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Molecular biology of the infection mechanism of uropathogenic Escherichia coli

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Uropathogenic Escherichia coli (UPEC) is a type of bacteria that infects the urinary tract in human beings leading to urinary tract infections (UTIs). The activation of the innate immune response for UPEC in the urinary tract is dependent upon pattern recognition receptors (PRR), recognition of UPEC and pathogen-associated molecular patterns (PAMPs), which include lipopolysaccharide (LPS), flagella, type 1 pili and pap pili. This immune response is characterised by the production of inflammatory cytokines and chemokines by the urothelium which results in the rapid recruitment of neutrophils into the bladder lumen, which in turn results in bacterial clearance. Nuclear factor-kappa light chain enhancer for activated B cells (NF-κB) is a transcriptional factor that is essential for upregulating T cell development, maturation and also proliferation. It has been observed that NF-κB upregulates the genes essential for the production of interferon-gamma, a cytokine that induces an essential signal during macrophage activation. So UPEC evades the human immune system by suppressing the activation of this NF-κB, thereby sabotaging the signalling pathway essential for T cell development. UPEC does this by producing the Toll/interleukinÃ¢â‚¬â€˜1 receptor domainÃ¢â‚¬â€˜containing protein C (TcpC), a toxin that suppresses Toll-like receptors (TLR) signalling which are responsible for the activation of antimicrobial responses. Additionally, UPEC stabilises the production of the nuclear factor of kappa light polypeptide gene enhancer in B-cells inhibitor, alpha (IκBα) which inhibits the action of NF-κB by trapping the molecules in the cytoplasm and degrading them. This results in restricting them from entering the nucleus to aid in the transcription of genes that code for cytokines that are essential for lymphocyte development and activation. Therefore, the modulation of the innate immune response by the UPEC may also affect other urothelial responses such as apoptosis and other intracellular signalling pathways.

Keywords: Uropathogenic Escherichia coli, Nuclear factor-kappa B, Infection mechanism, Urinary tract infection, Immune system, Signalling pathways

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