**Gene therapy**

Gene therapy is a process of incorporating genetic material into living human cells in order to repair damaged or mutated DNA. Genetic therapy is thought to be the next step in cancer treatment and treatment of inherited genetic diseases. In general there are two types of gene therapy.

Germ-line genetic therapy is a process of incorporating genetic material in germ cells (eggs or spermatozoids). This treatment is done in a case of hereditary condition that is inherited to a child and may lead to future development of cancer or disease. Somatic gene therapy is a process of incorporating genes or DNA strains into somatic cells of humans. In this process a so called vector is used as a carrier of the genetic material or the genetic material is directly injected in the affected tissue.

Viruses are the most promising vectors at the moment. Viruses incorporate their DNA into the genetic material of the human cells and use their replication mechanisms to replicate virus DNA. This is why genetically engineered genetic material can be incorporated in human cells using a virus. There are many types of viruses and all of them have different characteristics. Adenoviruses at the moment are very good candidates for gene therapy because they carry lowest risk for complications. China’s heath system already approved one adenovirus as a vector for genetic therapy of throat cancer.

There are other nonviral methods for genetic treatment. A direct “naked DNA” injection in living tissue is one of them. DNA in a form of plasmid is injected in muscles and this treatment shows promising results. Other available method for genetic treatment is incorporating oligonucleotides into the mutated or dysfunctional gene in order to disrupt its function and stop the progress of underlying disease.

**Urinary incontinence in women**

**Urinary incontinence** is frequent problem in women, especially elderly women after menopause. It’s defined as involuntary leakage of urine during walking, standing, coughing, sneezing etc. It’s often a problem that is under diagnosed and often not mentioned to the doctor. The urethra and bladder are both located in the lower abdomen. Normally in men and women, the urinary sphincter and the angle between the bladder and the urethra prevent urinary leakage. Proximal urethra in the lower abdomen is influenced under the pressure of the surrounding tissue and intra abdominal pressure that also prevents leakage. Finally the muscles in the perinea region also act as another sphincter. Additionally, in men the prostate that is located under the bladder acts as a second sphincter that prevents urine incontinence in men and this is one reason why urinary incontinence is not common in men.

There are different types of incontinence.

**Stress incontinence** is defined as loss of small amounts of urine associated with coughing, laughing, sneezing, exercising or other movements that increase intra-abdominal pressure and increase the pressure on the bladder. Main reason for this is weakness of perineal musculature in post menopausal women. Lowered estrogen levels may lead to lower muscular pressure around the urethra, increasing chances of leakage. Also pregnancy is another risk factor for this condition resulting in weakening of the perineal musculature and connective tissue.

**Urge incontinence** is feeling the need for urgent urination what usually results in micture of small amounts an urine. The main reason for this is the so called overactive bladder or neurogenic bladder. Involuntary actions of bladder muscles can occur because of damage to the muscles of the bladder, to the nervous system in general or to the nerves from damage in the lower spinal cord, some diseases like myasthenia gravis, systemic lupus etc.

### Overflow incontinence occurs when the patient’s bladder is always full due to incomplete emptying of the bladder or a blocked urethra. Reason for this condition may be weak bladder muscles resulting in incomplete emptying of the bladder, damage of the nerves from diabetes, spinal cord injuries and other conditions. This condition is rare in women, but sometimes can be caused by some secondary conditions like a vaginal prolapse. In this condition the bladder is always full and some movements can result in leakage of small amounts of urine.

### There are also other reasons for incontinence like structural damages from surgical intervention, catheterization, radiologic treatment etc.

### The treatment for this condition depends of the condition that is the reason for urinary incontinence. You must contact you physician in order to find the etiology of the condition. There are many treatments available. So called Kegel exercises strengthen the perinea muscles by exercise what can be helpful, except in overflow incontinence. There are medications available that are designed to relax the bladder muscles (trospium for example) or hormones (like estrogen) that increases the tonus of the perineal muscles. For effective treatment and increased quality of life in many cases the patient can help himself by reducing the amount of fluid before bedtime, doing exercises to strengthen perineal muscles, taking certain medications or orthopedic devices (pesoar). Operative treatment is also an option for difficult cases where conventional methods do not help. Urinary incontinence is a condition that often occurs in women after menopause period and which can be treated if you'd specify your doctor about your symptoms and the treatment is guided by his advice. Urinary incontinence is nothing shameful, and if you have this condition contact your doctor.

**Acute pharyngitis**

Acute pharyngitis is inflammation of the pharynx and all of the structures present in this anatomical area (uvula, soft palate, tonsils). It can be caused by different etiological factors but mostly viruses, bacteria or some type of chemical irritation, allergic reaction or other factors. It is characterized by findings of pharyngeal erythema, fever, sensitivity of the cervical lymph nodes, enlarged tonsils and can be complicated by other conditions like scarlet fever, conjunctivitis, vomiting (especially in younger children) etc.

Because there are a number of causes for this condition there is a need to differentiate the etiological agent, is it bacteria, virus or some other cause. Antibiotics are ineffective against viruses, and in some cases (for example mononucleosis) can even cause side effects (rashes, erythema, pruritus etc.).

Most common bacterial cause of acute pharyngitis are group A beta-hemolitic streptococci (Alan 2001). This bacterium is the most common cause of bacterial pharyngitis in children between ages 4-7. It is estimated that in 15 to 30 percents of the children diagnosed with acute pharyngitis the etiological agent is group A streptococci (Choby 2009). Characteristics of pharyngitis caused by this agent are rapid onset of symptoms with cough, rhinorea, headache, vomiting, fever, anterior cervical adenopathy etc. (Brook and Dohar 2006). Streptococcal pharyngitis carries a danger of severe complications. Streptococci invade the surface layer of the pharyngeal tissue and secrete toxins and proteases. This can cause rash and appearance of scarlet fever. It is important that M protein that is found on the surface of some of group A streptococci is immunologically very similar to antigens found in myocardial sarcolema and joints. This is the reason why rheumatic fever is a severe complication that can damage mostly the heart valves but joints and kidney also. Circulating antibodies against streptococci can deposit in the kidneys and cause kidney damage and glomerunolenphritis (Brook and Dohar 2006) (Hahn et al. 2005). This is why it is important to recognize streptococcal infection and start treatment with antibiotics early in order to prevent complications. Diagnosis can be easily made by throat culture (which is time consuming and usually needs 24 hours or more to obtain the results). Other more prompt method for detection is Rapid antigen detection test which detects the specific antigen of the bacteria. Bacterial infection can be recognized by biochemical analysis also (elevated leucocytes, erythrocyte sedimentation rate, C-reactive protein etc). There are other bacteria that can be the causative agent of pharingitis like group C, G or F streptococci, M. Pneumoniae, C Diphteriae and a number of other bacteria, that are less common than streprococci and are accompanied with less (but not absent) complications.

The specific diagnosis of etiology of pharyngitis is important because in a case of viral pharingitis the treatment with antibiotics doesn’t have any effect and can lead to development of resistance against antibiotics. It is important to know that viral pharyngitis is most common type of pharyngitis and in this case the condition usually tend to resolve on its own and only supportive treatment is necessary. Most common viral agent responsible for pharyngitis are adenoviruses. Adenoviruses directly invade and attack the pharyngeal mucosa resulting in redness, pain and feeling of sore throat. Most commonly this infection is accompanied with conjunctivitis and tearing from the eyes, the so called pharyngoconjunctival fever. It is manifested with generalized myalgia, fever, conjunctivitis and even swelling of the eyelids may occur, and some form of gastrointestinal disturbances (like nausea and vomiting in younger children). On examination the pharynx is red with enlarged anterior cervical lymph nodes. The condition lasts for 10 days and only supportive treatment is sufficient.

Rhinoviruses are the second most common cause of acute pharyngitis. They cause about 20 percents of acute pharyngitisand is characterized by local redness, swelling and pain in the mucosa, painful swallowing, sore throat and red tonsils. The same symptoms however are more generalized and also present in the nasal mucosa and eustachian tubes so symptoms of runny nose and otitis in children can also be present. There are many other viruses that can cause pharyngitis. Epstein - Barr virus can cause Infective mononucleosis. It is a condition that is transmitted through naso-pharyngeal secretions, and is usually transmitted to children by a direct contact. It is characterized by findings of local edema, swelling and hyperemia of the tonsils (that can be covered with white exudates and may resemble bacterial pharyngitis), sore throat, painful swallowing etc. Enlargement of the posterior and anterior lymph nodes is a clinical characteristic of this conditions and by this symptom can be differentiated from bacterial pharyngitis which only causes anterior lymphadenitis. There are other viral etiological agents that can cause acute pharyngitis (Herpes viruses, Coronavirus, Respiratory sincicial vrusand other viruses) and the symptomathology is similar.

In our case we have a 6 years old male who had been in good health with no significant medical problems. In late September this patient presented to a pediatrician’s office with a complaint of sore throat, fever, headache, and swollen glands in his neck for the past 36 h. On physical examination (PE), he had fever of 38ºC, a red posterior pharynx, yellowish exudate on his tonsils, and multiple, enlarged, tender cervical lymph nodes. Based on our previous information’s that we presented about the most probable causative agent for acute pharyngitis we can make some conclusions. The child had tonsilo-pharyngeal exudates and lymphadenopathy of the anterior cervical lymph nodes. This findings increase the statistical likelihood of streptococcal pharyngitis (Alan et al. 2002). There are many algorithms and calculations that try to explain the likelihood of streptococcal infection, for example absence of high fever, erythema and symptoms that are characteristic for the common cold are indicators that the disease has viral origin (Wald et al. 1998). In one study made by Hsin et al. 2003 they examined 416 children with clinicl diagnosis of acute pharingitis. Viruses were isolated in 29.6 % of the children and bacteria in 17.5 % of the children. They only found that children with viral pharyngitis had longer duration of high temperature. Because of the small percentage of isolated bacteria in this study they don’t recommend rutine use of antibiotics in acute pharyngitis in children. However the children which were identified with bacterial infection received antibiotic, but they gave antibiotics to the children that were clinically suspicious to bacterial pharyngitis also.

This is the doctor’s dilemma which is present in everyday practice. Should he start antibiotic treatment if he suspects streptococcal pharyngitis on empirical basis or he should wait the results from the throat culture and avoid usage of antibiotics, but with present risk that the disease is caused by streptococci after all? Absence of throat culture leads to increased usage of antibiotics, because physicians tend to “play it safe” and give antibiotics anyway. Throat culture can be obtained by a period of 1-2 days; time needed for incubation of the specimen, acquiring the results, the control examination etc. This is not a long period for some significant progression or changes in the disease, but often there is a problem with the worried parents who are asking why we don’t start the antibiotic treatment. rapid antigen detection test is fast, but less reliable method than throat culture (80-90% compared to higher than 90% for throat culture), but positive test is an indication for immediate start with antibiotic treatment. Negative results however, if there is a clinical indication for streptococcal pharyngitis should be confirmed with throat culture (Alan et al. 2002). There are studies however that recommend that routine throat culture is not needed because majority of pharyngitis in children is caused by viral pathogens (Hsin et al. 2003). We must conclude that personal experience of the general practice doctors or pediatrician’s has significant importance in decision for antibiotic treatment. Beside the fact that there is a lot of research on the subject still there is a chance that this particular case is caused by streptococci and if there are clinical signs of streptococcal pharyngitis – sore throat, fever greather than 38 degrees celsius, exudate on the tonsils, and enlargement of the anterior cervical lumph nodes, antibiotic treatment should always be an option (Choby 2009).

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**Physiology and Pharmacology of Hypertension**

Cardiovascular diseases are the most important cause of morbidity and mortality in the world responsible for more than third of global causes of death. Hypertension has important role in developing cardiovascular diseases, ischemic disease of the heart and heart and kidney failure, blindness and a number of other conditions. According to WHO there are at least 970 million people in the world who suffer from high blood pressure and in the same time WHO recognizes the hypertension as the most significant factor for premature death world-wide. In the same time WHO is predicting that the problem is only growing and is estimating that until year 2025 there will 1.25 billion people who will suffer from hypertension (Kearney et al. 2005) (Mackay and Mensah 2004) (WHO 2002). It is found that treating hypertension had lead to 40 percents reduction of cerebral stroke and about 15 percents reduction of acute myocardial infarction (WHO 2002) (Colins et al. 1990). What is interesting data obtained globally in the world found that about 62 percents of cerebral insults and about 50 percents of ischemic heart morbidity can be attributed to sub-optimal regulated blood pressure (systolic pressure above 115 mmHg). This only means that blood pressure should be monitored more closely by trained and experienced physicians. However World health organization found that globally the ability to treat hypertension is variable with huge difference between the countries. In this survey conducted on 167 countries by the World health organization in 67 percents of them there was no national anti-hypertension program, physicians were not trained to manage hypertension in 45 percents of the countries, antihypertensive drugs were not available in 25 percents, basic equipment was not available in 8 percents etc. (Alwan et al. 2001). Hypertension is believed to be a disease of the modern society, but the prevalence of hypertension in developing countries, especially in the urban areas is now similar to the prevalence in western countries (Vorster 2002). This can be attributed to the modern day of life that is accepted in the developing countries because it is found that primitive people around the world have no hypertension and their blood pressure doesn’t elevate with age (Carvalho et al 1989). This is important because we can see that hypertension is a modifiable factor that is dependent on the lifestyle of the person and along with other modifiable factors like obesity, stress, sedentary lifestyle, smoking, alcohol intake, vitamin D deficiency and other factors. Hypertension however is the most important modifiable factor that can significantly influence the well being of the general population worldwide (Kyrou et al. 2006) (Wofford and Hall 2004).

Hypertension is defined as elevated systolic or diastolic pressure above the normal reference values. Normal blood pressure is systolic blood pressure lower that 120 mmHg and diastolic pressure lower that 80 mmHg The systolic pressure is recognized as normal in population above age 50 if it is not greater than 140 mmHg and systolic not greater than 90 mmHg. (Chobanian et al. 2003). There are two main types of hypertension primary and secondary hypertension. Secondary hypertension is responsible for only 5 percents of the incidence of hypertension worldwide (Chiong et al 2008). It is a condition where the elevated blood pressure is a result of some other morbidity within the organism that is treatable or non treatable and is the primary factor for elevated blood pressure. It is very important to distinguish between these two types because the treatment is much different. Secondary hypertension can be caused by variety of condition like disease in endocrine system like Cushing’s disease where the adrenal glands produce excess cortisol (Dodt et al. 2009). Other condition that can lead to secondary hypertension is hyperthyroidism, where in order to treat the hypertension we will also need to treat the primary disease that is causing the elevated blood pressure (Geffner and Hershman 1992). Pheochromocitoma, coarctation of the aortha, hyperaldoseronism, polycystic kidney disease, acromgaly, brain tumor, cocaine usage, hyperparathireoidism and a number of other primary conditions can cause secondary hypertension. Characteristic of secondary hypertension is that the treatment of the primary condition will result in reducing of the hypertension. This is the main difference between primary and secondary hypertension (Chiong et al. 2008).

Primary or essential hypertension on the other hand is responsible for 95 percents of all cases of hypertension (Carretero and Oparil 2000). Characteristic for primary hypertension is that the incidence of primary hypertension increases with age, and younger persons with relatively for age elevated blood pressure at younger ages are at increased risk of developing essential hypertension later in life. Essential hypertension is also a risk factor for other secondary complications like cerebro-vascular disease, cardiac events, renal diseases and other conditions (Franz et al. 2007). It is characteristic that the main cause for essential hypertension is not known. There are a lot of theories that try to explain the etiology of this condition, but almost all agree that modern way of life and habits are the most important factors contributing to essential hypertension. This is supported by the fact that essential hypertension is not present in primitive societies, as shown by some studies (Carvalho et al 1989). Essential hypertension is characterized by sustained elevated systolic blood pressure above 140 mmHg and diastolic blood pressure above 90 mmHg. Other characteristics of essential hypertension are:

- Normal or elevated cardiac output or after-load early in the disease;

- Increased cardiac work;

- Reduced renal and skin blood flow, accelerated excretion of sodium by the kidney’s and other kidney abnormalities and in the same time normal blood flow to most other organ systems;

- Reduced plasma volume;

- Over-reactivity of the blood pressure to stress, abnormal vascular reactions on trigger factors (cold, heat, other factors), changed circulatory homeostasis etc. (Laragh et al. 1983).

There are many suggested etiological factors that are found to predispose to developing essential hypertension. First mentioned is the genetic predisposition to essential hypertension. It is well known fact that family history of hypertension leads to susceptibility to essential hypertension in one individual. Many genes are recognized that are associated with increased susceptibility to hypertension (more than 50) and new genes are identified on a daily basis (Loscalzo el al. 2008). At least 10 genes are found to have direct effect on raising or lowering the blood pressure by increasing or decreasing the salt and water ressorption or excretion in the kidney’s (Lifton 1996). Examples of Mendellian inheritance where only one gene is responsible for genetically predisposed hypertension are rare, for example in Liddle’s syndrome, due to mutation of the epithelial sodium channel (ENaC) (Rossier and Schild 2008). More commonly inherited susceptibility to essential hypertension has multifactorial inheritance, where multiple genes have influence in increased susceptibility to hypertension. Genes that can lead to fenotype that can additionally lead to increased susceptibility to hypertension, genes responsible for obesity, diabetes mellitus, renal function changes etc. and other yet not recognized genes that may lead to increased susceptibility to essential hypertension in some patients (Kotchen et al. 2000).

Excess sodium intake is another suspected etiological factor that is believed that is responsible to the development of essential hypertension. Excess intake of sodium can elevate the blood pressure with multiple mechanisms once the ability of the kidney’s to eliminate excess sodium are reached. Excess dietary sodium leads to increase in fluid volume in the blood circulation and therefore increased preload of the heart, which results in increased cardiac output or afterload. Local regulatory mechanisms in peripheral blood circulation then increase the vascular resistance in order to compensate for the increased circulation due to increased blood pressure, which causes even greater rise in blood pressure. Elevated concentrations of sodium on the other hand stimulate antidiuretic hormone and activates the reniin-angiotensin system that further leads to reabsorption of water and salt (Loscalzo el al. 2008). But excess sodium intake causes hypertension by other mechanisms also like affects the reactivity of the blood vessels, affects the normal renal function etc. (Campese et al. 1996) (Barba et al. 1996). The importance of excess sodium intake can be best seen on some studies on primitive people. It is found in a number of studies that primitive societies that have small salt intake don’t have hypertension and their blood pressure remains normal with age (Carvalho et al 1989) (Page et al. 1981). Now when these primitive people adopt modern day diet and they also manifest elevated blood pressure and increase hypertension incidence with increased age (Klag et al. 1995). Also experimental studies show that hypertensive patients when conducted on salt ingestion diet tend to significantly reduce their blood pressure (Cutler et al. 1991). A term called salt sensitivity is introduced in order to recognize the increased susceptibility to hypertension in some individuals with excess salt intake. Weinberger et al. 1986 found that hypertensive people react with higher blood pressures after a 1 day 10 mmol diet of salt compared to non-hypertensive people (51 percents compared to 21 percents). There are many other suggested reasons for this salt sensitivity (genetic, environmental etc) (Weinberger et al. 1986).

Increased cardiac output as a cause of essential hypertension is found as a cause especially in younger adults. This increase of cardiac output in younger people is caused by increased contractibility of the heart by increased sympathetic stimulation. However this is believed that is only the first step in the evolution of essential hypertension because it is found that in developed essential hypertension increased peripheral resistance is accompanied by normal cardiac output (Cowley 1992). However this initial elevation of the blood pressure caused by overactive sympathetic system can further induce persistent elevation on the peripheral resistance by blood vessel thickening and remmodelation (Higashi et al. 1997).

Abnormal activation of the rennin-angiotensin system is another factor that is found that may have influence in developing essential hypertension. This is very important mechanism of essential hypertension and essential hypertension is divided in 2 groups: rennin elevated and non-renin elevated essential hypertension. There are several mechanisms that may induce activation of the rennin-angiotensin system. Nephron heterogenicity is one hypothesis for increased activity of the rennin-angiotensin system in essential hypertension. Base on this theory there are ischemic nephrons along with hiperfiltering nephrons within the kidney and the ischemic nephrons are responsible for the excess rennin production (Sealey et al. 1988).

Obesity is another important factor that may lead to increased susceptibility to essential hypertension. It is found that more that 85 percents of the cases of essential hypertension are present in persons with body mass index above 25 (Haslam and James 2005). It is found that obesity causes elevated blood pressure by a number of mechanisms, including activation of the sympathetic nervous system and activation of the rennin-angiotensin system (Rahmouni et al. 2005). Obesity is also closely related to insulin resistance which is another factor that may predispose to essential hypertension. It is a condition of elevated levels of insulin on the blood due to reduced sensibility to insulin in the tissues that are effector-organs for insulin (like muscles, liver etc). Adipose tissues in obese people raises the level of non-saturated fatty acids in the blood, alter the metabolism of the liver, lead to increased production of inflammatory cytokines, plasminogen activator factor – 1 and other active products that lead to a condition similar to chronic inflammation that can lead to elevated blood pressure. Insulin is responsible for regulating the metabolism of glucose in the body, but also can stimulate the sympathetic nervous system that can lead to elevated blood pressure (Grundy et al 2005). There are studies also that show that increased insulin level in insulin resistance leads to salt sensitivity also (Modan et al. 1985).

There are other suggested hypotheses and possible factors that can predispose to essential hypertension, but as we mentioned above the exact cause of this condition is still unknown. Newer the less essential hypertension can be categorized in several groups based on it severity. Condition called prehypertension is a condition where is estimated that the person is at risk to develop hypertension further in his life. At this stage high blood pressure can still be treated with life style modifications and medicament al treatment is still not necessary (Shaw 2009). It is declared as measurement of systolic pressure between 120-139 mmHg and diastolic pressure between 80 and 89 mmHg (Chobanian et al. 2003). At this stage the elevated blood pressure can still be modified with life style changes and no medication treatment is still necessary. Life stage changes include:

- weight loss and moderate aerobic exercises- it is found that regular, moderate exercises (like walking) improve the resting heart rate and lower blood pressure (Elley and Arroll 2002)

- reducing dietary salt intake and adoption of diet rich in potassium (or usage of potassium chloride as a substitute for sodium chloride) because potassium helps eliminate excess sodium through the kidney’s (Klaus et al. 2009)

- cessation of tobacco and alcohol consumption which are found that induce hypertension by yet not fully understood mechanisms, however it is found that tobacco and alcohol cessation significantly reduces the complications of hypertension like cerebrovascular insults and myocardial infarction (Groppeli et al. 1992).

- additional dietary changes, like acceptance of the so called DASH diet (dietary approaches to stop hypertension), which is diet rich in fruits and vegetables that is low fat or saturated fat-free diet (Appel et al. 1997)

. Reducing stress with some relaxation techniques (bio-feedback or progressive muscle relaxation or other techniques) or reducing the environmental triggers of stress (like high noise pollution, bad work lighting, bad work-relations etc.) is found that can significantly reduce hypertension (Nakao et al. 2003).

- Other factors are also important like reducing dietary shugar, increasing omega 3 fatty acids intake and other factors.

On the other hand prehypertension may progress to other more severe stages of hypertension that are classified as stage 1 where the systolic blood pressure is between 140-159 mmHg and diastolic blood pressure is between 90 and 99 mmHg and stage 2 where systolic pressure is above 160 mmHg and diastolic above 100 mmHg. These two stage of hypertension require medicamentation in order to regulate the blood pressure and reduce the incidences of complications.

There are many antihypertensive drugs that are now available in order to treat elevated blood pressure. All of them can be divided in several groups based on their mechanism of action. They are thiazide diuretics, ACE inhibitors, calcium-channel blockers, beta adrenergic blockers, angiotensin II receptor antagonists, vasodilators etc.

Thiazide diuretics lower blood pressure by inhibiting the reabsorbtion of sodium and chloride in the distal tubules of the kidney’s by blocking the activity of the Na+Cl- channels (Hughes 2004). They are recommended as first line drugs of choice in treating hypertension due to their positive effect on reducing the risk of death due to heart attack and heart failure or cerebral insult (Wright and Musini 2009). They are also the first choice of treatment because they are the cheapest antihypertensive drugs with smaller economical impact on the patients and the economy (Whitworth 2003).

Angiotensing converting enzyme inhibitors (ACE inhibitors) are already the first drugs of choice in treating hypertension some developed countries like Australia (Guide to management of hypertension 2008). In the normal physiology of the kidney’s, drop of blood volume in the kidney’s results in production of rennin. Rennin than stimulates production of angiotensin I, that is then converted by the angiotenzin converting enzyme to angiotenzin II. Angiotensin II causes blood vasoconstriction and additionally stimulates secretion of aldosterone. ACE inhibitors manifest their antihypertensive activity by blocking the chain of events in the rennin-angiotensin system that is causing activation of aldosterone, that causes reabsorption of water and sodium and therefore increasing the blood pressure by increasing the preload of the heart (Ajayi et al. 1985). It is found that ACE inhibitors have additional positive effect against heart muscle remmodellation in hypertension and manifest cardio-protective effects (Krum et al 2004). Additionally they have reno-protective effect in patients with diabetes mellitus (Luno et al 2005). This is why ACE inhibitors are one of the most important drugs in treating hypertension. Also ACE inhibitors have additional synergistic effect on lowering blood pressure when they are used with thiazide diuretics (British National Formulary; 54th Edition (2007).

Calcium channel blockers are a group of drugs that are used for treating hypertension and their antihypertensive effect is attributed to the blockage of the calcium channels in the heart muscle cells and blood vessels. The manifest their antihypertensive effect by decreasing the force of myocardial contraction (or negative inotropic effect), also the slow the rate of myocardial contraction (or they have negative chronotropic effect), and also in the blood vessels the cause relaxation of the smooth muscles and effect of vasodilatation and therefore they decrease the afterload of the heart. Calcium channel blockers are found to be the most effective antihypertensive treatment in older patients with essential hypertension due to their vasodilatatory effect (Nelson 2010).

Beta adrenergic blockers are a group of drugs that decrease the effect of the sympathetic nervous system on the heart by diminishing the effect of epinephrine and other catecholamine’s (Frishman, Cheng and Nawarskas 2005). Catecholamine’s stimulate the Beta 1 receptors in the heart that produce increased heart rate (positive chronotropic effect) and increased heart force of contraction (inotropic effect). In the kidney’s beta 1 receptor stimulation produces release of rennin and activation of the rennin-angiotensin system (Perez 2006). The antihypertensive effect of beta-blocker is due to blockage of the effects of this stimulation and therefore reduction of the cardiac output with their negative chronotropic and inotropic effect and also reduction of the rennin secretion and activation of the rennin-angiotensin system. Therefore the main mode of action of these drugs is reducing the effect of stress and sympathetic activity on the heart (Frishman, Cheng and Nawarskas 2005). This is why beta-blockers are most effective in younger individuals where the hypertension is caused by overactive sympathetic nervous system due to stress and other factors (Frishman, Cheng and Nawarskas 2005).

There are other antihypertensive drugs available like aldosterone antagonists, vasodilatators, centrally active adrenergic drugs and other that have different mechanisms of action but are used in some special cases when other drugs are ineffective. Combination of antihypertensive drugs is also used if a single drug therapy remains ineffective however the above mentioned drugs are the drugs that are most commonly used in treating hypertension (Nelson 2010).

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