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REVIEW ON STUDY OF TELMISARTANIN UV SPECTROSCOPY AND HPLC

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ABSTRACT

Angiotensin II receptor blocker (ARB) telmisartan is commonly administered for the treatment of hypertension and specific cardiovascular diseases. It works by the type 1 angiotensin II. (ATI) receptors, which attraction angiotensin II from having its vasoconstrictive and aldosterone-secreting reactions. In addition, unique characteristics of telmisartan have been discovered, such as partial agonism at activation receptor for peroxisome proliferator gamma (PPAR-Y), it will offer extra perks to the cardiovascular and metabolic systems. Its capacity to reduce blood pressure, lowering circulatory events, and improving outcomes among patients with to variety of cardiovascular risk factors has been shown in clinical research. The safety profile of telmisartan is generally favourable and it is well- tolerated. In any medication, there is a chance of some side effects, such as hyperkalemia, hypotension, and renal failure. All things considered, telmisartan is a significant medicine alternative with the treatment of blood-vascular diseases also hypertension, especially in individuals who also have concurrent metabolic abnormalities.

Keywords: Blood Pressure, Recptor, Hypertension, Telmisartan, angiotension.

INTRODUCTION

2-{[4-methyl-6-(1-methyl-1H,3-benzodiazol-2-yl)-2-propyl-1H-1,3-benzodiazol-1-yl]methyl}phenyl) benzoic acid be present in telmisartan. Angiotensin II receptor antagonists (ARBs) as this type are used to treat high blood pressure.. It is used to treatment of high blood pressure. It increase high blood pressure helps prevent strokes, heart attacks, and kidney problems. Oral route is preferred route of drug administration as smooth more convenient of drug uptake.[1,2,3]

The review of Literature published because there are many method like HPLC, UV, HPTLC and LC-MS/MS to work out of Telmisartan. Telmisartan is also available as an HPLC sample using the simultaneous technique. The analytical formulation method development of drug molecule. They create a system for estimation drug samples that is simple to handle sensitive, precise, accurately, and repeatable. The ICH guideline is developing and accuracy of UV spectroscopy.[4,5]

History of Telmisartan

The commonly recognised angiotension-2 receptor blocker (ARB) having a long track record in the drug industry is telmisartan.

- **Research and Creation:** Telmisartan was advanced by Boehringer Ingelheim Pharmaceuticals, Inc in 1990s as a part of project aimed at generate effective antihypertensive drug improved safety profiles.
- **Approval:** According to the first few years of the 2000s, the telmisartan was approved for medical used in several of countries, including the US and Europe. In 2000s, telmisartan for was given the US Food and Drug Administration's approval (FDA).[6]
- **Mechanism of Action:** In selectively blocking the angiotension-2 type 1 (AT1) receptor, telmisartan lowers blood pressure and causes vasodilation. The pharmacological literature is well documented in this mechanism.[7]
- **Clinical Use:** To the treatment of hypertension, telmisartan may be prescribed, either by its products or in addition to further

antihypertensive medications. Inside high-risk patients, it is also used to prevent cardiovascular events. Studies conducted in the real world and in clinical trials established its safety and effectiveness.[8]

- **Pharmacokinetics:** Telmisartan has separate pharmacologic characteristics, including an extended life span and elevated lipophilicity. These characteristics encourage the medication's once-daily dosage the schedule and long-lasting blood pressure-lowering benefits.[9]
- **Research and Development:** The Research on telmisartan's possible medicinal uses beyond hypertension, which includes its role in neuroprotection, metabolic syndrome, and renal protection, continues continuous.[9]

Marketed Formulation of Telmisartan

In all over the world, telmisartan is marketed in several types of formulations, such as tablets, capsules, and combination products. These formulations, of which are made by various pharmaceutical companies, may contain telmisartan by itself or in additional to other antihypertensive drugs.

- **Micardis Tablets:** The under Boehringer Ingelheim Pharmaceuticals, Inc. supplies telmisartan tablets under the brand name Micardis. Micardis tablets are available in different strengths, usually in the range of 20 mg to 80 mg, and are used to treat hypertension and lower the risk of cardiovascular disease.[11]
- **Pritor Tablets:** Pritor is another brand name for Telmisartan tablets also marketed by Borhringer Ingelheim in confident countries. Like Micardis, Pritor tablets are avalible in different stringth and are indicated considering treatment of hypertension.[12]
- **Twynsta Tablets:** The Amlodipine, a medication that blocks calcium channels, and telmisartan are combined in the product Twynsta. Boehringer Ingelheim is the company that markets this combination, which comes in different strengths and is used to treat hypertension.[13]
- **Telmisartan/Hydrochlorothiazide Combination Tablets:** The Tablet forms of telmisartan are also used when combined with the diuretic hydrochlorothiazide. The pharmacies all over the world market these combination products under different brand names.[14]
- **Telmisartan Capsules:** Tablets are the most common form of telmisartan, other than capsules may be available for certain formulations. Generic pharmaceutical companies may manufacture these capsules and market it under different brand names.[15]

Pharmacodynamic Properties

Nonpeptide angiotensin II antagonist telmisartan used orally that works in concert with the AT1 receptor subtype. It has the greatest attraction regarding the AT1 receptor along with the lowest attachement to the AT2 sense organ among the accessible commercially ARBs. Angiotensin I converts into angiotensin II with the action of the angiotensin-converting enzyme (ACE, kininase II). Angiotensin II, the main pressor of the rennin-angiotensin system, results in Vasoconstriction stimulates the heart, induces the kidneys to absorb sodium, and increases the production and secretion of aldosterone. Telmisartan spend by preventing the vasoconstrictor and aldosterone secretary effects of angiotensin II.[16]

Workings of Action in Telmisartan

Telmisartan is define reversible and specifically to the vascular smooth muscle and adenal gland receptors smooth muscle, interfere with the binding of angiotensin II toward the angiotensin II AT1-receptor. The decreased systemic vascular resistance occurs when the consequences of angiotensin II, a vasoconstrictor that also generates the formation and distribution of steroids be blocked. The angiotensin change enzyme additional hormone receptors, and ions channel are not inhibited by telmisartan. Study has show telmisartan functions as a partial agonist of PPARγ, a known target for medications that treat diabetes. This implies that telmisartan can regulate insulin resistance, improve lipid and carbohydrate metabolism, and avoid the adverse effects responsible to full PARγ activators.[17]

HPLC Work in Telmisartan

The following have been the components of the liquid chromatographic system. Photodiode array (PDA) detector, Rheodyne injectors combining a 20µl fixed loop, Herbert Knauer, Advanced Scientific Apparatus with Smartline Pump 100ml/min, and detection. Using Genesis C18 column with 5 µm standard size and 250×4.6 nm i.d., chromatographic analysis be carried out using Eurochrome software. It picked up free samples of analytically pure RAM and TEL from Cipla Ltd. in Verna, Goa, India. In the process of making the mobile phase, the orthophosphoric acid and potassium dihydrogen phosphate (KH_2PO_4) to sodium dodecyl sulfate. The good chemicals in Mumbai, India were of analytical grade, while acetonitrile(C_2H_3N), methanol(CH_3OH) and water

purchased from e-mark in Mumbai, India were in HPLC grade. Purchased from the area pharmacy, the tablet formulation contained the prescribed dosage of 40 mg TEL and 5 mg RAM.[18]

- **Analytical Method Development:** The development HPLC techniques for the quantification the telmisartan in a number of pattern, such as tablets, capsules, and biological samples, has been the subject of numerous studies. To obtain highly precise and precise results, these methods usually involve optimum parameters such as the detection wavelength, column type, and mobile phase composition.
- **Validation of HPLC Methods:** There are established HPLC techniques for telmisartan analysis that are appropriate for pharmacokinetic research and routine quality control, as demonstrated by analysis studies in the literature. It usually, robustness, specificity, linearity, and accuracy are actually validation guidelines.
- **Use in Research on Pharmacokinetics:** Telmisartan concentrations in biological samples are frequently measured using HPLC-based assays for pharmacokinetic research. These studies provide significant insights into the distribution, metabolism, removal, and absorption of drugs in humans as well as animals.
- **Stability Studies:** The analysing the stability in biological matrices and drug formulations of telmisartan under varied storage conditions, HPLC methods are used. The quality and duration of storage of products containing telmisartan are ensure by these studies.[19-21]

Advantages of Telmisartan

- **Cardiovascular Protection:** It has been demonstrated that telmisartan secures the cardiovascular system, reducing the risk for major cardiovascular events. It comparing telmisartan to placebo or ramipril, the ONTARGET trial decreased in the combined result in cardiovascular expiry, stroke, myocardial infarction (MI), or being hospitalised due to cardiac failure.[22]
- **Hypertension Control:** Patients with BP can effectively lower the blood pressure with telmisartan. Research has shown that when taken once daily, it can maintain blood pressure control over up to 24 hours, which improves patient adherence and blood pressure control.[23]
- **Renal Protection:** In particular for those with diabetes and hypertension, telmisartan has renoprotective effects. Telmisartan reduced the advance of renal disease in risky individuals, including those with type II diabetes, according to the TRANSCEND trial.[24]
- **Metabolic Benefits:** It benefits to metabolism beyond controlling high blood pressure have been associated with telmisartan. According to studies, telmisartan improves lipid profiles and insulin sensitivity, that can reduce the risk of developing diabetes and dyslipidemia.[25]
- **Safety Profile:** Telmisartan is usually tolerated well and has a good safety profile. It is safe for long-term use because clinical trials have shown that its side effect profile is similar to a placebo.[26]

Dissadvantage of Telmisartan

- **Hyperkalemia:** It similar to other ARBs, telmisartan may sometimes increase serum potassium levels, especially in individuals who have previous kidney disease or use potassium supplements.[27]
- **Hypotension:** Telmisartan treatment can lead to a significant drop in blood pressure, or hypotension, particularly in patients who are volume-depleted or taking in line diuretics.[28]

- **Renal Dysfunction:** It particularly in people suffering from severe renal insufficiency or bilateral renal artery stenosis, telmisartan may induce or exacerbate renal dysfunction.[29]
- **Hepatic Impairment:** The Telmisartan can sometimes result in abnormalities in liver function, including high liver enzymes. Testing to liver function may need to be monitored as receiving treatment.[30]
- **Fetal Toxicity:** It due to the risk of fetal harm, including fetal injury or death, telmisartan should not be used during pregnancy. If taking telmisartan, women who are or may become pregnant should use an effective form of birth control.[31]
- **Hypersensitivity Reactions:** Telmisartan may in rare cases result in hypersensitivity reactions, such as angioedema and anaphylaxis. Individuals that have a history of angioedema unrelated to ARBs or ACE inhibitors may be at increased risk.[32]

Review of Literature

- **Sylvia Deppe, Rainer H Boger, Johanna Weiss, Ralf A Benndorf (2010) -** As an antihypertensive that has excellent acceptance, telmisartan be a part of the angiotensin II type 1 (AT1) receptors antagonist class, it is commonly used and more and more recommend. Its clinical significance will likely advance further because telmisartan was the first (AT1) receptors antagonist approved to prevent of cardiovascular events in high-risk cardiovascular victim as a result of the ONTARGET trial program's successful results.[33]
- **Miriam Sharp, Blair Jarvis & Karen L. Goa (2001) -** An antagonist of a angiotensin II receptor with a strong preference with type 1 angiotensin II receptors in telmisartan. Large-scale (n >100), randomised, double-blind and multicenter clinical studies involving individuals with mild to moderate hypertension showed that it worked a great deal better than a placebo. Mean supine trough systolic and pulse blood pressure reductions of before
15.5 and 10.5 mm Hg, properly, were look at with telmisartan 20 to 160 mg once daily. To 40 to 80 mg/day implemented one daily resulted in the greatest reduction of blood pressure. In dose-titration studies Amlodipine 5 to 10 mg/day or atenolol 50 to 100 mg/day proved to be as efficacious as telmisartan 40-120 mg/day. In both titration to response and additional research, telmisartan 20 to 160 mg/day was usually found to be direct as the medication 5 to 20 mg/day or the medication 10 to 40 mg/day.[34]
- **Dove Press (2006,September 15) -** Angiotensin II receptor blocker telmisartan in a large volume of the distribution or a 24-hour terminal elimination half life due to its high lipophilicity. The comparing the averages for the previous six hours concerning the dosage interval to those of ramipril 10 mg and valsartan 80 mg, ABPM has been used to demonstrate the effectiveness of telmisartan 80 mg immunotherapy. In addition telmisartan 80 mg, as compared to valsartan 160 mg, offers better blood pressure regulation after a dosage miss. Recent data from a large patient population indicates that ramipril 5–10 mg is less effective than telmisartan 80 mg at controlling the increase in blood pressure early in the morning. This suggests that telmisartan 80 mg could possess a greater beneficial effects over time risk toward the heart. The on going Global end point Trial (ONTARGET) for Telmisartan alone and in Combination with Ramipril is testing this hypothesis.[35]
- **Amrinder Singh, K.K.Jha, A.Mittal, Amit Kumar (2013) -** All additional receptor systems that control cardiovascular function are not impacted. It specifically blocks angiotensin II's stimulation of the AT1 receptor. High volume of distribution and telmisartan's specifically high lipophilicity suggest that the drug provides the therapeutically significant benefit of good tissue penetration. Additionally, it causes adipocytes' adiponectin protein content to increase and initiates peroxisome proliferator-activated a receptor c (PPAR-c). Telmisartan's solubility was found to be improved when the medication was dispersed completely using carriers such as poly vinyl pyrrolidonek30, polyethylene glycol 6000 (PEG6000), βeta-cyclodextrin, Gelucire 43/01, Poloxamer 407, PVP K30 and HPMC E4, PEG 6000, and $NaHCO_3$. The viewed data show that in drug's solid distribution was larger than the original amount.[36]
- **Jayram V.Gholave (2020) -** This study presents an easy drop liquid chromatographic technique with UV detection at 230 nm that can be used to analyse Telmisartan in various bulk drug samples. The additionally from of unidentified contamination utilising a mobile phase on Kromasil C_{18} column at 40°C made up in 1.0 ml/min of acetonitrile: methanol (80:20) as eluent-II and 0.1% adjusted ammonium hydroxide solution to PH of 11.63

at Trifluoroacetic acid (TFA) as eluent-I. The ability of this method to indicate stability was shown by the reality that the breakdown products that generated failed before hinder an detection of telmisartan or any of its potential contaminants. The guidelines of the International Council for Harmonisation (ICH) were observed in the execution of method validation studies concerning specificity, linearity, precision, accuracy, sensitivity, and robustness. The technique may prove helpful for both the assay of telmisartan in dosage formulations and the evaluation of its purity in bulk drug.[37]

- **Jagdish V. Bharad, Milind B. Ubale, Rajesh S. Jadhav (2016) -** The medication Telmisartan showed a greatest absorption at 296.5 nm and was set up to be linear over several 5 µg/ml to 25 µg/ml, with a correlation coefficient of 0.9994. Telmisartan's limit of quantification (LOQ) and Limit of detection (LOD) were determined to be 4.5µg/ml and 1.3µg/ml similarly. Precision and accuracy studies have been done to be able to verify the analytical process for the previously proposed method. Specificity, precision, linearity and range, ruggedness, accuracy, and recovery has been the test parameters in which the suggested method of analysis was validated. The indicated analytical method was therefore determined to be easy, simple, accurate, precise, repeatable, economical suitable for regular evaluation of quality control in dose forms for telmisartan tablets in formulation using UV Spectrophotometer.[38]
- **Reema H.Rupareliya and Hitendera S. Joshi (2013) -** The Isocratic RP-HPLC technique was created on water C_{18} 250*4.6 mm, 5 µm column with acetonitrile: buffer pH 3.0 with orthophosphoric acid (68:32) as the mobile phase. The analysis also done at 245 nm at a flow rate of using a photodiode array detector of 1.0 ml/min. Specificity, linearity, accuracy, precision, robustness and solution stability of the technique were all validated. They results indicated that the method was linear in the concentration range of 40–160 µg/ml as Telmisartan and 10–40 µg/ml as Cilnidipine in a correlation coefficient of 0.9990 and 0.9989, as well.[39]
- **M. Lakshmi Surekha, G. Kumara Swamy, G.Lakshmi Ashwini (2012) -** The concentration of the medicinal dose from of telmisartan was determined utillising an RP-HPLC method that was created and approval. It is simple, precise, quickly, and repeatable. Under ideal chromatographic conditions, separation was accomplished using a Zorbax-SB-18 octadecylsilyl (ODS) column (150 X 4.6 nm particle size 3.5µ). The mobile phase comprised of 1-Pentanesulfonic acid sodium salt monohydrate, 1 millilitre of perchloric acid, and 40:60 v/v triethyl amine:methanol to reduce the pH down to 2.7±0.05. 1.2 millilitres per minute at room temperature in an isocratic elution. It was determined that the limits of quantification and detection were, respectively, 0.6623 and 0.2515 mg/ml. Telmisartan material in the formulation was determined to be 99.95 percent.[40]
- **R.Gholve, S.Pekamwar,T. Kalyankar (2021) -** The development and validation of the stability-signifying chromatographic technique enabled that simultaneous estimation of Rosuvastatin calcium or telmisartan both with large quantities and tablet forms of dosage. The RP-HPLC elution be performed at 242.0 nm using column Oyster ODS3 (150 × 4.6 mm, 5 µm), that was used isocratic elution. The mobile phase consisted of 10 mM phosphate buffer with 1.1g of sodium salt octane-1-sulfonic acid, with a pH of 2.5 (adjusted with 5% OPA) and acetonitrile in 500:500 v/v ratio. The column was kept at room temperature (about 25 °C) with a flow rate of 1.0 ml/min. The ICH Q2 (R1) guideline was followed in the validation of the suggested technique.[41]

Conclusion

Early morning high blood pressure connects to a higher risk of cardiovascular disease. Antihypertensive drugs must control blood pressure in order to reduce this moment's risk. Sadly some antihypertensives that are taken once a day in the morning cannot satisfy this essential and might even put the at risk patient. Telmisartan is the extra-long half- life ARB. Numerous clinical studies using ABPM have demonstrated its capicity to lower blood pressure when the unsafe early morning hours. The reality that telmisartan been demonstrated to lessen the early morning blood pressure increase is also very important.

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