Scientific Foundation SPIROSKI, Skopje, Republic of North Macedonia
South East European Journal of Immunology. 2025 Mar 27; 8(CITIM):074
https://doi.org/10.3889/seejim.2025.6137
eISSN: 1857-9388
Category: *CITIM - Cancer Immunotherapy & Immunomonitoring (CITIM2025)*
Section: *Posters*

Molecular mechanisms of communication between innate immune cells and vascular cells in cancer and cardiovascular diseases

Razvan D Macarie*, Monica M Tucureanu, Letitia Ciortan, Mihaela Vadana, Andreea Mihaila, Miruna L Naie, Ana Maria Gan, Ileana Manduteanu, Elena Butoi

Inflammation Department, Institute of Cellular Biology and Pathology "Nicolae Simionescu", Bucharest, Romania

Citation: Macarie RD, Tucureanu MM, Ciortan L, Vadana M, Mihaila A, Naie ML, Gan AM, Manduteanu I, Butoi E. Molecular mechanisms of communication between innate immune cells and vascular cells in cancer and cardiovascular diseases. SEE J Immunol. 2025 Mar 27;8(CITIM):074. https://doi.org/10.3889/seejim.2025.6137.
Keywords: immune-vascular crosstalk, monocytes-macrophages, endothelial cells, smooth muscle cells, angiogenesis
***Correspondence:** Razvan D Macarie. Inflammation Department, Institute of Cellular Biology and Pathology "Nicolae Simionescu", Bucharest, Romania . E-mail: razvan.macarie@icbp.ro
Received: 01-March-2025
Accepted: 25-March-2025
Copyright: © 2025 Razvan Macarie, Monica Tucureanu, Letitia Ciortan, Mihaela Vadana, Andreea Mihaila, Miruna Naie, Ana Maria Gan, Ileana Manduteanu, Elena Butoi. This is an open-access article distributed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (CC BY-NC 4.0)
Funding: This research did not receive any financial support
Competing Interests: The authors have declared that no competing interests exist

Abstract

The immune-vascular crosstalk is a critical factor in cancer and cardiovascular diseases, driving disease progression through inflammatory, remodeling, and angiogenic pathways. Despite recent progress, the underlying molecular mechanisms that govern the interplay between vascular and immune cells remain elusive. Understanding these interactions provides opportunities for developing novel therapeutic strategies targeting immune and vascular components to improve treatment efficacy and patient outcomes.

In this context, our work aimed to investigate the communication between innate immune cells (monocytes-macrophages) with endothelial cells and smooth muscle cells (SMC). Using different models of cellular cross-talk between monocyte/macrophages and vascular cells, our data reveal that: ***i)*** upon their interaction with monocytes, the molecular signatures of *endothelial cells* suffer transcriptomic changes in processes related to cytoskeleton regulation, focal adhesions, cellular junctions, and cell adhesion, as evaluated by RNAseq analysis, leading to changes in endothelial cells adherence to extracellular matrix, endothelial permeability, monocyte adhesion, and transmigration; ***ii)*** the *SMC-monocyte* interaction induced, in each cell type, an increased mRNA and protein expression of TNFα, IL-1β, IL-6, CX3CR1, MMP-2 and MMP-9, dependent by fractalkine - CX3CR1 axis dependent and by MAPK signaling and activation of NF-kB and AP-1 transcription factors; ***iii)*** when *SMC communicated with macrophages* (MAC), the SMC exhibits increased expression and activity of metalloproteases MMP-9, MMP-1, and augmented secretion of VEGF. Moreover, the conditioned media collected from MAC–SMC co-culture promoted endothelial cell tube formation in Matrigel, signifying an increased angiogenic effect. In addition, MAC exhibited a general increased expression of chemokines (with VCC-1 and GRO-α having the highest fold increase) and of interleukins such as IL-5 (~8-fold) and IL-6 (~4-fold) in MAC. When the cross talk was realized in the presence of resistin (adipose-derived cytokine), a predominant increase of interleukins (the highest fold increase: IL-6, IL-27, IL-23 and IL-5) and an augmented expression of chemokines such as MIP-1β, GRO-α and CCL1 was obtained. Cell communication in the presence of ficolin-2 (a pattern recognition molecule that activates the lectin complement pathway, contributing to innate immunity), induced pro-inflammatory phenotypes in both cell types gained with increased MCP-1, IL-6 and TLR4, in SMC (by activating ERK/MAPK and NF-KB signaling pathways) and IL-1β, IL-6, and MIP-1β in MAC, ensuing enhanced monocyte transmigration.

All these data demonstrate that communication between immune cells and vascular cells affects factors and molecules that could alter processes such as inflammation, tissue remodeling, and angiogenesis, features that could directly dictate the regulation of both, cancer progression and cardiovascular diseases.