

In April, 1907, I found that a thigh, extirpated from the fresh cadaver of a dog, and transplanted onto another dog, could begin to heal in a very satisfactory manner.

This case demonstrated that it is possible to re-establish the circulation into a transplanted thigh and to obtain cicatrization of the anatomic structures. The union of the vascular anastomoses was excellent and the circulation of the limb constantly normal. Therefore, it was probable that, by using a little better technic, definitive results could be obtained.

A few other operations were performed, but in every case breaking of the bone suture or infection occurred. Nevertheless, by using more careful asepsis in the transplantation of the leg from one fox terrier to another, the new leg united to its host by first intention.

This experiment is the first example of successful grafting of a new limb on an animal. It demonstrates that the leg, in spite of the change of owner, remains normal. After a short period of edema and of high temperature, due perhaps to secondary causes, the new leg assumed the same appearance as the normal one. The temperature of the new foot did not differ from that of the other posterior foot. The healing of the cutaneous incision occurred normally, and the appearance of the skin was the same above and below the circular incision—that is, on the normal and transplanted part of the limb. No trophic troubles occurred. The cicatrization of a small exploratory incision made on the transplanted foot became slightly infected. Nevertheless, it healed rapidly, and the cicatrization was so perfect that the scar was not discernible on the twenty-second day. The normal and new tibias were strongly united by a fibrous callus. The question of the regeneration of nerves, and of the re-establishment of the functions, has still to be studied.

#### V. CONCLUSIONS.

It is proved that the remote results of the transplantation of fresh vessels can be perfect, and that arteries, kept for several days or weeks outside of the body, can be transplanted successfully, and that after more than one year the results remain excellent. It has been shown, also, for the first time, that transplanted kidneys functionate, that an animal, having undergone a double nephrectomy and the transplantation of both kidneys from another animal, can live normally for a few weeks, and that an animal which has undergone a double nephrectomy and the graft of one of his own kidneys can recover completely and live in perfect health for eight months, at least. Finally, it has been demonstrated that a leg extirpated from a dog and substituted for the corresponding leg of another dog, heals normally.

**Newspapers as a Guide to Science.**—The *Lancet* quotes the following gem of exposition from the editor of an English newspaper that was endeavoring to explain to its readers the problems raised by Mr. Francis Darwin's address at the recent meeting of the British Association for the Advancement of Science (see editorial, *THE JOURNAL*, Sept. 26, 1908, p. 1086): "Here, again, we pause to inquire who and what are the somatists? They are those who believe in the inheritance of acquired characters. The designation, which is new, is rather farfetched, but has a certain applicability, soma being the juice of a plant offered in libation to a Hindu god to strengthen him in his fight with the demons. It is identified—and here its applicability comes in—with the invigorating and immortalizing principles in Nature."

## THE STATISTICS OF ENDOANEURISMORRHAPHY, OR THE RADICAL CURE OF ANEURISM BY INTRASACCULAR SUTURE.

SUMMARY OF CASES REPORTED UP TO JUNE 1, 1908.\*

RUDOLPH MATAS, M.D.

NEW ORLEANS.

In 1902 I reported to the American Surgical Association, at its meeting in Albany, the first five cases of aneurism treated by this method, which were then described for the first time. The first case dated as far back as March 30, 1888, a little more than twenty years ago. In the transactions of the same association for 1895 the list was increased to 24 operations performed by 15 different operators. At the fifty-seventh annual session of this association, held in Boston, June 1, 1906, 34 operations performed by this method by 21 American operators,<sup>1</sup> were reported, and now (June 3, 1908) I am able to present a total of 85 cases treated by 52 surgeons, of whom 49 are American and 3 foreign. Thus, within the space of six years, since the first systematic description of the method of intrasaccular suture, the list has increased from 5 to 85 observations—a most gratifying increase, when we consider the comparative rarity of surgical aneurism in civil life, and the fact that the method suggested was a radical departure from the classical and accepted methods of practice.

For the liberal recognition given by the profession to the suggestions which I have had to offer and the generous encouragement which I have received, I am duly grateful, and I avail myself of this opportunity to publicly acknowledge my indebtedness to the many correspondents, collaborators and colleagues whose valued contributions, friendly criticism and sympathetic commendation have alone made possible the compilation of the convincing mass of evidence which I have now the honor to submit to you. I fervently trust that whatever the future may have in store for the cure of aneurism, the final judgment may be that the fundamental ideas which underlie the method of treatment here advocated are sound and conducive to surgical progress. In the short time allowed for this discussion I shall not attempt to make any comparative statement of the relative merits of endoaneurismorrhaphy as contrasted with other methods of treating aneurism, or engage in any controversy in reply to criticisms or commentaries which have come from various sources, and which, whether favorable or otherwise, I appreciate with due deference, but can not now consider with propriety, as the limitations of time will only permit of the presentation of the facts, which I trust will speak for themselves.

#### SYNOPSIS.

Total number of cases (arteriovenous aneurism excluded) .....	85
Total number of operators .....	52
Typical operations .....	77
Atypical operations .....	8
American operators .....	49
Foreign operators .....	3

#### GEOGRAPHICAL DISTRIBUTION.

##### UNITED STATES AND CANADA.

State and City.	Operators and No. Cases.	Total.
Alabama:		
Birmingham—George S. Brown, 1.....	1	

\* Read in the Section on Surgery and Anatomy of the American Medical Association, at the Fifty-ninth Annual Session, held at Chicago, June, 1908.

1. See, for references to this and previous contributions by the author, *THE JOURNAL A. M. A.*, Sept. 29, 1906, xlvii, 990-933.

## California:

San Francisco—Thos. W. Huntington, 1; Stanley Stillman, 1 (atypical)... 2

## District of Columbia:

Washington—James F. Mitchell, 1; George T. Vaughan, 1 (atypical)... 2

## Georgia:

Atlanta—F. W. McRae, 1.  
Savannah—Craig Barrow, 4; G. S. White, 2... 7

## Illinois:

Chicago—C. E. Humiston, 1; Carl Beck, 1... 2

## Indiana:

Indianapolis—H. O. Pantzer, 1... 1

## Kansas:

Jetmore—Anson B. Ingells, 2... 2

## Kentucky:

Lexington—W. O. Bullock, Jr., 4.  
Lebanon—R. C. McChord, 1... 5

## Louisiana:

New Orleans—Matas, 8; Danna, 7; Stafford, 3; Gessner, 2; Parham, 1; Martin and Parham, 1 (atypical); Kohlman and Newman, 1; Perkins, 1; S. P. Delaup, 1 (atypical)... 26

## Massachusetts:

Boston—J. C. Munro, 2... 2

## Mississippi:

Natchez—J. G. Lilly, 1 (atypical)... 1

## Missouri:

Kansas City—J. F. Binnie, 3; W. J. Frick, 1... 4

## North Carolina:

Wilmington—Thomas W. Green, 1... 1

## New York:

New York—Robert T. Morris, 1; Willy Meyer, 1; Robert Abbe, 2; F. H. Markoe, 1; W. Blake, 1... 6

## Pennsylvania:

Philadelphia—Frazier, 3; Gibbon, 2; Da Costa, 1; Stewart, 1; Van Lennep, 1... 8

## Rhode Island:

Providence—James W. Keefe, 1... 1

## Tennessee:

Memphis—M. Goltman, 2... 2

## Virginia:

Norfolk—Levi Old, 2; L. Brown, 1... 3

## Washington:

Tacoma—James R. Yocom, 1.  
Puget Sound—D. N. Carpenter, 1... 2

## Canada:

Montreal—J. M. Elder, 1... 1

Total in United States and Canada... 79

## FOREIGN.

## Spain:

Saragossa—R. Lozano, 4... 4

## Italy:

Naples—G. Del Conte, 1.  
Venice—D. Giordano, 1 (atypical)... 2

Total of foreign... 6

Grand Total... 85

## ANATOMIC DISTRIBUTION.

## TYPICAL AND ATYPICAL.

Abdominal aorta	2	External carotid	1
External iliac	1	Subclavian	1
Gluteal	1	Subclavo-axillary	2
Iliofemoral	5	Axillary	1
Femoral	18	Brachial	2
Popliteal	50		
Posterior tibial	1	Total	85

(Over 58 per cent. popliteal; over 21 per cent. femoral.)

## TYPES OF ENDOANEURISMORRHAPHY.

## OBLITERATIVE, FIFTY-NINE CASES.

Popliteal (4 atypical)	32	External iliac	1
Femoral (1 atypical)	12	Posterior tibial	1
Iliofemoral (2 atypical)	4	Gluteal	1
Abdominal aorta	2	External carotid	1
Subclavo-axillary	2	Subclavian	1
Brachial	2		

## RESTORATIVE, THIRTEEN CASES.

Popliteal	8	Femoral	5
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RECONSTRUCTIVE, THIRTEEN CASES.

Popliteal	10	Iliofemoral	1
Femoral	1	Axillary	1

Per cent.

Total obliterative	59	69.3
Total reconstructive	13	15.4
Total restorative	13	15.4

## POPLITEAL, FIFTY CASES.

## OBLITERATIVE (TYPICAL), TWENTY-EIGHT CASES.

R. Matas	4	F. W. Parham	1
J. A. Danna	3	R. Abbe	1
W. O. Bullock, Jr.	2	J. C. Da Costa	1
Craig Barrow	2	Randall Hunt	1
H. B. Gessner	2	C. E. Humiston	1
S. W. Stafford	2	T. W. Huntington	1
J. H. Gibbon	2	J. W. Keefe	1
George C. Miller	1	W. Blake	1
L. Lozano	2		

## ATYPICAL CASES, FOUR.

S. Stillman	1	J. D. Lilly	1
S. P. Delaup	1	Carl Beck	1

## POPLITEAL, RESTORATIVE, EIGHT CASES.

Hugo O. Pantzer	1	R. C. McChord	1
J. F. Binnie	1	Anson B. Ingells	1
C. H. Frazier	1	F. T. Markoe	1
W. Meyer	1	M. Goltman	1

## POPLITEAL, RECONSTRUCTIVE, TEN CASES.

Craig Barrow	1	I. Brown	1
J. F. Binnie	2	J. R. Yocom	1
J. A. Danna	1	W. J. Frick	1
Robert Morris	1	F. T. Stewart	1
G. A. Van Lennep	1		

## RESULTS IN POPLITEAL GROUP.

Deaths, 1 (tetanus, Stafford).  
Gangrene, 2 (Stafford, Lozano, vein ligated).  
Relapses, 3 (Morris, Danna, Binnie, all reconstructive operations).  
Secondary Hemorrhage.—(Binnie's third case, six weeks after suture and four weeks after ligature of superficial femoral. Recovery after amputation.)

Two obliterative operations (Matas and Craig Barrow) were performed after spontaneous gangrene of the foot had occurred; the operations were undertaken with the hope of arresting further progress of gangrene, by relieving tension in the popliteal space and thereby improving the chances of the collateral circulation. Recovery after amputation of leg in both instances.

## FEMORAL ANEURISM.

Typical, 17; atypical, 1—total, 18.

## OBLITERATIVE, ELEVEN CASES.

R. Matas	1	J. F. Mitchell	1
J. A. Danna	2	George S. Brown	1
W. O. Bullock	2	T. M. Green	1
C. H. Frazier	1	S. W. Stafford	1
D. N. Carpenter	1		

## RESTORATIVE, SIX CASES (ONE ATYPICAL).

George R. White	2	J. M. Elder	1
Kohlman and Newman	1	G. Del Conte (atypical)	1
		M. Goltman	1

## RECONSTRUCTIVE, ONE CASE.

Craig Barrow... 1

## RESULTS IN FEMORAL GROUP.

Death, 1... Stafford  
Gangrene, 2... Stafford, Frazier  
Secondary hemorrhage, 0.  
Relapses, 0.

## ILIOFEMORAL ANEURISM, FIVE CASES (TWO ATYPICAL).

## OBLITERATIVE, FOUR CASES (TWO ATYPICAL).

Matas, 1 (recovery).  
Levi Old, 1 (hemorrhage, secondary ligature of iliac, gangrene, exhaustion, death).  
Atypical, 2 cases.  
G. T. Vaughan, 1 (ligature, recovery from operation; death in 4 months from heart disease).  
D. Giordano, 1 (recovery).

## RECONSTRUCTIVE, ONE CASE.

Danna, 1 (relapse, rupture, death).

## EXTERNAL ILIAC.

Levi Old, 1, obliterative (death from pulmonary embolism).

## ABDOMINAL AORTA.

J. C. Munro, R. Lozano, 2, obliterative (death from shock, hemorrhage during operation).

## POSTERIOR TIBIAL.

W. M. Perkins, 1, obliterative (recovery).

## GLUTEAL.

Robert Abbe, 1, obliterative (recovery).

## EXTERNAL CAROTID.

Floyd McRae, 1, obliterative (recovery).

## SUBCLAVIAN.

Martin and Parham, 1, atypical, obliterative (recovery).

## SUBCLAVIO-AXILLARY.

J. C. Munro, R. Lozano, obliterative (recovery).

## AXILLARY.

Anson B. Ingells, 1, reconstructive (recovery).

## BRACHIAL.

Matas, 2, obliterative (recovery).

## RESULTS.

Total. 86 cases; 78 recoveries and 8 postoperative deaths; secondary hemorrhages, 2; gangrene, 4; relapses, 4 in all in reconstructive cases).

## DEATHS.

I. Obliterative Group (59 cases):	
Abdominal aortic (Lozano and Munro).....	2
External iliac (Levi Old).....	1
Iliofemoral (Levi Old).....	1
Femoral (Stafford).....	1
Popliteal (Stafford).....	1
Total.....	6
II. Restorative (13 cases).....	0
III. Reconstructive (13 cases) (Iliofemoral, Danna).....	1
Total deaths.....	8

## SECONDARY HEMORRHAGE.

I. Obliterative (59 cases).....	2
Iliofemoral (Levi Old).....	1
II. Restorative (13 cases).....	0
III. Reconstructive (13 cases).....	0
Popliteal (Binnie).....	0

## GANGRENE OF PERIPHERAL PARTS.

I. Obliterative (59 cases).....	4
Popliteal (Stafford, Lozano).....	2
Femoral (Frazier).....	1
Iliofemoral (Levi Old).....	1
II. Restorative (13 cases).....	0
III. Reconstructive (13 cases).....	0

## RELAPSES.

I. Obliterative (59 cases).....	0
II. Restorative (13 cases).....	0
III. Reconstructive (13 cases).....	4
Popliteal (Morris).....	1 (amputated; recovery).
Popliteal (Danna).....	1 (cured by secondary obliterative).
Popliteal (Binnie).....	1 (amputated; recovery).
Iliofemoral (Danna).....	1 (ruptured; death).

## COMMENTARIES.

**Mortality.**—To sum up the review of the mortality, if we eliminate the two aortic cases of Lozano and Munro, the popliteal of Stafford (tetanus); the femoral of Stafford (rupture of secondary aneurism, ligature of iliac, gangrene and sepsis), the external iliac of Levi Old (pulmonary embolism), five would be eliminated from the list, leaving two which can be directly charged to the operative procedure, or, at least, as direct post-operative sequences. The legitimate mortality, thus reduced from 7 to 2 deaths in 85 cases, would be equivalent to 2.3 per cent.; secondary hemorrhage, 2 in 85 cases, or 2.3 per cent.; gangrene, 4 in 85 cases, or 4.6 per cent. If we eliminate Lozano's and Stafford's popliteal cases, in which the vein was simultaneously injured and ligated; and Levi Old's iliofemoral, in which gangrene followed the secondary ligature of the external iliac, the percentage of gangrenes legitimately attributable to the intrasaccular operation would be one in 85, or 1.1 per cent.

**Relapses.**—These occurred only in the reconstructive operation; four in thirteen, or 28.9 per cent., or to the total, 4.7 per cent. It is to be noted that, in one of these cases the aneurism was cured permanently after the relapse by a secondary obliterative operation (popliteal, Danna), and from a previous knowledge of the conditions existing in the sac in two other cases, one popliteal (Morris) and one iliofemoral (Danna), there is every reason to believe that a similar cure could have been effected if an obliterative operation had been performed after the relapse had been recognized. In only one case (Binnie's popliteal) the local conditions would have been apparently unfavorable to any local intervention.

In closing this brief summary of the results thus far obtained by the method of endoaneurismorrhaphy, I would state that there are many important and hitherto undescribed details in the anatomy and morphology of aneurismal sacs, as well as their various modes of

development, which have come to light since the operating surgeons who have adopted it have been compelled to examine the interior of the aneurismal cavities in order to determine the technic suited to each individual case. In fact, I believe that a new chapter in the study of aneurism has been added as a result of the opportunities offered by this method of procedure. The conclusions drawn from this study (which will be published later) will be of decided practical value in the application of the technic.

It would also appear that the fundamental principle on which this operation is based, viz., that the endothelial lining of the vascular system which is continued in the aneurismal sac, is analogous in its pathologic behavior to the reactions and reparative processes which occur in the endothelial surfaces of other serosæ, such as the peritoneum and the pleuræ, has been absolutely confirmed by the mass of evidence presented in these eighty-five operations.

Another fundamental conclusion arrived at after a study of the restorative and reconstructive cases is that the law of Scarpa (1817), that great master of Pavia, to the effect that "a complete and radical cure of aneurism can not be obtained in whatever part of the body this tumor is situated unless the ulcerated, lacerated or wounded artery from which the aneurism is derived is, by assistance of Nature or of Nature combined with Art, obliterated and converted into a perfectly solid ligamentous substance"—a dictum which for nearly a century has never been disproved—is now challenged by the experience of this method in its restorative and reconstructive types. The conclusion is likewise supported by modern experimental research, which has fully demonstrated the successful suture and resection of wounded arteries, with complete restoration of the lumen of the artery and the functional integrity of the sutured vessel. All honor to Murphy and Carrel and the great company of distinguished workers who have followed in their footsteps in demonstrating this fundamental fact of such vital importance to the progress of vascular surgery. However, let us not forget that we owe largely to the genius and sagacity of Scarpa one of the earliest and most convincing statements of the doctrine of the unity of the serosæ and of the endothelial surfaces in their specific reactions when subjected to irritation.

It is the tardy recognition of this great truth, in the operation here advocated, that has made the plastic obliteration of sutured aneurismal orifices and of aneurismal cavities as much a matter of common experience as the adhesion and plastic union of opposed serous surfaces when sutured, is the fundamental and unfailing experience of the abdominal surgeon.

There are also points in the technic that have been recently elaborated, and of these the mode of obliterating the sac in special cases, according to pathologic conditions or topographic or regional requirements, are important. One of the features of the technic of the greatest importance is that of prophylactic hemostasis, which must be made absolute if a deliberately planned operation is to be successfully carried out. In regard to preventive hemostasis, it must be stated that the problem increases in complexity and difficulty as the aneurism to be attacked approaches the root of the limbs and the neck where constriction is impracticable. This preliminary control of the circulation by obtaining a mastery of the great regional trunks in order to control not only the direct circulation in the aneurism but that which is supplied by the collateral vessels, still

remains in the treatment of aneurisms by the intrasaccular methods, as good and thorough a test of the training and resources of a surgeon as it ever was in the days of the ligature and of extirpation.

To illustrate what is meant, I need only consider the difficulties in the way of completely controlling the circulation in high femoral, iliofemoral and iliac aneurisms in which the opening of the sac may be followed by the most formidable and even fatal hemorrhage if the inexperienced operator has trusted for prophylactic hemostasis to the compression or temporary ligation of the parent artery immediately above and below the sac. The cases of femoral aneurism reported by Frazier and Mitchell are good illustrations of the fallacy of such procedures and of the fact that it was only the resourcefulness and skill of these brilliant surgeons that averted a calamity that would have surely followed in less able hands. The difficulty in controlling the hemorrhage lies in the fact that numerous and complete collateral branches open into the parent trunk at its junction with the sac, or empty into the sac itself in the intermediary space between the inlet and the outlet of the aneurism. In femoral, iliofemoral and iliac aneurisms of large size and of the fusiform type the control of the parent trunk immediately above and below the sac is of no avail; to operate bloodlessly, the great vessel commanding the entire collateral supply of the limb must be compressed. In these cases it is only by direct compression and control of the common iliac through an abdominal incision that the collateral hemorrhage from the obturator, sciatic, pudic and gluteals can be controlled.

In a case of iliofemoral aneurism which recently came under my observation, even the compression of the common iliac and of the abdominal aorta at the bifurcation was not sufficient to secure an absolutely dry field. On opening the sac, which had apparently collapsed after direct compression of the common iliac, blood spurted out in a considerable stream, which was found to come from a well-developed epigastric. This could not be controlled by the direct compression of the common iliac or of the abdominal aorta. It was only by direct pressure on the bleeding orifice in the sac and its direct occlusion with a clamp that the bleeding was arrested and that the technic was carried out to completion with safety and deliberation. However, the temporary compression of the common iliac, which controls all the branches of collateral importance given by its internal branch is sufficient, as a rule, to secure a safe, if not an absolutely ischemic field in the majority of cases.

In the upper extremity, the hemostatic problem increases in gravity as we approach the axilla and the subclavian areas. In axillary aneurism, the third division of the subclavian should be controlled, while an elastic bandage applied to the arm as near as possible to the lower pole of the sac prevents the lower collaterals from feeding the aneurism after it is opened. The circulation in the right subclavian should be controlled by a preliminary compression of the innominate and, on the left side, by the first division of the subclavian.

In carotid aneurisms there are two problems to consider, the hemostatic problem and the secondary effects on the brain of an obliterative operation. In all these cases, especially in the pathologic aneurisms, and those which occur in all subjects above 40, the efficiency of the collateral circulation in nourishing the brain should be tested by temporary methods of occlusion, which must not damage the artery after remaining *in situ* over 48 hours while the patient's cerebral circulation

is kept under observation. Here Dr. Halsted's ingenious aluminum bands, Crile's or other clamps, or the temporary protected ligatures of Jordan and Doberauer may be applied with advantage. The danger of embolism following the restoration of the circulation after the application of these tests is to be especially feared in cases of carotid aneurism. It is a question that is yet undecided whether it is not the better plan to limit the temporary occlusion to the internal carotid above the bifurcation and beyond the sac so that while the collateral circulation through the circle of Willis is being tested, the circulation in the aneurism itself may not be interfered with sufficiently to favor the liberation of an embolus, should the release of the constriction become necessary.<sup>2</sup> I have recently found that with a simple band made of strands of silver wire, gradual or total compression can be applied to the carotid or any other vessel by using a minute metal clip which holds the wires together in parallel rolls and adjusts the compression very easily to any desired degree. The great desideratum in every case is to apply a device which will control the circulation in the vessel absolutely, without damaging the internal tunics and which can be removed at any time within the test period (forty-eight hours) should danger symptoms appear in the brain, or in the peripheral parts, when aneurisms in the limbs are being considered. This is well accomplished by Halsted's hands when applied as a means of partial or total occlusion. But the expertness required in properly adjusting and rolling them around the artery, or unrolling them when this may be required, without damage to the vessel, make it desirable that a simpler means of carrying out Dr. Halsted's admirable principles be adopted.

In conclusion, our experience demonstrates that in all *sacciform* aneurisms with a single orifice of communication, the closure of this orifice by suture, without interfering with the lumen of the artery or its blood-carrying function, should be regarded as an obligate part of the operation. The indications, however, for the reconstructive operation in *fusiform* aneurisms with separate orifices of entrance and exit, must still be considered *sub judice*.

When is the reconstructive operation or arterioplasty in an aneurismal sac to be regarded as necessary or justifiable?

Without attempting to discuss with Binnie the special types of fusiform aneurism in which the reconstruction of an artery is more or less indicated, I will simply state that in the large majority of the reported cases of aneurism of the extremities, and especially of the popliteal and femoral (which furnish the most crucial test of the efficiency and safety of any radical method) the simple obliterative procedure proved thoroughly satisfactory in accomplishing its purpose without interfering with the vitality of the distal parts.

2. The value of the temporary occlusion of the common or internal carotid for thirty-six or forty-eight hours, as a preliminary test of the competence of the cerebral circulation prior to the permanent occlusion or extirpation of these vessels, is based on the fact that cerebral disturbances occur, as a rule, immediately or a few hours after the carotid circuit has been interrupted. Usually, characteristic or premonitory cerebral disturbances appear within the first twelve or thirty-six hours, often immediately after the ligation. There are exceptional cases, however, in which postoperative hemiplegia and progressive signs of softening have appeared from one to three weeks after the ligation of the common carotid. These late postoperative brain complications are more likely to occur in suppurating or septic cases as the result of thrombosis or embolism. They were frequent in the pre-antiseptic period. Thus the patient on whom the first ligation of the common carotid for aneurism of this vessel (1805) was performed by Sir Astley Cooper, succumbed on the twenty-first day after the operation in a state of coma preceded by hemiplegia.

The evidence which has accumulated and which has been gathered in these reports, is sufficient to prove that the obliterative operation accomplishes the cure of the aneurism with less risk to the distal parts than either the ligature or the method of extirpation. This would now appear to be a proved clinical fact. The conditions which must determine in any given instance whether a reconstructive operation is indicated or an obliterative operation can be performed with absolute safety or not, will never be answered satisfactorily until an unerring clinical test of the adequacy of the collateral circulation after the preliminary compression of the main trunk which feeds the aneurism, will be at our command. The method of determining the peripheral blood pressure in the very tips of the extremities recently devised by the Russian surgeon, Korotkow, as the result of his experience with arteriovenous aneurisms in the Russo-Japanese war, and applied successfully by him, Petrov and v. Oppel,<sup>3</sup> may prove the final solution of the problem.

If the peripheral blood pressure is shown by the manometer (a modified Gaertner's tonometer) to be more or less sustained after the compression of the main trunk above the aneurism, then the obliterative operation may be safely applied. If, on the other hand, the blood pressure falls to zero, it is evident that the collateral circulation is inadequate and that no chance should be taken with the obliterative operation or with any procedure whatever (ligature, extirpation, etc.) which would permanently occlude the parent artery. In these rare cases (as a rule, aged or advanced arteriosclerotic subjects) the "reconstruction" of the artery is indicated, if only as a provisional measure. If this is impracticable, it may be the safer plan to limit the intervention to a *partial* occlusion of the main trunk with a constricting band on the proximal side, close to the aneurism, by the method suggested by Dr. Halsted, trusting that when obliteration finally takes place a collateral circulation may be developed sufficiently to preserve the vitality of the distal parts.

The objection to this plan is that, in advanced arteriosclerotic subjects, the collaterals do not always develop, for obvious reasons; that a thrombus may form at the seat of constriction; and again, in other cases, that the operation may fail to cure owing to the persistence of the circulation in the sac. Furthermore, as in the case of the ligature, the persistence of the tumor, after obliteration of the main artery, when coagulation takes place, does not relieve the tension in certain confined and compressed spaces (as in the popliteal area), where the evacuation of the sac is necessary to improve the perianeurismal and the distal circulation.

One of the great advantages of the intrasaccular method is that the sac is thoroughly emptied of its contents and that the perianeurismal tension is at once relieved, giving not only better opportunities for the development of the collateral circulation, but also relieving the obstruction to the return venous flow, as is so apparent in many edematous and choked limbs in advanced cases of popliteal aneurism.

NOTE.—Surgeons who have had personal experiences with the intrasaccular method (endoaneurismorrhaphy) will greatly oblige the author by communicating with him and furnishing clinical reports, which will be utilized and duly credited in a further statistical study of the reported cases.

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3. Von Oppel: Arch. f. Klin. Chir., 1908, lxxxv.

## SUCCESSFUL LIGATION OF THE INNOMINATE ARTERY.\*

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MEMPHIS.

Valentine Mott, who performed the first operation for ligation of the innominate artery in 1818, says:

Since the publication of Allan Burns' invaluable work on the surgical anatomy of head and neck, I have been in the habit of showing in my surgical lectures, the practicability of securing in a ligature, the arteria innominata; and I have had no hesitation in remarking that it was my opinion that this artery might be taken up for some condition of aneurisms and that a surgeon with a steady hand and a correct knowledge of the parts would be justified in doing it.

When the proper case presented itself to him he said further: "I could not for a moment hesitate in recommending and performing the operation."

### METHOD OF CLASSIFICATION.

I am presenting for consideration five classes of cases tabulated as follows:

1. Cases in which the innominate artery alone was ligated for subclavian aneurism. In this class the arteries are necessarily diseased; and the case I present to you falls under this class (Table 1).

2. Cases in which the innominate, carotid and vertebral arteries were ligated for aneurism of the innominate, carotid and subclavian arteries. Here also the vessels are diseased and more than one vessel is ligated, an extra precaution against hemorrhage or return of the aneurism (Table 2).

3. Cases in which the innominate artery was ligated for secondary hemorrhage and in which the vessels probably were not diseased and greater prospects of repair might be expected (Table 3).

4. Cases in which the artery ligated is indefinite and reported as innominate ligations; also miscellaneous cases (Table 4).

5. Cases in which ligation of the innominate artery was attempted but in which the operation was not completed (Table 5).

In the first class of cases, if Burrell's case is counted as a recovery, we have 0.11 per cent. recoveries. If this case is regarded as unfavorable, then the case I present is the only recovery in this class and shows 0.55 per cent. recoveries.

In the second class a percentage 35.7 is shown.

In the third class 33.3 per cent of the patients recovered.

In the fourth class there were no recoveries.

In the fifth class, strangely enough, we have a recovery percentage of 40 per cent.

Of the 46 cases actually accomplished, 15, or 32.5 per cent., were done in the United States of America and credited to the following cities: New York, 5 (Valentine Mott, Lynch, A. B. Mott, Bull, Curtis); Boston, 2 (Burrell, Gray); Philadelphia, 1 (Harte); San Francisco, 2 (Cooper, 2); New Orleans, 2 (Smythe, De Laup); Shreveport, 1 (Schumpert); Baltimore, 1 (Hall); Memphis, 1 (Burns). The United Kingdom gets 16 cases, with 8 to England, 3 to Scotland, 4 to Ireland and 1 to Wales. Mexico gets 1, Germany 1, India 2, Russia 4, France 2, Australia 2, Italy 1.

\* Read in the Section on Surgery and Anatomy of the American Medical Association, at the Fifty-ninth Annual Session, held at Chicago, June, 1908.