

Mental Health

The Invisible Challenge and the Opportunity

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KEYWORDS

• Mental health • Psychology • Psychiatry • Limb loss • Amputation • Amputee • Multi-disciplinary

KEY POINTS

- The mental health burden among patients with upper extremity limb loss can negatively affect quality of life and overall outcomes after reconstructive efforts for limb loss.
- A variety of mental health disorders may be encountered in this patient population.
- A multi-disciplinary approach to the treatment of upper extremity limb loss, including treatment of physical and mental health needs simultaneously is the most comprehensive way to assist this population.
- Multiple treatment options exist to address the variable presentations of mental health pathology in this patient population.

INTRODUCTION

According to data, over 1 million individuals in the United States are living with limb loss,¹ the majority of which are lower extremity limb loss (LELL). Because of this disparity, less focus has been given to understand the deleterious physical and psychological effects of upper extremity limb loss (UELL). Individuals with UELL are less likely to receive adequate treatment for mental health issues. Although traditionally viewed as a physical ailment, the impact on mental health is devastating, requiring significant life adaptations.²

Individuals with UELL are more likely to experience negative psychological outcomes, such as posttraumatic stress disorder (PTSD) and depression, compared to LELL peers.³ Psychosocial adjustment is poorer and levels of depression and anxiety are greater in individuals with UELL.³ Potential contributing factors to this

discrepancy include visibility of the UELL, impact on daily functioning, and ability for prosthetics to be concealed.⁴ In addition, studies demonstrate that those with isolated upper limb amputations had greater disability ratings when compared to LELL.⁵ Those with UELL were also more likely to have disability secondary to PTSD when compared to LELL.⁵ As such, it is critical to understand the psychological needs of individuals with UELL to promote enhanced recovery, increased quality of life, and improve functional outcomes.^{6,7}

This article aims to detail the mental health implications of UELL, and to underscore the importance of a timely, holistic approach, inclusive of the unique psychological needs of this population. In addition, we aim to delineate the importance of a multidisciplinary team inclusive of mental health professionals when performing bionic reconstruction for UELL.

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Abbreviations

ACT	<i>Acceptance and commitment therapy</i>
CBT	<i>Cognitive behavioral therapy</i>
IPT	<i>Interpersonal psychotherapy</i>
LELL	lower extremity limb loss
MBSR	<i>Mindfulness-Based Stress Reduction</i>
MI	<i>Motivational interviewing</i>
PTG	posttraumatic growth
PTSD	Posttraumatic stress disorder
UELL	upper extremity limb loss

DEFINITIONS AND CLINICAL PRESENTATION

The increased rates of mental health disorders in patients with UELL underscore the need for awareness by team members. Understanding and screening for these disorders will improve post-reconstructive outcomes.

Major depressive disorder is a mood disorder that presents with persistent sadness and loss of interest in previously enjoyed activities.⁸ Depression is diagnosed based on the presence of 5 of the following 9 symptoms for at least 2 weeks time: sleep disturbance, loss of interest, guilt, lack of energy, impaired concentration, change in appetite, psychomotor changes, suicidality, and depressed mood.⁸

Generalized anxiety disorder is the constant feeling of fear, worry or being overwhelmed with one's current situation.⁹ Anxiety leads to a wide variety of other mental health disorders and effects on a patient's daily activities and functional capacity. The anxiety is associated with 3 or more of the following: restlessness, easy fatigability, difficulty concentrating, irritability, muscle tension, and sleep disturbance.¹⁰

PTSD is a mental health disorder that arises from exposure to a traumatic event.¹¹ PTSD symptoms range widely from nightmares and somatic experiences, to changes in cognition, mood, experiences, and behavior.¹¹ Per DSM-5 Criteria, PTSD may take place by someone directly experiencing or witnessing a traumatic event resulting in presence of intrusive, avoidance, dissociative, and arousal symptoms and negative mood.¹²

Grief and mourning are common reactions to limb loss and most commonly experienced within the early stages of adjustment.^{2,13,14} Experiencing and processing the stages of grief can be central to rehabilitation, adjustment, and prosthetic adherence.

Body image is defined as the subjective outlook one has of their own body, despite what it objectively appears to be.¹⁵

BURDEN OF DISEASE***General Considerations***

The perception of pain has consequential effects on psychological functioning and quality of life in individuals with limb loss.¹⁶ In individuals with UELL increased pain leads to poorer psychosocial adaptation.^{17,18} In a sample of patients with acute traumatic hand injury, one-third of all patients considered their whole life situation to be worse as a result of the injury, reporting higher levels of both physical and psychological problems.¹⁹ Patients with amputations had even higher rates of reported worse life situations. Changes in finances and employment status, functional status, and psychosocial roles are consequences of UELL, leading to impaired psychological functioning.² The inability to return to these activities, including the likelihood that most with limb loss will be unable to return to their original occupation, leads to a further mental health burden.^{20,21}

Psychosocial adaptation may be influenced by several factors, including subjective experience of pain, ability to participate in valued activities,^{18,22} and presence of a strong support system.¹⁸ Further, specific demographic factors, such as education, age, time since injury, have been shown to negatively impact one's psychological adjustment to UELL.¹⁷ Specifically, data have shown that individuals with less than a college degree, older than 23 years, and being less than 6 months post-injury, are more likely to experience negative adaptation.

Major Depressive Disorder

Over half (55.4%) of individuals who experienced UELL met criteria indicative of a clinically significant level of depression.^{22,23} Further, of those experiencing clinically significant levels of depression, 21% reported co-occurring PTSD.²² In addition to psychological impairment, PTSD and depression have been shown to influence pain ratings and activity restriction.^{22,24}

Generalized Anxiety Disorder

Anxiety in the population with limb loss is higher than in the general population. Anxiety, like depression, does not occur in a vacuum but rather has consequential effects on recovery after limb loss. Specifically, anxiety is negatively associated with healing after amputation.²⁵ Further, anxiety has been associated with length of original inpatient stay, number of hospitalizations, number of follow ups per year, pain perception, and rehabilitation satisfaction.²⁶

Posttraumatic Stress Disorder

A study assessing the mental health implications on military limb loss found that patients had a much higher rate of PTSD, which resulted in significant disability.²⁷ Higher PTSD scores were associated with higher pain scores and depressive symptoms, further impacting patients' lives.²⁷ In UELL samples, estimates of individuals who meet criteria for PTSD range from 13% to 26%.^{22,28} The impact of PTSD affects individuals' quality of life and functional impairment. Specifically, in individuals with UELL, PTSD-related symptoms contribute to higher disability scores and greater perception of disability^{5,29,30}; patients with PTSD tend to endorse higher perceptions of pain,^{19,22} and are significantly less likely to return to work.³¹

Grief

Grief and mourning are common reactions to limb loss and most commonly experienced within the early stages of adjustment.^{2,13,14} For some, loss of a limb can involve psychological distress equivalent to the death of a loved one.¹³

Body image

It is common for individuals with UELL to experience body image disturbances.^{2,14} During the first few weeks after acute traumatic hand injury, 44% of patients felt uneasy or avoided looking at the hand. One year later, 38% continued to have uneasiness at the sight of the hand.¹⁹ Further, individuals with UELL have noted a change to their self-image, most notably a heightened awareness of their physical differences and a change in their physical abilities.³² Negative body image has been associated with increased presence of psychiatric disorders,³³ such as depression and anxiety¹⁹ and psychological maladjustment.¹⁴ Further, body image can also impact one's acceptance of the prosthesis, impacting both psychological and functional outcomes.

TREATMENT

Individuals with UELL experience significant psychological impairment, underscoring the importance of mental health treatment. Individuals who received just 2 months of treatment demonstrated reduced depression and anxiety in addition to reduced body image disturbances.¹⁴ However, mental health services are not readily available to the UELL population. In fact, less than half (45%) of those with significant depressive symptoms reported receiving mental health services in the previous 12 months.³⁴ Of those who did, more than half (55%) reported that they needed additional

services. A map of our treatment protocol is outlined in [Fig. 1](#).

Treatment Options

- *Individual therapy*: Psychotherapy can provide the opportunity for cognitive, emotional and experiential learning, create opportunities for the instillation of hope and decrease/eliminate negative feelings. The following specific approaches can be employed:
 - *Cognitive behavioral therapy (CBT)*: CBT is a short-term psychological treatment that focuses on how individuals think, feel, and behave, with an emphasis on how thoughts both create and maintain psychological distress. Utilizing CBT, individuals learn techniques to challenge maladaptive cognitions and behaviors to improve the quality of life and well-being.³⁵ CBT is well established for the treatment of chronic pain³⁶ and body image.³⁷ Though no research has specifically applied CBT interventions to UELL, it is reasonable to assume that it would be effective in treating the psychological distress and adjustment difficulties seen in those with UELL.
 - *Mindfulness-based stress reduction (MBSR)*: MBSR facilitates increased awareness of the present moment, fostering an open, nonjudgmental attitude, through the use of mindfulness meditation, body awareness and gentle movements. It has demonstrated benefits in improving pain intensity scores,^{38,39} and can also be applied to reduce psychological distress,³⁹ improve depression,^{38,40} and improve anxiety.⁴⁰ Applying MBSR can also be used to improve prosthetic usage and overall functioning by fostering an enhanced mind-body connection and promoting intentional engagement with new prosthetic devices.
 - *Biofeedback*: Biofeedback is a technique that uses electronic devices to monitor physiologic processes, such as heart rate, brain activity, muscle tension, and skin temperature. Feedback is given in the moment, allowing individuals to become aware of, and control, their own physiologic responses. As it relates to UELL, biofeedback has many applications, including managing phantom limb pain⁴¹ and chronic pain,⁴² improving prosthetic functioning,⁴³ and overall stress reduction.⁴⁴ Specifically, electromyographic (EMG) biofeedback has been shown to promote improved muscle control, allowing individuals to change the

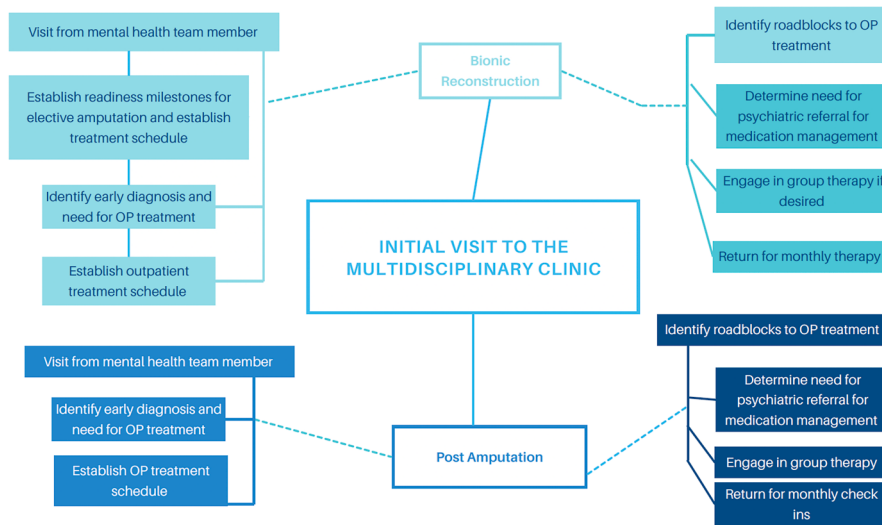


Fig. 1. Flowchart of the treatment of patients when they come to the initial visit in the multidisciplinary clinic.

strength of their muscle contractions based on real-time feedback.⁴³

- *Acceptance and commitment therapy (ACT)*: ACT is a treatment aimed to help individuals accept psychologically painful truths in addition to clarifying values and living a life consistent with those values. ACT teaches acceptance, which can help individuals with UELL move toward a place of acknowledgment and openness, thereby allowing individuals to engage more meaningfully in value-based activities. Engaging in valued activities has been shown to increase the likelihood of positive emotions and countering distress in individuals with UELL.²⁴ Further, engagement in meaningful activities was associated with improved self-worth.³²
- *Interpersonal psychotherapy (IPT)*: IPT targets key areas of interpersonal disputes, including grief and loss, role disputes, and life transitions, each thought to play a role in contributing to, and maintaining, depressive symptoms. The goal of IPT is to decrease depressed mood and improve interpersonal functioning by enhancing communication skills in relationships.⁴⁵ Given that individuals with UELL are likely to experience at least one, if not more, of the key target areas, IPT can be readily applied.
- *Motivational interviewing (MI)*. Individuals with UELL often face many issues that result in the need for behavior change. MI is a brief, client-centered therapeutic approach to facilitate behavior change. MI

can be employed to treat individuals with UELL as they navigate their readiness for continued surgical interventions, adherence and compliance to recommended physical and occupational therapies, exploration of prosthetic devices and engagement in psychosocial support of individual and/or group psychotherapy.

- *Group therapy*: Social support serves as a buffer against negative effects of trauma and other stressful events. Specifically, social support seeking is negatively associated with symptoms of depression and positively associated with social adaptation.⁴⁶

In relation to UELL, peer support has been linked to improved outcomes including psychological, social, and quality of life.⁴⁷ One way to bolster social support in the UELL population is through support groups. The benefits of support groups can be derived from Irvin Yalom's Twelve Curative Factors in group psychotherapy, which explain the transformation from isolated individuals to cohesive group members with identity.⁴⁸

Mechanisms of change through Yalom's curative factors address many of the psychosocial impacts upon those with UELL. Cohesiveness allows patients to experience feelings of support, trust and belonging to one another. Universality allows patients to realize that others exist who share similar thoughts, feelings and issues, reducing the stress of feeling alone.¹⁴ Self-understanding allows patients to understand the covert factors influencing their behavior and emotions. Instillation of hope allows patients to benefit from witnessing the success of other group

members and can envision themselves following a similar path.¹⁴

RECOMMENDATIONS

A multidisciplinary approach to patient-centered care, in which mental health is a critical pillar, allows for treating providers to actively contribute to an individual's care. Engagement with an interdisciplinary team fosters communication and enables a holistic approach to wellness. For example, a patient struggling with prosthetic adjustment may share frustrations in one aspect of treatment, however, be reluctant to do so in another. Collaboration among providers allows for best practices from the entire team in accordance with the patient's treatment plan.⁴⁹

With regards to bionic reconstruction, a patient's mental health journey begins at time point zero, whether that is the initial visit to the multidisciplinary clinic or at the time of amputation itself.

The psychology team provides preoperative and postoperative consultations in the hospital. Preoperatively, we address the patient's psychological readiness, which includes discussing anxiety or depressive symptoms, processing expectations (specifically, challenging unrealistic expectations), and addressing maladaptive coping skills that may negatively impact recovery. Further, we teach patients coping skills to manage pre-surgery anxiety and post-surgery pain, explore anticipated lifestyle changes, identify and problem solve potential challenges, and identify support. At this point, it is crucial to identify pre-existing mental health conditions and needs for service. Postoperatively, we facilitate emotional processing, which may include grief, shock, sadness, frustrations, and anxiety. We utilize strategies to help individuals cope with pain, utilize a strength-based approach to promote resilience, and prevent mental health complications by removing barriers to psychological treatment.

The first introduction at the clinic begins with an individual needs assessment, in which the psychologist meets privately with the patient to gather psychosocial history. Information gathered includes previous mental health diagnoses and treatment, current symptoms, social support, details preceding the limb loss, anniversary date of limb loss, history of suicide attempts, and current desire for mental health treatment and access to care. Gathering this information is important to help identify stressors, support, protective factors, strengths, cultural factors, and past experiences that may contribute to the patient's current functioning and future prognosis. Clinic services are explained, including group therapy and individual

therapy options. If warranted, pharmacologic referrals are made. Beyond information gathering, this initial meeting is essential to facilitate a strong introduction to the multidisciplinary clinic and the possibility of mental health treatment. It provides patients an opportunity to feel seen and heard and fosters a collaborative treatment approach, which enhances their engagement and ultimate recovery. Of note, many individuals may not immediately be ready or willing to engage in mental health services. It is crucial to support their autonomy in this decision while at the same time, leaving the door open for future care.

Patients are given psychological screening measures at each clinic visit to assess their overall mental health. Psychologists review the scores and provide individual consultations should a particular score exceed the threshold or a patient endorse a concerning item. Further, psychologists routinely follow up with patients on an individual level to assess overall well-being, mental health needs, and barriers to treatment.

Facilitated by psychologists, group psychotherapy within the clinic offers patients a meeting place to connect and engage with fellow UELL patients. The group format provides opportunity for a variety of topic exploration based on patient experience and has included anticipatory anxiety related to an upcoming surgery, apprehension or frustration with a new prosthetic device, help seeking and rejecting behaviors, and/or interpersonal dynamics which have shifted due to their UELL. The cohesion of members and the universality of their unique experiences creates an inherently deep connection wherein many become hospital visitors for each other after secondary surgery. Thoughts and feelings expressed in groups are further assessed by psychologists individually if a patient expresses distressed mood, impaired functioning, or need for additional services.

FUTURE CONSIDERATIONS

As noted, the negative effects following UELL are widespread. However, it is not uncommon for individuals to experience growth following a traumatic or distressing experience. Specifically, the concept of posttraumatic growth (PTG) is defined as "the experience of significant positive change arising from the struggle with a major life crisis."⁵⁰ PTG has been demonstrated in a wide range of populations, including individuals with amputation.⁵¹ It appears that certain processes in the aftermath of an event help foster positive outcomes, such as PTG. For instance, individuals with UELL experience psychological recovery and acceptance of limb loss more positively when factors such as good

medical care, social support, and high resilience are present.⁵² This underscores the importance of providing timely, multi-disciplinary, and individualized care to individuals with UELL.

Virtual reality therapy is increasing in popularity for the treatment of depression and anxiety as well as the treatment of phantom limb syndrome and residual limb pain.^{53,54} Pain catastrophizing is a negative repetitive thought process which is believed to be characterized by pessimism and helplessness in response to pain.⁵⁵ This thinking pattern associated with one's pain can magnify negative thoughts, increase anxiety and depression about the potential pain as well as impede progress in bionic reconstruction.⁵⁶ Virtual reality, as a treatment intervention, has shown to improve phantom limb pain intensity and phantom limb sensations when used with high intensity.⁵⁴ Combining these treatment areas to address the psychological, emotional, physical, and mental distress experienced for those with UELL could potentially shift a patient's engagement in treatment, therapy, improve functionality, and prosthetic adherence.

Case Presentation

M.K. is a 54 year old man who was first injured 10 years prior to presentation. M.K. underwent extensive attempts to reconstruct his left hand with nine surgeries over a 3 year period performed at an outside hospital. Prior to his injury and amputation, M.K. was employed full-time as a heavy equipment operator, was married and had a positive relationship with his daughter. After the initial injury, M.K. was afflicted with severe persistent pain in addition to the loss of function related to the injury itself. M.K. informed our multidisciplinary team that his chronic pain was so severe and destructive to his well-being that it led him to substance abuse, partial homelessness, interpersonal conflict with his spouse, and estrangement from his daughter. M.K.'s substance abuse led to multiple near death episodes and consistent suicidal ideations.

M.K. was introduced to the ARMS clinic for possible bionic reconstruction of his left arm, which would include elective trans-radial amputation and nerve reconstruction. In order to qualify, M.K. had to undergo intense rehabilitation to treat substance abuse and underlying psychological distress. In addition, M.K. underwent prehab training with occupational therapy and pre-amputation prosthetics training in preparation for surgery. M.K. eventually underwent trans-radial amputation with targeted muscle reinnervation (TMR)/regenerative peripheral nerve interface

(RPNI) and was fitted with an NIPOP (near immediate postoperative prosthesis) which he quickly utilized for daily functional bimanual tasks. Since joining the clinic, M.K. has been active in his sobriety (attending alcoholics anonymous [AA]/narcotics anonymous [NA] meetings and speaking about how drugs and alcohol contributed to and worsened his depression), has utilized the division of vocational rehabilitation to return to employment, returned to a work training program, attended driver's education rehabilitation, has repaired his relationships with his ex-wife and daughter and now resides in the home with them. M.K. actively participates in group therapy, sharing with others how the group environment, as well as his own individual therapy, have been helpful in his recovery and adjustment to upper limb loss.

SUMMARY

Attending to the mental health needs of individuals with UELL is critical to ensure comprehensive care. Mental health treatment helps individuals process the psychological outcomes of UELL, including depression, anxiety, PTSD, grief, and body image concerns, and develop adaptive coping skills to promote recovery and enhance quality of life. Including mental health clinicians on the multidisciplinary treatment team serves to optimize outcomes, enhance psychological functioning, and foster a sense of recovery and mastery.

CLINICS CARE POINTS

- Screen early, screen repeatedly. Psychological distress is dynamic after upper extremity limb loss (UELL); a normal initial screen does not exclude later deterioration. Incorporate brief validated screening tools at every clinic visit, not just intake.
- Pain is not just physical—treat it as a biopsychosocial driver. Worsening pain correlates with poorer psychosocial adaptation and higher rates of depression and PTSD. Escalating pain complaints should trigger parallel mental health evaluation, not just medication adjustment.
- Do not mistake disengagement for noncompliance. Avoidance of therapy, prosthetic training, or follow-up is often a manifestation of anxiety, PTSD, or grief, rather than lack of motivation. Address underlying drivers before labeling patients as “difficult.”
- Expectation management is a clinical intervention. Unrealistic expectations regarding prosthetic function or bionic reconstruction predict dissatisfaction and disengagement.

Preoperative counseling should explicitly address functional limitations, adaptation timelines, and effort required.

- Body image concerns directly impact prosthetic adoption. Patients with unresolved body image disturbance are less likely to consistently use prosthetics. Early referral for targeted therapy (eg, CBT) can improve both psychological and functional outcomes.
- Grief is expected—but prolonged dysfunction is not. Acute grief is a normal part of adjustment. However, persistent withdrawal, hopelessness, or functional decline beyond early recovery should prompt formal mental health intervention, not reassurance alone.
- Leverage the multidisciplinary team proactively. Patients often disclose different concerns to different providers. Regular communication between surgeons, therapists, and mental health professionals is essential to identify hidden barriers to recovery.
- Peer support is a high-yield, underutilized intervention. Structured group therapy or peer mentorship reduces isolation, improves coping, and enhances adaptation. This should be considered standard adjunctive care, not optional.
- Assess readiness before major reconstructive decisions. For elective amputation or bionic reconstruction, evaluate psychological readiness, coping strategies, substance use, and support systems. Poor readiness predicts worse outcomes despite technically successful surgery.
- Address social determinants as part of treatment. Employment loss, financial stress, and social instability significantly worsen psychological outcomes. Early integration of vocational rehabilitation, social work, and case management improves long-term recovery.
- Be vigilant for substance use and suicidality. Chronic pain and psychological distress increase risk. Direct questioning about substance use and suicidal ideation should be routine, not reactive.
- Mental health care improves surgical outcomes. Engagement in psychological treatment is associated with improvements in depression, anxiety, body image, and overall function—making it a core component of reconstruction, not an adjunct.

DISCLOSURES

The authors have no financial or commercial conflicts related to this article to disclose. There are no funding sources to report.

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