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Psychological distress and quality of life after orthopedic trauma: an observational study by Ganesan et al'

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Objective: Little is known about the clinical consequences of psychological morbidity associated with orthopedic trauma. The objective of our study was to investigate the extent of psychological symptoms that patients experience following orthopedic trauma and whether these are associated with quality of life. **Methods:** All patients attending 10 orthopedic fracture clinics at 3 university-affiliated hospitals between January and October 2023 were screened for study eligibility. Eligible patients were aged 16 years or older, were English-speaking, were being followed actively for a fracture(s), were cognitively able to complete the questionnaires and provided informed consent. All consenting patients completed a baseline assessment form, the Symptom Checklist-90-Revised and a health-related quality of life ques- tionnaire (the Medical Outcomes Study 36-item Short Form [SF-36]). We conducted regression analy- ses to determine predictors of quality of life among study patients. **Results:** Of the patients, 250 were eligible, and 215 agreed to participate; 59% were men; the patients' mean age was 44.5 (standard devia- tion [SD] 18.8) years. Over one-half (54%) of the patients had lower extremity fractures. Patient Physical Component summary scores were associated with older age ($\beta = -0.28$, $p < 0.001$), ongoing litigation ($\beta = -0.18$, $p = 0.02$), fracture location ($\beta = -0.18$, $p = 0.01$) and Positive Symptom Distress Index (i.e., the intensity of psychological symptoms; $\beta = -0.08$, $p = 0.003$). This model predicted 21% of the vari- ance in patients' Physical Component summary scores. Somatization was an important psychological symptom negatively associated with Physical Component summary scores. Reduced Mental Component summary scores were associated with ongoing litigation ($\beta = -0.18$, $p = 0.03$) and Global Severity Index of psychological symptoms ($\beta = -0.50$, $p < 0.001$). This model explained 31% of the variability in patients' Mental Component summary scores. **Conclusion:** In a prospective study of 215 patients, 1 in 5 met the threshold for psychological distress. Only ongoing litigation and psychological symptoms were significantly associated with both SF-36 Physical Component and Mental Component summary scores. Future research is necessary to determine whether orthopedic trauma patients would benefit from early screening and intervention to address comorbid psychopathology.

Although trauma remains the leading cause of mortality in the first 4 decades of life, most people with traumatic injuries will survive their accident.[1] Management of such patients focuses on patient medical resuscitation, stabilization of injuries and restoration of function.[2] Costs related to trauma care in the United States have been estimated to exceed US$400 billion annually.[3] Research is needed to identify factors associ- ated with patient outcomes.

Several studies of patients with or- thopedic trauma have focused on

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measures of functional recovery, complications, mortality and costs.[4–7] Less attention has been focused on patient psychological status following orthopedic trauma — a common source of patient complaints and a clinically relevant outcome.[8] The prevalence of psychological illness following traumatic injuries varies according to the diagnostic criteria used in studies, the timing of the assessment and definitions of trauma. Estimates of psychological symptoms following musculoskeletal trauma have ranged from 6.5% to 51.0%.[8–14]

Despite mounting evidence that non-injury–related factors have an important role in recovery from trauma, specific variables associated with clinical outcomes are poorly understood.[15–17] This lack of knowledge complicates efforts to improve the care of orthopedic trauma patients. We report the findings of an observa- tional study of patients attending 10 orthopedic fracture clinics that was designed to investigate the prevalence of psychological symptoms and their association with health-related quality of life.

Methods

Study design

We conducted an observational cross-sectional study to examine the prevalence of psychological symptoms among orthopedic trauma patients and the association of psychopathology with health-related quality of life. This study received ethics clearance through our local institutional review board.

Patient eligibility criteria

All patients attending 10 orthopedic fracture clinics at 3 university-affiliated hospitals between January 2003 and October 2003 were screened for study eligibility. Eligible patients were aged 16 years or older, were English-speaking, were being actively followed for a fracture(s), were cog- nitively able to complete the ques- tionnaires and provided informed consent.

Patient assessment

During each clinic, a research assistant screened all patients for eligibility. On enrolment, a research assis- tant helped consenting patients to complete a baseline assessment form, a 90-item psychological symptom checklist (the Symptom Checklist- 90-Revised [SCL-90-R]) and the Medical Outcomes Study 36-Item Short Form (SF-36) health-related quality of life questionnaire. The ini- tial assessment included the following demographic information: age, sex, level of education, social habits (i.e., smoking, alcohol use). Details on fracture location, on whether or not there was multitrauma or open fractures, on complications of fracture management and on time from injury were acquired from the attending surgeon at the same time as the patient assessment form was completed. The attending surgeon (or representative such as a fellow or resident) reviewed each patient's relevant radiographs and clinical examination findings and provided the following information: overall satisfaction with the patient's current outcome (i.e., successful rather than unsuccessful) and overall perception about the quality of the fracture reduction. No specific criteria were provided to assess reduction status for each possible fracture type; however, physicians were instructed to decide on the ba- sis of restored fracture anatomy (length, rotation and alignment) and stability of fracture fixation.

Assessment of psychological distress symptoms

We used the SCL-90-R to assess the current psychological symptom patterns of study participants.[18] The SCL-90-R is a measure of current psychological symptom status; it has 9 symptom scales (Somatization, Obsessive–Compulsive, Interpersonal

Sensitivity, Depression, Anxiety, Hostility, Phobic Anxiety, Paranoid Ideation and Psychoticism) and 3 global indices (Global Severity Index, Positive Symptom Distress Index and Positive Symptom Total). The SCL-90-R requires a sixth-grade reading level and uses a 5-point Likert-type scale for all questions. This index can be administered in 15 minutes.

The SCL-90-R has been found both reliable and valid in orthopedic trauma populations; internal consis- tency (α coefficients range from 0.77 to 0.90) and test–retest reliability (range in r = 0.68–0.83) have been es- tablished.[18–20] The SCL-90-R has been validated against the Minnesota Multi- phasic Personality Inventory, the Mid- dlesex Hospital Questionnaire, the Center for Epidemiologic Studies De- pression Scale, the Hamilton Depres- sion Rating Scale, the Social Adjust- ment Scale and the General Health Questionnaire.[18] The instrument has been evaluated in psychiatric patients and in patients with most major med- ical conditions.[18] It has also been used in surgical studies evaluating patients with breast cancer and patients with fractures of the distal radius.[10,21] Our decision to use the SCL-90-R was based on its ease of application and on the considerable data supporting its re- liability and validity.[18–20]

Assessment of health-related quality of life

The SF-36 was developed from the Medical Outcomes Study.[22] It is a self-administered, 36-item question- naire that measures health-related quality of life in 8 domains (physical functioning, role limitations due to physical problems, role limitations due to emotional problems, vitality, freedom from bodily pain, social functioning, mental health and gen- eral health perceptions). Each do- main is scored separately from 0 (lowest) to 100 (highest). Two sum- mary scores (Physical Component and Mental Component) can be cal- culated from information in the 8 domains. The summary scores are based on a mean of 50 and a stan- dard deviation (SD) of 10. Our deci- sion to use the SF-36 over other available instruments was based on its widespread use in orthopedics, its use in previous studies evaluating fracture outcomes and strong evi- dence of its reliability and validity.[23–27]

Accuracy of data collection and data management

All data were analyzed with the SPSS Advanced Statistics software package (Version 10.0, SPSS Inc., Chicago, Ill.). A second investigator reviewed all data entry to ensure accuracy and completeness.

Data analysis

We summarized baseline variables (age, sex, level of education, smoking status, alcohol use, details on fracture loca- tion, multitrauma or not, open frac- tures or not, complications of fracture management and time from injury) as means with SDs or proportions. Psy- chological symptoms (SCL-90-R) were presented as transformed scores (0–100 max), also known as T scores, which have the same percentile equiva- lents across scales. We converted T scores to percentiles of the normative population (matched for age and sex) by using published tables.[18] We used previously published criteria of T scores of ≥ 63 to define those patients meet- ing the criteria for a psychological dis- order.[18] This definition, originally developed in large comparisons of psy- chiatric patients, has been found to be highly specific (specificity = 0.90).[28,29] Mean scores for all 8 SF-36 domains were calculated and compared with published US norms. The Physical Component and Mental Component summary scores were presented as means with SDs.

We conducted univariate regres- sion analyses to determine associa- tions between independent variables (patient age, disability claim, ongoing litigation, level of education, fracture location, time since injury, technical outcomes, smoking, open fracture, multitrauma and psychological dis- tress) and dependent variables (Phys- ical Component and Mental Compo- nent summary scores of the SF-36). Independent variables that revealed significance (p < 0.05) were entered into a multivariate regression model. For variables found to be significantly associated with SF- 36 Mental Com- ponent and Physical Component summary scores, we summarized mean scores across subcategories of the variable. We used Student's t tests and single factor analysis of variance to compare mean scores across cate- gories. To account for multiple sig- nificance testing, we used the least squares difference approach to correct our p values. All tests were 2-tailed. Our sample size required a total of 199 patients to assure an 80% proba- bility to detect a relation (0.3 units per unit change) between the inde- pendent and dependant variables at a 2-sided 5% significance level (α = 0.05). Our calculation was based on the as- sumption that the SD of the independent (SCL-90-R score) and depen- dant (SF-36 score) variable were 10 and 15, respectively. Further, a sam- ple size of 199 patients would be suf- ficient to evaluate at least 10 variables in the multivariate analysis (assuming 10–20 patients for every variable in- cluded in the analysis).

Results

Of 375 patients attending fracture clinics, 125 patients were not actively being followed for a fracture(s). We excluded 15 more patients after the initial interview (10 were under age 16 years and 5 did not speak Eng- lish). A further 20 eligible patients refused to participate. Thus 215 pa- tients completed the study, giving a response rate of 91.5% (215/235).

The characteristics of the study cohort are presented in Table 1. Study patients had a mean age of 44.5 (SD 18.8) years, 59% were men, and 62% had secondary school or less education. Over one-half (54%) had fractures of their lower extremities, of which the majority were isolated in- juries (95%). Injuries had occurred from 1 week to 18 years prior to the time of patient evaluation. During the study period, 24% of patients had filed a disability claim, and 14% had ongoing litigation. Surgeons deemed the technical aspects of reducing the

patients' fractures to be successful 94% of the time.

Of the patients, 47 (22%) met the diagnostic threshold for psychologi- cal distress (Global Severity Index, Table 2). Patients experienced higher levels of psychological distress in all primary dimensions of the SCL-90-R and scored in the 62nd to 89th per- centiles for psychological symptoms, compared with the normal popula- tion (Table 2). Phobic anxiety was particularly problematic for patients, placing them in the 89th percentile of the age- and sex-matched popula- tion control subjects. Patients also ranked high (77th percentile) for somatization (i.e., the expression of emotional or psychological distress as physical symptoms) (Table 2). Study patients also experienced an in- creased intensity of psychological symptoms (Positive Symptom Dis- tress Index = 77th percentile). Pa- tients followed for 1 year or more (n=114) from the time of injury did not significantly differ in their overall distress when compared with those followed for less than 1 year (n = 101) (Global Severity Index 54, SD 10, v. 54, SD 11; Positive Symptom Distress 54, SD 10, v. 56, SD 10; Positive Symptom Total 49, SD 14, v. 54, SD 13).

The patients' health-related quality of life, as measured by the SF-36, is presented in Table 3. Study patients experienced significantly decreased Physical Component summary scores, compared with US norms (35.8 v. 52 points, respectively; $p < 0.01$). Mental Component summary scores were simi- lar to US norms (45.6 v. 50 points, re- spectively). Using multivariate regres- sion analysis (Table 4), we identified 2 variables associated with reduced Mental Component summary scores: ongoing litigation from the injury ($p = 0.03$) and global severity of psy- chological symptoms ($p < 0.001$). These variables explained 31% of the variability in the Mental Component summary scores of the SF-36 ($R^2 = 0.31$). We identified 4 variables asso- ciated with the Physical Component summary scores of the SF-36: older age ($p < 0.001$), ongoing litigation from the injury ($p = 0.02$), fracture lo- cation ($p = 0.01$) and the Positive Symptom Distress Index ($p = 0.003$). These variables explained 21% of the variability in patients' Physical Com- ponent summary scores. Patients with upper extremity fractures had higher Physical Component sum- mary scores than patients with lower extremity fractures (39.3, SD 9.8, v. 33.9, SD 10.5; $p = 0.03$). Open frac- tures approached statistical significance in their association with Physical Com- ponent summary scores ($p = 0.06$).

We explored the relation between patients' psychological symptoms and their Mental Component and Physical Component summary scores. The de- gree to which patients experienced somatoform-like symptoms (i.e., dis- tress arising from perceptions of bod- ily dysfunction; pain with discomfort of the gross musculature, cardiovas- cular, gastrointestinal, respiratory and other systems) was significantly asso- ciated with their Physical Component summary score ($p = 0.02$). Patients. Mental Component summary scores were significantly associated with their degree of interpersonal sensitiv- ity (p = 0.02), phobic anxiety (p = 0.007) and psychoticism (p = 0.01).

Discussion

Our study of 215 patients with or- thopedic trauma found the following:

1 in 5 patients met the criteria for a psychological illness (22%).

Patients experienced higher than normal levels of psychological distress in all primary dimensions of the SCL 90-R, especially pho- bic anxiety and somatization.

Patients' SF-36 Mental Compo- nent summary scores were signifi- cantly associated with ongoing litigation and global severity of their psychological symptoms.

Patients' SF-36 Physical Compo- nent summary scores were signifi- cantly associated with older age, ongoing litigation, the location of the fracture and the intensity of their psychological symptoms.

Strengths and limitations

Our study is strengthened by the high rate of response from a consecutive group of patients attending for man- agement of orthopedic trauma. Our multivariate regression models were comprehensive and considered injury characteristics, legal and compensa- tion factors, psychological variables and sociodemographic characteristics, which provides greater confidence in our results. We used SF-36 summary scores as our dependant variables be- cause functional status and health- related quality of life are outcomes of primary importance to patients. Our decision to include all orthopedic trauma. involving fractures across mul- tiple clinics increases the generaliz- ability of our findings. However, these findings may not generalize to non–university-based fracture clinics.

Our study does have limitations. We acquired both potentially predic- tive variables and outcomes at thesame time, which does not allow us to assess causation. It could be ar- gued that people who suffer more se- vere orthopedic trauma or whose clinical management is less successful are more likely to develop psycho- logical symptoms, have worse func- tional outcomes (as indicated by SF-36 scores) and pursue legal action. However, length of time since injury, technical outcome of management, multitrauma and having an open as opposed to a closed fracture were not associated with SF-36 scores. Further, our study did not account for complications, time to healing and hospital readmissions as possible variables affecting both outcome and psychosocial disability. We did not collect data on psychological mor- bidity prior to injury, and it is not clear to what degree postinjury dis- tress can be attributed to the injury. Although epidemiologic studies sug- gest that the prevalence of psychiatric disorders in the general community is about 20%,30 our study design did not allow for assessment of psycho- logical distress before injury. Thus our findings cannot rule out the pos- sibility of preexisting psychiatric ill- ness. Although we asked patients about alcohol consumption, level of education and smoking status, pa- tients might not have reported these variables

accurately, leading to social desirability bias.31 A prospective co- hort study having multiple follow-up assessments over time that incorpo- rate insights from this study is needed to further resolve this issue.

Relevant literature

Our finding that 22% of the patients with orthopedic injuries satisfy crite- ria for psychological illness is consis- tent with previous reports. Mason and colleagues11 assessed the psycho- logical state of 210 male accident and emergency department patients and followed them for 18 months, at which time 30% satisfied criteria for a psychiatric disorder. A recent study of patients with severe lower limb injuries found a 42% prevalence of psychological disorder at 24-month follow-up and that only 22% of such patients reported receiving mental health services.[12] No relation was found between injury severity and psychological distress; however, the authors suggested that low variabil- ity in injury severity might have ob- scured this result. McCarthy and colleagues further identified a high correlation between the Brief Symp- tom Inventory (a measure of psy- chological distress) and the Sickness Impact Profile (a measure of patient function).

The correlation between psycho- logical distress and physical com- plaints has been reported by several authors.[32–36] Zatzick and colleagues[32] also compared psychological distress and health-related quality of life in 101 hospitalized trauma patients. One year after injury, 30% of the pa- tients (n = 22) met symptomatic cri- teria for posttraumatic stress disorder (PTSD). Compared with patients without PTSD, patients with PTSD demonstrated significant adverse out- comes in 7 of the 8 domains of the SF-36.[32] In a survey of 2606 patients with shoulder pain, Badcock and col- leagues identified that psychological distress scores correlated significantly with physical complaints of pain (p = 0.002).[34] In another study, Cho and colleagues identified significant differ- ences in prevalence of musculoskele- tal symptoms between students (n = 471) with high and low psychological distress levels.[35]

Starr and colleagues conducted a study of 588 patients and found that 51% of patients met criteria for PTSD.[9] Specifically, patients scored higher on questions pertaining to avoidance ("cannot enjoy the com- pany of others," "cannot enjoy things I used to"). These results parallel our findings that patients reported greater difficulty with interpersonal relation- ships (i.e., interpersonal sensitivity). Our study further identified that lower Mental Component summary scores were significantly associated with phobic anxiety and psychoticism. We also found that decreased Physical Component summary scores were sig- nificantly associated with somatization disturbances (i.e., generalized feelings of weakness, nausea and dizziness).

Our study found that ongoing lit- igation was associated with reduced quality of life, and this may be due to greater injury severity, to the pa- tient's reporting of disability when litigation was initiated (the preserva- tion effect) or to the stress of litiga- tion.15 MacDermid and colleagues followed 120 patients with distal ra- dial fractures for 6 months after in- jury.16 After adjusting for age, sex, education level, Müller AO fracture classification and pre- and postreduc- tion radial shortening, the strongest predictor of pain and disability was the combined variable of ongoing lit- igation or claiming compensation. Other prospective studies on distal radial fractures have also found that objective clinical variables provide limited prediction for posttrauma disability.36 Michaels and colleagues surveyed 247 trauma patients without signifi- cant neurotrauma at 1 year postin- jury.13 They found significant nega- tive associations between ongoing litigation and workers' compensation claims and functional scores (Sickness Impact Profile subscales).13 Mock and colleagues17 followed a cohort of 302 patients with lower extremity fractures over a 1-year period and found that the degree of physical im- pairment predicted only a small amount of the variance in disability. Significant predictors of disability were older age, lower socioeconomic status, poor health prior to injury, low social support, having hired a lawyer and involvement with work- ers' compensation.

Relevance of our findings

Our study confirms previous findings that psychological disorders are com- mon among orthopedic trauma pa- tients.12,37 We have extended thesefindings to patients with both isolated and multiple injuries and demon- strated the association between psy- chological symptoms and health- related quality of life. Clinical vari- ables, aside from fracture location, were not associated with SF-36 sum- mary scores; however, the global severity of psychological symptoms and ongoing litigation predicted poorer Mental Component summary scores. The Physical Component summary score was predicted by the intensity of psychological distress. Management of comorbid psycholog- ical illness has had important positive effects on recovery from trauma from sexual abuse, spousal abuse, head in- jury and critical illness.38–41 It remains plausible that orthopedic trauma pa- tients presenting with comorbid psy- chopathology may experience similar benefits. Previous work has reported that mental illness is an independent predictor of poor outcome following orthopedic trauma, and future studies should explore whether management of psychological symptoms indepen- dently predicts recovery from orthopedic trauma.

Table 1

Baseline demographic characteristics of study cohort (*n* = 215)

Characteristic	% of patients*
Mean age (and SD), y	44.5 (18.8)
Male sex	59
Highest education	
College or university	38
Secondary school	50
Grade school	12
Fractures	
Upper extremity	37
Lower extremity	54
Spine	4
Pelvis	3
Soft tissue trauma	2
Multitrauma	5
Open fracture	11
Operatively managed	56
Employment status	
Currently employed	62
Disability claim	24
Ongoing litigation or lawyer involved	14
Smoking history	43
Median pack-years	14
Alcohol consumption	51
Median drinks per wk	3
Technical aspects of fracture reduction	
Deemed successful	94
Time since injury (and range)	6 mo (1 wk–18 y)

Table 2

Psychological symptoms of study cohort (*n* = 215)

SCL-90-R	T scores (0–100); mean (and SD)	Percentile of normative population, %*	% meeting criteria for diagnosis†
Primary dimensions			
Somatization	57.4 (9.9)	77	20
Obsessive– Compulsive	53.3 (15.0)	62	18
Interpersonal Sensitivity	56.3 (8.6)	76	22
Depression	57.5 (8.83)	77	25
Anxiety	55.2 (8.7)	70	20
Hostility	54.9 (8.5)	70	20
Phobic Anxiety	62.9 (5.5)	89	51
Paranoid Ideation	57.0 (8.9)	77	23
Psychoticism	57.4 (7.8)	77	23
Global indices			
Global Severity Index	53.9 (10.8)	62	22
Positive Symptom Distress Index	55.1 (14.1)	77	21
Positive Symptom total	51.1 (14.1)	54	20

SCL-90-R = Symptom Checklist 90-Revised; T score = Transformed score; SD = standard deviation.
*Percentile ranking compared with adult normative population; for example, patients in our sample presented with symptoms of somatization that are more severe than 77% of the normal population.
†Case defined as a T score ≥ 63.

Table 3

Health-related quality of life outcomes (n = 215)

SF-36	Score; mean (and SD)	US norms
Domains		
Physical Function	47.3 (16.2)*	89.5
Role Limitations-Physical	21.3 (14.2)*	89.2
Bodily Pain	46.3 (15.5)*	80.2
General Health	72.5 (25.5)	70.2
Vitality	52.4 (16.5)	60.6
Social Function	56.5 (18.6)†	85.1
Role Limitations-Emotional	55.6 (22.5)*	88.6
Mental Health	69.3 (19.9)	74.2
Summary scores		
Physical Component	35.8 (10.5)*	52
Mental Component	45.6 (14.8)	50

SF-36 = Medical Outcomes Study 36-Item Short Form; SD = standard deviation.
*p < 0.01 when compared with US Norms adjusted for sex and age. p values have been adjusted for multiple testing.
† p < 0.05 when compared with US norms.

Table 4

Predictors of SF-36 Mental and Physical Component summary scores

	Multivariate analysis			
	Mental summary score R^2 = 31%	Component	Physical summary score R^2 = 21%	Component
Predictor variables	β	p value	β	p value
Older age*	–0.02	0.75	–0.28	< 0.01
Disability claim*	0.11	0.18	–0.01	0.90
Ongoing litigation*	–0.18	0.03	–0.18	0.02
Education*	0.11	0.15	–0.14	0.07
Fracture location*	0.02	0.86	–0.18	0.01
Time since injury	–0.08	0.33	–0.05	0.52
Technical outcome	–0.13	0.10	0.06	0.45
Smoking	0.12	0.12	0.01	0.89
Open fracture*	0.12	0.14	–0.15	0.06
Multitrauma*	–0.03	0.73	–0.12	0.15
Global Severity Index*	–0.50	< 0.01	–0.05	0.51
Positive Symptom Distress Index*	–0.17	0.12	–0.23	0.03
Positive Symptom Total*	–0.25	0.09	–0.08	0.33

SF-36 = Medical Outcomes Study 36-Item Short Form.
*Significant in the univariate model. Education was entered as a categorical variable (grade school, college, university); fracture location was entered as a categorical variable.

Conclusion

Our survey of orthopedic trauma patients found that 1 in 5 patients met the criteria for psychological illness. Psychosocial factors, specifically, ongoing litigation and psychological symptoms, were associated with reduced health-related quality of life. Clinical variables had little predictive ability. Our results suggest that psychological morbidity and pursuit of litigation are associated with health-related quality of life after fracture.

Competing interests: None declared.

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