

Plasma Medicine: New Medical Technology

Pathum Sookaromdee¹, Viroj Wiwanitkit²

¹Private Academic Consultant, Bangkok, Thailand.

²Honorary Professor, Dr DY Patil University, Pune, India.

Abstract

Plasma medicine is the new way of medicine. The plasma has many specific biomedical applications created in the open air. A number of reactive oxygen species (ROS) and reactive nitrogen species (RNS), are produced by the controlled reaction. Conceptually, plasma treatment can result in ROS and NO accumulation both intracellularly and extracellularly, which will be useful in medicine.

Keywords: plasma, medicine, application.

Introduction

Plasma is a quasi-neutral gas of neutral and charged particles that has a specific collective behavioral pattern. In physics, it is the fourth state of matter along with solids, gases, and liquids. Plasma medicine is the new way of medicine. The plasma has many specific biomedical applications created in the open air. A number of reactive oxygen species (ROS) and reactive nitrogen species (RNS), are produced by the controlled reaction [1]. Conceptually, plasma treatment can result in ROS and NO accumulation both intracellularly and extracellularly, which will be useful in medicine [1].

Plasma medicine in therapy

There are some new reports on using plasma medicine for therapeutic purposes. For example, plasma-based electrosurgical devices are available and useful for tissue coagulation, cutting, desiccation, and cauterizing [2]. Important reports on applied plasma therapy are summarized in the following table 1. Most reports are application in clinical dermatology and on clody.

Table 1. Reports on using plasma medicine for therapeutic purposes

Reports	Details
Bernhardt et al. [3]	Bernhardt et al. Discussed on applied plasma medicine in dermatology [3]. Bernhardt et al. noted that the technology was useful for treating chronic wounds in humans and could be applied for cancer research [3].
Heinlin et al. [4]	Heinlin et al. said that “ <i>First clinical trials show the efficacy and tolerability of plasma in treating infected chronic wounds</i> [4].”

Karrer and Arndt [5]	Karrer and Arndt. said that <i>“In dermatology, new horizons are being opened for wound healing, tissue regeneration, treatment of skin infections, and tumor therapy [5].”</i>
Boeckmann et al. [6]	Boeckmann et al. noted that <i>“While the use of cold atmospheric pressure plasma for disinfection and wound treatment has already moved into clinical practice, further applications such as cancer treatment are still exploratory [6].”</i>
Zuboret al. [7]	Zuboret al. noted that cold Atmospheric pressure plasma was a new tool for the management of vulva cancer and vulvar premalignant lesions in gynaecological oncology [7].

Plasma medicine in diagnosis

The report on using plasma medicine for diagnostic purposes is limited. Application of the plasma medicine in laboratory medicine is an interesting issue for further researching.

Conflict of interest: None

References

1. Yan X, Ouyang J, Zhang C, Shi Z, Wang B, Ostrikov KK. Plasma medicine for neuroscience—an introduction. *Chin Neurosurg J.* 2019 Oct 19; 5: 25.
2. Gay-Mimbrera J, García MC, Isla-Tejera B, Rodero-Serrano A, García-Nieto AV, Ruano J. Clinical and Biological Principles of Cold Atmospheric Plasma Application in Skin Cancer. *AdvTher.* 2016 Jun; 33(6):894-909. doi: 10.1007/s12325-016-0338-1.
3. Bernhardt T, Semmler ML, Schäfer M, Bekeschus S, Emmert S, Boeckmann L. Plasma Medicine: Applications of Cold Atmospheric Pressure Plasma in Dermatology. *Oxid Med Cell Longev.* 2019 Sep 3; 2019: 3873928.
4. Heinlin J, Morfill G, Landthaler M, Stolz W, Isbary G, Zimmermann JL, Shimizu T, Karrer S. Plasma medicine: possible applications in dermatology. *J Dtsch Dermatol Ges.* 2010 Dec; 8(12): 968-76.
5. Karrer S, Arndt S. Plasma medicine in dermatology: Mechanisms of action and clinical applications. *Hautarzt.* 2015 Nov; 66(11): 819-28.
6. Boeckmann L, Bernhardt T, Schäfer M, Semmler ML, Kordt M, Waldner AC, Wendt F, Sagwal S, Bekeschus S, Berner J, Kwiatek E, Frey A, Fischer T, Emmert S. Current indications for plasma therapy in dermatology. *Hautarzt.* 2020 Feb; 71(2): 109-113.
7. Zubor P, Wang Y, Liskova A, Samec M, Koklesova L, Dankova Z, Dørum A, Kajo K, Dvorska D, Lucansky V, Malicherova B, Kasubova I, Bujnak J, Mlyncek M, Dussan CA, Kubatka P, Büsselberg D, Golubnitschaja O. Cold Atmospheric Pressure Plasma (CAP) as a New Tool for the Management of Vulva Cancer and Vulvar Premalignant Lesions in Gynaecological Oncology. *Int J Mol Sci.* 2020 Oct 27; 21(21): 7988.