Review of Analytical Techniques for the Detection of Drugs Used in Kaposi Sarcoma

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Abstract

Human herpesvirus 8 is linked to the aetiology of Kaposi sarcoma, a rare angioproliferative tumour. Kaposi sarcoma lesions are characterized by purplish, red-blue, or brown-black macules, papules, and nodules that are vulnerable to bleeding and ulceration and commonly affect the skin or mucosal surfaces. Some of the medications utilised in the therapy are doxil, pomalidomide, paclitaxel and vinblastine sulfate. In the current study, a quick overview of the analytical techniques created for the estimate of these medications was covered.

Keywords: *Kaposi Sarcoma, Doxil, Paclitaxel, Pomalidomide and Vinblastine sulfate*

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Introduction

Infection with the human herpes virus is the primary cause of Kaposi's sarcoma (KS), a malignancy (HHV8 or K-HSV).Patients who are immunosuppressed (such as those with HIV or who have undergone transplantation) as well as immunocompetent people (the endemic population) can both get KS.The clinical pathology of KS varies greatly depending on the location of the lesions (lymph node, internal, or cutaneous), clinical stage (patch, plaque, or nodular), and epidemiological classification. The virus that causes KS is known as KSHV, or human herpesvirus-8. Viral proteins can lead to KS-related cellular changes that enable the virus to evade the host immune system and enable the infected cell to survive and proliferate even in the presence of the virus. **[1]**. Doxil, Paclitaxel, Pomalidomide, and Vinblastinesulfate are a some of the medications used to treat Kaposi sarcoma (figure1). A review of analytical techniques created thus far for the assay of these medications were discussed in the current study. (table-1).

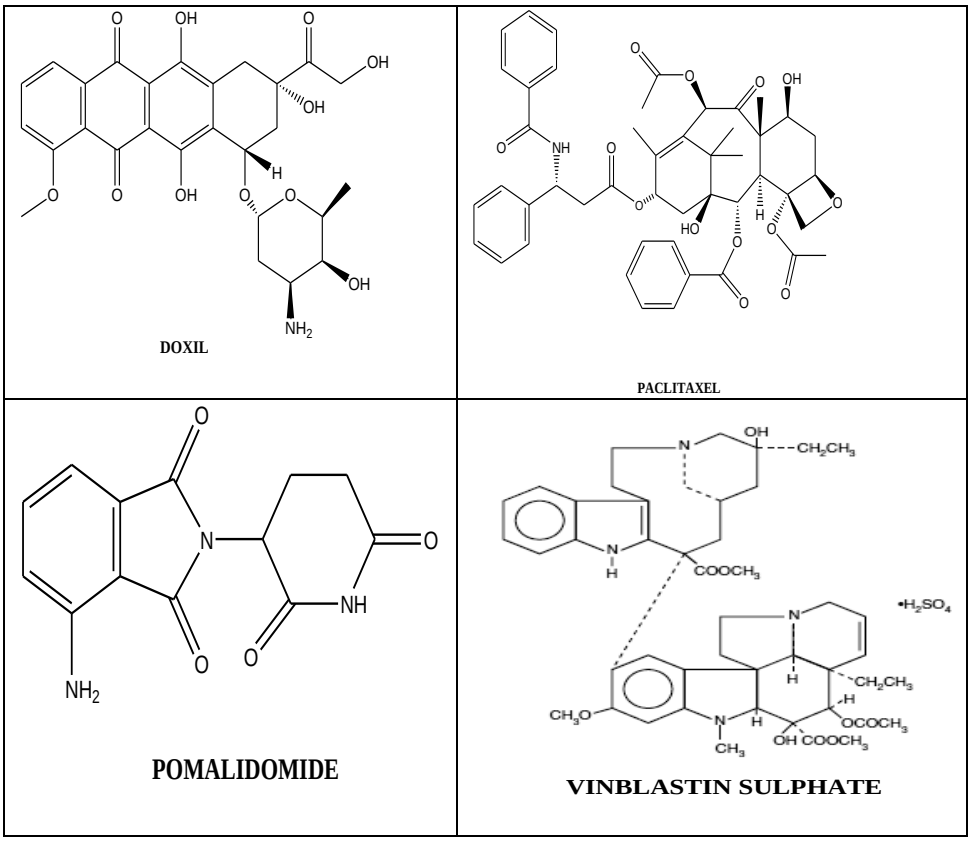

Figure-1: Chemical Structure of Drugs used in Kaposi Sarcoma

The first-line chemotherapy treatment for Kaposi sarcoma is doxorubicin ($C_{27}H_{29}NO_{11}$) liposomal peptides. Anthracycline antibiotic doxorubicin (DXR) inhibits topoisomerase II, suppresses transcription, and causes cytotoxicity by generating oxygen free radicals. It is also known to intercalate with DNA base pairs and bind to DNA-associated enzymes. [2].

Paclitaxel is a potent second-line alternative to liposomal anthracyclines ($C_{47}H_{51}NO_{14}$). The medicine paclitaxel has the power to prevent angiogenesis through a variety of mechanisms. Cell motility, proliferation, and migration are all hampered as a result of its initial effect on

microtubules. Additionally, paclitaxel downregulates VEGF and Angiopoietin-1 while upregulating thrombospondin-1 (TSP-1)(Ang-1)67. [3].

Pomalidomide ($C_{13}H_{11}N_3O_4$), an oral thalidomide derivative, possesses antiangiogenic, antiproliferative, and immune-modulating effects. The E3 ubiquitin ligase cereblon, which breaks down the proteins ikaros (IKZF1) and aiolos, is the mechanism by which they function (IKZF3). 17,18 Examples of downstream consequences include an increase in CD4+ and CD8+ T-cell costimulation, as well as the modification of tumour necrosis factor, interleukin-6, and vascular epithelial growth factor (VEGF).[4].

Vinblastine ($C_{46}H_{60}N_4O_{13}S$), one of the vinca alkaloids, prevents tublin from polymerizing, which prevents the disappearance of the microtubular spindle and halts cell division in its metaphase. Furthermore, the medication may induce the cytochrome P450 monooxygenase system to generate an excessive amount of ROS or RNS. [5]

Table- 1: Review of analytical methods published for the drugs used in Kaposi Sarcoma

METHOD	MOBILE PHASE(V/V)	REFERENCE
DOXIL		
1.LIQUID CHROMATOGRAPHY-TANDEM MASS SPECTROMETRY	0.1%formic acid in water and 0.1%formic acid in acetonitrile.	6
2.ULTRACENTRIFUGATION	doxorubicin-2mg/mL with 97.3% encapsulation in the loaded liposomes.	7
3.HPLC (RAT PLASMA)	water:acetonitrile(30:70,pH 3.0,adjusted with 85%phosphoric acid)	8
4.RP-HPLC METHOD FROM VACCUM FOAM DRIED FORMULATION	acetonitrile:0.01M o-phosphoric acid (40:60)	9
PACLITAXEL		
HPLC Method (Micelles in tumor Bearing Mice)	Sodium acetate buffer Salution (0.01M)/acetonitrile at (58/42 v/v)	10
RP-HPLC	Methanol: Acetonitrile: hateve (40:40:20)v/v)	11
RP-HPLC (Human Plasma)	60% acetonitrile, 40% of 10nm ammonium acetate buffer solution and 0.1% formic acid	12

RP-UFLC	Acetonitrile and Phosphate buffer = 50:50 at a flow rate 1.0 ml/minute.	13
RP-HPLC	Acetonitrile:Water 80:20 (v/v)	14
HPLC-MSMS	Acetonitrile -water + formic acid 0.1% (55:45.vlv)	15
LC-MS/MS (Human Plasma)	Methanol and 0.1 formic acid in Millia Water (90:10 v/v)	16
POMALIDOMIDE		
RP-HPLC	Methanol: Phosphate buffer = 60:40 ratio at a flow rate of 1.0/ min	17
LC/MS (Mouse Plasma and Brain Tissue)	Water and Acetonitrile with 0.1% Formic acid	18
LC-MS/MS (Human plasma)	Methanol and 10 mmol/L Aqueous solution of ammonium acetate containing 0.1% Formic acid	19
Hyphenated LC/MS Techniques	0.1% of Formic acid solution and Acetonitrile	20
UPLC-MS/MS (Human plasma)	0.1% (v/v) Formic acid in Water to Methanol at a ratio of 12:88	21
RP-UPLC	0.1 Potassium dihydrogen orthophosphate	22
LC- MS	0.1 Formic acid solution and Methanol	23
VINBLASTINESULFATE		
RP_HPLC Method	methanol – phosphate buffer (5 mM, pH 6.0)	24
LC–APCI–MS/MMSl (Canine plasma and urine sample)	5 mM ammonium acetate and methanol.	25
LC –high resolution mass spectrometry (Tumour tissue)	water and acetonitrile. The flow rate was 0.3 mL/min	26

Conclusion:

The authors working in analytical chemistry will find the present review to be extremely beneficial for developing methods and validating medications used to treat kaposi sarcoma.

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