Analytical Method Development and Validation of Noscapine Hydrochloride: Review

Abstract: Analytical method development and validation are the continuous and inter-dependent task associated with the research and development, quality control and quality assurance departments. Analytical procedures play a critical role in equivalence and risk assessment, management. It helps in establishment of product-specific acceptance criteria and stability of results. Validation should demonstrate that the analytical procedure is suitable for its intended purpose. Design of experiment is a powerful tool for the method characterization and validation. Analytical professionals should be comfortable to use it to characterize and optimize the analytical method. An effective analytical method development and its validation can provide significant improvements in precision and a reduction in bias errors. It can further help to avoid costly and time consuming exercises.

Literature survey reveals that few Spectroscopy, HPLC, HPTLC methods have been reported for the estimation of Noscapine hydrochloride. The published methods were validated for various parameters as per ICH guidelines. Statistical analysis provided that the published methods were reproducible and selective for the estimation of the Noscapine hydrochloride in pure and pharmaceutical dosage form.

Key words: Noscapine hydrochloride, Literature Survey, Validation, Method Development, ICH Guidelines.

INTRODUCTION 1:

Noscapine Hydrochloride is the orally available hydrochloride salt of the opioid agonist noscapine, a phthalideisoquinoline alkaloid derived from the opium poppy Papaver somniferum, with mild analgesic, antitussive, and potential antineoplastic activities. Noscapine binds to tubulin and alters its conformation, resulting in a disruption of the dynamics of microtubule assembly (by increasing the time that microtubules spend idle in a paused state) and subsequently, the inhibition of mitosis and tumor cell death. Unlike other tubulin inhibitors such as the taxanes and vinca alkaloids, noscapine does not affect microtubule polymerization.

Fig. 1: Structure of Noscapine hydrochloride.

Literature survey:

1. Yin et al2, has developed and validated a high-performance liquid chromatography procedure for the simultaneous determination of aminophylline, methoxyphenamine hydrochloride, noscapine and chlorphenamine maleate in commercially available compound capsule dosage forms. The separation and quantification were achieved on an Ultrasphere C18 column using a mobile phase of dichloromethane-methanol-0.25% (v/v) diethylamine aqueous solution (20:60:20, v/v/v) at a flow rate of 1 ml/min with detection of all analytes at 264 nm. The separation was achieved within 6 min for each drug mixture. The method showed good linearity for the aminophylline, noscapine, chlorphenamine maleate and methoxyphenamine hydrochloride mixture in the 125-750, 35-210, 10-60 and 62.5-375 µg/ml ranges, respectively.

2. Qing-hua et al3, was established a sensitive and specific method for the determination of noscapine, methoxyphenamine and theophylline in human plasma. Methoxyphenamine and noscapine were extracted from plasma by a liquid-liquid extraction and subsequent back-extraction, and simultaneously determined by RP-HPLC using clenbuterol hydrochloride as internal standard with
ultraviolet detection at 200 nm for methoxynaphtamine, at 215 nm for noscapine using mobile phase containing acetamidile-water. Theophylline was determined by RP-HPLC with ultraviolet detection at 272 nm, after precipitation of proteins with 50% trichloroacetic acid, using mobile phase of 15% methanol (containing 5 mmol/l sodium hexane sulfonate, adjusted pH to 3.1 with acetic acid). The linear ranges were 0.1-5 mg/l, 5-500 μg/l and 1-100 μg/l for theophylline, methoxyphenamine and noscapine, respectively. The method is sensitive, specific, and suitable for drug level monitoring in clinical pharmacokinetic study.

3. Acevska et al., was developed and validated separation of six target alkaloids from Papaver somniferum L. (morphine, codeine, oripavine, thebaine, papaverine, and noscapine) by RP-HPLC method. The effects of ion-pairing agents, pH value of the mobile phase, concentration of the buffer components, mobile phase organic modifier, and column temperature were studied. Regardless of the large differences in their pKa values, all alkaloids were separated within a close retention window, and good peak shape was achieved for each of the six alkaloids. The proposed method has adequate selectivity, linearity, accuracy, precision, and reproducibility and is applicable for poppy straw.

4. Krenn et al., was developed and validated by RP-HPLC method for the separation of the five major alkaloids from Papaver somniferum L. (morphine, codeine, thebaine, papaverine, and noscapine). By use of a base deactivated silica- based stationary phase excellent peak shape was achieved for each substance. The five alkaloids were quantified by internal standardization within good precision.

5. Parag S. Mahadik et al., was developed and validated a simple, rapid, and sensitive RP-HPLC method was developed and validated for the simultaneous determination of degradation impurity of Noscapine HCl. The method was developed to determine Papaverine in Noscapine Hydrochloride. Separation was achieved within 45 min on a Waters Sunfire, C18, 250 x 4.6 mm, 5μ particle size column using mobile phase consisting of 1-octane sulfonic acid buffer pH-3.0 and Acetonitrile. Gradient flow mode with a flow rate of 0.8 ml/min and detection was carried out at 260 nm. The column temperature was 45°C while sample temperature was 25°C. A complete validation procedure was carried out. There was good resolution observed between Noscapine and Papaverine Peak which is about 2.8. The proposed method exhibited excellent linearity over the concentration ranges of 1.2 μg/ml to 6.0 μg/ml for Papaverine and Noscapine. The proposed method was applied for bulk drug of Noscapine HCl for accuracy study with recovery of 101.26% to 104.52%.

6. Margareta Johansson et al., was established a System peaks were generated in an ion-pair reversed-phase system by co-injection of an alkylsulphate with the analytes. The acidic mobile phase contained acetonitrile and an aliphatic tertiary amine as a co-ion. The retention time of the system peak was regulated by the concentration and hydrophobicity of the co-ion and the alkylsulphate. The peak performance of the analytes was affected by co-elution with a system peak.

7. Ashour et al., was developed and validated a sensitive, selective, precise and stability-indicating thin-layer chromatographic (TLC) method for the analysis of noscapine, both as a bulk drug and in its formulation. The method employed TLC aluminium plates precoated with silica gel 60F-254 as the stationary phase. The solvent system consisted of chloroform-methanol (10:0.5 v/v). Densitometric analysis of noscapine and its degradation products was carried out in the absorbance mode at 254 nm. This system was found to give compact symmetrical spots for noscapine Rf value 0.85 +/- 0.04. Noscapine was subjected to acid and alkali hydrolysis, oxidation and photo degradation. The drug undergoes photo degradation and also degrades under acidic and basic conditions. The degraded products were also well resolved from the pure drug with significantly different Rf values and they were quantitatively determined. Linearity was found to be in the 1.0-10.0 μg , 0.4-3.2 μg, 1.0-9.0 μg and 0.5-5.0 μg/band ranges for noscapine, cotarine, meconine and opionic acid, respectively. The polynomial regression analysis for the calibration plots showed a good polynomial relationship with r2 of 0.9998, 0.9989, 0.9996 and 0.9997 for noscapine and its three degradation products, cotarine, meconine and opionic acid, respectively.

8. Shrenik Gangwal et al., has developed and validated a UV spectroscopy procedure for the simultaneous determination of noscapine, chlorpheniramine maleate and ephedrine hydrochloride, in a capsule formulation. Shimadzu UV 160A spectrophotometer. Determinations were made in 0.1 N HCl. In Method I, absorbance of sample solution is measured at 312 nm, 283.8 nm and 257 nm for the simultaneous determination of three drugs. Method II is based on multiwavelength spectroscopic method. Recordings of absorbances of standard solutions at 312 nm, 263 nm, 257 nm and 251 nm were processed by means of statistical calculations and results for sample solutions were obtained. The methods have been validated statistically and were found to be satisfactory.
Conclusion:

Literature survey suggested that various UV-Spectroscopy, HPLC, HPTLC methods were developed and reported. The published methods were validated for various parameters as per ICH guidelines. Statistical analysis proved that the published methods were reproducible and selective. Thus it can be concluded that the reported and published methods can be successfully applied for the estimation of the Noscapine hydrochloride in pure and pharmaceutical dosage form.

References: