

The Journal of Bone and Joint Surgery

American Volume

Constructive Hip Surgery With the Vitallium Mold

A REPORT ON 1,000 CASES OF ARTHROPLASTY OF
THE HIP OVER A FIFTEEN-YEAR PERIOD*

BY OTTO E. AUFRANC, M.D., BOSTON, MASSACHUSETTS

From the Massachusetts General Hospital, Boston

INTRODUCTION

This report presents the results in and the lessons learned from a group of patients who had Vitallium-mold arthroplasties of the hip. Such a report may be biased because I believe in the principle of mold arthroplasty, because I have learned a great deal about how to use it, and because I have had a personal hand in the surgery and after-care of all of the patients. In order to overcome most of this prejudice, the examination of many of the patients and the evaluation of all the data have been carried out by an orthopaedic surgeon, Dr. Elliott Sweet, who had nothing to do with the surgery or the convalescent management of these patients.

The late Dr. M. N. Smith-Petersen, Dr. Carroll Larson, and I have either done or supervised the surgery in all of the patients.

MATERIAL

All of the patients were subjected to hip surgery at the Massachusetts General Hospital. The first Vitallium-mold arthroplasty of the hip was done in June 1938. The patient had bony ankylosis of his left hip and a rigid spine resulting from rheumatoid arthritis. In 1941, mold arthroplasty was done on the right hip. When he was last examined, the patient had no pain, walked with crutches, and worked at household chores. He could dress himself except for putting on his shoes and socks. He had 75 degrees of flexion in the left hip and 85 degrees in the right hip. There was no flexion deformity. He reported by letter, not long ago, that he had no pain, that he still used crutches, and that he was a little stiffer than he was when last examined. He could still dress himself, except for the putting on of his shoes. He was active from 8:00 in the morning to 9:00 at night with household chores and visits to neighbors. He occasionally took an afternoon rest. He was sixty-five years old.

Vitallium-mold arthroplasty is still being done at the Massachusetts General Hospital. It is almost eighteen years since this procedure was first applied to hip conditions. During these years over 1,000 patients have had arthroplasties; over 200 of these have had arthroplasties bilaterally.

* Read at the Annual Meeting of The American Orthopaedic Association, Banff, Alberta, Canada, June 23, 1956.

The present report is concerned with 1,000 consecutive patients (Table 1). The patients operated on more recently are in an active convalescent stage. Except to say that I believe a greater range of motion, less pain, and more stable hips are being obtained now than previously, due to the use of a true-arc mold of slightly greater size than a hemisphere, the use of improved instruments and technique, and a better understanding of convalescent care, I am not concerned with these recent patients in this report.

An accurate follow-up study has been made of Massachusetts residents who had had Vitallium-mold arthroplasty of the hip during the years 1946 through 1954. This study, in which there was a 91 per cent follow-up examination of available patients, is to be reported at a later date.

TABLE 1

MATERIAL

Total patients	1000
Both hips	193
Supplemental surgery	225
Sepsis	43
Died	3

EVALUATION

The evaluation terms *excellent*, *good*, *satisfactory*, and *unsatisfactory* are, in general, self-explanatory. An over-all evaluation of *satisfactory* indicates the patient's condition has been improved and that the surgery was worth doing. A surgical or clinical evaluation of *unsatisfactory* implies dissatisfaction or that the over-all condition of the patient has not been improved. Not infrequently, however, a rating of *unsatisfactory* by the surgeon becomes *good* or *excellent* in the patient's evaluation. This difference in rating, for example, is encountered in the bedridden patient with rheumatoid arthritis and bilateral bony ankylosis of the hips who has been mobilized by one or multiple procedures. He would favor having the surgery all over again simply to prevent himself from being completely disabled again.

The reverse of this is occasionally true. A surgical evaluation of *excellent* is not unusual in a mold arthroplasty done after a dislocation of the hip with an extensive fracture of the acetabulum. This evaluation may be slightly slanted by the surgeon because of what the result might have been if surgery had not been done. The patient's point of view is slanted in that he had a normal hip before the injury and anything less than normal is unsatisfactory to him. The right evaluation is probably somewhere in between as these and other emotional factors cannot be overlooked.

The analysis of the data in general confirms clinical experience. However, the figures, even in the data tables, may have no statistical significance. I do not attach any such significance to them; I use them, as the statistician probably does, to determine trends.

Fig. 1: B. L. Surgical view of a hip ten years after a Vitallium-mold arthroplasty. The patient had rheumatoid arthritis with a bony ankylosis of both hips and knees. It was necessary to do supplemental surgery because of overgrowth of bone and increasing limitation of motion.

Fig. 2: N. A. Seven and one-half years after a mold arthroplasty. This patient always had some pain after the original procedure; there was increasing pain and limitation of motion. Notice the white areas on the femoral head and in the acetabulum which are bare bone (Fig. 4). The finding of bare bone, more often on the head, has been frequent in those patients requiring supplementary surgery for persistent pain without physical findings or x-ray evidence of what might be the cause. After the supplemental surgery and removal of these areas of bare bone the patient reported that his preoperative pain was gone. This patient has remained free of pain and has maintained about a normal range of motion. She walks without support and without a limp.

Fig. 3: A. A. Five years after arthroplasty (Fig. 5). Supplementary surgery was done to increase the range of motion. The motion gained has been maintained and the patient denies pain.

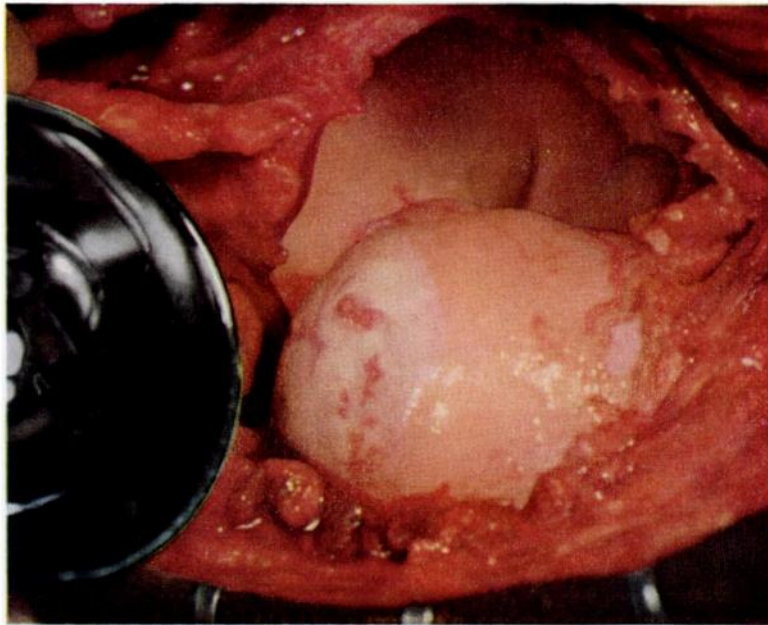


FIG. 1

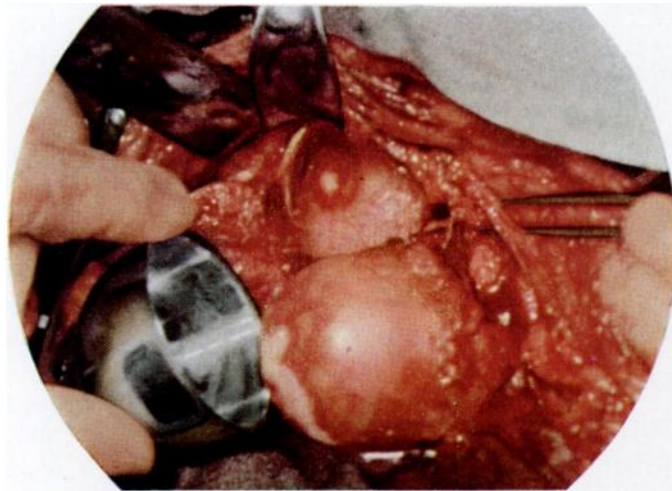


FIG. 2



FIG. 3

Another feature which makes it impossible to evaluate the results in these patients accurately is the general impression of what the condition would have been if the surgery had not been done. In the final analysis, a procedure is worth while if the patients who have had it would be willing to go through it again for the same gain. Such a group of patients would normally include all of those with satisfactory results and better. Even in most of the unsatisfactory results the patient and the surgeon are in general agreement that the surgery was worth while, even though the anticipated result was not accomplished.

Any clinical research worker is struck almost immediately by the poverty of useful information in a clinical record. This poverty is so great for specific cases such as ours, that it is almost necessary to assume that the patient's condition was severe enough for

TABLE II
CLINICAL EVALUATION

PATIENT EVALUATION	CLINICAL EVALUATION				
	Excellent	Good	Satisfactory	Unsatisfactory	Total
Enthusiastic	45 (100%)	115 (66%)	276 (46%)	29 (16%)	460 (46%)
Satisfied		55 (31%)	216 (36%)	83 (46%)	360 (36%)
Non-committal			66 (11%)	29 (16%)	100 (10%)
Dissatisfied		5 (3%)	36 (6%)	36 (20%)	80 (8%)
Total Patients	45 (100%)	175 (100%)	600 (100%)	180 (100%)	1,000 (100%)

one or several reasons to warrant the operation since he had had it. Any attempt to compare accurately his condition before the operation with that after the operation was actually impossible. The best that could be done was to question the patient as to his preoperative condition and to compare his answers with the fragments in the record. The information elicited often did not seem to correspond with the clinical record or apply to the patient. Even those records in which adequate preoperative information had been recorded by a reliable person would differ materially from the patient's memory of his preoperative condition. An enthusiastic patient would recall how severe his condition had been before surgery, while a patient with an unsatisfactory result remembered that he really was not so badly off before the operation.

In such evaluation, there is need for some simple terms to express the present condition of the patient and not necessarily the end result. Such functional factors as range of motion, strength, durability, self-sufficiency, independence, or limitations must all play some part in deciding whether or not the patient has an excellent, good, satisfactory or unsatisfactory result.

The time of evaluation after surgery also causes the recording of the result to vary. Contrary to some reports, we have found that it is usual for the patient to say he is better this year or this month than last year or last month. In some instances, patients who three years after surgery, were dissatisfied with the result obtained, were enthusiastic ten years after surgery. An occasional patient had used a cane for support for five years or more and then had discarded it entirely, maintaining good to excellent gait without discomfort. Others preferred to continue to use a single crutch for major walking (particularly right-handed people whose right hips were involved) although they were able to walk well without support. This is especially true of patients over seventy years of age.

The use of a walking support is generally looked upon by the public and many of our medical friends as the badge of failure. It is not. If we can make our aids adornments, they are accepted; they are not so acceptable, however, if there is the slightest hint of a limp or of a hitch in the gait or if there is a need to use a cane for better walking or for a

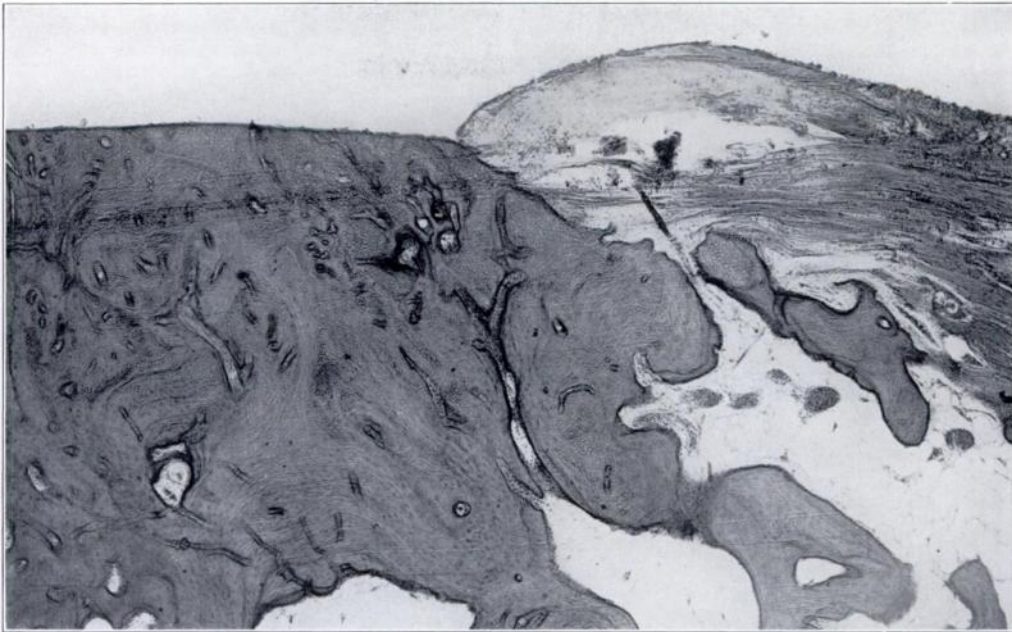


FIG. 4

High-power section through the margin of a "corn" on the femoral head where the healing has been interrupted (Fig. 2).

more active life. Those of us who deal with maintaining locomotion agree whole-heartedly with Dr. Blount that patients should not throw away the cane.



FIG. 5

Microscopic section through the fibrocartilage on the femoral head (Fig. 3). The fibrous strands seem to arise vertically from the bony base and then stream out horizontally as they near the weight-bearing surface. This general pattern was found in many other specimens.

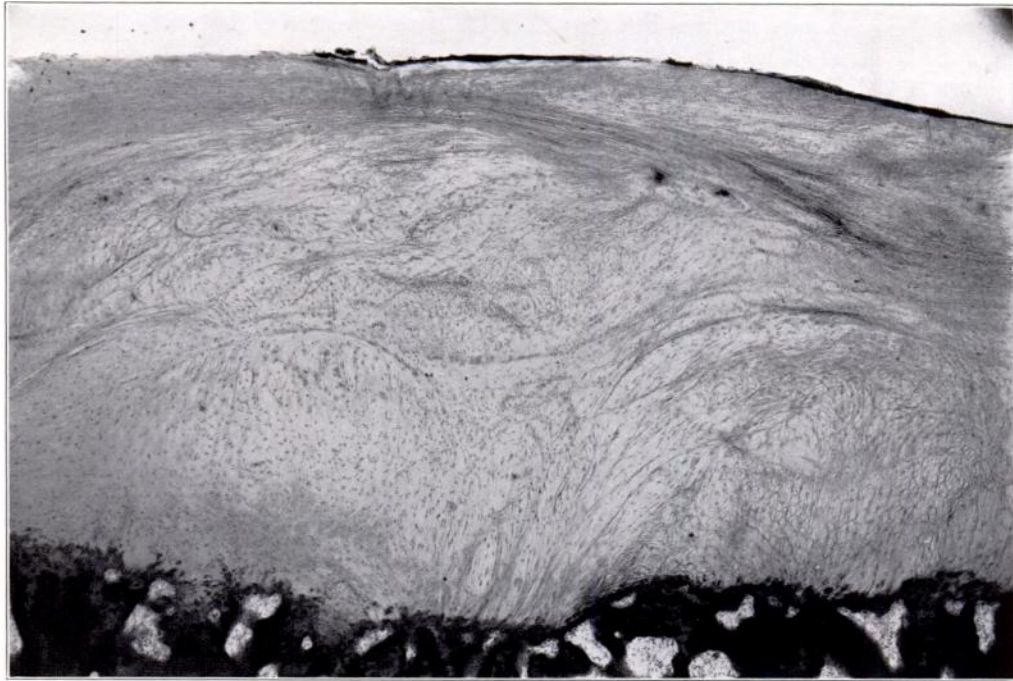


FIG. 6

G. M. Six years after arthroplasty. Section of a femoral head in a patient who had rheumatoid arthritis. This is fibrocartilage.

LESSONS

In the surgical evaluation, the excellent results have taught nothing, but they give hope and a goal. Often, it is not known what was done or what the patient did that

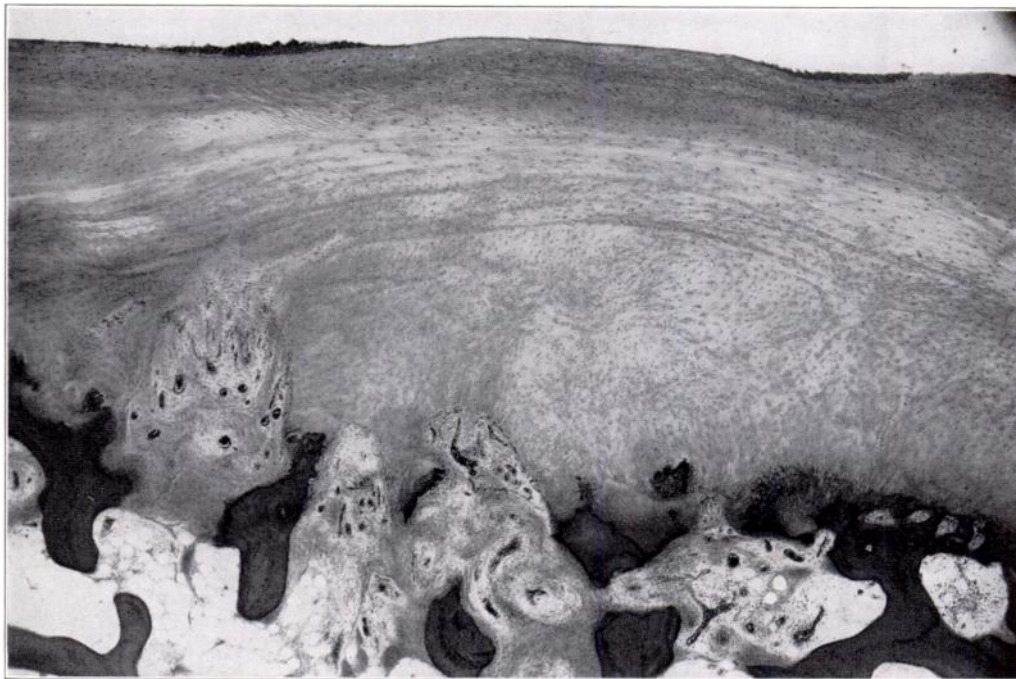


FIG. 7

A. C. This is a section of a femoral head showing fibrocartilage. (Areas were considered by an eminent pathologist as indicating the presence of hyaline cartilage.)

TABLE III

PAIN

	Per cent
Denies pain	22
Slight to none at rest	31
Moderate—at times	29
Uncomfortable unpredictable (aware of hip most of the time)	17.2
Pain all the time	0.8

made the result so good. The roentgenograms may not show a good result and the patients may not have followed a good program. Often, however, the roentgenograms show good results and the patients have followed instructions carefully.

The good and satisfactory results keep one from being content with what has been done. The result might have been better if something had been done differently at surgery or if the after-care had been managed differently or if the patients had been better understood. It is through study of their cases and analysis of their problems and their personalities that technique has been improved and convalescent programs have been developed to suit the needs of the individual patient.

The unsatisfactory results have taught the most of all. Patience, understanding, and a genuine concern for the patients' welfare are most important. By listening to all of their complaints, by reviewing all of their activities, social as well as physical, and by carefully analyzing the subjective and objective findings through repeated examinations, a simple source of trouble may be found. It may then be easily eliminated. By working carefully, unhurriedly, and gently with these patients satisfactory, good, and, at times, excellent results have been obtained. But in those patients who continue to have pain, who lose motion and in whom deformities and poor gait develop, it becomes necessary to recommend further surgery.

In the early days further surgery was called revision. This implied that little, if anything, had been accomplished by the original procedure, while in fact much may have been accomplished in the relief of some pain, the correction of a deformity, or the development of muscle control. In those patients in whom there had been bony ankylosis, a fair range of motion may have been obtained. It is, thus, more accurate to call further surgery supplementary surgery and, at the same time, ease the conscience of the surgeon and soften the blow to the patient. Both are medical necessities. However, as long as the over-all condition of the patient continues to improve or does not deteriorate, supplementary surgery should be delayed.

TABLE IV

COMPLICATIONS

Deaths	3
Thrombophlebitis	50
Pulmonary emboli	37
Subluxations	16
Dislocations	4
Transient peroneal palsy	1
Permanent peroneal palsy	1
Fractured neck of femur	3
Fractured shaft	2
Jaundice (probably from blood)	2
Femoral nerve (motor) severed	1
Femoral nerve (motor) partially severed	1

TABLE V
SEPSIS
43 Patients (4.3 per cent)

	Patients
Rheumatoid arthritis (214 hips)	8
Old septic cases (80 patients)	13
Old fractures—septic before arthroplasty (121 patients)	7
Others (including ten tuberculous patients)	15
Cups removed	12

In revisions or supplemental surgery the prime lesson learned has been the healing of tissue. That knowledge must be applied to the management of these patients. Let us consider the facts of an arthroplasty of the hip. Raw bleeding bone (in fact the fractured ends of bone) is shaped and the attachments of muscles of great strength are released. A major joint is dislocated. All of this needs to heal. First, the fractured femur cannot be trusted to bear weight for many months to a year and full weight-bearing should not be allowed until enough time has passed for firm healing of tendon and bone. A program of gradually increasing activity and weight-bearing has been evolved which gives safe margins for these activities. Secondly, it would be folly to expect muscles that have been

TABLE VI
SUPPLEMENTAL SURGERY
225 Revisions (22.5 per cent)

	Per cent
Rheumatoid arthritis	36
Old septic cases	30
Congenital hips	22
Old fractures of neck (7 cases septic at operation)	14
Malum coxae	4
Fracture dislocations (2 cases)	0.8

weak for months or even years to become strong in weeks. The one great goal to be obtained in a hip patient is durability. Durability seems to result more certainly in those patients who follow the rules and who protect the hip until enough time has elapsed for firm healing to have taken place.

The general timing of protection in these hips has been arrived at by the application of the general knowledge of bone healing as long-term protection. Gentle, simple muscle-setting exercises and active, assisted motions in bed are begun and continued within the limits of pain-producing motions. Any exercise or motion that produces pain which lasts any length of time afterward is made less strenuous. If by reducing the effort by one

TABLE VII
DURABILITY
(A changing quality)

	One Hip (Per cent)	Two Hips (Per cent)
Support all of the time (cane or crutches)	27	55
Support part of the time (cane or crutch)	40	30
No support	33	15
Walk up to one mile	50	47

half, the exercise or motion still produces pain that lasts, then that specific activity is discontinued for several days or until all of the pain is gone. It is then resumed at a slower pace or an easier motion is substituted that will often accomplish the same thing.

The motion and friction of partial, comfortable weight-bearing are the elements that make for a durable joint. Weight-bearing must be actively protected until the full range of motion has been obtained. If early full weight-bearing is allowed (under six months), it is possible that the patient may wear through the healing on the head of the femur and in the acetabulum (Figs. 2 and 4). There have been a number of patients who have been very comfortable until some specific episode produced pain on weight-bearing. From this they never recovered. Sitting too long, standing improperly, or frequently abusing the hip in other ways, such as trying to catch up on exercises, will produce this result. At supplemental surgery this wearing through the healing is readily seen. Belief in its pain-producing potential stems from the patients themselves. Often on recovery from these second operations they will say, "My hip is sore but *that* pain is gone."

Another lesson learned has been the need to transplant the iliopsoas tendon to the anterior medial border of the distal portion of the capsule in order to give the tendon a direct pull for function. This came about by finding the tendon embedded in the scar tissue between the mold and the acetabulum. Through having the muscle pull directed across the front of the mold, the muscle functions more efficiently, stabilizes the joint, diminishes the tendency to a permanent flexion deformity, and prevents a position of external rotation. In patients with a short femoral neck or in those with no neck, as in a shaft arthroplasty, it is necessary to move the greater trochanter with its attached abductors down the lateral portion of the shaft, or to insert the tendons of the abductors into the vastus externus¹⁰.

The other lessons learned are totally unsupported by statistical evidence of their worth; I list them on simple faith:

1. The reconstruction of the hip is not complete until the hip is relatively stable through its major functional positions.
2. The head of the femur and its acetabulum both need to be reconstructed and reshaped until they fit comfortably together with the interposed mold without strain.
3. The muscles that are to move the hip should have functional force lines toward stabilizing and moving it efficiently.
4. In the surgical closure of such a hip, the tissues should fall together without undue tension.
5. A full range of motion should be obtained before full strength is tried for, for this will prevent excess new-bone formation.
6. A long period of walking with crutches with a *comfortable* amount of partial weight-bearing as a major part of the exercise program is recommended; this should be continued (sometimes for as long as two and three years after the operation) until a strong hip has been developed.
7. In any patient who has a tendency to limp, adequate support in order to prevent limping is necessary. This may mean that a cane, a crutch, or crutches are needed to support the muscles part of the time until they are strong.

COMPLICATIONS

In any large series in which such extensive surgery as a reconstruction of the hip has been done, one would normally expect a death on the operating table. This has not yet happened. One patient died one week after surgery without regaining a conscious state. A most thorough postmortem examination failed to reveal the cause of death. The patient had said before going under the anaesthesia that she did not believe she would wake up. A second patient died three weeks after surgery of a cerebral vascular accident while on anticoagulant therapy for a presumptive diagnosis of thrombophlebitis. She had

stated that she was too old to go on with the pain in her hip and it was not really worth while to fix it as she did not have long to live anyway. A third death occurred four months after surgery as a complication of sepsis.

If I thought statistics meaningful, I would say that these three deaths might have occurred normally during this time in a sample of this size. None would doubt it, since the ages of the entire group ranged from eight to eighty years. I prefer to believe that our number of deaths were low because of the care in the preoperative evaluation, the preparation, during surgery, and, afterward, in convalescence. Most important was the excellence of the anaesthetists and the replacement of blood as it was lost. Blood replacement averages one unit of blood for every hour of operating time. The amount is greater in hips with old scars and sepsis.

Wound sepsis is a major disaster in the reconstructed hip. Hospitalization because of sepsis may extend up to two years and requires many operative procedures and countless hours of nursing care and results in untold misery to the patient and his surgeon. Everything possible is done to prevent this complication. Important precautionary measures, in addition to the standard antisepsis precautions, are: surgical preparation in the operating room; careful skin towel isolation, the use of local antibiotics at the time of closure of the wound, *a thorough débridement of all tissue strands, traumatized capsule, and muscle before closure*, and a surgical closure of the tissues without undue tension.

Thrombophlebitis has not been a common complication. Often the swelling of the extremities and muscle soreness in an exercise-enthusiastic patient may be mistaken for thrombophlebitis.

Absorption of the head and shortening of the neck under the mold have occurred. These have not been as much of a problem as had been anticipated; it was difficult to discover ten patients with these complications. Those in whom they occurred include two patients with sepsis, one patient with rheumatoid arthritis, one patient with intrapelvic protrusion, one patient with degenerative arthritis, one patient with an old fractured neck of the femur with aseptic necrosis, three patients with Charcot hips, and one patient with tuberculosis. In all of these absorption and shortening were proved during supplemental surgery. Undoubtedly there are other patients with more or less absorption in whom the complication was not sufficient to require supplemental surgery.

There is less absorption of head and less gradual intrapelvic protrusion of the mold if weight-bearing is protected until bone healing has taken place and if weight-bearing is distributed over a larger surface. Thus, as large a mold as is practical is used.

Dislocations of the mold have been few, twenty, and are now a rarity since care is taken to shape an acetabulum with its dome properly placed and since muscles are transplanted whenever necessary in order to stabilize their functional forces.

MODIFICATIONS OF TECHNIQUE

Practically all of the arthroplasties in this report were done through the anterior approach. The general technique of exposing the hip as described by Smith-Petersen was followed. As a surgical procedure is repeated many times, it undergoes a normal evolution. Changes creep in unnoticed at first and then become routine. Other changes are very deliberately made as a result of need and experience. Some of these changes in technique have been described in the *Instructional Course Lectures of The American Academy of Orthopaedic Surgeons*, Vol. 9, 1954, and in the Third Edition of *Campbell's Operative Orthopedics*, 1956. Only a few of the principles involved need to be emphasized here.

Exposure of the joint should be comfortably adequate. Strong retraction of the tissues and skin that produce unnecessary trauma and ischaemia of long duration should be avoided. Sharp dissection, release of muscle attachments from bone, and slightly more than adequate subperiosteal reflection are preferable to overstretching and possible tearing of muscle.

Specifically, the following steps have been added at the proper sequence in the exposure. The skin and subcutaneous fat and fascia are isolated from the depth of the wound. This is done by suturing a saline moist gauze handkerchief to the deeper layers. This protects the superficial layers from drying and from the repeated and unavoidable trauma involved in the making of the new joint. The gluteus minimus tendon is almost routinely tenotomized at the greater trochanter in order to allow exposure of the superior part of the femoral neck without undue reflection of muscle from the lateral wing of the ilium. The capsule, synovial membrane, and the straight and reflected heads of the rectus femoris muscle are reflected from the front of the joint in one piece. As nearly as possible, the capsule and synovial membrane are left in place and serve as a protection to the surrounding structures from the normal trauma of bone work in reshaping the joint. Finally, after a thorough irrigation of the wound, the entire synovial membrane and capsule are excised. This results in a removal of all traumatized tissue and leaves freshly cut surfaces for healing in the depth of the wound. All devitalized strands of tissue are excised.

At times the exposure is made easier by tenotomizing the iliopsoas tendon as well as the gluteus minimus. This is specifically true in patients with a shallow acetabulum or congenital dislocation of the hip. In these conditions, it is necessary to deepen the acetabulum medially and to secure the function of the hip in a more medial position. By transplanting the tendon of the iliopsoas to the anterior distal portion of the capsule, the hip is stabilized in this new position. The muscle has a straighter pull for function in flexion in this position.

Surgical closure of a wound about a joint requires approximation without undue necrotizing tension. After closure of the wound and after the sutures have been tied, the joint should be moved through its full range of motion. If the sutures have been properly placed, they will not break or pull out.

After-care of these patients has been adequately covered previously^{2, 3}. The general principles of this care seem worthy of emphasis. Protection should be maintained until bone healing is sufficient to allow weight-bearing on a mechanically levered joint. Since this leverage is more than the body weight, protection should extend in time until dense bone healing has taken place. This will require many months, sometimes a year or more.

Motion is secured by gentle persuasion and by support of the joint and the muscles. This support should last as long as there is any tendency to soreness or to limping, with an immediate return to crutches or cane support should there be any recurrence of soreness or limping. This should continue for a safe margin beyond the time of the disappearance of the soreness and limp. The strength of the muscles may be safely developed after an adequate range of motion has been obtained but not before firm bone healing has taken place.

SELECTION OF CASES

Mold arthroplasty is a procedure of choice in cases of bony ankylosis, traumatic or degenerative arthritis, old and fresh fractures of the acetabulum, rheumatoid arthritis before and after ankylosis (preferably before), old septic hips with and without draining sinuses, and as salvage following failure of other procedures including the insertion of a prosthesis and previous mold arthroplasties. In the salvage procedure, a shaft arthroplasty is done with the mold placed on the end of the femur. In this, the abductors must be transplanted down and the iliopsoas must be transplanted forward.

In patients with an adequate stock, the procedure has stood the test of eighteen years of experience with results which encourage its continued use. Congenital subluxations are particularly suitable for mold arthroplasty. In patients with congenital dislocation of the hip in whom there is an adequate femoral head and in whom an adequate socket can be developed, the results from the use of the procedure have been good and excellent. When there has been loss of a large area of the femoral head or when there is

inadequate material for arthroplasty, the femoral-head prosthesis can be used with encouraging early results.

Mold arthroplasty is a sound surgical procedure; it needs, however, to be properly applied. Good to excellent results will be more frequent if the patients are managed according to the principles of bone healing and of muscle control. In summary, I would like to say that if good to excellent surgery has been performed, these hips can be persuaded but not forced to a good or excellent result.

REFERENCES

1. ADAMS, J. C.: A Reconsideration of Cup Arthroplasty of the Hip. With a Precise Method of Concentric Arthroplasty. *J. Bone and Joint Surg.*, **35-B**: 199-208, May 1953.
2. AUFRANC, O. E.: Constructive Hip Surgery with Mold Arthroplasty. *In* Instructional Course Lectures, The American Academy of Orthopaedic Surgeons, 1954. Vol. 11, pp. 163-187. Ann Arbor, J. W. Edwards, 1954.
3. AUFRANC, O. E.: Hip Arthroplasty with Vitallium Mold. *In* Campbell's Operative Orthopedics. Ed. 3, Vol. II, pp. 1385-1418. Edited by Robert A. Knight. St. Louis, The C. V. Mosby Company, 1956.
4. AUFRANC, O. E., and SWEET, E. B.: Unpublished data.
5. BADGLEY, C. E.: Arthroplasty of the Hip for Degenerative Hip Disease. *In* Regional Orthopaedic Surgery and Fundamental Orthopaedic Problems, Instructional Course Lectures, The American Academy of Orthopaedic Surgeons, 1946, pp. 207-222. Ann Arbor, J. W. Edwards, 1946.
6. BICKELL, W. E., and BABB, F. S.: Cup Arthroplasty of the Hip. *J. Bone and Joint Surg.*, **30-A**: 647-656, July, 1948.
7. BLOUNT, W. P.: Don't Throw Away the Cane! *J. Bone and Joint Surg.*, **30-A**: 695-708, June 1956.
8. BRACKETT, E. G.: Operative Treatment of Osteoarthritis. *Am. J. Orthop. Surg.*, **13**: 46-58, July 1915.
9. CAMPBELL, W. C.: End Results in Arthroplasties of the Hip. *J. Michigan State Med. Soc.*, **33**: 49-58, 1934.
10. COLONNA, P. C.: A Reconstruction Operation for Old Ununited Fracture of the Femoral Neck. *J. Bone and Joint Surg.*, **19**: 945-954, Oct. 1937.
11. GIBSON, ALEXANDER: Vitallium Cup Arthroplasty of the Hip Joint. *J. Bone and Joint Surg.*, **31-A**: 861-868, Oct. 1949.
12. GIBSON, ALEXANDER: Arthroplasty of the Hip Joint. *Canadian Med. Assn. J.*, **71**: 353-356, 1954.
13. GIBSON, ALEXANDER, and WILLIAMS T. H.: Changes in the Femoral Head Underlying a Vitallium Cup. *J. Bone and Joint Surg.*, **33-B**: 119-121, Feb. 1951.
14. HAGGART, G. E., and HAMMOND, GEORGE: Treatment of Degenerative Arthritis of the Hip Joint in Older Patients. *Surg. Clin. North America*, **34**: 829-837, 1954.
15. HAMMOND, GEORGE; CRAWFORD, H. R.; and HAGGART, G. E.: Vitallium Mold Arthroplasty of the Hip. *J. Am. Med. Assn.*, **158**: 161-165, 1955.
16. HARRISON, M. H. M.; SCHAJOWICZ, F.; and TRUETA, J.: Osteoarthritis of the Hip: A Study of the Nature and Evolution of the Disease. *J. Bone and Joint Surg.*, **35-B**: 598-626, Nov. 1953.
17. JUDET, ROBERT, and JUDET, JEAN: Technique and Results with the Acrylic Femoral Head Prosthesis. *J. Bone and Joint Surg.*, **34-B**: 173-180, May 1952.
18. LAW, W. A.: Post-Operative Study of the Vitallium Mould Arthroplasty of the Hip Joint. *J. Bone and Joint Surg.*, **30-B**: 76-83, Feb. 1948.
19. SHEPHERD, M. M.: Assessment of Function after Arthroplasty of the Hip. *J. Bone and Joint Surg.*, **36-B**: 354-363, Aug. 1954.
20. SHEPHERD, M. M.: A Review of 650 Hip Arthroplasty Operations. *J. Bone and Joint Surg.*, **36-B**: 567-577, Nov. 1954.
21. SMITH-PETERSEN, M. N.: Arthroplasty of the Hip. A New Method. *J. Bone and Joint Surg.*, **21**: 269-288, Apr. 1939.
22. SMITH-PETERSEN, M. N.: Evolution of Mould Arthroplasty of the Hip Joint. *J. Bone and Joint Surg.*, **30-B**: 59-75, Feb. 1948.
23. SMITH-PETERSEN, M. N.; LARSON, C. B.; AUFRANC, O. E.; and LAW, W. A.: Complications of Old Fractures of the Neck of the Femur. Results of Treatment by Vitallium-Mold Arthroplasty. *J. Bone and Joint Surg.*, **29**: 41-48, 1947.
24. STINCHFIELD, F. E.: Surgical Treatment of the Arthritic Hip. *Surg., Gynec., and Obstet.*, **96**: 733-738, 1953.
25. THOMSON, J. E. M.: A Prosthesis for the Femoral Head. A Preliminary Report. *J. Bone and Joint Surg.*, **34-A**: 175-182, Jan. 1951.
26. WILSON, P. D.: Trochanteric Arthroplasty in the Treatment of Ununited Fractures of the Neck of the Femur. *J. Bone and Joint Surg.*, **29**: 313-327, Apr. 1947.

(Continued on page 316)

Dr. Nachlas has been conservative in his estimation of the indications for this operation and in his evaluation of the results obtained in his relatively small series. He reported that stability had been obtained and that the hips had good or normal motion and were without significant pain. Only three of his patients exhibited a limp on examination. The roentgenographic appearance of some of the hips would lead one to expect that arthritic symptoms will ultimately appear. The fact remains that these patients have had from fourteen to twenty-two years of satisfactory service from their hips—a result which in itself renders this operation worthy of serious consideration.

DR. NACHLAS (closing): It should be emphasized that the cases reported in this paper were not chosen at random, for all of the patients who had been operated upon within the time interval selected for this study were included.

The operation is not difficult. Occasionally one end of the bucket handle may break, but this broken end can be fastened down if necessary. Bone healing in this area is good. The capacity of bone to fill a gap in the acetabulum with callus was tested in the following manner: in one patient, instead of the osteotomy gap being filled by a full graft, a small plug of bone was inserted in one corner to serve as a wedge which would maintain the position of the bucket handle. Following this procedure the acetabulum healed satisfactorily.

The use of osteotomy of the femur in order to correct a rotational deformity is a separate problem and should be discussed elsewhere.

DISCUSSION

VITALLIUM-MOLD ARTHROPLASTY

(Continued from page 248)

DR. J. E. M. THOMSON, LINCOLN, NEBRASKA: In our experience, the use of the cup arthroplasty is more suitable in young patients; in patients over sixty, complications and the need for revisions have discouraged our use of cup arthroplasty. A critical analysis of cup arthroplasties performed in the treatment of painful osteo-arthritis in old people resulted in our turning to the use of a femoral-head prosthesis six years ago. From the use of the prosthesis we have had a measure of satisfaction. However, we are not convinced that it is right to sacrifice so much of the head and neck of the femur as is necessary with the use of a metal replacement.

Dr. Aufranc's review of 1,000 patients who had had cup arthroplasties is informative and interesting. Much more information is needed, however, in order that we may know in what type of disabled hip and in what age group the cup arthroplasty is most useful. One might assume from this report that cup arthroplasty is the operation of choice in any hip disability.

When one realizes the many months of convalescence and economic loss involved in this surgical procedure, one cannot but help admire the more than satisfactory doctor-patient relationship implied in the 62 per cent of patients with unsatisfactory results who were either enthusiastic or satisfied with the result obtained; one cannot help but admire the conviction in the 22 per cent of the patients who accepted one or more surgical revisions. After supplemental surgery, apparently only 5 per cent were improved.

It is unfortunate that the universal inadequacy of our method of measuring preoperative disability greatly hampers the effort to know the improvement in the patient as a result of ensuing surgery. As Dr. Aufranc pointed out, the patient himself is of little help.

When one puts a movable metal contrivance into an old septic hip joint, he is courting danger. Such joints we know from bitter experience are no place for metal cups or prostheses.

What had been hoped for in Dr. Aufranc's presentation was an analysis of the specific pathological conditions of the hip and at what ages a cup arthroplasty is most suitable. With this information from such a large series of arthroplasties, we could much better appreciate the value and place of cup arthroplasty.

DR. CARL E. BADGLEY, ANN ARBOR, MICHIGAN: In the properly selected patient, the operation properly performed can produce, under the guiding influence of the Vitallium mold, a functional hip joint. It must be recognized that the surgical principles of repair must not be disregarded. It takes time and patience with motion and rest at the right time, a long period of non-weight-bearing, carefully supervised walking with crutches and later walking with a cane until the hip structure whose component parts have been molded to fit one another is fit to bear weight.

Our experience of eighteen years demonstrates that, as a rule, once a cup arthroplasty has been successful, it remains so.