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Anticancer, Antimicrobial and Antitumour Activities of Antimony Complexes

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ABSTRACT: This review conceptualizes the historical anticancer antimicrobial and antitumour activities of compounds of antimony with examples.

KEYWORDS: Antimony, Anticancer, Antimicrobial, Antitumour Activities.

1. INTRODUCTION

Antimony is a natural element, a metalloid with atomic number of 51 [1]. The symbol, Sb, has a Latin derivation known as stibium [1]. It has two common oxidation states of +III (Sb_2O_3) and +V (Sb_2O_5) like arsenic (As_2O_3 and As_2O_5) [2]. In addition to the + III and +V oxidation states of antimony, another compound of antimony is antimony tetroxide, Sb_2O_4. [3].

B. Desoize from his study gave his perspective that antimony was a poison, but Sb_2O_3, was very much less toxic than As_2O_3 [4]. C. Hansell also wrote that antimony was toxic when absorbed when breathing or orally [1]. Treatments that entail mainly antimony are referred to as, antimonies [5]. Many centuries ago, antimony was used as therapeutics. Some researchers wrote about its earliest use in Egypt for cosmetic reasons, though the statement was a misread [5, 6]. The relevance of antimony in beforetime medicine is acknowledged because of the deliberation of its use during that era [5-7]. In the 14th century, Alchemist John of Rupescissa, used antimony and its compounds as therapeutic agents to treat two parasitic diseases of leishmaniasis and schistosomiasis [5]. In the 16th century, Paracelsus used antimony, as a panacea and he commended it as one out of the seven surprises on the earth [5]. In 1905, Plimmer and Thompson confirmed the actions of sodium and potassium salts of tartrate against the disease of trypanosomiasis. Further use was extended to Africa for the treatment of trypanosomiasis in human [5]. In 1913, Vianna used potassium antimony(III) tartrate to treat leishmanial [5] and also reported the application of trivalent antimony, tarteremetic to treat cutaneous leishmaniasis [5]. The same year, 1913, Di Cristina, Caronia and Roger established the efficacy against visceral leishmaniasis [6]. Afterwards, the drug was discovered to be very toxic and not stable in tropical climate [5]. The disagreement of Shortt from India with the outcome made him to write that the use of antimony had drawbacks of clinical resistances and set back [5].

M. Cole concluded from his statement that, there was no need for the use of tartar emetic due to the side effects of being an irritant drug that caused coughing, despair and chest aches [5-6]. In 1920, Brahmachari introduced the use of pentavalent antimonials where the compound of urea stibamine was synthesized [5]. It was an efficient, effective chemotherapeutic agent used by Indians to save their lives against a disease known as Indian kala-azar [5]. Other scientists like Schmidt Kikuth worked to develop less poisonous pentavalent antimonials, such as the syntheses of antimony gluconate

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and sodium stibogluconate in 1937 and 1945 respectively [5]. Sodium antimony gluconate and meglumine antimoniate were the two mostly used antimony compounds manufactured in India by Albert-David and by Rhone-Poulence in Paris respectively [8].

More than hundred years ago, the use of antimony and its compounds as drugs were due to their potentials and chemotherapeutic effectiveness against the disease of acute promyelocytic leukemia, APL [9]. Within 1960, Edward Tiekink, Sharma et al and Hsu et al stated that compounds of Sb (III) had potentials for antitumor activities with amino polydentate carboxylic acids for oxygen coordination modes, among some metal ions such as Ba, Bi, Co, Cu, Mn, Ni, Pb, Sn and Zn [10-13]. They further said the in vivo application resulted to an increase in life span of mice induced with Ehrlich ascites tumour and spindle sarcoma [10, 11]. For nitrogen coordination modes, Edward Tiekink and Sharma P. et al reported that Na[Sb (Hdtpa)].4.5 H2O displayed cytotoxic properties in human promyelocytic HL-60 cells. [10-12]. The H5dtpa in Na [Sb (Hdtpa)].4.5 H2O is diethylenetriaminepentaacetic acid and also a potential for antitumour activities when applied in vivo [10-12]. For sulfur donors, diphenylantimony(III) thiolates of Ph2Sb(S2PPh2) and Ph2Sb(S2P (OPr)2 of thiolates' ligands displayed both potentials for antitumour activities from screening done in vitro and in vivo, but possessed mutagenic effect at higher concentrations [10-12]. Antitumour activities were also displayed when tungstic heteropolyanions were coordinated with antimony coupled with the potentials of anti-viral activity [11]. Antimony (V) compounds also possess potentials for cytotoxicity [10-11]. The most effective Sb (V) compounds had donations from adenine and diaminoanthraquinone [10-11]. Toxic effects of therapeutic application of antimony compounds are cardiotoxicity, nephrotoxicity and pancreatitis [14].

2. CONCLUSION

The review of the compounds of antimony justified the fact that though metal is considered toxic, the compounds, most especially the complexes have biological relevance in the areas of anticancer, antiparasitic and antitumour activities.

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