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Liquid chromatographical methods for determination of selected antihypertensive drugs: a review

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ABSTRACT

This work summarizes of the analytical methods reported in the literature for the separation and quantification using several liquid chromatographic methods for the determination of antihypertensives in biological matrices and pharmaceutical formulations have been discussed in the course of this review, namely RPHPLC, HPTLC and LC-MS methods; their selectivity, sensitivity, accuracy and reproducibility make them a good choice for analysis.

KEY WORDS: Hypertension, analysis, Liquid chromatography.

INTRODUCTION

Hypertension is one of the most serious diseases of the XXI century concerning about 20-30% of the world population of adults. Early detection and proper pharmacotherapy of hypertension could decrease the risk of stroke, left ventricular hypertrophy, cerebral hemorrhage, cerebral vessel disease or peripheral artery disease (Szanajderman, 1998; Kupershmit, 1998). Diuretics, particularly thiazides and thiazide-like, loop diuretics and potassium sparing diuretics are applied in the hypertension treatment. From treatment perspective, complexes consisting of the selective and nonselective β-adrenergic receptor antagonists and α-adrenergic receptor antagonists,vasodilators, calcium channel blockers, ACE inhibitors (from angiotensin-converting enzyme) and angiotensin receptor antagonists play significant role. Diversity of chemical structures present in a group of hypotensive drugs encourage for searching new methods useful in their quantitative analysis.In this review by taking into account, the number of liquid chromatography methods discussed previously by Stolarczykin (2010), that leads to the availability of fast, selective, sensitive,precise and accurate analytical methods for the quantitative determination of selected antihypertensive drugs in biological fluids and pharmaceutical formulations.

Liquid chromatographical methods: Generally in aqueous solutions, Antihypertensive drugs are likely to exist in the ionic form, use of an acidic mobile phase/addition of ion-pair reagents to the mobile phase is recommended in most cases present in this review.The use of other chromatographical procedures extended along with reversed-phase liquid chromatography are High-performance thin-layer chromatography (HPTLC) is a different chromatographic technique that can also be successfully applied to separate analytes in a mixture. Paul (2011) developed High performance liquid Chromatography method for the simultaneous determination of Telmisartan and Amlodipine besylate combination in tablets.Patel (2011) developed High performance liquid Chromatography method for the simultaneous determination of Eprosartan and Hydrochlorothiazide combination in tablets. Liu (2011) introduced a HPLC method using MS/MS detection for Hydarlazine quantification in BALB/C mouse plasma and brain. Wankhede (2010) described two spectroscopic methods and High performance liquid Chromatography for the simultaneous determination of Losartan, Amlodipine besylate and Hydrochlorothiazide combination in tablets.Kavitha (2010) developed and validated a RP-HPLC method for the analysis of Atenolol, Hydrochlorothiazide and Losartan potassium in tablet formulation. Mustafa celebier (2010) developed and validated a HPLC method for the simultaneous estimation of Amlodipin and Valsartan in their combined dosage forms and for drug dissolution studies. Farouk (2010) developeda isocratic RP-HPLC method and subsequent validated for the analysis of Torasemide, Irbesartan and Olmesartanmedoxomil. Suresh Kumar (2010) developeda reversed-phase liquid chromatographic method for the simultaneous estimation of Atorvastatin Calcium and Telmisartan in tablet formulations.Patil (2010) developeda High-performance thin-layer chromatographic method for analysis of Telmisartan and Atorvastatin calcium in fixed dose combination. Bahia Moussa (2010)developeda reversed phase liquid chromatography and thin layer chromatography methods as a stability indicating assays of OlmesartanMedoxomil in presence of its acid or alkaline induced degradation products. Della Grace Thomas Parambi (2010) developeda quantitative HPTLC method for determination of OlmesartanMedoxomil in tablet dosage form. ZaveriMaitreyi (2010) developed a precise and validated RP-HPLC method for the simultaneous determination of Atenolol and Hydrochlorothiazide in tablet formulation. Wankhede (2009)described two

spectroscopic methods and High performance liquid Chromatography for the simultaneous determination of Olmesartanmedoximil and Amlodipine besylate combination in tablets. Shah (2008) developed High performance liquid Chromatography method for the simultaneous determination of Atorvastatin calcium and Amlodipine besylate combination in tablets. Wankhede (2007) developed High performance liquid Chromatography for the simultaneous determination of Telmisartan and Hydrochlorothiazide combination in tablets. Palled (2005) developed High performance liquid Chromatography method for the determination of Telmisartan in tablets. Manes (1990) described HPLC method for determination of Hydralazine and its metabolite in human plasma using Methyl Red as Internal standard. Wong (1987) developed a specific and sensitive method for extraction and analysis of Hydralazine by High-performance liquid chromatography with electrochemical detection. Molles (1985) reported HPLC method which utilizes the derivatization product of Hydralazine with p-Hydroxybenzaldehyde or p-Anisaldehyde as an internal standard.

Table.1.Liquid chromatography methods for determination of Anti-Hypertensives

Ahs	Method	Detection	Sample	Column	Mobile phase
Telmisartan and Amlodipine besylate	HPLC	UV=237nm	Pharmaceuticals	Symmetry C18 column (250 mm x 4.6 mm i.d, 5µm)	methanol, Acetonitrile, Potassium dihydrogen phosphate buffer (60:40; pH 4.0)
Eprosartan and Hydrochlorothiazide	HPLC	UV=240nm	Pharmaceuticals	Phenomenex C18 column (250 mm x 4.6 mm i.d, 5µm)	0.5% formic acid, methanol, Acetonitrile (80:25:20; pH 2.8)
Hydralazine	LC-MS-MS	m/z 225.2 →129.5	mouse plasma and brain	Agilent ZORBAX SB-C18	0.01 mol/l methanol: ammonium acetate (60:40, v/v)
Losartan, Amlodipine besylate and Hydrochlorothiazide	HPLC	UV=238nm	Pharmaceuticals	Kromasil C-18 (5µm, 250*4.6 mm)	Acetonitrile, 0.025 mol/L Potassium dihydrogen phosphate buffer (43:57; pH 3.7)
atenolol, hydrochlorothiazide and losartan potassium	HPLC	UV=270nm	Pharmaceuticals	Phenomenex C18 (250 mm x 4.6 mm i.d, 5µm)	acetonitrile: 50mM potassium dihydrogenortho phosphate (pH-3.5) ratio 50:50v/v
Amlodipine and valsartan	HPLC	UV=240nm	Pharmaceuticals	Waters Atlantis d C18 (250 mm x 4.6 mm. i.d., 5.0µm)	phosphate buffer (pH-3.6): acetonitrile: methanol (46:44:10v/v/v),
Torasemide, Irbesartan and Olmesartanmedoxomil	HPLC	UV=280nm	Pharmaceutical	Waters Atlantis d C18 (250 mm x 4.6 mm. i.d., 5.0µm)	phosphate buffer pH 3:acetonitrile (60:40,v/v), phosphate buffer pH 3.2:acetonitrile (60:40,v/v)
atorvastatin calcium and telmisartan	HPLC	UV=254nm	Pharmaceutical	Waters Symmetry C18 (250 mm x 4.6 mm. i.d., 5.0µm)	ammonium acetate (0.02M, pH 4.0 adjusted with glacial acetic acid) and acetonitrile in ratio (40:60 v/v)
Telmisartan and Atorvastatin calcium	HPTLC	Densitometric	Pharmaceuticals	Silica gel G 60 F_{254}, HPTLC plates	toluene: methanol (7: 3, v/v)
Olmesartan	HPLC HPTLC	UV=257nm Densito-metric	Pharmaceuticals	Agilent, Exclipse XDB- C18 column Silica gel G 60 F_{254}, HPTLC plates	acetonitrile: methanol: water: glacial acetic acid (40:35:25:0.1 v/v/v/v) chloroform: methanol: formic acid (8:1.5:0.5 v/v/v)
Olmesartan	HPTLC	Densito-metric	Pharmaceuticals	Silica gel G 60 F_{254} HPTLC plates	chloroform: acetonitrile: toluene: glacial acetic acid, (1:8:1:0.1(v/v/v/v)
Atenolol and Hydrochlorothiazide	HPLC	UV=286nm	Pharmaceuticals	Zorbax SB-CN (250 x 4.6 mm), 5µm	Water: Buffer: Methanol (50:35:15)
Olmesartan and Amlodipine besylate	HPLC	UV=238nm	Pharmaceuticals	Kromasil C-18(5µm, 250*4.6 mm)	Acetonitrile 0.05 mol/L, Potassium dihydrogen phosphate buffer (50:50)

Atorvastatin calcium and Amlodipine besylate	HPLC	UV=240nm	Pharmaceuticals	Phenomenex C18 column (250 mm x 4.6 mm i.d, 5µm)	methanol, Acetonitrile, 0.05mol/L, Potassium dihydrogen phosphate buffer (20:50:30; pH 3.5)
Telmisartan and Hydrochlorothiazide	HPLC	UV=238nm	Pharmaceuticals	ODS Hypersil C-18 (5µm,250*4.6 mm)	Acetonitrile 0.05 mol/L, Potassium dihydrogen phosphate buffer (60:40; pH 3.0)
Telmisartan	HPLC	UV=245nm	Pharmaceuticals	Hypersil BDS C-18 (5µm,250*4.6 mm)	methanol, Acetonitrile (40:60)
Hydralazine	HPLC	UV=408nm	Human plasma	ODS-2 column packed with spherisorb (250 × 4, 3 µm)	acetonitrile: aqueous triethylamine phosphate buffer (80:20, v/v - pH 3)
Hydralazine	HPLC	Electro chemical detection	Human plasma	Supelcosil LC-18-DB (5µm)	66% methanol in 0.055 *M* citric acid/0.02 *M* dibasic sodium phosphate (pH 2.5).
Hydralazine	HPLC	UV=295nm	Human plasma	µBondapak Phenyl column (30 cm x 3.9 mm I.D.10 µm)	methanol: 2% acetic acid solution (60:40, v/v)

CONCLUSION

This work is a comprehensive and critical review of the analytical methods reported in the literature for the determination of selected antihypertensive drugs in biological matrices and pharmaceutical formulation. Overall, it should be noted that a large number of liquid chromatographic methods have been reported.These methods constitute useful tools for pharmacokinetic and toxicological studies or for quality control tests. Moreover, some of them may support the routine therapeutic drug monitoring of these antihypertensive drugs in clinical practice.

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