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Pharmacologic and Nonpharmacologic Approaches
to the Treatment of Hypertension with
Implications for the Clinical Nurse Specialist
Patricia A. Peters

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Abstract

Hypertension is a ubiquitous and life-threatening disease. It is a major risk factor in the etiology of most cardiovascular diseases. A U.S. Health Survey report has concluded from screening data that 60,000,000 U.S. adults have hypertension. Traditionally, this disease has been treated pharmacologically. This approach has been found to be effective particularly in the treatment of moderate hypertension. Unfortunately, antihypertensive medications also cause many undesirable side effects, and their cost can be quite significant. Therefore, alternate methods of control have been proposed and researched. These methods include relaxation, meditation and biofeedback.

Many of these alternate methods, although behaviorally related, have physiologic rationale. In this paper an overview of the pharmacologic treatments and a more detailed description of the behavioral approaches will be presented. Also a critical review of the research findings pertaining to the behavioral methods of treatment will be included. Finally, a discussion of the implications for the Clinical Nurse Specialist dealing in this area will be presented. (KT).

APPROVAL SHEET

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Abstract

Hypertension is a ubiquitous and life-threatening disease. It is a major risk factor in the etiology of most cardiovascular diseases. A U.S. Health Survey report has concluded from screening data that 60,000,000 U.S. adults have hypertension. Traditionally, this disease has been treated pharmacologically. This approach has been found to be effective particularly in the treatment of moderate hypertension. Unfortunately, antihypertensive medications also cause many undesirable side effects, and their cost can be quite significant. Therefore, alternate methods of control have been proposed and researched. These methods include relaxation, meditation and biofeedback.

Many of these alternate methods, although behaviorally related, have physiologic rationale. In this paper an overview of the pharmacologic treatments and a more detailed description of the behavioral approaches will be presented. Also a critical review of the research findings pertaining to the behavioral methods of treatment will be included. Finally, a discussion of the implications for the Clinical Nurse Specialist dealing in this area will be presented.

INTRODUCTION

Cardiovascular disorders are reported to be the most prevalent cause of adult death in this country each year. And hypertension is a major factor in the etiology of most cardiovascular diseases (Allen, 1983; Kaplan, 1985; Seer, 1979). A United States (U.S.) Health Survey report has concluded from screening data that 60,000,000 U.S. adults have hypertension (McMahon, 1984; Roffman & Thomas, 1985). Unfortunately, in a vast majority of these cases (90-95%), the pathophysiological cause is not known. This type of hypertension is known as essential hypertension. The remainder of incidence is attributed to secondary hypertension, which has known etiologies such as renal, endocrine, and neurogenic disorders. However, several factors have been identified as having a role in the pathogenesis of essential hypertension. These factors include genetic disposition, body weight, sodium intake, alcohol intake, and environmental stressors (McMahon, 1984; Roffman & Thomas, 1985).

Hypertension has been associated with deleterious effects on the bodies of the human population. In 1985, Roffman & Thomas reported that hypertensive patients have a morbidity risk twice that of normotensive patients. This risk is increased even more when such factors as cigarette

smoking and elevated cholesterol levels are present in individuals. Untreated hypertension can lead to complications that affect the heart, kidneys, brain, central nervous system, and many other organs (Frumkin, Nathan, Prout, & Cohen, 1978). The Framingham study, which is a large epidemiological study that has been examining hypertension since 1948 has shown both systolic and diastolic blood pressure (SBP and DBP) to be of equal importance (Seer, 1979). To date, much research has been conducted on hypertension--including its etiology and treatment. But not all the questions have not been answered. For this reason, the research must continue.

Treatment

Currently, hypertension is being treated pharmacologically with such agents as diuretics, vasodilators, adrenergic receptor blockers, angiotensin-converting enzyme inhibitors, and calcium channel blockers. Unfortunately, these medications can also produce undesirable side effects, and the cost of the treatment can be quite high. Therefore, alternate methods of blood pressure control have been explored.

Some of the nonpharmacologic approaches to hypertension control include dietary salt restriction, weight control, exercise programs, and monitored alcohol

intake. This author will examine still other approaches that have been introduced within the past two decades. These include such techniques as meditation, hypnosis, relaxation, and biofeedback. A review of the literature on the research completed in the nonpharmacologic approach will also be presented. Finally, a view of the nurse's role in the control of hypertension will be discussed. For purposes of this paper, only essential hypertension will be considered and will, hereafter, will be referred to as hypertension.

PHYSIOLOGIC MECHANISMS RELATED TO HYPERTENSION

The American Heart Association (AHA) bases its definition of hypertension on consistently elevated blood pressure readings. According to the Heart Association, hypertension can be diagnosed in a patient whose diastolic pressure exceeds 90 mmHg on three consecutive visits. A consistent systolic pressure of greater than 160 mmHg has been associated with significant morbidity, especially in the elderly population and in patients with advanced cardiovascular disease (Roffman & Thomas, 1985).

Before an explanation of the mode of action of antihypertensive medications and comparable non-pharmacologic treatments is undertaken, a discussion of the body's physiology as it relates to blood pressure is in order. Physiologists have long held that homeostasis of the bodily processes is necessary for human existence. This homeostasis or equilibrium of the internal environment is accomplished by the body's ability to control the internal environment by a regulatory mechanism called a feedback loop. This mechanism protects humans from large fluctuations or disturbances in the external environment (Sterling & Eyer, 1981).

Much of the internal environment is controlled by hormones. These hormones may act locally on its target organ (independent of neural control), or they may be centrally regulated by the brain, usually in several ways (Sterling & Eyer, 1981). First, the brain controls bodily systems through the sympathetic and parasympathetic divisions of the autonomic nervous system. The brain also controls bodily hormones by its own hypothalamic hormones. These hormones (which are produced in the hypothalamus) act directly on peripheral tissue, on peripheral hormone-secreting cells, and/or on the pituitary gland (Schally, Kastin, & Arimura, 1977).

The central control for homeostasis is necessary for two reasons. First, neural (or central) control allows hormonal changes to occur in anticipation of changes in the feedback system. This aids in reducing the size of the fluctuations that occur. Secondly, because most processes are constantly varying due to involvement demands, central control is necessary for adaptive changes to take place. For example, if blood pressure were under only local negative feedback, it would be automatically corrected with every deviation from normal. Adaptation would be impossible to achieve because of the constant fluctuations of blood pressure that occur due to arousal and relaxation states (Sterling & Eyer, 1981).

Blood pressure rises as a result of one/or a combination of three mechanisms. These mechanisms are 1) an increase in intravascular fluid volume, 2) an increased cardiac output, and 3) an increase in peripheral vascular resistance. These mechanisms can be explained by the controls aforementioned.

Normally, when the blood pressure is low, the kidney is stimulated, either locally or by the sympathetic nervous system, to secrete renin. Renin leads to the secretion of the adrenal hormone, aldosterone. Aldosterone, in turn, causes the kidney to excrete less sodium and water by constricting the renal arterioles, thus raising the volume of the intravascular fluid. Aldosterone may also be produced from the release of a hormone called the adrenocorticotrophic hormone (ACTH) which is secreted from the pituitary gland.

The second mechanism, an increased cardiac output, is also a result of sympathetic nervous system innervation. When the blood pressure is low, neural sensors, such as the carotid sinuses are stimulated to detect this. The brain uses this information to cause the heart to increase its output. It does this by stimulating sympathetic neurons and/or the adrenal medulla to release catecholamines commonly known as epinephrine and norepinephrine. The catecholamines cause an increase in heart rate and stroke

volume. They can also cause an elevation of blood pressure by causing constriction of blood vessels. This is particularly true for norepinephrine.

Finally, the autonomic nervous system causes, either by direct sympathetic stimulation or by releasing norepinephrine from the adrenal medulla, blood vessels to constrict when the blood pressure is low, thus causing an increase in the peripheral vascular resistance and elevating the blood pressure. Aldosterone also causes marked constriction of the peripheral arterioles and moderate constriction of the veins. Thirdly, vasopressin, which is released from the pituitary acts as a vasoconstrictor and results in elevated blood pressures (Seer, 1981). Koch-Weser reported, in 1974, that abnormally high peripheral vascular resistance is the major hemodynamic disturbance in patients with chronic hypertension.

Ideally, these three major mechanisms, just mentioned, operate in concert with each other to maintain a normal blood pressure. But as the statistics show, many times this is not the case. When one or all of these mechanisms are ineffective in controlling blood pressure, an exogenous method of control is necessary. Drug therapy is most often chosen as this method.

THE PHARMACOLOGY OF ANTIHYPERTENSIVE MEDICATIONS

Antihypertensive medications first became available in the late 1950's for the treatment of high blood pressure. Many controlled studies have shown their effectiveness in reducing the mortality from stroke and from renal and heart failure in patients with moderate hypertension (diastolic pressures between 105 and 120 mmHg); although, similar benefits have not been correlated with mild hypertension (diastolic pressures between 90 and 105 mmHg) (United States Public Health Service Hospital Cooperative Study Group, 1967, 1970). The medications commonly used for blood pressure control include diuretics, vasodilators, calcium channel blockers, adrenergic blocking agents, and angiotensin converting enzyme inhibitors. The American Heart Association has advocated a stepped-care approach of drug therapy treatment as a guide in managing hypertensive patients (Joint National Committee on Detection, Evaluation, and Treatment of High Blood Pressure, 1984).

The stepped-care guidelines have suggested that therapy should be initiated with a small dose of an antihypertensive medication, increasing the dose of that drug, and then adding or substituting other drugs in increasing doses if needed until the blood pressure goal is

reached, side effects become unbearable, or a maximum dose of a drug is reached (Joint National Committee on Detection, Evaluation, and Treatment of High Blood Pressure, 1984). See Table 3.1 for the major categories of antihypertensive medications used in this approach. A brief explanation of the mechanisms of action of each of these categories will follow.

Step 1	<p>Less than a full dose of thiazide-type diuretic OR Less than a full dose of beta-blocker</p> <p>Proceed to full dose if necessary and desirable.</p>
Step 2	<p>If Blood Pressure is not controlled:</p> <p>↓</p> <p>Add a small dose of an adrenergic inhibiting agent OR Add a small dose of thiazide-type diuretic</p> <p>Proceed to full dose if necessary and desirable.</p> <p>Additional substitutions may be made at this point.*</p>
Step 3	<p>If BP control is not achieved:</p> <p>↓</p> <p>Add a vasodilator</p>
Step 4	<p>If BP control is not achieved:</p> <p>↓</p> <p>Add guanethidine monosulfate**</p>
	<p>* An angiotensin-converting enzyme inhibitor may be substituted at Step 2, 3, or 4 if side effects limit use of other agents or if other agents are ineffective. Slow calcium channel blockers may be acceptable as Step 2 or Step 3 drugs.</p> <p>** An adrenergic inhibitor</p>

Table 3.1. Stepped-Care Approach to Drug Therapy
 (Obtained from the 1984 Report of the Joint National Committee on Detection, Evaluation, and Treatment of High Blood Pressure, p.17).

Diuretics

The mechanism of the antihypertensive effect of many of the diuretics is unclear, but the effect has been attributed to:

- 1) a loss of body sodium and water by action on the renal tubules. This in turn causes a decrease in intravascular fluid volume and thus a lower blood pressure,
 - 2) a decreased receptor sensitivity to vasopressor substances,
 - 3) direct arteriole dilatation and,
 - 4) decreased total peripheral resistance
- (McMahon, 1984).

Diuretics have traditionally been a first drug of choice in treating hypertension. However, results of The Multiple Risk Factor Intervention Trial (MRFIT) (1982), a multifactor program which studied various risk factors in 12,866 men, showed that there was an increased incidence of sudden cardiac deaths associated with hydrochlorothiazide (a thiazide diuretic). Therefore, beta-blockers are now to be considered a first step in the stepped care approach.

Beta-adrenergic blockade

Hemodynamic mechanisms, central nervous system actions, and renin-angiotensin effects have all been associated with the antihypertensive actions of these drugs. Hansson & Werko also reported in 1977 that their studies showed a lowering of peripheral resistance during chronic treatment with a beta-blocker. Hansson & Werko (1977) suggested that beta blockers may change the sensitivity of the baroreceptors, which could explain the change in the total peripheral resistance. Finally, these blocking agents have been demonstrated to reduce renin release and plasma renin activity in humans. All these effects could be instrumental in the control of blood pressure.

Vasodilators

As stated earlier, it is believed that an increase in peripheral vascular resistance is the major hemodynamic disturbance in most hypertensive persons. Generally, the cardiac output is normal; although it may be elevated in the early stages of essential hypertension and reduced in those patients with cardiac enlargement due to hypertension (Sterling & Eyer, 1981). Direct-acting vasodilators reduce arterial tone and thereby, decrease peripheral resistance. They do not interfere with sympathetic nervous system

functioning. Hydralazine, for instance, dilates arterioles as compared to veins which minimizes postural hypotension and promotes an increase in cardiac output (Roffman & Thomas, 1985).

Angiotensin-Converting Enzyme ((ACE) Inhibitors

ACE Inhibitors prevent the conversion of angiotensin I to angiotensin II (a potent vasoconstrictor) by competing with angiotensin I for the active site of ACE. Inhibition of ACE results in decreased plasma angiotensin II concentrations, thereby reducing blood pressure through decreased vasoconstriction (McEvoy, 1987)

It has also been suggested that decreases in plasma angiotensin II leads to decreased aldosterone secretion from the adrenal cortex. Therefore, the hypotensive effects of the ACE inhibitors may be due in part to the decreased sodium and water retention resulting from a reduction in aldosterone secretion (McEvoy, 1987).

Calcium Channel Blockers

A rather new classification of drugs, the calcium channel blockers, are currently being used effectively in the treatment of hypertension. These agents cause arteriolar dilatation by acting directly on vascular smooth muscle. They do this by interfering with the calcium gates

that assist in regulation of smooth muscle contraction. This results in a lowered peripheral vascular resistance and thus, a lowering of blood pressure (McMahon, 1984).

Adverse Reactions Associated with Antihypertensives

As stated earlier, although antihypertensive medications have proven effective in controlling blood pressure, they unfortunately also cause adverse reactions--reactions that may even result in death. For example, some diuretics have been reported to cause fatalities due to bone marrow aplasia and cerebral edema with pulmonary congestion. Thiazides have also been reported to induce encephalopathy and coma due to acute hyponatremia, cerebrovascular insufficiency due to plasma volume contraction, hepatic insufficiency, and hyperosmolar hyperglycemia (McMahon, 1984).

Among the other medications used for hypertension, McMahon (1984) reported that beta-blockers have been found to cause such reactions as confusion, hallucinations, male impotence, depression, congestive heart failure, syncope, and suicide attempts. Vasodilators are known to have caused fluid retention, tremors, lethargy, nightmares, dyspnea, anxiety, pancytopenia, and lymphadenopathy. The side effects from calcium channel blockers include peripheral edema, palpitations, constipation, 3rd degree AV

block, and hypotension. Finally, some of the occasional (0.5-5.0 %) adverse reactions associated with the ACE inhibitors include proteinuria, leukopenia, dizziness, tachycardia, and acute renal failure (McMahon, 1984).

The reactions just mentioned are, by no means, all that have been reported with these medications; but, as one may conclude, the effects can be quite undesirable. It is true that some of these reactions rarely occur, but if alternate or adjuvant therapy can reduce or eliminate the need for these medications, such approaches would be preferred. Also, many patients are opposed to long-term treatments. In 1983, Haynes, reported that half of the patients started on antihypertensive therapy will stop their therapy within one year, and in some surveys, only 20 to 30% of the individuals known to have hypertension have their blood pressure under good control.

NONPHARMACOLOGIC APPROACHES TO HYPERTENSION CONTROL

Hypertension has been described as an "epidemic of major proportions in western society" (Seer, 1979, p.1015). Its prevalence has been estimated to be from 10 to 30% of the total adult population. Over 80% of this population have blood pressures in the "mild" range i.e., diastolic 90-104 mmHg (Sterling & Eyer, 1981). In 1981, Guttmacher et al. reported that most physicians began to treat mild hypertension with drugs before there was any evidence that this was a beneficial treatment. Once there was evidence of the effectiveness of drug therapy for the more severe elevations of blood pressure, which is reported to be in the late 1960's, most physicians immediately started treating all hypertensive patients with medication. Therefore currently, a controversy exists over whether nonpharmacologic treatment approaches can be as effective as medications in the management of mild hypertension.

As previously mentioned, these nonpharmacologic approaches include such controls as weight and dietary salt reduction, exercise, and cessation of smoking. Other major categories of approaches are psychotherapy, environmental modification, relaxation and biofeedback. These latter approaches have traditionally been considered psychological in nature, and have also been termed behavioral approaches.

Although these techniques may be considered psychological maneuvers, they have physiological associations and consequences. For purposes of this paper, many of the behavioral approaches will be briefly mentioned with subsequent references to research conducted in these areas, but the major emphasis will be on the areas of relaxation/meditation and biofeedback.

Stress is frequently associated with the common occurrence of hypertension. The term, stress, has been used interchangeable with such terms as anxiety, conflict, tension, frustration, emotional disturbance, and trauma (Cofer and Appley, 1964). Although everyone today seems to be talking about it, stress is rarely defined in the same way each time it is used. And except for a few specialized scientists, no one has really tried to define it (Selye, 1983).

Historically (1929), Walter Cannon, a physiologist, first reported on a now well-known phenomenon that he named the "fight or flight" response. Cannon showed that emotional arousal elicited a variety of autonomic nervous system reactions. This, in turn, caused the activation of many bodily systems including the endocrine, cardiovascular, muscular, and respiratory systems. According to Cannon, increased blood pressure, heart and respiratory rates assisted in physiologically preparing animals for flight in

fearful situations, and when the animal was calmed, these responses quickly dissipated. Although some aspects of Cannon's theory have changed over the years, the assumptions regarding the link between emotional arousal and blood pressure changes remain today (Lynch & Thomas, 1985).

Since that time, the phenomenon of stress has been extensively researched and publicized. Stress has been considered an etiologic factor in many disease states of this day--including hypertension, cancer, respiratory, and gastrointestinal dysfunction. Hans Seyle is well known for his contributions to this area and has offered the most widely accepted definition of stress. He defined stress as the "nonspecific response of the body to any demand made upon it to adapt, whether that demand produces pleasure or pain" (Seyle, 1946). Seyle emphasized that environmental agents or stimuli that trigger the stress are called stressors. Therefore, a stressor is the cause, and stress is the physiological result (Seyle, 1983). Also important in Seyle's definition is the fact both pleasure and pain can elicit the stress response.

The equilibrium or homeostasis of the internal environment of the human body is disrupted by environmental stressors. These stressors stimulate both the sympathetic and parasympathetic divisions of the autonomic nervous system. Generally, the terminal nerve endings of the

parasympathetic division secrete acetylcholine and its fibers are said to be cholinergic. Conversely, the sympathetic nerve endings normally secrete norepinephrine and are referred to as adrenergic. These synaptic transmitters act on different organs to cause their respective effects (Guyton, 1981). There is no generalization to explain whether sympathetic or parasympathetic stimulation will excite or cause an inhibition of a particular organ. Also, when sympathetic stimulation excites a particular organ, parasympathetic stimulation often inhibits it (Guyton, 1981). This is true in the fight or flight response.

Cannon (1929) found that stimulation of both divisions of the autonomic system occurred with the alarm or stress reaction. But the two divisions have opposite effects in most of the affected organs. Stimulation of the sympathetic nervous system cause significant changes primarily in the muscular, cardiovascular, and respiratory systems. The human body is prepared for flight in that the heart rate and cardiac output is increased, and peripheral vasoconstriction occurs in order to divert more blood flow to the vital organs and skeletal muscles. These effects also result in an elevation of arterial blood pressure. Other effects include bronchodilatation which allows an increase in airflow--thus, providing more oxygen to skeletal muscles and

other bodily cells. It should be noted, however, that not all body systems are aroused in the sympathetic response. The reproductive and gastrointestinal systems are, in fact, inhibited because these processes are not necessary in the flight response.

Conversely, stimulation of the parasympathetic nervous system causes an inhibition of the major organs affected by the stress response, i.e., the heart and lungs. This distinction between the sympathetic and parasympathetic divisions has relevance to the various nonpharmacologic treatment approaches and will be discussed later.

It is also believed that some form of adaptation occurs with the stress response. Seyle (1946) is also famous for his observations and experimentations that resulted in describing the process that is now called the general adaptation syndrome (GAS). The triad that accompanies this syndrome is the 1) alarm reaction, 2) stage of resistance, and 3) stage of exhaustion. The alarm reaction is similar to Cannon's fight or flight response. In addition, Seyle theorized that in order for humans to maintain a homeostatic balance, adaptation must occur (stage of resistance). Finally, he hypothesized that this adaptation causes a strain on the body, and that eventually organ systems will break when they can no longer hold up under the pressure (stage of exhaustion). Diseases that

occur as a result of the body's exhausted adaptation are called stress-related diseases. Hypertension has been included in this category of diseases.

Numerous models describing the stress response exist today. Lindsey and Carrieri (1986) have offered a comprehensive one. They defined stress as a sociopsychophysiological phenomenon composed of intellectual, behavioral, metabolic, and other physiological responses to endogenous and/or exogenous stressors. These stressors may involve thoughts and feelings, actual or perceived threats, or afferent inputs that signal illness, injury or cold. The stress response is protective and adaptive; it is graded, i.e., the extent of the response depends on the intensity and duration of the stimuli. Lindsey and Carrieri also described stress as an integrated response which is modified by such individual characteristics as genetic endowment, age, gender, previous experiences, and concurrent illness.

The mechanism for the stress response is quite extensive, requiring many feedback loops and resulting in an altered physiological equilibrium (Lindsey & Carrieri, 1986). Although there is disagreement regarding the stereotypical nature of the stress response (Lazarus, 1984; Mason, 1975), Seyle (1983) holds that the nonspecific response of the body to a stressor is always the same,

regardless of the particular stimulus. What differs is the degree of response. This typical response, with primary emphasis on cardiac effects, will be briefly described.

The afferent input that is generated from sensory or psychological stressors is ultimately processed in the central nervous system. The neural information is forwarded to the hypothalamus and the hypothalamus, in turn, coordinates the homeostatic adjustments. This hypothalamus integration effects: 1) the sympathetic nervous system discharge via the autonomic nervous system, 2) the release of selected anterior pituitary hormones, and 3) the release of vasopressin in the posterior pituitary from the hypothalamic neurons (Lindsey & Carrieri, 1986).

There are many responses to the sympathetic nervous system discharge. The liver, pancreas, kidneys, adrenal medulla, and peripheral tissues that are innervated with sympathetic nerve endings all respond to stimuli. The release of norepinephrine by the sympathetic nerve endings cause an increase in cardiac output and blood pressure primarily due to a release of renin by the kidney and an increase in vascular smooth-muscle contraction. The adrenal medulla secretes epinephrine in response to the sympathetic discharge. The secretion of epinephrine also contributes to the aforementioned cardiac effects.

Lindsey & Carrieri (1986) explained that the secretion of adrenocorticotropin hormone (ACTH) from the anterior pituitary is also increased. ACTH in turn, stimulates the release of cortisol and aldosterone from the adrenal cortex. Cortisol potentiates the effect of epinephrine and also allows the sustained vascular smooth-muscle contraction caused by the catecholamines; this too, contributing to an elevated blood pressure.

Aldosterone causes the renal tubule cells to retain sodium and excrete potassium. Vasopressin/antidiuretic hormone (ADH) also acts on the renal tubules to cause a reabsorption of water from the tubules. All these responses result in an increased fluid volume (Lindsey & Carrieri, 1986). This increase in fluid volume may lead to an elevated blood pressure.

Finally, repeated exposure to stressors are believed to result in adaptive changes (Lazarus, 1984; Lindsey & Carrieri, 1986; Seyle, 1983). Also, after the stress response, there is a reparative phase which is indicated by a decrease in the excretion of urinary nitrogen. This process is critical to the repair of damaged tissue. Lindsey & Carrieri, 1986; Sterling & Eyer, 1981).

The above stress model demonstrates that many facets of blood pressure regulation are influenced during the stress response. As Lindsey and Carrieri stated in 1986,

although specific direct evidence of hypertension caused by stress does not exist, some consider hypertension to be a pathological consequence of stress. Seyle (1983) explained that in typical diseases of adaptation (which heart attacks have been described), insufficient, excessive, or faulty reactions to stressors are the root of the problem. And hypertension has been determined to be a risk factor in the development of heart disease and subsequent myocardial infarctions.

Although the alarm reaction of the stress response was first identified by Seyle more than 40 years ago, no one is sure today of the nature of the first mediator (Seyle, 1983). Lazarus (1974) argued that Seyle's research on the GAS confounded the physiologically noxious stimuli with the psychologically noxious. In 1974, Lazarus reported that there is "limited but provocative empirical evidence" that the essential mediator of the GAS could be psychological (p.325). Much disagreement remains on the what this primary mediator to the stress response is, but Seyle (1983) stated that whatever the nature of it, its existence is assured by its effects (p.6).

Lazarus (1984) based his model of the stress response on the concept of cognitive appraisal. He defined cognitive appraisal as the expression of the evaluation of the significance of a transaction for an individual's well-being

and the potential for that person to master the continuous and dynamic interplay between the person and environmental stimulus. He described this appraisal as the cornerstone of the psychological analysis of emotion. He went on to describe emotion as a disturbance that includes three components. The first is the subjective affect which includes the conscious features of the cognitive appraisal. The second is the behavioral action impulses which varies from one emotion to another. And the third is the physiological changes that are related to species-specific forms of mobilization for action (Lazarus, 1974).

Another model, developed by Roger Allen (1983), also has the concept of cognitive appraisal incorporated into its linear design. Allen stated that a majority of stressors in our culture today are cognitive in origin. He went on to define this type of stress as psychogenic stress and explained it as an adaptive, physical response of the body that is brought about by a cognitive arousal, and is a subcategory of the more comprehensive term, psychosomatic (meaning mind and body). Allen explained that the term, psychosomatic, refers to a interaction between the mind (psyche) and the mind (soma). But there are different types of mind-body links. The difference is whether the change originates in the mind or in the body. When the mind influences the body, it is labeled psychosomatic. On the

other hand, when the body affects cognitive functioning, this is said to be somatopsychic. This distinction has implications in some of the nonpharmacologic approaches to blood pressure control, and will be referred to later.

Allen outlined a model that described the basic steps of the mind-body link--from the stressor to the disease. Allen's model is described in more detail here due to the fact that his model offers a more basic explanation of the stress response, which may be beneficial to use with patients who are attempting to understand the concept. Also the steps of his model can be related to the various nonpharmacologic approaches to the management of hypertension which will be later discussed. The sequence of Allen's psychosomatic model is displayed in Table 4.1 .

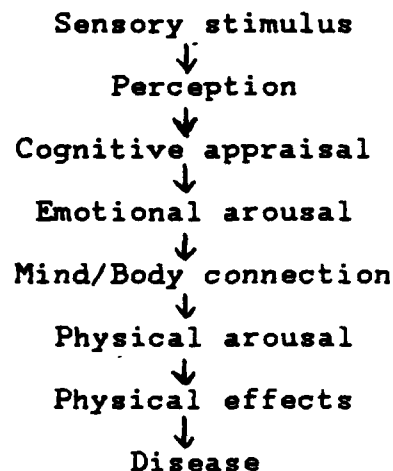


Table 4.1. Steps of psychosomatic model.

A brief explanation each step of the model is also presented. The sensory stimulus is the initial, external cause of the stress. Perception involves the senses that pick up and deliver the stimulus to the brain. Perception does not involve thought, interpretation, or labeling. This process is the cognitive appraisal. Following cognitive appraisal, emotional arousal occurs. This arousal may be exhibited as anger, fear, ecstasy, hatred, anxiety, etc. The mind-body connection links the emotional arousal to physical arousal, or the mobilization of the body. The physical arousal readies the body for the next step which are the physical effects. These effects are measured as changes in the body's end organs, such as the heart, lungs, intestines, arteries, etc. The last step of the model is disease. Disease results if the physical effects strain the somatic balance to the breaking point.

Allen's model has implications for various behavioral approaches in the management of hypertension. If the chain of events is interrupted at any step, the next step cannot occur, and the final result, disease, is prevented. These implications will also be addressed in the discussions of the associated approaches.

One problem with Allen's model is its simplicity. Because the concept of stress is quite complex, it is difficult to condense it to a basic level without

sacrificing some critical principles. The model also centers on psychological mediators of the stress response without considering the physical stressors that are also capable of eliciting the stress response. Allen also fails to include behavior or adaptational outcomes that are results of the stress response.

As one can conclude, there are still many unanswered questions regarding this intertwined subject, and research needs to continue in order to find answers. Efforts must be made in the research approach to consider the patient holistically. The patient must be considered as a physical, emotional, and social being. As mentioned previously, the patient's emotions, in addition to physical parameters need to be considered when treatment decisions are required for a disorder. This is true of the hypertensive patient, as well. The following nonpharmacologic approaches to hypertension management utilize a behavioral approach to treatment that should be assessed for their effectiveness as the sole intervention for the control of hypertension or as adjuvant therapy.

Relaxation

Therapy with the behavioral approaches is based on the fact that events in the emotional life of patients influences the lability of the blood pressure and affect the

progress of hypertension (Shapiro et al., 1977). These event activate an integrated hypothalamic response that is mediated through the sympathetic nervous system and produce the associated response that has been previously discussed. This fight or flight reaction has also been labeled the defense mechanism, emergency response, or ergotropic response. (Lavey & Taylor, 1983).

In contrast, a second integrated hypothalamic response, which is associated with a decrease in sympathetic nervous system activity, has been labeled the trophotrophic or relaxation response. In 1978, Taylor defined relaxation as a decrease in CNS arousability. This lowered arousability is defined by an increase in the degree of stimulus required to produce a measurable phasic change in a physiological indicator (i.e., BP) over base line. This response results in such things as a decreased oxygen consumption, heart rate, respiratory rate, and intensity of electroencephalographic alpha and theta waves (Benson, Greenwood, & Klemchuk, 1975; Gelhorn, 1972; Lavey & Taylor, 1983).

In 1981, Sterling & Eyer stated that in order for a body to be healthy, the periods of arousal or hypermetabolic states must be balanced with periods of relaxation. This also is necessary for replenishment of resources and repair of tissue or cellular damage. Therefore, it is hypothesized

that diseases such as hypertension may be prevented and or treated by either reducing the frequency of the emergency reaction response or increasing the elicitation of the relaxation response (Benson, Greenwood, & Klemchuk, 1975). There are several nonpharmacologic approaches capable of accomplishing this. (Glasgow, Gaarder, & Engel, 1982; Hatch, 1985; Shoemaker & Tasto, 1975; Patel, Marmot & Terry, 1981).

The relaxation response can be divided into two major categories--psychosomatic and somatopsychic (Allen, 1983). Psychosomatic relaxation begins with the mind and includes such techniques as meditation, selective awareness (hypnosis and autogenic training) and EEG biofeedback training. Somatopsychic, on the other hand, begins with body. Examples of this type of relaxation are progressive neuromuscular relaxation, yoga, and most biofeedback parameters.

There are some misconceptions about relaxation that deserve mentioning. First of all, relaxation should not be associated with leisure activities because very often, leisure activities can be quite stressful, i.e., watching exciting television shows or participating in sporting activities. Secondly, relaxation is not sleep. Sleep, also, may be stressful due to its emotionally charged phases. Thirdly, relaxation is sometimes believed to cause effects similar to tranquilizing drugs. But these drugs, in

fact, turn off bodily sensations and awareness; whereas, relaxation increases awareness while relaxing the body. Finally, relaxation does not mean mental passivity. Conversely, relaxation involves activities that maintain a mental and physical arousal of the body, but at a reduced level (Allen, 1983).

Relaxation training does come with a few warnings. Because effective training has produced reductions in blood pressure and blood sugar levels, those individuals with hypotension, and hypoglycemia should consult their physician before beginning training.

Selective Awareness

The concept of selective awareness is involved in many relaxation techniques. Allen (1983) included the techniques of hypnosis and autogenic training in this category. There are two main goals of selective awareness. The first is to train one's ability to concentrate and control the direction of one's thoughts. The second is to provide positive mental stimuli that can compete with negative sensations. These techniques interrupt Allen's psychosomatic model by terminating cognitive arousal, emotional responses, and thus, the physical effects.

Hypnosis is probably the first form of selective awareness. An Austrian physician, Anton Mesmer, is credited with its development and application during the late 18th and 19th century. Although his techniques would be considered bizarre by today's standards, the results have been attributed to his ability to convince his patients that the treatment was sound and that it would cure them. His technique produced a state of consciousness that was highly susceptible to suggestion, which is a characteristic of hypnosis (Allen, 1983).

Another selective awareness technique used to alter the state of consciousness is autogenic training. This technique was developed in 1932 by a German psychiatrist, Johannes Schultz. Schultz's work originated in part from autohypnosis, which is an induction of hypnosis without the aid of a therapist. From this, autogenic training (meaning self origin) evolved. This training was designed to produce both mental and physical relaxation, and it has been used in conjunction with biofeedback training (Allen, 1983).

These selective awareness techniques aid in redirecting emotionally arousing events that trigger the physiologic stress response, to positive and adaptive responses. They can be therapeutic for such stress-related diseases such as hypertension, in that they promote deep relaxation and a trophotropic response.

Somatopsychic Techniques

The somatopsychic interaction between the mind and body occurs when changes in the body affect the mind. Two techniques that fall into this category that will be briefly discussed here are yoga and muscular relaxation. Both of these procedures have been studied as to their effectiveness in the control of hypertension.

The historical roots of yoga can be traced back to the sixth century B.C. Allen (1983) explained that the goal of yoga is to attain a self-realization that involves a philosophy, discipline, meditation, and transcendence, in addition to body posturing and controlled breathing patterns. Yoga enables its practitioner to be acutely aware of somatic changes. This allows for early recognition of stress related responses so that imbalances can be corrected before they become severe.

Progressive neuromuscular relaxation was introduced by Edmund Jacobson in 1929, who was a physician that recognized an association between muscular tension and somatic disease. Jacobson used this technique on hypertensive patients, in addition to patients with several other disorders. The technique involves a series of progressive tension/release intervals, operating on one muscle group at a time (Allen, 1983).

The purpose of this technique is to reduce maladaptive neuromuscular arousal and decrease stress reactions. It contributes to trophotrophic conditioning by terminating the feedback from many end organs involved in the stress response. Somatic awareness is to be gained by teaching the practitioner to recognize deep physical relaxation (Allen, 1983).

Although Jacobsen used this technique with hypertensive patients, Allen (1983) reported that the tension interval can cause increases in blood pressure and should therefore be used with caution in hypertension. This concern was not evident in the studies found in the literature on this procedure. A few persons have reported immediate pain, especially headaches, with this technique.

Meditation

Meditative practices have existed for centuries, primarily in a religious context. Christian cultures, Jewish mysticism, and Eastern religions such as Zen, Yoga, Hinduism, Shintoism, and Taoism all have employed some type of meditation in their practices. More recently, secular practices such as autogenic training, progressive relaxation, hypnosis, and transcendental meditation have evolved in the western societies. Most of these techniques

have already been discussed. Benson et al. (1975) listed four elements that are common to all these practices.

First of all, there should be a mental devise such as a sound or word to free one's mind from external thoughts. Secondly, a passive attitude is necessary so that one does not worry when the mind is distracted, which commonly occurs. Extraneous thoughts should be redirected to the technique. Thirdly, there should be decreased muscle tone. The subject should be in a comfortable position so that minimal muscular activity is required. It is recommended that the subject sit with back straight. This position offers two advantages. First, it aids in preventing the practitioner from falling asleep, and it also results in sharper attention and clearer thoughts. As a method of systemic relaxation, meditation requires a clear wakeful mind. Finally, Benson recommends that subjects practice in a quiet environment that is free of sensory distractions. This is especially beneficial when first beginning this technique, because subjects practicing in quiet environments have been found to lower their physiologic stress responses quicker than those in noisy environments. But the same subjects (six months later) showed that those who practised in the noisy environments were able to lower their stressful arousal better than the quiet environment subjects. Therefore, in order to stay calm in stressful conditions,

one should eventually practice meditation in noisy environments also (Allen, 1983). Allen also emphasized that regular practice is necessary for effective meditation. Meditation requires a retraining of the mind so regular practice is required to allow the newly learned patterns of behavior to dominate one's practice.

Meditation disrupts Allen's psychosomatic model at the cognitive appraisal step. By constantly focusing on and repeating a benign stimulus, the mind is free of emotionally charged thoughts. This results in a stabilized, low level of arousal which is a parasympathetic-dominant condition. This aids in trophotropic conditioning. Meditation also interrupts the emotional arousal step of Allen's model. Subjects involved in training have found that they get less upset at environmental stressors. There is a mental tranquility that accompanies meditation and prompts the practitioners to avoid life's hassles.

Wallace & Benson (1972) reported several physiological reactions that their subjects exhibited during a study involving a derivation of the yoga technique--transcendental meditation (TM). Unlike yoga, TM does not require intense concentration or rigorous physical control. The training period is relatively short and consists of two daily 15 to 20 minute sessions. Wallace and Benson found that their subjects showed a decrease in oxygen consumption and carbon

dioxide elimination. These findings are consistent with a lowering of the metabolic rate. They also found that their subjects had lower blood lactate levels. These researchers theorized that all these responses are due to the effect that meditation has on the sympathetic nervous system. That is, it reduces the activity of a major part of the sympathetic nervous system, thereby causing less constriction of the blood vessels. This effects would be similar to those of the beta-blocker medications. This reduction of the sympathetic nervous system could also account for the lowered lactate levels. Since it is known that epinephrine stimulates lactate production, a decrease in epinephrine (evidence of lowered sympathetic stimulation) would result in this finding. Therefore, a decrease in sympathetic stimulation leads also to lowering of the blood pressure.

Goleman & Schwartz (1976) have also presented interesting findings. They showed that meditators have a greater response to sudden stimuli than nonmeditators, but that the duration of the response is shorter in meditators. Therefore, it is said that meditators may quickly react to the world, but they also immediately relax. This is beneficial, in that, there is a greater probability for chronic system imbalance the longer the system is aroused.

Meditation is not recommended for Type A individuals because these people are not comfortable with sitting still for long periods of time, and may therefore become frustrated with the procedure. It is also to be used with caution in persons with hypertension and hypoglycemia as explained with the concept of relaxation strategies (Allen, 1983).

Because meditation also causes an increase in somatic awareness, it is not uncommon for its practitioners to experience minor aches and pains. This problem is usually resolved in a few days, when the relaxation effect catches up with the increased awareness. It is also important for meditators to spend some time to return their altered state of consciousness to the external world, so that they can arise feeling refreshed and alert rather than dazed (Allen, 1983).

Biofeedback

Biofeedback can be defined as a technique that provides immediate information, through electronic instrumentation of a physiologic parameter which is not usually accurately perceived by an individual (Allen, 1983; Miller, 1969). Although autonomic nervous system functioning has been traditionally described as an involuntary control, the use of biofeedback techniques is

changing that belief. These techniques assist an individual in overriding the autonomic activity and controlling many bodily functions via conscious thought. Biofeedback does this by showing the individual what the systems are doing.

Historically, Pavlov theorized that learning occurred in two ways--operant conditioning and classical conditioning. Classical conditioning occurred automatically and involved conditioned responses through changing unconditioned stimuli to conditioned stimuli. On the other hand, operant conditioning or instrumental conditioning involved a recognition of reward and punishment that was contingent on an individual's behavior. Only the voluntary nervous system was thought to be capable of learning this more advanced type of learning (Ciarcia & Leigh, 1981).

It was not until the 1960's that scientists seriously began looking at the possibility of successful operant conditioning of the autonomic nervous system. In the mid 1960's, Miller and DiCara studied the voluntary control of visceral organs in animals. These investigators showed that rats were able to increase or decrease blood flow to one ear as opposed to another in order to receive a reward--a direct stimulation to the medial forebrain bundle (or pleasure center) of the brain. They also demonstrated that rats could increase or decrease glomerular filtration rate and intestinal contractions. They placed the rats in a

curarized state to show that muscular control need not be present to cause changes in the parameters. Unfortunately because no one was able to replicate miller and Diccara's finding, their work came under criticism.

But others were still quite interested in the idea. In 1962, Kamiya found that human subjects could increase or decrease the amount of alpha waves on electroencephalogram by giving the signals of light and/or tone (which served as rewards). In the late 1960's, Shapiro and his associates began experimenting with college students in teaching them to control the cardiovascular system through operant learning condition. They showed that the students learned to increase or decrease blood pressure, heart rate, and to dissociate blood pressure from the heart rate. Although the amount of change in blood pressure was not clinically significant, these researchers showed that operant learning techniques had the potential for application in hypertensive patients (Ciaricia & Leigh, 1981).

Biofeedback has three major goals--to treat physical disease, to help prevent psychosomatic problems, and to open up new possibilities for human potential (Allen, 1983). Because the autonomic nervous system is so instrumental in the cause of stress-related disorders, biofeedback reaches for it first goal by assisting in the control of these activities. Secondly, biofeedback allows an individual to

work on bodily structures and systems before damage actually takes place, or very early in the process. Finally, biofeedback may aid individuals in acquiring positive performance and well-being, and in turn, emotional health.

As mentioned previously, biofeedback instruments first sense physiologic events (commonly electrical) and interpret or transduce them into a form that is accessible to the body's senses, so that the measured parameter can be displayed and ultimately controlled. Therefore, the display is either auditory, visual, or both. Commonly used varieties of feedback training include electroencepalography, electromyography, cardiovascular parameters, and electrodermal activity. Technology has only recently made instruments available for biofeedback training.

Ciarcia & Leigh (1981) discussed several techniques that have been used for hypertension. One procedure requires that the subject be hooked up to a polygraph that monitors the ECG, heart rate and blood pressure. The pressure is measured by a constant cuff that is inflated near the actual blood pressure so that beat-by-beat readings can occur depending on the change in blood pressure toward a higher or lower level. This system was found to be effective for systolic reading but far less reliable for diastolic pressure readings. It is also expensive and not

applicable for home use, because it requires use by trained personnel.

Another technique is an intermittent blood pressure devise (arterisone) which gives blood pressure readings in intervals, which can then be compared to the previous readings. This technique may be used at home, but it is unable to monitor rapid changes in the blood pressure. Finally, there are techniques that measure mean arterial flow indirectly by impedance cardiography, but this procedure's usefulness has been controversial.

Biofeedback has augmented the effectiveness of systematic relaxation techniques by determining which are most effective for a particular individual. It also aids in enhancing relaxation skills in order to achieve the desired low arousal state and internal control. Training sessions usually last 20 to 30 minutes and the number of sessions required to learn a particular task depends on the parameter to be controlled and on the subject. For example, peripheral blood flow, which is instrumental in arterial blood pressure, requires significantly more training time, because the parameter is a more intangible one to the subject than, perhaps, muscular relaxation.

Biofeedback training should not necessitate the use of an instrument indefinitely. Successful training enables the subject to be aware of internal sensations and changes.

Once the subject has gained control of the parameter, the instrument may be discontinued. One of the most common difficulties of the training is that people try too hard. A passive attitude mind-set must be established, and then relaxation allowed to occur.

As mentioned earlier, other procedures are also being evaluated for their effectiveness in the control of blood pressure. These include psychotherapy, environmental modification, and placebo effects. These methods have also shown desirable results but will not be addressed in this paper. Next, however, a review of some of the studies on the behavioral methods previously explained, that have appeared in the literature, will be presented.

Other Behavioral Methods

Several other nonpharmacologic approaches to hypertension management have been previously referred to. These include weight reduction, modification of sodium, exercise, moderation of alcohol consumption and avoidance of tobacco. These measures will be briefly addressed next.

A Report of the Hypertension Task Force, published in 1979, stated that there is a strong correlation between body weight and blood pressure, particularly among children and young to middle-age adults. Reisin (1978) also reported that substantial decreases in blood pressure result during

weight loss, even if the ideal body weight is not achieved. It is recommended that weight reduction in obese persons be a part of therapy of hypertension management.

Salt reduction also has been shown to be effective in lowering the blood pressure of some individuals. Parijs (1973) reported that approximately two grams of sodium may reduce elevated blood pressure, although only certain patients with hypertension may respond. Again hypertensive patients should be taught about this dietary consideration, along with information about sodium labeling of canned foods and other processed foods.

In 1982, Klatsky made recommendations on alcohol consumption. Based on the findings that more than two ounces of ethanol alcohol per day may lead to elevated blood pressure, Klatsky advised that for controlling hypertension in patients who drink, the limit of ingested ethanol should not exceed two ounces.

The two last areas are tobacco avoidance and exercise. Although nicotine will raise arterial pressure acutely, there is no definitive evidence that identifies the prolonged use of tobacco with an increased risk of hypertension. However, a cardiovascular risk has been shown in those individuals who smoke (Stamler, 1985). The 1984 Report of the National Committee on Detection, Evaluation, and Treatment of High Blood Pressure stated that a regular

isotonic exercise program (i.e., walking, jogging, swimming, etc.) is an aid in reducing weight and may be beneficial to the patient with essential hypertension. Therefore both a regular exercise program and cessation of smoking should be encouraged in patients with hypertension.

Many studies examining the effectiveness of behavioral techniques are available in the literature. Some of those studies will be presented next. The approaches examined will be limited to yoga, hypnosis, relaxation/meditation and biofeedback.

CRITICAL REVIEW OF RESEARCH FINDINGS

Within the past two decades, a considerable amount of research has been conducted on the various behavioral approaches to control hypertension. Unfortunately, there remain controversial findings. Much of this may be due to problems in the methodological procedures utilized by the researchers. These problems will be pointed out in the discussion of individual studies.

Two techniques hypothesized to be effective in the control of hypertension are yoga and hypnosis. There are few studies found in the literature on these two techniques, but some of those studies will be discussed here.

Patel & North (1975) studied 34 hypertensive patients comparing yoga relaxation with biofeedback to a general relaxation control group. They found significant decreases of both SBP ($p < 0.005$) and DBP ($p < 0.001$) in the treatment group compared to the controls. However, all but one of the subjects were on antihypertensive medications, but the study did not report on the specific types of medications prescribed or on any controls used for the differences, if any. Also because both yoga and biofeedback were examined as a treatment, it cannot be determined how much each contributed to the effects of the results.

In 1967, Datey, Dismayed, Dalvi, & Vinekar studied just the effects of yoga on 47 hypertensive patients and found either significant reductions ($p < 0.05$) in mean arterial blood pressure or in required amounts of medications for 52 percent of the subjects. There was no control group for comparison in this study, and the treatment groups varied in size. Also in addition to essential hypertensives, renal and arteriosclerotic etiologies of hypertension were all studied together. This makes a conclusive finding very difficult.

Deabler, Fidel, Dillenkoffer, & Elder (1973) examined the effects of hypnosis and muscular relaxation on hypertension when compared to a control group that received only instructions to sit quietly. Although they reported significant decreases in both SBP and DBP with the use of hypnosis, they did not differentiate their relaxation effects from the hypnotic effects. Also they did not assess and therefore, control for any of the subject's susceptibility to hypnosis. Also a very minimal baseline BP was established before the training began. It is critical to establish a reliable baseline BP over several assessment sessions, because as subjects adapt to laboratory situations, their blood pressure usually decreases (Seer, 1979).

In 1977, Friedman and Taub described their results after examining four different groups: hypnosis only, biofeedback only, hypnosis and biofeedback combined, and measurement only. These researcher found that although both the hypnosis only and biofeedback only groups showed significant lowering of their diastolic blood pressures, when intergroup comparisons were made, the hypnosis only procedure showed the most impressive effects ($p < .05$). The combination procedure of hypnosis and biofeedback was as ineffective as the measurement only group. Again, minimal baseline BP assessments were established. Also subjects receiving medications were mixed with subjects not receiving medications, and no procedures were implemented to control for this or the various medications prescribed for the subjects.

Luborsky et al. (1982) also compared four groups. Their groups were subjects treated 1) with medications, 2) with relaxation, 3) with biofeedback, and 4) with a mild exercise control group. These researchers found that the pharmacologically treated subjects showed the most significant decreases in both SBP and DBP ($p < .05$). The relaxation and biofeedback groups showed more benefits than the control group, but the difference was not statistically significant. Although when criteria for clinical significance of blood pressure reductions were defined,

i.e., a decreases of more than 10 percent in mean BP, a decrease of more than 10 mmHg in mean BP, and a decrease to a level lower than 140/90 mm Hg, these two treatments showed significance. This was a fairly well controlled study, in that, it clearly defined a minimum pretrial BP and adequately assessed the presence of essential hypertension. There was a control group for comparison, and the medication group was very similar in the type of medication administered. Their analysis used pretrial BP readings as a covariate, and they also objectively measured compliance in all the regimens, in order to control for this common problem. They did find the differences in compliance between groups to be non-significant, with the exception that the relaxation group was lower in daily practice than the medication group ($p < .05$). Because of the clinical significance of these findings, these researchers concluded that motivated patients should be given an opportunity to first try behavioral approaches to determine their significance.

In 1985, Hatch et al. reported findings that showed no significant differences among their behaviorally treated groups or between any of the behaviorally treated groups and the group treated with medication alone, but there were significant decreases in the blood pressures of the subjects in behavioral therapy ($p < 0.05$). In addition, these groups

also showed a significant decrease in the amounts of medication required ($p < 0.05$). This group of researchers also examined subject compliance and showed that all three behavioral groups showed a high degree of compliance. This study differs from Luborsky et al., in that, all the subjects were receiving medications. Also this study included a 12 month follow-up which is critical for studying the long-term effectiveness of these approaches. These researchers found that both SBP and DBP remained significantly lower at the 12 month interval ($p < .05$).

Shoemaker & Tasto (1975) researched the effects of muscle relaxation verses the effects of noncontinuous biofeedback on hypertension. Their results showed that muscular relaxation had more of an effect on lowering blood pressure than noncontinuous biofeedback. These findings could be attributed to two causes. Some researchers (Benson, 1972) believe that relaxation requires a passive attitude whereas, biofeedback requires a conscious effort of concentrating on a machine, thus contributing to a higher BP. Also the noncontinuous form of biofeedback has been found by researchers (Shapiro, Tursky, & Gershon, 1969; Schwartz, 1972) to result in subjects exhibiting less control over internal functionings such as blood pressure. Unfortunately, this study only examined pre and post

treatment blood pressure readings which do not indicate what happens between treatment sessions.

Another study conducted by Stone & DeLeo (1976) showed that subjects trained in a Buddhist meditation technique exhibited a significantly lower supine and upright blood pressures ($p < 0.05$) than those subjects who only had blood pressure checks. These researchers also determined the level of DPH , plasma volume, and plasma renin activity (PRA) in their subjects. DPH is a catecholamine-synthesizing enzyme, and its presence in plasma has been hypothesized to be a good indicator of sympathetic nervous system activity. It has also been proposed that adrenergic activity stimulates the secretion of renin. Stone & DeLeo found both a reduction of DPH activity and furosemide-stimulated PRA in the plasma of the behaviorally treated subjects. Because no significant plasma volume levels were detected, these researchers concluded that there was an association between a reduced peripheral adrenergic activity and one type of psychotherapeutic method of blood pressure reduction. Problems with study were that relatively young subjects (mean age, 28 years) were studied, and the two groups studied were unequal in numbers and not randomly assigned. Also no follow-up was undertaken.

In another study by Patel, Marmot & Terry (1981), 204 employees of a large industry were placed into two groups--one group receiving biofeedback that included relaxation and stress management and another group that received only health education information. This was a fairly controlled study in that the groups were approximately equal in size, there was random assignment, and associated cardiac risk factors were considered in the selection of subjects. In this study, not only did the biofeedback show a significant decrease in both SBP and DBP from the control group ($p < 0.001$), but this group also showed a greater reduction in plasma renin activity and plasma aldosterone concentrations ($p < 0.01$). In addition, the blood pressures of the treatment group remained significantly lower at an eight month follow-up, but the PRA and aldosterone levels did not. This effect suggested to the researchers that the mechanisms responsible for long-term maintenance of blood pressure reduction may differ from the mechanisms for acute reduction.

As one may conclude, the definitive results of the effectiveness of nonpharmacologic approaches to high blood pressure control are not in. Primarily, this is due to such a variety of methodologies being utilized, and because many of the studies are not well controlled. This is not to say that these approaches should not be considered, because a

majority of the results showed, at least, a clinically significant reduction in both diastolic and systolic blood pressures. But, certainly, a stronger argument can be made for the use of these approaches when the findings are the results of well developed and controlled studies. Without such studies, the medical community will not likely lend an ear to the ideas.

Nurses are a critical link between the physician and hypertensive patient and the population at large. Based on the information presented thus far in this paper, some principles for the nurse's role in both the pharmacologic and nonpharmacologic approaches to hypertension management will follow, and finally, conclude the discussion.

IMPLICATIONS FOR THE CLINICAL NURSE SPECIALIST

Hypertension is a health disorder that is of universal concern to health care providers. Due to its estimated prevalence of 60,000,000 United States (U.S.) adults (McMahon, 1984; Roffman & Thomas, 1985), and its widely-accepted association with cardiovascular disease, the number one cause of adult death in the U.S.; there is valid reason for concern in this country. Also, untreated chronic hypertension leads to complications that affect the heart, kidneys, and the central nervous system. Hypertensive patients have a morbidity risk twice that of normotensives. This risk increases to three times that of normotensive individuals when the hypertensive patient smokes cigarettes or has an elevated cholesterol level (Roffman & Thomas, 1985).

Since the late 1950's, medications have played an important role in the management of hypertension. The Veterans Administration Cooperative Study Group on Hypertensive Agents (1967) demonstrated the effectiveness of antihypertensive medications in reducing mortality from stroke and from renal and heart failure in patients with moderate hypertension (i.e., DBP between 105 and 120 mm Hg). The major categories of antihypertensive medications used today are diuretics, adrenergic receptor blockers,

vasodialators, angiotensin-converting enzyme inhibitors, and calcium channel blockers. Nurses must be cognizant of these various categories of antihypertensive agents when caring for hypertensive patients. This awareness must include the contraindications and common adverse reactions of each medication that is administered, as well as the pharmacology of the medication, which provides the basis for many nursing considerations.

On the other hand, another study conducted by The Veterans Administration Cooperative Study Group on Hypertensive Agents (1972) did not show therapeutic benefits from medications with mild or borderline hypertensives (DBP between 90 and 105 mm Hg). Also as cited by Lynch & Thomas in 1985, the Multiple Risk Factor Intervention Trial (MRFIT), a large-scale epidemiological study, found a higher incidence of mortality in the group of mild hypertensives with electrocardiographic abnormalities who were taking antihypertensive medications when compared to those not treated with antihypertensives. Evidence from this study, along with research demonstrating beneficial results from nonpharmacologic approaches to hypertension management, prompted Brandt (1983) to report that "the Food and Drug Administration recommends that physicians should begin treatment of mild hypertension with nonpharmacological

measures as long as this approach is effective in maintaining blood pressure" (p.25).

Advocates of nonpharmacological approaches for the treatment of hypertension also substantiate their case by stating that antihypertensive medications often cause adverse reactions, the cost of antihypertensive therapy can be quite high, and many patients are non-compliant with the various regimens.

As stated earlier, side effects from antihypertensives may range from sedation to male impotence to death. Croog et al. (1986) examined the effects of three antihypertensive medications on the quality of life. The three medications studied were captopril (an ACE inhibitor), propranolol (a beta-blocker), and methyldopa (an alpha-adrenergic depressant). The Quality of Life Scales that were utilized included general well being, physical symptoms, sexual dysfunction, work performance, sleep dysfunction, cognitive function, life satisfaction, and social participation. These researchers found that patients taking captopril, when compared to patients taking methyldopa scored significantly higher ($p < 0.05$ to < 0.01) on measures of general well being, had fewer side effects, and had better scores for cognitive functioning, work performance, and life satisfaction. As compared with patients taking propranolol, patients taking captopril had significantly ($p < 0.05$ to < 0.01) more positive

changes in well-being, physical symptoms, and sexual dysfunction. Also the scores of patients in the propranolol group showed more favorable changes in work performance than those in the methyldopa group ($p < 0.05$). These researchers concluded that antihypertensive medications do effect the patient's quality of life. Methods are available to objectively measure these various effects. Therefore, a meaningful assessment of these reactions should be made in order to identify the various effects on quality of life. Ideally, the therapeutic effectiveness of a drug should be balanced with the quality of life aspects, so that higher compliance rates may be obtained.

All of this information leads one to the fact that the advance nurse practitioner has a major role in the management and care of hypertensive patients. As a Clinical Nurse Specialist (CNS), the roles of expert clinician, researcher, collaborator, educator, consultant, and change agent may all be utilized.

The CNS as Expert Clinician

The expert clinician recognizes that there are four major concepts in most nursing theory development. According to the UMAB Conceptual Framework, those concepts are man, health, environment, and nursing. Definitions and/or philosophies regarding these concepts must be

established before nursing diagnoses and interventions can be made. The UMAB Conceptual Framework will be utilized in this paper for this purpose.

Man has been defined as a living being that is capable of thinking, communicating, and guiding chosen efforts to the benefit or harm of self or others. Man forms groups and functions in an interdependent manner within those groups. Man is also in a dynamic interaction with the environment.

The UMAB Framework conceptualizes environment along three dimensions: physical, personal, and cognitive. Both man and the environment are constantly influenced and being influenced by the other. The nurse can work to manipulate these dimensions of man's environment to the benefit or detriment of man's competent functioning or health.

Health is conceptualized as competence. Health is a result of how the patient interacts with the environment and again is identified as physical, personal, and cognitive expressions of health. Health is unique to individuals and to cultures, and it is dynamic.

Finally nursing considers the physical, personal, social, and cognitive aspects of man when working toward the goal of man's competent functioning, which is independent of nursing assistance.

In the management of hypertensive patients, after an assessment of the various dimensions of the patient, environment, and health is obtained, the nurse must determine the goal or desired outcome of any treatment modality. With a hypertensive patient, that goal is to maintain the patient's blood pressure (transient fluctuations excepted) within a range that will limit the chance of morbidity or mortality for the patient.

When evaluating a treatment modality, the nurse must consider the physical, psychosocial, and cognitive implications that affect the patient and the interacting environment. For example, Lynch & Thomas (1985) reported a finding that is relevant to the personal or psychosocial dimension of man and health, when an individual's blood pressure is measured. They reported that the act of speaking can lead to a rapid and significant rise in BP in populations that range from schoolchildren to geriatric patients, and in normotensive to hypertensive individuals. This elevation decreases back to baseline soon after the person stops speaking. A consideration of this information would prompt the expert clinician to ensure that the patient remains quiet at least several seconds prior to a blood measurement.

The CNS as Researcher

One aspect of the researcher role of the CNS is the critical analysis of current studies being reported. Much has been reported on the benefits of nonpharmacological approaches in the control of hypertension, however, the methodologies are so varied that it is difficult to compare the findings in order to make conclusive statements. The CNS must therefore be able to recognize the problems in the methodologies before accepting the results. Furthermore, the CNS can identify areas requiring more research, to aid in filling in this cleft of knowledge. For instance, the cognitive dimension of health may be considered for study regarding the issue of compliance in hypertensive patients.

Some individuals seem to possess more or less control over their responses to the environment (or stressors) than others. One of these responses may be BP levels. Patient non-compliance is a commonly cited problem in antihypertensive medication treatment protocols, and is therefore a rationale for nonpharmacological approaches. But if a patient refuses or fails to adhere to a medication protocol for some reason, why may this same patient be more receptive to a more time-consuming and disciplined regimen of behavioral approaches such as relaxation and/or

biofeedback? Acting in the role of researcher, the CNS may develop and implement a study to examine this question.

Research conducted on a construct known as locus of control (LOC) has demonstrated that this construct may be a determinant of an individual's behavior or responses (Galeis, Pease, & Wolins, 1984). Based on Rotter's (1966) social learning theory, an externally oriented individual (external LOC) believes that outcomes or events are determined by luck, fate, or chance. On the other hand, internally oriented individuals believe that outcomes are contingent on one's own behavior. The internal individual, therefore, maintains higher perceptions of self-control than the externally oriented individual. Thus, the nurse researcher may ask the following three research questions in this proposed quasi-experimental study.

1. Is there a relationship between internally oriented individuals and the rate of compliance in taking antihypertensive medications?
2. Do more internally oriented individuals show a difference in their levels of SBP and DBP after relaxation/biofeedback training when compared to the externally oriented individual?
3. Is there a difference in SBP and DBP levels of hypertensive individuals who augment their medication protocol with behavioral approaches?

Methodology

A convenience sample of 80 patients diagnosed with uncomplicated essential borderline hypertension (DBP between 90 and 105 mm Hg) will be selected from an outpatient department of a large hospital who are involved in either step one or two of the stepped care approach to hypertension management. Patients under the age of 18 and over 65 will be excluded. After confidentiality is ensured and consent is obtained from the volunteer subjects, BP measurements will be obtained and recorded twice a month by health care professionals instructed in the proper procedures of BP measurement (for accuracy and standardization). All subjects will be instructed on hypertension, to include risk factors and the principles underlying relaxation and biofeedback. All subjects will follow the stepped care approach to hypertension control for six months. After six months the subjects will be evaluated and coded on their LOC and compliance rates. Following this, the patients will be randomly assigned to two groups. One group will continue with the stepped care approach (medication only), and the second group (treatment group) will have relaxation/biofeedback training included as part of their protocol. The training will be conducted by clinicians prepared in this area. Subjects will be instructed to

practice the training at least 20 minutes each day, three days per week. Daily logs will be maintained to monitor compliance. BP measurements will continue twice monthly for three months for both groups. After the second three month period, compliance rates for both groups will be determined, and a cross-over of groups will occur. The cross-over will be accomplished to further minimize differences in the groups that may not have been eliminated by randomization.

Instrumentation

Dutweiler's (1984) Internal Control Index will be used to measure the patient's level of internal orientation. This is pencil and paper tool that measures 28 responses on a Likert scale (interval data). The questionnaire has revealed a high level of internal consistency (.84) and content validity. Compliance rates will be determined by a simple questionnaire that reflects percentage rates of compliance and categorizes those rates into a Likert scale.

Analysis

A Pearson r will be calculated to determine if a relationship exists between internally oriented subjects and the scores on compliance in taking antihypertensive medications. Also, a repeated measures ANCOVA will be computed to determine if there is a difference in either the

SBP or DBP levels between the treatment group and the comparison group (medication only). The subjects' baseline BP's will be the co-variate. Finally, an repeated measures ANOVA will be calculated to determine if those subjects who are more internally controlled show a significant difference in their SBP and/or DBP levels after three months of relaxation/biofeedback training when compared to the less internally controlled subjects.

The CNS as Educator

The CNS also functions as an educator of both health care professionals and of the public. Keeping nursing personnel abreast of the most current information on hypertension management, including new medications and recent research findings conducted in the area, are both part of the CNS's role. Educating the public, either as patients or in preventive health care settings, on the risk factors associated with hypertension is also very important. This information should include diet, stress management, and effects of smoking and exercise.

The CNS as Consultant and Collaborator

The CNS who maintains current information on hypertension can certainly serve as an excellent resource person for this information. The CNS should also collaborate with other nursing personnel and the medical staff to ensure that the most effective and holistic approach of treatment be instituted for the hypertensive patient. The CNS who critically analyzes the various approaches to hypertension management and their indication, needs to share the findings with physicians. For instance, some patients may obtain better hypertension control with nonpharmacologic approaches, whereas, others may do better taking medications. Determining a patient's sense of control, as the above study proposes, may offer one reason why a patient is not being controlled with medications, or may indicate which patients may benefit more from a behavioral rather than pharmacologic approach to hypertension control.

The CNS as Change Agent

The change agent role of the CNS is evident throughout all the other roles of the CNS. Knowledge and application of change theory principles are critical to the

effectiveness of the CNS roles. Without successful change, progress in today's health care environment is minimized. With successful change, the CNS may be instrumental in lowering morbidity and mortality rates related to hypertension.

CONCLUSION

Hypertension is a ubiquitous disease. And, fortunately, research continues in this area in order to determine etiologies and effective treatment modalities. In collaboration with the physician, the Clinical Nurse Specialist can contribute a great amount of knowledge and expertise in attaining these goals of hypertension management. With the enormous amount of new information on hypertension constantly being generated, the CNS must strive to maintain and analyze the most current information in order to ensure the most effective treatment. Hopefully with more effective management and public education, the reward of lowered incidences of the disease will become a reality.

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