SWIMMING AND CARDIOVASCULAR FITNESS IN THE OLDER AGE GROUP AND SWIM TRAINING IN THE OLDER AGE GROUP

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Coronary artery disease and myocardial infarction (heart attacks) are diseases of high prevalence in Western Europe and North America. Some observers, indeed, consider these disorders as epidemic.[1] As a result of information developed from animal experimental data, clinical observations, and particularly from prospective longitudinal epidemiological research (in which a group of men, free of the disease at the beginning of the study, are followed and the characteristics of those who develop the disorder are compared to the features of those who do not) the concept of coronary risk factors was developed. Coronary risk factors are defined as "those abnormalities demonstrable in persons free of clinical coronary heart disease and known to be associated with significantly increased risk of developing the disease in subsequent years." These have been summarized in a recent paper by Stamler et al[2] and are as follows:

(1) Increase age.

(2) Being a male.

(3) Hypercholesterolemia--high levels of cholesterol (an important fat-like constituent of blood) in the serum. Individuals with very high levels of cholesterol experience 3-4 times as many heart attacks as those with low levels. In a recent study it was found that over a third of American men over the age of 50 had high cholesterol levels, that is, levels of 250 mg/100 cs of blood serum (or greater).

(4) Hypertension. High blood pressure is associated with increased risk of heart attacks and even minor blood pressure elevations increase the risk.

(5) Diabetes mellitus.

(6) Obesity. There is some dispute as to whether obesity in itself is a pure risk factor or whether it merely increases the likelihood of having other risk factors such as high blood pressure, diabetes, and high blood cholesterol.

(7) Diet. The average middle class American diet of today seems to be high in calories, cholesterol fats, sugars and salt--all of which in large quantities promote the development of hypertension, hypercholesterolemia, obesity, and diabetes.

(8) Cigarette smoking. Many studies have documented the observation that heavy cigarette smoking is associated with increased risk of developing heart disease.

(9) Increased serum uric acid levels.

(10) Certain kidney and thyroid disorders.

(11) A family history of coronary disease.

(12) Certain behavioral patterns. Friedman and Roseman[3] have described two personality types. One, type A which is associated with a definite increased risk of developing heart disease and another, type B where the risk is much less. Type A individuals are described as those with driving, impatient personalities who are extremely aware of the uses of time and continuously feel themselves under the pressures of meeting deadlines. Type B individuals are described as being more placid than the type A, less driving, less impatient, more contemplative, and not under pressure of continuous time demands. It is important to realize that it takes a combination of both an individual's personality and the circumstances of his life to bring forth the full-blown type. For example, a person with a predisposition towards a type A approach placed in a setting of a nondemanding nature and unhurried atmosphere will not show the full type A characteristics.

(13) Certain electrocardiographic abnormalities.

(14) Decreased vital capacity.

(15) A low level of physical activity.

These risk factors are additive so that people who are obese, diabetic, heavy smokers, sedentary and have high blood pressure as well as high serum cholesterol, have enormously greater chance of developing coronary artery disease than the individuals without these characteristics. There are all gradations in between depending on the risk factors which a given individual possesses. It must be remembered, of course, that these risks apply in an actuarial sense, just like the tables used by the life insurance companies. That is, one can never be sure that any given person. no matter how many risk factors he possesses, will develop a heart attack in the next 10 years. Rather one can say out of a thousand people who have such characteristics a large number will develop the disease.

There is great interest in the question as to whether exercise (in this case, swimming) can exert a beneficial effect not only on the cardiovascular system but also on the vital capacity of the lungs. In this connection there is a recent excellent review by Alterkrose on exercise and the cardiovascular system written for a medical audience.[4]

Some years ago Dr. J. N. Morris, the distinguished British epidemiologist, made a study of employees of the London Transport and other industries in which there was a gradation of physical activity. He showed that men in physically active jobs, for example, bus conductors on double-decker busses as opposed to bus drivers; or postmen, as opposed to clerks, had a lower incidence of coronary artery disease than did their counterparts matched for age, etc., who occupied sedentary positions.[5]

There have been a number of other studies since Morris's pioneering work. A few have been contradictory but most have confirmed that coronary artery disease is less common in those who have a good deal of physical activity associated with their work than those who do not, even when such variables as social class, age, etc., are taken into account.

A question which has long been of concern to those involved in athletics, whether as competitor or as coach, concerns the longevity of former college athletes. The earliest work on this subject was carried out by Dr. Morgan in England who studied the fate of varsity oarsmen from Oxford and Cambridge, who had rowed in The Boat Race between 1829 and 1869. There was no evidence to suggest that these former athletes had died at a rate any greater than other men of similar education and class in 19th centry England. Pomeroy and White studied coronary heart disease in former Harvard football players.[6] Of the 355 men who were traced, 87 had a known cause of death. Of the 87, 25 or 29% died of coronary heart disease. A major finding was that the amount of exercise taken habitually during the subject's lifetime was an indicator of the likelihood of his developing the disease. Those in the coronary group engaged in less vigorous exercise than the others and no individual in their study who maintained a heavy exercise program developed coronary heart disease. Doctor Albert Damon of Harvard University has shown in a study of deceased Harvard graduates born in the last century that those who had participated in athletics but had not become lettermen had greater longevity than either nonathletes or athletes who had won their letter in a varsity sport. The varsity athletes had the shortest life span. No information was available as to whether exercise was continued after college.

A Swedish study of individuals who had reached their 100th birthday indicated that all had a substantial amount of exercise per day. Other studies such as those of Dublin in the United States who studied college

graduates who had left school between 1870 and 1905, and Rock who analyzed the life history of Cambridge athletes who were at the University between 1860 and 1900, indicated that there was no essential difference in the longevity in students who were athletes while at University and those who were not. There was no information developed, however, as to whether exercise had been continued after leaving college.

A study of Finnish skiers did indicate that their life expectancy exceeded that of the general male population by several years. It seems probable that heavy exercise early in one's life which is abruptly terminated in the stage of early adulthood does not confer any life-long benefit on the heart. However, continued daily exercise throughout life might do so. Clarence DeMar ("Mr. Marathon") was a marathon runner who continued running his entire life. He died at the age of 70 of cancer. Physiological studies carried out at the age of 65 indicated that he still was in excellent condition in terms of his low rise in blood lactic acid and his oxygen utilization after exercise on the treadmill. Microscopic examination of his coronary arteries at the time of autopsy showed them to be very large and completely unobstructed. The amount of atherosclerosis of the arteries was very much less than one would expect for a man of his age.[7]

There are a number of mechanisms by which continued heavy exercise might benefit the heart.

(1) Exercise and blood components.

There is some evidence in the medical literature that exercise lowers the level of serum cholesterol. In order to lower blood cholesterol the exercise apparently has to be of the most vigorous and active type with much muscular movement.[8] Observation on individuals who are subjected to heavy levels of training indicated that the exercise was instrumental in lowering their pre-training cholesterol levels to ones in the low normal range. Work on swimmers, who already had low levels of cholesterol, indicated that there was very little further lowering by training.[9]

In a study of Finnish lumberjacks, Karvonen showed that hard working lumberjacks who had huge caloric and fat intake maintained serum cholesterol levels similar to other males in the local population in their age group. Similarly, villagers in the Swiss Alps who had very heavy physical exertion had low serum cholesterols even though they had a high intake of dairy fats.[10] However, even the heaviest exercise may not be able to prevent elevated serum cholesterol if social and psychological stress is severe enough.

Work at the U.S. Navy Medical Neuropsychiatric Research Unit, San Diego, California, with individuals in the underwater demolition training school during "hell week" showed that these subjects had a marked rise in serum cholesterol (and a fall in serum uric acid) in spite of superhuman physical demands.[11] Apparently the intense psychological stress was sufficient to mobilize cholesterol in the serum in spite of the concomitant intense physical exertion. Animal work on this problem has been somewhat ambigious but Mayer has reported an unequivocal relationship between inactivity and obesity in animals. It would appear, in any case, both in animals and in humans that a substantial level of physical activity must be maintained over a long period of time for any beneficial influence on serum cholesterol to be manifest.

(2) Exercise and the cardiovascular and hemic systems.

It is well known that a program of regular physical training increases the hemoglobin content and oxygen carrying capacity of the blood. In addition there is increased vagal tone and decreased peripheral resistance. There is some evidence to show that a fall in blood pressure follows regular exercise. The author has studied members of his Naval Training Center, San Diego, swimming team, all of whom were over 30 years of age and has noted a decrease in resting blood pressure, both systolic and diastolic, in these swimmers over a three months period.

Immediately after an exercise session, however, the pressure may be temporarily elevated. Similarly, the resting pulse rate is decreased for individuals after extended training so that there is increased cardiac efficiency.

In addition, there is some experimental evidence to indicate that exercise may stimulate the growth of coronary collateral vessels (this means the development of new channels or enlarged old channels which can act to carry more blood to heart muscles particularly if there is a blockage of the primary vascularization).[12] The evidence that increased collateral coronary circulation in response to exercise can actually occur in man is not totally accepted as yet. There are also studies which show two other possible benefits of an exercise program. The first of these is the increased production of myoglobin, a substance which gives off oxygen in the heart muscle under appropriate conditions, and the second is a decrease in clotting time and thus decreased likelihood of intravascular clots forming in the coronary arteries.[13]

(3) Exercise and obesity.

A running exercise program has been shown to result in the loss of body fat at a time when the fat-free weight did not change significantly.[14] It is well known also that obese individuals are often inactive as compared to their nonobese companion.

(4) Exercise and a sense of psychic well-being.

Most discussions in this area must necessarily be of a speculative nature. It is possible, however, that an exercise regimen results not only in an enhanced sense of well-being but also acts to decrease hormonal production which might affect the levels of circulating fats in the blood. There are adrenal hormones secreted during situations of anxiety which mobilize fats and fat-like substances in the blood.

A Swimming Program to Promote Cardiovascular Fitness

If we agree that there is a preponderance of evidence indicating that a long-term program of appropriate exercise might act as a prophylactic against the development of coronary artery disease than it would seem that swimming would have much to offer in this regard. Cooper in his best selling book "Aerobics" meticulously outlines various exercise regimens to promote fitness.[15] His premises about the value of exercise of the type he advocates are perhaps stated with more certainty than many students of the subject would concur in. However, his practical suggestions are excellent. Essentially he outlines a spectrum of exercise schedules for men at all levels of fitness. The primary physical activity stressed by Cooper and others at present is that of running. However, I believe swimming has certain unique advantages provided, of course, one has a suitable pool available.

In the first place the act of swimming itself is felt to be pleasurable by many individuals (although probably not by those training 12,000 meters a day for the Olympic team). Actually there is a rhythmical sensation in swimming not dissimilar to that of dancing and there is the pleasant feel of the water. In addition swimming employs a wider variety of muscle groups than does running. The force of the water serves to hold up the joints and muscles, and the likelihood of joint trouble, except in the case of individuals who really swim hard, is less than in such activities as running or tennis.

In a separate communication the author will outline a program for swim training in an older age group. Suffice it to say here that the important elements in such a program include a thorough physical examination prior to commencing the regimen, careful monitoring of the cardiovascular system through frequent examination of pulse rate, blood pressure, etc., and a long warm-up before hard swims are made, careful attention to the problem of cumulative fatigue and consequent weakened resistance to disease, particularly of an infectious nature. Provided

these sorts of precautions are observed it is perfectly possible for individuals over 30 or 40 to be trained to the point where they can swim quite an adequate race. Their times, of course, are very much slower than those of the young people but are better than one might guess.

In Southern California over the last few years there have sprung up a large number of track clubs or senior sections in track clubs where individuals over 35 train and compete. There are many running events for older people every week during the season in Southern California. In fact in July there was held, in San Diego, a two-day National Masters Track and Field Championship for individuals over 40. The meet was a great success, attracted national publicity, had no untoward incidents associated with it and gave a large boost to physical fitness. In Germany a marathon run for men over 55 was won this year by a man of 80. In a similar vein, in the many rough water swims of 1/2 to 1 mile in length, held here in Southern California, there is a division (an increasingly popular one) for men over 45. In Australia and in the United Kingdom the swimming clubs at their annual galas generally have a competitive swim for people in older age groups (in Australia even an over 70 division). I think it is high time that American swimmers do something similar but better. Americans are a very competitive people and those prone to heart attacks at least as competitive as others. Americans are also pragmatic and like to work towards a defined goal. A training regimen that never trains for anything and prepares for no competition is extremely difficult to maintain. Yet we know that unless exercise is sustained and unless exercise challenges the cardiorespiratory system sufficiently to produce hard breathing and a rapid pulse, it is useless. In the Navy we are fortunate enough to have interservice competition plus our local AAU. However, there must be all sorts of mature men in civilian swimming programs who would like to compete under the usual precautions in events other than rough water swims. Obviously the primary duty of AAU and the American Swim Coaches Association is to promote competitive swimming for young people and the production of our splendid national and Olympic champions. Nevertheless I think it would be possible to institute some sort of senior or master competition in such groups as 25-34, 35-44, above 45, etc. My own experience would lead me to suggest that the 100 and 1500-meter free style and the 200-breast stroke and backstroke would be appropriate events. The butterfly and individual medley does not seem well suited to older competition. Obviously these events could easily be added to many AAU meets (except for the 1500). One or two heats in the other events spread out over two days would scarcely be burdensome to those planning and running the meet. If the program really got rolling than there is no reason why, just as in track and field, the competition could not become national or international.

Summary

Coronary artery disease is an extraordinarily common and devastating disorder of middle aged and even young men in the United States and Western Europe. An increasing risk of developing the disease is associated with such factors as high blood pressure, obesity, high levels of cholesterol in the blood serum, cigarette smoking, certain behavioral patterns, decreased vital capacity and a low level of physical activity. There is much evidence to indicate that exercise may well help prevent heart attacks through such mechanisms as increasing heart efficiency, decreasing the level of serum cholesterol, decreasing obesity, decreasing high blood pressure and promoting psychic well-being.

It is necessary, however, that the exercise be continued throughout life. Athletic activity in high school or college is of no help in later years. The exercise must be part of a regular scheduled year-round activity. It is suggested that swimming has many unique advantages for such an endeavor. It is further suggested that American Swim Coaches Association and the Amateur Athletic Union of the United States consider the possibility of

developing competition in older age groups as a motivating force for the continuance of a regular training program of a healthful nature.

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SWIM TRAINING IN THE OLDER AGE GROUP

Some years of experience in training individuals over 30 or even over 40 in vigorous swimming has led to a series of recommendations which might be of interest to coaches and other physical educators who wish to promote fitness. A previous communication outlines some of the possible benefits to the cardiorespiratory system of continued swimming at a challenging level. This brief article embodies some specific recommendation as to how to carry this program out safely.

1. Prior to the commencement of this program all the individuals to take part should have a complete physical examination including such measurements as blood pressure and electrocardiogram. In addition they should have a complete blood count and urinalysis. There should be no evidence on any of these studies of any serious illness or defect.

2. The scheduling of the workouts must be such that it is possible for the swimmers to take part at least 3 times a week. Either the lunch hour or immediately after work is the best time. The workout should be no more than 1 hour in length.

3. Before each workout the participants should take a very long and hot shower to get their muscles warm and filled with blood. Similarly the warm-up prior to any kind of effort swims should be ample, for example, a slow 500 meters swim followed by a 200-meter kick and a 200-meter pull, or some other variant on this theme, but in any case covering about 800 meters.

4. After the long shower and lengthy warm-up the swimmers are capable of doing several timed repeats. For example, 2 to 4 times 200 meters with 2 minutes rest in between each. Variants on this theme include 2 times 400 meters, 1 time 800 meters, etc. Once a week the group can swim a 1500-meter effort.

5. Surprisingly, some short rest interval work is very well tolerated, provided the swimmers do not go in an all out fashion but rather emphasize smooth and steady pace. For example, 4 times 50 meters with 10 seconds rest in between each effort is a good and safe builder of endurance.

6. The workout should end in a steady swim down and the total distance covered approximates 2000 meters. After finishing the workout another prolonged shower or sauna bath is indicated with the usual attention to the prevention of chilling, ear infection and so forth which applies to all age groups.

7. There are some very specific dangers to be considered and avoided:

(1) Orthopedic difficulties. Anyone who has visited an athletic club locker room can attest to the observation that such areas are filled with middle-aged men with tennis elbows, bursitis, torn muscles, sore knees, etc. In swimmers too, there is a definite danger of joint and muscle problems. This can be almost completely prevented by the prolonged showers and warm-ups prior to any effort swimming. In addition one must avoid all out sprints of the kind used in the younger age group. This means that of the 3 basic patterns of swim conditioning: prolonged distance swimming; short rest, low quality work; and high quality all out speed work--one can utilize the first two but the third only sparingly in the older age group. Even 2 or 3 all-out 50's often result in a pulled muscle or very sore joints, whereas the longer swims or the low quality repeats give a superb challenge to the cardiorespiratory system but do not injure the musculoskeletal apparatus.

(2) Exhaustion. In this age group or in any age group, for that matter, if a participant begins to feel progressively more tired (that is, if he is past the first week or two when everyone feels tired), then he should ease up and rest. If he does not he will very likely become ill. Trained athletes are certainly not resistant to infections and in fact may be more susceptible than certain untrained groups. In any case, in spite of chlorine,

etc., there are usually plenty of viruses and bacteria in the environment to supply the necessary infectious material to overcome the bodily defenses of an exhausted athlete.

(3) No cardiovascular disorders or problems of any kind have been encountered, but, of course, all the subjects were free of heart disease prior to the beginning of training.

8. Benefits: As has been noted in a previous article the subjects show a decline in pulse rate, both resting and after exercise, a decrease in blood pressure and an increase in vital capacity over pretraining levels. The second benefit is a definite increase in a sense of well-being and a decrease in feelings of inner tension and even depression. There is something about the act of swimming hard that seems to dissipate for many people the vexations of their daily lives. Third, the subjects seem to delight in the feeling of competition (primarily competition within themselves) and a feeling of accomplishment in the lowering of their initial high times.

9. A training regime of this kind will bring an older swimmer to better than 90% of his previous achieved times. For example if many years before he was able to swim a 55-second 100-yard freestyle he can now swim 59 seconds. This sort of level can be extrapolated to other strokes and other distances. In Naval meets many of our older swimmers have made the finals of events and occasionally even won. This has been particularly true in the longer distance races because their conditioning was superior to that of some of the young men, whose practices were necessarily interrupted by the exigencies of their naval duties.

If the above precautions are observed one can safely train persons of any age to the point where they are very fit and where they feel measurable benefits have been added to their lives emotionally as well as physically.

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