IJAPC

Vol. 13 Iss. 1

E ISSN
2350 0204

WWW.IJAPC.COM

GGP

Int J Ayu Pharm Chem
REVIEW ARTICLE
www.ijapc.com
e-ISSN 2350-0204

The Saga of Silver from Argentum to Silver Nanoparticles

Kamath M*

*Division of Ayurveda, Centre for Integrative Medicine and Research (CIMR), Manipal Academy of Higher Education, Manipal, KA, India

ABSTRACT

Rajata is kept in Loha Varga in Indian alchemy, the silver most commonly used for various properties are whiter and bright whereas Agrahya Rajata becomes yellowish red, rough and light. The use of metallic silver is an antimicrobial agent has long been recognized.

Silver yields two key benefits: (i) they are broad-spectrum antibiotics (ii) At the nanoscale, silver exhibits unusual unfamiliar physical, chemical and biological attributes. Nanosilver means which are very minute then 100 nm and comprise of 15-20,000 silver atoms.

Due to its antimicrobial property, nanosilver coatings using in special kinds of garments and coatings on different implants. NS Nano Silver has possessed anti-inflammatory activity and helps in the management of healing process of the wound, Nanosilver can be used manufacturing in better dressings for wounds, burns which helps in the rapid healing or repair of damaged cell process during wound.

KEYWORDS

Rajata, *Nanoparticle*, *Silver*

Greentree Group Publishers

Received 06/04/20 Accepted 28/05/2020 Published 10/07/2020

INTRODUCTION

Rajata is known as silver. A detailed description of Rajata you will get it in Rasa Shastra (Indian alchemy), proper use of Rajata both for utensils and medicine started only after the medieval period of Rasa Shastra. After analyzing the available books . , Rajata can be described as below: Group-? Rajata is kept in Loha Varga in Indian alchemy, based on quality, silver is of superior and inferior quality. Good quality Raiata is heavy, smooth, soft and white like Shankha or moon. After cutting and heating it should be clear, non-brittle, white and solid. It bears heat and hammering whereas inferior quality Rajata breaks with cracks and looks hard. In the intense fire, The silver most commonly used for various properties are more white and bright whereas Agrahya Rajata becomes yellowish red, rough and light.

The use of metallic silver is one of the antimicrobial agent has long been recognized[1,2]. Silver mainly processes two key benefits:

1) broad-spectrum antibiotic~~s~~ and

2) still allied with drug resistance

3). Its usage can afford a novel therapeutic property scar wound healing[3] it was observed that the antibacterial The activity of antibiotics like penicillin G, amoxicillin, erythromycin, clindamycin [4].

Diluted silver nitrate solution ~~is~~ was used subsequently during 19th century period in the management of infections and burns ~~earlier~~ even before the introduction of silver sulphadiazine cream [5]. It is observed that Silver-coated coverings have been proved to be active at killing a broader range of bacteria than the cream base, and they cause not as much of irritating in comparison to silver nitrate solution tolerated [6].

Silver-coated dressings are used comprehensively in the treatment of the wound, especially burn wounds [7,8], chronic leg ulcers[9], diabetic wounds[10] and traumatic injuries. These coverings differ in containing compounds to sustained silver-ion release preparation[11] and silver-based crystalline nanoparticles[12]. The practice of these combinations and we have to focus on the mechanisms of silver resistance [13].

It is observed that the benefit of Ag Silver use is having narrow side effects of adverse effect, And it can be resolved with cessation of therapy[14,15]. The antibacterial commonly available bacterial stains silver-coated dressings were equated against burn-wound pathogens likely MRSA, E. faecalis, P. aeruginosa, E. coli, E.cloacae, P. vulgaris, A. baumannii and BM4454, using a broth culture method. The rapidity demolishing these pathogens evaluated.[17] During 1000 B.C., the antimicrobial attributes of silver in rendering potable drinking water were cherished[16.17].

As a metal, silver is relatively inert and is poorly absorbed by mammalian or bacterial cells. However, in the occurrence of wound fluids or other secretions, it easily ionizes and converts highly reactive in binding to proteins and cell membranes[20]. Like to other heavy metals, silver is toxic to microorganisms ~~by poisoning~~ as it poisons the respiratory enzymes and constituents of the microbial electron transport system, it also damages some DNA function [21,22]. The greatest important nanoproduct is nanosilver. Nanosilver means which are smaller than 100 nm and contain 20-15,000 silver atoms.

At the nanoscale, silver exhibits unusual unfamiliar physical, chemical and biological attributes. Due to its antimicrobial property, nanosilver coatings are useful in various types of cloths, useful in different kinds of implants. NS has possessed anti-inflammatory activity and helps in wound healing, wound dressings and burns[23,24,25].

It is observed that the experimental wound-healing properties of silver nanoparticles in a wound healing observed that it results in the speedy recovery and better-quality cosmetic look occur in a dose-dependent way[26]. And it is observed that silver nanoparticles (AgNPs) have the potency to enhance wound healing by accelerating re-epithelization and enhanced variation of fibroblasts. However, the working mode of AgNPs in repairing skin is unknown.

So AgNPs were mainly held responsible management of collagen and causes the wound healing process [27]. The human body has many systems one among is a female genital tract. A way of entry of potential nanosilver has been fused into maternal hygiene products[28,29,30], nanoparticles Here may undergo various processes like binding and react with proteins, phagocytosis, clearance etc.

While these nanoparticles can stimulate a spectrum of tissue responses such as cell generation and activation of reactive oxygen species (ROS), inflammation and cell death[31] done based on various techniques used in the manufacture of these textiles are called “smart textiles” It is observed that Intradermal nanoparticles have the ability to enter the subcutaneous lymphatics[32] While Injured skin also permits these micron-sized particles to help to improve the dermis and local lymph nodes [33].

Dressings and bandages coated with silver nanocrystallites are good for inhibition of skin sepsis-like burns and DVT, or Diabetic ulcers. Nanoparticles to enter through meet halfway skin barrier and increase access to the dermal capillaries. Absorption of nanosilver into the circulation has been indicated. Despite experimental and clinical studies endorsing the dermal biocompatibility of nano silver-based dressings [34,35,36], these obvious differences might be attributable to the difference in experimental conditions and techniques working. Thus, the establishment of a set of integrated and standardized evaluation protocols is necessary.

It is revealed that Genotoxity observed in fast growth in the use of silver nanomaterials metal in those using consumer silver nanoparticle products and biomedical applications resulted in increased exposure to humans and the environment[37].

DISCUSSION

Modern literature of silver was also reviewed. The Latin name of silver i.e. Argentum gives the meaning white and shining; this supports the appearance of silver as lustrous white metal.

The modern usage of silver is also a precious metal in jewellery. It is also used to prepare medals and high-end musical instruments, in photography, electronics, in nuclear reactors and as a catalyst. Apart from this, medical use of silver is gaining popularity. Its old use was in dentistry as a dental filling.

Now after the extensive research antimicrobial effect of silver ions, nanoparticles and silver compound has been established. Hence it is being used in clothing, wound dressings etc. Septicemia main cause of people died from burns and diabetic wounds. The US Centers for Disease Control have forecast more deaths from antimicrobial-resistant bacteria t by 2050.

Silver nanoparticles are metal-based nanoparticles and are appreciated for their excellent antimicrobial properties. However, recently some disadvantages were observed in case of fighting infections, such as bacterial resistance. This analysis best part of the treatment tactics of using wound management and finally genotoxicity.

CONCLUSION

Silver (Rajatha) one of the most ancient and noble metal explained in Indan alchemy its ideal form for internal administration is Calcinated silver (rajatha bhasma). Silver ions, silver nanoparticles and silver compounds have indicated the antimicrobial effect. Alcoholic extract of rajatha bhasma was formed to be most useful in all types of bacterial strain studied like Escherichia coli, Pseudomonas aeruginosa, Staphylococcus aureus and Candida albicans. However, Candida albicans remain resistant against all the test drug samples used. In conclusion, silver one of the noble metal .further studies are required to expose its qualities.

REFERENCES

1. Klasen, H. J. (2000). A historical review of the use of silver in the treatment of burns. II. Renewed interest for silver. Burns, 26(2), 131-138.

2. Lansdown, A. B. (2002). Silver I: its antibacterial properties and mechanism of action. Journal of wound care, 11(4), 125-130.

3. Lansdown, A. B. (2002). Silver I: its antibacterial properties and mechanism of action. Journal of wound care, 11(4), 125-130.

3. Tian, J., Wong, K. K., Ho, C. M., Lok, C. N., Yu, W. Y., Che, C. M., ... & Tam, P. K. (2007). Topical delivery of silver nanoparticles promotes wound healing.ChemMedChem: Chemistry Enabling Drug Discovery, 2(1), 129-136.

4. Rai, M., Yadav, A., & Gade, A. (2009). Silver nanoparticles as a new generation of antimicrobials.Biotechnology advances, 27(1), 76-83.

5. Fox, C. L. (1968). Silver sulfadiazine-a new topical therapy for pseudomonas in burns: therapy of pseudomonas infection in burns. Archives of surgery, 96(2), 184-188.

6. Wright, J.B., Lam, K., & Burrell, R. E. (1998). Wound management in an era of increasing bacterial antibiotic resistance: a role for topical silver treatment. American journal of infection control, 26(6), 572-577.

7. Ross, D., Phipps, A., & Clarke, J. (1993). The use of cerium nitrate-silver sulphadiazine as a topical burns dressing. British journal of plastic surgery, 46(7), 582-584.

8. Caruso, D. M., Foster, K. N.,Hermans, M. H., & Rick, C. (2004). Aquacel Ag® in the management of partial-thickness burns: results of a clinical trial. The Journal of burn care & rehabilitation, 25(1), 89-97.

9. Karlsmark, T., Agerslev, R. H., Bendz, S. H., Larsen, J. R., Roed-Petersen, J., & Andersen, K.E. (2003). Clinical performance of a new silver dressing, Contreet Foam, for chronic exuding venous leg ulcers. Journal of wound care, 12(9), 351-354.

10. Hilton, J. R., Williams, D. T., Beuker, B., Miller, D. R., & Harding, K. G. (2004). Wound dressings in diabetic foot disease. Clinical infectious diseases, 39(Supplement_2), S100-S103.

11. White, R. J. (2001). An historical overview of the use of silver in wound management. British Journal of Nursing, 10(Sup4), S3-S8.

12. Klaus, T., Joerger, R., Olsson, E., & Granqvist, C. G. (1999). Silver-based crystalline nanoparticles, microbially fabricated. Proceedings of the National Academy of Sciences, 96(24), 13611-13614.

13. Silver, S. (2003). Bacterial silver

resistance: molecular biology and uses and misuses of silver compounds. FEMS microbiology reviews, 27(2-3), 341-353.
14. Lansdown, A. B.G. (2002). Silver 2: toxicity in mammals and how its products aid wound repair. Journal of wound care, 11(5), 173-177.
15. Marshall, J. P., & Schneider, R. P. (1977). Systemic argyria secondary to topical silver nitrate. Archives of Dermatology, 113(8), 1077-1079.
16. Ip, M., Lui, S. L., Poon, V. K., Lung, I., & Burd, A. (2006). Antimicrobial activities of silver dressings: an in vitro comparison. Journal of medical microbiology, 55(1), 59-63.
17. A.D. Russell, W.B. Hugo;Antimicrobial activity and action of silver Prog Med Chem, 31 (1994), 351-370
18.J.W. Richard III, B.A. Spencer, L.F. McCoy Acticoat™ versus Silverlon®: the truth J Burns Surg Wound Care, 1 (2002), 11
20. Lansdown, A. B. (2010). Silver in healthcare: its antimicrobial efficacy and safety in use. Royal Society of Chemistry.
21. Choudhury, R., & Srivastava, S. (2001). Mechanism of zinc resistance in Pseudomonas putida strain S4. World Journal of Microbiology and Biotechnology, 17(2), 149-153.
22. Wright, J. B., Lam, K., & Burrell, R. E. (1998). Wound management in an era of increasing bacterial antibiotic resistance: a role for topical silver treatment.American journal of infection control, 26(6), 572-577.
23. Atiyeh, B. S., Costagliola, M., Hayek, S. N., & Dibo, S. A. (2007). Effect of silver on burn wound infection control and healing: review of the literature. burns, 33(2), 139-148.
24. Chaloupka, K., Malam, Y., & Seifalian, A. M. (2010). Nanosilver as a new generation of nanoproduct in biomedical applications. Trends in biotechnology, 28(11), 580-588.
25 Tian, J., Wong, K. K., Ho, C. M., Lok, C.N., Yu, W. Y., Che, C. M., ... & Tam, P. K. (2007). Topical delivery of silver nanoparticles promotes wound healing. ChemMedChem: Chemistry Enabling Drug Discovery, 2(1), 129-136.
26. Kwan, K. H., Liu, X., To, M. K., Yeung, K. W., Ho, C. M., & Wong, K. K. (2011). Modulation of collagen alignment by silver nanoparticles results in better mechanical properties in wound healing.Nanomedicine: Nanotechnology, Biology and Medicine, 7(4), 497-504.
27. Chen, X., & Schluesener, H. J. (2008). Nanosilver: a nanoproduct in medical application. Toxicology letters, 176(1), 1-12.
28. Zhang, Y., Chen, F., Zhuang, J., Tang, Y., Wang, D., Wang, Y., ... & Ren, N. (2002). Synthesis of silver nanoparticles via

electrochemical reduction on compact zeolite film modified electrodes. Chemical Communications, (23), 2814-2815.
29. Sun, Y.,& Xia, Y. (2002). Shape-controlled synthesis of gold and silver nanoparticles. science, 298(5601), 2176-2179.
30. Chen, X., & Schluesener, H. J. (2008). Nanosilver: a nanoproduct in medical application. Toxicology letters, 176(1), 1-12.
31. Gopee, N. V., Roberts, D. W., Webb, P., Cozart, C. R., Siitonen, P. H., Warbritton, A. R., ... & Howard, P.C. (2007). Migration of intradermally injected quantum dots to sentinel organs in mice. Toxicological Sciences, 98(1), 249-257.
32. Kim, S., Lim, Y. T., Soltesz, E. G., De Grand, A. M., Lee, J., Nakayama, A., ... & Cohn, L. H. (2004). Near-infrared fluorescent type II quantum dots for sentinel lymph node mapping. Nature biotechnology, 22(1), 93-97.
33. Chen, J., Han, C. M., Lin, X. W., Tang, Z. J., & Su, S. J. (2006). Effect of silver nanoparticle dressing on second degree burn wound. Zhonghua wai ke za zhi [Chinese journal of surgery], 44(1), 50-52.
34.Wright, J. B., Lam, K., Buret, A. G., Olson, M. E., & Burrell, R. E. (2002). Early healing events in a porcine model of contaminated wounds: effects of nanocrystalline silver on matrix metalloproteinases, cell apoptosis, and healing. Wound Repair and Regeneration, 10(3), 141-151.
35. Supp, A. P., Neely, A. N., Supp, D. M., Warden, G. D., & Boyce, S. T. (2005). Evaluation of cytotoxicity and antimicrobial activity of Acticoat® burn dressing for management of microbial contamination in cultured skin substitutes grafted to athymic mice. Journal of Burn Care & Rehabilitation, 26(3), 238-246.
36. Muangman, P., Chuntrasakul, C., Silthram, S., Suvanchote, S., Benjathanung, R., Kittidacha, S., & Rueksomtawin, S. (2006). Comparison of efficacy of 1% silver sulfadiazine and ActicoatTM for treatment of partial-thickness burn wounds.JOURNAL-MEDICAL ASSOCIATION OF THAILAND, 89(7), 953.
37. Patlolla, A. K., & Tchounwou, P. B. (2020). Genotoxicity of Silver Nanoparticles (Ag-NPs) in In Vitro and In Vivo Models. In Nanotechnology in Skin, Soft Tissue, and Bone Infections . 269-281. Springer, Cham.