SURGERY IN THE AGED PRE-OPERATIVE AND POST-OPERATIVE CARE

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Demographic Trends

NEARLY half the patients admitted to general wards of hospitals today are over the age of 60 (*Lancet*, 1963); the average age of patients admitted to Geriatric Units varies between 75 and 80, and in the Sunderland Geriatric Unit over one-third of all the admissions are over 80 years. The number of operations performed on patients of 60 and over (excluding orthopaedic and urological conditions) by one surgical team in Sunderland has increased from 344 in 1952 to 614 in 1962, those over 60 accounting for 20% of the total number of cases operated on by the team during 1962.

Although this figure is loaded by the special co-operation which exists between this surgical team and the geriatric unit, the number of operations performed on patients in the older age groups by other surgical teams in the area has also increased. The following table shows a comparison of the number of operations done in different groups in 1952, 1957 and 1962, by one surgical team. Co-operation with the Geriatric Unit was unchanged throughout this period.

By 1975 it is estimated that one-seventh of the total population of England and Wales will be over the age of 60. Already there are 3½ million persons in Britain of 70 years and over, and nearly 2,000,000 of 75 years or more (Godber, 1962). Clearly in the future Geriatric Units will

feel an increasing shortage of beds to the extent that failure to deal with surgical cases may contribute to a complete breakdown.

Operative Mortality in Old Age

The risks of surgery in the aged have been over-estimated. Today the operative mortality for older patients is certainly less than it was in the past, due to the advances which have been made in anaesthesia, control of infection, understanding of water and electrolyte balance and improved operative techniques. Carp (1950) found an overall improvement of 25% in the mortality in elective and emergency surgery between 1939-1944 and 1945-1949, and a mortality rate for emergency surgery two to two and a quarter times that of elective surgery. Bosch, in 500 major operations during the period 1947-49 on patients of 60 years and over, noted a mortality of 9.6% as compared with 3.01% for patients under 60 (Bosch, Islam, Tarr and Beling, 1962). Of his cases 9% were emergencies and they included orthopaedic, urological and gynaecological conditions. Bosch also found that the mortality rate in patients with concomitant disease was 12.3 as compared with 6.6% of those without. For comparison, our figures for 1962 are shown in Table 2.

This table also demonstrates the increase of mortality rate with age. Our mortality rate for elective operations during this period was 6.4% as

TABLE I
OPERATIONS PERFORMED BY ONE SURGICAL TEAM

Year	Total	Over 60 Years	Age 60-69		Age 70-79		Age 80 and Over	
			No.	Percentage of Total	No.	Percentage of Total	No.	Percentage of Total
1952 ..	1,301	359	202	56.2	146	40.7	13	3.6
1957 ..	2,935	540	316	58.5	180	33.3	44	8.1
1962 ..	3,032	614	361	58.8	189	30.9	64	10.4

TABLE 2
NUMBER OF DEATHS IN VARIOUS AGE GROUPS OVER 60
YEARS (1962)

Age Group	No. of Operations	No. of Deaths	Mortality Rate
60-69	361	15	4.2%
70-79	189	16	8.4%
80 years and above	64	11	17.2%
All groups ..	614	42	6.9%

compared with 13% for emergencies. It is, however, difficult to obtain comparable series because some surgeons avoid operating on a bad risk case, whereas others accept a higher mortality rate by taking on the critically ill subject. Nevertheless, what can be done pre-operatively to reduce the risk has been in the past underestimated, and with proper care even the most seriously ill old person has a reasonable chance of survival.

Pre-operative Assessment and Preparation

Successful pre- and post-operative care in old age depends largely on an appreciation of the physiological differences between the young and old, and on a thorough clinical assessment and examination of the patient to detect latent disease which might become patent under conditions of surgical stress. For example, in the old there is loss of efficiency in the homeostatic mechanisms controlling water, electrolytes, blood chemistry and temperature. The aged do not tolerate heat and cold well. Their vasomotor responses are less effective. They are, therefore, more susceptible to sudden changes in circulating blood volume such as those which occur in shock, hæmorrhage or burns. Hypoxia is poorly tolerated by the heart and cerebrum. Disturbances of water and electrolyte balance rapidly occur so that the elderly patient more readily becomes overhydrated with the danger of pulmonary œdema, or dehydrated with the danger of pre-renal failure. Their response to infection is diminished so that the temperature chart gives little warning of inflammation. It should be remembered that confusional states in the elderly commonly arise as a result of disturbances of all the above mechanisms. The rate of metabolism is also lowered in old age and mild hypothyroid states are common, depression of bone marrow function is not unusual and in some cases is due to thyroid deficiency. The aged also tolerate certain drugs badly, barbiturates and morphine particularly produce undesirable reactions and side-effects.

The multiple pathology which is a feature of disease in old age makes assessment of all the bodily and mental functions necessary before major surgery is undertaken. Furthermore, the old

person's intolerance of an adverse or even a strange environment is important and must be met by understandable explanation and reassurance.

To ensure effective liaison between physician and surgeon and continuity of care throughout, the Sunderland Geriatric Unit and Surgical Department have had, since 1952, combined wards so that during preparation, surgery and convalescence the patient remains in the same bed, in the same ward with the same medical and nursing staff. All patients in these wards as a routine have a full clinical examination and the following tests are made pre-operatively:—

Hb. and film, blood group, PCV, serum proteins, WR, blood urea, urine analysis, ECG and X-ray of the chest. Liver function tests and prothrombin estimations are also done where there is a possibility of hepatic insufficiency. The blood volume is estimated in those cases where it is suspected that hypovolaemia associated with dehydration are invalidating hæmatocrit measurements.

The importance of correction of depleted blood volume pre-operatively cannot be over-emphasised. Beling, Bosch and Carter (1952) found that in 190 elderly patients who did not have blood volume studies prior to surgery and were given blood according to bedside indications, the mortality rate was 17.4% compared to 8% in 100 patients who had blood volume studies and sufficient blood before operation to restore the estimated normal volume. Death rate from cardiac failure in the first group of patients was 5.2% as compared with none in those who had adequate blood replacement pre-operatively.

In assessing the clinical state of the patient an attempt should be made to relate the patient's biological age to his chronological age. These do not always by any means correspond, and a person of 75 may look years younger and be vigorous and in good health, whereas another at the age of 60 may look considerably older than his years. On the whole it is the latter type which constitute the bad risks, and who need to be examined with great care to detect and correct abnormalities, if operation is to be carried out without undue mortality. No patient is refused operation because of the presence of disease if it can be corrected even temporarily.

Patients with cardio-vascular insufficiency are accepted unless in irreversible heart failure. Most operations can be undertaken on patients who have had a coronary thrombosis if they are not in actual cardiac failure, but unless there is extreme urgency surgery should be postponed for three months after the infarction. This does not, however, apply to operations on the gall-bladder which carry a very high mortality rate in patients

with co-existing heart disease. Gaster found the operative mortality ten times greater in operations on the biliary tract in those over 50, as compared with those under this age. Amdrup, Halkieq, Køster, Sønder and Zachariae (1958) report a mortality of 15% in biliary tract surgery over the age of 70. Autopsies on our patients who died following operation for cholecystectomy, showed that the majority of the deaths were due to coronary occlusion, most of the remainder being due to peritonitis. We believe that our mortality rate for this condition, which is lower than in some reports, is due mainly to exclusion or pre-operative preparation of patients with concomitant coronary artery disease (Table 3). Although less than 5% of such patients assessed by us are refused surgery we were concerned about the resulting prolonged suffering from biliary pain, but on follow-up found they had generally died of their cardiac disease within one or two years. It would seem that cardiac deaths following biliary operations are only anticipating the natural event by a few months, and it is undesirable that they should be attributed by relatives to the surgery. On the other hand we advise cholecystectomy when gall-stones are found in younger

patients even if symptomless in order to avoid this dilemma in later life.

Chronic bronchitics tolerate operation well. In our experiences the post-operative mortality in bronchitics undergoing major surgery has not been greater than in those without respiratory disease provided that before operation they are given instruction in postural coughing, antibiotics after sensitivity testing of organisms in their sputum, and a period of high protein feeding.

The worst malnutrition and electrolyte imbalance occur in patients with pyloric stenosis—the regime adopted pre-operatively in these cases is as follows:

Where stenosis is suspected a Jacques tube is swallowed by the patient and the stomach contents aspirated. The appearance and quantity of the aspirate will show whether stenosis with gastric retention is present or not. If it is present all oral fluids are absolutely forbidden and the gastric contents are aspirated four hourly until the aspirate is clear fluid and less than 100 ml. The period between aspirations is then lengthened to 12 hours and then to 24 hours if there is no increase in quantity. After two days of 24-hourly aspirations plain water is given by mouth in small but increasing quantities and the contents of the stomach aspirated each morning when the patient wakes before he has had a drink. Any increase in aspirate is an indication for going back one stage in the treatment. After two days of oral water, dry biscuits or hard toast (which cannot be swallowed without choking) are given and gradually the diet increased by the addition of food that has been passed through a cooking sieve. All normal foods are given in this way. Raw milk is forbidden because it coagulates into a tough clot in the stomach but the proprietary dried milks with mineral and vitamin additions can be used safely. During the period of total restriction of oral feeding the patient is given water and electrolytes as required by the rectal route or intravenously. Rectal feeding is convenient, involves less risk of complications and is almost always sufficient in these cases. When the patient has gained a further 5 lb. in weight after rehydration he is fit for operation.

Obesity creates major technical difficulties for the surgeon: the fat has poor resistance to sepsis and the excess weight makes post-operative movement including coughing more difficult. Weight reduction is essential even if it can only be achieved by in-patient dieting. The cause of any anæmia is investigated and treated, L-thyroxin is given where there is hypothyroidism.

If renal insufficiency is suspected due to a high blood urea in spite of adequate fluid intake and output, then it is advisable to assess renal tubular

TABLE 3
MORTALITY RATE (1962) IN PATIENTS AGED 60 AND OVER ACCORDING TO OPERATION PERFORMED

Name of Operation	No. of Operations	No. of Deaths	Mortality Rate of the Operation
Abdomino-perineal resection of rectum	15	8	53.3%
Gastrectomy for ulcer, including emergency gastrectomy for hæmatemesis	15	6	40.0%
Gastrectomy for carcinoma stomach	8	1	12.5%
Gastroenterostomy for ulcer	2	0	0.0%
Gastroenterostomy for carcinoma stomach ..	2	1	50.0%
Cholecystectomy and biliary shunt	53	5	9.4%
Amputation of leg	19	7	36.8%
Bowel resection	37	4	10.8%
Laparotomy and repair of perforation	7	1	14.3%
Other laparotomies	13	3	23.1%
Appendicectomy	13	0	0.0%
Mastectomy (radical)	22	0	0.0%
Total major operations ..	206	36	17.5%
Other operations (herniæ, lumbar sympathectomies, etc.)	408	6	1.5%
All operations	614	42	6.9%

function; for this the water concentration and dilution test of Volhard is used. Impairment of renal function is a dangerous complication especially where the surgical procedure may produce electrolyte imbalance or make artificial feeding necessary.

Diabetes of mild type is not uncommon in the elderly and is no contra-indication to surgery. Glycosuria due to diabetes should be controlled with diet alone, or diet with sulphonylureas, or insulin. During the pre-operative period it is important to give sufficient carbohydrate, about 175 g. daily and keep the blood sugar level between 200 to 250 g. throughout the 24 hours. The aged do not tolerate sudden fluctuations in blood level and a fall, which in a younger patient would be of no significance, in old people may produce hypoglycæmic shock. The reduced blood volume resulting from this may precipitate a coronary or cerebral thrombosis.

On the day before operation the diabetic patient can take his normal diet with or without insulin. The operation should, if possible, be timed for mid-morning, breakfast is withheld and the blood sugar estimated two hours before the administration of the anæsthetic. If it is not higher than 100 mg./100 ml. then 10 to 20 g. of glucose in hypertonic solution is given as a single intravenous injection; if the blood sugar is higher than 200 a small dose of globin insulin usually lowers the blood level in about four hours, when the patient will have already recovered consciousness. Between these blood sugar values special treatment is usually not needed as the blood glucose concentration during and immediately after operation remains steady and serious ketosis does not develop. The above technique developed by Dunlop (1957) ensures that the patient comes to the anæsthetist with an empty stomach. Aspiration pneumonia is a serious complication, especially in the aged with weak powers of coughing.

Post-operatively it is essential to give carbohydrate and to 'cover' it with insulin so as to prevent the development of ketosis. The majority of patients are able to take a cup of sweet tea in the late afternoon of operation, and one or two fluid feeds of 250 to 500 g. of carbohydrate later in the evening. The blood glucose is estimated after the operation at about 1 p.m. If the concentration lies between 100 to 200 g./100 ml. about one-third of the usual daily dose of insulin is given, increasing or decreasing the dose if the level is above or below these limits. Globin insulin is an appropriate preparation to use, for when it is given about 1 p.m. it starts to work in about four hours when the first carbohydrate food is taken and begins to exert its maximum effect between 8 p.m. and midnight thus 'covering' the two later feeds. If oral

feeding is contra-indicated 1½ litres of a 5% glucose solution, containing 75 g. of carbohydrate, must be given during the evening by intravenous infusion and continued as necessary, the appropriate soluble insulin cover given at intervals in dosage determined by frequent estimations of the blood glucose concentration.

Emergency surgery in diabetes demands the closest co-operation between the surgeon, anæsthetist and physician. No diabetic with clinical ketosis should be given a general anæsthetic unless the emergency is extreme. When ketosis, heavy glycosuria and dehydration are present the indication for pre-operative intravenous fluid, electrolyte replacement and the administration of considerable doses of soluble insulin is absolute.

The most common operation in the diabetic is amputation of a gangrenous limb. We are inclined to agree with Amdrup and others (1958) that very little is attained by expectant therapy in established gangrene and we are now operating earlier in these cases, the patient being given pre-operative instruction in wheel-chair and other rehabilitation techniques which he will need to use post-operatively.

Anæsthesia

The choice of anæsthetist is more important than the choice of anæsthetic. Full oxygenation should be maintained and in the aged the dose of pre-medication should be reduced by half. In order to minimize the rise of post-operative cerebral thrombosis, it is important that the anæsthetist should move the head and neck with great care to avoid kinking of the carotid vessels when introducing endotracheal tubes. It is important that the anæsthetist should watch the blood pressure closely throughout the operation, blood replacement being carried out in the theatre if there is any significant fall.

Post-operation Care

The gag reflex of the old person is diminished and special care should be taken when the patient is coming round from the anæsthetic to avoid aspiration of vomit. Suction should be used to remove excess secretion from the bronchi to prevent post-operative atelectasis. In old people the minimum of sedation should be used and opiates and barbiturates avoided. Methadone in a 10 mg. dose, repeated if necessary, is the drug of choice for pain. Chlorpromazine has radically altered the approach to the confused and violent post-operative case. Such cases in the past had to be heavily sedated which was, of course, most dangerous. Chlorpromazine controls their restlessness without sedating them and has been most valuable (Sanford, 1960). It is important when

the patient is unconscious or drowsy that he should be moved half-hourly in order to prevent the development of pressure sores (Exton-Smith and Norton, 1960). Oxygen therapy is indicated if there is the slightest sign of cardiac embarrassment. As soon as the patient comes round he should be encouraged to cough and breathe deeply. With very few exceptions the patient should be got up within 24 hours of operation and walk a little. This is the most important factor in improving aeration of the lungs, and in the prevention of post-operative intravascular thrombosis and embolic phenomena. The chief contra-indication is the presence of serious inflammatory disease such as peritonitis.

Until the urine output reaches 1 litre/24 hrs. a very careful check should be kept on fluid intake and output. The normal physiological response to surgery and trauma is increased activity of adreno-cortical hormones, and secretion of anti-diuretic hormone. This results for the first 24 hours in a retention of sodium and water, with low urine output of raised specific gravity. The impaired excretion of sodium may last from three to six days; this is associated after the first 24 hours by a marked fall of urinary concentration of sodium and chloride. At the same time, i.e. after 24 hours and lasting usually for two to four days post-operatively, mobilization of potassium occurs with increased excretion of potassium and nitrogen, due to tissue breakdown. Concomitant with the water retention after operation there is a fall in plasma sodium and chloride and a rise in plasma potassium (Le Quesne, 1957).

Most patients are able to return to normal fluid intake a few hours after operation and the urinary output will be satisfactory. If, however, the charts show a discrepancy between intake and output the cause should be determined. If there is known to be renal impairment the fluid intake will have to be adjusted accordingly. If albumin is found in the urine post-operatively in a patient who has had a marked drop of blood pressure or has received blood during the course of the operation, then renal tubular damage should be suspected. This is fortunately a rare event.

When fluids and electrolytes have to be given by rectum or intravenously during the post-operative phase difficulties may arise, as the elderly patient is less able to adjust his response. There is danger, during the first 24 hours, of overhydration. This can cause nausea and vomiting, confusional states and oedema. There is also danger of salt overload with development of pulmonary oedema. Potassium deficiency generally appears on or after the fourth day and results in paralytic ileus, muscular weakness and fatigue. Great care should, therefore, be taken in administering fluids

to the elderly, and it is always wise to keep them on the dry side for the first 24 hours; about 1 litre is a reasonable allowance. The fluid intake after the first day should be balanced against the normal losses, i.e. 1,000 ml./24 hrs. for insensible loss, 1,000 ml. to allow a reasonable urinary output. No salt should be added during this phase. When diuresis occurs the intake should be raised to 3 litres, and it is desirable to add 5 g. salt if there has been loss from vomiting or other cause. After the fourth day 4 to 6 g. potassium will be needed where there has been previous loss. Potassium deficiency characteristically occurs at the time when recovery of the patient begins, that is to say when rapid tissue breakdown with its release of large quantities of potassium into the circulation ceases.

As mentioned previously early ambulation is an essential part of post-operative care. Patients are encouraged in self-care from the start and it is important to notice how well the patient learns to cope on his own as this indicates whether a protected environment will be needed on discharge from hospital. Early application can then be made for admission to Part III accommodation or to the Local Authority for a Home Help, Home Nurse and other aids if the patient is to return home. It is important that these arrangements are made in advance of discharge as the longer an old person remains in hospital, the more likely he is to be rejected by his relatives. It is preferable for the doctor to have a personal talk with the relatives to discuss any social problems which may hinder progress.

Mention has been made of confusional states which might arise and complicate convalescence; these are rare if the regime outlined has been adopted. Nevertheless it is necessary to draw attention to two other important causes of confusional states frequently overlooked—retention of urine and faecal impaction. The former not only occurs in elderly men with prostatism but it is not at all uncommon in women particularly when they are faecally impacted. Retention of urine should always be considered in any old person who develops a confusional state. The omission of a rectal examination in the confused elderly patient can quite rightly be regarded as negligent.

A further post-operative complication with paucity of physical signs that may quite easily be missed is atelectasis due to small pulmonary emboli. This usually occurs about the third post-operative day and the presence of tachycardia and dyspnoea may be the only indication of it. Tenderness in the calf muscles should be sought as a routine; when present it may indicate venous thrombosis and anticoagulants should be used if the condition seems to be progressive. The

importance of movement in the prevention of embolic and thrombotic episodes cannot be too strongly stressed. Wound dehiscence is a complication of poor nutritional state associated with post-operative cough. The importance of quite an extensive period of in-patient treatment before operation to improve nutrition is emphasized; postural coughing, by making expectoration easier, reduces the risk of ruptured abdomen.

The mortality rate is often higher in old people than it should be because they come to surgery with advanced disease and malnutrition. Even with the best post-operative care one can only achieve modest results in these cases. The very high mortality rate for abdomino-perineal resection of the colon in the aged seems to be due to malnutrition resulting from prolonged illness and late diagnosis. This is especially tragic because this particular type of cancer is not one liable to produce early secondaries. Here again emphasis must be placed on careful investigation including rectal examination of all patients who have abdominal symptoms, change of bowel habit, change in appearance of faeces or who are losing weight. Examination under anaesthesia and sigmoidoscopy are valuable in the diagnosis of this condition and of carcinoma of the colon before an advanced stage has been reached. It cannot be too strongly emphasized that negative barium studies should not be taken as proof of

the absence of cancer of the gastro-intestinal tract where symptoms suggest its presence.

Summary

Although operative mortality increases with age it can be considerably reduced by pre-operative assessment and treatment and post-operative care. Special emphasis is placed on the detection of intercurrent disease which is common in the aged. Full correction of water and electrolyte imbalance, diminished blood volume and anaemia is essential. Thyroid deficiency, cardiovascular and respiratory disease, renal and hepatic insufficiency must all be diagnosed if present and treated before operation. Before cardiac assessment with ECG study was made a routine in cases with gall-bladder disease a considerable incidence of post-operative cardiac infarction occurred. Early ambulation and an atmosphere of activity and optimism are especially necessary in the geriatric surgical ward.

It has been found that the needs of the aged surgical case are best met by nursing them in a medico-surgical ward. Diagnosis, pre-operative assessment and preparation, the operation and post-operative care are completed from the one bed, with one nursing team and with the continuous attention of physician and surgeon. When this level of treatment is given to the aged they stand surgery well and it is rare for any patient to be found unfit for operation.

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