Development and Validation of UV Spectrophotometric Method of Naratriptan Hydrochloride in Bulk and Pharmaceutical Formulation

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ABSTRACT:
Naratriptan Hydrochloride (NH) is a selective 5-HT1 agonist developed for the acute treatment of migraine which acts by stimulating constriction of dilated cranial arteries and by inhibiting the release of neurogenic inflammatory mediators. A simple, sensitive, precise, accurate and economical UV-Spectrophotometric method has been developed for the determination of NH in bulk and pharmaceutical dosage form. Absorption for NH was measured at maximum wavelength 281nm. The percentage recovery of NH in pharmaceutical dosage form was found to be 99.43 to 98.53 %. The developed method was validated with respect to linearity, accuracy (recovery), precision and specificity. Beers law was obeyed in the concentration range of 2-10μg/ml having line equation y = 0.019x with correlation coefficient of 0.99. Results of the analysis were validated according to the ICH guidelines. The results obtained were statistically evaluated and were found to be accurate and reproducible. The proposed method can be successfully applied for the estimation of Naratriptan Hydrochloride in bulk and pharmaceutical dosage form.

INTRODUCTION:
Migraine, a multifactorial primary headache disorder, is characterized by unilateral, intense, and pulsatile headaches leading to cause of medical disability[1]. Worldwide, Migraine is the fifth leading cause of disability which is three times more common among females than males, with peak prevalence occurring between early and middle adulthood [2]. NH is a 5-HT1 agonist used for the treatment of migraine headaches. The chemical structure of NH is shown in Figure 1. NH is available in oral form (conventional and orally disintegrating tablets) and subcutaneous formulations have been developed [3] with the recommended dose of 1 and 2.5 mg with the oral bioavailability of 50-60%. NH is an effective and well tolerated abortive antimigraine medication and has been used preventively in transformed migraine [4].

As reported in the literature very few analytical methods have been investigated for the estimation of NH in pharmaceutical dosage form and in biological fluids. UV-Vis spectrophotomeric [5-7], HPLC [8,9] and UPLC [10] are the methods used for the determination of NH. In the present investigation a simple, sensitive, precise, accurate and economical UV-Spectrophotometric method has been developed for the determination of NH in bulk and pharmaceutical dosage form. The data generated and the method validation confirms the reproducibility of the method.

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tended for targeting brain, the intranasal route is preferred where drug is directly transported to the brain through the olfactory lobes [11]. Considering the nasal physiology the *in-vitro* diffusion and *ex-vivo* permeation studies are supposed to be conducted in phosphate buffer 6.4 (preferred media for nasal formulations). Hence the proposed media selected was Phosphate buffer 6.4 for analytical method development.

**Preparation of standard stock solution:**
Standard drug solution of NH was prepared by dissolving 10mg of NH in 20ml ethanol and was transferred to 100ml volumetric flask and volume was made up to mark with phosphate buffer pH 6.4 to obtain stock solution of 100μg/ml concentration. Obtained solution was bath sonicated for 5 minutes to obtain the clear solution. The solution was scanned (figure 1) in the range of 200-400 nm against blank.

**Figure 2: Spectrum of Naratriptan Hydrochloride**

**Validation as per ICH guidelines**

**Linearity:** The linearity of the response of the drug was verified at 2 to 10μg/ml concentration. Accurately weighed 10mg of NH was dissolved in phosphate buffer 6.4 to get the stock solution of 100μg/ml. From this stock solution aliquots of 0.1, 0.2, 0.4, 0.6, 0.8 and 1ml were withdrawn and further diluted to 10 ml with phosphate buffer pH 6.4 to obtain concentrations range of 1 to 10μg/ml. The absorbance for different concentration (Table 1) was measured at 281nm by using UV spectrophotometer. The calibration curve was obtained by plotting the absorbance versus concentration data and were treated by linear regression analysis (figure 3).

**Table 1: Observation table for calibration curve of NH**

| Sr. no. | Conc. (μg) | Absorbance |
|---------|------------|------------|
| 1       | 1          | 0.021      |
| 2       | 2          | 0.043      |
| 3       | 4          | 0.079      |
| 4       | 6          | 0.118      |
| 5       | 8          | 0.158      |
| 6       | 10         | 0.201      |

**Assay:** Initially ten tablets were weighed and powdered. The amount of tablet powder equivalent to 2.5 mg of NH was weighed accurately and transfer to 20 ml phosphate buffer 6.4 for 15 min with frequent shaking and volume was made up to 100 ml mark with phosphate buffer pH 6.4.

**Precision:**
Assay of method precision (intra-day precision) was evaluated for three independent assays of test samples of NH. The intermediate precision (inter-day precision) of the method was also evaluated using two different analysts, systems and different days in the same laboratory. The precision data is reported in the table 2.

**Table 2: Evaluation of intra-day and inter-day accuracy and precision**

| NH (μg/ml) | Intraday Accuracy and precision | Interday Accuracy and precision |
|------------|---------------------------------|---------------------------------|
|            | NH found (μg/ml) | RE %  | RSD % | NH found (μg/ml) | RE %  | RSD % |
| 4          | 3.753              | 0.2354 | 1.45  | 3.815              | 0.3125 | 1.52  |
| 6          | 5.795              | 0.3124 | 1.34  | 5.863              | 0.3947 | 1.45  |
| 8          | 7.859              | 0.4101 | 1.25  | 7.876              | 0.3995 | 1.37  |

**Accuracy (Recovery Test):** Recovery experiment was conducted to confirm the accuracy of the method. The recovery experiments were performed by adding known amounts to tablet. The recovery was performed at three levels, 80, 100 and 120% of NH standard concentration. The recovery samples were prepared in afore mentioned procedure. Three samples were prepared for each recovery level. The solutions were then analyzed, and the percentage recoveries were calculated from the calibration curve. The recovery values for NH are listed in the table 3.

**Table 3: Recovery data**

| Level of addition (%) | Amount of NH added (μg) | Amount of NH found (μg) | % Recovery | % RSD |
|-----------------------|-------------------------|-------------------------|------------|-------|
| 80                    | 3.2                     | 3.15                    | 98.43      | 1.21  |
| 100                   | 4                       | 3.95                    | 98.5       | 1.15  |
| 120                   | 4.8                     | 4.73                    | 98.54      | 1.11  |

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6.4. The solution was then filtered through whatmann filter paper # 41. This filtrate was diluted suitably with the media to get the solution of 8μg/ml concentration. The absorbance was measured against blank. The drug content of the preparation was calculated using standard calibration curve. Amount of drug estimated by this method is given in Table 4.

Table 4: Assay Results of Tablet Dosage Form.

| Formulation | Actual amount (mg) | Amount Found (mg) | % of Drug Found |
|-------------|--------------------|-------------------|-----------------|
| Tablet      | 2.5                | 2.51              | 100.4           |

RESULT AND DISCUSSION:
The equation of the calibration curve for NH was found to be $y = 0.019x$, the calibration curve was found to be linear in the aforementioned concentrations. A linear correlation was found which obeys Beer Lambert’s Law in the concentration range of 2-10 μg/ml (Figure 1). Regression analysis of Beer’s law data using the method of least squares was made to evaluate the slope (b), intercept (a) and the correlation coefficient ($r^2$) where the slope was found to be $y = 0.019x$ and the correlation coefficient was found to be 0.99. The maximum wavelength observed was at 222 and 283 nm (table 5), where the wavelength of 283 nm was considered for the analytical method development. The value of molar extinction coefficient and sandell’s sensitivity for EH estimated was 6.743 x 10^3 L/mol/cm and 0.497 μg/cm² respectively, as mentioned All the discussed parameters are listed in the table 5.
The detection limit of an individual analytical procedure is the lowest amount of analyte in a sample that can be detected but not necessarily quantitated as an exact value. The quantitation limit of an individual analytical procedure is the lowest amount of analyte in a sample that can be quantitatively determined with suitable precision and accuracy. The quantitation limit is a parameter of quantitative assays for low levels of compounds in sample matrices which is basically used for the determination of impurities and/or degradation products. The value of LOD (0.323) and LOQ (0.979) are determined by using standard deviation of the response and slope approach as defined in International Conference on Harmonization (ICH) guidelines [12] and are given in Table 5. Precision (Table 2), recovery data (Table 3) and assay (Table 4) confirms the reproducibility and accuracy of the method.

Table 5: Showing the maximum spectrum at different wavelength

| Peak | Start (nm) | Apex (nm) | End (nm) | Height (Abs) | Area (Abs*nm) |
|------|------------|-----------|---------|-------------|--------------|
| 1    | 800.0      | 283.0     | 247.0   | 0.036       | 5.66         |
| 2    | 247.0      | 222.0     | 200.0   | 0.189       | 5.057        |

Table 6: Optical characteristics and regression data for the proposed method for NH

| Parameter                                  | Analytical data |
|--------------------------------------------|-----------------|
| Linearity Range (μg/ml)                    | 2-10            |
| λ max (nm)                                 | 283             |
| Molar extinction coefficient               | 674.283         |
| Sandell’s sensitivity                      | 0.497           |
| Slope                                      | 0.019           |
| Intercept                                  | 0               |
| Standard deviation about regression (Sy)   | 0.0065          |
| Standard deviation of Slope (Sb)          | 0.0007          |
| Standard deviation of intercept (Sa)       | 0.0039          |
| Correlation co-efficient (r)               | 0.999           |
| Limit of detection (LOD, μg/ml)            | 0.323           |
| Limit of quantification (LOQ, μg/ml)       | 0.979           |

CONCLUSIONS:
From the results recorded it can be concluded that spectrophotometric method using the Phosphate buffer 6.4 as the media was found to be new, accurate, precise and economic for the determination of NH. The proposed method shows better sensitivity. In comparison with the existing visible spectrophotometric methods for the quantification of NH, the present modified method can be considered green as it demonstrates the development of spectrophotometry method without the usage of organic solvent. In addition, the proposed method employs an inexpensive instrument. Overall the proposed new and ecofriendly spectrophotometric method is economical and suitable for quality control of NH in bulk, fixed-dose combination tablets.

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REFERENCE:
[1] Tfelt-Hansen P, De Vries P, Saxena P. Triptans in migraine. Drugs 60. 2000; 6:1259-1287.
[2] Li J, Douglas S, Drago R, and Roth B. Triptans for Migraine. Contemporary Drug Synthesis: 161-187.
[3] Gunasekara, Nishan S, Wiseman L. Naratriptan. CNS drugs. 1997; 8(5):402-408.
[4] Mathew N. Naratriptan: a review. Expert opin investig drug. 1999; 8(5):687-695.
[5] Ramesh C, Nagarjuna R., Narayana T, Prasada Rao K, Ganga Rao B. New Spectrophotometric Methods for the Determination of NH in Bulk and its Pharmaceutical Formulations. Orient J Chem. 2011; 27(1):313-316.
[6] Sreelakshmi, A, Devala Rao G, Sudhakara S. Novel Spectrophotometric methods for the estimation of NH in Pharmaceutical dosage form. Biosci Biotechnol Res Asia. 2013; 10(2):913-916.
[7] Borse J, Shirkhedkar A. Estimation of NH in Bulk and Formulation by First Order Derivative UV-Spectrophotometric Methods. J Ap-
plied Pharm Sci 2012; 2(06):227-229.

[8] Ramu G, Biksham B, Sravan K, Rambabu C. Assay of NH in pharmaceutical formulations by RP-HPLC method. J Pharm Res (2012); 5(5):2627-2630.

[9] Reddy C, Shaiwy Awen B, Babu Rao C, Shaik R. Method development and validation for NH determination in human plasma by HPLC with tandem mass spectrometry detection, and its application to bioequivalence study. Braz J Pharm Sci. 2011; 47(1):13-22.

[10] Patel K, Singh S, Sahu P, Trivedi P. Development and validation of stability indicating assay method for NH by ultra performance liquid chromatography. Der Pharmacia Lettre 2011; 3(6):102-107.

[11] Talegaonkar S, Mishra P. Intranasal delivery: An approach to bypass the blood brain barrier. Indian J Pharmacol. 2004; 36(3):140.

[12] Guideline, ICH Harmonized Tripartite. "Validation of analytical procedures: text and methodology." Q2 (R1) 1 (2005).

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