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## *Surgery of Major Blood Vessels: Standards of Care*

Victor G. deWolfe, M. D.\*

[This article presents a "technical standards of care" approach to the question of malpractice. The article describes a common disease, its symptoms and proper diagnosis, proper methods of treatment and surgery, and the probable results. The footnotes give briefly the various aspects of liability of the physician for malpractice, which liability may arise due to mistakes, negligence or unexpected occurrences in this type of treatment. The author acknowledges with thanks research assistance on points of law by B. Joan Holdridge of The Cleveland-Marshall Law Review staff.]

**I**T HAS BEEN WELL established that about 60 per cent of people more than 40 years of age will die of some manifestation of arteriosclerosis—cerebral, renal, coronary or peripheral—and that arteriosclerosis continues to gain ground as this country's number one killer. Little progress has been made in discovering the cause or cure of arteriosclerosis, but in recent years dramatic progress has been made in the treatment of one type of the disease, namely, arteriosclerosis obliterans. Although the treatment does not cure the disease, the manifestations in selected cases can be completely relieved. Heretofore, the great amount of information about arteriosclerosis obliterans has been theoretical, but many features of the disease which previously were conjectural now can be demonstrated by angiography (the x-ray visualization of a blood vessel, following the injection of a radio-opaque substance). Knowledge of the medical facts is important to attorneys handling cases involving this disease.

### Pathology

Arteriosclerosis obliterans is an occlusive arterial disease due to hardening and degeneration of the arterial walls, a condition of unknown origin in which the passageway of the artery becomes smaller because of the piling up of atheromatous plaques

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in the inner coat of the artery, which becomes greatly thickened. Clotting may occur on these plaques and cause complete occlusion. Occasionally, hemorrhage within the walls of the artery also will occlude the passageway of the artery and result in a complete block. Microscopically, the degenerative nature of arteriosclerosis obliterans is characterized by a greatly thickened inner coat and occlusion of the passageway of the artery by a clot that becomes organized and often becomes calcified. The middle coat, the outer coat and the tissue around the artery, the veins and the nerves are free of the disease.

The disease develops slowly and insidiously, and meanwhile collateral vessels form. The collateral vessels usually are adequate to maintain the viability of the affected part. This collateral circulation develops as the need arises by dilation and growth of pre-existing arterial channels. However, in most cases, the collateral circulation is not sufficient to prevent symptoms, especially during exercise, and the typical symptom of intermittent pain in the leg when walking will appear. As the disease progresses, collateral vessels may become occluded, pain may occur while the patient is resting, and ulceration and gangrene may develop.

When a clot forms in situ and suddenly occludes an artery, the condition is similar to that which occurs when an embolus (a clot which circulates in the blood stream and obstructs a blood vessel) suddenly occludes an artery. Collateral vessels do not have time to develop, marked deficiency of blood to the part and gangrene frequently occur, and amputation often is necessary. Acute occlusion is not the rule in cases of arteriosclerosis obliterans, which usually develops slowly and insidiously.

As a result of a study of more than 800 angiograms, two distinct types of arteriosclerosis obliterans have been recognized. The first type occurs in elderly patients, predominantly men, whose average age is 65 years. The patients have severe and diffuse arterial disease and 20 per cent of them are diabetic.

The second type of arteriosclerosis obliterans occurs in patients whose average age is about 50 years. The pathologic changes, however, are the same as those in the first type of the disease with the exception that the occlusion tends to be localized and the arteries elsewhere in the body are relatively free of the disease. Patients with this type of the disease respond favorably to resection of the involved segment and its replacement with a graft.

### Symptoms and Signs

The first symptom of arteriosclerosis obliterans almost always is intermittent pain in the leg when walking except in cases of acute occlusion. The patient will state that he can walk only a certain distance before the onset of pain, fatigue or a cramp causes him to stop. When he stops, the distress disappears in a minute or two, and he can then walk the same distance again. Most people think that the pain occurs only in the calf. It is true that it occurs more frequently in the calf, but it can and frequently does occur at other levels, depending on the site of the occlusion. When the aorta or iliac arteries are involved, the pain is in the hip; when the external iliac and common femoral arteries are involved, it usually is in the thigh; when the superficial femoral artery is involved, it is in the calf; and when the arteries of the leg are involved, the pain frequently is in the foot. Thus, the level of the pain is a reliable indication of the location of the block in the artery.

As the disease progresses, coldness and numbness may occur in the foot, and pain eventually may occur when the patient is at rest. This pain becomes worse at night. It is a relentless, gnawing pain, which sometimes is relieved when the patient sits up and hangs his foot over the side of the bed. It often causes the patient to spend his nights sleeping in a chair. Eventually ulceration and gangrene may occur.

If intermittent pain is the only symptom at the time of physical examination, the nutritional status usually is good. However, as the disease progresses and pain occurs when the patient is at rest, the foot will be cold and there often will be changes due to the poor circulation, such as poor growth of the nails, a dry scaly skin, athlete's foot, ulceration and gangrene.

### Diagnosis<sup>1</sup>

It is relatively simple to make a diagnosis of arteriosclerosis obliterans on the basis of the history, the presence of intermittent pain in the leg, the absence of pulsation, the occurrence of

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<sup>1</sup> Generally speaking, a physician is not liable for a mistake in diagnosis provided that he exercised due or ordinary skill, care, diligence and judgment in making it. The mere proof that a wrong diagnosis was made will not support a verdict against a physician, for there must also be proof that the mistake was due to his failure to exercise that requisite degree of care

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pallor when the leg is elevated, and the occurrence of rubor (redness) when the leg is depressed. However, there are certain important features that cannot be learned by physical examination, and these demonstrate the extremely valuable contribution of angiography.<sup>2</sup> On an angiogram one can see the exact location of the occlusion, and the location of other occlusions. One can tell whether or not the vessels below the occlusion are open, and this is of the utmost importance if grafting is to be considered, because these vessels must be open if a graft is to be successful. Moreover, one can learn about the status of the collateral circulation, which is important in the prognosis of the disease. Finally,

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and skill. *Atkins v. Humes*, Fla., 107 So. 2d 253 (1958); *Crovella v. Cochrane*, Fla., 102 So. 2d 307 (1958); *Booth v. U. S.*, 155 F. Supp. 235 (Ct. Cl., 1957); *Skodje v. Hardy*, 47 Wash. 2d 557, 288 P. 2d 471 (1955).

Thus, liability would not arise where the symptoms of the patient are obscure or such that even a skilled practitioner might be mistaken in his diagnosis, but where the symptoms are so well known that a responsible, competent physician or surgeon ought to be able to diagnose the disease, his negligence in failing to do so is presumed. *McHugh v. Audet*, 72 F. Supp. 394 (D. C. Pa., 1947); *Williams v. Chamberlain*, Mo., 316 S. W. 2d 505 (1958). A patient is entitled to thorough and careful examination by the physician insofar as the condition of the patient and the attending circumstances will permit. *Mayo v. McClung*, 83 Ga. App. 548, 64 S. E. 2d 330 (1951); *Johnson v. Borland*, 317 Mich. 225, 26 N. W. 2d 755 (1947).

An incorrect diagnosis of a patient's condition may have harmful results because improper treatment is instituted or because the patient loses the opportunity to receive proper treatment. When the failure to treat the actual disease is relied upon to establish liability, it has generally been held that it is necessary to show that the condition was in fact one which might have been expected to respond to proper treatment if such treatment had been immediately begun. *Huffman v. Lindquist*, 37 Cal. 2d 465, 234 P. 34, 29 A. L. R. 2d 495 (1951); *Pellota v. Whiting*, 132 F. 2d 857 (C. A. 2, 1943).

And in cases where the harmful results are allegedly produced by the treatment given, following incorrect diagnosis, it is necessary to distinguish between the results actually produced by the treatment and those which are a natural consequence of the progression of the patient's disease. *Domenci v. Pratt*, 111 Vt. 245, 13 A. 2d 204 (1940); *Clark v. George*, 148 Minn. 52, 180 N. W. 1011 (1921).

<sup>2</sup> It has been generally held that it is a matter for the jury, after proper instructions from the trial court, to determine whether, under all the circumstances of the case, the physician or surgeon is guilty of negligence in failing to make tests or in failing to resort to other methods in order to determine the necessity of operation, or special treatment, or a different mode of treatment. *Wade v. Ravenswood Hospital Assn.*, 3 Ill. App. 2d 102, 120 N. E. 2d 345 (1954); *Friedman v. Dresel*, 139 Cal. App. 2d 333, 293 P. 2d 488 (1956); *Sibert v. Boger*, Mo., 260 S. W. 2d 569 (1953). However, the failure to use such other methods (such as X-ray pictures) is almost universally held to establish a prima facie case of negligence which is sufficient to support a verdict of the jury unless rebutted by the defendant. *Agnew v. City of Los Angeles*, 82 Cal. App. 2d 616, 186 P. 2d 450 (1947); *Kingston v. McGrath*, 232 F. 2d 495 (C. A. 9, 1956).

the angiogram will indicate the best level for amputation<sup>3</sup> when this is necessary. It particularly will indicate whether amputation can be performed below the knee, which is important to the patient.

Angiography<sup>4</sup> must be adequately detailed. In cases of high occlusion in the aorta or in the iliac vessels of the abdomen, one should make an aortogram, and a retrograde femoral arteriogram should be made if the lower end of the block cannot be seen on the aortogram. A routine "prograde" femoral arteriogram also should be made to determine whether the runoff is good in the extremities. Only bilateral femoral arteriography is necessary in cases of occlusion of the femoral artery in the thigh.

On the basis of the history and physical findings, one frequently can predict rather closely what will be seen on angiograms. In cases in which the only symptom is intermittent pain when walking, one would expect the angiogram to disclose mild diffuse disease or a segmental block. In from 50 to 60 per cent of such cases, the segmental block will be amenable to resection and grafting. In cases in which the patients have more severe symptoms, such as ulcers or pain which occurs at rest, one can expect the angiogram to disclose severe disease, segmental occlusion and diffuse disease, or multiple segmental blocks.

### Natural History and Angiographic Patterns of Arteriosclerosis Obliterans

From the study of many hundreds of arteriosclerotic patients it is now possible to trace the natural history of the disease by angiographic methods. This is another example of the value of angiography. Three typical patterns have been evolved from this study: (1) that showing only diffuse disease of the inner coat's occlusion, (2) that showing a segmental block with refilling

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<sup>3</sup> There have been decisions which hold that the degree of care required is much higher where the operation or treatment contemplated will result in maiming, disfigurement or sterilization, and that any negligence in the diagnosis and treatment of such cases is actionable. *Bang v. Charles T. Miller Hospital*, 251 Minn. 427, 88 N. W. 2d 186 (1958).

<sup>4</sup> A physician is under a duty to call in an expert in reading diagnostic devices whenever a condition appears upon the graph or picture with which he is not fully familiar. Failure to call in such a specialist may be actionable negligence. *Lippold v. Kidd*, 126 Or. 160, 269 P. 210, 59 A. L. R. (1928); *Kuhn v. Banker*, 133 Ohio St. 304, 13 N. E. 2d 242, 115 A. L. R. 292 (1938).

of the parent vessel, and (3) that showing a nonsegmental block without refilling. Those angiographic pathologic patterns that best illustrate the natural history of this disease will next be described.

In the first stages there are slight irregularities in the outline in the femoral arteriogram of the superficial femoral artery as it passes through Hunter's canal. These irregular areas are plaques in the artery, and we consider them to be an early stage in the development of arteriosclerosis obliterans. As the disease progresses, the passageway becomes narrowed and finally becomes completely occluded. Occlusions tend to occur in Hunter's canal, possibly for mechanical reasons. Blocks in the superficial femoral artery almost always start there. Forks in the blood vessels also are sites in which blocks frequently occur.

In the next stage of the disease, a clot forms on a plaque and causes a small segmental block. The arteries are free of disease above and below the occlusion. The patient is an excellent candidate for resection of the occluded segment and grafting.

With more severe disease, the superficial femoral artery may be blocked at its origin. Good refilling of the main artery is not evident, and there is no flow below the knee. Since there is no outflow, the lower segment of the artery is not suitable for the attachment of a graft. Such a patient is not a candidate for a grafting operation, but probably is a candidate for either sympathectomy (cutting of a nerve) or an amputation.

In the case of diffuse disease of the superficial femoral artery without a block, if a block should occur, the patient would not be a suitable candidate for a grafting operation. In cases of this type, grafting is often attempted as a desperation procedure, but, as a general rule, the rate of success is much lower than it is in cases in which the patients are relatively free of extensive disease.

The development of the disease in the abdomen can be traced in a similar manner by aortography. Almost all occlusions of the arteries of the abdomen and pelvis are amenable to grafting, and this operative procedure is successful in a large percentage of cases.

Diffuse disease of the aorta and of the common and external iliac arteries also may occur without occlusion. The symptoms are mild, and operation is not performed unless serious trouble develops.

### Treatment

The following question frequently is asked: What happens if a grafting operation is not performed in cases of arteriosclerosis obliterans? In some cases, no difficulty will occur.<sup>5</sup> However, the disease usually tends to progress in one of the following ways: (1) There may not be any change in the symptoms, that is, the block may become longer but may not interfere with the collateral vessels; (2) there may be a slow increase in symptoms as small collateral vessels become occluded as the disease progresses; (3) there may be a rapid increase in the severity of the symptoms, particularly in elderly patients who have diabetes.

Arterial grafting should be done when possible in cases of arteriosclerosis obliterans.<sup>6</sup> When it cannot be done because of

<sup>5</sup> As a general rule, a physician, if he knows that the treatment he has adopted is unnecessary or will probably be of little or no benefit, or that there is another method of treatment that is more likely to be successful which he has not the training or facilities to give and which may be given by accessible specialists, is under a duty to advise his patient of these facts, and his failure to do so constitutes a breach of his professional duty to his patient. *Tvedt v. Haugen*, 70 N. D. 338, 294 N. W. 183, 132 A. L. R. 379 (1940); *Smith v. Mallinckrodt Chemical Works*, 212 Mo. App. 158, 251 S. W. 155 (1923). Thus, when a physician tells a patient that he needs an unnecessary operation or where he assures him that a certain treatment will effect a cure, knowing in advance that it will not, such assertion may be such a misrepresentation of fact as to make the physician liable for fraud in case an action thereon is brought by the patient. *Hedin v. Minneapolis Medical & Surgical Institute*, 62 Minn. 146, 64 N. W. 158, 35 L. R. A. 417, 54 Am. St. Rep. 628 (1895). Or where the disease is incurable or not responding to treatment, failure so to advise the patient is negligence. *Baldor v. Rogers*, Fla., 81 S. 2d 658, 55 A. L. R. 2d 453 (1954); *Beardsley v. Ewing*, 40 N. D. 373, 168 N. W. 791 (1918).

<sup>6</sup> The physician is in a position of trust and confidence as regards his patient, and it is his duty to act with the utmost good faith toward the patient. *Adams v. Ison*, Ky. App., 249 S. W. 2d 791 (1952); *Wohlgemuth v. Meyer*, 139 Cal. App. 2d 326, 293 P. 2d 816 (1956). Thus he impliedly contracts and represents that he possesses the ordinary degree of skill and learning commonly possessed by reputable physicians in the same general line of practice in the same locality. *Agnew v. City of Los Angeles*, 82 Cal. App. 2d 616, 186 P. 2d 450 (1947); *Snyder v. Pantaleo*, 143 Conn. 290, 122 A. 2d 21 (1956); *Kingston v. McGrath*, 232 F. 2d 495 (C. A. 9, 1956). However some courts now hold that due to our advanced means of communication, the test should be whether or not the degree of skill and care exercised was the same as that commonly possessed by reputable physicians in similar localities. This test would protect the patient in an area where the doctors have not kept up with the general medical advances while the first test would not. *Hoover v. Geiss*, 2 Wash. 2d 237, 97 P. 2d 689 (1940); *Goheen v. Graber*, 181 Kan. 107, 309 P. 2d 636 (1957).

Not only must the physician exercise this requisite degree of skill and care, but he must also exercise diligence and good judgment to accomplish the purpose for which he is employed; i. e., he must exercise his best judgment, the judgment of a physician. *Christian v. Wilmington General Hospital Assn.*, 50 Del. 552, 135 A. 2d 727 (1957); *Stallcup v. Coscarart*, 79 Ariz. 42, 282 P. 2d 791 (1955); *Wilson v. Martin Memorial Hospital*, 232 N. C. 362, 61 S. E. 2d 102 (1950).

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a contraindication or because of a patient's refusal,<sup>7</sup> the patient should be given a simple program of conservative care. This has been found to be as effective as all of the elaborate apparatus and drugs advocated over the years.

If intermittent pain is the only symptom, the patient should be told to stop smoking and be instructed in the care of the feet, that is, how to avoid infection, calluses, corns, athlete's foot, etc. He should elevate the head of the bed on blocks to a height of 4 to 6 in., because the optimal amount of blood flow to the lower extremities is obtained with the bed in this position. He should

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Courts have held that it is the physician's duty to keep abreast of progress in the profession and to utilize accepted and recognized methods both in diagnosis and treatment. *Reed v. Church*, 175 Va. 284, 8 S. E. 2d 285 (1940); *Stone v. Goodman*, 241 App. Div. 290, 271 N. Y. S. 500 (1934).

Since the duty of the physician to exercise the requisite degree of skill and care is predicated by the law on the relation of physician and patient, it makes no difference whether the services are rendered gratuitously or not. *Kershaw v. Tilberry*, 214 Cal. 679, 8 P. 2d 109 (1932).

It should be noted that a greater degree of skill is expected of the specialist than of the general practitioner, and the law therefore holds him to a higher degree of care. *Carbone v. Warburton*, 11 N. J. 418, 94 A. 2d 680 (1953); *Rule v. Cheeseman*, 181 Kan. 957, 317 P. 2d 472 (1957). This higher degree of care is determined by the degree of skill ordinarily exercised by specialists in the same field of practice. *Crovella v. Cochrane*, \_\_Fla.\_\_, 102 S. 2d 307 (1958).

<sup>7</sup> Since an operation without the consent of the patient is a trespass and constitutes a technical assault and battery, the surgeon may not operate unless specific consent is obtained. *Bakewell v. Kahle*, 125 Mont. 89, 232 P. 2d 127 (1951); *Cody v. Fraser*, 122 Colo. 252, 222 P. 2d 422 (1950). Furthermore any extension of the operation beyond that to which consent has been given will result in liability, unless need for such further surgery develops or becomes apparent during the operation for which consent was given and such further surgery is necessary for the preservation of the life or health of the patient. *Reddington v. Clayman*, 334 Mass. 244, 134 N. E. 2d 920 (1956); *Hundley v. St. Francis Hospital*, 161 Cal. App. 2d 762, 327 P. 2d 131 (1958).

It would seem that the confidential relation between physician and patient imposes a duty upon the physician to inform his patient of the nature and character of his disease or injury unless the patient himself specifically indicates a desire not to know. *Lund, The Doctor, The Patient and The Truth*, 19 Tenn. L. R. 344 (1946). Thus if it is known that a particular treatment involves certain dangers, such aspects of the treatment must be clearly and accurately explained to the patient; otherwise any consent obtained from the patient is invalid and the obtaining of such consent without such explanation may be considered to be fraud. *Salgo v. Leland Stanford Jr. University Bd. of Trustees*, 154 Cal. App. 2d 560, 317 P. 2d 170 (1957); *Hobbs v. Kizer*, 236 F. 681 (8th Cir., 1916).

In addition, it has been strongly contended that "ghost surgery," i.e., an operation by a surgeon other than the one authorized by the patient, may constitute criminal assault. *King, A Lawyer Prescribes a Cure for Ghost Surgery*, 13 Medical Economics 410 (1954). But a recent New York case has again held that liability does not arise merely because a surgeon other than the one to whom the consent was given performed the operation. *McAlpin v. Brown*, \_\_Misc.\_\_, 181 N. Y. S. 2d 525 (1958).

be encouraged to walk as much as he desires, because walking helps the development of the collateral circulation, but he should walk slowly and stop at the first sign of distress.

Vasodilator drugs are not recommended as they have been found useless in cases of this disease. They frequently will dilate the normal vessels, but will not dilate the abnormal vessels. This could be harmful if blood is shunted from the diseased vessels to normal vessels. Most workers in the field of peripheral vascular diseases regard attempts at generalized vasodilation as futile. However, if severe disease develops and is accompanied by pain which occurs when the patient is at rest, local vasodilation is useful, and a series of lumbar nerve blocks and sympathectomy often are worthwhile.

When small ulcers develop, all of the measures mentioned previously should be used in addition to bed rest, use of bland foot soaks, administration of antibiotics, and local application of antibiotic ointments. When large ulcers or gangrene occurs, amputation must be performed. Sympathectomy is useful if smoking has been discontinued entirely, if conservative measures have proved ineffective, if the disease is progressing, and if lumbar sympathetic blocks have produced an adequate response.

Arterial grafting is essential in cases of aneurysm of the aorta or arteries of the lower extremity, and it should be performed whenever possible.<sup>8</sup> This statement applies particularly to cases of aneurysm of the abdominal aorta, because 90 per cent of the patients will die if the aneurysm is not removed. Grafting also is useful for arterial insufficiency resulting from old emboli and for the correction of arteriovenous communications.

### Results<sup>9</sup>

Between March 1, 1954 and June 1, 1958, an arterial grafting operation was performed in 525 cases of arteriosclerosis obliterans or aneurysm. Freeze-dried homografts, sterilized with ethylene

<sup>8</sup> In the presence of absolute emergency the law presumes constructive consent to do what is necessary to save life; emergency having been defined as "an unforeseen combination of circumstances which calls for immediate action." *Wheeler v. Barker*, 92 Cal. App. 2d 776, 208 P. 2d 68 (1949). In fact it has been held that it is the surgeon's duty in an emergency endangering the patient's life or health to do whatever the occasion demands, within, of course, the usual practice among surgeons in the same field, irrespective of prior consent. *Jackovach v. Yocom*, 212 Iowa 914, 237 N. W. 441, 76 A. L. R. 551 (1931); *Kennedy v. Parrott*, 243 N. C. 355, 90 S. E. 2d 754 (1956).

<sup>9</sup> Under the Code of Hammurabi, Babylon, about 2250 B.C.: "If a physician make a deep incision upon a man with his brazen lancet and cause the

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oxide, were used in all of the cases because a superior artificial one had not yet been developed, because this type of graft has proved satisfactory in a high percentage of the cases, and because an attempt was made to keep the series "pure" so far as the grafting material was concerned.

The operation was elective in 361 cases and nonelective in 164 cases. In the cases in which the operation was elective, the symptoms were not urgent, and the patients could be treated surgically at the convenience of all parties concerned. The patients usually had intermittent pain when walking, or had an aneurysm that was not leaking or painful. In cases in which the operation was nonelective, the patients had ulcers or gangrene that otherwise would have made amputation inevitable, or they had a leaking or painful aneurysm and death seemed to be imminent.

Death occurred in 56 of the entire group of 525 cases.

In analyzing the results, the graft was considered successful if pulsation in the lower portion of the involved artery was restored postoperatively. If pulsation in the lower portion of the involved artery could not be felt postoperatively, the graft was considered a failure. Furthermore, the results were classified as an initial failure and as a late failure. In cases in which the result was classified as an initial failure, the graft was never open; in cases in which the result was classified as a late failure, the graft was open when the patient left the hospital, but it subsequently failed.

The result was classified as an initial failure in 31 cases and as a late failure in 70 cases. In 31 of the 70 cases in which the result was classified as a late failure, the patients were relieved of their symptoms but had no pulsation in the lower portion of the involved artery. In four of the cases, the patients had symptoms but refused further surgical treatment. In five cases, the

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man's death, or operate on the eye socket of a man with his bronze lancet and destroy the man's eye, they shall cut off his hand." Fortunately for the medical profession, that is not the law of today. At present a physician is not an insurer of the results of his treatment unless he specially contracted to effect a certain result. *Bruce v. U. S.*, 167 F. Supp. 579, (D. C. Cal., 1958); *Shaheen v. Knight*, 6 Lycoming 19, 11 D. & C. 2d 41 (Pa. Com. Pl., 1958); *Swanson v. Hill*, 166 F. Supp. 296 (D. C. N. D., 1958). Thus, if the physician has used the requisite degree of care, he is not liable if his treatment did not effect a cure. *Hunt v. Bradshaw*, 251 F. 2d 103 (C. A. 4, 1957). Even a statement to the effect that the operation or treatment will be successful is insufficient to constitute a warranty or implied guarantee so as to make the physician liable in tort. *Bartholomew v. Butts*, 232 Iowa 776, 5 N. W. 2d 7 (1942).

grafts were removed because of infection. A regrafting operation was performed in 30 of the 70 cases. In 26 of the 30 cases, the result of the second operation was successful and the patients have remained free of symptoms. The result of the second operation was classified as an initial failure in two cases and as a late failure in two cases.

The final result was successful in 78 per cent of the cases in which the operation was elective. It should be noted that the percentage of late failures has decreased remarkably during the last year and a half. This decrease is due to technical advances.<sup>10</sup> The result was successful in 86 per cent of the cases in which an elective operation was performed for aorto-iliac occlusion and in 82 per cent of the cases in which it was performed for aortic aneurysm. The result also was successful in 68 per cent of the cases in which an elective operation was performed for occlusion of the knee and leg arteries, but a regrafting operation was successfully performed in many of the failures.

The final result was successful in 58 per cent of the cases in which the operation was nonelective, but every successful result in this group of cases represents a salvaged extremity or life. A large number of the failures were initial failures.

There were no late failures in cases in which an elective or nonelective operation was performed for an aortic aneurysm. All of the failures were initial failures and were due to death of the patients.

A histopathologic study of homografts inserted in 33 cases has been made. In three cases, the specimens were obtained at

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<sup>10</sup> Although it is the duty of a physician or surgeon to keep up with the advances made by his profession, it is also his duty to refrain from trying experiments on his patients except in very rare cases. He must conform to the methods established by his school of practice for the treatment of given conditions, and if he departs from them, he does so at his own peril. This was first decided in *Slater v. Baker*, 95 Eng. Rep. 860 (1767) and since that time has been more or less continuously followed, e.g., *Langford v. Kosterlitz*, 105 Cal. App. 705, 290 P. 80 (1930). It has even been held that where only one course of treatment would be approved by physicians of ordinary skill, the adoption of any other course may be evidence of want of ordinary skill or care. *Patten v. Wiggin*, 51 Me. 594, 81 Am. Dec. 593 (1862); *Pike v. Honsinger*, 155 N. Y. 201, 49 N. E. 760, 63 Am. St. Rep. 655 (1898).

However, a physician does not have to use the treatment most generally used if he uses a method that has been approved by the profession. *Balder v. Rogers*, Fla., 81 S. 2d 658, 55 A. L. R. 2d 453 (1954). One court has suggested a test which would validate experiment by research personnel. Essentially the requirement is that the physician first fully explain the dangers to the patient, obtain his consent notwithstanding a complete comprehension of the peril involved, and then, if questioned, be able to justify his experiment by some reasonable theory. *Jackson v. Burnham*, 20 Colo. 532, 39 P. 577 (1895).

death; in 30 cases, they were obtained when a re-grafting operation was performed. In 28 of the 333 cases, the graft had failed because of the progression of arteriosclerosis in the portion of the involved artery below the graft. In these cases, the graft was essentially free of disease or defect. In one of the five remaining cases, arteriosclerosis had developed in the graft. A dissecting aneurysm had developed in one case. Multiple aneurysms had developed in another case, but the graft was still open. In this case, the graft was cut-down thoracic aorta, which was sutured along its entire length. Saccular aneurysms had developed in two cases.

### Summary

Great progress has been made in the treatment of arteriosclerosis obliterans and aneurysms, and the surgical treatment of these diseases now will produce excellent results in a large majority of cases. It is apparent that most failures of arterial homografts occur within the first year after operation. If the patient survives for one year without failure of the graft, there is little likelihood that the graft will fail subsequently. The standards of care in this category of medical and/or surgical treatment now are sufficiently settled to enable legal rules to be drawn as to propriety of medical care in a given case.