambaje [2], Salma Benayad [3], Youness Limami [3], Mounia Oudghiri [2]

1. Laboratory of Immunology and Biodiversity, Faculty of Sciences Ain Chock, Hassan II University, B.P 2693, Maarif, Casablanca, Morocco
2. Laboratory of Immunology and Biodiversity, Faculty of Sciences Ain Chock, Hassan II University, B.P2693, Maarif, Casablanca, Morocco
3. Laboratory of Health Sciences and Technologies, Higher Institute of Health Sciences, Hassan First University of Settat, Settat 26000, Morocco

Arthritis is a chronic inflammatory disorder characterized by progressive joint damage and immune dysregulation, significantly impacting patients' quality of life. Conventional treatments, such as NSAIDs and corticosteroids, while effective, often cause adverse effects, such as gastrointestinal bleeding, cardiovascular risks, and osteoporosis, particularly with long-term use. This study explores the anti-arthritic potential of Artemisia herba-alba, a medicinal plant with traditional anti-inflammatory uses, in carrageenan- and complete Freund's adjuvant (CFA)-induced arthritis models in rats.

Two arthritis models were used: (1) CFA-induced arthritis, where inflammation was triggered by means of a single subcutaneous CFA injection into the hind paw, evaluated over 15 days, and (2) carrageenan-induced arthritis, induced by means of repeated intra-articular carrageenan injections into the hind paw over 30 days. Male Wistar rats were divided into control, arthritic, and treatment groups. The treatment groups received oral A. herba-alba extracts (250 mg/kg or 500 mg/kg), while the positive control group received indomethacin (3 mg/kg). The hematological analysis quantified serum neutrophils and monocytes, and the histopathological examination assessed joint tissues using H&E staining.

A. herba-alba extracts demonstrated dose-dependent anti-inflammatory effects, with the 500 mg/kg dose outperforming indomethacin. The hematological analysis showed significant reductions in neutrophils and monocytes, indicating systemic immune modulation. The histopathological findings revealed reduced osteoclast activity, decreased neutrophil