1. Drug Name

   Adalimumab

2. Mechanism of Action (MoA)

   Adalimumab is a fully human monoclonal antibody (IgG1) that specifically binds to tumor necrosis factor-alpha (TNF-α), a pro-inflammatory cytokine. By neutralizing TNF-α, Adalimumab reduces inflammation and prevents immune-mediated tissue damage, making it effective in treating inflammatory bowel diseases such as Crohn's disease (CD) and ulcerative colitis (UC).

3. Pharmacokinetics

   Absorption: Administered subcutaneously (SC), reaching peak plasma concentration in approximately 4–6 days. Distribution: Exhibits a biphasic distribution with high specificity for TNF-α. Metabolism: Degraded via proteolysis in the reticuloendothelial system. Excretion: Eliminated mainly via intracellular catabolism, as monoclonal antibodies are not excreted through the liver or kidneys.

4. ADME (Absorption, Distribution, Metabolism, Excretion)

   Absorption: Bioavailability of approximately 64% after SC administration. Distribution: Volume of distribution (Vd) is 4.7–6 L, with extensive binding to TNF-α. Metabolism: Degraded into peptides and amino acids by proteolytic enzymes. Excretion: Eliminated via reticuloendothelial and lymphatic systems, not through renal or hepatic pathways.

5. Biodistribution

   Primarily found in plasma and extracellular fluids, targeting inflamed intestinal tissue in IBD patients. Crosses the placental barrier, but FcRn-mediated clearance reduces fetal exposure. Minimal penetration into the central nervous system (CNS) due to its large molecular size.

6. Target Binding

   High specificity and affinity for TNF-α (~0.1 nM binding affinity). Inhibits both soluble and transmembrane TNF-α, preventing its interaction with TNF receptors. Reduces downstream pro-inflammatory signaling cascades, such as NF-κB and MAPK pathways.

7. Pharmacodynamics

   Reduces pro-inflammatory cytokine production, including IL-1, IL-6, and interferon-γ. Decreases leukocyte migration and adhesion, preventing tissue damage in the gastrointestinal (GI) tract. Improves mucosal healing, reducing disease severity in Crohn's disease and ulcerative colitis. Onset of action: Effects observed within 2–4 weeks, with sustained response in long-term therapy.

8. Abbreviations

   IBD – Inflammatory Bowel Disease TNF-α – Tumor Necrosis Factor-alpha SC – Subcutaneous NF-κB – Nuclear Factor Kappa B MAPK – Mitogen-Activated Protein Kinase FcRn – Neonatal Fc Receptor CD – Crohn's Disease UC – Ulcerative Colitis

References

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