

SEVERE PSYCHIATRIC DISTURBANCES IN THE POST-OPERATIVE PERIOD—A FIVE-YEAR SURVEY OF BELFAST HOSPITALS

By

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THERE are few incidents more calculated to disturb the well-ordered routine of a surgical unit than when a patient develops a severe psychiatric disorder in the post-operative period. Such episodes may occur suddenly after an interval of seemingly uneventful recovery and in some instances may be of such severity as to result in an appreciable and even dangerous deterioration in the patient's physical state. The impact on relatives must also be considered, for it is easy to understand the dismay which they must experience on observing the patient pass from a state of apparent composure into one of hyperkinetic excitement, panic, or confusion.

The first comprehensive account of the disorder is usually attributed to Dupuytren of Paris (21). In the eighth of his series of clinical lectures in surgery published during 1834 he commented, "... finally, the brain itself may be overcome by pain, terror, or even joy, and reason leaves the patient at the instant when it is most necessary to his welfare that he should remain calm and undisturbed." Having presented 7 examples of "nervous delirium" he continued, "It begins sometimes by incoherent gestures and irregular movements, but most often in a sudden and unexpected manner, in individuals often placed in the most favourable circumstances . . . individuals affected with this kind of delirium are often so utterly insensible that patients with comminuted fractures of the lower extremity have dragged off all their dressings and walked about on the broken limb, without exhibiting any signs of pain; others, whose ribs were broken, tossed themselves about and sang without seeming to feel pain; finally, it has happened that a patient who had been operated on for hernia introduced his fingers into the wound, and amused himself by unrolling his intestines, as if he were working on a dead body."

Although the post-operative psychoses have been recognized for many years, there is little agreement regarding various aspects of the problem, such as incidence, the contribution of the anaesthetic and the relative importance of the site of operation.

In this paper a re-examination of relevant studies will be undertaken, and the association with cataract extraction, gynaecological and cardiac surgery will be particularly stressed. In addition, an evaluation of the disorder as it has occurred in the Belfast Hospitals over a 5-year period from 1 January, 1956 to 31 December, 1960 will be presented.

REVIEW OF THE LITERATURE

INCIDENCE

The incidence of post-operative psychosis is generally given as 1 in 400 operations (Kelly, 38). Da Costa (16) anticipates the frequency as 1 in 250 laparotomies. Lewis (42) considers such estimates to be excessively high and he reports that in a large general hospital where there were approximately 2,000

operations yearly the incidence over a 5-year period was 1 in 1,500. During a similar period Stengel, Zeitlyn and Rayner (62) studied 80 patients who had been admitted to St. Francis Hospital Observation Ward and to the Maudsley Hospital with this diagnosis. The patients had been transferred from 35 hospitals in London and beyond and the authors suggested that the number of patients lost from their series by referral elsewhere was not significant. They did not indicate the total number of operations carried out in these hospitals during the period of study and therefore the incidence of severe post-operative psychiatric disturbance cannot be assessed. Nevertheless, from such a large catchment area, the total appears low and would seem to indicate that the disorder is comparatively uncommon. Recently Scott (58) has discussed this disorder in the aged and described 11 cases as occurring in 2,000 surgical procedures.

It is difficult to estimate retrospectively the overall incidence for a variety of reasons. The manual *International Classification of Disease* does not list post-operative psychosis as a specific entity, and the clinical picture varies so that cases may be assigned to different categories, the primary diagnosis listed as schizophrenia, depression or delirium, and a superficial statistical study of the post-operative psychoses as a group rendered extremely difficult. Furthermore, it is probable that many cases having less severe psychiatric disturbances are not referred to a psychiatrist, this largely depending on the willingness of the surgeon to deal with such problems and the capacity of the nursing staff to adapt to psychiatric nursing. Again, a psychiatrist may be asked for advice and include a brief statement in the general notes. Unless the patient is transferred to his unit no formal clinical records may be available. The type of patient generally treated in the ward may partly determine whether referral is undertaken. A mild to moderate degree of post-operative confusion may not be regarded as exceptional in an ophthalmic department where a large proportion of the patients are elderly and having cataract extraction, whereas in a general surgical ward such an episode would probably give rise to much more concern.

SITE OF OPERATION

In spite of uncertainty regarding the incidence of the disorder it has, for many years, been held that two surgical procedures, namely gynaecological operations and cataract extraction, are particularly liable to give rise to post-operative psychoses. Recently there has been an increasing awareness of the frequency with which psychiatric disturbance follows cardiac surgery.

(i) *Cataract Extraction*

The first report in English literature of psychiatric sequelae to cataract extraction was published in the *Medical Times and Gazette* in 1854. Pre-operatively a 65-year-old man with bilateral cataract was agitated to such a degree that extraction had to be postponed for 24 hours so that chloroform could be administered. During the first post-operative day "delirium set in, and continued with violence until . . ." the fifth day, when he made a satisfactory recovery.

Since then many authors have emphasized the frequency with which psychotic disturbance follows the operation and the incidence has usually been given as 2–3 per cent. (Greenwood, 31; Oltman and Friedman, 49). Brownell (10) found 30 cases of delirium in 962 instances of cataract extraction performed at the Ophthalmic Clinic of the University of Michigan between 1904 and 1917.

Preu and Guida (50) commented on the psychogenic nature of the illness though they described only 4 cases. They thought that the ageing process was to be considered only in its experiential aspect and not in the sense of senile arterio-sclerotic encephalopathy. Blindfolding has been regarded as significant in precipitation of the psychiatric disturbance (Brownell, 10; Greenwood, 31; Russell, 54) and removal of the bandages leads, in many cases, to elimination of the disturbance. In such instances the success of unmasking will, of course, depend on the degree of visual impairment in the eye not operated upon. Studies of experimental sensory isolation are pertinent in this context (Heron, 35; Shurley, 60). Such investigations establish that most individuals, irrespective of age, can be profoundly affected by a restriction of stimuli received through sight, sound and touch.

Elderly persons readily become emotionally disturbed when confronted with new situations, especially if these are inadequately comprehended and associated with feelings of insecurity. It has long been appreciated that a sympathetic and understanding nursing staff can do much to support and fortify the patient during the period of blindfolding and thereby may help to relieve or prevent post-operative psychosis. Such disturbance is liable to increase in severity at night as auditory cues of day-time activity are reduced, and silence, interrupted by isolated and muffled sounds, becomes the patient's principal contact with the world he can no longer see. Misinterpretation of these stimuli may induce panic. Bruns (11) treated 272 consecutive patients having cataract extraction on an ambulatory basis. Each was returned to his home immediately after the operation and in no cases did psychosis develop. Weisman and Hackett (66) have discussed the paramount importance of establishing a strongly-supportive doctor-patient relationship in the prevention and treatment of post-operative delirium.

Linn and his co-workers (44) demonstrated the effect of masking pre-operatively. They studied 21 consecutive patients admitted for senile cataract extraction. Prior to surgery each subject was blindfolded for a period of at least 12 hours and in 10 patients the procedure was associated with disturbed behaviour. Anxiety could be relieved by removal of the mask. Post-operatively 20 patients (95 per cent.) demonstrated some alteration in behaviour including delusions, hallucinations, disorientation and confabulation.

It is evident that many cases of post-operative cataract delirium can be understood in terms of the inability of vulnerable patients to adapt to severe psychic stress in the form of anxiety-provoking surgery and temporary loss of vision in unfamiliar surroundings. It seems, therefore, that an important prophylactic measure would be to admit the patient for a sufficient period pre-operatively to permit him to become familiar with his surroundings and become acquainted with the doctors and nurses who will be responsible for his welfare. An interesting study by Wynne, Fang and Gibson (68) lends support to this. In the 10-year period 1941-1951 there were 26 cases of post-operative psychosis following cataract extraction transferred to the disturbed ward of the Psychiatric Service, Massachusetts General Hospital. Cataract extraction was performed 10 times more frequently than retinopexy. Following 1,950 retinopexies, 4 patients were noted to be psychotic but in only one instance was there the possibility that the operation had been the precipitating factor. The retinopexy group had a much greater number of eye operations previously and the time allotted for pre-operative preparation was significantly greater in this group. It was considered that this factor was most important in that the cataract patients had little or no experience of previous ophthalmic surgery. There

seemed to be no association between the exhibition of drugs such as atropine or barbiturates and the development of psychiatric disturbance.

It would appear that the loss of visual cues may be sufficient in itself to induce a psychotic reaction in a proportion of patients. In others the operation merely brings to light a dementing process which had not been recognized beforehand, and sedation with barbiturates post-operatively may serve in a number of these to heighten the confusion. A factor which also warrants consideration is that some of these patients may have been living a solitary existence and quantitative or qualitative dietary deficiency may condition them to post-operative psychiatric disorders.

(ii) *Gynaecological Surgery*

At one time genital disorders were regarded as a cause of insanity in women and accordingly gynaecological surgery was advocated as a therapeutic measure. Russell (55), in 1897, deprecating this practice commented: "The specialist in surgical gynaecology believes that insanity in women is largely, if not altogether, due to pelvic disorders, and he proceeds to restore to reason the unhappy victim by unsheathing his scalpel and removing the offending organ. He wages his most relentless fury on the ovaries, for in them he believes reside the chief demoniacal spirits that torture the unhappy lunatic.—Happy, thrice happy should man be because of the simplicity of his genital outfit, and its meagre attraction for the operation of surgical science."

Both gynaecologists and psychiatrists have remarked on the psychological implications of hysterectomy. Donovan (19) has commented "the loss of menstrual function is perceived by the woman as a blow to normal feminine self-esteem". Weiss and English (67) point out that hysterectomy means termination of child-bearing capacity and the more it antedates the menopause the greater is the likelihood of associated psychological disturbance. Even after the menopause it may lead to conscious or unconscious resentment for the operation is regarded as interfering with capacity to function sexually or to be a satisfactory sexual partner. Lindemann (43) studied 51 women by neuropsychiatric examination prior to major abdominal surgery. Post-operatively 13 patients showed restlessness, insomnia, agitation and pre-occupation with depressive thought content beginning from 3 to 4 weeks after surgery and lasting for more than 3 months. The relative frequency of this disorder was much greater after pelvic operations than cholecystectomy, and it developed more frequently in those who had a previous history of depressive episodes. No significant relationship to pre-operative anxiety, sexual maladjustment or environmental factors could be demonstrated in the group studied. Stengel and his colleagues (62) found that gynaecological procedures were highly represented in their series of post-operative psychosis, and hysterectomy comparatively more frequently than any other gynaecological operation. They proposed that reasons for this may be the psychological significance of hysterectomy, "its frequency in a vulnerable age" and the degree of the procedure itself. They were careful to point out that in such a small series as theirs the significance of this finding might be questionable and that large-scale investigation on a regional basis was required to allow of more valid conclusions. Their findings could also be explained if their series was a biased one with a disproportionately high percentage of referrals from a unit where there was interest in psychiatric response to gynaecological surgery. Kroger (41) advocates careful pre-operative evaluation of the personality needs of all patients sub-

mitted for the operation, thereby facilitating physical, sexual and social adjustment. When physical indications for the procedure are predominant the emotional disturbance may initially be overshadowed. When hysterectomy is recommended for borderline indications all patients should have pre-operative psychological appraisal. Hollender (36) found that of 203 women admitted to Syracuse Psychiatric Hospital in 1958 there were 9 in whom pelvic surgery appeared to be the precipitating event. This was regarded as in sharp contrast to the total of 5 women admitted following operations of all other kinds. Apart from two patients presenting with a clinical picture of schizophrenia all those who had pelvic operations displayed agitation and depression. It was felt that the disorder could be understood in terms of a profound psychological reaction to loss of child-bearing capacity.

As yet it cannot be stated categorically that hysterectomy *per se* carries a significantly higher incidence of severe psychiatric disturbance than does any other operation of similar magnitude in the same age group. Apart from Lindemann's report (43) there is a lamentable lack of relevant studies, and the specific emotional implications of the procedure would seem to warrant further evaluation. As such psychological reactions to hysterectomy are stressed in medical teaching and literature, often supported only by clinical impressions, the doctor may be more likely to enquire for and comment on such responses and be unaware of similar states following other operations. Again, we do not know how frequently hysterectomy, as compared to other procedures, is undertaken for predominantly emotional disturbance. In relation to this problem Gidro-Frank, Gordon and Taylor (29) have recently called attention to the significance of emotional factors in women presenting with pelvic pain. Psychiatric features, evident post-operatively, may have been present but unobserved pre-operatively, especially if the patient was in hospital for only a brief period before surgery.

(iii) *Cardiac Surgery*

Serious psychiatric disturbances have been observed to occur with considerable frequency following mitral valvotomy. Fox and his co-workers (28) interviewed pre- and post-operatively 32 patients submitted for this operation and noted that 6 (19 per cent.) had "obvious emotional disturbances" following the procedure. In addition, several other cases had less severe and more transient psychiatric sequelae. This report could be criticized in that the authors gave little information on objective measures of physical deterioration or improvement. Nevertheless, theirs was a valuable contribution, for as far as can be ascertained it was the first report on psychiatric complications in heart surgery. Bliss, Rumel and Branch (5) studied the hospital records of 37 patients who had undergone mitral surgery, and found 4 cases of post-valvotomy schizophrenic reactions; a further two patients developed confusional states. This is equivalent to approximately 16 per cent. of the total. A further six patients "although not psychotic, were sufficiently anxious and depressed to merit comments by both physicians and nurses". Bolton and Bailey (7) analysed the records of 1,500 consecutive patients who had had some type of intracardiac procedure for correction of valvular defects resulting from rheumatic fever. Even minor degrees of mental aberration were considered as post-operative psychosis. Whilst appreciating the difficulty in accurate evaluation of what constitutes abnormality it was felt that symptoms such as "euphoria, depression and mental confusion in minor degrees, as well as the usual frank psychotic mani-

festations, should be classified as such". The incidence of post-operative psychosis was 3·14 per cent. There appeared to be no relationship between the development of psychosis and sex, age, severity of heart disease, duration of failure, or complications at surgery leading to cerebral ischaemia. The one factor which seemed to influence the occurrence of psychic disturbance was the type of lesion. Cases of acquired heart disease with a "dynamically significant mitral insufficiency" were associated with a higher incidence of mental aberration than other lesions. Kaplan (37) examined 18 patients after the operation; 3 cases (17 per cent.) became psychotic and a variety of psycho-neurotic reactions occurred in others. Dencker and Sandahl (17) have noted in a brief communication that of 61 patients undergoing mitral valvotomy 3 became psychotic soon after the operation. However the frequency of major mental symptoms pre-operatively was also high, as 5 patients, including 2 of the 3 above "had had episodes of disorientation, delusions and/or hallucinations, usually with amnesia for at least a few days—in fact, organic psychoses". Another had a chronic depressive illness and repeatedly attempted suicide. The psychotic picture pre-operatively did not differ from that after surgery and it was suggested that the high incidence of severe psychiatric disturbance after surgery may not have been evident if some patients had not been psychiatrically disturbed before. Zaks (69) suggests that the disturbances may not be entirely psychogenic but that psychiatric problems in the rheumatic heart patients may be precipitated by "organic changes" in the course of the disease and valvular surgery. Priest *et al.* (51) suggest that the cardiac output may not be maintained during some intracardiac manipulations and cortical ischaemia follows.

Our knowledge of the psychiatric implications of heart surgery requires to be expanded, for here particularly is uneventful convalescence of paramount importance to the well-being of the patient.

ANAESTHESIA AND AGE

The anaesthetic is often incriminated as a direct cause of post-operative psychosis. Doyle (20) has distinguished between the post-anaesthetic and organic types of the disorder, reputed to follow immediately after the operation, and the "interval psychosis" where the onset of mental disturbance is preceded by a latent period of variable duration. Almost 40 years earlier Dent (18) had also implied such a distinction by stating, "I cannot believe that in the cases in which, as so frequently happens, complete mental recovery takes place after the anaesthetic, the mania then creeping in after this distinct and lucid interval of time, the anaesthetic has anything to do with the matter." However, it is well established that in a proportion of cases the psychiatric condition is directly or indirectly attributable to the anaesthetic. Batten and Courville (3) have issued a warning regarding nitrous oxide anaesthesia; in a survey of the literature they found 11 well-defined cases where mental disturbance followed induction with this agent, and they described a further 10 cases with which they were personally acquainted. In patients dying within a few days or weeks patchy necrosis or subtotal destruction of the cerebral cortex was found, often with necrotic change in the lenticular nuclei. Anoxaemic anoxia rather than a direct toxic effect seemed responsible. Bourne (8, 9) also has outlined some unhappy consequences of nitrous oxide administered in dental practice, even to young subjects.

It is, however, the elderly who are particularly vulnerable, as the incidence

of undesirable physical and psychiatric sequelae to surgical procedures increases with age. Klug and McPherson (40), dealing with this problem from the physical aspect, reviewed 732 operations performed upon patients of 60 years or over. Wound infection, gastro-intestinal, pulmonary and cardiovascular complications occurred in 35 per cent. as compared to 23 per cent. of the control series comprising patients under 60 years of age. The complication rate for minor surgery was 11 per cent. in the elderly and 4 per cent. in the younger group. Stresses which would seem to have no influence upon the young may produce a profound psychiatric upset in the older subject (Robinson, 52). Physiological and psychic balance, precariously adjusted, would be exceedingly vulnerable to such factors as transitory episodes of vascular insufficiency and cerebral anoxia. Studies by Fazekas and his associates (25) and by Scheinberg, Blackburn, Rich and Seslaw (56) have demonstrated that there is a marked decrease in cerebral blood flow and increased cerebral vascular resistance in individuals over 50 years of age. These changes are more pronounced in persons with cerebrovascular disease than in controls of the same age without demonstrable vascular pathology. Corday *et al.* (15) introduced the term "acute cerebral vascular insufficiency". They demonstrated clinically and experimentally that sudden arterial hypotension can result in transient or permanent cerebral damage. Profound haemodynamic changes have been observed during surgery (Snyder, 61; Fletcher *et al.*, 27; Clowes *et al.*, 12; Dwyer and George, 22; Heilbrunn and Allbritten, 34). Using a variety of methods such as dye dilution or radio-isotope dilution techniques there is almost general agreement that a decrease in cardiac output takes place during general anaesthesia, although the degree cited varies from study to study. Hypotensive anaesthesia has been regarded as contra-indicated in the elderly by many workers (Enderby and Pelmore, 24; Bedford, 4; Gray, 30). However, in a recent article Rollanson and Hough (53) pointed out that many clinicians have employed hypotensive techniques in these people. In the literature reviewed by them a total of 490 cases were recorded with a gross mortality of 40, only 9 of these being associated with the anaesthetic technique employed. They concluded that mortality and morbidity would seem to be no greater with hypotensive than with normotensive techniques. It has been claimed that the procedure is safe provided the systolic blood pressure is maintained above 80 mm. of Hg. Bedford (4) in a stimulating paper challenged the advocates of hypotensive anaesthesia, commenting, "The onus lies heavily upon them to prove that their technique is free from risk; and here it is not enough to quote survivals, for the patient's mental state is also a matter of great moment both to himself and his relatives. Until such proof is forthcoming, this practice should be condemned."

The unfortunate patient's ageing cerebral tissue may be assaulted by other potent antagonists and Allison (2) has drawn attention to the importance of avoiding dehydration and mineral depletion. He considers that whilst the organic cerebral consequences of factors such as these are usually reversible, the effects of anoxia and hypoglycaemia are often irreversible, these being associated with cellular death.

Sturgis *et al.* (63) have presented a preliminary report of the patterns of behaviour during anaesthesia recovery in 12 patients having hysterectomy and correlated this with the speed and quality of post-operative convalescence. In their experience post-operative response has little direct relation to physical factors such as duration and extent of surgery or blood loss. Those patients showing disciplined control on emerging into consciousness progressed satisfactorily with no overt physiological or psychological complications. Those

who were in "a childish state of utter dependence, hostility and inability to co-operate" often had a stormy physical and psychiatric convalescence.

ALCOHOL AND METABOLIC FACTORS

Alcoholic excess appears to facilitate post-operative complications, both physical and mental, but this has already been adequately discussed by Lewis (42).

A very considerable volume of research is available on the endocrine and metabolic phenomena associated with surgery. Little is known, however, of the biochemistry of post-operative psychoses and Moore's (47) standard reference of over 1,000 pages on the metabolism of surgery deals with the psychiatric aspects in less than 20 lines and gives no reference to metabolic studies dealing specifically with this problem. There is known to be individual variation to stress in terms of endocrine and metabolic function (e.g. Bliss *et al.*, 6; Schottstaedt *et al.*, 57; Cohen and Silverman, 14) and it would, in many instances, be difficult to evaluate biochemical investigations carried out during a disturbed phase post-operatively, as a pre-operative base line would not have been established.

PSYCHOGENIC FACTORS

Apart from the psychological implications of surgery already examined in relation to cataract extraction other studies warrant consideration. In 1909 Kelly commented that a "history of prolonged worry and dread of operation is the most influential cause of post-operative mental disturbance". Da Costa (16), writing from the standpoint of the surgeon, commented on the combined effect of pre-morbid personality, fear of the operation and physical factors such as blood loss and sepsis in precipitating the disorder. Abeles (1) also stressed that no one factor is responsible and suggested that in many cases the operation only serves to bring to light a latent psychotic tendency and that fears of death and mutilation are significant factors. Ebaugh (23) cautions against inadequate or injudicious preparation. Ill-considered and tactless remarks can engender panic and fear. Bernard Meyer (46) has given a comprehensive account of the profound emotional implications of hospital admission. Titchener and his colleagues (64) have indicated that ageing patients who have lost the proximity and support of family, friends, or visitors developed a psychosis in response to stress of illness and surgery more often than those who retained close family contacts. Sheffer and Greifenstein (59) investigated 100 surgical patients by a questionnaire and 50 of them had, in addition, a psychiatric interview. Fear of what might be seen, heard or felt in the operating theatre motivated 43 per cent. to select general anaesthesia as their first choice if they could select the anaesthetic. The anaesthetist was regarded as an impersonal and distant figure who carried out his appointed task both skilfully and efficiently but without emotional impact on the patient. Denial of fear or anxiety in relation to the operation or anaesthetic operated as a defence mechanism in 62 per cent. of all subjects. Hackett and Weisman (32, 33) have recently discussed the psychiatric management of operative syndromes, this term being employed to describe the various psychiatric complications which can arise during the course of surgical treatment. They stressed the importance of support by the psychiatrist throughout the patient's stay in hospital.

The duration of the latent interval recorded between surgery and the development of psychic derangement varies from study to study, and Stengel (62) has noted that in 3 of his cases it was as great as 9 weeks. The fact that a schizophrenic or depressive psychosis develops in the third post-operative month does not imply that the operation was responsible, especially if there was a former history of a similar disorder. Such patients might have become disturbed even if surgery had not supervened and the longer the latent interval the more critical should be evaluation of the relationship.

Some authors believe that post-operative psychotic reactions have specific clinical features. Muncie (48) described 4 cases presenting with early fear, mistrust and depression later developing into elation and over-activity with fear very much in evidence. It has been suggested that this is an attempt by the patient, as a reaction to his extreme fear of death, to convince those around him that he is still alive. Cobb and McDermott (13) have pointed out that the clinical picture is not so much that of acute delirium with confusion and disorientation but rather that of a vague alteration in perception and mood. Washburne and Carns (65) describe the mental symptoms as comprising a manic type of reaction which may incorporate psychomotor excitement, delirium, delusions which are predominantly those of persecution, and also visual or auditory hallucinations. Lindemann (43) maintains that agitated depression is the characteristic response in women after lower abdominal operations. Feiling (26), however, emphasizes the non-specific character of the disorder, and Stengel and his co-workers (62) also could not support the existence of a specific clinical entity "post-operative psychosis". An interesting paper by Oltman and Friedman (49) has recorded that whereas the elderly presented with confusion, disorientation, increased motor activity, hallucinations and noisy unco-operative behaviour, the younger patients demonstrated "a state of acute catatonia, withdrawal and stupor indistinguishable from schizophrenia".

THE PRESENT STUDY

Material and Method

The purpose of this enquiry was to re-examine the association between surgery and severe psychiatric disturbance. Particular consideration was to be given to incidence, clinical manifestations, previous and family history of mental disturbance and the patient's subsequent history principally in relation to further surgery. Again, having been acquainted with a number of such patients admitted to the Department of Mental Health the role of psychogenic factors could be assessed. It was also postulated that electroencephalographic studies after recovery from the illness might show a high proportion of abnormalities. Kennard (39), for example, has reviewed a number of studies demonstrating that the electroencephalogram in patients having functional neurosis or psychosis is more frequently abnormal than in the so-called normal population.

It was felt that such an appraisal as has been outlined could readily be undertaken in this area for a variety of reasons.

(i) If psychiatric evaluation is indicated for any patient in the Belfast Hospitals administered by the Northern Ireland Hospitals Authority, referrals will be to either the Department of Mental Health in the City Hospital or to Purdysburn Mental Hospital. This has the very obvious advantage that leakage

is negligible, as compared with larger cities served by several psychiatric clinics attached to general hospitals and in addition a number of mental hospitals.

(ii) The population of Belfast is a relatively stable one and little difficulty was anticipated in contacting patients for follow-up purposes.

(iii) Patients might be more willing to attend for review, since the great majority would be living within a 5-mile radius of this department.

(iv) Statistics with regard to the total number of operations carried out in the Belfast area could be readily obtained from the Hospitals Authority.

(v) General hospital notes are conveniently available for perusal.

The clinical records of both psychiatric units were then examined for the 5-year period from 1 January, 1956 to 31 December, 1960. In this department there operates a coding system on a standardized item sheet, and such a search was therefore extremely simple and reliable. However, at present no such system is available in Purdysburn Hospital. The admission registers of this hospital for the stated period were then examined and note was made of all patients admitted on transfer from general hospitals, irrespective of psychiatric diagnosis. Each case record was then studied and patients appearing to fall within the compass of this study were selected. It then became apparent that the sample had to be further refined and the following categories were excluded.

(i) Psychiatric disturbance following brain surgery. One such patient, for example, had eventfully survived two previous operations for partial removal of a brain tumour. When a third and more extensive removal was undertaken there followed a severe confusional state.

(ii) Psychiatric disorder following Caesarean section, as such patients might be more appropriately considered in the group of puerperal psychoses.

(iii) Patients in whom, although admitted after surgery, the primary diagnosis was dementia. Several elderly persons had been admitted following various orthopaedic procedures for fractures but it seemed likely that the operation had little to do with their mental state. Probably families had been coping with a dementing but ambulant relative until physical illness had necessitated treatment in hospital, and on account of the patient's mental state post-operative care could not be provided in a general hospital ward.

(iv) A number of subjects were chronic hysterics, psychopaths or drug addicts and it was apparent that surgery had been dictated by the patients' mental state rather than being directly responsible for it.

Using these criteria, a total of 36 cases were traced in the two departments during the 5-year period.

Each patient was then contacted by letter and asked to attend, being told that the interview was requested only for research purposes. Before each interview the appropriate general hospital records were studied.

RESULTS

Incidence

Excluding maternity and paediatric services there were 57,600 major operations performed in this area over the 5-year period under review. The incidence of severe psychiatric disturbance following surgery was therefore 1 in 1,600 operations. It was considered that in some instances a patient could develop a severe mental disorder attributable to surgery after discharge from

hospital, especially if his post-operative stay was brief, and admission to the mental hospital would then be from home. In view of the method of collecting material in this enquiry such cases would not be detected. To further explore this possibility 600 case records of admissions during the period of study were selected at random and examined. In no instance did surgery appear to be a contributory factor and it was evident that any leakage in this manner could be regarded as negligible.

Age and Sex

The series consisted of 15 males and 21 females and ages ranged from 26 to 70 years, the average being 48·8 years (males, 47·9 years; females, 49·6 years). Distribution according to age is presented in Figure 1 and the greatest proportion of cases is noted to be amongst the 41–45 year olds. In such a small series no valid conclusions regarding age and sex distribution could be entertained. The sex difference might be explained if more females were undergoing surgery, but in two surgical units with equal distribution of beds to each sex there was approximately the same number of operations on both groups over a two-year period. The same might apply to the age factor but also from these units there was no evidence that the 41–45 group constituted the greatest percentage of admissions. In fact, surgery was almost twice as common in the two groups from 46 to 55 years of age.

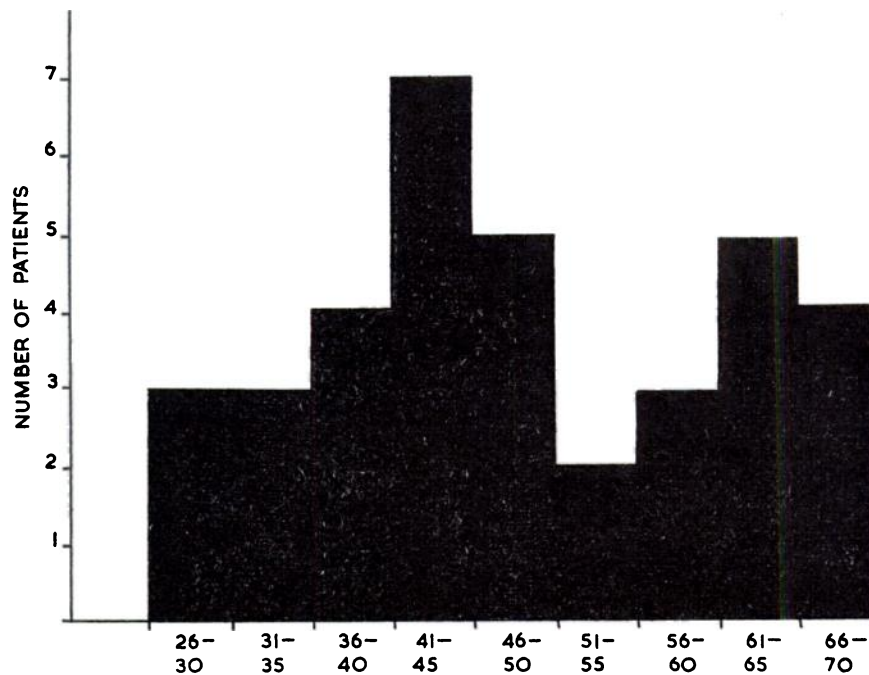


FIG. 1.

Site of Operation

Table I summarizes the sites of operation. Notable features are the high representation of mitral valvotomies and the fact that hysterectomy was regarded as contributory in only one case. Unfortunately precise figures for the

frequency of each operation are not available, but it seems likely that hysterectomy is a more common procedure than valvotomy. However, the high incidence of severe psychiatric disturbance following heart surgery which has been cited by various authors cannot be supported by observation in this area. The records of 50 consecutive patients having mitral surgery from this hospital have been closely studied and a further 30 patients have been seen before and after surgery for detailed psychiatric assessment. In only one of those patients studied retrospectively has a severe psychiatric complication occurred post-operatively. Of the 30 subjects examined in more detail one patient had a mild confusional episode lasting 48 hours. However, other reactions, particularly hysterical, are not uncommon. The abdominal operations noted were variously repair of perforated duodenal ulcer, repair of traumatic rupture of the bladder, ileostomy, colostomy, colectomy and choledocho-duodenostomy. Apart from hysterectomy the gynaecological procedures were for salpingectomy and oophorectomy, uterine suspension and cervical biopsy.

TABLE I
Sites of Operations

Operation	M	F
Dental procedures	2	—
Ear	—	1
Thyroid	—	1
Breast	—	2
Lung	1	—
Heart	2	5
Aorta (embolectomy)	—	1
Sympathectomy	—	1
Stomach	2	—
Gall bladder	1	1
Intestinal	1	3
Other abdominal	3	1
Hysterectomy	—	1
Other gynaecological	—	3
Excision pilonidal sinus	1	—
Haemorrhoidectomy	1	—
Orthopaedic	1	1

Clinical Picture

The following types of psychiatric disturbance were noted:

Confusional states	12 cases
Schizophrenia	9 cases
Depression	13 cases
Mania	2 cases

The clinical presentation did not seem to differ from that occurring in persons where surgery is not a factor. Six patients had post-operative physical complications. A 33-year-old woman who had mitral valvotomy developed pyrexia of 100–101° F. and had a small subconjunctival haemorrhage. No definite evidence of subacute bacterial endocarditis was found, but it was felt that in view of the fever she must be treated as such. She was therefore given a course of terramycin and streptomycin and was responding satisfactorily when transferred to a psychiatric unit with a confusional state. A similar mental disturbance appeared after aortic embolectomy in a 53-year-old woman.

Anuria was a complication after surgery, but this had responded to treatment before delirium developed 10 days post-operatively. Dehydration appeared to be significant in precipitating confusion in another subject having had an ileostomy for ulcerative colitis. Another presenting with an acute delirious state 10 days after valvotomy had had a small cerebral embolus within a few hours of surgery with transient facial paresis but otherwise no physical complications were evident. Two patients developed pyrexia up to 101° F. related to pulmonary infection and a stitch abscess, but these were responding to chemotherapy when transfer was necessary. There was no evidence in any case that the anaesthetic was directly responsible for the psychosis. However, in many records comment was limited to the type of agents employed and in some instances even this was not indicated. It seems likely that in a long and busy operating session anaesthetic difficulties might not be remarked upon in the clinical notes and therefore such notes would not reliably indicate anything less than severe complications of anaesthesia. Alcohol consumption at least in moderate amounts and for some years was admitted by 6 persons and 5 of these presented with confusional states.

In a number of cases psychogenic factors seemed important but their precise significance is uncertain. Similar factors would seem to operate in many instances but few develop severe psychiatric disturbances. A few examples may be outlined.

M.N. (male, 32 years). Presenting with flatulence and mild abdominal discomfort he had been surprised when told that cholecystectomy was indicated. It was his first admission to hospital. After waiting 6 days for operation he had been told that it could not be undertaken for several days and was allowed home for 1 week. He was very apprehensive on the morning of the operation and then after pre-medication he was advised that as several emergencies had been admitted a further delay of several hours was indicated. He was in a state of considerable anxiety when brought to the theatre. Within 24 hours of his operation a patient died in a bed nearby. Mr. M.N. described how he "felt terrified" by this and seemed to be in "a very bad dream". A confusional state developed and necessitated psychiatric management.

F.M. (female, 44 years). She complained that when told valvotomy was indicated "it seemed the world had come to an end—it came as a great shock for I thought the operation was the last thing in the world for me—a neighbour told me it was far too serious an operation". Immediately after surgery, not expecting to feel so unwell, she concluded that it had not been successful and became extremely apprehensive, anticipating that death was imminent.

B.E. (female, 63 years). Moderately confused following ileostomy she had been screened from other patients. Thus she was deprived of the visual perceptual cues of routine ward activity and this seemed to increase the degree of confusion.

Latent Interval

In 7 cases, all depressive illnesses, the precise interval between surgery and development of psychiatric symptoms could not be established but in all instances they appeared within a few days or weeks. As could be anticipated the onset of mania, confusional states or schizophrenia can often be more precisely noted, and in all patients falling within these diagnostic categories the latent interval was clearly defined in general and mental hospital notes. Table II presents the interval between surgery and the onset of psychiatric

TABLE II

Interval between Operation and Onset of Psychiatric Symptoms

Latent interval	..	..	0-24	-3	-5	-10	-2	-5	-8
			hours	days	days	days	weeks	weeks	weeks
Number of patients	..	..	4	5	2	8	6	3	1

symptoms. In 25 cases, approximately 70 per cent. of the total, the psychiatric illness began in the first 2 weeks of the post-operative period. Table III indicates the latent interval in relation to each diagnostic category and it will be noted that whilst all confusional states appeared within 2 weeks of surgery the latent period in schizophrenic and especially affective illnesses was more variable.

TABLE III
Latent Interval and Type of Post-operative Mental Disorder

Latent interval	..	..	0-24 hours	-3 days	-5 days	-10 days	-2 weeks	-5 weeks	-8 weeks
Confusional states	..	..	2	3	2	1	4	-	-
Schizophrenia	..	..	1	1	-	4	2	1	-
Depression	..	..	1	-	-	2	-	2	1
Mania	..	..	-	1	-	1	-	-	-

Duration of Stay in Hospital Pre-operatively

It was postulated that those patients who developed severe psychiatric disorders post-operatively might have spent a shorter time than usual in hospital before surgery and, having less opportunity to become familiar with their surroundings, be more liable to become disturbed. Four (11 per cent.) patients were emergency admissions and of the others the duration of stay in hospital prior to surgery varied from 1 to 55 days with a mean of 8.2 days. The records of 100 surgical patients selected at random indicated that 14 per cent. were emergencies and in the remainder the duration of stay in hospital prior to operation varied from 1 to 20 days with a mean of 6.1 days. It therefore could not be established in this series that the patients under review had less preparation in terms of time in hospital pre-operatively.

Previous History of Nervous Illness

There was no evidence that any patient was mentally ill just prior to surgery but 4 had a previous history of psychiatric illness. A 32-year-old male who presented with an acute schizophrenic reaction had received deep insulin therapy 5 years earlier. A 63-year-old woman transferred post-operatively with a toxic confusional state had a depressive illness some years before which responded to E.C.T. Two women presented with similar disorders to those experienced 19 and 10 years previously following childbirth.

Six (17 per cent.) patients were noted to have had previous surgery and in each instance uncomplicated by psychiatric disturbance. Of a control group of 100 surgical patients 23 per cent. had been operated upon before.

Family History of Psychiatric Illness

Eight patients (22 per cent.) had a family history of mental illness necessitating psychiatric management. Of 3 patients presenting with schizophrenic reactions two had siblings whose records showed that they also had had schizophrenic illnesses. In a sister of the third a diagnosis of depression had been made. Of 3 patients having confusional states one had a schizophrenic son but in the others the relatives' clinical notes could not be secured and diagnoses were not established. A patient experiencing post-operative depression had a mentally defective child whilst the mother of another was dementing. Only 5 of 78 patients (6 per cent.) who had survived valvotomy uneventfully

admitted that a member of their family had required treatment in a mental hospital. Thus a family history of mental illness was almost 4 times as common in those having post-operative psychoses as in those having no severe psychiatric disturbance following mitral surgery. The difference to be observed in the frequency is significant at the 5 per cent. level, that is a difference as wide as this would be expected to occur by chance less than 1 in 20 times.

Subsequent Medical and Psychiatric History

It was not possible to trace 9 patients at the addresses given in hospital records and this may be related to the current tendency to move into new housing estates. A further 2 patients had died, one from carcinoma of the pancreas and the other following acute intestinal obstruction. Four did not attend or reply to our communications. Two replied stating that they could not be present because of domestic and business commitments but said that they had remained well since discharge. It was therefore possible to arrange for only 19 patients to attend for review. The time from operation to interview varied from 9 months to 5 years with an average of 2½ years. Sixteen had remained well. Only one patient had required further surgery in the interval—an epididymectomy, and the post-operative period was uneventful. A woman of 33 years who had had an acute schizophrenic disorder after valvotomy had a similar psychiatric disturbance following childbirth 18 months later and again required in-patient psychiatric treatment. Two others, having had schizophrenic reactions, required readmission. One had an exacerbation of symptoms, whilst in the other the clinical picture was now mainly depressive and responded to E.C.T. Unfortunately, on account of the large number of non-attenders, no valid conclusions are possible regarding the fate of these people as a group.

Electroencephalography

Each patient agreed to have an EEG and the results are presented in Table IV. Each record has been analysed in terms of the wave forms alpha, theta and beta. No patient admitted to having drugs. Three females were still menstruating regularly and in each case the period had occurred 1–2 weeks previously. Only 4 records (21 per cent.) could be regarded as normal. However, in 12 cases (63 per cent.) the tracing could be considered as only mildly abnormal. Nevertheless, it may be that such findings reflect a basic instability rendering these individuals more liable to post-operatively psychotic breakdown.

DISCUSSION

It must be stressed that this report deals only with post-operative psychotic disorders of such severity as to warrant management in a psychiatric unit. Milder disturbances are much more common. The frequency of severe disturbance was found to be 1 in 1,600 operations and this estimate is substantially in agreement with Lewis' observation (42). It is understandable that most physicians and surgeons should press for transfer of very disturbed subjects and it seems unlikely that many cases have been lost from this series through having been nursed through the psychotic phase in general wards. The incidence as found in this study is in contrast to the estimates of 1 in 250 or 400 operations quoted by others (16, 38). However, these reports were published several decades ago and since that time there has been considerable progress in both anaesthetic technique and post-operative care. Antibiotics are available as a therapeutic and

TABLE IV

Summary of EEG Findings in Patients having had Severe Psychiatric Disturbance Post-operatively

No.	P.T.	Age	Alpha (α)	Theta (θ)	Beta (β)	Conclusions
1.	W.G.	47	11-13 c/s	5-7 c/s increased by hyperventilation.	—	Mild instability increased by hyperventilation.
2.	G.C.	61	8-11 c/s	Occasional at 7 c/s	—	Within normal limits.
3.	J.M.	41	9-13 c/s	Occasional at 7 c/s	—	Within normal limits.
4.	A.P.	66	8-10 c/s	Excess at 4-7 c/s	Low voltage at 18-20 c/s	Unstable — Increased by hyperventilation.
5.	M.B.	28	11-12 c/s	Occasional at 6-7 c/s increased by hyperventilation	—	Mild instability in response to hyperventilation.
6.	J.M.	49	8-11 c/s	Occasional at 6-7 c/s increased by hyperventilation	Low voltage at 17-19 c/s	Mild instability in response to hyperventilation.
7.	N.M.	32	9-11 c/s	—	—	Normal.
8.	E.L.	46	8-13 c/s	—	Excess at 16-19 c/s	Very mild abnormality in view of excess fast activity.
9.	E.B.	63	8-10 c/s	5-7 c/s	—	Mild instability.
10.	F.T.	35	9-12 c/s	—	17-18 c/s	? mildly abnormal in view of fast activity.
11.	V.S.	57	8-10 c/s	5-7 c/s with hyperventilation 4 c/s	—	Mild instability increased by overbreathing.
12.	S.M.	52	9-11 c/s	—	—	Normal.
13.	A.B.	47	8-12 c/s	4-7 c/s. Lambda on eye opening	—	Moderately abnormal in view of amount of theta.
14.	J.A.	44	8-9 c/s	5-7 c/s on hyperventilation—mainly anteriorly	—	Mild instability to hyperventilation.
15.	J.M.	58	9-13 c/s	5-7 c/s increased by hyperventilation	—	Mildly abnormal and unstable. Instability increased by hyperventilation.
16.	T.H.	65	Little at 8 c/s	7 c/s. Dominant. Occasional 4-5 c/s	—	Abnormal. Low frequency dominant.
17.	M.F.	47	8-11 c/s	5-7 c/s. Increased by hyperventilation	15-23 c/s	Unstable. Increased by hyperventilation. Also mildly abnormal in view of fast activity not within limits of normal cortical.
18.	E.R.	40	9-11 c/s	7 c/s increased by hyperventilation (5-7 c/s)	—	Very mild instability to hyperventilation.
19.	F.B.	55	8-12 c/s	6-7 c/s	—	Mild instability.

prophylactic measure and there is an increasing awareness of the necessity for maintaining electrolyte balance. Importance must also be attached to the tendency to have the patient up and about as soon as possible. The discovery of the phenothiazines has been a further major therapeutic advance. Hospital staff having little or no experience in coping with major psychiatric disturbances are liable to become apprehensive when faced with such a situation. Their anxiety, in turn, reflects on the patient, sedation may be employed unwisely and as a measure of desperation, the patient may become more disturbed and thus a vicious circle is established. Carefully considered exhibition of a phenothiazine rapidly controls motor restlessness and such a state of affairs may be prevented.

Mitral valvotomy was found to be highly represented and it may be that the very considerable and peculiar psychological significance of cardiac surgery in addition to the magnitude of the procedure involved are important factors. Nevertheless, this study cannot support the high psychiatric morbidity quoted in other studies (5, 28, 37).

It was evident that post-operative mental disturbances have no uniform clinical presentation and confusional, schizophrenic or affective disorders can all occur. Six patients (17 per cent.) had physical complications following surgery but Klug and McPherson (40) have pointed out that such complications occur in 23 per cent. of persons under 60 years of age in the post-operative period. In none of the patients in this series could the anaesthetic be regarded as a primary causative factor. However, this claim is based on the assumption that, as the clinical notes did not comment on any complications of anaesthesia, no such complications occurred.

The role of emotional factors cannot be adequately assessed in any study which is largely retrospective, but in some cases they appeared to be relevant. As has already been pointed out, some degree of emotional disturbance is present in many patients awaiting surgery—for few can anticipate it with complete equanimity—but only a very small proportion becomes overtly disturbed post-operatively.

The conclusions which can be drawn from this study are limited but neither duration of stay in hospital before operation nor previous experience of surgery appeared to be significant factors. It does not follow that these could not be of considerable importance in an older and less readily adaptable age group.

Constitutional predisposition is suggested by observations on family histories. A more acceptable control group would have been general surgical patients rather than a series all having the same procedure—namely valvotomy. It could be argued that surgical procedures are sometimes employed in the treatment of what might be regarded as psychosomatic illnesses. Thus, there might be a higher family incidence of psychiatric disorder in a general group than in the group of patients here used for comparison. However, in the series, there were only 6 patients having surgery for illnesses which might be emotionally determined—peptic ulceration, thyrotoxicosis, and ulcerative colitis. One such patient had a positive family history. Again, if a surgical patient is approached in brief interview and questioned regarding a family history of mental disorder by a doctor he has not previously seen, it is unlikely that he will be forthcoming. The mitral group are the subject of a detailed study being undertaken at present, each is interviewed on several occasions, a better rapport is established and accordingly their statements may be regarded as more reliable.

Further support for constitutional predisposition is offered by EEG

findings, but obviously appraisal of a much larger number of subjects is indicated to allow of valid conclusions.

SUMMARY

A review of studies relating to severe psychiatric disturbance in the post-operative period has been undertaken. Various aspects of this disorder as it has presented in the Belfast Hospitals over a 5-year period have been discussed. Incidence has been estimated as 1 in every 1,600 surgical procedures. Valvotomy was highly represented but this study could not support the observations of other workers with regard to frequency. Neither could this investigation support the suggestion that a distinct clinical entity "post-operative psychosis" exists. Duration of stay in hospital pre-operatively was not regarded as being a significant factor. There was evidence of constitutional predisposition and it would seem that physical or psychogenic factors operating in such people may precipitate a disturbance following surgery.

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REFERENCES

1. ABELES, M. M., *Amer. J. Psychiat.*, 1938, **94**, 1187.
2. ALLISON, R. S., *Brit. Med. J.*, 1952, *ii*, 1286.
3. BATTEN, C. T., and COURVILLE, C. B., *Anesthesiology*, 1940, **1**, 261.
4. BEDFORD, P. D., *Lancet*, 1955, *ii*, 259.
5. BLISS, E. L., RUMEL, W. R., and BRANCH, C. H., *A.M.A. Arch. Neurol. Psychiat.*, 1955, **74**, 249.
6. *Idem*, MIGEON, C. L., BRANCH, C. H., and SAMUELS, L. T., *Psychosom. Med.*, 1956, **18**, 56.
7. BOLTON, H. E., and BAILEY, C. P., "Psychosomatic Aspects of Cardiovascular Surgery", in: *Psychosomatic Aspects of Surgery*, 1955 (Cantor and Foxe, editors). New York: Grune & Stratton.
8. BOURNE, J. G., *Lancet*, 1952, *ii*, 705.
9. *Idem*, *ibid.*, 1955, *ii*, 295.
10. BROWNELL, M. E., *Trans. Clin. Soc. Univ. Mich. Ann Arbor*, 1916-17, 1917, **8**, 74.
11. BRUNS, H. D., *Ann. Ophthalm.*, 1916, **25**, 718.
12. CLOWES, G. H. A., JR., DEL GUERCIO, L. R., and BARWINSKY, J., *Arch. Surg.*, 1960, **81**, 212.
13. COBB, S., and MCDERMOTT, N. T., *Med. Clin. N. Amer.*, 1938, **22**, 569.
14. COHEN, S. I., and SILVERMAN, A. J., *J. Psychosom. Res.*, 1959, **3**, 185.
15. CORDAY, E., ROTHENBERG, S., and PUTNAM, T. J., *A.M.A. Arch. Neurol. Psychiat.*, 1953, **69**, 551.
16. DA COSTA, J. C., *Surg. Gynec. Obstet.*, 1910, **11**, 577.
17. DENCKER, S. J., and SANDAHL, A., *Lancet*, 1961, *i*, 1230.
18. DENT, C. T., *J. Ment. Sci.*, 1889, **35**, 1.
19. DONOVAN, J. C., *Amer. J. Obstet. Gynec.*, 1958, **75**, 72.
20. DOYLE, J. B., *Brit. J. Anaesth.*, 1928, **6**, 37.
21. DUPUYTREN, BARON, *Lancet*, 1834, *i*, 919.
22. DWYER, B., and GEORGE, E., *Aust. N.Z. J. Surg.*, 1960, **30**, 102.
23. EBAUGH, F. G., *Surg. Gynec. Obstet.*, 1939, **68**, 372.
24. ENDERBY, G. E. H., and PELMORE, J. F., *Lancet*, 1951, *i*, 663.
25. FAZEKAS, J. F., ALMAN, R. W., and BESSMAN, A. N., *Amer. J. Med. Sci.*, 1952, **223**, 245.
26. FEILING, A., *Practitioner*, 1937, **138**, 259.
27. FLETCHER, G., PENDER, J. W., and WOOD, E. H., *Anesth. Analg.*, 1956, **35**, 18.
28. FOX, H. M., RIZZO, N. D., and GIFFORD, S., *Psychosom. Med.*, 1954, **16**, 186.
29. GIDRO-FRANK, L., GORDON, T., and TAYLOR, H. C., *Amer. J. Obstet. Gynec.*, 1960, **79**, 1184.
30. GRAY, T. C., *Lancet*, 1957, *i*, 383.
31. GREENWOOD, A., *J. Amer. Med. Ass.*, 1928, **91**, 1713.
32. HACKETT, T. P., and WEISMAN, A. D., *Psychosom. Med.*, 1960, **22**, 267.

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33. *Idem, ibid.*, 1960, 22, 356.
34. HEILBRUNN, A., and ALLBRITTEN, F. F., *Ann. Surg.*, 1960, 152, 197.
35. HERON, W., *Scientific American*, 1957, 196, 52.
36. HOLLENDER, M. C., *Amer. J. Obstet. Gynec.*, 1960, 79, 498.
37. KAPLAN, S. M., *Psychosom. Med.*, 1956, 18, 221.
38. KELLY, H. A., *Amer. J. Obstet. Gynec.*, 1909, 59, 1035.
39. KENNARD, M. A., *Psychosom. Med.*, 1953, 15, 95.
40. KLUG, T. J., and MCPHERSON, R. C., *Amer. J. Surg.*, 1959, 97, 713.
41. KROGER, W. S., *West. J. Surg.*, 1957, 65, 317.
42. LEWIS, A., "The Relation between Operative Risk and the Patient's General Condition", *Report XVI Congrès International de Chirurgie, Copenhague, 1955*.
43. LINDEMANN, E., *Amer. J. Psychiat.*, 1941, 98, 132.
44. LINN, L., KAHN, R. L., COLES, R., COHEN, J., MARSHALL, D., and WEINSTEIN, E. A., *ibid.*, 1953, 110, 281.
45. *Medical Times and Gazette*, London, 1854, 9, 266.
46. MEYER, B. C., *Psychosom. Med.*, 1958, 20, 203.
47. MOORE, F. D., *Metabolic Care of the Surgical Patient*, 1959. Philadelphia and London: W. B. Saunders Company.
48. MUNCIE, W., *A.M.A. Arch. Neurol. Psychiat.*, 1934, 32, 681.
49. OLTMAN, J. E., and FRIEDMAN, S., *Psychiat. Quart.*, 1943, 17, 405.
50. PREU, P. W., and GUIDA, F. P., *A.M.A. Arch. Neurol. Psychiat.*, 1937, 38, 818.
51. PRIEST, W. S., ZAKS, M. S., YACORZYNSKI, G. K., and BOSHER, G. K., *Med. Clin. N. Amer.*, 1957, 155.
52. ROBINSON, G. W., *Amer. J. Psychiat.*, 1942, 99, 110.
53. ROLLANSON, W. N., and HOUGH, J. M., *Brit. J. Anaesth.*, 1960, 32, 286.
54. RUSSELL, E. C., *Ann. Surg.*, 1935, 101, 313.
55. RUSSELL, J., *Brit. Med. J.*, 1897, ii, 770.
56. SCHEINBERG, P., BLACKBURN, I., RICH, M., and SESLAW, M., *A.M.A. Arch. Neurol. Psychiat.*, 1953, 70, 77.
57. SCHOTTSTAEDT, W. W., GRACE, W. J., and WOLFF, H. G., *J. Amer. Med. Ass.*, 1955, 157, 1485.
58. SCOTT, J., *Amer. J. Surg.*, 1960, 100, 38.
59. SHEFFER, M. B., and GREIFENSTEIN, F. E., *Anesthesiology*, 1960, 21, 502.
60. SHURLEY, J. T., *Amer. J. Psychiat.*, 1960, 117, 539.
61. SYNDER, J. E., *J. Clin. Invest.*, 1938, 17, 571.
62. STENGEL, E., ZEITLYN, B. B., and RAYNER, E. H., *J. Ment. Sci.*, 1958, 104, 389.
63. STURGIS, S. H., ROBESY, H., PIERSON, H., GATES, P., PLAUT, T., MENZER-BENARON, D., *Obstet. Gynec.*, 1956, 7, 363.
64. TITCHENER, J. L., ZWERLING, I., GOTTSCHALK, L., LEVINE, M., CULBERTSON, W., COHEN, S., and SILVER, H., *Surg. Gynec. Obstet.*, 1956, 102, 59.
65. WASHBURNE, A. C., and CARNS, M. L., *J. Nerv. Ment. Dis.*, 1935, 82, 508.
66. WEISMAN, A. D., and HACKETT, T. P., *New Engl. J. Med.*, 1958, 258, 1284.
67. WEISS, E., and ENGLISH, O. S., *Psychosomatic Medicine*, 1957. 3rd Edition. Philadelphia and London: W. B. Saunders Company, p. 394.
68. WYNNE, L. C., FANG, H. C., and GIBSON, J. G., Unpublished data.
69. ZAKS, M. S., *Cardiology*, 1959. Vol. 3. (Luisada, A. A., editor.) New York: McGraw-Hill Book Company Inc.

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