

1990

The Year Book of  
VASCULAR  
SURGERY®

1990

# The Year Book of VASCULAR SURGERY®



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## Journals Represented

Year Book Medical Publishers subscribes to and surveys nearly 850 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 Neurochirurgica  
Acta Neurologica Scandinavica  
Acta Physiologica Scandinavica  
Acta Radiologica  
American Heart Journal  
American Journal of Cardiology  
American Journal of Clinical Pathology  
American Journal of Emergency Medicine  
American Journal of Gastroenterology  
American Journal of Hematology  
American Journal of Medicine  
American Journal of Obstetrics and Gynecology  
American Journal of Physical Medicine and Rehabilitation  
American Journal of Physiology  
American Journal of Roentgenology  
American Journal of Surgery  
American Journal of the Medical Sciences  
American Surgeon  
Angiology  
Annales Chirurgiae et Gynecologiae  
Annales de Radiologie  
Annals of Plastic Surgery  
Annals of Surgery  
Annals of the Royal College of Surgeons of England  
Annals of Thoracic Surgery  
Annals of Vascular Surgery  
Archives of Dermatology  
Archives of Disease in Childhood  
Archives of Internal Medicine  
Archives of Pathology and Laboratory Medicine  
Archives of Surgery  
Arteriosclerosis  
Atherosclerosis  
Australasian Radiology  
British Heart Journal  
British Journal of Dermatology  
British Journal of Industrial Medicine  
British Journal of Plastic Surgery  
British Journal of Radiology  
British Journal of Surgery  
British Journal of Urology  
British Medical Journal  
Canadian Journal of Neurological Sciences  
Canadian Journal of Surgery  
Cardiovascular and Interventional Radiology  
Cardiovascular Research  
Chest

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Chirurg  
Circulation  
Circulation Research  
Clínica Química Acta  
Clinical Orthopaedics and Related Research  
Critical Care Medicine  
Deutsche Medizinische Wochenschrift  
European Journal of Radiology  
European Journal of Vascular Surgery  
Foot and Ankle  
Gastroenterology  
Human Pathology  
IEEE Transactions on Biomedical Engineering  
Injury  
International Angiology  
Journal de Radiologie  
Journal of Biomedical Engineering  
Journal of Bone and Joint Surgery (American volume)  
Journal of Cardiovascular Surgery  
Journal of Clinical Investigation  
Journal of Clinical Pathology  
Journal of Computer Assisted Tomography  
Journal of Cranio-Maxillo-Facial Surgery  
Journal of Dermatologic Surgery and Oncology  
Journal of Laboratory and Clinical Medicine  
Journal of Nuclear Medicine  
Journal of Pediatric Orthopedics  
Journal of Rheumatology  
Journal of Surgical Research  
Journal of the American Academy of Dermatology  
Journal of the American College of Cardiology  
Journal of the American Medical Association  
Journal of Thoracic and Cardiovascular Surgery  
Journal of Trauma  
Journal of Urology  
Journal of Vascular Surgery  
Lancet  
Mayo Clinic Proceedings  
Medical Journal of Australia  
Medicine  
Nature  
Nephron  
Neurosurgery  
New England Journal of Medicine  
Plastic and Reconstructive Surgery  
Presse Medicale  
Radiology  
South African Medical Journal  
Scandinavian Journal of Work Environment and Health  
Schweizerische Medizinische Wochenschrift  
Semaine Des Hopitaux  
Skeletal Radiology  
Southern Medical Journal

Stroke

Surgery

Surgery, Gynecology and Obstetrics

Ultrasound in Medicine and Biology

Urologic Radiology

Urology

VASA: Zeitschrift für Gefasskrankheiten

World Journal of Surgery



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## Introduction

"We believe that the world is knowable, that there are simple rules governing the behavior of matter . . ."—Sheldon Glashow, Nobel Laureate in Physics (1)

It is increasingly recognized in our empiric practice of vascular surgery that our future is dependent upon advances in pure science. The hyperplastic response of the arterial wall to injury on the one hand, and the continued degeneration of this wall in aneurysmal disease on the other, severely compromise our ability to care for patients. Technically, arteries can be rebored by hot lasers, molecular bonds broken by cold lasers, and atheroma removed by shavers or pulverized by slow or rapid rotational devices. The result is the same: myointimal hyperplasia.

Similarly, aneurysms can be excluded from the circulation in the common infrarenal location and the less common suprarenal, thoracoabdominal, femoral, and popliteal territories. The result is the same: continued arterial wall degeneration as elastase works its inexorable destruction of elastin. Then we perform whole segment replacements of the aorta by elephant-trunk operations and other staged, formidable onslaughts in which we create a generation of Dacron men.

And so we, who are empiric surgeons, turn to our scientific colleagues for help. We have done this in the past, and they have responded. Science has always been advanced by technological innovation. We needed less invasive means of revascularization: Optical engineers and physicists delivered the laser in its various incarnations. Mechanical engineers delivered endarterectomy tools and christened them atherectomy devices. Now we ask our friends in cellular biology to solve more fundamental problems. We ask them to teach us to turn off the response to arterial injury that we turn on. We ask the protein chemists among us to solve the chicken-egg problem of adventitial inflammatory response-elastase elaboration, to turn off aneurysm formation in our postoperative patients to whom we promised longer life.

In the pages that follow, in this YEAR BOOK OF VASCULAR SURGERY, is the unifying thread of our need for a solution to fundamental problems. This is unstated for the most part. We tend to chronicle success rather than state need. Here, we describe technical success in imaging, application of color in triplex scanning, and arteriography without contrast by magnetic resonance imaging. Here, our specialty tots up results of retroperitoneal and transperitoneal aortic reconstruction and summarizes the successes and failures of extra-anatomical, anatomical, translocated, and subcutaneous grafting. Also here are contributions from our colleagues who teach us the practical application of developing knowledge of the interplay of coagulation factors and normally circulating anticoagulants: the interactions of endothelium with hemodynamic laws of streaming, flow, shear. Here are the advances of our chosen specialty.

We believe, like Glashow, the Harvard theoretical physicist, that our world of vascular surgery is knowable, that the problems as described in this YEAR BOOK are solvable. We believe that encompassing the knowledge collected

here and elsewhere will allow us to perceive the rules that govern vascular responses, cellular reactions, protein cross-linking, thrombosis, and lysis. Preparation of this YEAR BOOK from 3,500 articles published in 107 journals (28 of which are entitled "Journal") is an attempt to do this: to provide access to information applicable to our specialty but available for the most part outside of our literature. If this attempt succeeds, we as vascular surgeons can be more scientific and less empiric. We can then follow the advice of the renowned educator, Abraham Flexner, who championed the use of the scientific method" . . . wherein it is relevant to bedside practice." (2)

**John J. Bergan, M.D.**  
**James S. T. Yao, M.D.**

## References

1. Glashow S: *The New York Times*, Oct 22, 1989.
2. Flexner A: *Medical Education in the United States and Canada: A Report to the Carnegie Foundation for the Advancement of Teaching*. New York, Merrymont Press, 1910.

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# 1 Basic Considerations

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## **Cigarette Smoking and the Outcome After Lower Limb Arterial Surgery**

Lassila R, Lepäntalo M (Helsinki Univ Central Hosp)

*Acta Chir Scand* 154:635-640, November-December 1988

1-1

Cigarette smoking is the most important risk factor for the development of occlusive peripheral arterial disease of the lower limbs. The effects of smoking also may play an important role in the postoperative phase after surgical treatment of peripheral arterial disease. A prospective 3-year follow-up was performed to assess the effect of smoking on postoperative outcome in patients treated for lower limb peripheral arterial disease.

The study population consisted of 139 men and 51 women aged 43-75 years, 109 of whom underwent arterial reconstruction for alleviation of intermittent claudication and 81 for limb salvage. At presentation, 173 of the 190 patients were smokers. For analysis of outcome data, patients were divided into 4 groups according to smoking habits during follow-up. Outcome was evaluated in terms of death and new cardiovascular events.

Nonsmokers who never smoked were mainly older women who had many concomitant diseases. During the 3-year follow-up period, 48 patients stopped smoking, 26 of them after experiencing adverse events. At follow-up, 12 patients were nonsmokers, 53 were ex-smokers, 45 were moderate smokers, and 80 were heavy smokers. Of 70 patients who experienced local adverse events, 30 were heavy smokers. Seventeen heavy smokers required major amputation, compared with only 1 moderate smoker and 1 ex-smoker. Forty-four patients died during the course of the study. The 3-year relative cumulative survival rate among men who smoked heavily was 0.40, and among moderate smokers, 0.65. Heavy smokers died mostly of cardiovascular causes. There is a strong association between heavy smoking, cardiovascular mortality, and severe local adverse events.

► Although documentation of smoking represents relatively soft data, in fact the extremes of smoking habits in these patients provide an informative study. Clearly, continuous heavy smoking seems to enhance arterial thrombus formation. Platelet activation may be the underlying fundamental mechanism.

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## **Effects of Cessation of Smoking on Serum Lipids and High Density Lipoprotein-Cholesterol**

Moffatt RJ (Florida State Univ, Tallahassee)

*Atherosclerosis* 74:85-89, November 1988

1-2

An increased level of high-density lipoprotein-cholesterol (HDL-C) is a protective factor in coronary artery disease (CAD). Because results of previous

studies show that smoking is inversely related to HDL-C, the effect of cessation of smoking on serum lipid and lipoprotein levels was investigated in 26 women who smoked a minimum of 20 cigarettes daily for the past 5 years. Twelve abstained from smoking for a period of 60 days (ex-smokers), 6 stopped smoking for 30 days and then resumed for an additional 30 days (re-smokers), and 8 continued to smoke for the entire 60 days (smokers). Ten women who never smoked served as nonsmoking controls (nonsmokers).

Precessation HDL-C levels in all groups of smokers were significantly lower by 15% to 20% than in nonsmokers, for an average difference of 9.8 mg/dl. By day 30 of cessation, HDL-C levels increased significantly by 5.7 mg/dl in ex-smokers, and by 10.5 mg/dl for re-smokers, and were significantly higher than levels in smokers. By day 60, the HDL-C level in ex-smokers increased by another 6.8 mg/dl, whereas levels in re-smokers returned to precessation levels. Total serum cholesterol and triglyceride levels did not differ between smokers and nonsmokers.

These findings show that cigarette smoking is associated with lower HDL-C levels in women. The effect of smoking on HDL-C is not cumulative and can be reversed as early as 30 days after cessation of smoking.

► Perhaps unrelated to the platelet-activating effect of smoking is its effect on HDL-C. In this regard, cessation of smoking improves HDL-C levels, at least in women.

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### Passive Smoking Affects Endothelium and Platelets

Davis JW, Shelton L, Watanabe IS, Arnold J (VA Med Ctr, Kansas City, Mo; Univ of Kansas, Kansas City)

*Arch Intern Med* 149:386-389, February 1989

1-3

Cigarette smoking induces changes in the endothelium and affects platelet function, and endothelial damage and enhanced platelet aggregate formation may be important in the pathogenesis of atherosclerosis and arterial thrombosis. To determine whether passive smoking in a naturally occurring environment affects endothelium and platelet function in a manner similar to that seen in active smokers, 10 healthy, nonsmoking men aged 23-49 years were studied. Blood samples were collected before and after sitting for 20 minutes in open hospital corridors where patients had come to smoke. The blood samples were then analyzed to determine the platelet aggregate ratio, endothelial cell count, plasma concentration of nicotine, and carboxyhemoglobin levels. Each man completed 2 experiments.

In each of the men the platelet aggregate ratio was lower and the endothelial cell count was higher after exposure to environmental cigarette smoke. None of the men had detectable plasma levels of nicotine before the start of the study, but 9 of the 10 had such levels after 20 minutes of passive smoking. Nine men also had higher levels of carboxyhemoglobin after passive smoking than before. However, plasma concentrations of nicotine and carboxyhemoglobin were not significantly associated with endothelial cell counts or platelet aggregate ratios.

Passive exposure to cigarette smoke affects the endothelial cell count and

platelet aggregate ratio in a manner similar to that previously observed with active smoking.

- Sadly, endothelium and platelet aggregation in nonsmokers is affected by their heavy smoking companions.

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### **The Effect of Nicotine on Energy Expenditure During Light Physical Activity**

Perkins KA, Epstein LH, Marks BL, Stiller RL, Jacob RG (Univ of Pittsburgh)  
*N Engl J Med* 320:898–903, April 6, 1989

1–4

The metabolic effects of nicotine are implicated in the demonstrable relationship between smoking and lower body weight, but the exact nature of this relationship is not understood.<sup>1</sup> Energy expenditure was measured during bicycle work simulating light daily activity in 10 male smokers given nicotine, 15 µg/kg, and in 10 others given placebo. Nicotine was administered using a measured-dose nasal spray pump in a double-blind design.

The excess energy expenditure ascribed to nicotine was more than twice as great during exercise than at rest. Placebo spray did not influence energy expenditure at rest or on exercise in either the smokers or a comparison group of nonsmokers. Respiratory quotient values did not differ significantly in the various groups. There also were no group differences in miles pedaled, confirming standardization of activity. Both groups of smokers had higher levels of perceived exertion than nonsmokers had.

Light exercise enhances the metabolic effects of nicotine, but the metabolic effects of smoking appear to be transient. The decrease in metabolic rate after cessation of smoking may be complete within 24 hours, leading to immediate weight gain.

- The phenomenon of weight gain on cessation of smoking is a disturbing one. It may be that the metabolic effect of nicotine plays a greater role than was previously believed. Simply put, the implications are that smokers who habitually smoke while taking coffee breaks and otherwise indulging in no physical activity gain more weight than smokers whose habit is to smoke during light physical activity.

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### **Mechanical Factors Predisposing to Intimal Hyperplasia and Medial Thickening in Autogenous Vein Grafts**

Dobrin PB, Littooy FN, Endean ED (Hines VA Hosp, Hines, Ill; Loyola Univ, Maywood, Ill)  
*Surgery* 105:393–400, March 1989

1–5

Autogenous veins undergo myointimal hyperplasia and medial thickening when used as arterial bypass grafts. Exposing veins to arterial pressure and flow subjects them to 3 static deformations, 3 static stresses, increased pulsatile deformations, pulsatile stresses, and altered shear stresses at the blood-intima interface. Because they all occur simultaneously, it is unclear which of these 9



mechanical factors predispose to the structural changes that occur in the vein grafts. Three sequential experiments were performed in 38 dogs to determine which factors correlate with intimal hyperplasia and medial thickening.

Intimal hyperplasia was best associated with low-flow velocity, a factor correlated with low blood-artery shear stress. It appeared to be independent of deformations and stresses in the circumferential, longitudinal, and radial directions and of pulsations. In contrast, medial thickening was best associated with increased deformation of the vein wall in the circumferential direction, i.e., increased diameter.

These findings correlate with clinical responses of vein grafts. Low-flow velocities may increase the residence time of blood elements such as platelets at the luminal surface. Another clinical application is in the end-to-side anastomosis, whose cross-sectional area is greater than that of a comparable end-to-end anastomosis. In this case, doubling the effective radius of an anastomosis reduces the flow velocity, thereby partially explaining the greater intimal hyperplasia in end-to-side anastomoses. The higher flow velocities in internal mammary artery grafts, as opposed to the larger saphenous vein, used in coronary artery bypass grafting may explain the greater long-term patency rate of these grafts, because increased flow velocities inhibit the development of intimal hyperplasia and atherosclerosis.

► Clearly, mechanical factors affect atherogenesis. An artery that is a donor to a cross public bypass may be protected from atherogenesis. Other applications of the principles described in this abstract come to mind readily.

### Three-Dimensional Doppler Velocimetry of Flow Jets

Fox MD, Gardiner WM (Univ of Connecticut)

*IEEE Trans Biomed Engineering* 35:834-841, October 1988

1-6

In Doppler studies it has not been possible to quantify the blood velocity vector, especially in flow jets, where a channel that could be used to estimate flow direction is lacking. A closed-form solution of the Doppler equation was developed for the magnitude and angle of the 3-dimensional velocity vector. The solution, based on multiple conventional transmit-receive Doppler probes, can be applied by adapting existing Doppler units.

Turntable studies showed that the 3-dimensional angle independent theory correctly predicted velocity within an average of 3.2% over a 26-degree range of Doppler angles. Studies using a flow phantom indicated general agreement with theory. When a jet stream was used to model stenotic vessels, valve abnormalities, and septal defects, the results were within 1.4% to 3.8% of actual velocity over an 18-degree range of Doppler angles.

The 3-dimensional array of continuous-wave Doppler probes may prove well suited to detecting jet stream velocities in the cardiovascular system, but further studies that model clinical situations more realistically are required.

► Jet effects produced by such common phenomena as carotid stenosis and distal end-to-side grafts demand careful study.

**Animal Models and the Study of Atherosclerosis**

Vesselinovitch D (Univ of Chicago)

*Arch Pathol Lab Med* 112:1011–1017, October 1988

1–7

The pathogenesis of atherosclerosis is extremely complex. Knowledge of the pathogenesis of atherosclerosis has evolved almost simultaneously with the development of satisfactory animal models in atherosclerosis research. The use of animal models makes it possible to control for environmental and genetic variables, to carry out large studies within a relatively short period of time, to study combinations of selected risk factors with almost complete exclusion of other risk factors, and to measure the effect of various interventions on the rate of development and the fate of atherosclerosis, both before and after death.

For animal models to be useful in the study of atherosclerosis, animals should be inexpensive, widely available, and easy to maintain and manipulate. However, above all, animals should be similar to humans with respect to their anatomy, physiology, and biochemistry, and should have the major characteristics of atherosclerosis in such a way as to be a counterpart of familial hypercholesterolemia.

Different aspects of atherosclerosis require different types of animal models. Choosing the most appropriate animal model for a specific problem requires knowledge of which animal model is most suited to the investigator's particular project (table).

Animal Models Used in the Study of Atherosclerosis

Species	Aspects
<b>Avian Animal Models</b>	
Pigeons	Early events of atherosclerosis; genetic interstrain variabilities (White Carneau and Show Racer)
Japanese quail	Genetic variability in susceptibility; screening of antiatherosclerotic and hypocholesterolemic drugs; sex differences
Turkey	Dissecting aneurysms (Broad-Breasted Bronze); hypertension
Chicken	Viral infection and atherosclerosis (herpes virus of Marek's disease)
<b>Mammalian Nonprimate Models</b>	
Rabbits and hares	Dietary induction; lipoprotein metabolism (Watanabe hyperlipoproteinemic strain); dietary and drug intervention; immune complexes; clonal characteristics of lesions (hybrid hare)
Swine	Dietary induction (Yucatan miniature pigs); lesion components, complications; treatment for coronary heart disease; developing of diagnostic and therapeutic procedures (eg, arteriography, measurements of cardiac function, and open heart surgery); platelet function in von Willebrand-like conditions
Dogs	Lesion components, complications; diagnostic follow-up of lesions

(cont'd)



Table (continued)

## Nonhuman Primate Models

Rhesus monkeys ( <i>Macaca mulatta</i> )	Dietary induction; dietary and/or drug intervention; sex and age differences; lesion topography, components; clinical complications; lipoprotein and lipid metabolism; intraspecies variability; lipolytic enzymes; developing of diagnostic and therapeutic procedures
Cynomolgus monkeys ( <i>Macaca fascicularis</i> )	Dietary induction; diet and/or drug intervention; sex difference; coronary artery lesions, complications; immune complexes; behavioral factors
Stump-tailed macaques ( <i>Macaca arctoides</i> )	Dietary induction; coronary artery lesions, complications; cerebral artery lesions; hypertension; obesity
Pig-tailed macaques ( <i>Macaca nemestrina</i> )	Dietary induction; lesion components; lipoprotein and sex; lipoprotein and alcohol consumption
Celebes black ape ( <i>Macaca nigra</i> )	Diabetes
New World nonhuman primates	
Squirrel monkeys ( <i>Saimiri sciureus</i> )	Dietary induction; genetic interstrain variation in cholesterol metabolism; lesion components, complications (eg, cerebral infarction); gallstone formation (Brazilian squirrel monkeys)
Capuchins ( <i>Cebus albifrons</i> , <i>Cebus ateles</i> , <i>Cebus apella</i> , <i>Cebus fatiella</i> )	Age difference; dietary hypercholesterolemia
African nonhuman primates	
African green monkeys ( <i>Cercopithecus aethiops</i> , <i>Erythrocebus patas</i> )	Dietary induction; lipoprotein and lipid metabolism; relationship between lipoprotein profiles and arterial lesions; lesion components, complications
Baboons ( <i>Papio anubis</i> , <i>Papio cynocephalus</i> , <i>Papio ursinus</i> )	Relationship between serum lipoproteins and arterial lesions; genetic strain with lipoprotein phenotypes susceptible to atherosclerosis

(Courtesy of Vesselinovitch D. Arch Pathol Lab Med 112:1011-1017, October 1998.)

► As indicated in the table, effective recommendations concerning the prevention or treatment of atherosclerosis depend on accurate study of the appropriate model.

### Reduction of Atherosclerosis by Administration of Dehydroepiandrosterone: A Study in the Hypercholesterolemic New Zealand White Rabbit With Aortic Intimal Injury

Gordon GB, Bush DE, Weisman HF (Johns Hopkins Med Insts)

J Clin Invest 82:712-720, August 1988

1-8

Dehydroepiandrosterone (DHEA) is an endogenous steroid that blocks carcinogenesis and exerts antiproliferative properties. It is a potent inhibitor of