The Surgical Treatment of Coronary Heart Disease:  
a Review and Critique of the Literature*

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In the United States, heart disease is the leading cause of death, out-ranking malignancies, accidents, pneumonia, and tuberculosis. One of every two persons will die of some form of heart disease. This increase in incidence, making it the number one killer in the nation, is both relative and absolute: as the infectious diseases are being brought more and more under control, and the standard of living and the life expectancy of the average American are steadily climbing, the insidious and chronic diseases become more prominent. Statistics, however, clearly show that there has been an absolute rise in the incidence of heart disease over the past 20 years or so. The direct cause of this rise is the greatly increased incidence of coronary heart disease. Since 1930, with the exclusion of coronary disease, heart disease has steadily decreased, whereas coronary disease per se has rapidly increased.

As our understanding and hence, symptomatic treatment of coronary heart disease have improved, the relative prognosis of people suffering from this condition has improved. In 25 year follow-up studies of 200 patients with myocardial infarctions, and 456 with angina pectoris, Richards, Bland and White1 have reported the following: the average survival of patients from the onset of angina pectoris symptoms is about 10 years; 76 per cent of these patients die of cardiac causes. Angina pectoris does decrease the average life expectancy, but not exceptionally so; in other words, at any given age, 7 per cent of men and 5.3 per cent of women with angina pectoris, in addition to the predicted mortality of the population at large, will die. Turning to myocardial infarction, the average survival time is five years, considering the total number of patients. Those who completely recover from the initial attack, however, have an average survival rate of better than 10 years.

Medical and Surgical Approaches Compared

The statistics quoted above concerning prognosis point out that coronary heart disease is not universally fatal over a short span of time, and that modern medicine can successfully combat the nation's leading cause of death. It cannot be questioned that prompt medical therapy (morphine, rest, oxygen, anticoagulation, etc.) is greatly responsible for the encouraging trend in prognosis; but regardless of present advances and advances to come, strict medical therapy for the coronary heart disease patient is purely a symptomatic and "hold the fort" approach. There are two opportunities open today for a more definitive approach to the problem: 1) the prophylactic prevention of coronary atherosclerosis by diet or other means, and 2) the correction of the circulatory problem once it has come into existence.

*This paper was compiled from an essay written by the author during his senior year at the College of Physicians and Surgeons, Columbia University, and was selected as the second prize winning essay in the American College of Chest Physicians 1957 contest.
The latter approach, the surgical treatment of coronary heart disease, is the topic of this paper. Before entering into the work done in the field today, it would be advantageous to outline the eventual objectives of surgical therapy:

1. Increase the life expectancy of patients with coronary heart disease.
2. Decrease pain; i.e., angina pectoris.
3. Decrease work limitations; return patients to relatively active existence.
4. Prevent myocardial infarctions.
5. If not prevent myocardial infarction, convert what would have been a fatal infarct to a non-fatal one, and convert what would have been a large infarct to a smaller one.
6. Possibly prevent death by ventricular fibrillation. Autopsy series of patients dying of coronary occlusion reveal no tissue damage (cardiac wall necrosis) in one third of the cases, and in only 10 per cent of the hearts is damage so severe that one can say it is incompatible with life; likewise, patients die of coronary occlusion with a small area of infarction, and other patients having died of an unrelated cause have massive old infarcts. On the basis of this evidence, Dr. Claude Beck2 postulates that the 90 per cent with no, or only a small amount of, visible damage, die as result of ventricular fibrillation, brought on by what he calls an electrically unstable heart. In dogs, he has shown with direct cardiac wall electrocardiography, that there is a potential difference between a normal area of myocardium and an ischemic one, caused by coronary narrowing, and that at a critical potential difference, this heart can be sent into ventricular fibrillation.

Surgical Techniques Utilized

There are two leading schools of approach to the problem today: there are those, primarily Thompson and Beck, who advocate revascularization through the development of new anastomotic channels, and Vineberg's group, who advocate implantation of an already functioning artery into the heart muscle directly.

Beck Procedure3 (the one he now finds most successful in leading to the development of intercoronary anastomotic channels).

1. Parietal pericardium and surface of heart are abraded by burrs—to provide raw surfaces for granulation tissue ridges.
2. Two tenths of a gram of coarsely ground asbestos is applied to the heart surface—to stimulate formation of granulation tissue and new arterial channels.
3. The coronary sinus is occluded to a diameter of 3 mm.—to provide back pressure and thereby, greater filling of small collateral radicals.
4. Parietal pericardium and mediastinal fat are applied to the surface of the heart—to provide a source of ingrowing vascular granulation tissue.

Thompson Procedure.4 Thompson only inserts a non-absorbable and irritating substance into the pericardial sac; he uses magnesium silicate (talc).
**Vineberg Procedure.** Implantation of the left internal mammary artery into the left ventricle via a myocardial tunnel—on the basis that atherosclerosis occurs in the epicardial part of the coronaries and not the myocardial part which is rich in patent communications; therefore, this procedure is essentially a by-pass operation of an obstructed circulation.

**Animal Experimentation**

Before any of these procedures were attempted on man, a large amount of animal experimentation was carried out. Outlined below is some of the more interesting work designed to show the efficacy of these methods.

Beck. By utilizing the Mautz-Gregg backflow technique, which essentially consists of measuring the backflow blood from the distal end of a cut coronary artery, the proximal end having been ligated, Beck showed that his procedure adds 4.7 c.c. of blood per minute, or 282 c.c. per hour, to an area of myocardium made ischemic by complete ligation of the artery that normally supplies this area. This increase in backflow has been found intact one year after operation. He has also shown that this increase in backflow has decreased the mortality in dogs whose coronaries were ligated after the Beck procedure had been performed, and that the size of the precipitated infarction, if any, was measurably reduced.

Vineberg. Vineberg has set up five rigid dog laboratory criteria for a successful revascularization operation, and he has data to show that his procedure fulfills all of his conditions. His criteria are:

1. The anatomic demonstration of functioning vessels of arteriolar size (over 40 microns in diameter) by injection methods (Schlesinger injection lead acetate-agar-mass), serial sections, etc., present between the coronary circulation and the extracardiac source of blood over a period of six months and longer.

2. Survival without infarction post ligation of one of the major coronary vessels. Eighty per cent of controls (no Vineberg procedure) died post ligation, and the other 20 per cent survived with infarction. All of the dogs receiving the Vineberg operation survived the coronary ligation without infarction.

3. Subsequent interruption of the extra-coronary circulation should lead to immediate death or survival with a large infarct; this occurred in Vineberg's own series.

4. Increased flow to heart muscle fibers by oxygen consumption studies. The heart is arrested and perfused via the internal mammary artery implant, and as the oxygen saturation drops from 98 per cent at the internal mammary artery, to 40 per cent at the coronary sinus, the heart starts to beat again, demonstrating not only that blood travels through the heart from the internal mammary artery implant, but that blood is brought into close approximation with the myocardial fibers, allowing them to make use of the blood oxygen content.

5. The satisfactory treatment of artificially produced coronary artery insufficiency: cellophane is wrapped around the anterior descending branch of the left coronary artery during the first operative procedure, providing a focus for surrounding fibrosis, and thereby simulating the gradual coronary occlusion of atherosclerosis. In
three months the animals showed a marked reduction in exercise tolerance on a treadmill. Then one half of the dogs receive the revascularization procedure; further evaluation tests are carried out on the treadmill in another three to five months, when the animals that had received the Vineberg implantation operation had regained a substantial amount of exercise tolerance, coming close to their average pre-experiment treadmill time; whereas the animals who did not have the Vineberg operation at the three month mark had, at the end of six to eight months post-cellophane occlusion, very severe exercise tolerance reduction. (Table I)

Sewell. Some interesting work, as yet unpublished, has been done by Dr. William Sewell at the Albany Hospital, who, by a technique similar to Vineberg's has evidence that the development of a collateral anastomotic bed between the extra-cardiac source and the coronaries is a function of need; i.e., an area of ischemia and hence, relative hypotension to the extra-cardiac source stimulates the formation of anastomotic channels, whereas, without the presence of ischemia and a relatively low pressure area, the stimulus for the development of collateral channels is far less. Vineberg himself has some data to show that in non-ischemic hearts the average anastomotic rate is 46 per cent with 67 per cent open vessels, whereas, in ischemic hearts, the average anastomotic rate is 71 per cent with 86 per cent open vessels.

Selection of Patients for Surgery

Turning to the evaluation of these procedures in human subjects, the first consideration is the selection of patients.

Indications (based primarily on Beck's indications).
1. Patients with a strong family history of coronary heart disease; the only case done to date for this reason by Beck was a patient whose father, uncle, and two brothers died of coronary heart disease.
2. Severe angina pectoris.
3. Patients with one or more myocardial infarctions, with normal or slightly increased heart size, and able to work; the majority of patients fall within this classification.
4. Patients with previous infarctions, greatly increased heart size, unable to work; if one aids these patients, it is to be considered strict salvage; they represent the majority of mortality figures.

Contraindications.
1. Active failure and greatly enlarged heart size.

| TABLE I—VINEBERG, ET AL.: FOUR YEARS CLINICAL EXPERIENCE WITH INTERNAL MAMMARY ARTERY IMPLANTATION |
|------------------------------------------------------|------------------|
| (Treadmill Time: 8½ mph)                            | Tolerance Time in Minutes |
| Average pre-experiment                               | 9-12             |
| 3 months post coronary occlusion (all dogs)          | 2.5-4            |
| No implantation: 6-8 months post coronary occlusion  | 1.6              |
| 3 months post implantation operation, and            |                  |
| 6 months post coronary occlusion                      | 6-8              |
2. Less than six months post infarction.
3. Progressive disease; infarct following infarct.
4. Suddenly increasing angina pectoris; this may be a sign of an impending myocardial infarction, and is an indication to delay surgery.

Results of Coronary Heart Disease Surgery

The following are the statistics dealing with the results of coronary heart disease surgery, compiled by the men who have done the major part of it:

Beck. In a series of 192 patients, Beck reports improvement with respect to pain (i.e., angina pectoris) in 84.8 per cent, with 36.3 per cent having no pain, and 48.5 per cent only mild pain after the procedure; whereas previous to the operation, the group reported on all had moderate to severe angina pectoris. He reports improvement with respect to work limitation in 78.6 per cent, 27.2 per cent having no, and 51.4 per cent having some residual limitation after surgery. His overall operative mortality is 6.6 per cent, over the last 100 operations, however, his mortality was 0 per cent. Beck compares his one year and two year follow-up results with a series of 88 patients of Lindgren’s, admitted to the hospital for, but one reason or another, not receiving sympathectomy for severe angina pectoris. Beck’s one year mortality (not including operative mortality) was 6.6 per cent, Lindgren’s was 17 per cent, and at the two year mark, Beck’s mortality figure was 18 per cent, and Lindgren’s was 30 per cent.

Thompson. In a series of 57 patients, Thompson reports 90 per cent of patients improved more than 50 per cent, and 40 per cent improved more than 75 per cent, with respect to the pain of angina pectoris and work limitation. His operative mortality is 12 per cent. His 14 years’ experience with his operation reveals an average post-operative survival time of nine and a half years. He has some post mortem 10 year follow-up specimens which reveal that the adhesive granular pericarditis is continuous (i.e., foreign body particles are not absorbed), that no permanent (non-granulous) scar is formed, that the anastomotic channels are permanent and patent, and that constrictive pericarditis does not occur.

Vineberg. Finally, in a small series of 29 patients, Vineberg reports 70 per cent improvement with respect to the categories of pain and work limitations, and an operative mortality of 4.3 per cent (Cumulative Table II).

DISCUSSION

There has been a good deal of criticism, in and out of the literature, leveled at the surgical treatment of coronary heart disease. One of the earliest arguments advanced against the experimental approach in dogs was that the coronary circulation pattern varies considerably from animal to animal; it is argued, therefore, that individualistic canine patterns might influence accumulated data, and that scientific repetition of an experiment by different investigators would be impossible. This objection can probably be overcome by using a large enough series of animals (Beck has now done over 5000 operations on dogs), and by specifying and standardizing the exact sites of undertaken manipulations. Within a large series individual idiosyncrases would become negligible if the overall results were found to be statistically significant.

A more damaging criticism of animal experiments is leveled by Blumgart and Paul, who question extrapolation from experimentation done on the hearts of normal dogs to clinical operations on ischemic human hearts. In the quoted article, these authors offer three illustrations from the literature to substantiate their point of view: Work done by Schlesinger and Blumgart using the Schlesinger lead acetate-agar injection mass, which will only fill vascular channels over 40 microns (80 microns in fresh
## TABLE II

**CUMULATIVE RESULTS OF BECK, THOMPSON, AND VINEBERG**

<table>
<thead>
<tr>
<th></th>
<th>Beck (192 pts.)</th>
<th>Lindgren (88 pts.)</th>
<th>Thompson (57 pts.)</th>
<th>Vineberg (29 pts.)</th>
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</thead>
<tbody>
<tr>
<td>Improvement of angina:</td>
<td></td>
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<tr>
<td>no pain:</td>
<td>36.3</td>
<td>84.8 per cent</td>
<td>90 per cent improved over 50 per cent</td>
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<td>mild pain:</td>
<td>48.5</td>
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<td>Work limitation improvement:</td>
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<tr>
<td>no limitations:</td>
<td>27.7</td>
<td>78.6 per cent</td>
<td>40 per cent improved over 75 per cent</td>
<td></td>
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<tr>
<td>some limitations:</td>
<td>51.9</td>
<td></td>
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<tr>
<td>Operative mortality:</td>
<td>6.6 per cent</td>
<td></td>
<td>12 per cent</td>
<td>4.3 per cent</td>
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<td>(0 per cent of past 100 pts.)</td>
<td></td>
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<tr>
<td>1 year mortality:</td>
<td>6.6 per cent</td>
<td>17 per cent</td>
<td>average post operation survival is 9½ years</td>
<td></td>
</tr>
<tr>
<td>2 year mortality:</td>
<td>18 per cent</td>
<td>30 per cent</td>
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specimens) in diameter, demonstrated that intercoronary anastomosis of that size exist in only 15 per cent of normal hearts, but in the presence of coronary narrowing or occlusion, they are abundant and exist in close to 100 per cent of ischemic hearts. This network is so rich indeed that Blugmart and Paul find it difficult to conceive how it can be further increased by surgical means. Eckstein and Lichtenberger in 1934 showed that the long-term protection against coronary ligation in dogs receiving the Beck aorta to coronary sinus anastomotic procedure was the result of the stimulation of a functional intercoronary collateral bed, and not any direct aortic flow to the heart via the coronary sinus, since this communication, sclerosed and closed down, six to eight weeks after the graft procedure. The conclusions drawn from this by Blugmart and Paul are that since grafting does not add a sustained flow of new arterial blood to the heart, and that since intercoronary anastomoses already exist in the ischemic human heart, it is not justifiable to do a procedure to establish a status which already exists. Finally, the authors refer to Burchell's article which points out that the epicardium was a barrier to supplying any substantial flow of blood to the myocardium from surgically produced pericardial adhesions.

What defense can cardiac surgery offer against these criticisms? Considering them in reverse order: attempts to remove Burchell's epicardial barrier are seen in the work of Harken and his group; Beck and Vineberg. Harken removes the epicardium by painting it with 95 per cent phenol, and finds that three months after this procedure arterial communications exist via the pericardial adhesions, and that therefore, a successful deepicardialization is easily feasible and that subsequent extracoronary anastomotic communications can develop between the myocardium and the pericardial adhesions. Beck removes the epicardial barrier with his burring operation early in his procedure, and Vineberg bypasses the epicardium through the use of his myocardo-tunnel.

Turning to the aortic to coronary sinus graft failure, Beck soon realized that his attempt at an arterial retrograde venous shunt had, as its only lasting results, the coronary anastomotic handshing of the tissues, for the venous drainage system of the heart does not seem to be able to handle arterial pressures over any length of time, He abandoned, therefore, this more complicated procedure, involving two operative manipulations (one to establish the graft, and in two to three weeks, re-entering the coronary orifice), in favor of the Beck operation previously outlined. That no external arterial blood flow per se can be brought directly to the heart has been essentially disproved by the work of Vineberg, who has demonstrated patent communications, open over six months time, between the extracardiac source of blood (the internal mammary artery implant) and the coronaries, through the use of the Schlesinger injection mass. Furthermore, as has been shown by both Vineberg and Sewell, an ischemic heart, the heart Blugmart states cannot be benefited by surgery, stimulates the development of an even higher percentage of patent extra-coronary arterial communications.

As to the question of intercoronary anastomoses, and the question of whether one is justified in extrapolating from animal data to human surgery, only time and the accumulation of human data will tell. Can surgery benefit the heart already rich in intercoronary anastomoses? Only a critical evaluation of postoperative human statistics can answer that question. Likewise, justification for the transference of animal data to the human sphere is a function of, not only in experimental surgery, but in all animal research, the human results from that transference.

This leads directly to an analysis of the criteria used to judge data in this field today. Beck, Thompson, Vineberg, Harken, etc., all measure their results in terms of relief of pain (angina pectoris) and a return to a relatively active life. These criteria have been attacked by many, including Blugmart and Paul, on the grounds that these are subjective criteria, capable of being influenced by the patient's emotional expectations; and that operative manipulations might eliminate pain by the cutting of sensory fibers, and not by actually increasing the blood flow to cardiac muscle. Most cardiac surgeons would refute the idea that the techniques utilized today for coronary heart disease surgery could destroy the major sensory outflow of the heart. It cannot be denied that pain is a subjective finding, and that individuals vary in their suggestibility with respect to the severity of the pain. We are, however, willing to take the subjective word of the patient that the sublingual insertion of nitroglycerine or the subcutaneous injection of morphine relieves the pain of angina pectoris and myocardial infarction. And furthermore, the patient with true severe angina pectoris will not be cured of his disease or greatly relieved of it by suggestions and the aura of surgery alone.

The other criteria of evaluating human data are an increase in the life span of patients with coronary heart disease, and a decrease in the number and size of any ensuing infarcts. Blugmart and Paul call this almost impossible to evaluate due to the inherent unpredictability of the clinical course of the disease. This attitude is rather a defeatist one as well as being rather unimaginative with respect to the excellent existing statistics concerning coronary heart disease. The 25 year follow-up series of 200 patients with myocardial infarction, and 466 patients with angina pectoris, by Richards, Bland and White, give us an excellent picture of the prognosis of patients with coronary heart disease (receiving good medical care and follow-up).
originally diagnosed in the 1920s. Future series (e.g., long-term follow-up of patients who have been anti-coagulated) might even be more optimistic, and at any rate, will provide an average life expectancy figure for patients on medical therapy alone that surgical series of the future must overshoot if they are to prove that surgery prolongs life. Thompson, who has obtained an average life expectancy of nine and a half years in his series of 57 patients, compares quite favorably with the five or six years (depending on immediate death from infarction or not) year life expectancy of the myocardial infarct patient in Richards, Bland, and White's series. Thompson's patients cannot be compared against the 10 year survival of patients with complete recovery after the initial attack, for none of his patients were free of symptoms prior to surgery; on the contrary, his patients were the ones with the severest post infarction incapacity.

One highly justified criticism leveled against the surgeons doing procedures for coronary heart disease is that they, outside of the national statistics, the Richards, Bland, and White series being an example, have no good control group. The Lindgren group with which Beck compares his statistics is not a comparable matched group of controls. It would seem an absolute necessity at this time that one of the leading surgical groups in the field, in conjunction with its hospital's medical staff, study, on a long-term follow-up basis, a large series of two well-matched coronary heart disease patient groups, one group receiving medical therapy alone, and the other group having circulatory surgery performed on them as well.

It should be stated that the work done in the field to date is only a start, an experiment, comparable to the first cholecystectomies or aortic aneurysm graft replacements; and with time, as in other, now tried surgical procedures, the risk will decrease and the successful results will probably increase. Finally, it should be remembered that the revascularization approaches utilized today are indirect ones and do not attack the site of the disease, the coronaries themselves, for the standard approach to the heart would lead to fibrillation and death in a good percentage of the cases if the coronaries were themselves manipulated. It is, however, within the realm of realistic speculation that with the use of hypothermia and by-pass cardiaic machinery, direct operative procedures—e.g., endarterectomy, graft replacement of a diseased segment, arterial graft to a coronary distal to an occlusive process—will be feasible operations in the not too distant future.

**SUMMARY**

1. The three leading surgical approaches to the revascularization of an ischemic myocardium are those of: a) Beck: heart surface abrasion; insertion of coarsely ground asbestos; occlusion of the coronary sinus to 3 mm.; and application of the pericardium and mediastinal fat pad to the surface of the heart; b) Thompson: insertion of magnesium silicate, a non-absorbable and irritant substance into the pericardial sac. c) Vineberg: implantation of the left internal mammary artery into the left ventricle via a myocardial tunnel.

2. Noteworthy and provocative animal experiments to show the validity of revascularization procedures have been carried out by: a) Beck, who has shown that his technique adds a flow of 4.7 c.c. of blood per minute to an ischemic area of myocardium, and that the quantity of backflow decreases the mortality in dogs whose coronaries were subsequently ligated; b) Vineberg, who has demonstrated anatomically functioning vessels of arteriolar size between the coronary circulation and the extracardiac source, these anastomoses protecting the animal from a myocardial infarction post ligation of one of the major coronaries. He has also artificially recreated the gradual occlusive process of atherosclerosis, and by exercise tolerance tests has shown that animals receiving his procedure midway in their ischemic decline from normal tolerance regain most of their exercise potential, whereas the controls continue to lose their original exercise tolerance.

3. The human results of coronary heart disease surgery are promising: there has been a substantial decrease in the pain of angina pectoris, and an increase in the work capacity of the coronary heart disease patient; and there is some evidence that the eventual life expectancy of patients undergoing surgery has been increased.

4. It is evident that the greatest difficulty in justly appraising the benefits of surgery to the coronary heart disease patient is the lack of proper control series anywhere in the literature.

**RESUMEN**

1. Los tres métodos quirúrgicos principales para la revascularización del miocardio isquémico son: a) Beck: la abrasión de la superficie cardíaca; inserción de asbesto grueso; occlusión del seno coronario a 3 mm.; y aplicación del colchón de asbesto y mediastinal a la superficie del corazón; b) Thompson: inyección de silicato de magnesio, substancia no absorbible e irritante, en saco pericárdico; c) Vineberg: Implantación de arteria mamaria interna izquierda dentro del ventrículo izquierdo por vía de un túnel en el miocardio.

2. Se han llevado a cabo experimentos notables y atractivos en animales para mostrar la validez de los métodos de revascularización por: a) Beck que ha demostrado
que esta técnica agrega un caudal de 4.7 c.c. de sangre por minuto al área isquémica
del miocardio y que la cantidad de reflejo decrece la mortalidad en los perros cuyas
coronarias han sido ligadas después; b) Vineberg que ha demostrado la existencia de
vasos anatómicamente capaces de funcionar de tamaño arteriolar entre la circulación
coronaria y la fuente extracardíaca, siendo estas anastomosis las que protegen al
animal del infarto cardiaco después de la ligadura de una de sus coronarias.

El, también ha vuelto a crear el proceso gradual oclusivo de la ateroesclerosis y por
las pruebas de tolerancia del ejercicio ha mostrado que los animales sujetos a este
procedimiento a mitad de la evolución de la declinación isquémica recuperan la mayoría
de su potencial de ejercicio en tanto que los controles continúan perdiendo su tolerancia
original al ejercicio.

3. Los resultados de la cirugía coronaria en los humanos es prometedora; ha habido
un decrecimiento franco del dolor en la angina de pecho y un aumento en la capacidad
de trabajo del enfermo con enfermedad coronaria; y hay alguna evidencia de que el
término de vida de estos enfermos se alarga.

4. Es evidente que la mayor dificultad radica en la exacta estimación de los bene-
ficios de la cirugía coronaria por la falta de series adecuadas de control en la literatura.

RESUME

1. Les trois tentatives chirurgicales essentielles qui permettent la revascularisation
d'un myocarde ischémique sont celles de
a) Beck: abrasion de la surface cardiaque; insertion d'amiantite grossièrement
moulu; occlusion du sinus coronarien sur 3 mm.; et application du coussinet graisseux
péritendien et médiastinal sur la surface du coeur;

b) Thompson: injection de silicate de magnésie, substance non résorbable et irritante
dans le sac péritendien;

b) Vineberg: implantation de l'artère mammaire interne gauche dans le ventricule
gauche par un tunnel myocardique.

2. Des expériences valables et pleines de promesses pour montrer la validité
des moyens de revascularisation être menées à bien sur l'animal par:

a) Beck: qui a montré que sa technique addition a un débit de 4,7 cc. de sang par
minute à la zone ischémique du myocarde, et que cette quantité diminue la mortalité
chez les chiens dont les coronaires ont été ligaturées ensuite.

b) Vineberg, qui a démontré l'existence de vaisseaux de la taille des artéioles,
fonctionnant entre la circulation coronaire et la source extracardiaque, ces anastomoses
protègent l'animal d'un infarctus myocardique après ligature d'une des principales
coronaires. Il a également recréé artificiellement le processus oclusif progressif de
l'athérosclérose et par des tests de tolérance à l'effort, a montré que les animaux
soumis à son procédé, regagnaient la plus grande partie de leur potentiel d'effort,
tandis que les animaux témoins continuaient à perdre leur tolérance initiale à l'effort.

3. Les résultats de la chirurgie pour affection coronarienne sont prometteurs chez
l'homme: diminution appreciable de la douleur dans l'angi de poitrine, et augmenta-
tion de la capacité de travail du malade atteint d'affection coronarienne. On a la
preuve certaine que la survie des malades subissant cette chirurgie a été augmentée.

4. Il est évident que la plus grande difficulté d'apprécier à leur juste valeur les
bienfaits de la chirurgie chez les malades atteints de maladie coronarienne est due à
l'absence de cas sérieusement contrôlés dans la littérature.

ZUSAMMENFASSUNG

1. Die drei Hauptsächlichen chirurgischen Wege für die Revascularisierung eines
ischämischen Myocards sind diejenigen von:

a) Beck: Abrasio der Herzoberfläche; Aufbringung von grobkönnig grundiertem
Asbest; Verschluss des Coronarissinus bis auf 3 mm; Anheftung des pericardialen und
mediastinalen Fettlagers an die Herzoberfläche;

b) Thompson: Aufbringung von Magnesiumsilikat, einer nicht absorbierbaren und
reizenden Substanz in das Innere des Herzbeutels.

c) Vineberg: Implantation der linken art. ham. int. in den linken Ventrikel mittels
eines Tunnels durch das Myocard.

2. Bemerkenswerte und anregende Tierversuche, um den Wert der Methoden der
Revascularisierung zu demonstrieren sind ausgeführt worden von: a) Beck, der
nachgewiesen hat, dass durch seine Technik einem ischämischen Bezirk des Myocards
eine Durchströmung von 4,7 ccm Blut pro Minute zugeführt wird und dass das Aus-
mass des Rückflusses die Mortalität von Hunden verringernt, deren Coronararterien
anschliessend unterbunden wurden; b) Vineberg, er wies anamnisch funktionierende
Gefäße der Extrakardialsicht von Arteriolen nach zwischen dem koronaren Cir-
kulationssystem und der extrakardialen Quelle, wobei diese Anastomosen das Tier vor
einem Myocard-Infarkt bewahrten nach Ligatur einer der grösseren Coronararterien.
Er hat auch auf künstlichem Wege den Prozess des schrittweisen Verschlusses, der Atherosklerose entsprechend, hervorgerufen, und bei Belastungsproben zeigte er, dass Tiere, an denen sein Verfahren angewandt worden war, auf halbem Wege zu ihrem ischaemischen Verfall von normaler Verträglichkeit den grössten Teil ihres Belastungspotentials wiedererlangen, wo hingegen die Kontrolltiere fortgesetzt die ursprüngliche Belastungstoleranz weiter verlieren.


REFERENCES


