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PERCUTANEOUS TRANSTHORACIC BIOPSY USING TRU-CUT NEEDLE

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ABSTRACT

Biopsies of thoracic lesions guidance. 22 of the 112 lesions were mediastinal and 83 were pleuroparenchymal. A large-bore 14-gauge Tru-cut needle was used in all patients. Adequate specimens for histologic examination were obtained in 98%. The overall accuracy was 91% with 9% false negative and no false positive diagnoses. Despite the large size of the needle, the total number of complications remained low (17%). Pneumothorax was detectable in 11.5% of biopsies and hemoptysis in 2.6%. Tru-cut needle is suitable for biopsying chest wall tumors, pleural based lesions, superior sulcus tumors, and accessible mediastinal lesions. The instrument is useful not only for diagnosing malignacy but also for determining specific malignant cell types and diagnosing benign disorders.

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INTRODUCTION

Transthoracic needle biopsy has become a valuable and reliable method for obtaining a diagnosis of thoracic lesions[1,2,3] and the radiologist is increasingly being called upon to perform this procedure. At the same time, selection of the proper needle is becoming more complex as the number of types increases and reports of better results with certain needles proliferate.[4] The use of a large-bore needle in experienced hands greatly increases diagnostic yield without significantly affecting the morbidity associated with the procedure.[5] It is the purpose of this article to demonstrate the high diagnostic and recovery rate of percutaneous transthoracic biopsy using the Tru-cut needle.

MATERIALS AND METHODS

Percutaneous biopsy of thoracic masses was perfomed in 112 cases from February, 1986 through June, 1988 at the Vali Asr-Imam Khomeini Hospital affiliated to the Tehran University of Medical Sciences. Most of the patients were 50-65 years old. The youngest patient biopsied was 12 years of age. There were 76 men and 36 women. 67 needle biopsies were performed in hospitalized patients and 45 on an outpatient basis.

Masses deep within the thorax which caused lung collapse were only biopsied occasionally since such neoplasms were generally diagnosed by transbronchial techniques. The biopsies were performed without any routine premedication but local anesthesia was used in all patients. A 14-gauge Tru-cut needle made by Travenol Corporation was used in all patients. It consists of an inner needle with a cleft to hold the tissue and an outer cannula with a cutting edge.

Substantial tissue sample can be obtained for histologic examination with a single needle pass. Radiographic and other imaging studies included standard posteroanterior and lateral chest films in all cases, and in some instances, computed tomography of the chest, and conventional lung and mediastinal tomography. Two methods were utilized in planning and guiding for cutting biopsies. CT was used for needle guidance in 82 of the 112 cases; the rest were biopsied with fluoroscopy alone. For the first type of the procedure, bolus injections of contrast material were given in order to differentiate large vascular structures from central and mediastinal lesions and also for demonstrating small

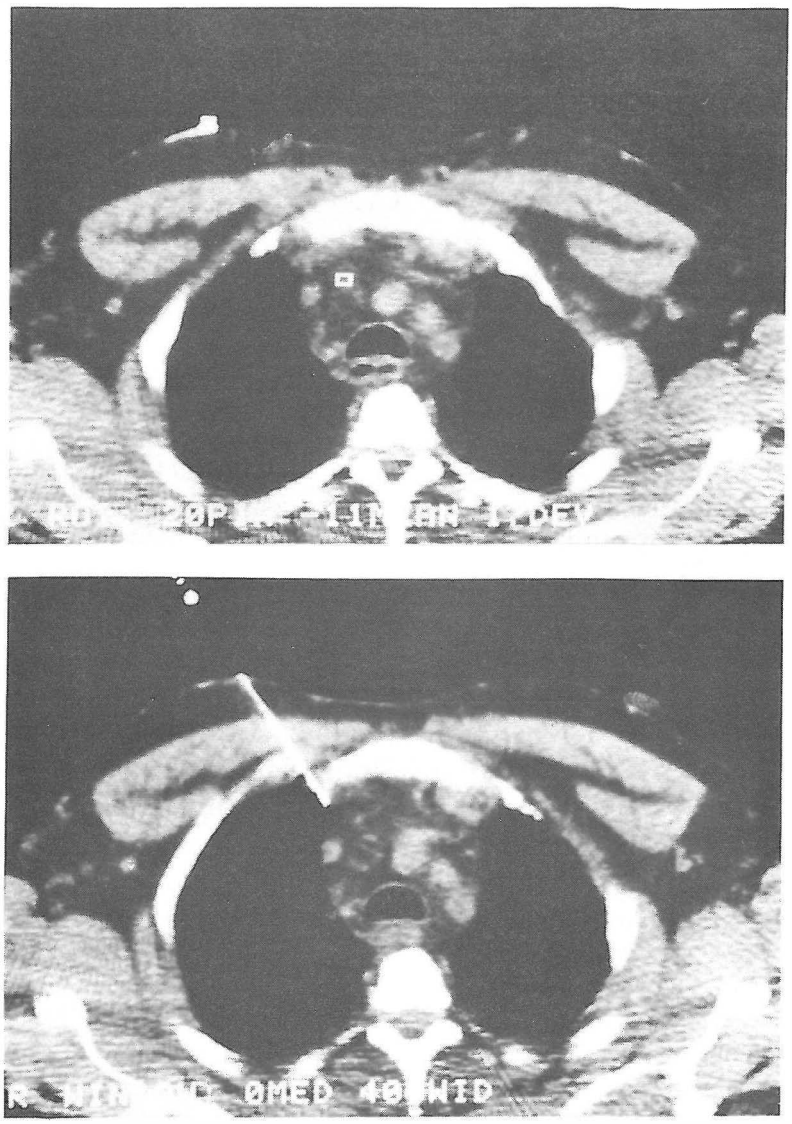

Figure 1. Transthoracic needle biopsy under CT guidance in a 45-year-old man with SVC obstruction syndrome. A. contrast enhanced CT reveals skin metal marker at entry site. B. Biopsy needle has been inserted into mediastinum between supraaortic vessels. Histologic examination domonstrated mediastinal fibrosis.

hydatid cysts that may simulate a small round solid mass in nonenhanced studies. Whether an anterior or posterior approach was used depended on which route provided the shortest distance from the skin to the lesion and based on knowledge of prior radiographic and CT studies. The point of needle insertion was determined from the initial scan series using a radiopaque marker on the skin. In order to locate the needle tip in small lesions, or within a nonnecrotic part of large lesions, repeated scanning was carried out during needle insertion (Figure 1). When the needle was situated correctly near the lesion the inner clefted needle was insterted into the mass and tissue sample was sliced by a sharp advancing of the outer cutting cannula while the inner needle was held stationary. Lesions that required traversing lung parenchyma were sampled only once, but for peripheral and accessible mediastinal lesions two to five samples were obtained. In those patients suspected of developing early pneumothorax the scan was repeated at least once at the end of the procedure. Fluoroscopy-guided biopsy was used in 30 cases. Biopsies were performed on a conventional remote-control fluoroscopic table in a similar manner described above. Tissue specimens from Tru-cut biopsies were placed into a bottle that contained formalin and sent for appropriate histologic and bacteriologic examination. Following twenty minutes, an expiration posteroanterior chest flim was

obtained for assessment of pneumothorax.

RESULTS

Tables I and II summarize the etiology of lesions and histologic diagnoses established by cutting needle. Table III demonstrates the results of percutaneous tru-cut needle biopsies. From 112 needle biopsies, even though an adequate specimen for histologic examination was obtained in 110 patients (98%), the final diagnosis could not be assessed in 9 patients. The total accuracy was 91% with 9% false negative and no false positive diagnoses. 29 lesions of the 112 biopsies were mediastinal and the rest pleuroparenchymal. A specific diagnosis was obtained in 103 patients. This was verified by histologic surgical specimens in 47 patients, by response to radiation, and by appropriate subsequent clinical course or response to specific treatment in the others.

Of the 29 mediastinal lesions, the specimen obtained from Tru-cut needle biopsy was satisfactory in 28 patients. A definite histologic diagnosis was obtained in 27 cases. In two patients findings of needle biopsy were inconclusive, and the correct diagnosis was established at surgery. These included one small-cell carcinoma and one anterior mediastinal lymphoma. In one of the two false negatives only necrotic material was obtained during the biopsy attempt and in another patient an inflammatory process was reported in histologic examination. There were no false positive diagnoses. The mediastinal overall accuracy was 93%. In the remaining 83 cases there were 82 parenchymal biopsies and one pleural lesion. False negative diagnosis occurred in seven of 83 pleuropulmonary lesions. Final diagnosis was confirmed by clinical follow up in three, and by surgical resection in four cases. These included one metastatic hypernephroma, two intrabronchial squamous cell carcinomas, one necrotic squamous cell carcinoma, one adenocarcinoma, and two adenoid cystic carcinomas. Adequate specimens were obtained in 82 of 83 cases. In one patient only necrotic material was revealed by percutaneous needle biopsy but subsequent surgical intervention demonstrated an inoperable squamous cell carcinoma. The overall accuracy for pleuroparenchymal lesions was 91%.

Of 112 patients, 12 were represented clinically with superior sulcus tumor. Eight were on the right side and four on the left. Pathologic specimens revealed eight squamous cell carcinomas, two adenocarcinomas, one metastatic adenocarcinoma, and one bronchioloalveolar cell carcinoma. All biopsies were performed with Tru-cut needle under CT guidance, and no complication was demonstrated.

The total number of complications was 17 (15%).

Table I: Etiology of Pleuropulmonary Lesions and Histologic Diagnosis Established by Tru-cut Needle

Etiology	No. of patients	Specific Diagnosis	Adequate Specimen
Metastases	8	7	8
Squamous Cell Carcinoma	24	21	23
Undifferentiated Carcinoma	8	8	8
Large Cell Carcinoma	7	7	7
Small Cell Carcinoma	11	11	11
Adenocarcinoma	12	11	12
Bronchioloalveolar Carcinoma	4	4	4
Adenoid Cystic Carcinoma	2	-	2
Hodgkin's Disease	1	1	1
Round Cell Tumor	1	1	1
Malignant Mesothelioma	1	1	1
Progressive Fibrosis	1	1	1
Interstitial Pneumonitis	1	1	1
Nonspecific Granuloma	1	1	1
Hamartoma	1	1	1
Total	83	76	82

Table II: Etiology of Mediastinal Lesions and Histologic Diagnosis Established by Tru-cut Needle

Etiology	No. of patients	Specific Diagnosis	Adequate Specimen
Metastases	3	3	3
Malignant Teratoma	1	1	1
Malignant Thymoma	1	1	1
Hodgkin's Lymphoma	3	2	3
Non-Hodgkin's Lymphoma	8	8	8
Small Cell Carcinoma	4	3	3
Neurogenic Tumor	2	2	2
Ectopic Thyroid	1	1	1
Thymolipoma	1	1	1
Lipoid Mass	3	3	3
Fibrosing Mediastinitis	1	1	1
Sarcoidosis	1	1	1
Total	29	27	28

Table III: Results of Percutaneous Tru-cut Needle Biopsies of Thoracic Lesions

Location	No.	False Neg.	False Pos.	Overall Accuracy
Pleuropulmonary	83	7(9%)	0(0%)	91%
Malignant	79			
Benign	4			
Mediastinal	29	2(10%)	0(0%)	93%
Malignant	20			
Benign	9			
Total	112	9(9%)	0(0%)	91%

Table IV. Complications of Percutaneous Tru-cut Needle Biopsies Of Thoracic Lesions

Complication	Mediastinal	Pleuropulmonary	Total
Hemoptysis	1	2	3(2.6%)
Pneumothorax	3	10	13(11.5%)
Cellulitis	-	1	1(1%)
Total	4	13	17(15%)

There were no deaths in the experience reported here (Table IV). Pneumothorax was detectable in 11.5% of biopsies. Most of them were small and none required chest tube placement. Hemopstysis was observed in three patients (2.6%). Anticoagulant regimen was responsible for hemoptysis in one and puncture of hilar vessels in others. Cellulitis was detected at the puncture site in one patient which recovered within several days by conservative treatment.

DISCUSSION

Percutaneous transthoracic needle biopsy is the procedure which is most likely to establish either a definitive diagnosis or an accurate description of the disease process. With increasing use of this method, more cases are being diagnosed and fewer patients are subjected to thoracotomy. Numerous types of biopsy needles have been introduced over the years with the goal of improved tissue diagnosis. In thin and small bore needles the question of the superiority of one instrument over another has not been critically demonstrated. Clinical comparison of small and large-caliber cutting needles for biopsy were performed by Haaga, et al.[3] They concluded that although a 22-gauge thin-bore biopsy needle had a high recovery rate in a large percentage of cases, however, the larger cutting needles more consistently demonstrated a higher recovery rate and diagnostic specimen. Andriole, et al evaluated a wide variety of needles of different caliber, cutting tip, and bevel in the laboratory.[4] They found that large-bore needles were superior to thin needles. As the needle bore increases, the size and quality of tissue samples becomes greater.

In the study presented here, a 14-gauge Travenol Tru-cut needle was used in all cases. This led to a correct diagnosis for 91% of all lesions. Satisfactory specimens for histologic diagnosis was obtained in 98%, with 9% false negative and no false positive diagnoses. The instrument was useful not only for diagnosing malignancy but also for determining specific malignant cell types and diagnosing benign disorders (Figure 2). The diagnosis of benign lesions is necessary for eliminating thoracic surgery. The general accuracy rate for benign lesions, although few in number, was excellent and the pathologist had adequate tissue for architectural analysis. It should be emphasized that two of nine false negative diagnoses involved intrabronchial lesions resulting from a collapsed segment or lobe, so percutaneous biopsy tissue obtained by large needle biopsy was negative because the collapsed lungs were biopsied. Therefore it is recommended to use bronchoscopy as the first step in such cases.

Although fluoroscopically-guided needle aspiration biopsy of thoracic lesions is a highly accurate diagnostic procedure, a percentage of false negative or inadequate results will be encountered. Since CT equipment became available in my department, it was selected for all needle guidances and now I recommend it in all percutaneous Tru-cut needle biopsies.

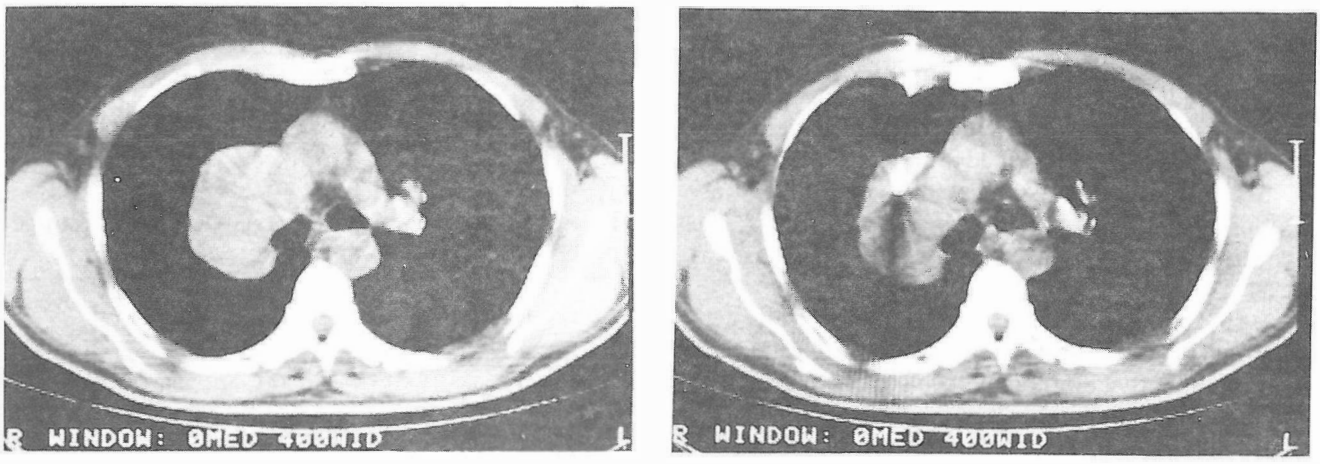

Figure 2. A). Thoracic CT in a 54-year-old man with negative bronchoscopy demontrates a paracaval mass near the right hilum. B. CT slice during percutaneous biopsy shows optimal needle location as it engages the lesion. Pathologic specimen revealed squamous cell carcinoma.

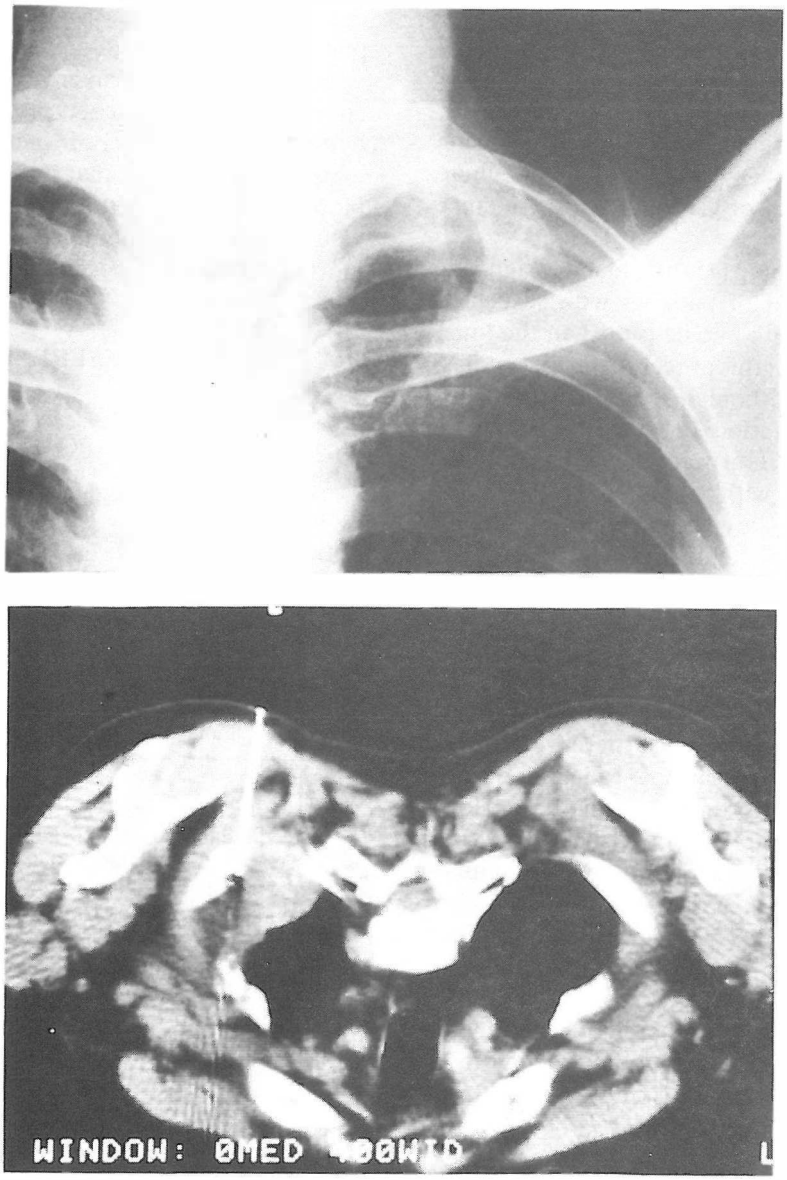

Figure 3. A 75-year-old man with shoulder pain. A. Posteroanterior chest radiograph demonstrates asymmetric apical cap in the left side.B. Prone CT during biopsy shows needle tip in apical mass. Pathologic examination revealed squamous cell carcinoma. CT is the best procedure for demonstrating early superior sulcus tumors.

Guidance by CT is advantageous in the region of the thoracic inlet, hilum, middle mediastinum, and chest wall masses,[1,5,7,8] in pleural based lesions, patients with SVC syndrome, and in those lesions with central necrosis which have only a thin rim of identifiable neoplastic tissue. The dense opacification of vascular structures that can be achieved with contrast enhancement allows the selection of an approach that avoids traversing them. CT is useful for determining the depth of the mass and its relation to other structures and for identifying a path for minimal danger for passage of the large needle. Because of the high incidence of hydatid cysts in our country, CT is a good modality for differentiating them from solid coin lesions.

Superior sulcus tumor is a form of bronchogenic carcinoma arising in the extreme apex of the lung. Sputum cytology and bronchoscopy is often nondiagnostic in these peripheral lesions, and needle biopsy is the most efficacious nonsurgical method of establishing a pathologic diagnosis. Radiographic findings may be quite subtle, consisting of only slight asymmetric apical thickening with or withouth bone destruction, hence CT is necessary for accurate assessment of the local extent of disease and resectability of tumor. In

evaluating these tumors, O'Connell, et al. demonstrated a 69% success rate using a 22-gauge needle for percutaneous access.[9] They reflected this low accuracy rate to scant cellularity and abundant desmoplastic reaction in these lesions. In the present study, a 100% accuracy rate was revealed. This is related to using large bore cutting needles for obtaining adequate specimens, and selection of CT for needle guidance (Figure 3).

Pecutaneous needle biopsy is a valuable diagnostic tool in the management of patients with suspected mediastinal mass. As with needle biopsy in the lung, the primary indication for this procedure in the mediastinum is to differentiate benign from malignant disease. A potential limitation of mediastinal needle biopsy is the difficulty in interpreting lymphoproliferative diseases.[5] However, with adequate tissue obtained by large needle biopsy, key features, such as Reed-Sternberg cells, can be demonstrated clearly. The presence of dense fibrosis in the nodular sclerosis type of Hodgkin's disease creates difficulty in obtaining adequate material for interpretation. In my experience percutaneous needle biopsy was very useful in the diagnosis of lymphoma. Of the 12 lymphomas (11 mediastinal and one parenchymal), there were 8 non-Hodgkin lymphomas, and 4 cases of Hodgkin's disease with one false diagnosis for the latter. In other studies that used fine needle aspiration biopsy, poorer results were achieved in the cytologic examination of lymphoma. In Weisbord's series, only 66.7% of cases were correctly diagnosed by PNAB.[10] The high accuracy rate (91%) in the present study is probably related to large specimens obtained by the Tru-cut needle.

Serious complictions with percutaneous needle biopsy of thoracic lesions are infrequent. Pneumothorax, the most frequent complication, occurs in 15%-27% of cases, and hemoptysis, the second most frequent complication has been reported in 2%-16% of cases.[11] My results support this with 11.5% pneumothorax and 2.6% hemoptysis frequency rates.

Selection of the proper needle is becoming more complex as the number of types increases and reports of better results with certain needles proliferate. This experience has shown that percutaneous transthoracic biopsy using large cutting needles is an efficient and valuable diagnostic method with little morbidity and no mortality, and CT is neccessary for this procedure.

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EVALUATION OF TWO DOSES TERFENADIN AND CHLORPHENIRAMINE IN THE TREATMENT OF ALLERGIC RHINITIS

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INTRODUCTION

Allergic rhinitis is a common disease in east Iran (Khorasan Province) where about 10 to 15% of the general population suffer from this allergic reaction.[1]

In North America estimates suggest that 12 million (29%) of the 41.5 million persons with upper respiratory allergies do not seek medical care because of the side effects of treatment. Terfenadin, a nonsedating antihistamine, could be helpful in the management of these patients. This drug is not available in Iran and the other antihistamines give drowsiness, headache, dry mouth and fatigue Objective studies in Europe and North America suggest that terfenadin is free of these depressant side effects.[3-10]

We compared the clinical efficacy and side effects of terfenadin and chlorpheniramine and confirmed the prior reports,[12-17] and demonstrated that terfenadin can be helful in the treatment of allergic rhinitis.

MATERIALS AND METHODS

Thirty six subjects with clinical history of allergic rhinitis entered the study. These were 10 males and 26 females ranging in age from 20 to 52 years (mean age 35 years). The diagnosis was established by the clinical history and physical findings and corraborated by positive skin prick test to appropriate allergic pollen extract which is common in east Iran (prepared by Bencard and Donei/Hollister Co.) All had 3+ to 4+ wheal and flare reaction. All subjects had a history of hay fever for at least 2 years. Each potential subject had a history of response to antihistamine therapy during the previous fall pollen seasons.

Subjects were excluded from the study for the following reasons:

- pregnancy and lactation
- nasal polyps, sinusitis, asthma
- a history of systemic corticosteroid therapy for hay fever
- use of depot corticosteroid within 2 months prior to initiation of the study.
- allergen immunotherapy
- use of antibiotics or disodium cromoglycate nasal spray.

Study Design

A double-blind randomized parallel study plan was used to compare the outcome of the treatment with terfenadin, 60 mg twice daily and chlorpheniramine, 4 mg three times daily. Each subject was also given a diary card for evaluation. On the card 7 main symptoms were listed normally: Sneezing, rhinorrhea, nasopharyngeal itching, nasal congestion, itching eyes, red eyes and watery eyes, and space for side effects like drowsiness, headache, dizziness, weakness, fatigue and dry mouth.

The patients were clinically evaluated at the beginning and the end of a 7 day treatment period.

RESULTS

Of the 36 patients in the study, 20 patients were in the terfenadin treatment group and 16 in the chlorpheniramine group. The differences in potency are shown in Table I and Figure 1.

Table I. Clinical effects of terfenadin and chlorpheniramine

Symptoms	Terfenadin	Chlorpheniramine
Sneezing	100%	98%
Nasal obstruction	81%	78%
Rhinorrhea	80%	75%
Itching nose	70%	70%
Itching eyes	70%	70%

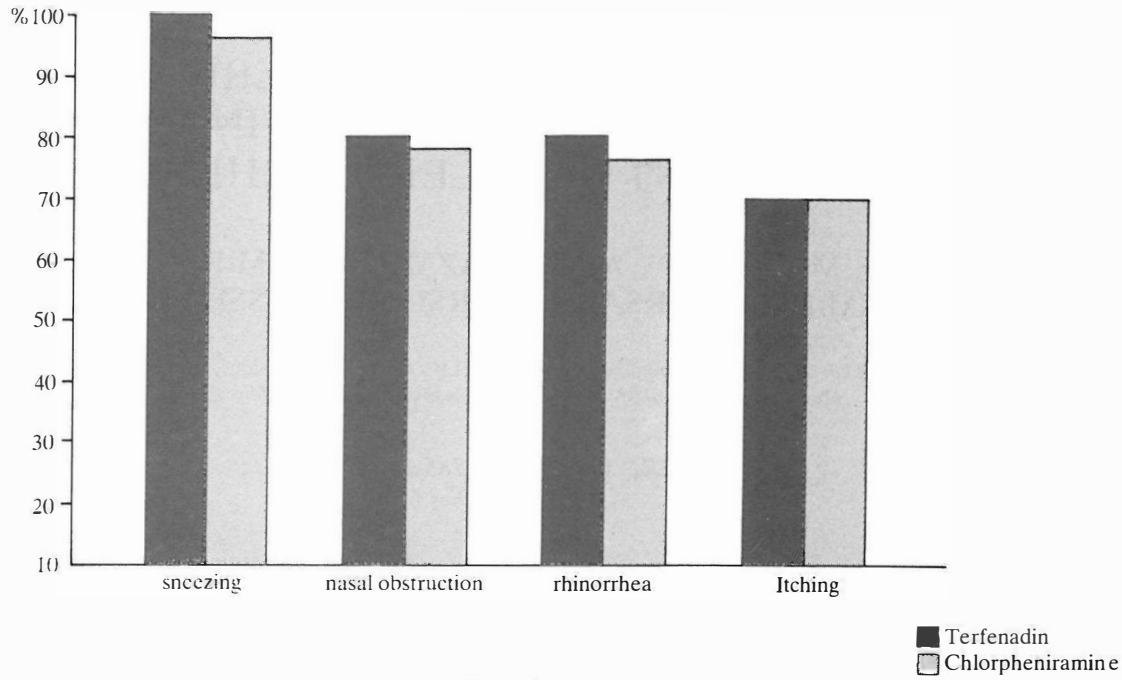

Figure 1

Slight differences is potency are observed in this study between terfenadin and chlorpheniramine.

Side effects and central nervous system effects are shown in Table II and Figure 2.

Table II. Side effects and central nervous system effects of terfenadin and chlorpheniramine.

Adverse effect	Terfenadine	Chlorpheniramine
Drowsiness	0.8%	14.5%
Headache	4%	5%
Dizziness	2.5%	4%
Weakness	0.9%	3%
Fatigue	0.8%	2%
Dry mouth	0.8%	2%

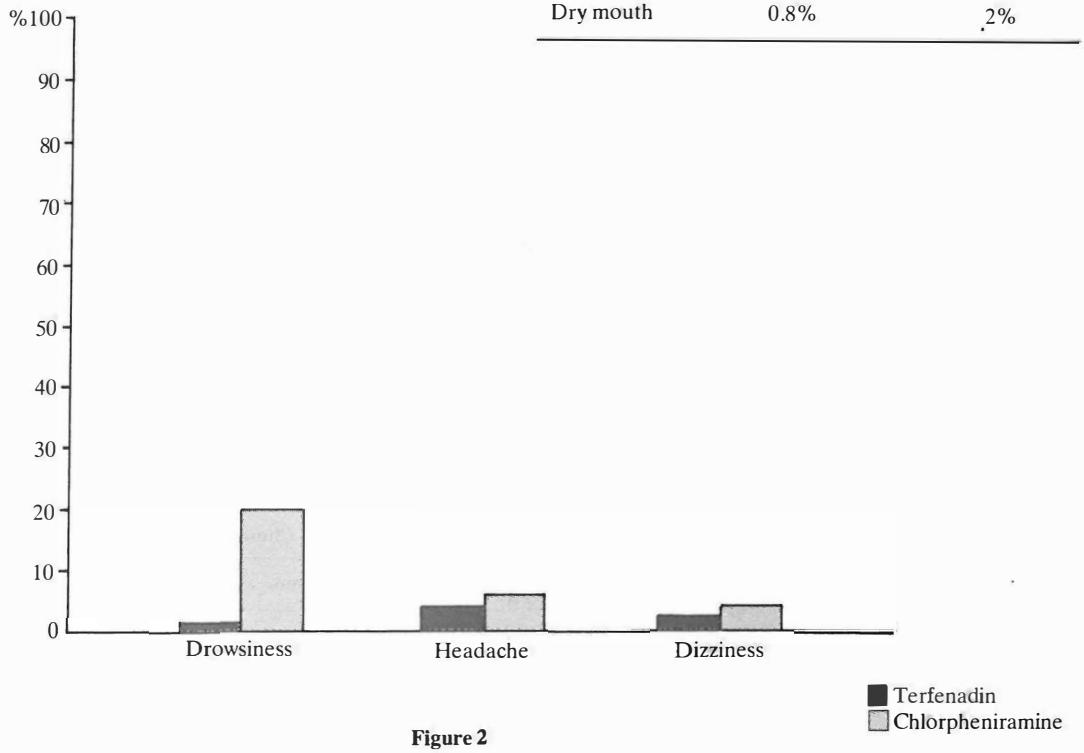

Figure 2

There is a significant difference of central nervous system side effects between terfenadin and chlorpheniramine.

DISCUSSION

Antihistamines are effective in the treatment of many allergic and non-allergic conditions, but sedation and other side effects frequently accompany antihistamine therapy.[3] These side effects force many patients with allergic rhinitis to use other forms of treatment. In this study we confirmed that terfenadin is an antihistamine devoid of any significant central nervous system or anti-cholinergic side effects. This finding has been reported previously.[4]

Terfenadin represents an improved form of therapy for allergic rhinitis and it is effective in relieving symptoms. It is noticed that the currently recommended dose of terfenadin (60 mg tablets bid) may be the maximum dose for some patients. Some patients with allergic rhinitis in Iran have relief of symptoms with only 60 mg of terfenadin daily:

Terfenadin was approved for use in the United States in 1985. It has been used extensively in Europe,[5] but it is not currently used in Iran.

Allergic rhinitis is a common condition in east Iran. As this study shows a low incidence of side effects and central nervous system effects with this anti-histamine, we hope it will be available in the Islamic Republic of Iran soon.

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