J Anesth (1994) 8:277–283

Journal of Anesthesia

Assessment of postoperative pain: Contributing factors to the differences between patients and doctors

SHINICHI SAKURA[1], TADAHIKO NONOUE[2], TAKESHI NOMURA[2], and TOSHIHIKO NAKATANI[2]

[1] Department of Anesthesia, C450, University of California, San Francisco, 521 Parnassus Avenue, San Francisco, CA 94143-0648, USA
[2] Department of Anesthesiology, Tottori Prefectural Central Hospital, 730 Ezu, Tottori, 680 Japan

Abstract: This study was undertaken to compare the assessment of pain intensity by 50 patients and by their doctors according to a visual analog scale 5 h and 20 h after major abdominal surgery, and to examine the relationships between the differences in rating of patients and doctors and the factors inherent in the patients which include preoperative expectation of pain, level of anxiety, and the surgical history of the patient. The ratings given by the patients were significantly higher than those given by the doctors at both time periods. However, the correlation between the ratings given by the two was low: $r = 0.31$ and $r_s = 0.27$ at 5 h after the operation, and $r = 0.58$ and $r_s = 0.49$ at 20 h. The results of analysis using Hayashi's quantification theory Type II indicated a moderate association between the rating difference and the patient's age, surgical history, preoperative state of anxiety, and expectation of pain. It is concluded that postoperative pain management, whether in clinical practice or in research, necessitates more consideration of the several above-mentioned individual factors and a preoperative interview in which the patient's level of anxiety and the amount of information the patient has concerning the surgery and postoperative pain is clearly assessed.

Key words: Postoperative pain, Visual analogue scale, Psychologic responses, Anxiety

Introduction

The visual analog scale (VAS) is considered one of the most reliable and sensitive pain rating methods currently available [1–3] and is therefore widely used in the assessment of postoperative pain in both clinical practice and research [4,5]. In almost all previous studies, patients have been asked to indicate the severity of pain on this scale, whereas, in some clinical situations, pain evaluations made by the medical staff according to the behavior or expression of patients are expedient and have also been used.

However, recently we have shown that there is a considerable difference between the ratings on the subjective-rated VAS made by patients and those on the objective-rated VAS by doctors in the early postoperative period [6]. These findings seem to be similar to those reported by Forrest et al. [7] who studied patients with acute abdominal pain, but differ in terms of the correlation between the estimates by the patients and those by the doctors, which was low in our previous study. This may indicate that the postoperative state provides a specific setting for assessing pain.

Requiring good visual and motor coordination, the execution of a discrete mark on the VAS may be difficult for patients who are just recovering from anesthesia and feel very drowsy, or for patients under sedative and analgesic medication. On the other hand, psychological states and personality variables have been alleged to influence the magnitude of perceived pain [8]. Martinez-Urrutia [9], for instance, observed that highly anxious surgical patients reported more pain than less anxious patients, in both the pre- and postoperative periods. Pain tolerance is said to be different among patients [10]. The amount of information an individual has regarding surgery and postoperative pain has also been found to affect perceived pain levels [11]. Furthermore, some patients may exaggerate pain.

The purpose of the present study was to identify the factors in patients that would influence the difference between postoperative pain estimates made with a VAS by patients and by doctors. We compared the ratings by the two assessors following major abdominal surgery, and examined the relationship between the patient and

Address correspondence to: S. Sakura
Received for publication on March 23, 1993; accepted on December 24, 1993

doctor rating difference and personality variables, level of preoperative anxiety, and the amount of information patients possessed regarding their postoperative pain using Hayashi's quantification theory Type II [12], which is a kind of discriminant analysis for qualitative data.

Subjects and methods

Subjects

Over a 6-month period, patients who met all of the following criteria were considered eligible for entry into the study: ASA physical status I or II; age between 21 and 75 years; no contraindication to the insertion of an epidural catheter; scheduled for major abdominal surgery; no medical history of organic brain damage, mental retardation, or other significant psychological disturbances. The study protocol was approved by our institution's human research review committee and informed consent was obtained from each patient.

Procedure

The anesthetic preoperative interview was standardized and performed by one of five staff anesthetists on the day before surgery. It included a brief preoperative history, a physical examination of the pulmonary and cardiovascular systems, and an evaluation of the upper airway. At the end of the interview, patients were given the opportunity to voice any specific concerns or ask any further questions and then asked to complete the Spielberger State-Trait Anxiety Inventory (STAI), which consists of two separate self-report scales for measuring trait anxiety (A trait) and state anxiety (A state) [13]. They were also asked to complete a modification of a questionnaire (Table 1), previously introduced by Owen et al. [14] for the purpose of examining patients' expectations regarding postoperative pain and pain relief, and were given training in the use of the VAS.

Table 1. Questionnaire about expectation of postoperative pain

Q1. How much pain do you expect to have after your operation?
(1) No pain
(2) Mild pain
(3) Moderate pain
(4) Severe pain
(5) Unbearable pain
(6) Don't know

Q2. If you are given medicine for pain after your operation, do you want it to give you:
(1) No relief
(2) Little relief
(3) Moderate relief
(4) A lot of relief
(5) Complete relief

Q3. If you have pain after your operation, when would you most likely ask for pain relieving medicine?
(1) When having some pain
(2) When pain becomes severe
(3) Not ask. Wait until it is offered
(4) Ask, regardless of the amount of pain
(5) Rather put up with the pain than have medicine

Premedication comprised hydroxyzine 25–50 mg and atropine 0.3–0.5 mg given intramuscularly 1 h before the patient was taken to the operating room, where an epidural catheter (Portex, Kent, England) was inserted at the level where the middle dermatome was crossed by the surgical incision. The epidural space was identified by the hanging drop technique. Intraoperatively, all the patients were subjected to inhalation anesthesia consisting of nitrous oxide, oxygen (4:2 l/min) and 0.3–0.7% isoflurane after induction with 4 mg/kg of thiamylal and tracheal intubation, following 0.2 mg/kg vecuronium, and received intermittent injections of plain lidocaine via the epidural catheter. After completion of the surgical procedures, all patients were extubated and taken to a postsurgical care unit.

As for postoperative pain treatment, each patient received intermittent epidural injections of a combination of 4–6 ml of 0.25% or 0.5% bupivacaine and 1–3 mg of morphine at 8-h intervals, starting immediately after surgery and ending on the 3rd postoperative day. Additional treatment for pain such as a bolus epidural injection of 0.25% bupivacaine and an indomethacin suppository was given upon request.

Five and 20 h after surgery, each patient was asked to indicate the intensity of pain at rest on a 10-cm-long visual analog scale, on which the end-points were "no pain" and "worst pain imaginable." Within a few minutes a similar estimate was made by the doctor who had conducted the preoperative interview of the patient but had not been informed of the results of the preoperative questionnaires in advance. He/she had no access to the patient's rating. In this way, a pair of simultaneous but independent estimates were made of the pain intensity.

Statistical analysis

The statistical analysis was carried out using both parametric and non-parametric methods since a question has been raised as to whether the VAS may be an interval scale [14], which is considered to be a prerequisite for the use of parametric methods. Pairwise comparisons were undertaken using Student's *t*-test or Wilcoxon's rank sum test. Pearson's product moment correlation coefficient (r) or Spearman's rank correlation coefficient (r_s) was calculated to determine the relationship between the ratings given by the patients and those of the doctors. When using parametric statistics, the measures of locations are given as means and their dispersions as standard deviations (SD); the medians and the interquartile range are used as the corresponding measures for variables used in the nonparametric tests. $P < 0.05$ was considered to be statistically significant.

To identify the contributing factors to the differences in rating between patients and doctors, Hayashi's quantification theory Type II was employed. This theory is a model for differentiating the group to which each case belongs by means of nonquantitative traits. According to the outcome of the discriminatory analysis, a calculation numerical value, which is called a "category score," was given to each category of the nonquantitative traits and a partial correlation coefficient was calculated for each item. A numerical score for each case was obtained by adding the category scores for each category together. The partial correlation coefficient for each item represents the weight for discrimination. A wider range of category scores for each item also indicates a greater contribution of the outside variable, that is, the patient and doctor rating difference in the present study.

Results

Fifty patients were enrolled in the study. There were 35 men and 15 women. Their ages ranged from 29 to 75 years with a mean age of 60, and body weights from 42 to 73 kg with a mean weight of 56.1. The operations performed are presented in Table 2. All the participants used the scale correctly and none of the patients received any analgesics or sedatives within 3 h before the assessment of pain.

Table 3 summarizes the patients' and the examining doctors' assessments of pain, and the differences in the ratings given by them. At each time, the ratings given by the doctors were significantly lower than those given by the patients, and the differences in rating between patients and doctors were similar at both times. Figure 1 contains scattergrams showing the relationship between the ratings given. The correlation was significant but low at each time when pain was assessed: $r = 0.31$ and $r_s = 0.27$ at 5 h after the operation; $r = 0.58$ and $r_s = 0.49$ at 20 h. The differences between these correlation coefficients were not significant.

The relationship between the patient and doctor rating differences 5 h after surgery and the possible contributing factors inherent in the patients was examined using Hayashi's quantification theory Type II. The patient and doctor rating difference at 5 h (D) served as the outside variable, and all the patients were divided accordingly into three groups as follows: group I included those whose D value was less than −2 cm; group II included those whose D value was within ±2 cm; and group III consisted of those whose D value was more than +2 cm. At the same time, the following variables were used as possible predictors or "items" in the analysis: age, sex, ASA physical status, type of surgery, disease, duration of surgery, history of previous surgery, A trait, A state, and questions 1 to 3 of the questionnaire regarding the expectation of postoperative pain. Numerical items, such as age, duration of surgery, A trait, and A state were classified into four categories: sample datum (S) < mean (M) − standard deviation (SD), $M - SD \le S < M$, $M \le S < M + SD$, and $M + SD \le S$. With respect to nominal items, the type of surgery was grouped into two categories, upper abdominal surgery and lower abdominal surgery; and history of previous surgery into three categories, none, once, and more than once. Disease was divided into three categories according to whether the patient had been diagnosed as having cancer and was informed of it.

The results of the analysis are shown in Table 4. Six patients were placed in group I, 22 in group II, and 22 in group III. The correlation ratio ($\eta^2 = 0.71$) revealed that the groups were well discriminated from one another, as also indicated by a histogram (Fig. 2) showing

Table 2. Operative procedures

Procedure	Number
Gastrectomy	18
Biliary procedures	12
Hepatectomy	6
Rectal amputation	4
Jejunal resection	4
Hemicolectomy	3
Pancreatectomy	1
Cystectomy and ileal conduit	1
Reconstruction of abdominal aorta	1

Table 3. Patients' and doctors' assessment of pain on visual analog scale

Elapsed time	Patients (cm)	Doctors (cm)	Difference[a] (cm)
5 h	3.1 ± 1.8	2.2 ± 1.3**	0.9 ± 1.9
	(3.1, 2.0)	(2.1, 2.2)‡	(1.0, 2.3)
20 h	2.9 ± 1.8	2.4 ± 1.1*	0.5 ± 1.4
	(2.9, 1.6)	(2.2, 1.5)†	(0.4, 1.4)

Values are mean ± SD and (median, interquartile range).
[a] Difference between the ratings given by the patients and by the doctors. There was no significant difference between the two "Differences" either by Student's *t*-test or by Wilcoxon's rank sum test.
* $P < 0.05$, ** $P < 0.01$ when compared with the patients' rating by Student's *t*-test.
† $P < 0.05$, ‡ $P < 0.01$ when compared with the patients' rating by Wilcoxon's rank sum test.

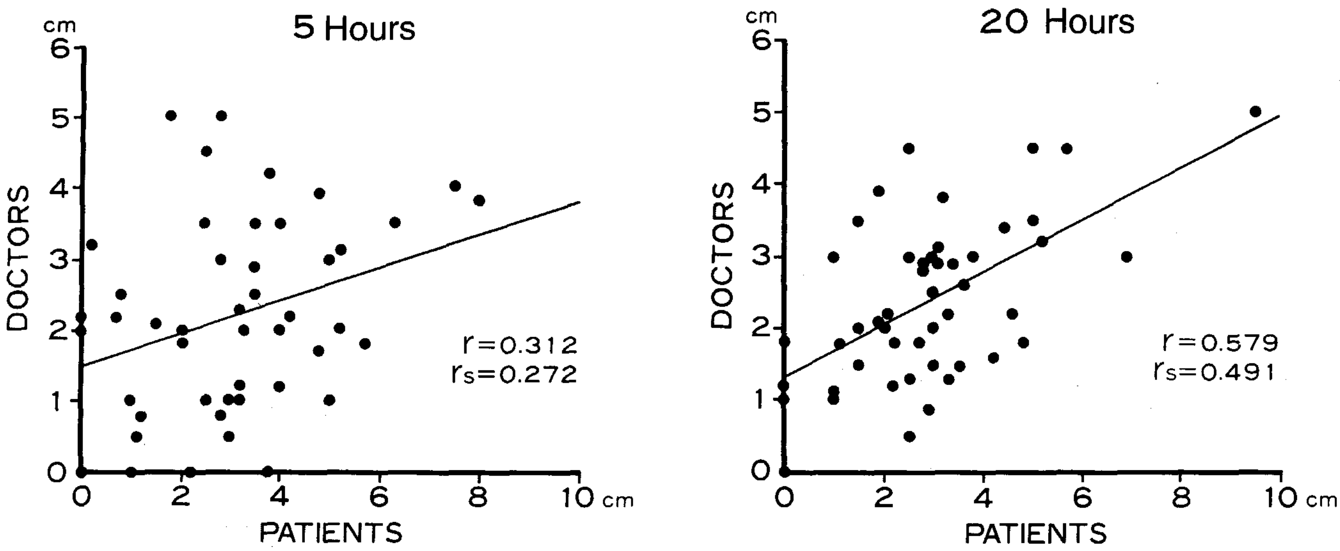

Fig. 1. Relationship between the visual analog scale (VAS) assessments made by the patients and the doctors at 5 and 20 h postoperatively. r = Pearson's product moment correlation coefficient. r_s = Spearman's rank correlation coefficient

the numerical scores of the patients. Age, surgical history, preoperative state anxiety, and questions 1 and 3 of the questionnaire regarding the expectation of postoperative pain, all correlated well with the rating difference in terms of the partial correlation coefficients and the ranges. Since group I showed the lowest category score of the outside variable (−2.03), group III the highest (0.74) with group II in the middle (−0.19), a lower category score signified a low patient and doctor rating difference and a higher score signified a high rating difference if an item had a high partial correlation coefficient and a wide range.

Discussion

The present study demonstrates that the patients' rating of postoperative pain using the VAS is significantly different from that of the doctors', and the correlation between the ratings given by the two groups is low. Furthermore, the difference in ratings given by two assessors is associated with several of the patients' individual factors such as age, surgical history, preoperative state anxiety, and preoperative expectations regarding postoperative pain and pain relief.

There was great variability in individual patients' responses and likewise in the doctors' estimates. The utilization of subjects undergoing various operative procedures was probably the source of the variation, since they are associated with varying degrees of postoperative pain [15]. We, however, tried to examine the effect of different procedures on the patient and doctor rating differences. The utilization of five different doctors was another factor in the variation. We, however, sought to replicate traditional clinical conditions and to avoid a specific bias by using only one. We chose highly experienced doctors as observers, as is usual in our hospital.

Age of the patient was demonstrated to be a significant contributing factor to the patient and doctor rating difference. In terms of the category score, there was a tendency for patients aged 72 years or older to give lower ratings than the doctors, while patients aged 47 years or younger gave higher ratings. It appears that, with increasing age, the ratings given by the patients became lower compared with those given by the doc-

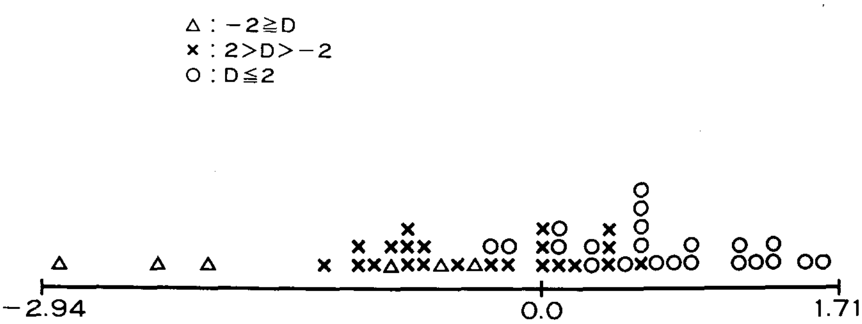

Fig. 2. Histogram showing the numerical scores of the patients. D, the patient and doctor rating difference with the VAS 5 h after surgery

Table 4. Results of quantification theory Type II analysis relating individual factors to the patient and doctor rating differences at 5 h postoperatively

Item	Category	Number	Category score	Range	Partial correlation coefficient
Age (years)	−47	7	0.61	1.35	0.39
	48–59	13	−0.10		
	60–71	22	0.13		
	72–	8	−0.73		
Sex	Female	15	−0.16	0.24	0.13
	Male	35	0.07		
ASA physical status	I	20	−0.01	0.01	0.00
	II	30	0.01		
Type of surgery	Upper abdominal	10	0.04	0.05	0.03
	Lower abdominal	40	−0.01		
Disease	Benign	17	−0.10	0.15	0.08
	Malignant (uninformed)	27	0.05		
	Malignant (informed)	6	0.05		
Duration of surgery (min)	−80	8	0.40	0.72	0.31
	81–162	20	0.00		
	163–244	17	−0.31		
	245–	5	0.41		
Previous surgery	None	24	−0.10	1.58	0.49
	Once	17	0.64		
	More than once	9	−0.94		
A trait	−32	8	−0.06	0.28	0.14
	33–42	16	0.18		
	43–52	15	−0.08		
	53–	11	−0.10		
A state	−32	7	−0.21	1.07	0.42
	33–43	13	−0.57		
	44–54	24	0.25		
	55–	6	0.49		
Q1*	(1)	4	−1.29	2.09	0.48
	(2)	6	0.80		
	(3)	14	0.22		
	(4)	14	−0.18		
	(5)	0	−1.29		
	(6)	12	−0.01		
Q2*	(1)	0	0.64	0.89	0.06
	(2)	3	0.69		
	(3)	9	0.14		
	(4)	32	−0.20		
	(5)	6	0.51		
Q3*	(1)	11	−0.50	3.16	0.68
	(2)	34	0.50		
	(3)	3	−2.67		
	(4)	2	−1.74		
	(5)	0	−0.50		
Outside variable	Group I ($D \leq -2$)	6	−2.03	$\eta^2 = 0.71$[a]	
	Group II ($-2 < D < 2$)	22	−0.19		
	Group III ($2 \leq D$)	22	0.74		

* Preoperative questionnaire about patients' expectations of pain and pain relief.
[a] Correlation ratio.
A, anxiety; D, the difference between the ratings given by patients and doctors.

tors. This may not be explained simply by differences in pain tolerance, about which previous studies have shown conflicting results. Woodrow et al. [10] indicated that the explanation for the discrepancy in the observations in those studies lay in the methods involved for measuring pain tolerance, and that, as age increases, tolerance to cutaneous pain increases and tolerance to deep pain decreases. It is of additional importance to note the contention by Kremer et al. [16] that VAS measurements may be unreliable in the case of aged patients whose abstracting ability is low. It is a common clinical observation that there is a higher incidence of postoperative mental deterioration in elderly patients [17].

There was also a strong relationship between history of previous surgery and the patient and doctor rating difference. It is unclear why patients who had undergone previous surgery once tended to give higher ratings than the doctors did, whereas the reverse tended to be true for those who had undergone surgery more than once. Although no one has reported on the influence of previous surgery on postoperative pain, Mersky and Spear [18] have reported that the frequency of pain complaints is related to the number of previous pain experiences, which seems to conflict with our results. Those who had undergone many operations seemed to have enough information about the impending surgery, and this knowledge might have resulted in insensitivity to postoperative pain in those patients.

While subjects with a high STAI A state tended to give higher VAS ratings than doctors, low A state patients gave lower ratings. The patient's anxiety level, in anticipation of the impending medical procedure, has been shown to significantly affect the perception of pain intensity [9]. Scott et al. [8] have demonstrated that state anxiety, which is elevated prior to surgery but declines after surgery, is a significant linear predictor of postoperative pain, as opposed to trait anxiety, which is a constant measure of individual differences in proneness to anxiety. Our findings of a moderate positive correlation between A state and the patient and doctor rating difference, therefore, seem to be reasonable.

The responses to the preoperative questions which examined the patients' expectations of postoperative pain and pain relief also functioned as one of the contributing factors. It is of interest to note that, although small in number, the patients who had expected no pain after surgery tended to give low ratings.

The evidence that several individual patient factors affected the rating difference between patients and doctors implies that these factors influence the evaluations made by patients, doctors, or both. Great personal variability in the ratings given by both patients and doctors suggests that consideration should be given to the individual factors in assessing postoperative pain with either the subjective-rated VAS or the objective-rated VAS. In clinical research, therefore, groups studied should be matched not only by conventional characteristics such as age, sex, type of surgery, and so forth, but also by other individual factors including preoperative level of anxiety and the amount of information the patients have concerning surgery and postoperative pain.

Besides, it is obvious that insufficient preoperative communication between patients and doctors led to the low correlation with inaccurate assessments by doctors. Although a standardized interview was conducted preoperatively, the doctors were not informed of the results of the preoperative questionnaires in advance. Conversely, the evidence of better correlations seen in the assessments carried out as time elapsed might be explained by the information obtained by the doctors after the operation. While the patients were not informed of the results of each assessment, the doctors knew the results before making the next evaluation. Reading the previous records might have influenced the doctor's assessment 20 h after surgery.

In conclusion, we have demonstrated that the difference in ratings of postoperative pain with the VAS given by patients and doctors is associated with individual factors such as age, surgical history, preoperative state anxiety, and preoperative expectations regarding postoperative pain and pain relief. The results suggest the need to carefully consider the above mentioned several individual factors and also to substantiate the importance of the preoperative interview, in which the patients' preoperative level of anxiety and the amount of information the patients possess concerning surgery and postoperative pain can be clearly assessed, for the management of postoperative pain, whether in clinical practice or in research.

References

1. Scott J, Huskisson EC (1976) Graphic representation of pain. Pain 2:175–184
2. Ohnhaus EE, Adler R (1975) Methodological problems in the measurement of pain: a comparison between the verbal rating scale and the visual analogue scale. Pain 1:379–384
3. Revill SI, Robinson JO, Rosen M, et al. (1976) The reliability of a linear analogue for evaluating pain. Anaesthesia 31:1191–1198
4. Shulman M, Sandler AN, Bradley JW, et al. (1984) Post-thoracotomy pain and pulmonary function following epidural and systemic morphine. Anesthesiology 61:569–575
5. Chrubasik J, Wiemers K (1985) Continuous-plus-on-demand epidural infusion of morphine for postoperative pain relief by means of a small, externally worn infusion device. Anesthesiology 62:263–267
6. Sakura S, Nonoue T, Nomura T, et al. Differences in the assessment of postoperative pain when evaluated by patients and doctors. J Anesth
7. Forrest M, Hermann G, Andersen B (1989) Assessment of pain: a comparison between patients and doctors. Acta Anaesthesiol Scand 33:255–256
8. Scott LE, Clum GA, Peoples JB (1983) Preoperative predictors of postoperative pain. Pain 15:283–293
9. Martinez-Urrutia A (1975) Anxiety and pain in surgical patients. J Consult Clin Psychol 43:437–442
10. Woodrow KM, Friedman GD, Siegelaub AB, et al. (1972) Pain tolerance: differences according to age, sex and race. Psychosom Med 34:548–556
11. Egbert LD, Battit GE, Welch CE, et al. (1964) Reduction of postoperative pain by encouragement and instruction of patients. New Engl J Med 270:825–827
12. Hayashi C (1954) Multidimensional quantification. II. Proc Jpn Acad 30:165–169
13. Spielberger CD, Gorsuch RL, Lushene R, et al. (1983) Manual for the State-Trait Anxiety Inventory ("Self-Evaluation Questionnaire"). Palo Alto, Consulting Psychologists Press

14. Owen H, McMillan V, Rogowski D (1989) Postoperative pain therapy: a survey of patients' expectations and their experiences. Anesth Analg 68:645–648
15. Drew FL, Moriarty RW, Shapiro AP (1968) An approach to the measurement of the pain and anxiety responses of surgical patients. Psychosom Med 30:826–836
16. Kremer E, Atkinson JH, Ignelzi RJ (1981) Measurement of pain: patient preference does not confound pain measurement. Pain 10:241–248
17. Smith RJ, Roberts NM, Rodgers RJ, et al. (1986) Adverse cognitive effects of general anaesthesia in young and elderly patients. Int Clin Psychopharmacol 1:253–259
18. Mersky H, Spear FG (1967) Pain: psychological and psychiatric aspects. Bailliere, Tindall and Cassell, London, pp 71–87