Education Bulletin

Jan./Feb. '00

American Association for Respiratory Care

Notes from the Editor

by Arthur Jones, EdD, RRT

Among the many honors bestowed at the AARC International Respiratory Congress last December were those given to students who have written exemplary research papers through the American Respiratory Care Foundation's (ARCF) Education Recognition Award Program. The awards given to these fledgling authors are well deserved. These students represent a very important future resource for the respiratory care profession. As the millennium unfolds, many of the "old guard" will be retiring. We must develop a continuous supply of RC professionals with the talent, intellect, and energy to assume the reins of leadership. These awardees are among that group. By competing in the ARCF program, these students have not only learned to how conduct research, but also how to communicate their findings in a professional manner.

The awards that these students receive also honor their mentors. Usually, there is an interested, motivating professor somewhere behind such achievements, and we should commend those mentors for their contributions in developing leaders for the future of the profession. We are proud and pleased to publish the winning student papers, which will appear in this and forthcoming issues as space permits, in our *Bulletin*. ■

Notes from the Chair

by David W. Chang, EdD, RRT

If you are reading this issue of *Bulletin*, you will have survived the Y2K bug! On behalf of the Education Section membership, I wish you a happy and productive 2000.

Speaking of wishes and resolutions, January is a time to set new goals for the new year. I would like to ask you to consider the following as you formulate your professional goals for the year 2000:

Send in your research abstracts for presentation at the Summer Forum in Vail, CO, and International Respiratory Congress in Cincinnati, OH. (Contact Gudi Pryor at zzpryor@washburn.edu.)

Submit a research paper to the *Education Annual*. (Contact David Shelledy at shelledy@uthscsa.edu.)

Write an article of interest for the *Education Bulletin*. (Contact Arthur Jones at jonesap@uthscsa.edu.)

Volunteer to serve on one of six Education Section Committees.

(Contact David Chang at chang_david@colstate.edu.)

Thank you for your continuing support, and Happy New Year! ■

From the NBRC

The NBRC recognizes the important role that respiratory care educators play in disseminating information and providing feedback to students and potential candidates for the NBRC's examination programs. In an effort to strengthen this valuable relationship with you and to provide the most current and timely information, the NBRC is pleased to take advantage of the AARC Education Section's invitation to become a regular contributor to the *Education Bulletin*.

Release of candidate scores by name to education programs

In response to requests from many of you, on November 20 the NBRC Board of Trustees unanimously approved the release of candidate scores, by name, to education programs. This decision was made in an effort to assist you in evaluating, modifying, and improving your educational programs.

Candidates will be able to sign a statement on the new computer-based testing applications authorizing release of this information. In the past, the NBRC has been strongly encouraged by legal counsel to keep candidate test scores confidential. However, due to your increased need for the information to demonstrate compliance with accreditation thresholds, the previous policy was reevaluated. Legal counsel has drafted an appropriate release statement for the NBRC's computer-based testing applications to allow candidates the option of providing results to their educational programs.

Computer-based testing 2000

As you are well aware by now, the NBRC's transition to computer-based testing is nearly complete and we are ready to begin

"NBRC" continued on page 2

"NBRC" continued from page 1

testing at 87 sites around the country on January 10. We have completed production of a new candidate handbook package which consists of general information outlining the application policies and procedures for all of the NBRC's examination programs, a generic application form to be used to apply for any of the five examinations, and examination-specific content outlines. These handbooks are designed to be reference materials that can be kept for use over a period of time. A supply of the new candidate handbooks was sent to all accredited education programs in late December. Additional applications are always available upon request.

New web-based self-assessment examinations

In addition to computer-based testing for credentialing purposes, the NBRC will be offering self-assessment examinations via the web site (www.nbrc.org). This exciting new service will provide students the freedom to experience not only the opportunity to evaluate their preparation for the credentialing examinations, but to become comfortable with the examinations offered on the computer. A new self-assessment brochure offering these new products, their prices, and the release schedule was mailed to all accredited education programs in late December. Please note: paper and pencil self-assessment examinations will remain available.

How you can help

The implementation of computer-based testing and the use of technology to enhance current self-assessment products and services are steps toward providing more flexibility for national credentialing candidates. Please assist us in encouraging your graduates to apply for a computer-based testing examination in 2000 and your colleagues to participate in the voluntary recredentialing process. Credentialed practitioners may already attempt their respective examinations for voluntary recredentialing every three years.

In addition, please provide feedback to us regarding this transition into technology. We are committed to building a strong computer-based testing program that is responsive to the needs of the respiratory care community. Your comments will help us achieve this goal and continue to improve the credentialing system for the profession.

Lastly, we are interested in your ideas and suggestions for future NBRC columns in this *Bulletin*. You may send your thoughts to: Michelle A. Cheney, MBA, assistant executive director, National Board for Respiratory Care, 8310 Nieman Road, Lenexa, KS 66214, (913) 599-4200, extension 478, FAX (913) 541-0156, e-mail: mcheney@nbrc.org. ■

Education Bulletin

is published by the
American Association for Respiratory Care
11030 Ables Lane
Dallas, TX 75229-4593
(972) 243-2272
FAX (972) 484-2720
e-mail: info@aarc.org

Kelli Hagen
AARC communications coordinator

Debbie Bunch
Bulletin managing editor

Edwards Printing
Bulletin typesetting

Chair
David Chang, EdD, RRT
Respiratory Therapy
Columbus State University
4225 University Avenue
Columbus, GA 31907
(706) 568-2130
FAX (706) 569-3101
e-mail: chang_david@colstate.edu

Bulletin Editor
Arthur Jones, EdD, RRT
Department of Respiratory Care
The University of Texas Health Science Center at San Antonio
7703 Floyd Curl Drive
San Antonio, TX 78284-7784
(210) 567-8857
FAX (210) 567-8852
e-mail: jonesap@uthscsa.edu

Medical Advisor
Richard Sheldon, MD (ATS)
(909) 792-7563
FAX (909) 792-1641

Montelukast, Zafirlukast, and Zileuton, Leukotriene Inhibitors in the Treatment of Asthma

by Gelicia C. Jackson

Editor's Note: Gelicia C. Jackson is the 1999 recipient of the ARCF Jimmy A. Young Memorial Education Recognition Award. She was recognized at the AARC International Respiratory Congress held last December in Las Vegas, NV. Gelicia is a student in the respiratory care program at Georgia State University in Atlanta. To obtain information on this and other competitive awards for RC students, contact the American Respiratory Care Foundation at (972) 243-2272.

Asthma is an important health problem around the world today, affecting 14.6 million Americans alone, according to the American Lung Association. Asthma is currently known as a disease where there is chronic inflammation of the airway, which causes airflow inhibitions and hyperresponsiveness to stimuli. For a number of years, bronchodilators and corticosteroids have been an effective means for the treatment of asthma. Bronchodilators, such as β_2-agonists (salmeterol, albuterol) and methylxanthines, have been proven to effectively stop asthma attacks after they have started.1 Moreover, corticosteroids, such as prednisone (Deltasone), have effectively been proven to prevent asthma attacks from starting.[2] While existing treatments prove to be effective, asthma continues to be a clinical problem that needs new, innovative treatments.

New understanding of asthma has revealed a number of aspects that have added a new direction to asthma therapy. A complex network of inflammatory cells which excrete mediators,[3] such as histamine, cysteinyl leukotrienes, and eosinophil products, has been found.[4] The discovery of this new information has caused conventional views about asthma and asthma treatments to change. Because of the recent advances in the understanding of the pathophysiology of asthma, a new emerging asthma therapy has developed.[4] This new therapy, known as antileukotriene therapy, involves a new class of medications that will block the action of leukotrienes (LT). This new class of medications includes three LT inhibitor drugs: zafirlukast (Accolate), zileuton (Zyflo), and montelukast (Singulair), which have been effectively proven in clinical trials to block the activity of leukotrienes. The purpose of this paper is to review the physiology, pharmacology, and the clinical application of the antileukotriene agents in the treatment of asthma.

Leukotrienes

Leukotrienes are identified as inflammatory lipid mediators that are synthesized from arachidonic acid.[5] The name leukotriene reflects their production from and action on leukocytes ("leuko," meaning white blood cell, and "triene," meaning a characteristic chemical feature).[7]

Biosynthesis

Leukotrienes make up a class of inflam-

"Asthma" continued on page 3

"Asthma" continued from page 2

matory mediators that are synthesized from one of three essential fatty acids, arachidonic acid. The synthesis of LTs occurs in the 5-lipoxygenase enzyme, which produces several species of leukotrienes with characteristic biological activities.[8] Arachidonic acid is released from phospholipids and within the cell membrane by enzyme activation from phospholipase-A_2.[9] When released by the action of this phospholipase, there are two different pathways for arachidonic acid metabolism: the cyclooxygenase pathway and the 5-lipoxygenase (5-LO) pathway. The cyclooxygenase pathway converts arachidonic acid to four prostaglandins, PGE_2, PGD_2, PGF_2, and PGI_2, and thromboxane. However, the 5-LO pathway converts the arachidonic acid to leukotrienes. As Figure 1 shows, the 5-LO combines with 5-lipoxygenase-activating protein (FLAP), which is a complex that will form leukotriene A_4 (LTA_4), an eicosatetraenoic acid,[10] by forming an intermediate, 5-hydroxy-eicosatetraenoic acid (5-HPETE).[10] The leukotriene LTA_4 is then converted to either leukotriene B_4 (LTB_4), synthesized by monocytes and macrophages,[9] or to leukotriene C_4 (LTC_4). Leukotriene B_4 is formed by way of LTA_4 hydrolase, which catalyzes the enzymatic hydrolysis of LTA4.[10] However, LTA_4 is converted to LTC_4 by Leukotriene C_4 synthase, which catalyzes the conjugation of LTA_4 with reduced glutathione.[10] Once LTC_4 has been produced, it is further broken down outside the cell into leukotriene D_4 (LTD_4) and leukotriene E_4 (LTE_4). The leukotrienes LTC_4, LTD_4, and LTE_4 form a group known as the cysteinyl leukotrienes, which are synthesized by mast cells, eosinophils, basophils, macrophages, and monocytes.[9] It is the cysteinyl leukotrienes and LTB_4 that are likely to play a role in asthma, although the full extent of their contribution has not been clearly established.[8]

The role of leukotrienes in asthma

Asthma is frequently characterized by the immunologic release of chemical mediators, which leads to narrowing of the airways, excessive mucous production, and airway inflammation.[11] These changes are the result of the release of potent chemical mediators of inflammation such as leukotrienes. The cysteinyl leukotrienes (cysLTs) are originally described by their activity as "slow-reacting substance of anaphylaxis"(SRS-A).[3] Cysteinyl LTs are released by inflammatory cells, which are present in the airways of asthmatic individuals, and have become leading targets for new asthma therapies.[12] The cysLTs have been implicated as important mediators in the pathophysiology of asthma. Although cysLTs are not the only mediators responsible, they do exert many effects that correspond with the clinical expression of asthma, such as increased microvascular permeability and hypersecretion of mucus.[3] These leukotrienes, LTC_4, LTD_4, and LTE_4, also cause constriction of bronchial muscle and vascular smooth muscle.[11] However, although minor compared to cysLTs, LTB_4 is likely to play a role in asthma as well. Because of the effects that these leukotrienes cause, they are the main focus in the pathophysiologic mechanisms of asthma.[10]

Cysteinyl LTs directly contract airway smooth muscle. The cysteinyl leukotrienes are produced by a number of cell types, particularly mast cells and macrophages. Mast cells generate several mediators, including histamine, and synthesize the cysLTs, while macrophages generate LTB_4 and the cysLTs as well.[5] Because both mast cells and macrophages are found in the airway, they can be sources of cysLTs when activated. LTC_4 and LTD_4 have proven to be 1,000 times more potent than histamine in the contraction of the bronchus, with a longer duration of action.[12]

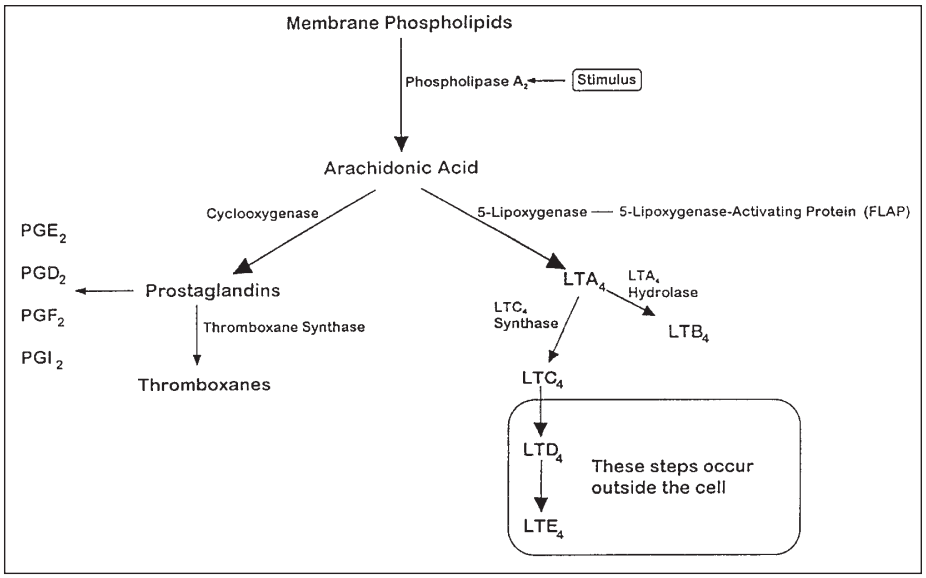

Figure 1. The formation of leukotrienes, prostaglandins, and thromboxanes from arachidonic acid metabolism. (Adapted from Spector)[9]

In human skin, LTC_4 and LTD_4 produce flare responses and increase maximal airway narrowing induction in normal patients.[13] Both large and small airways of asthmatic patients are constricted by cysLTs.[13] These vasodilating and bronchoconstricting effects of cysteinyl leukotrienes suggest their central role in asthma. In contrast, the role of LTB_4 in asthma is unclear. Leukotriene B_4 is a chemoattractant that stimulates chemotactic activity for neutrophils and the release of mediators and enzymes.[5,8] Leukotriene B_4 may have an indirect effect due to the stimulation of interleukin (IL)-5 production by T-cells and promotion of the effects of IL-4 on IgE production by B-cells.[3] Because of the specificity for neutrophil recruitment into the lung, LTB_4 has the capacity to activate those cells, causing inflammation.[5]

Cysteinyl leukotrienes also stimulate hypersecretion of mucus in human airways. LTC_4 and LTD_4 are also potent stimulants of mucous in human airways.[13] Because of the recruitment of eosinophils and neutrophils, LTC_4 and LTD_4 are released. With the release of these cysLTs, mucus is produced and secreted in human airways. Studies on human airways have shown increased release of mucus in response to LTC_4 and LTD_4 secretion. In a recent study, subjects with asthma who were 6 to 9 times more responsive to LTC_4 and LTD_4 than LTE_4 were found to have an increase in the eosinophils.[8] The data from this study suggest that those subjects more responsive to LTC_4 and LTD_4 had an enhanced secretion of mucus compared to normal subjects.

In addition, cysteinyl leukotrienes stimulate increased vascular permeability. Increased vascular permeability is an important feature of airway obstruction in asthma. The cysLTs act on the vasculature to produce vasodilation, which increases vascular permeability. In recent studies, LTC_4, LTD_4, or LTE_4 was given to patients in small quantities by injection.[9] Within minutes of the injection, patients developed wheal and flare reactions.[9] The result of the study suggests that cysLTs cause vascular permeability. The cysLTs have profound effects on the features of asthma. The studies show supporting evidence that these leukotrienes have a central role in increased vascular permeability, mucus production, bronchoconstriction, and vasodilating in asthma.

Antileukotriene therapy

Although many therapeutic agents have been used throughout the years, antileukotriene agents have been developed to be effective against asthma. Because of the dangerous effects that leukotrienes have in asthma, the creation of drugs that are capable of reducing or even eliminating the production of leukotrienes can be extremely valuable in asthma therapy.[7] The pharmaceutical industry developed agents with antileukotriene effects that inhibit the production and block the action of leukotrienes.[9] Although a number of antileukotriene agents have been developed, these agents fall into two main classes known as leukotriene synthesis inhibitors and leukotriene receptor antagonists. Therefore,

"Asthma" continued on page 4

"Asthma" continued from page 3

the two basic modes of action for the inhibition of leukotriene effects are inhibition of leukotriene synthesis and antagonism of leukotriene receptors, respectively.[13] Although there are many different approaches available for inhibiting leukotriene synthesis, 5-lipoxygenase (5-LO) inhibitors seem to be the most effective. However, the antagonism of leukotriene receptors occurs through the use of specific cysteinyl leukotriene receptor antagonists to block the actions of cysLTs.[13]

Inhibitors of 5-LO prevent not only the synthesis of LTB_4; these inhibitors prevent that of cysteinyl leukotrienes as well.[13] 5-LO inhibitors inhibit LT biosynthesis by directly inhibiting 5-lipoxygenase by binding to the 5-LO activating protein, which has been proven by the antileukotriene agent zileuton.[9] Zileuton is a 5-LO inhibitor that directly blocks the catalytic activity of 5-lipoxygenase itself,[3] and is one of the three currently available antileukotriene drugs.

Leukotriene receptor antagonists inhibit several agents that provoke narrowing of the airway in asthma.[13] Receptors for leukotrienes are categorized into two classes: receptor for LTB_4, known as BLT-receptors, and receptors for cysteinyl leukotrienes, known as cysLT receptors.[13] Of the cysLT receptors, there are two subgroups, known as $cysLT_1$ and $cysLT_2$.[5] $CysLT_1$ receptor antagonists specifically block the effects of cysLTs, but do not affect LTB_4.[8] Montelukast and zafirlukast are two examples of cysLT receptor antagonists that have proven to be effective.[5] Montelukast inhibits LTD_4 while zafirlukast is a receptor antagonist of LTD_4 and LTE_4, which are components of SRS-A.

Pharmacology

Inhibitors of the synthesis of leukotrienes, zileuton, and leukotriene receptor antagonists, montelukast and zafirlukast, have improved pulmonary function as well as asthma symptoms. Because these medications have been shown to be well tolerated and effective in the treatment of asthma, they have recently been approved by the FDA for general clinical use.

Montelukast

Montelukast, also known as Singulair, is a potent, specific leukotriene receptor antagonist that has shown a substantial block of airway leukotriene receptors as long as 24 hours after dosing.[14] This receptor antagonist is an orally active drug with a dosage of 10 mg. for a film-coated tablet and 5 mg. for a chewable Singulair tablet. In the metabolism of arachidonic acid, the cysteinyl leukotrienes are produced. These cysteinyl leukotrienes then bind to the $cysLT_1$ receptors in the human airway. Montelukast will bind to the $cysLT_1$ receptor, blocking the actions of LTD_4 at that $cysLT_1$ receptor site. This antileukotriene drug has shown a clinical benefit for patients with chronic asthma.[14] In addition to improving airway obstruction, montelukast also provides protection against episodes of worsening asthma.[14] Therefore, montelukast (Singulair) has provided a definite clinical benefit to chronic asthma patients.

	Age	Dose	Interactions	Side Effects
5-LO Inhibitor Zileuton (Zyflo)	≥ 12	600 mg, qid	Warfarin, Seldane, Theophylline, Propranolol	Liver enzyme elevation
$CysLT_1$ Receptor Antagonists				
Zafirlukast (Accolate)	≥ 12	20 mg, bid	Warfarin, Seldane, Theophylline,	Possible liver enzyme effects
Montelukast (Singulair)	≥ 6	5 mg (chew) 10 mg (both q.d.)	None	None

Table 1. Summary of dosage, age, drug interactions, and side effects for the 5-lipoxygenase inhibitor Zileuton (Zyflo) and the leukotriene receptor antagonists Zafirlukast (Accolate) and Montelukast (Singulair). (Based on Rau JL, lecture notes-personal communication)

Zafirlukast

Zafirlukast, known as Accolate, is a second receptor antagonist of the cysLTs LTD_4 and LTE_4. This leukotriene antagonist is used in the treatment of chronic asthma patients, with an oral dosage of a 20 mg. tablet (Table 1).[15] Similar to montelukast, instead of the cysLTs acting on receptors in the airway ($cysLT_1$ receptors), zafirlukast acts on the LTD_4 and LTE_4 at the $cysLT_1$ receptor site, blocking the action of the leukotrienes. Zafirlukast inhibits bronchoconstriction and attenuates the early- and late-phase reactions, although it has little effect on the late-phase reaction.[15] Therefore, zafirlukast shows definite clinical promise in protection against chronic asthma.

Zileuton

Zileuton, also called Zyflo, is a specific inhibitor of 5-lipoxygenzase that is a controller agent rather than a reliever.[15] This drug is administered orally in a 600 mg. tablet daily (Table 1).[15] Zileuton inhibits LT formation by first inhibiting the 5-lipoxygenase, which would catalyze leukotriene formation.[9] 5-LO, while in the presence of FLAP, will catalyze the conversion of arachidonic acid to prostaglandins and LTA_4, followed by that of the other leukotrienes. However, by inhibiting the conversion of arachidonic acid to these other leukotrienes, the leukotriene responses will be successfully blocked.[15] Zileuton has proven to inhibit bronchoconstriction induced by various allergins, and has provided benefits in asthma.

Clinical Application

Side effects

Zafirlukast and zileuton are the only two antileukotriene drugs that have significant side effects based on clinical experience to date. Montelukast has an advantage over the other two drugs because it has not only proven to be effective but also lacks side effects seen with zafirlukast and zileuton.

Zafirlukast (Accolate): Side effects that were reported by patients and volunteers are as follows: headache, infection, nausea, diarrhea, and abdominal pain.[16]

Zileuton (Zyflo): The side effects for this oral medication include headache, pain, abdominal pain, loss of strength, and dyspepsia.[15] Perhaps the most serious side effect of Zyflo is the elevation of liver function tests. Thus, monitored liver enzyme testing is recommended.[17] Symptoms of liver dysfunction may also develop, which include right upper quadrant pain, nausea, fatigue, lethargy, pruritis, jaundice, or flu-like symptoms.[17]

Drug Interactions

Zafirlukast and zileuton are the only medications that have drug interactions. Montelukast has another advantage over zileuton and zafirlukast because it has been proven effective with no drug interaction.

Zafirlukast: In a drug interaction study in volunteers, zafirlukast was found to have drug interaction with warfarin.[18] Zafirlukast caused prothrombin time to increase by 35%.[18] This interaction is most likely due to the inhibition by zafirlukast of a cytochrome isoenzyme system. Thus, Accolate may have an effect on other drugs that are known to metabolize the cytochrome isoenzyme system.[18]

Zileuton: Zileuton has drug interactions with two drugs that are important in respiratory care, theophylline and warfarin.[15] Zileuton causes an increase in the concentration of theophylline and prothrombin time when given with these drugs.[15] To decrease the effects of the drug interaction with warfarin, the dosage amounts should be adjusted and monitored.[15]

"Asthma" continued on page 5

"Asthma" continued from page 4

Efficacy
Montelukast

In terms of efficacy, the newer generation of leukotriene antagonists is more promising.[13] Studies show that leukotriene receptor antagonists inhibit several factors that provoke airway narrowing, such as exercise and allergens.[13]

Montelukast has proved to significantly improve airway obstruction.[14] In a placebo-controlled study, the clinical effect of montelukast and placebo were compared. Of the 681 patients who participated in the study, 408 patients were given the montelukast treatment, 10 mg. once daily at bedtime, while 273 patients were given the placebo treatment.[14] With the montelukast treatment, improved airway obstruction was shown by an increase in the forced expiratory volume in 1 second (FEV_1) of 13.1%, whereas the placebo treatment showed a 4.2% increase.[14] In addition, the morning peak expiratory flow rate (PEFR) was 24.0 L/min (placebo, 4.6 L/min.) while the evening PEFR was 15.9 L/min. (placebo, 4.2 L/min).[14] The airway improvement shown in the evening PEFR suggests that the 10 mg. of montelukast given once daily can provide protection throughout a 24-hour interval.[14] These improvements in airway obstruction were consistent throughout the period of the study. Thus, this clinical study demonstrates that montelukast provided a clinical benefit by consistent and significant improvement of airway obstruction, patient-reported endpoints, and asthma outcomes.[14]

In another study, montelukast provided significant protection against exercise-induced asthma. This 12 week, placebo-controlled study evaluated the effect of montelukast once daily on airway hyperresponsiveness to exercise and the overall clinical condition of patients with mild asthma.[19] Two hundred fifty patients were screened for this study, but only 110 patients who had asthma for more than one year participated.[19] The protection against bronchoconstriction by the montelukast therapy was significantly greater than that of the placebo treatment. The area under the FEV_1 curve showed a 47.4% degree of inhibition by the montelukast treatment compared with placebo treatment.[19] In addition, the montelukast therapy had no adverse effects throughout the period of the study. Thus, the 10 mg. of montelukast once daily provided significant protection against exercise-induced bronchoconstriction.[19]

Zafirlukast

By blocking receptors that mediate bronchoconstriction, vascular permeability, and mucous secretion, zafirlukast has shown to significantly improve the symptoms of asthma.[20] A U.S conducted study showed that Accolate improved asthma symptoms within one week of starting treatment.[18] With the zafirlukast treatment, 20 mg. twice daily, the patients had a FEV_1 of 5 liters.[18] Moreover, the Accolate treatment showed a morning PEFR of 22.06 L/min. (placebo 7.63 L/min.) and an evening PEFR of 13.12 L/min. (placebo 10.14 L/min.).[18] These results show that zafirlukast is an effective drug in the improvement of mild to moderate asthma symptoms.

However, there is some variability in the protection afforded by zafirlukast.[15] A study evaluating the challenge of exercise using 20 mg. of zafirlukast provided complete protection to three patients, while four patients had only partial protection and one patient had no protection.[15] Although this study shows that the protection afforded by zafirlukast is questionable, this receptor antagonist still has high efficacy. Thus, zafirlukast has shown to significantly improve airway function and reduce asthma symptoms.[13]

Zileuton

Zileuton has shown to be effective in providing benefits in chronic asthma.[14] In a 4 week study, Zyflo improved airway function and symptoms.[13] This placebo-controlled trial used patients with mild to moderate asthma at the highest dose of 2.4 gm./day.[13] The data from the study showed a mean increase in FEV_1 of 13.4% and a PEFR increase of 10%. In addition, there were no significant side effects reported, and the protection afforded by zileuton was found to last up to 10 days.[13] In a one-week study, zileuton improved airway obstruction, as well patient-reported end points.[15]

Conclusion

The recent understanding of asthma has led to the use of antileukotriene treatment, which has provided a new direction for asthma therapy. The new leukotriene inhibitor therapy includes zafirlukast, montelukast, and zileuton. The leukotrienes make up a class of inflammatory mediators synthesized from arachidonic acid, and the cysteinyl leukotrienes have been found to play an important role in asthma. Cysteinyl leukotrienes are released by inflammatory cells in human airways, which cause bronchial constriction, vascular constriction, increased microvascular permeability, and mucous secretion. The antileukotriene medications are proving to be well tolerated and effective in asthma treatment. In terms of efficacy, studies show that 5-lipoxygenase inhibitors and cysLT receptor antagonists provide a clinical benefit to asthmatic individuals. However, montelukast (Singulair) has an advantage over the other two agents because it has proven to be effective with only minor side effects and no drug interactions. Although the antileukotriene agents have provided new opportunities, existing asthma treatments are still effectively used. Perhaps, with the use of the antileukotriene therapy in combination with existing asthma medications, a new level in the treatment of asthma will provide more asthmatic individuals with greater opportunities.

"Asthma" continued on page 6

Save These Dates!

AARC Summer Forum
Vale, Co.
June 2-4, 2000

46th International Respiratory Congress
Cincinatti, OH
October 7-10, 2000

AARC Asthma Disease Management Course
Vale, CO
June 4-5, 2000

Atlanta, GA
Nov. 17-18, 2000

Are You on the Education Section Email List?

This free section member service facilitates:

- following RC trends from across the US
- networking to advance career opportunities
- sharing and learning new RC techniques

Sign Up Today on Your Section's Home Page!
http://aarc.org/sections/section_index.html

"Asthma" continued from page 5

References

American Medical Association Asthma Information Treatment Center. Controller Medications: Long-Acting Bronchodilators. JAMA (Internet address): http://www.ama-assn.org/special/asthma/treatment/drug/drug4.htm (May 26, 1999).

American Medical Association Asthma Information Treatment Center. Controller Medications: Oral Corticosteroids. JAMA (Internet address): http://www.ama-assn.org/special/asthma/treatment/drug/drug3.htm (May 26, 1999).

Holgate ST, Bradding P, Sampson AP. Leukotriene antagonists and synthesis inhibitors: New directions in asthma therapy. J Allergy Clin Immunol 1996;98(1):3-6,10.

Dahlen B, Zetterstrom O, Bjork T, Dahlen S-E. The leukotriene-antagonist ICI-204,219 inhibits the early airway reaction to cumulative bronchial challenge with allergen in atopic asthmatics. Eur Respir J 1994;7:1-2.

Busse WW. Leukotrienes and Inflammation. Am J Respir Crit Care Med 1998;157(1, suppl):S210-S213.

Aharony D. Pharmacology of Leukotriene Receptor Antagonists. Am J Respir Crit Care Med 1998;157(2, suppl):S214.

American Medical Association Asthma Information Center Newsline. Leukotrienes. JAMA (Internet address): http://www.projectsinknowledge.com/navweb…pecial/asthma/newsline/briefing/leuko.htm (May 26, 1999).

Busse W. The role and contribution of leukotrienes in asthma. Ann Allergy Asthma Immunol 1998;81:17,19-24.

Spector SL. Leukotriene inhibitors and antagonists in asthma. Ann Allergy Asthma Immunol 1995;75:463-466.

Lewis RA, Austen KF, Soberman RJ. Leukotrienes and other products of the 5-lipoxygenase pathway. N Engl J Med 1990;323(10):645.

Grundel RH, Witek TJ, Schachter EN, Wegner CD. The leukotrienes: pharmacologic and clinical implications for respiratory care. Respir Care 1986;31(2):137-138.

Reiss TF, Sorkness CA, Stricker W. Effects of montelukast (MK-0476), a potent cysteinyl leukotriene receptor antagonsist, on bronchodilation in asthmatic subjects treated with and without inhaled corticosteroids. Thorax 1997;52:45-47.

Chung KF. Leukotriene receptor antagonists and biosynthesis inhibitors: potential breakthrough in asthma therapy. Eur Respir J 1995;8:1203-1209.

Reiss TF, Chervinsky P, Dockhorn RJ. Montelukast, a once daily leukotriene receptor antagonist, in the treatment of chronic asthma. Arch Intern Med 1998;158:1213-15,1218-19.

Rau JL. Respiratory Care Pharmacology. St. Louis: Mosby, 1998.

American Medical Association Asthma Information Treatment Center. Controller Medications: oral anti-leukotrienes. JAMA (Internet address): http://www.projectsinknowledge.com/navweb…ma/special/asthma/treatmnt/drug/drug5.htm (May 26, 1999).

Zyflo (Zileuton). Professional Information Brochure. Illinois: Abbot Laboratories, 1996.

Accolate (Zafirlukast). Professional Information Brochure. Delaware: Zeneca Pharmaceuticals, 1996.

Leff JA, Busse WW, Pearlman D. Montelukast, a leukotriene-receptor antagonist, for the treatment of mild asthma and exercise-induced bronchoconstriction. N Engl J Med 1998;339:147-151.

Zafirlukast Approved for Asthma. Med Sci Bull 1996;19(3):1. ■

Call for Summer Forum Abstracts & Poster Presentations

The 2000 Summer Forum, scheduled for June 2-4 in Vail, CO, will offer two opportunities for participants to share their scholarly activities with colleagues:

Research abstract presentations dealing with respiratory care education. (Paper presentations will be limited to 15 minutes, including five minutes for discussion.)

Poster presentations dealing with education models, methods, or materials that can be shared for noncommercial use. (Individual topics and presenters will be briefly introduced; additional time will be allowed for individual review of posters or display materials and interaction with the presenters.)

Research abstracts and the Education Section Review Committee must submit poster presentation proposals by February 21 for review. All abstracts and proposals will be peer-reviewed, and authors will be notified of decisions by April 3. Questions may be directed to Gudrun Pryor, BS, RRT.

Please send the abstract and cover sheet to: Gudrun Pryor, BS, RRT, Respiratory Therapy, Washburn University, 1700 College, Topeka, KS 66621, (785) 231-1010, ext. 1287, e-mail: zzpryor@washburn.edu. ■

Favorite Web Sites

by David W. Chang, EdD, RRT and Arthur Jones, EdD, RRT

For work: http://andromeda.rutgers.edu/~jlynch/Writing/ (Grade = A+)

Guide to Grammar and Style by Jack Lynch, assistant professor of English at Rutgers University, is an extremely useful site for improving one's writing skills. While most word processing programs provide grammar and spell check functions, this site gives simple instructions and clear examples on many forgotten (or never learned) rules of writing. The site has numerous hyperlinks and offers a simple search tool on the initial web page. For example, click on "P" and it takes you to a list of topics, including paragraphs, parameter, parentheses, participles, etc. A click on "dangling participle" gives you the following mini-lesson:

Dangling Participle. A participle is a verb ending in "ing" and is called dangling when the subject of the "ing" verb and the subject of the sentence do not agree. An example is, "Rushing to finish the paper, Bob's printer broke." Here the subject is Bob's printer, but the printer isn't doing the rushing. Better would be, "While Bob was rushing to finish the paper, his printer broke." (Pay close attention to sentences beginning with "When ____ing.") One way to tell whether the participle is dangling is to put the clause with the participle right after the subject of the sentence: "Bob's printer, rushing to finish the paper, broke" doesn't sound right. Not all words ending in "ing" are participles: in the sentence, "Answering the questions in chapter four is your next assignment," the word "answering" functions as a noun, not a verb. (These nouns ending in "ing" are called gerunds.)

– David Chang

For work: http://www.mco.edu/lib/instr/libinstc.html

Here is a web site for those who intend to write journal articles. This useful site details the requirements for publication in all of the major medical journals. For example, if one desires to publish in CHEST, one can find all of the requirements for manuscript submission, as well as the necessary forms, which can be downloaded. Included among the information are financial requirements. Indeed, some journals require authors to pay for the cost of printing, which can be substantial. So, prospective authors will want to check this one out.

– Arthur Jones

For fun: http://www.ebay.com (Grade = A)

If your monthly long-distance phone bills approach three digits (in front of the decimal point), you may want to consider getting one of those pre-paid phone cards that carry an extremely low per minute charge. These cards often do carry a connection charge and/or a monthly maintenance fee. But while the initial fees are high, the "talk time" charge can be as low as one cent per minute! Obviously, it is to your advantage only if the long distance calls are long (30 minutes or more). It is ideal if you and/or your children have friends and relatives far away and like to talk, talk, talk.

To get more information about prepaid phone cards, visit http://prepaid.phonecall.net/Cards/uninocon.htm and scroll down to the bottom of the page to the FAQ (Frequent Asked Questions) section. There you will find many online auction sites where you can buy prepaid phone cards that suit your needs. The most comprehensive and user-friendly is probably eBay. Go to http://www.ebay.com and search "1 cent phone card" or search "prepaid phone card" and save, save, save.

– David Chang

Submission Guidelines For Bulletin Articles

All section members are encouraged to share information about their programs through articles in the *Bulletin*. Here are our guidelines for submission:

Article length: *Bulletin* articles may be between 500 and 1,000 words.

Format: In addition to a paper copy, all articles must be submitted on a 3½ inch floppy disk saved in Microsoft Word or TEXT ONLY (ASCII) formats, or e-mailed to the editor in one of those formats.

Deadlines: All articles must be submitted to the editor according to the following schedule of deadlines-

Jan.-Feb.: December 1
Mar.-April: February 1
May-June: April 1
July-Aug.: June 1
Sept.-Oct.: August 1
Nov.-Dec.: October 1

Article Review: All authors may review a copy of their article before it goes to press. If you would like to review a copy of your article, please include a FAX number when you submit it to the editor. It is the responsibility of the author to: 1) request the opportunity to review the article before it goes to press, and 2) contact the editor by the stated deadline if any changes need to be made before the article goes to press.

Education Resource Directory Posted Online

In the last issue of the Bulletin I requested updates for your Resource Directory and announced that an updated version would be printed and mailed with this issue. However, upon examining the current list more closely, I realized that merely "calling for updates" wasn't sufficient to get the list into prime condition. For example, many people on the list have not given me current contact information including email addresses which for many is a key networking tool.

I have decided to spend some serious time rebuilding your Resource Directory into a tool that will be the most helpful possible. While that process is underway, I believe it is best to simply post the current list on your section's home page on AARC Online. In doing so I can make regular updates and the information you access will be entirely accurate. Until new lists are compiled and printed, I recommend you refer to your section's home page for current information. If you do not have access to the Internet, you should use your printed list from 1999 keeping in mind that some of the information is no longer accurate.

So now, again, I am calling for your support of the Education Resource Directory. If you are on the current list, please send me confirmation of your contact information as listed and also give me your email address. If you want to be added to the list, please send me the information requested in the form below. You may complete the following form and mail or fax it to me (11030 Ables Lane, Dallas, TX 75229 / 972/484-2720) or the best option would be to email me (hagen@aarc.org). With your help we will soon have a truly helpful Resource Directory filled with names of people who are dedicated to helping others in their field succeed — and you will have accurate contact information to make it as easy as possible to take advantage of their expertise and advise.

*Name*_____

*Address*_____

*Phone*_____ *FAX*_____

*e-mail*_____

Areas of Expertise: (Check all that apply)

Program Administration

__Accreditation Issues

__Recruitment and Retention

__Admission Criteria

Teaching

__NBRC Matrices-

__Educational Software (IBM)

__Readability Assessment

__Textbook Selection Methodology

__Curriculum Development

Subject Matter Experts

__Adult Critical Care

__Health Informatics

__Metabolic Studies

__Neonatal/Pediatric

__Pulmonary Function

__Respiratory Physiology

__Successful Teaching of Analytical Thinking Skills

Evaluation

__Clinical

__Laboratory

__Didactic

__Test Construction

__Test Item Analysis

__Surveying Methodology and Instrument

Research and Publication

__Internet Resources

__Educational Research

__Clinical Research

__Research Statistics

__Publication

__Grant Proposal

Other Areas of Expertise

__EKG, PFT, Neonatal Transport, PALS, NRP Instructor

__Instructional Technology

__Mathematical Modeling and Computer Simulation

__Program Development and Implementation

__Pulmonary Rehabilitation