A CLINICAL INVESTIGATION OF REACTIONS TO PAIN

By

H. MERSKEY

A. GILLIS

and

K. S. MARSZALEK

THIS paper represents an attempt to measure the reliability of the clinical assessment of the reaction to pain and further to estimate the significance of this reaction in a group of chronic schizophrenic patients.

Several modern writers (Lewis, 1942; Medvei, 1949; Holmes, 1950; Adrian, 1956; Bishop, 1956; Beecher, 1959) have agreed that it is difficult to define the concept of pain or else have largely avoided doing so (cf. Adrian, 1947; Wolff and Wolf, 1958), by tackling their subject in a pragmatic way. However, no one seems to object to its use as an expedient and meaningful term, and Hall (1953) observes that what is meant by pain should be apparent in each investigation from the description of the experimental conditions and controls, the instructions, the results and the conclusions. The approach used here has been to apply single defined stimuli and to make a graded clinical estimate of the objective and subjective responses. In addition a pressure algometer has been used to provide measures of Pain Perception Threshold and Pain Reaction Point.

TECHNIQUES

Eighty male chronic schizophrenic patients were examined independently by two of us (A.G. and H.M.). They had all been ill for a minimum period of two years. Some were in receipt of tranquillizing drugs which were noted. All were classified according to age, type of illness, and length of time in hospital.

Tests

The tests, which were applied twice, consisted of soft pin-pricking to the palms, cheeks and soles of the feet and the use of the pressure algometer. The pin-pricking was done to each part first with the eyes shut and then with the eyes open. The order of testing sides was determined from a list of random numbers. The pricking was done rapidly 12 times with a hypodermic needle, generally just hard enough to avoid drawing blood. Each pin-prick test was scored on a 5-point scale from 0 to 4 for each of three modes of reactions, namely withdrawal movement (M), wincing (W) and subjective experience (S). The method of assessment was as follows:

(*a*) Movement Withdrawal (M)

0. No withdrawal of part stimulated.
1. Slight withdrawal of the part stimulated, not sufficient to avoid further stimulation.
2. Moderate withdrawal almost sufficient to avoid further stimulation.
3. Marked withdrawal sufficient to avoid further stimulation.
4. Total withdrawal involving both the part stimulated and other parts of the body not being stimulated.

https://doi.org/10.1192/bjp.108.454.347 Published online by Cambridge University Press

(*b*) Facial Wincing (W)

0. No facial wincing.
1. Slight rapid contraction of one area of facial musculature, and/or rapid eye tremor.
2. Slight rapid contraction of more than one area of facial musculature.
3. 1 plus vocal emission.
4. 2 plus vocal emission.

(*c*) Subjective Experience (S)

After each stimulus the patient was asked "Did that hurt you?" If he replied in the negative, a score of 0 was made; if in the affirmative he was asked, "Would you say that hurt you a little, moderately, or a lot?" Depending upon his reply scores of 1, 2 or 3 were given. If the patient spontaneously related his experience as very painful a score of 4 was given.

This method is taken from the paper of Stengel *et al.* (1955) except for the observation of eyelid flutter which has been added by us.

The pressure algometer is an instrument which has been known for many years and was described again by Keele (1954) in connection with the investigation of sensitivity to pain. It consists of a circular wooden plunger with a smooth flat end 0·5 cm. in diameter; the plunger is attached to a graduated spring within a metal or wooden cylinder. Pressure can be applied to a flat surface at a standard rate of increase of 1 kg./second. We have used this technique to determine Pain Perception Threshold and Pain Reaction Point so far as these two were separable in our patients. The site of application was the tibia and the P.P.T. was taken as the point when the patient said he could first feel pain; the pressure was then continued without interruption and the patient asked to say when it hurt either "a lot", or "very much". This was taken as the Pain Reaction Point. As it depends on verbal response, this test is of course less easy to apply to chronic schizophrenics than to others and we often only obtained a Pain Reaction Point at which the patient flinched or withdrew without speaking. Because of this we present only the results on the Reaction Point here.

Lastly, the third author in this study (K.S.M.) assessed all the patients on a modification of the Gardner Ward Behaviour Rating Scale. This scale (Wilcox, 1942; Lorr, 1954) is ordinarily used to estimate activity and behaviour control in mental hospital patients. The estimates were made in conjunction with the nursing staff. The sections before modification which were used from the Gardner scale were those for (1) Attention to Personal Affairs, (2) Sociability, (3) Activity Control, (4) Work Capacity. As they all gave very similar results for the individual patients, the final analysis of scores has been confined to the following scale of activity control:

0. None—Actively restless, or frequently and for considerable periods motionless.
1. Poor—Quite restless or very retarded.
2. Fair—Occasionally restless or mildly apathetic.
3. Good—Only rarely shows excessive activity or apathy.
4. Very Good—Normal degree of activity.

The results were classified numerically and according to the direction in which activity was altered, scores for overactivity being graded as positive, those for underactivity as negative.

Results

The average of the mean scores for all the individuals is shown for each investigator in Table I. It will be seen that taking withdrawal movement (M), facial movement (W) and subjective estimates (S) together the investigators obtained almost identical average results. Taking scores for S and M.W. separately, however, it appears that one of us (H.M.) scored higher for M plus

W and lower for S than did the other (A.G.). To some extent the differences between the two observers are systematic ones since H.M. appears either to have provoked more physical response than A.G. or to have scaled it as greater whilst tending relatively to minimize the degree of subjective response. Conversely A.G. obtained less physical response but may have scaled the subjective reactions as relatively greater. We think the differences might have been reduced by still better joint standardization of the assessment of responses. Nevertheless there remains a considerable degree of correlation between the two observers both for all the modes taken together and for each taken separately as may be seen from the correlation coefficients set out in Table II. The lowest of these is the one for withdrawal yet even this is significant at the level $p<0\cdot001$. Likewise the averages of the algometer readings are close together and these have an even higher degree of correlation ($r=0\cdot8$) than the other measures. This correlation is further illustrated in the figure which shows the scatter diagram for the algometer readings. The inter-relationships between many of these measures are also significant (Table III).

TABLE I

Average of Mean Scores for each Investigator for Reactivity to Pin-Prick and for the Algometer Pain Reaction Point for 80 Patients

	MWS	MW	S	Algometer
A.G.	1·19	1·00	1·59	3·07
H.M.	1·24	1·37	0·98	3·36

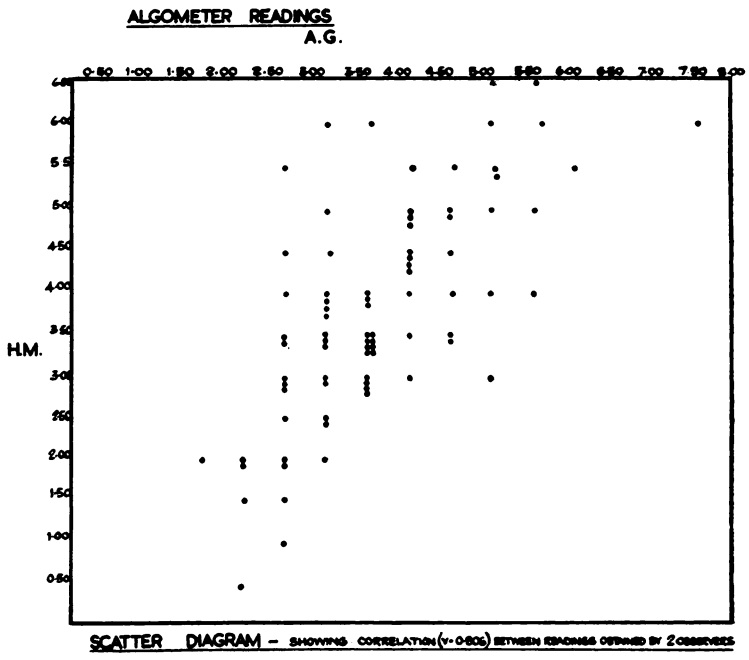

FIG. 1.

TABLE II

Correlations Between the Scores Found for 80 Patients by Two Investigators. (H.M. and A.G.)

Test Mode	MWS	MW	M	W	S	Algometer
Product Moment Correlation Coefficient ..	0·683	0·703	0·67	0·476	0·488	0·806

$p < 0{\cdot}001$ in all cases

TABLE III

Intercorrelations Between the Test Modes For Each Observer Separately and Combined

Correlation Coefficients

	M with W	M with S	W with S	M with Algometer	W with Algometer	S with Algometer	MWS with Algometer
A.G.	0·612†	0·494†	0·455†	−0·275**	−0·202	−0·063	−0·27**
H.M.	0·638†	0·524†	0·6†	−0·514†	−0·241*	−0·258*	−0·346**
Combined Correlations for A.G. and H.M. ..	0·625†	0·509†	0·528†	−0·394†	−0·222*	−0·161	−0·31†

* $p < 0{\cdot}05$
** $p < 0{\cdot}02$
† $p < 0{\cdot}001$

In considering the reliability of the tests attention has also been paid to the order in which they were given. Table IV shows the results for each investigator for the patients who were tested first by A.G. and likewise the results for each investigator for those patients who were tested first by H.M. It is clear that order of testing had no significant effect on the scores for reaction to pin-prick which the investigators obtained since their average scores have the same relationship no matter who tested the patients first. In the case of the algometer readings, however, there is an interesting tendency for the reading to fall with repetition. This trend is significant at the 5·0 per cent. level of confidence.

TABLE IV

Scores According to Order of Testing

	36 Patients Tested First by A.G.					44 Patients Tested First by H.M.				
	M	W	S	MWS	Algometer	M	W	S	MWS	Algometer
A.G.	1·07	0·92	1·45	1·10	3·77	1·01	0·98	1·77	1·26	3·54
H.M.	1·19	1·29	0·99	1·15	3·39	1·39	1·53	1·00	1·31	3·89

In Table V the average scores according to age are set out for each investigator. There is a clear trend towards higher scores in the oldest and youngest groups with a reduction in scores in the middle age groups. In particular the differences between the 35–44 year old group and the 55–64 year old group are of significance for both observers (differences for M.W.S. together for A.G. being significant at the 2 per cent. level of confidence and for H.M. at the 5 per cent. level of confidence). The differences of the means for the individual modes have

TABLE V

Average Scores According to Age as Found by Each Investigator

		A.G.					H.M.				
Age Group	No.	M	W	S	MWS	Algo-meter	M	W	S	MWS	Algo-meter
25–34	15	1·13	0·97	1·81	1·27	4·14	1·18	1·45	1·11	1·20	3·89
35–44	27	0·73	0·89	1·10	0·93**	3·8	1·08	1·21	1·19	1·17*	3·72
45–54	14	1·12	0·83	1·78	1·13	3·69	1·26	1·37	0·85	1·16	3·32
55–64	18	1·26	1·27	1·60	1·38**	3·35	1·64	1·96	1·24	1·61*	2·99

Two patients aged 23–24 years and Four patients aged over 64 years excluded from the groups.

** $p < 0·02$
* $p < 0·05$

not been tested for significance but follow the same trends. The differences for the algometer means are not significant but in relation to the pin-prick reactivity scores they follow the expected pattern being generally high where the pin-prick scores are low and conversely. Neither differences in diagnosis nor differences found in activity appear to be sufficient to account for these variations but there is a considerable difference in the drugs which the 35–44 year old group were receiving compared with the other groups. The average dose of phenothiazines was highest in the 35–44 year old group and proportionately more patients received such medication in this group than in the others. Twenty-five out of 27 were having phenothiazines in the 35–44 year old group whereas only 10 out of 18 were having them in the oldest age group and the quantities of drugs given in these and in the other groups appear similarly to have been in inverse proportion to the pain reaction scores. We therefore conclude that the difference in response in the age groups is most likely to be due to differences in medication, a finding which is of interest since it would tend to support the view on which Beecher (1959) has laid great emphasis, that the reaction to pain is reduced by sedative or tranquillizing drugs as well as by "analgesics".

In Table VI the results for each investigator in the case of those 12 patients who had paranoid schizophrenia or paraphrenia are set out. This was the main

TABLE VI

Average Results for Each Investigator in Paranoid Group and a Control Group

		A.G.					H.M.				
	Mean Age	M	W	S	MWS	Algo-meter	M	W	S	MWS	Algo-meter
Paranoid Patients	46·5	0·65	0·56	1·52	0·90*	3·89	0·75	1·57	1·04	1·12	4·15
Control Group	46·5	1·38	1·20	1·95	1·52*	3·98	1·49	1·51	0·85	1·28	3·53

* $p < 0·02$

diagnostic group which could be separated from the majority who had mixed or mainly hebephrenic forms of illness. Together with the paranoid group a control group of patients is analysed. This control group was obtained by taking the next subsequent patient of the same age after each paranoid patient in the list of subjects. For each investigator the control group scored more than the

paranoid group for M.W.S. and in the case of A.G. the differences are of significance at the 2 per cent. level of confidence. Moreover these differences are not explicable in terms of differences in general ward activity or drug administration and it therefore appears that it is a characteristic of the paranoid group to respond less to experimental stimuli which are acknowledged as such.

In Table VII the grouped results are set out for patients according to their activity scores. The figures found for the sub-groups are not shown but accord with the distribution obtained here. The notable feature of these results appears to be that patients whose degree of activity is normal or nearly so react less than either the very overactive or the very apathetic group. The difference between the normal and the underactive groups is indeed significant for H.M. at the 5 per cent. level of confidence.

TABLE VII

Average Results for each Investigator for 80 patients with Pin-Prick and Algometer tests grouped according to Scores on Activity Control Section of Ward Behaviour Rating Scale*

		A.G.					H.M.				
Group	No.	M	W	S	MWS	Algo-meter	M	W	S	MWS	Algo-meter
Overactive Scores — 0+, 1+ or 2+	24	1·04	1·0	1·41	1·14	3·56	1·23	1·6	0·88	1·24	3·39
Normal Scores — 3+, 4, 3−	26	1·00	0·84	1·55	1·12	3·90	1·04	1·29	0·88	1·06†	3·72
Underactive Scores — 0−, 1−, 2−	29	1·13	1·03	1·79	1·32	3·85	1·38	1·71	1·19	1·43†	3·32

* One patient omitted because of cyclical behaviour changes.

† $p<0·05$

In interpreting these differences it was thought possible that the factor of tension might not have been adequately represented in the behaviour scoring system and 76 of the patients who remained available were therefore re-assessed by K.S.M. in a brief clinical interview and graded as either tense, apathetic or normal. No significant differences were then found, however, in the pin-prick reactivity and algometer scores of these groups either taken overall or amongst the underactive patients alone.

Of the several measures employed the most consistent is the Pain Reaction Point as determined with the pressure algometer, the correlation between the figures of the two observers being 0·8. Inspection of the tables shows that the average Reaction Point generally varies inversely with the pin-prick reactivity scores but this is not invariable and in no case has a significant difference between any two of the group reaction points been found with the algometer. The reason for this lesser discrimination with the algometer than with the hypodermic needle and the relatively low correlation between them ($r=-0·31$) is not certain but may be a special feature of this particular diagnostic group.

DISCUSSION

From the results obtained it seems reasonable to conclude that there is a moderate degree of consistency and replicability of findings with the techniques used and although it remains to compare these findings with those in normal

and non-psychotic groups, some additional information has been gained on particular matters. The lessened degree of reactivity found in paranoid patients may well be related to their clinical condition and it is worthy of note too that an apparent difference between age-groups has been found which is correlated with their dosage of tranquillizing drugs. Also as expected there is a tendency for the Pain Reaction Point to vary inversely with the Pin-Prick Reactivity Score. Within the modes of reaction to pin-prick considered there is also seen to be a common trend to higher or lower scores in particular groups so that it is probably correct to conclude from the evidence that the physical reaction which a person makes even to minor experimental pain runs approximately parallel with the subjective experience even though the latter is particularly difficult to assess in schizophrenic subjects. Whilst the tests employed are clearly practicable for simple experimental purposes it must be acknowledged that they have so far been shown to be of value more for the comparison of groups by individual investigators than as a clinical scale on which patients may be placed according to diagnosis or specific emotional factors. For the latter purposes the range of idiosyncratic individual differences appears too large and the correlation between individual observers although definite is insufficiently precise.

If an explanation is to be found of the failure to discriminate between groups with the algometer it might seem to lie in the relative inability of the chronic schizophrenic patient to execute purposive movements or make purposive observations in the test situation. This has been well illustrated in the widely quoted work of Malmo *et al.* (1951). But the reaction points recorded here had a high degree of consistency and were based upon flinching or withdrawal by the patient as well as on his 'intended' verbal behaviour and were better correlated between occasions of testing ($r=0\cdot8$) than his own verbal assessment of the intensity of the pin-prick ($r=0\cdot7$). For the present therefore we have to reject the supposition that differences between groups with the algometer have failed to appear, as with the pin-prick tests, because the patients' answers were more variable than their reactions. Indeed the variation which schizophrenic groups show with this particular measure is less than with other measures. A speculative explanation could be that the response to painful pressure of this type is of a more primitive and therefore more constant nature than the response to pin-prick but we do not have any supporting evidence for such a hypothesis.

It has already been noted that there was a trend in the pin-prick reactivity scores for those who were hypoactive in their general behaviour to score in a similar way to those who were hyperactive, both groups scoring more than those who were simply normally active. It is possible that this may be explained by reference to the work of Malmo *et al.*, quoted above. It was clearly shown by those authors that the levels of muscular tension and similar indices were high in patients who were not superficially responsive in stress situations. Insofar as the involuntary response to pin-prick is a measure of non-purposive muscular tension the disparity between the ratings on the Ward Behaviour Scale and the pin-prick tests might appear intelligible. Unfortunately the further assessment of tension that was made is not associated with differences in the scores for reactivity to pin-prick or with the algometer. It is probably a fault of the assessment of tension, however, that it was made several weeks or months later than the other measures were taken, these latter being close together in time, and numerous patients appeared to the assessor to have changed from their previous behaviour state. Our findings are therefore not necessarily in conflict with the findings of other workers who have obtained a trend for pin-prick reactivity

which corresponds to the expected clinical findings of reduced activity and tension in patients of various types who scored low on the pin-prick reactivity scale (Stengel, *et al.*, 1955 and 1958). They do lead us to conclude, however, that underactivity in ward behaviour in schizophrenics may well be a special phenomenon of hospital life which cannot automatically be related to reduced sensitivity to other stimuli.

The foregoing result was an unexpected one yet there is experimental data in existence to which it may be relevant and which helps to confirm its likelihood. Tong (1960) and Tong and Murphy (1960) have shown that in delinquent subjects those who relapsed outside hospital had previously scored either high or low stress conditioning experiments. Those who subsequently did well tended to have conditioning scores about the mean. The parallel with our findings for Ward Behaviour is quite striking although prediction of the subsequent course of our schizophrenic subjects is not in question. Moreover the measures for MW and S intercorrelate highly amongst themselves (Table II) so that there is further reason for taking them to be representative of a psychological function which expresses itself quite consistently in these several aspects of behaviour. This function is most appropriately called clinical reactivity to pain and we conclude from our data that the somatic response and the subjective estimate of it are generally in agreement. This is not necessarily the case in other types of bodily and mental function since autonomic and respiratory responses to painful operative stimuli under general anaesthesia may be quite marked even when the unconscious patient does not "express himself" with a groan.

Summary

An investigation has been made into the reliability of clinical estimates of the response to mild cutaneous pain and of the pain reaction point as determined with the pressure algometer. A highly significant correlation was found between two independent observers using these measures to assess the response to pain of 80 male chronic schizophrenic patients. Amongst these patients a significant difference in the scores of certain age groups has been attributed to the effect of tranquillizing drugs, itself a matter of some interest. Paranoid patients were also found to differ from an otherwise comparable group of subjects, the paranoid patients reacting less in the experimental situation, but this could not be attributed to differences in medication. When the patients were grouped according to the degree of their activity on the wards those showing a normal degree of activity scored lower in their responses to pin-prick than either the overactive or the underactive groups. It is considered that the high score of the underactive groups indicates that ward behaviour in schizophrenics is a poor measure of sensitivity to stimulation. Significant intercorrelations have also been found between the different measures of reactivity suggesting that they are representative of a psychological function which expresses itself consistently both in motor response and in verbal behaviour.

Acknowledgements

We are grateful to the nursing staff of Cherry Knowle Hospital for their willing assistance. The pressure algometer was kindly constructed by Mr. W. Troupe and secretarial assistance was provided with the help of the Research Sub-Committee of the Newcastle Regional Hospital Board. Mr. R. F. Garside of the Department of Psychological Medicine of Durham University advised us on the statistical handling of the data and Mr. E. Cope checked the calculations. To all of these our thanks are due.

References

ADRIAN, E. D., "The Physical Background of Perception", 1947. Oxford: Clarendon Press.
Idem., Personal communication, 1956, cit., Beecher, 1959.
BEECHER, H. K., "Measurement of Subjective Responses: Quantitive Effects of Drugs", 1959. New York: Oxford Univ. Press.
BISHOP, G. H., Personal communication, 1956, cit., Beecher, 1959.
HALL, K. R. L., *Brit. J. Psychol.*, 1953, **44,** 279.
HOLMES, G., "Some Clinical Aspects of Pain. In Pain and Its Problems" (Ed.) Ogilvie, H., and Thomson, W. A. R., 1950, Eyre and Spottiswood.
KEELE, K. D., *Lancet*, 1954, *i*, 636.
LEWIS, T. L., *Pain*, 1942. New York: Macmillan.
LORR, M., *Psychol. Bull.*, 1954, **51,** 119.
MALMO, R. B., SHAGASS, C., and SMITH, A. A., *J. Personality*, 1951, **19,** 359.
MEDVEI, V. C., "The Mental and Physical Effects of Pain", 1949. Edinburgh: E. & S. Livingstone Ltd.
STENGEL, E., OLDHAM, A. J., and EHRENBERG, A. S. C., *J. Ment. Sci.*, 1955, **101,** 52.
STENGEL, E., OLDHAM, A. J., and EHRENBERG, A. S. C., *J. Ment. Sci.*, 1958, **104,** 435.
TONG, J. E., *J. Ment. Subnorm.*, 1960, **6,** 77.
TONG, J. E., and MURPHY, I. C., *J. Ment. Sci.*, 1960, **106,** 1273.
WILCOX, P. H., *Amer. J. Psychiat.*, 1942, **98,** 874.
WOLFF, H. G., and WOLF, S., *Pain*, 2nd Ed., 1958. Springfield: Charles C. Thomas.

H. Merskey, M.A., B.M., B.Ch., D.P.M., *Assistant Psychiatrist; at present Lecturer in Psychiatry, University of Sheffield*

A. Gillis, B.Sc., M.B., M.R.C.P.E., D.P.M., *Consultant Psychiatrist*

K. S. Marszalek, Dip.Psych., *Senior Clinical Psychologist*

Cherry Knowle Hospital, Ryhope, Sunderland