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A review on chromatographic method for estimation of Benidipine hydrochloride and Telmisartan

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Abstract
Benidipine Hydrochloride is a dihydropyridine calcium channel blocker and used in small subset of pulmonary hypertension, hypertension and angina pectoris. Telmisartan is an angiotensin Π receptor antagonist and used in high blood pressure, congestive heart failure and to reduce death for people with left ventricular dysfunction after having had a heart attack. Under clinical trial it's proved that the combination of Benidipine Hydrochloride with angiotensin II type 1 receptor blockers (ARBs) when adequate anti-hypertensive effects are not achieved by ARBs alone which provides superior the targeted blood pressure and prevent cardiovascular events with the fewest adverse drug effects.

Keywords: benidipine hydrochloride, telmisartan, HPLC (high performance liquid chromatography), HPTLC (high performance thin layer chromatography), LC (liquid chromatography)

Introduction [1-8]

Benidipine Hydrochloride (3-(3R)-1-benzylpiperidin-3-yl 5-methyl (4R)-2, 6-dimethyl-4-(3-nitrophenyl)-1, 4 dihydropyridine-3, 5-dicarboxylate hydrochloride) is a dihydropyridine calcium channel blocker and used in small subset of pulmonary hypertension, hypertension and angina pectoris. The vasorelaxant effect of Benidipine hydrochloride is due to its affinity towards dihydropyridine binding sites in calcium channels. Binding of Benidipine hydrochloride with calcium channels inhibits calcium current. The onset of action is slow, which results in minimal tachycardia or palpitation. Telmisartan(2-(4-{[4-Methyl-6-(1-methyl-1H-1,3-benzodiazol-2-yl)-2-propyl-1H-1,3-benzodiazol-1-yl] methyl} phenyl) benzoic acid) is used in high blood pressure, congestive heart failure and to reduce death for people with left ventricular dysfunction after having had a heart attack. Telmisartan interferes with the binding of angiotensin II to the angiotensin II AT_1-receptor by binding reversibly and selectively to the receptors in vascular smooth muscle and the adrenal gland. As angiotensin II is a vasoconstrictor, which also stimulates the synthesis and release of aldosterone, blockage of its effects results in decreases in systemic vascular resistance. Benidipine Hydrochloride is soluble in methanol and water available as Yellowish or yellow crystalline powder. Telmisartan is soluble in methanol and chloroform, sparingly soluble in strong acid and soluble in strong base and available as White crystalline powder.

Official and Reported methods are categorized depending on the following considerations:

1. Single component analyzed by chromatographic method.
2. Analysis of Benidipine Hydrochloride and Telmisaratn in combination with other drugs by chromatographic method.

Table 1: Reported Analytical Method of Benidipine Hydrochloride: [9-10]

Sr. No	Dosage Form	Method	Description
1.	Impurities of Benidipine Hcl	HPLC/UPLC (stability study)	Detection wavelength: 237nm
			Mobile phase: phosphate buffer: methanol: THF (65:27:8)
			Column: C18 column
			Flow rate:0.75ml/min
2.	Benidipine HCl	RP-LC	Concentration range:
			3.25-54.20 µg/ml for glassy carbon electrode
			1.08 µg mL^{-1} and54.20 µg mL^{-1}
			For boron doped diamond
			Mobile phase:
			Acetonitrile:water (55:45)
			Stationary phase:
			C_{18} column
			Flow rate:
			1 ml/min

Table 2: Reported Analytical Method of Telmisartan: [11-22]

Sr No.	Dosage Form	Method	Description
1.	Telmisartan in bulk and tablet dosage form	RP-HPLC	Stationary phase: C_{18} column
			Mobile phase: Buffer: Methanol (40:60)
			Detection wavelength: 230 nm
			Linearity range: 4-20 µg/ml
			R^2 Value :0.999
			Flow rate: 1.2 ml/min
			Injection volume: 10 µl
			Retention time:6.26 min
2.	Telmisartan in serum sample	RP-HPLC	Detection wavelength: 282 nm
			Mobile phase:Buffer: ACN (35:65)
			Stationary phase:Equsil, 250*4.6mm, 5µ
			% RSD:< 2*
			Limit of Detection:30 µg/ml
			Limit of Quantification:60 µg/ml
			Flow rate:1ml/min
3.	Telmisartan in pure and pharmaceutical formulation	Stability indicating RP-HPLC Method	Detection wavelength: 230 nm
			Mobile phase: Buffer: Methanol (40:60) v/v
			Stationary phase: C18 column (4.6*150 mm, 3.5 µm)
			Retention time: 2.6 min
			Linearity range: 20-100µg/ml
			R^2 Value: 0.9998
			% Recovery: 100.3-101.9
			% RSD: 0.84
			Flow rate: 0.5ml/min
4.	Telmisartan and Hydrochlorothiazide, Ramipril in tablet dosage form	RP-HPLC	Detection wavelength:220 nm
			Mobile phase:
			Acetonitrile:buffer (50:50)
			Stationary phase:
			C^{18} column
			Retention time:
			Telmisartan:13.8 min
			Hydrochlorothiazide: 3.2 min
			Ramipril: 5 min
			Linearity range:
			Telmisartan:10-50 µg/ml
			Hydrochlorothiazide:
			2-10 µg/ml
			Ramipril: 5-25µg/ml
			Limit of Detection:
			Telmisartan: 1.5µg/ml
			Hydrochlorothiazide: 0.03 µg/ml.
			Ramipril:0.05 µg/ml
			Limit of Quantification: Telmisartan: 3.5µg/ml
			Hydrochlorothiazide: 1 µg/ml
			Ramipril:1.5 µg/ml
5.	Telmisartan and Hydrochlorothiazide in pharmaceutical dosage form	RP-HPLC	Detection wavelength:271 nm
			Mobile phase: ACN:KH_2PO_4
			(60:40)
			Stationary phase:C18 Column
			Linearity range:
			Telmisartan:4-12µg/ml
			Hydrochlorothiazide:1.3-3.9µg/ml
			Retention time:
			Telmisartan:2.85 min
			Hydrochlorothiazide:5.79 min
			% drug recovery:
			Telmisartan:99.8 %
			Hydrochlorothiazide: 100.1 %
6.	Telmisartan and Ramipril in tablets	RP-HPLC	Detection wavelength: 210 nm
			Mobile phase: 0.01 M Potassium Dihydrogen Phosphate buffer:
			Methanol: Acetonitrile (15:15:70)

			Stationary phase: C_{18} column
			Retention time: Ramipril: 3.68 min
			Telmisartan: 4.98 min
			% Recovery:
			Ramipril: 99.90-101.64
			Telmisartan: 99.45 -100.99
			LOD:
			Ramipril: 0.5 µg/ml
			Telmisartan: 1.5 µg/ml
			LOQ:
			Ramipril:1.5µg/ml
			Telmisartan:3.0µg/ml
			Flow rate: 1.0 ml/min
7.	Telmisartan and Rosuvastatin in bulk and pharmaceutical dosage form	RP-HPLC	Detection wavelength: 231 nm
			Mobile phase:
			Acetonitrile: Potassium Dihydrogen phosphate (60:40)
			Stationary phase:
			C_{18} column
			Retention time:
			Telmisartan:5.35 min
			Rosuvastatin: 3.57 min
			Linearity range:
			Telmisartan:
			10-60µg/ml
			Rosuvastatin:2.5-15µg/ml
			LOD:
			Telmisartan: 0.097µg/ml
			Rosuvastatin:0.0295 µg/ml
			LOQ:
			Telmisartan: 0.07µg/ml
			Rosuvastatin:0.02 µg/ml
			Flow rate:1.0 ml/min
8.	Telmisartan and hydrochlorothiazide in human plasma	RP-HPLC	Detection wavelength: 270nm
			Mobile phase:
			Methanol:10mm Ammonium Acetate solution (35:65v/v)
			Stationary phase:
			Shim-pack cyanopropyl column
			Retention time:
			Telmisartan: 5.19min
			Hydrochlorothiazide: 2.97min
			Linearity:
			Telmisartan: 1-10 lg/ml
			Hydrochlorothiazide: 0.31-3.12lg/ml
			Flow rate: 1ml/min
9.	Telmisartan and Indapamide in pure marketed formulation	RP-HPLC	Detection wavelength: 285 nm
			Mobile phase:
			Buffer: Acetonitrile: Methanol
			(40:25:30)
			Stationary phase:
			C^{18} column
			Retention time:
			Telmisartan: 4.7 min
			Indapamide: 10.7 min
			Linearity:
			Telmisartan: 6-22.5 µg/ml
			Indapamide: 11.2-42 µg/ml
			R^2 Value:
			Telmisartan: 0.999
			Indapamide: 0.9997
			% Recovery:98-102%
			LOD:
			Telmisartan: 0.030µg/ml

			Indapamide: 0.056 µg/ml
			LOQ:
			Telmisartan: 0.15 µg/ml
			Indapamide: 0.28µg/ml
			Flow rate:1ml/min
10.	Telmisartan and Chlorthialidone in bulk and pharmaceutical dosage form	HPTLC	Detection wavelength: 242 nm
			Mobile phase:
			Acetonitrile: Toluene: Glacial acetic acid
			(7.5:2.5:0.05v/v/v)
			Stationary phase:
			Precoated silica gel plates
			R_f factor:
			Telmisartan: 0.26±0.02
			Chlorthialidone: 0.67±0.02
11.	Telmisartan and Indapamide in bulk drug and pharmaceutical dosage form	HPTLC	Detection wavelength: 259 nm
			Mobile phase:
			Toluene: Ethyl acetate: Acetone: Methanol (7:4:3:1v/v/v/v)
			Stationary phase:
			Aluminium plates precoated with silica gel
			Linearity:
			Indapamide: 300-1000 ng/spot
			Telmisartan: 600-2000 ng/spot
			LOD:
			Indapamide: 100 ng/spot
			Telmisartan: 200ng/spot
			LOQ:
			Indapamide: 300ng/spot
			Telmisartan: 600ng/spot
12.	Amlodipine Besylate and Telmisartan in bulk drug and dosage form	HPTLC	Detection wavelength: 323 nm
			Mobile phase:
			Ethyl acetate: 1,4 dioxane: Methanol: 25% ammonia
			(15:1.5:3:1.5 v/v)
			Stationary phase:
			Precoated silica gel on aluminium sheets
			Linearity:
			Telmisartan: 100-500µg/ml
			Amlodipine Besylate: 200-1000 µg/ml
			%Recovery:
			Telmisartan: 100.38
			Amlodipine Besylate: 100.24
			LOD:
			Telmisartan: 0.25 µg/ml
			Amlodipine Besylate: 0.0236 µg/ml
			LOQ:
			Telmisartan: 0.0747 µg/ml
			Amlodipine Besylate: 0.0714 µg/ml

Conclusion

According to this review it was concluded that for Benidipine Hydrochloride and Telmisartan Chromatographic methods are available for single and combination with other drugs. The mobile phase containing Acetonitrile, Water, Methanol, and Phosphate buffer were common for most of the chromatographic method to provide good resolution. For chromatographic method flow rate is observed in the range 0.7-1 ml/min to get good resolution time. Hence this all methods found to be simple, accurate, economic, precise and reproducible in nature. Most of Methods were of RP-HPLC because these methods provided with best available reliability, repeatability, analysis time and sensitivity.

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