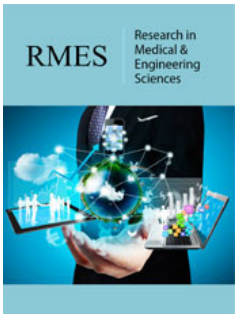
Crimson Publishers
Wings to the Research

Mini Review

Potential Value of Anti-inflammatory in the Prevention and Treatment of Deep Vein Thrombosis

ISSN: 2576-8816



Li Li Sun, Ming Zhang* and Xiao Qiang Li*

Department of Vascular Surgery, Nanjing Drum Tower Hospital, The Affiliated Hospital of Nanjing University Medical School, Nanjing, Jiangsu, China

Abstract

The incidence of deep vein thrombosis (DVT) has been increasing in recent years. In addition to endothelial injury, blood stasis and hypercoagulability, thromb-inflammation describes the complex interplay between inflammation and coagulation that plays a critical role in the pathophysiology of DVT. Leukocytes, endothelial cells and platelets interact with each other, which promote inflammation and play a key role in DVT formation and development. Here, we review the relationship between inflammation and DVT, providing potential value for the development of anti-inflammatory drugs in the prevention and treatment of DVT.

Keywords: Thrombo-inflammation; Coagulation; Deep vein thrombosis; Anti-inflammatory

***Corresponding author:** Xiao Qiang Li and Ming Zhang, MD, PhD, Department of Vascular Surgery, Nanjing Drum Tower Hospital, The Affiliated Hospital of Nanjing University Medical School, #321 Zhongshan Road, Nanjing, 210008, Jiangsu, China

Submission: November 22, 2022
Published: November 29, 2022

Volume 10 - Issue 1

How to cite this article: Li Li Sun, Ming Zhang* and Xiao Qiang Li*. Potential Value of Anti-inflammatory in the Prevention and Treatment of Deep Vein Thrombosis. Res Med Eng Sci. 10(1). RMES.000728. 2022. DOI: 10.31031/RMES.2022.10.000728

Introduction

There is increasing evidence of functional interdependence of inflammation and thrombosis in vascular diseases [1,2]. The interaction between the two processes of thrombosis and inflammation, in which inflammation promotes thrombosis and thrombosis amplifies inflammation, is mediated by endothelial cells, leukocytes and platelets in a process known as immuno-thrombosis [2,3]. Currently, the commonly used clinical treatments for DVT, including anticoagulation and thrombolysis, etc., have the risk of bleeding. Therefore, there is potential value that target inflammation for prevention and treatment of DVT.

Involvement of inflammation in the pathophysiology of DVT

Inflammation plays a key role in the occurrence and development of DVT. On the one hand, inflammation promotes DVT formation and progression, and on the other hand, DVT further amplifies the inflammatory response.

Formation of DVT

Under normal physiological conditions, endothelial cells are in a resting state, and adhesion factor intercellular adhesion molecule-1 is mainly distributed in the junctions between endothelial cells, which has anti-inflammatory, anticoagulant and antithrombotic effects [4]. It is first mechanically activated and, due to inflammation, increases the expression of P-selectin on its surface, thus promoting the adhesion of leukocytes and platelets [5,6]. Intriguingly, anti-P-selectin antibodies have been reported to reduce inflammation, thereby decreasing venous thrombus formation, without increasing the risk of bleeding [7]. Pro-inflammatory cytokines promote the procoagulant state mainly by inducing the expression of tissue factors, thus accelerating the formation of venous thrombosis [8]. To be sure, anti-inflammatory is effective in reducing the risk of DVT formation.

Development of DVT

Fibrinolysis and matrix remodeling are major events in the development of venous thrombosis, affecting the mechanical recanalization of venous thrombosis and the occurrence of post-thrombotic syndrome. In the late stage of DVT, inflammation, particularly through leukocyte recruitment in the vessel wall and thrombus, accelerating its fibrosis, making the vascular wall less compliant, thicker and more conducive to the recurrence of DVT. Polymorphonuclear neutrophils promote DVT resolution and vascular remodeling through NETosis, urokinase release, collagenase and matrix metalloproteases-9 (MMP-9) [9,10]. Interestingly, MMP9 inactivation causes more macrophages infiltration into the thrombus and a relative decrease in the hardness of collagen and elastin fibers during resolution of vein thrombus, which has a significant effect on thrombus resolution and the recovery of vessel wall elasticity but does not affect thrombus formation [11]. Additionally, inflammation has a significant impact on post-DVT vessel recanalization, vessel scarring, fibrosis, compliance, and eventual valve damage. To some extent, anti-inflammatory therapy affects resolution of vein thrombosis and vascular remodeling, as well as the incidence of post-thrombotic syndrome.

Discussion

At present, the commonly used clinical treatments for DVT include anticoagulation and thrombolysis, which increase the risk of bleeding. Inflammation plays a different role in the occurrence and progression of DVT through different molecular mechanisms. Anti-inflammatory therapy is a potentially effective treatment for DVT, which reduces the interference to the normal clotting system and to some extent decreases the occurrence of bleeding related complications. However, the targets of anti-inflammatory therapy may differ at different stages in the progression of DVT. Further research on safe and effective targets for prevention and treatment of DVT in different stages of DVT progression is still needed.

Acknowledgement

This work was supported by grants from the National Natural Science Foundation of China (No. 82070496).

Conflicts of Interest

The authors declare no conflict of interest.

References

1. Kuijpers MJE, Heemskerk JWM, Jurk K (2022) Molecular mechanisms of hemostasis, thrombosis and thrombo-inflammation. International Journal of Molecular Sciences 23(10): 5825.
2. Stark K, Massberg S (2021) Interplay between inflammation and thrombosis in cardiovascular pathology. Nature Reviews Cardiology 18(9): 666-682.
3. Pilard M, Ollivier EL, Gourdou Latyszenok V, Couturaud F, Lemarie CA (2022) Endothelial cell phenotype, a major determinant of venous thrombo-inflammation. Frontiers in Cardiovascular Medicine 9: 864735.
4. Li YS, Haga JH, Chien S (2005) Molecular basis of the effects of shear stress on vascular endothelial cells. Journal of Biomechanics 38(10): 1949-1971.
5. Navarrete S, Solar C, Tapia R, Pereira J, Fuentes E, et al. (2022) Pathophysiology of deep vein thrombosis. Clinical and Experimental Medicine.
6. Mackman N (2012) New insights into the mechanisms of venous thrombosis. The Journal of Clinical Investigation 122(7): 2331-2336.
7. Downing LJ, Wakefield TW, Strieter RM, Prince MR, Londy FJ, et al. (1997) Anti-P-selectin antibody decreases inflammation and thrombus formation in venous thrombosis. Journal of Vascular Surgery 25(5): 816-827.
8. Branchford BR, Carpenter SL (2018) The role of inflammation in venous thromboembolism. Frontiers in Pediatrics 6: 142.
9. Borgel D, Bianchini E, Lasne D, Pascreau T, Saller F (2019) Inflammation in deep vein thrombosis: a therapeutic target? Hematology 24(1): 742-750.
10. Raffetto JD, Khalil RA (2008) Matrix metalloproteinases in venous tissue remodeling and varicose vein formation. Current Vascular Pharmacology 6(3): 158-172.
11. Deatrick KB, Obi A, Luke CE, Elfline MA, Sood V, etal. (2013) Matrix metalloproteinase-9 deletion is associated with decreased mid-term vein wall fibrosis in experimental stasis DVT. Thrombosis Research 132(3): 360-366.