A STUDY IN GERIATRIC ANAESTHESIA—FRACTURED NECK OF THE FEMUR*

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ANAESTHESIA for the geriatric patient has become increasingly common during the last two decades. As the life span of our population increases so does the necessity of operating on older patients, both electively and for emergency procedures. The magnitude of the problem will be appreciated if it is realized that in our hospital, out of a random total of 2270 consecutive anaesthetics, over 11 per cent were in patients 70 years of age and over. *Pari passu* with the extension of the need for operative intervention, the concept has changed as to what constitutes a geriatric patient. Whereas some 25 years ago the age of 65 years was considered often the limit at which elective procedures could be safely carried out, and beyond which age even many serious emergency procedures were rejected, the average patient of 65 years today is a reasonably fit person. Hence the concept of geriatrics is one which does not lend itself easily to definition and it is well to judge a patient by his physiological rather than his chronological age. This point, of course, has been made before and is a well-accepted fact.

Some years ago we analysed a consecutive series of anaesthetics for geriatric patients¹ and confirmed the experience of many that, on the whole, these patients are not as poor risks as might have been expected. It has been said, and perhaps rightly so, that had these patients not enjoyed good health in the past, they would not have reached as advanced an age as they did. Nevertheless, associated conditions due to the degenerative changes of old age are the rule rather than the exception. These changes affect all organ systems and hence the margin of safety in these patients is markedly limited. Therefore it is imperative that adequate tissue oxygenation and vital functions be assiduously maintained at near-normal levels, and that allowance be made for the reduced ability of the parenchymatous systems to detoxify or eliminate parentally administered drugs. The geriatric patient will not tolerate violation of the basic principles of anaesthesia because of decrease in functional activity, depletion of vital reserves, and lack of adaptability of internal homeostasis.

When reviewing clinical cases one is faced always with the problem of a myriad of variables which make it difficult to draw valid conclusions. Hence we have chosen to analyse our series of fractured hips. This is a major surgical condition prevalent in the aged and thus at least some of these variables are eliminated.

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PRESENT STUDY

The total number of cases available between January 1955 and December 1962 was 212. This represents an incidence of one in every 148 operations. There were 92 fractures of the femoral neck. Sixty of these were pinned and the remainder had arthroplasties. One hundred and twenty others had trochanteric fractures all of which, of course, required pinning. No differentiation is made among the various types of pins and pin-plates used.

In the post-hospital follow-up studies only the 198 operations done up to July 1962 will be considered, since more recent cases do not lend themselves to a meaningful interpretation of long-range results.

RESULTS

Age (Table I)

As may be expected in a study of this kind, the majority of patients were over 70 years old (70%), and 82 per cent were over 60 years of age. Indeed, it was our intention to study hip fracture from the point of view of the problems of anaesthesia for geriatric patients.

TABLE I

AGE*

Age	Pinning	Arthroplasty
10-19	1	—
20-29	3	—
30-39	5	—
40-49	6	2
50-59	18	2
60-69	25	4
70-79	72	13
80-89	40	7
90-99	10	3
100+	—	1
Total	180	32

*68½ per cent of patients are 70 years and older;
82½ per cent are 60 years and older.

Sex (Table II)

It is interesting to see that the ratio of females to males in this series was slightly over 2:1. However, the proportion must be considered in the light of the ratio of living females to males in the geriatric age groups. Life insurance tables

TABLE II

SEX

Sex	Pinning	Arthroplasty	Total*
Male	60	8	68
Female	120	24	144
Total	180	32	

*Ratio female : male = 2.1:1.

indicate that on the Canadian prairies the proportion of females to males at age 70 is approximately 7:6, while at age 80 it is above 4:3 and at 90 it is 8:5. Since there is no age group in which the female population is more than double the male population, one can conclude that women are indeed more prone to this injury than men.

Physical Status (Table III)

Our classification of physical status follows the old recommendations of the American Society of Anesthesiologists, with the exception that physical status VI has been subdivided into IIIE and IVE. It follows that a total of 160 operations were carried out electively, and 52 as emergency procedures. We have defined

TABLE III
PHYSICAL STATUS*

Physical status	Pinning	Arthroplasty
I	9	—
II	34	6
III	82	20
IV	9	—
V	16	1
IIIE	25	5
IVE	4	—
VII	1	—
Total	180	32
Elective	134	26
Emergency	46	6

*Ratio elective : emergency = 3.1:1.

elective operations as operations booked not later than the night before the operation, and emergency procedures as those which were booked on the day of operation. In the latter, anaesthetic evaluation was of necessity less thorough. We have had the clinical impression that there was little indication to operate on these patients as emergencies, and that the disadvantages of the lack of preoperative assessment and preparation far outweighed the advantages which may have been gained by earlier mobilization of the patients through immediate operation. This assumption explains the ratio of 3.2 elective operations to each emergency procedure.

Preoperative Complications (Table IV)

Two hundred and twenty-four preoperative complications of significance were noted, and 55 patients had more than one complication. Some of these had been completely, and most of them partially, corrected or controlled at the time of operation.

Preoperative Assessment (Table V)

Eighty per cent of all patients had electrocardiograms done, of which almost 60 per cent were abnormal tracings and only 18 per cent were completely normal. The percentage of electrocardiograms taken was essentially the same as that of the medical consultations obtained. It was only slightly less than the percentage

of patients 60 years and older. Thus one can say that for all intents and purposes all patients over the age of 60 years had a medical consultation which included an electrocardiogram. In 12 instances the internist recommended postponement of the operation because of the patient's poor condition, and this was done.

TABLE IV
PREOPERATIVE COMPLICATIONS*

Complications	Pinning	Arthroplasty
Cardiovascular*		
Major	96	19
Minor	1	—
Respiratory		
Major	26	6
Minor	2	—
Diabetes	22	3
C.N.S.	11	4
Obesity	13	1
Others	15	5
None	41	2

*55 patients had more than one complication.

TABLE V
PREOPERATIVE WORK-UP

	Pinning	Arthroplasty
(A) Electrocardiogram*		
None	40	2
Normal	29	6
Borderline	31	4
Definitely abnormal	80	20
Total	180	32
(B) Medical consultation		
Yes	137†	30
No	43	2
Total	180	32
(C) Haemoglobin at operation		
8-10 gm. %	3	—
10-12	39	4
12-14	78	19
Over 14	60	9
Total	180	32

*80 per cent of patients had E.C.G. done of which 59 per cent of tracings were abnormal.

†In 12 of these, operation was postponed at internist's recommendation; 79 per cent had medical consultation.

If one considers a haemoglobin of 12 gm.% as adequate, then 46 patients showed some degree of anaemia, which is just a little over 21 per cent of the total. However, these figures are misleading, since it is quite likely that some of the others who had normal or even high haemoglobins may have been in a state of haemo-concentration.

Preoperative Medication (Table VI)

This consisted in the large majority of cases of small amounts of meperidine, usually not exceeding 25 mg. in the aged, with either atropine or, much less frequently, hyoscine. Atropine alone was given to those in whom the use of a narcotic seemed contraindicated.

TABLE VI
PREOPERATIVE MEDICATION

	Pinning	Arthroplasty
Atropine	47	11
Meperidine-atropine	98	13
Meperidine-hyoscine	9	2
Others	18	5
None	8	1
Total	180	32

Position and Anaesthetic Technique (Table VII)

All but two hip pinnings were carried out in the supine position, whereas the large majority of the arthroplasties were done with the patient in the lateral position.

Eighty-two per cent of all patients had general anaesthesia. This percentage is very much higher for procedures carried out in recent years after halothane and azeotropic halothane-ether had become available. Almost all regional procedures were done during the earlier years of the study. We have had the impression that these patients tolerate general anaesthesia well, and that there was, therefore, little

TABLE VII
POSITION AND ANAESTHETIC TECHNIQUES

	Pinning	Arthroplasty
(A) Position		
Supine	178	3
Lateral	2	29
Total	180	32
(B) Techniques		
General*	143	31
Regional	37	1
Total	180	32
(C) Intubation		
Yes†	39	28
No	141	4
Total	180	32
(D) Blood transfusion		
Yes‡	106	18
No	74	14
Total	180	32

*82 per cent of patients had general anaesthesia.

†25 per cent of patients in the supine position receiving general anaesthesia were intubated.

‡58.5 per cent of patients had blood transfusions.

justification for turning them on their side or sitting them up for the introduction of a spinal or epidural needle, bearing in mind the considerable discomfort which is inflicted by these manoeuvres.

While the patients in the lateral position require endotracheal intubation in almost all instances, this is by no means necessary in patients in the supine position. Indeed, in recent years we have attempted to avoid endotracheal intubation in order to allow us to carry the anaesthesia at the lightest possible level. With some little care, difficulties with the airway or with leaks around the mask need not arise. The trachea was intubated in only 25 per cent of all patients in the supine position who received a general anaesthetic. Most of these were done during the earlier years and endotracheal intubation has rarely been carried out in recent times unless specifically indicated.

Almost 60 per cent of patients received blood transfusions during the operation in order to correct existing anaemia or to replace operative blood loss. All patients had intravenous infusions of 5 per cent dextrose in water.

General Anaesthesia (Table VIII)

In well over 90 per cent of cases anaesthesia was induced by the administration of intravenous barbiturates. Usually a sleep dose was injected to facilitate painless transfer from the bed to the orthopaedic table. One hundred and twenty-five milligrams of 2.5 per cent thiopental or equivalent was never exceeded in elderly patients and usually they reacted slightly to the painful stimulation. As soon as

TABLE VIII
GENERAL ANAESTHESIA

	Pinning	Arthroplasty
(A) Induction		
Intravenous*	132	27
Gaseous	11	4
Total	143	31
(B) Maintenance		
N ₂ O-diethyl ether	4	—
N ₂ O-halothane	6	5
N ₂ O-halothane-5% alcohol	1	—
N ₂ O-fluothane/ether	77	20
N ₂ O-trichlorethylene	52	4
N ₂ O-chloroform	2	—
N ₂ O-methoxyflurane	—	1
N ₂ O-meperidine	1	—
N ₂ O	—	1
Total	143	31
(C) Relaxants		
D-Tubocurarine	4	—
Dimethyl tubocurarine	15	7
Gallamine	9 (2)†	3
Succinylcholine	24 (7)	16
None	91	5
Total	143	31

*93 per cent of patients had intravenous induction.

†Figures in parentheses denote the number of cases in which the relaxant was administered for manipulation of the fracture only.

they had been transferred onto the operating table anaesthesia was continued by inhalational means.

All maintenance was based on nitrous oxide as the primary agent, with ample oxygen and such secondary agents as the anaesthetist deemed advisable. In the majority of the earlier cases trichlorethylene was used for that purpose, while in later years azeotropic halothane-ether predominated. Halothane-ether was chosen also for most arthroplasties, since this operation has been done more frequently in the last three to four years.

Muscle relaxants were required in all those patients whose tracheae were intubated, but they were avoided in the majority in whom intubation was not done, in order to permit spontaneous respiration throughout. In some instances a short-acting muscle relaxant was injected merely for the purpose of facilitating disimpaction and manipulation of the fracture even when an endotracheal tube had not been passed. Where longer-acting relaxants were administered to non-intubated patients they were given in very small amounts, usually just to smooth out some minor difficulty, such as respiratory stridor.

Regional Anaesthesia (Table IX)

This was used relatively infrequently, for example, in some 17 per cent of patients, for reasons pointed out above. When it was used, a single or continuous subarachnoid block was preferred because of its greater technical simplicity, as compared with epidural anaesthesia, in a patient who could not be adequately positioned.

TABLE IX
REGIONAL ANAESTHESIA

	Pinning	Arthroplasty
(A) Techniques		
Subarachnoid	12	1
Continuous subarachnoid	21	—
Epidural	2	—
Local infiltration with supplement	2	—
Total	37	1
(B) Vasopressors		
Prophylactic	5	1
Therapeutic†	13	—

*Figures in parentheses denote the number of cases in which a general supplement was administered.

†Incidence of therapeutic vasopressors (excluding operations under local infiltration): 37 per cent.

Hypotension requiring the therapeutic use of vasopressors occurred 13 times, or in 37 per cent of cases. In no instance was hypotension permitted to persist and in all cases it was possible to maintain adequate circulatory homoeostasis by that means.

Duration of Anaesthesia and Operation (Table X)

Most anaesthetics lasted between 1½ and 3 hours. This period includes the rather cumbersome positioning of the patient, and orthopaedic preparation. The

large majority of operations were completed in between 1 and 3 hours. Many of the delays in this operation are due to waiting for development of X-ray films, which are taken repeatedly in the course of the operation.

TABLE X
DURATION OF ANAESTHESIA AND OPERATION

	Pinning	Arthroplasty
(A) Anaesthesia		
Less than 1 hour	6	—
1-1½ hours	19	8
1½-2 hours	44	8
2-3 hours	92	15
3-4 hours	17	1
4-5 hours	2	—
Total	180	32
(B) Operation		
Less than 1 hour	17	8
1-1½ hours	49	10
1½-2 hours	66	10
2-3 hours	44	4
3-4 hours	4	—
Total	180	32

Complications during Anaesthesia (Table XI)

Significant complications requiring remedial measures occurred in 21 per cent of cases. Of these, hypotension was by far the most common, and was by no means restricted to regional anaesthesia alone. However, it is noteworthy that whereas regional anaesthesia was associated with an incidence of hypotension of 37 per cent, general anaesthesia carried an incidence of only 8 per cent.

TABLE XI
COMPLICATIONS DURING ANAESTHESIA*

	Pinning	Arthroplasty
Hypotension	27	3
Bradycardia	2	—
Arrhythmias	9	1
Bronchospasm	2	—
Vomiting on induction	—	1
None	140	27
Total	180	32

*Incidence of complications: 21 per cent.

Postoperative Complications (Table XII)

As may be expected in patients in this age group, most significant complications were of a cardiovascular or respiratory nature. A fairly high proportion of these led to, or were the actual cause of, death. Seven patients had more than one complication. On the other hand, it is noteworthy that 133 patients, that is just slightly over 62 per cent, had no significant complications whatever.

TABLE XII
POSTOPERATIVE COMPLICATIONS*
(Including deaths)

	Pinning	Arthroplasty
Cardiovascular, major	22 (8)	1
Thrombophlebitis	9	—
Respiratory, major	16 (9)	1
Respiratory, minor	3	—
Urinary tract	15	2
C.N.S.	3 (1)	—
Electrolyte imbalance	1	—
P.U.O.	7	—
Hypoglycaemia	1 (1)	—
Ileus	1	4
None	108	25
	Total: 78	Total: 8

*Seven patients had more than one complication.
Figures in parentheses denote deaths in hospital.

Time from Injury to Admission (Table XIII)

Most patients were admitted within 24 hours of injury. Relatively few reached the hospital within 12 hours and some were transferred as late as two weeks after injury. One patient came to this hospital five months after injury.

TABLE XIII
TIME FROM INJURY TO ADMISSION

	Pinning	Arthroplasty
0-12 hours	35	13
12-24 hours	96	12
24-48 hours	18	3
48-72 hours	16	—
72 hours to 1 week	7	1
1-2 weeks	7	1
2-3 weeks	—	2
5 months	1	—
Total	180	32

TABLE XIV
TIME FROM ADMISSION TO OPERATION

	Pinning	Arthroplasty
0-12 hours	17	1
12-24 hours	77	12
24-48 hours	43	8
48-72 hours	16	4
72 hours to 1 week	15	2
1-2 weeks	9	2
2-3 weeks	3	2
3-4 weeks	—	1
Total	180	32

Time from Admission to Operation (Table XIV)

As has been pointed out above, it has been our practice to attempt not to operate on these patients as emergencies, and consequently the large majority of these patients were operated on within 12 to 48 hours of admission. In some cases

operation was delayed further, even up to three weeks, if the patient's condition did not warrant earlier intervention.

Deaths in Hospital

Any series of this kind must in the final analysis be judged by its clinical success or otherwise. Therefore, close scrutiny of mortality and morbidity is essential.

Nineteen patients died during their stay in hospital, for a total hospital mortality rate of 8.9 per cent. This is almost identical with figures in the literature.² Table XV lists these deaths in detail. All followed pinnings and there were no deaths in the arthroplasty series.

There was only one death among patients under 70 years of age, which is equivalent to 1½ per cent of all patients in that age group, whereas the hospital death-rate for patients over the age of 70 was 12.3 per cent. If one breaks down this figure further, one finds that the death rate of those in age group 70 to 79 years was 10.5 per cent, that in age group 80 to 89 years was 17 per cent, and that in 90 years and over was just above 7 per cent. While it is logical that octogenarians should have a higher mortality than patients in their seventies, the lower death-rate of the nonagenarians might well be fortuitous, and due to the relatively small number of fourteen in this group.

The death rate of males was almost twice that of females, being 13.3 per cent and 7 per cent respectively.

Nine patients out of 72, or 17.3 per cent, who were operated upon as emergencies, expired during their stay in hospital, whereas the corresponding figure for elective procedures was 6.3 per cent. The fact that the incidence of death was almost three times as high in emergency procedures would seem to be significant.

Two of the 19 patients who died in hospital had hypotension during the operation. One of these died on the 42nd postoperative day from pulmonary embolus and the other after 24 hours from thrombosis of the superior mesenteric artery. However, there was clinical evidence in this case that this condition had pre-existed, but it was not diagnosed with certainty at the time of operation. The other 17 patients who died had no complications during anaesthesia. With one exception, all patients had one or more major preoperative complication and in many instances the cause of death was related to these.

There was no difference in the incidence of deaths amongst those patients defined as anaemic and the remainder, the incidence in each group being 9 per cent.

There is no good evidence that duration of anaesthesia or operation influenced the final outcome to any significant degree (Table XVI). While it is true that the shorter procedures had an incidence of hospital deaths which was below the percentage of operations in that same group, and that anaesthetics between 2 and 3 hours and operations lasting 1½ to 2 hours had a higher death-rate when similarly compared, this increased incidence did not apply to cases of longer duration.

It is also difficult to find a consistent correlation between time from injury to admission and the interval from admission to operation on the one hand and the final outcome on the other.

TABLE XV

DEATHS IN HOSPITAL
(Pinning only)

Age	Sex	Physical status	Hb.	Injury to admission	Admission to operation	Preoperative complications	Duration of anaesthesia	Duration of operation	Anaesthetic complications	Time of death	Principal cause of death
67	F	III	16 0	2 hours	4 days	Cardiovascular system	2 hours	1½ hours	Hypotension	42 days	Pulmonary emboli
71	M	III	11 4	72 hours	14 hours	Cardiovascular system	2 hours	1½ hours	None	3 days	Bronchopneumonia, enterocolitis, uraemia
73	F	III	13 4	12 hours	43 hours	Cardiovascular system, diabetes	1½ hours	¾ hour	None	24 hours	Congestive heart failure
79	M	III	13 8	48 hours	33 hours	Respiratory system, cardiovascular system	2½ hours	1½ hours	None	30 days	Pneumonia
80	F	III	13 5	3 hours	36 hours	Diabetes	2½ hours	2 hours	None	29 days	Congestive heart failure
80	F	III	14 0	48 hours	7 days	Respiratory system	2¼ hours	2 hours	None	15 days	Pneumonia
84	M	III	11 4	24 hours	17 hours	Respiratory system, central nervous system, cardiovascular system	2 hours	1½ hours	None	3 days	Cerebrovascular accident
90	F	III	12 8	4 days	36 hours	Cardiovascular system, respiratory system, diabetes	2½ hours	1½ hours	None	4 days	Congestive heart failure
76	M	III E	13 6	In hospital	16 hours	Cardiovascular system	1¼ hours	1 hour	None	21 days	Pneumonia
76	F	III E	14 6	48 hours	3 hours	Respiratory system	2¼ hours	1¼ hours	None	22 days	Pneumonia
77	M	III E	13 3	24 hours	15 hours	Cardiovascular system, diabetes	1¼ hours	1¼ hours	None	36 days	Hypoglycaemic, coma
89	M	III E	13 4	6 hours	15 hours	Cardiovascular system	2¼ hours	1½ hours	None	20 hours	Bronchopneumonia, pulmonary embolism
81	M	IV	13 4	12 days	5 days	Cardiovascular system, respiratory system	1½ hours	1 hour	None	3 days	Congestive heart failure
86	M	IV	14 6	24 hours	72 hours	Cardiovascular system, prehepatic coma	2¼ hours	1½ hours	None	3 days	Portal cirrhosis with hepatic encephalopathy
71	M	IV E	14 8	24 hours	18 hours	Cardiovascular system, respiratory system	2½ hours	1½ hours	Hypotension	24 hours	Pneumonia, superior mesenteric arterial thrombosis
81	F	IV E	11 1	1 hour	19 hours	Cardiovascular system	2¼ hours	1½ hours	None	43 days	Pulmonary embolus
83	F	IV E	10 2	24 hours	22 hours	Cardiovascular system	1¼ hours	1½ hours	None	61 days	Pneumonia
74	F	V	14 4	2 hours	4½ hours	None	2½ hours	1¼ hours	None	9 days	Pulmonary embolus
70	F	VII	12 0	In hospital	15 hours	Cardiovascular system, Parkinsonism	3¼ hours	2½ hours	None	86 days	Congestive heart failure

TABLE XVI
DEATHS RELATED TO DURATION OF ANAESTHESIA AND
OPERATION

Duration	Number of deaths	Per cent incidence of deaths	Per cent of all operations
Anaesthesia			
Less than 1 hour	0	0	2.8
1-1½ hours	1	5	12.7
1½-2 hours	4	21.5	24.5
2-3 hours	13	68.5	50.5
3-4 hours	1	5	8.5
4-5 hours	0	0	1
Operation			
Less than 1 hour	1	5	11.5
1-1½ hours	4	21	28.5
1½-2 hours	11	58	36.5
2-3 hours	3	16	22
3-4 hours	0	0	1.5

Time of Death

This time in relation to the end of anaesthesia is listed in Table XVII. On the average, death occurred on the 26th day of hospital stay. Three patients died within 24 hours. Significantly, two of these were operated upon as emergencies and all three died from causes unrelated to anaesthesia.

TABLE XVII
TIME OF DEATH*

Within 24 hours of end of operation	3
24-48 hours	—
48-72 hours	4
3 days to 1 week	1
1-3 weeks	3
3-4 weeks	2
1-2 months	4
Over 2 months	2

*Average day of death: 26th day.

Non-Fatal Pulmonary Emboli (Table XVIII)

There were 9 non-fatal pulmonary emboli in the pinning series and, again, none amongst the arthroplasties. It should be noted here, however, that arthroplasties were reserved for relatively fit patients who could be expected to be fully mobilized within a reasonable period.

Mobilization and Hospital Stay (Table XIX)

Patients who had undergone hip-pinning and had no significant postoperative complications were allowed to sit up, on the average, a little bit beyond the 8th day, whereas those with postoperative complications sat up on the 10th day. In both groups the total stay in hospital was similar at slightly over 42 days.

Arthroplasties who had no complications sat up on the average on the 15th

postoperative day, and those with postoperative complications, on the 22nd postoperative day. The stay in hospital of the uncomplicated arthroplasties was 47 days on the average, whereas those with complications stayed an average of 67 days.

TABLE XVIII
NON-FATAL PULMONARY EMBOLI
(Pinning only)

Age	Sex	Status	Injury to admission	Admission for operation	Time of occurrence postoperatively	Cardiac rhythm
59	M	II	9 hours	40 hours	14 days	Sinus rhythm
71	F	II	24 hours	57 hours	11 days	Sinus rhythm
75	F	II	24 hours	24 hours	11 days	Auricular fibrillation
75	M	II	1 week	17 hours	14 days	Sinus rhythm
76	M	II	24 hours	24 hours	31 days	Sinus rhythm
60	F	III	24 hours	24 hours	5 weeks	Sinus rhythm
73	F	III	72 hours	40 hours	24 hours	Sinus rhythm
83	F	III	24 hours	72 hours	21 days	Sinus rhythm
84	M	IV	48 hours	72 hours	11 days	Sinus rhythm

TABLE XIX
MOBILIZATION AND DISCHARGE

	Pinning	Arthroplasty
No complications		
Operation to sit-up time	8 31 days	15 2 days
Days in hospital	42 9 days	47 days
Postoperative complications		
Operation to sit-up time	10 25 days	22 8 days
Days in hospital	42 5 days	67 2 days

On Discharge from Hospital (Table XX)

Fifty-three hip-pinnings and 9 arthroplasties were ambulatory for a total of 32 per cent of patients alive on discharge. Ninety-five hip-pinnings and 21 arthroplasties were discharged in wheelchairs, for a total of 60 per cent, which is almost double the ambulatory group. Thirteen hip-pinnings were bedridden on discharge and so were two arthroplasties, making a total of 8 per cent.

TABLE XX
CONDITION ON DISCHARGE
(193 live patients)

	Pinning	Arthroplasty
Ambulatory	53	9
Wheelchair	95	21
Stretcher	13	2
Total	161	32

Many of these became ambulatory at a later stage (Table XXI). From this it would appear that patients with arthroplasties fared less well functionally than those whose hips had been pinned.

TABLE XXI
FUNCTIONAL RECOVERY

	Pinning	Arthroplasty
Discharged in wheelchair		
Walking without support	42	4
Walking with support	20	5
Not walking	4	6
Died since discharge	25	4
Unknown	4	2
Discharged on stretcher		
Walking without support	—	—
Walking with support	4	—
Not walking	3	1
Died since discharge	6	—
Unknown	—	1

Follow-up

This follow-up includes cases operated upon up to July 1962 and, therefore, the following tables exclude all operations within the past 10 months. Initially a questionnaire was sent to all patients and, in those instances where no response was received, the patient's referring doctor was contacted. If no contact could be established, municipalities were contacted and, in the remainder, enquiry was made with the Provincial Department of Vital Statistics, so that those who had died in the meantime could be counted as such, and causes of death established. After all these steps had been taken, complete contact had been lost with only seven patients and a 96 per cent follow-up had been achieved.

TABLE XXII
FOLLOW-UP

	Pinning	Arthroplasty
Alive and well		
6 months to 1 year	9	5
1-2 years	24	6
2-3 years	21	5
3-4 years	21	4
4-5 years	8	—
5-6 years	15	1
6-7 years	9	—
7-8 years	1	—
Total	108	21

Of those who had left hospital, 129 (65%) were alive and well by March, 1963, up to 8 years postoperatively (Table XXII). Forty had died since discharge from hospital. Their physical status at operation and principal causes of death are listed in Table XXIII. The average age at death was over 80 years. This includes two rather young patients. One of these was 36 years old and died 15 months after operation from carcinoma of the breast; the other was a 51-year-old man who died one year postoperatively from carcinoma of the pancreas and cerebral haemorrhage. A 62-year-old woman died one year postoperatively from myocardial infarction. All others were over the age of 70 years at the time of death.

TABLE XXIII
FOLLOW-UP

	Deaths	Pinning (35 deaths)	Arthroplasty (5 deaths)
Status			
I		1	—
II		4	—
III		21	5
IV		5	—
IIIE		4	—
Causes			
Pneumonia		10	—
Congestive heart failure		9	4
Cerebral vascular accident		6	—
Myocardial infarct		5	1
Diabetic gangrene		1	—
Uraemia		1	—
Hepatic coma		1	—
Carcinoma		2	—
Average age at death		80.8 years	82.6 years

SUMMARY

Two hundred and twelve consecutive hip fractures have been reviewed. There were no anaesthetic deaths in this series and only three patients died within 24 hours of the end of anaesthesia, but from causes not directly related to the anaesthetic management. With an over-all hospital mortality of slightly under 9 per cent this is not a dangerous operation, bearing in mind the frequently very advanced age of these patients and associated major diseases of the cardio-respiratory system.

In terms of functional recovery, hip-pinning seems to be a more satisfactory operation than arthroplasty, even in this series where patients for arthroplasty were selected because of their good general condition and the anticipation of good functional recovery. Although almost 60 per cent of patients left the hospital still in wheelchairs after a stay frequently of many weeks, the large majority of them eventually became ambulatory, many of them without support. Of those who did not become fully ambulatory, there were certainly a few who had not been so before the accident and, therefore, they had been restored really to the preoperative status quo. Obviously no more can be expected from the operation.

Perhaps the most significant finding in this study has been the poor survival in patients operated upon as emergencies, and thus the realization of the benefits of an adequate all-round preparation to improve the general status as much as possible. This, despite the fact that early mobilization of these patients is obviously desirable to prevent cardiovascular and thrombotic complications. On balance, there is no doubt that the risk of an increased incidence of these post-operative complications must be borne for the sake of adequate preparation and the reduction in over-all mortality figures. Although not infrequently many days were spent to improve the general condition of the patient as much as could

reasonably be expected, spot checks of blood gases pre- and post-operatively have shown that most of these patients are in a state of at least compensated metabolic acidosis. No conclusions are being drawn from these findings at the present time since an inadequate number of patients has been studied. This project is now under way and comparisons will be made with geriatric patients who are not acutely ill, in order to determine a baseline for the aged.

Our clinical results have convinced us that it is unnecessary in the large majority of cases to use endotracheal intubation in the anaesthetic management of hip-pinnings, provided a perfect airway can be maintained. This permits a much lighter level of anaesthesia and the surgical stimulation is sufficient to ensure adequate respiratory exchange. These patients should be awake within minutes of the completion of the operation. Results from regional anaesthesia are not superior to those following general anaesthetic techniques, so that it is hardly justified to inflict on these patients the discomfort of positioning for spinal or epidural puncture. The actual choice of anaesthetic agent is of secondary importance as compared with meticulous management.

The postoperative period is characterized by the relatively frequent occurrence of pulmonary emboli, many of which are fatal. Routine prophylactic anticoagulant therapy has not been used in our series. Better results could be obtained if this complication could be prevented effectively. Other complications must be minimized by continuous and intensive postoperative management and supervision.

RÉSUMÉ

On a étudié deux cent douze opérations pour fracture de la hanche; de ce nombre, 92 étaient des fractures du col du fémur et 120 des fractures trochantériennes. Des 92 fractures du col, 60 furent traitées par des clous, et 32 subirent des arthroplasties. Quatre-vingt-deux pour cent de ces malades avaient plus de 60 ans, et 70 pour cent avaient plus de 70 ans. Les femmes étaient deux fois plus nombreuses que les hommes. Le rapport entre la chirurgie électorale et l'urgence s'établissait à 3.2 pour 1. Pour 80 pour cent de l'ensemble des malades, on demanda une consultation en médecine; environ le même nombre eurent un électrocardiogramme avant l'opération; le tracé fut anormal dans 60 pour cent des cas. L'anesthésie générale fut pratiquée pour 82 pour cent des malades; les autres eurent une rachidienne ou une épidurale. Dans la plupart des cas, l'induction à l'anesthésie générale fut pratiquée à l'aide d'un barbiturique à action ultra rapide en injection intraveineuse. Toujours l'anesthésie fut continuée au protoxyde d'azote additionné, la plupart du temps, de trichloréthylène, d'halothane ou de mélange azéotropique fluothane-éther. Les myobrésolutifs ne furent utilisés que pour les manipulations de la fracture ou pour l'intubation endotrachéale. L'intubation fut rarement pratiquée pour l'enclouage lorsque le malade était en décubitus dorsal; par ailleurs elle fut d'usage courant pour les arthroplasties, puisque pour cette opération, le malade est couché sur le côté.

La plus fréquente complication observée au cours de l'anesthésie fut l'hypotension; elle se produisit dans 37 pour cent des cas opérés sous anesthésie régionale mais, dans seulement 8 pour cent des cas d'anesthésie générale;

l'administration intraveineuse de vasopresseurs corrigea rapidement cette complication.

Au cours de leur hospitalisation 8.9 pour cent des malades moururent; de ce nombre, trois sont décédés moins de 24 heures après l'opération. Il n'y eut aucune fatalité parmi les cas d'arthroplasties. Ces résultats sont satisfaisants si l'on considère l'âge, avancé et la présence de troubles cardio-respiratoires graves chez plusieurs de ces malades. Les deux observations les plus intéressantes furent que le taux de mortalité fut presque deux fois plus élevé chez les hommes et presque trois fois plus élevé pour les cas d'urgence. La durée de l'anesthésie ou de l'opération n'a pas semblé influencer les résultats. Les embolies pulmonaires dépassèrent, par une forte marge, toutes les autres complications postopératoires; plusieurs fois, ces embolies furent la cause de la mort. La plupart de ces malades reçurent leur congé alors qu'ils étaient encore en chaise roulante; mais plusieurs purent marcher par la suite.

On a suivi durant une assez longue période les 198 malades opérés avant juillet 1962. Parmi ceux qui avaient quitté l'hôpital vivants, 65 pour cent vivaient encore en 1963, c'est-à-dire jusqu'à huit ans après l'opération. Quatre-vingt étaient décédés depuis leur départ de l'hôpital.

Nous avons conclu que, si possible, cette opération ne doit pas être pratiquée d'urgence, mais que les malades doivent être étudiés attentivement et que leur état général doit être amélioré autant que possible. Nous sommes aussi convaincus que, dans la plupart des cas, l'intubation endotrachéale n'est pas nécessaire; il est très avantageux de maintenir une anesthésie légère, ce qui est plus facile si le malade n'est pas intubé. Peu importe le choix de l'agent anesthésique, pourvu qu'on tienne compte des principes d'une bonne anesthésie.

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