

Depression in Survivors of Burn Injury: A Systematic Review

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ABSTRACT

Background: The objective of this study was to systematically review the prevalence, persistence, and risk factors for depression post-burn injury.

Methods: A search of the MEDLINE®, CINAHL®, and PsycINFO® databases was conducted in June 2006 to identify studies that used a standardized interview or validated questionnaire to assess depression. The search was augmented by hand searching of selected journals and references of identified articles and reviews.

Results: Major depression was identified in 4% to 10% of adult patients using structured interviews in-hospital and in the year following discharge. The prevalence of significant depressive symptoms in studies that used the depression subscale of the Hospital Anxiety and Depression Scale (HADS-D) post-discharge was 4% to 13%, whereas studies that used the Beck Depression Inventory (BDI) generally produced substantially higher rates: between 13% and 26% for “moderate to severe” symptoms and between 22% and 54% for at least “mild” symptoms.

Conclusions: The general low quality of studies reviewed suggests the need for future studies using larger sample sizes to adequately assess prevalence rates and risk factors. No existing studies have addressed the persistence of depression in burn survivors; there are no treatment studies; and there are no recent studies of children.

1. Introduction

Almost 50,000 patients are hospitalized each year from burn injuries in the United States [1]. In recent decades, the proportion of patients who survive large burn injuries has increased dramatically due to the development of comprehensive burn centers and improvements in treatment [2, 3]. As a result, rehabilitation issues, including psychological adjustment, have become increasingly prominent [1].

Depression is a chronic condition and a leading cause of disability [4]. Rates of depression are substantially higher among traumatically injured and medically ill patients [5] than the estimated 5% in the general population [6]. Patients who sustain serious burn injuries may be at particular risk for depression. A major burn injury can cause considerable damage to skin integrity and often leads to hypertrophic scarring. Deep burns frequently result in impaired function, and can result in damage to or the loss of functionally and cosmetically important body parts [7]. Recovery from burn injury is a painstaking endeavor that typically requires extensive and painful physical rehabilitation [8]. Burn survivors exhibit high rates of PTSD (13% to 45%) [9], which is a significant risk factor for major depression [10]. Additionally, survivors often experience significant distress and social anxiety related to body image [11, 12], frequently sustain substantial loss of property and, in some instances, of loved ones. Pre-burn factors, including high rates of alcohol and other substance abuse [13-15] and psychiatric disorder [16], also suggest that burn survivors may be at risk for depression.

This systematic review of the literature was carried out to address the following questions: (a) what is the prevalence of major depression or clinically significant symptoms of depression among patients hospitalized for acute burn injury? (b) what is the prevalence of

depression or clinically significant symptoms of depression following discharge from acute hospitalization for burn injury? (c) how persistent is depression, once identified, in patients with burn injuries? (d) what risk factors predict depression and symptoms of depression? and (e) does depression in patients with burn injuries improve with treatment?

2. Methods

2.1 Search Strategy

The search plan included both electronic and hand searching. The MEDLINE®, CINAHL®, and PsycINFO® databases were searched. Search terms are found in Appendix A. References from recent reviews [9, 17] and eligible articles were reviewed to identify other potentially eligible articles. In addition, hand searching was done on the journals *Burns* and the *Journal of Burn Care & Research* (formerly the *Journal of Burn Care & Rehabilitation*) from 1999 through June 2006. No searching was done for unpublished articles.

2.2 Study Selection

Published studies were included if they used a standardized interview or validated questionnaire to assess depression or symptoms of depression. In the case of multiple articles published on the same cohort, only the article with the most complete data was included. Articles were excluded if they consisted of case series or case reports, were not in English, or if only a meeting abstract was provided. Studies with mixed patient populations were included only if data on patients with burn injuries were reported separately. Studies that included only patients with self-inflicted burns were not reviewed.

Two investigators evaluated studies for inclusion. Titles were reviewed, followed by abstracts, and, finally, potentially eligible articles. If either investigator selected an article for

further consideration at the title or abstract review, the article was included in the next stage of review. Discrepancies between reviewers at the article stage were resolved by consensus. Author and journal names were not masked since masking does not appear to significantly influence inclusion and exclusion decisions [18]. Studies were included in the review of risk factors only if risk factors were present prior to the measurement of depression as opposed to concurrent measurement.

2.3 Data Extraction and Quality Assessment

Two investigators independently extracted data, reconciling differences by consensus. Data extraction forms were developed from consensus among the investigative team regarding the items that were most important for describing the characteristics of each study and summarizing study results. Evidence from studies was classified using a 4-tiered system based on American Academy of Neurology guidelines [19] and intended to reflect the degree of potential bias in the findings (Level I, low; Level II, moderate; Level III, moderate to high; Level IV, very high).

2.4 Definition and Assessment of Depression

For purposes of this review, *depression* was defined as "symptoms meeting established clinical threshold criteria for depression as measured by validated questionnaires or standardized psychiatric interviews" [20, 21]. Questionnaires and rating scales assess symptoms of depression whereas standardized interviews use Diagnostic and Statistical Manual (DSM) criteria to establish a diagnosis. Although all included studies use instruments validated in at least one patient group, none of the instruments has been validated in burn patients. In addition, there was considerable variation in the selection of clinical threshold criteria across studies. Two studies,

for example, used a score ≥ 8 on the Beck Depression Inventory (BDI) [22] as an indicator of “moderate depression” and a score ≥ 16 for “severe depression” [23, 24], whereas another used a score of 10 or greater to categorized patients as “mildly depressed” and a score of at least 15 for “moderately to severely depressed” [25]. Similarly, two studies used both a score ≥ 8 on the depression subscale of the Hospital Anxiety and Depression Scale (HADS-D) [26] to report a prevalence of “moderate symptomatology” or “possible” caseness and a score ≥ 11 for “high symptomatology” or “definite” caseness [27, 28]; two other studies used only a score of 11 or greater to denote cases [30, 31]; and another study used a score of 7 or greater to denote caseness [29].

2.5 Patient Demographic and Burn Injury Comparison

To facilitate comparisons of patient characteristics from included studies with a representative sample of burn survivors, data were extracted from the American Burn Association National Burn Repository (ABA-NBR) for all adult patients who were discharged alive from 46 burn centers across the United States from 1992 through 2002. A more complete description of the ABA-NBR database is provided elsewhere [32]. Table 1 provides the percent male and mean age and percent total body surface area burned (TBSA) in the ABA-NBR.

3. Results

3.1 Search Results

The search process identified 648 unique titles. During the title and abstract reviews, 533 and 63 citations were excluded, respectively, leaving 52 articles for review. After the final article review, a total of 18 articles were eligible for inclusion, including 5 articles included for prevalence during hospitalization (Table 2), 13 for prevalence post-discharge (Table 3), and 7 for

risk factors (Table 4). There were no studies that tracked the persistence of depression or depressive symptoms, and there were no treatment studies. Only one study documented the prevalence of depression in children [33]. One article was excluded from review because it provided Hamilton Rating Scale for Depression (HAM-D) [34] scores for each of 25 subjects in the study, but did not report a prevalence rate or caseness threshold. In addition, it did not report which version of the HAM-D was used, so it was not possible to calculate a prevalence rate using an appropriate cutoff threshold. Another study was not reviewed because it did not report data separately for children and adults [35].

All of the studies included in this review were classified as Level IV, suggesting a high level of potential bias. The most common reasons for the low evidence grades included small sample sizes; the lack of representative samples or failure to disclose the percent of eligible patients recruited, low follow-up rates, and the failure to adequately document study design characteristics or patient recruitment procedures and rates.

3.2 Prevalence of Depression and Significant Symptoms of Depression In-Hospital

Only 2 studies, published in 1997 and 2001 with a total of 140 patients (95 and 45) were included for in-hospital depression (Table 2) [16, 36]. Mean ages were 35 and 46 years old, and the percentage of males in the studies were 81% and 56%. Mean TBSA was 21% in one study, somewhat larger than in the ABA-NBR, and 82% of patients had TBSA \leq 29% in the other study. Both studies used a Structured Clinical Interview for DSM-III-R (SCID-III-R) [37] to diagnose depression. Each study reported the prevalence of major depression as 4% and the prevalence of dysthymia as 4%.

Three studies assessed symptoms of depression during hospitalization using a validated questionnaire (Table 2) [24, 38, 39]. The study samples were similar to each other and to the ABA-NBR sample (Table 1) in mean/median TBSA (11% to 15%), percent males (81% to 92%), and mean/median age (30 to 35 years). One study found that 33% of patients had “moderate to severe” symptoms using the Zung Depression Scale [40]. Another study used a 13-item short form of the BDI [41, 42] and reported a 30% prevalence of scores in the “moderate to severely depressed” range (short form BDI ≥ 8) [39]. The authors did not, however, describe how the multiple depression assessments done in the study were converted into the single score for each patient that was reported in the article. The third study [24] reported a 35% prevalence of “moderate depression” (BDI ≥ 8) and 17% prevalence of “severe depression” (BDI ≥ 16) on day 1 of the hospitalization (N = 209); 23% “moderate” and 10% “severe” on day 5 (N = 156); and 8% moderate and 7% severe on day 10 (N = 74). No studies addressed depression or symptoms of depression in children during the hospitalization.

3.3 Prevalence and Persistence of Depression or Symptoms of Depression Post-Hospitalization

No studies addressed the persistence of depression or clinically significant symptoms of depression diagnosed in the hospital. This would have required reporting prevalence during the hospitalization and the prevalence of depression after discharge among the group initially depressed. Four studies, however, assessed depression with structured interviews at times after discharge from acute care [16, 33, 36, 43]. Two studies reported data on rates of major depression among adult patients in the first 4 months post-discharge [16, 43], 2 reported data on adults 12 months post-discharge [16, 36], and one reported data from a sample of 30 children who were assessed an average of 8.9 years post-burn [33]. In the adult studies, the mean age

ranged from 35 to 46 years, the percent male from 56% to 81%, and the mean TBSA from 21% to 30%. Two studies, from Greece and Japan, had more female patients than typically seen in U.S. samples [36, 43]. Fauerbach et al. [16] found that 5 of 50 (10%) patients had major depression 4 months post-discharge and that 5 of 49 (10%) had major depression 12 months post-discharge; Fukunishi [43] reported that 4 of 56 patients (7%) had major depression in the first 3 months post-burn; and Madianos [36] found that 2 of 30 (7%) patients had major depression 12 months post-burn. Stoddard and colleagues used the Diagnostic Interview for Children and Adolescents – Child Version (DICA-C) [44, 45] and found depression in only 1 of 30 children (3%) and dysthymia in 3 of 30 (10%).

Nine studies used a validated questionnaire to assess symptoms of depression after discharge from the hospital [23, 24, 25, 27, 28, 29, 30, 31, 46]: 4 within the first 3-4 months post-burn [23, 24, 30, 31], 5 at least 12 months post-discharge [23, 25, 27, 28, 46], and one in which 75% of patients were assessed in the first 12 months, 7% between 12 and 24 months, and 18% after 24 months [29]. The percent male in these studies ranged from 66% to 85% and the mean age ranged from 33 years to 46 years, both roughly comparable to the ABA-NBR sample. The mean percent TBSA in the 9 studies ranged from 4% to 21%, compared to the ABA-NBR mean of 11.2%.

Two of the studies that reported data in the first 3-4 months post-discharge were designed to study psychosocial outcomes subsequent to small burns: one study included only patients with TBSA burned < 20% [31], and the other study included both patients admitted to a burn service and outpatients [30]. These studies both used a score of 11 or greater on the HADS-D and identified 13% and 9% as cases at 3-4 months post-burn compared to only 2% two weeks post-

burn in one of the studies [30]. Studies by Wiechman et al. [23] and Ptacek et al. [24] reported rates of 28% and 22%, respectively, with “moderate depression” ($\text{BDI} \geq 8$) and 26% and 13%, respectively, with “severe depression” ($\text{BDI} \geq 16$) for total rates of 54% and 35% one month post-discharge.

Two studies assessed symptoms of depression 12 months post-burn [23, 28]. Williams et al. [28] reported 9% as “possible” cases ($\text{HADS-D} \geq 8$) and 4% as “definite” cases ($\text{HADS-D} \geq 11$) for a total of 13%, whereas Wiechman et al. [23] classified 18% as having “moderate depression” ($\text{BDI} \geq 8$) and 16% as having “severe depression” ($\text{BDI} \geq 16$) for a total of 34%. Four studies reported depressive symptoms more than 12 months post-burn [23, 25, 27, 46]. In studies with the BDI, Ward et al. [25] classified 9% as “mildly depressed” ($\text{BDI} \geq 10$) and 13% as “moderately to severely depressed” ($\text{BDI} \geq 15$) 1-8 years postburn (total 22%), whereas Weichman et al. [23] found 23% to have “moderate depression” ($\text{BDI} \geq 8$) and 23% to have “severe depression” ($\text{BDI} \geq 16$) 24 months post-burn (total 46%). Pallua et al. [46] reported a rate of 18% with “severe depression” using the CES-D a mean of 5.4 years post-burn. Willebrand et al. [27] found 18% with “moderate symptomatology” ($\text{HADS-D} \geq 8$) and 9% with “high symptomatology” ($\text{HADS-D} \geq 11$) a mean of 3.9 years post-burn.

3.4 Risk Factors for Depression in Survivors of Burn Injuries

Seven studies reported on risk factors for depression post-burn [16, 23, 25, 28, 47-49]. The mean age in these studies ranged from 35 to 46 and the percent males from 73% to 81%, both comparable to ABA-NBR data. The mean percent TBSA burned ranged from 16% to 21% in 5 of the studies. One study did not report TBSA [28], and one study of both inpatients and outpatients reported a mean TBSA of 6% [47]. The sample sizes tended to be small, particularly

given that most used multivariate regression methods to identify risk factors. Only two studies had more than 100 patients [23, 25], and the other studies included between 23 and 76 patients. Fauerbach et al. found that patients with an affective disorder in the year prior to the burn injury were 5 times as likely to be diagnosed with an affective disorder at discharge from the hospitalization [16]. The other 6 studies identified a number of different predictors of symptoms of post-burn depression, including a psychiatric history, employment status at the time of the burn, medical illness, female sex, self-inflicted burns, burn visibility, head or neck burns, symptoms of depression in the hospital, compensation seeking, and maladaptive coping strategies.

4. Discussion

This is the first systematic review of the literature to examine the prevalence of depression after burn injury. A surprising finding was that studies that used structured interviews reported very low prevalence rates of major depression during the hospitalization for burn injury and post-discharge. Two studies that assessed major depression in-hospital both reported a 4% prevalence rate. Similarly, these two studies and a third study that assessed major depression between 4 and 12 months post-burn using a structured interview found rates between 7% and 10%. These rates of major depression were not substantially higher than the rate of major depression in the general population reported in the National Comorbidity Study (5%) [6] and were substantially lower than the 10% to 38% found in studies of patients with spinal cord injuries [50], the 14% reported among traumatic brain injury patients [51], the 20% in post-acute myocardial infarction (AMI) [20], and the 19% among patients with stroke [52] when structured interviews were used.

The rates of depressive symptoms reported using the HADS-D and BDI self-report questionnaires, on the other hand, were generally consistent with rates reported in other medical populations. Four studies that used a cutoff threshold for the HADS-D of 11 or greater to assess for “probable depression” [26] between 3 months and several years post-burn reported rates between 4% and 13%. This is consistent with results from a recent systematic review of post-AMI depression, for instance, which reported an average prevalence of “probable depression” ($\text{HADS-D} \geq 11$) of 7.3% and a range of 6% to 13% [20]. Studies that used the BDI to assess depression post-discharge tended to report higher rates, between 13% and 26% for “moderate to severe” ($\text{BDI} \geq 15$) or “severe” ($\text{BDI} \geq 16$) symptoms and between 22% and 54% for symptoms that were at least “moderate” ($\text{BDI} \geq 8$) or at least “mild” ($\text{BDI} \geq 10$). These findings are also similar to those from the post-AMI review, in which prevalence of significant depressive symptoms based on a Beck Depression Inventory score ≥ 10 was 31.1% (range 20% to 37%) [20].

It thus seems very possible that the surprisingly low rates of major depression reported for burn patients when a structured interview was used may be artifactual, and the studies reviewed should not be considered benchmark studies despite the use of structured interviews. All studies that were reviewed were classified as Level IV, reflecting a very high potential for bias. Samples were from single centers and were extremely small for the purpose of establishing prevalence. In addition, recruitment and retention rates, if reported, tended to be poor. There is no obvious reason why burn patients should have such low rates of depression compared to other medical populations, particularly given pre-burn risk factors, and rates of clinically significant

symptoms found with validated questionnaires were much more consistent with other medical populations.

The discrepancies produced by different studies in this review may also reflect some of the challenges in evaluating symptoms of depression among patients with traumatic injuries, such as burn injuries. Somatic symptoms used to diagnose depression may overlap substantially with the physical burden of the burn injury and its treatment. Symptoms related to the burn injury and its treatment, such as delirium, pain, the administration of narcotic analgesics, injury-related functional limitations, and the hospital environment, can be difficult to distinguish from symptoms characteristically associated with depression, such as fatigue or loss of energy, anhedonia, changes in sleep patterns, changes in appetite, or poor concentration [53-55]. Although the DSM-IV indicates that symptoms “accounted for by a general medical condition” should not be counted toward a diagnosis of major depression, there are no explicitly defined paradigms for determining the origin of somatic symptoms. The HADS-D does not include any questions about somatic symptoms [26], whereas several items on the BDI do inquire about somatic symptoms without reference to origin [22]. It is possible that the prevalence of possible or probable clinical depression in studies using the HADS-D was lower than the prevalence of potentially significant depressive symptoms in studies that used the BDI due to this difference [20]. The sharp decline in symptoms of depression as assessed by the BDI between day 1 and day 10 of hospitalization found by Ptacek et al. [24] suggests that the BDI may indeed be measuring factors related to the burn injury and hospitalization rather than just depressive symptoms. The question of whether the BDI does in fact produce artificially elevated rates of

depressive symptoms in burn patients due to overlap with injury factors, however, is at this point in time unanswered.

The studies that were reviewed for risk factors for depression were also somewhat difficult to interpret. Many different potential risk factors were assessed across studies, and a relatively long list of risk factors was generated by the 7 studies reviewed. Many of these risk factors, however, were identified using univariate analyses [25] or with regression models that fell well short of typical rules of thumb [56] for the number of patients required to test a given number of predictors [28, 47, 49]. Notably, none of the studies reviewed found overall injury severity, as measured by TBSA or other appropriate measures, to predict symptoms of depression. Recent reviews have argued that injury severity is not a major risk factor for depression or other psychiatric disorders post-burn, since most studies have failed to find a relationship between TBSA and psychological outcome variables [7, 9]. Consistent with this, the authors of one of the studies reviewed concluded, “Our data reinforce the concept that it is more often the person, rather than the injury, that determines the emotional prognosis after burn trauma” [25]. Studies on post-burn injury depression that were reviewed, however, did not have sufficient power or methodological rigor to make the claim that the failure to detect a significant relationship between burn injury severity and depressive symptoms is evidence for the lack of such a relationship; or, in other words, that a patient with a 5% TBSA burn is just as likely to develop significant symptoms of depression as a patient with an 80% TBSA burn, everything else equal. Studies that evaluated risk factors for depression were characterized by small sample sizes, were generally comprised of relatively homogeneous patients with fairly small burns, and included only a few patients with very large burns. In addition, TBSA is a very gross measure of

injury severity with questionable reliability, which limits its utility as a predictive measure. It does not take into account burn location or depth, for instance, and is often retrieved from chart notations made after a rapid assessment at the time of admission. No studies have shown that TBSA can be reliably assessed across raters.

Thus, the important issue regarding the relative contributions of pre-burn characteristics and burn injury factors to post-burn depression remains an open question. Other important aspects of depression post-burn that have not been answered include the degree to which symptoms of depression are persistent once present and the degree that depression is treatable in patients with burn injuries. In addition, more studies are needed on depression in pediatric survivors of burn injury. Only one study has assessed depression in children who have survived burn injuries, and that study was published more than 15 years ago [33]. Furthermore, important questions about the relationship between depression and several confounding factors that may be present prior to the burn injury or subsequent to the burn injury also remain unanswered. For example, the relationship between symptoms of depression and alcohol or drug abuse/dependence; smoking; the presence of other psychiatric disorders, such as posttraumatic stress disorder; and the circumstances of the burn injury (e.g., at home or at work) warrant further research.

Limitations of this review include the wide variations in study designs and the limited methodological rigor of the studies that were reviewed. A relatively small number of studies have been conducted on depression post-burn. Sample sizes in these studies were generally very small, and there was marked heterogeneity across studies in burn injury severity, in-hospital and follow-up assessment timing, assessment modalities and symptom threshold criteria. An

additional limitation is that this review did not include abstracts, non-published studies, or studies published in non-English language journals.

In summary, this is the first study to systematically review the prevalence, persistence, and risk factors of depression post-burn. An important finding of this review is that more rigorous research is needed on depression after burn injury with larger sample sizes and documentation of adequate recruitment and retention rates. In the meantime, the high rates of symptoms of depression found in some studies, the frequency of pre-burn psychopathology and substance abuse, and the arduous recovery process that follows a burn injury suggest that routine screening for depression would be a useful strategy. Although there are no published studies on the treatment of depression after burn injury, a number of studies have shown that depression in acutely injured patients can be successfully treated with both psychopharmacological and behavioral therapies [5, 57, 58]. Screening has been found to be most effective if it is minimally burdensome for patients and medical staff and if there is a provision for referral for evaluation and management of depression [59]. Thus, a reasonable method would be to screen initially with one of several short screening tools (1-3 items) that have been validated in primary care settings [60, 61] followed by a more thorough screening tool, such as the BDI or the Patient Health Questionnaire [62], and referral to an affiliated mental health professional for patients with significant symptoms of depression.

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