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Vascular aging: molecular mechanisms and potential treatments for vascular rejuvenation

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Highlights

- Age-induced cell intrinsic and extrinsic changes alter EC and SMC function
- EC and SMC dysfunction mediates vascular aging
- Stem cell and gene therapies may restore the impaired vascular cell function and promote vascular repair
- Aging diminishes stem cell function
- NANOG reverses stem cell aging

ABSTRACT

Aging is the main risk factor contributing to vascular dysfunction and the progression of vascular diseases. In this review, we discuss the causes and mechanisms of vascular aging at the tissue and cellular level. We focus on Endothelial Cell (EC) and Smooth Muscle Cell (SMC) aging due to their critical role in mediating the defective vascular phenotype. We elaborate on two categories that contribute to cellular dysfunction: cell extrinsic and intrinsic factors. Extrinsic factors reflect systemic or environmental changes which alter EC and SMC homeostasis compromising vascular function. Intrinsic factors induce EC and SMC transformation resulting in cellular senescence. Replenishing or rejuvenating the aged/dysfunctional vascular cells is critical to the effective repair of the vasculature. As such, this review also elaborates on recent findings which indicate that stem cell and gene therapies may restore the impaired vascular cell function, reverse vascular aging, and prolong lifespan.

Keywords: vascular aging; vascular diseases; atherosclerosis; endothelial cells; smooth muscle cells; senescence; endothelial progenitor cells; mesenchymal stem cells; pluripotent factors; NANOG

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