YEAR BOOK®

YEAR BOOK OF REHABILITATION® 1989

KAPLAN

1989

The Year Book of REHABILITATION®

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Year Book Medical Publishers subscribes to and surveys nearly 700 U.S. and foreign medical and allied health journals. From these journals, the Editors select the articles to be abstracted. Journals represented in this YEAR BOOK are listed below.

Acta Chirurgica Scandinavica
Acta Odontologica Scandinavica
Acta Physiologica Scandinavica
Acta Psychiatrica Scandinavica
American Heart Journal
American Journal of Cardiology
American Journal of Epidemiology
American Journal of Kidney Diseases
American Journal of Neuroradiology
American Journal of Occupational Therapy
American Journal of Physical Medicine and Rehabilitation
American Journal of Physiology
American Journal of Psychiatry
Anesthesiology
Annals of International Medicine
Annals of Neurology
Annals of Otology, Rhinology and Laryngology
Annals of Plastic Surgery
Archives of Disease in Childhood
Archives of General Psychiatry
Archives of Neurology
Archives of Physical Medicine and Rehabilitation
Arthritis and Rheumatism
Athletic Training
Brain
Brain and Language
British Heart Journal
British Journal of Radiology
British Journal of Urology
British Medical Journal
Bulletin of the Menninger Clinic
Cell
Clinical Orthopaedics and Related Research
Clinical Pediatrics
Clinical Science
Developmental Medicine and Child Neurology
Diagnostic Microbiology and Infectious Disease
Electroencephalography and Clinical Neurophysiology
Experimental Neurology
Geriatrics
IEEE Transactions on BioMedical Engineering
International Disability Studies Journal
Journal of Adolescent Health Care
Journal of Advanced Nursing
Journal of the American Geriatrics Society
Journal of the American Medical Association
Journal of Applied Physiology
Journal of Biomedical Engineering

Journal of Bone and Joint Surgery (American volume)
Journal of Bone and Joint Surgery (British volume)
Journal of Cardiopulmonary Rehabilitation
Journal of Clinical Epidemiology
Journal of Clinical Ultrasound
Journal of Communication Disorders
Journal of Consulting and Clinical Psychology
Journal of Developmental and Behavioral Pediatrics
Journal of Gerontology
Journal of Hand Surgery (American volume)
Journal of Hand Surgery (British volume)
Journal of Health and Social Behavior
Journal of Internal Medicine
Journal of Neurology, Neurosurgery, and Psychiatry
Journal of Neurophysiology
Journal of Neuroscience Nursing
Journal of Neurosurgery
Journal of Orthopaedic and Sports Physical Therapy
Journal of Pediatric Orthopedics
Journal of Pediatric Surgery
Journal of Pediatrics
Journal of Phychosomatic Research
Journal of Rehabilitation
Journal of Rehabilitation Research and Development
Journal of Rheumatology
Journal of Speech and Hearing Disorders
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Journal of Sports Sciences
Journal of Trauma
Journal of Urology
Lancet
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Mayo Clinic Proceedings
Miltary Medicine
Muscle and Nerve
Nature
Neurology
Neurosurgery
New England Journal of Medicine
Nursing Research
Occupational Therapy Journal of Research
Orthopaedic Review
Orthotics and Prosthetics
Pain
Paraplegia
Pediatric Neurology
Pediatrics
Physical and Occupational Therapy in Pediatrics
Physical Therapy
Plastic and Reconstructive Surgery
Psychological Medicine

Psychophysiology
Radiology
Rehabilitation Nursing
Rehabilitation Psychology
Scandinavian Journal of Plastic and Reconstructive Surgery
Scandinavian Journal of Rehabilitation Medicine
Seminars in Hearing
Southern Medical Journal
Spine
Stroke
Thorax
Transplantation
VASA: Zeitschrift fur Grefasskrankheiten
Western Journal of Medicine

Publisher's Preface

We welcome Robert G. Frank, Ph.D., as an Associate Editor of the YEAR BOOK OF REHABILITATION. Dr. Frank, Associate Chairman of the Department of Physical Medicine and Rehabilitation Medicine at the Howard A. Rusk Rehabilitation Center, University of Missouri at Columbia, selected and commented on material related to rehabilitation psychology.

Introduction

As I walked outside yesterday, my eyes became very irritated and I started to sneeze. It forcefully reminded me that spring has arrived: a hot, active, exciting spring. True to form, our series has continued to evolve and grow. The organization of this book has, in fact, greatly changed.

Each of the editors now has his or her own chapter. Each editor has written an introduction to her or his chapter and has determined the order of the abstracts. There are now 8 chapters, on cardiac rehabilitation, rehabilitation psychology, nursing rehabilitation, neurologic rehabilitation, musculoskeletal rehabilitation, pediatric rehabilitation, therapies, and communication. This new organization is decentralized and has produced a great deal of variety within this volume. New topics reviewed include the theory of measurement, stress/pregnancy, ventilatory support, and transplantation. We especially wish to thank Ms. Nancy Gorham and Ms. Cathy Dombai for their energetic assistance.

Paul E. Kaplan, M.D.

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1 Exercise, Cardiopulmonary Transplantation Rehabilitation, and Related Topics

Introduction

This year has been especially fertile for research related to exercise and exercise-induced phenomena. Both animal and human populations have been investigated, with some fascinating results. One other topic explored here is transplantation. Even though the transplanted organ is supposed to react normally, very interesting musculoskeletal and neuromuscular functional deficiencies have been observed. This field is rapidly growing, thus providing even more promise for rehabilitation services and research. First, though, I wanted to present a paper with interesting consequences for rehabilitation medicine curricula.

Paul E Kaplan, M.D., F.A.C.P.

Continuity of Care: A Teaching Model
Klingbeil GEG, Fiedler IG (Med College of Wisconsin, Milwaukee)
Am J Phys Med Rehabil 67:77–81, April 1988 1–1

Rehabilitation medicine covers the treatment of patients from the onset of disability until the return to the community. A curriculum was developed for residents in rehabilitation medicine that includes acute care, inpatient rehabilitation, and community reentry.

The initial phase begins with emergency room entry and includes a stay in the acute care ward. The resident learns of the medical needs of patients who have sustained major trauma during this first phase of the program. During the rehabilitation phase, medically stable patients undergo restoration and preparation for community reintegration. The resident provides primary care, establishes goals, prescribes treatment, and supervises therapy. In the final stage of this program, the patient is ready for reentry into the community. The resident remains in contact with the patient through the clinic and follows each patient throughout the residency.

This curriculum should prepare the resident for all aspects of the role of physiatrist. The resident should come to understand the process of rehabilitation by follow-up of patients throughout the entire residency. Cost-effectiveness will also be learned through experience with community resources. This curriculum can be adapted for medical students.

▶ Because rehabilitation starts in a focal sense—trauma happening in a specific community—and ends in a local sense when the patient is reintroduced to his community, rehabilitation remains innately both local and focal rather than "global." The curriculum presented here, indeed, reads more like theology than the application of a scientific discipline. These types of considerations make one uneasy in studying the 2 appendixes. Is there any ambience in this model? Where and when does research get applied? What does "liaison with community agencies" mean? The proposed curriculum appears at once soft, compulsive, and rigid. It does not meet hard demands for quality scientific achievement and production: the hard edge of scientific progress.—P.E. Kaplen, M.D.

Exercise

The Cardiovascular Effects of Deconditioning After Endurance Training in Rats

Karhunen MK, Rämö MP, Kettunen R, Hirvonen L (Univ of Oulu, Finland)
Acta Physiol Scand 133:307–314, July 1988 1–2

Physical deconditioning, which is a sedentary period after intense endurance training, decreases stroke volume and end-diastolic volume during exercise compared with the trained state in human beings. This may result from a decrease in the training-induced left ventricular hypertrophy, sc. athlete's heart, and reduced filling of the left ventricle. The hemodynamic effects of endurance training and physical deconditioning in rats were assessed by open-chest intrumentation which allowed simultaneous measurements of cardiac contractility, preload, and afterload.

Anesthetized rats were used. Aortic and left ventricular pressure recordings and volume measurements were obtained using the thermodilution method during isoproterenol and $CaCl_2$ loads. Ten animals were in the training group, and 13 were in the control group. The resting stroke volume was significantly larger in the training group. During the $CaC1_2$ infusion, stroke index, end-diastolic, and end-systolic volumes increased in the training group and decreased in the control group. Isoproterenol and $CaCl_2$ decreased systemic vascular resistance in the training group but increased it in the control group. After a 6-week deconditioning after the training period, stroke index, end-diastolic, and end-systolic volumes decreased during $CaCl_2$ and isoproterenol infusions, similar to the control deconditioning group. Peripheral resistance increased in both the control and training groups. Cardiac hypertrophy seen during training was partially reversed after the deconditioning period.

It is concluded that endurance training improves the pumping performance of the rat heart by enhancing the diastolic filling of the left ventricle and reducing peripheral resistance during inotropic load. Left ventricular contractility was not affected. A 6-week deconditioning period after training returned the hemodynamic changes to sedentary levels.

▶ Deconditioning is a vital part of any rehabilitation program, including cardiac rehabilitation. This landmark article provides basic support for endurance training regimens. This type of regimen should now be applied in a similar manner to clinical situations. As much as possible in the future, deconditioning therapy should be identified, explored, and treated.—P.E. Kaplan, M.D.

High-Intensity Exercise Training Increases Vascular Transport Capacity of Rat Hindquarters

Sexton WL, Korthuis RJ, Laughlin MH (Univ of Missouri–Columbia)
Am J Physiol 254:H274–H278, February 1988 1–3

Vascular flow capacity has been reported to be increased with exercise training, although this notion is controversial. Some researchers contend that flow capacity is unchanged or even decreased in trained individuals. A study was conducted to determine whether high-intensity exercise training increases the vascular flow capacity and capillary exchange capacity in isolated rat hindquarters.

Twenty male Sprague-Dawley rats underwent 6 bouts of alternating running and recovery 5 days a week at 60 m per minute on a 15% grade for 6–10 weeks. A second group of 20 rats was confined to cages. Isolated, maximally dilated hindquarters perfused with an artificial plasma consisting of a Tyrode's solution containing 5 gm/100 ml of albumin were studied. Vascular flow capacity was assessed by measuring perfusate flow rate at 4 different perfusion pressures. Capillary exchange capacity was assessed by measuring the capillary filtration coefficient. Training efficacy was demonstrated by significant increases in succinate dehydrogenase activity in the white vastus lateralis and vastus intermedius muscles. Total hindquarter flow capacity increased 50% to 100% in trained rats. This increased flow capacity was associated with an elevation in the capillary filtration coefficient in the maximally vasodilated hindquarters, suggesting that the capillary exchange capacity was elevated with high-speed exercise training.

It is concluded that high-intensity exercise training produces an increase in vascular transport capacity of rat hindquarters skeletal muscle by elevating both capillary exchange capacity and vascular flow capacity.

▶ A basic axiom in applied physiology is that elucidated physiologic processes derived from animal investigation also apply to that other mammal, man. This animal experiment does indicate that, in these rats, some increase in vascular transport capacity probably occurred after training. Can this process be confirmed in man? Is this adaptation species-specific to these rats? Do other processes modify the total outcome in man?—P.E. Kaplan, M.D.

Motor Drive and Metabolic Responses During Repeated Submaximal Contractions in Humans

Vøllestad NK, Sejersted OM, Bahr R, Woods JJ, Bigland-Ritchie B (Natl Inst of Occupational Health, Oslo; John B Pierce Found Lab, New Haven, Conn)

J Appl Physiol 64:1421–1427, April 1988 1–4

Contractile failure during various types of exercise has been ascribed to intramuscular metabolic alterations. The temporal changes in force-generating capacity and metabolic state during intermittent isometric contractions in human beings were studied.

One-legged quadriceps contractions at 30% maximum voluntary contraction (MVC) were done for 6 seconds, with 4 seconds of rest between. The decrease in force-generating capacity was tested from brief MVCs and short bursts of 50-Hz stimulation applied at 5-minute intervals. After 1 minute of exercise, the MVC force declined linearly and parallel to the 50-Hz stimulation force, indicating that the contractile failure was caused by intramuscular processes. After 30 minutes of exercise, the MVC force declined by about 40%, compared with the value after 1 minute.

Two-legged contractions were then studied. Muscle biopsy specimens obtained after 5, 15, and 30 minutes of exercise showed only minor changes in the concentrations of glycogen, lactate, creatine phosphate, and adenosine triphosphate. At exhaustion, however, the concentrations of creatine phosphate and glycogen were decreased by 73% and 32%, respectively, and muscle lactate concentration increased to 4.8 mmole/kg wet weight.

The gradual decline in force-generating capacity was not caused by lactacidosis or lack of substrates for resynthesis of adenosine triphosphate. It must have resulted from excitation-contraction coupling failure. Exhaustion was closely related to phosphagen depletion without significant lactacidosis.

▶ This study was an attempt to modify the usual experimental conditions applied toward the study of muscular fatigue. Fatigue and exhaustion, however, are trendmendously complex, multifactorial processes. They act and interact through time to produce the demonstrated weakening. Would application of positron emission tomography scan technology help elucidate the metabolic mechanisms?—P.E. Kaplan, M.D.

Kinetics of Heart Rate Responses to Exercise

Bunc V, Heller J, Leso J (Charles Univ, Prague)

J Sports Sci 6:39–48, Summer 1988 1–5

The simplest and most commonly used way to assess the degree of adaptation to a bout of exercise and to test the functional circulatory capacity is to determine the kinetics of the heart rate (HR) response during and after exercise. To describe the kinetics of the reaction of the HR to the onset of exercise of constant intensity, the half-time of HR can be used.

Trained and untrained individuals were studied to test the hypotheses that the kinetics of HR response to exercise may be used for assessing functional capacity, and that the point at which HR departs from linearity in incremental exercise tests coincides with ventilatory threshold.

In a study of exercise of an intensity corresponding to 2 W/kg on a cycle ergomotor, half-time in 15 trained male rowers and 11 untrained men was determined. Half-time was smaller in the trained than in the untrained men. In both groups, half-time was positively correlated with resting HR and negatively correlated with maximal oxygen uptake. In another study, 28 trained male long-distance runners were tested on a treadmill and 17 untrained men were tested on a cycle ergometer using a continuous incremental protocol. The ventilatory threshold was determined from the dependence of $\dot{V}_E$ on $\dot{V}O_2$, $\dot{V}CO_2$, or both. The $\dot{V}O_2$, HR, and exercise intensity at threshold were compared with the parameters determined from the dependence of HR on exercise intensity. There were no significant differences between ventilatory threshold and HR break point levels.

From the first study, it is concluded that the regulation of HR in the transition range is very similar to the regulation of $\dot{V}O_2$ and energy requirements. From the second study, it is concluded that the HR break point level coincides with ventilatory threshold.

▶ Two rather deceptive, difficult obstacles remain to successful conclusion of this study. Even though the pulse is an easy and direct method of testing stress, it is not necessarily the most accurate way of determining heart work, especially in a patient with coronary artery disease. Second, positive results are not really supported by negative data. The concept, however, of exploring pulse response to exercise in a detailed and accurate manner is interesting. This study should be modified and repeated.—P.E. Kaplan, M.D.

A Comparison of Additional Heart Rates During Active Psychological Challenge Calculated From Upper Body and Lower Body Dynamic Exercise

Turner JR, Carroll D, Hanson J, Sims J (Univ of Birmingham, Birmingham, England)

Psychophysiology 25:209–216, March 1988 1–6

Recent studies in which heart rate, cardiac output, and oxygen consumption ($\dot{V}O_2$) were measured continuously during psychological challenge and graded physical exercise found that actual cardiac activity during stressful psychological challenges was significantly greater than predicted, thus suggesting a suprametabolic or additional cardiac activity during stressful mental tasks. Most of those studies used dynamic lower body rather than dynamic upper body exercise as the basis for measuring additional cardiac activity.

The Heart rate, $\dot{V}O_2$, and blood pressure were measured during 2 stressful mental tasks and during an upper body and a lower body graded

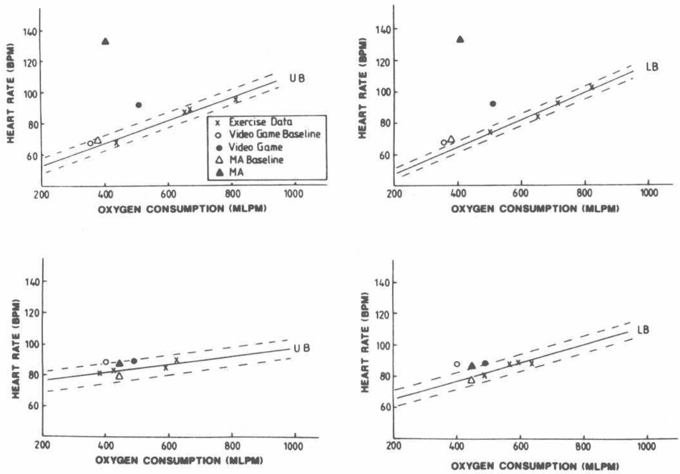

Fig 1–1.—Heart rate and oxygen consumption for 2 patients during both upper body *(UB)* and lower body *(LB)* graded isotonic exercise and task baseline and condition periods. Also shown are regression lines for exercise data with *dashed lines* indicating 2 SEs. (Courtesy of Turner JR, Carroll D, Hanson J, et al: *Psychophysiology* 25:209–216, March 1988.)

dynamic exercise task. Participating were 22 healthy males aged 16–28 years, each of whom performed an 8-minute mental arithmetic task, played a video game, and performed graded upper and lower body exercise tasks on an exercise machine (consisting of 3 increasing work loads for 4 minutes each).

The actual heart rate and systolic blood pressure during the mental arithmetic task and the video game were substantially increased. The heart rate was significantly higher than the predicted rate, thus confirming a considerable additional heart rate. There was no significant difference between the additional heart rate generated from the upper body and the lower body graded exercise tasks (Fig 1–1). These findings are in agreement with those of earlier dynamic exercise studies.

▶ This confirmatory series of studies documents 1 of the additional complexities in writing exercise prescriptions for people with coronary artery disease. If physical activity is limited in patients with advanced disease states, won't that limitation itself generate emotional and mental stress? Moreover, won't that emotional and mental stress be of such an order as to obviate the need for the limitation of physical activity? This riddle is true of people with advanced heart disease and amputations and people with advanced heart disease and strokes. This situation is also found when sexual activities are in question.—P.E. Kaplan, M.D.

Extrapolated Maximal Oxygen Consumption: A New Method for the Objective Analysis of Respiratory Gas Exchange During Exercise

Buller NP, Poole-Wilson PA (Cardiothoracic Inst, London; Natl Heart Hosp, London)
Br Heart J 59:212–217, February 1988 1–7

The lack of an objective and effort-independent measure of cardiorespiratory functional reserve is an important problem in evaluation of patients with chronic heart failure. In an attempt to obtain an objective measurement of cardiorespiratory functional reserve that is independent of exercise duration a mathematical model for analyzing respiratory gas exchange during treadmill exercise was developed.

Six healthy volunteers, 3 men and 3 women aged 25–33 years, and 12 men and 8 women aged 29–65 years with stable chronic heart failure underwent exercise testing by the modified Bruce protocol. Respiratory gas exchange was measured during maximal exercise by standard technique. A mathematical equation curve was used to model the relation between the rates of oxygen consumption and production of carbon dioxide. The maximal value of the equation curve was calculated and termed the *extrapolated maximal oxygen consumption.*

All exercise tests were performed without complications. The calculated extrapolated maximal oxygen consumption rates correlated closely with the maximal rates of oxygen consumption during exercise (Fig 1–2). Because the extrapolated maximal oxygen consumption is relatively independent of actual exercise duration, its use may avoid the spurious variation in measured exercise capacity that results from differences in a patient's motivation or a supervisor's encouragement. However, calculation of the extrapolated maximal oxygen consumption should not be used as a replacement for measuring actual maximal oxygen consumption; it

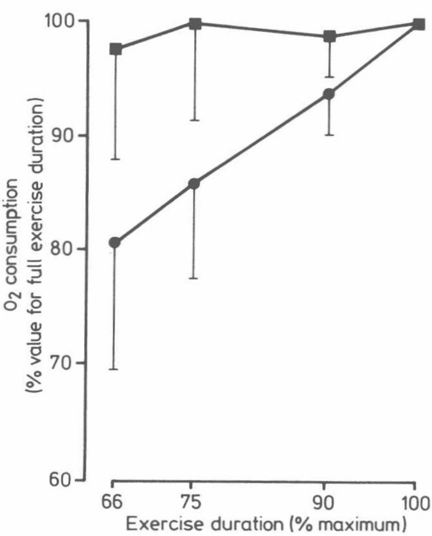

Fig 1–2.—Degree of dependence of measured oxygen consumption *(solid circles)* and extrapolated maximal oxygen consumption *(solid squares)* on exercise duration. Values are mean for all 26 subjects. *Bars* represent 1 SD. (Courtesy of Buller NP, Poole-Wilson PA: *Br Heart J* 59:212–217, February 1988.)