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REVIEW

An overview of psychosocial assessment procedures in reconstructive hand transplantation

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Summary

There have been more than 90 hand and upper extremity transplants performed worldwide. Functional and sensory outcomes have been reported in several studies, but little is known about the psychosocial outcomes. A comprehensive systematic literature review was performed, addressing the psychosocial impact of reconstructive hand transplantation. This review provides an overview of psychosocial evaluation protocols and identifies standards in this novel and exciting field. Essentials of the psychosocial assessment are discussed and a new protocol, the 'Chauvet Protocol', representing a standardized assessment protocol for future multicenter psychosocial trials is being introduced.

Introduction

The psychosocial assessment of patients undergoing reconstructive hand transplantation (RHT) represents a relatively new and novel approach in transplantation medicine [1–22], and as yet international guidelines and standardized criteria are not established [9]. If standardization in psychosocial assessment does not occur, the validity of data on psychosocial outcome and the development of clinically relevant reference values will be limited because of the lack of comparability.

Even though there are aspects of the psychosocial assessment which are unique to RHT as compared with solid organ transplantation [23], including phantom pain [24] and the psychiatric morbidity associated with traumatic amputation, a consensus exists that psychosocial assessment protocols share common characteristics [25]. In many ways, the psychosocial assessment in RHT is similar to solid organ transplantation; however, certain characteristics make this novel type of transplantation unique not the least of which is that RHT is life enhancing rather than life saving.

Psychosocial assessment in solid organ transplantation: consensus for reconstructive hand transplantation?

The primary goal of transplant programs is maximizing the psychosocial status, survival, and quality of life (QoL) of transplant patients, both before and after the transplantation [26,27]. Therefore, psychosocial issues warrant careful scrutiny in any kind of solid organ transplantation. To ensure that undesirable risks to transplant patients are minimized, the major focus in most transplant programs is on pretransplant psychosocial evaluation, as well as a growing post-transplant research literature on psychosocial costs and benefits to patients after solid organ transplantation [26].

While the need for a standardized approach to the psychosocial evaluation for hand transplant candidates clearly exists, as yet there is no universally accepted evaluation for solid organ transplant candidates. Several evaluation instruments exist including the 'Psychosocial Assessment of Candidates for Transplantation (PACT)' [28], the 'Transplant Evaluation Rating Scale (TERS)' [29], and the 'Stanford Integrated Psychosocial Assessment for Transplantation (SILPAT)' [30] stress the importance of reviewing the following domains: history of psychiatric pathology, family support, chemical dependency history, knowledge about transplantation, and history of compliance. Typically, issues related to body image concerns have not been a primary focus of the pretransplant evaluation although concerns about the impact of immunosuppressive medications on weight and appearance have implications for compliance. Recently, psychiatrists and psychologists discussed the need for developing commonly used instruments for the evaluation of pretransplant candidates to facilitate improved communication about transplant candidacy and share data across centers to improve research initiatives [31].

Although there is uniform recognition that psychosocial evaluation in solid organ transplantation is critical [32,33], there are no widely accepted standards for instruments of the evaluation. Ultimate goals are to ensure that the patients are psychosocially likely to come through the transplant experience well and to have fewer long-term costs than benefits [26]. Despite this, there has been only limited work that has attempted to identify robust predictors or correlates of psychosocial outcomes [34–43]. The psychosocial evaluation protocols should also identify areas in which interventions might be offered that could enhance patients' QoL and their ability and suitability to undergone solid organ transplantation [26]. Especially, with regard to post-transplant outcomes, there are clearly both psychosocial benefits and costs, but the fact that some patients do have poorer post-transplant outcomes points to the need for postsurgical follow-up care [44–47].

There have been more than 90 hand and upper extremity transplants performed worldwide between 1998 and 2012 [48,49]. Uniform guidelines and protocols for the pre- and post-transplant psychosocial evaluation of RHT patients do not exist. Although each transplant center that has established a RHT program has recognized the need for a psychosocial assessment, different center-specific evaluation protocols do exist and standardized evaluation guidelines or a common database for the systematic assessment of pre- and post-transplant psychosocial outcomes is still missing. Additionally, the assessed psychosocial outcomes in RHT are limited to post-transplant case reports, and systematic pre- and post-transplant studies on larger patient samples, such as follow-up studies on the psychosocial outcomes of kidney transplant patients, have still not been reported.

The purpose of this review is to systematically evaluate all previous manuscripts that describe a psychiatric/psychosocial assessment of patients before and after RHT.

Materials and methods

A comprehensive systematic review of the literature was conducted by reviewing manuscripts which describe any kind of psychiatric or psychosocial assessment of patients before and after RHT. We screened citations from MEDLINE, EMBASE, Web of Science, Psych INFO, Sociological Abstracts and CINAHL databases from 1998 (date of first hand transplantation, Lyon, France) through July 2012: Terms such as *allotransplantation, allograft, assessment, evaluation, hand transplantation, psychiatric, psychological, psychosocial* were used in the search strategies. The 'Related Articles' feature on PubMed and reference lists of all included studies were also reviewed. We tried to identify all manuscripts that addressed the psychiatric or psychosocial impact of RHT. The eligibility of each citation was evaluated, and the manuscripts were retrieved for any citation considered potentially relevant.

The inclusion criteria were peer-reviewed manuscripts (original articles or case reports/series; review articles were excluded) that investigated the psychiatric/psychosocial assessment of candidates seeking RHT/patients after RHT (e.g., pre- and postoperative psychological status, QoL, etc.).

Manuscripts that focused only on theoretical aspects of the psychiatric or psychosocial assessment of RHT patients or discussed only general psychiatric or psychological aspects of RHT without discussing concrete assessment strategies were not included in the final literature pool of this review.

Four reviewers (MK, SGJ, EM, GR) abstracted the following data from all manuscripts meeting eligibility criteria: reconstructive hand allotransplantation, described and

replicable psychiatric/psychosocial assessment. A common decision ('consensus rating') based on the two eligibility criteria was made as to whether a manuscript should be included or deselected. Additionally, all selected manuscripts have been rated regarding relevant psychosocial outcome factors (e.g., psychological function, social function, adherence, motivation, QoL, body image, etc.) using following inter-rating protocol: 0 = not applicable, 1 = clinical observation, 2 = interview, 3 = (semi-)structured interview protocol, and 4 = standardized questionnaires. If different methods are used, a multiple assessment is possible for each psychosocial outcome. Any discrepancies were discussed, and a common decision ('consensus rating') was made as to whether a manuscript should be included or deselected. Psychosocial instruments were reported in a descriptive fashion, as substantial differences among the primary manuscripts precluded the use of a meta-analysis to combine results.

Results

We screened more than 200 citations, retrieved 122 full-text manuscripts, and evaluated the eligibility of each manuscript. The final pool contained 83 manuscripts that addressed the psychiatric or psychosocial impact of RHT, but only 22 manuscripts met our review criteria [1–22], discussing the psychosocial assessment in a sufficient way. Twenty-one English [1–10,12–22] and one French (by Schuind *et al.* [11]) language manuscript met our inclusion criteria.

The 22 manuscripts were published between 1999 and 2012 (Table 1) [1–22]. Manuscripts were from eight countries: Most were conducted in the United States ($n = 7$) followed by France ($n = 4$), Austria ($n = 3$) and Spain ($n = 3$), Belgium ($n = 2$), Italy ($n = 1$), Poland ($n = 1$), and China ($n = 1$). Seventeen manuscripts primarily assessed the postoperative psychological health and well-being of hand transplant recipients [1,2,4–7,10–15,17–21], whereas five manuscripts additionally focused on the pre-transplant evaluation process [3,8,9,16,22]. Twelve manuscripts reported the application of standardized evaluation protocols and questionnaire-based procedures to assess recipients' psychosocial status [1,3,6–9,11,12,14,15,19,20]. Other manuscripts described the psychiatric/psychosocial assessment procedures more commonly without specifying the assessment procedures and instruments used in detail [2,4,5,10,13,16–18,21,22].

In all 22 manuscripts, a diagnostic clinical interview was part of the psychosocial/psychiatric assessment. Approximately half of the papers reported the use of psychometric instruments to complement the diagnostic interview. Of the papers that refer to psychometric instruments, there was variability in terms of which instruments were used. Four of the papers provided a relatively thorough description of the psychometric instruments used and what the instruments were intended to assess [3,6,7,9]. Several papers reported the use of projective tests, including the Rorschach and the Thematic Apperception Test.

Most of the reports were descriptive in nature. Six papers, however, discussed psychiatric outcomes in terms of the standardized hand score systems, for example the Hand Transplantation Score System (HTSS) [11,12,14,15,19,20]. Of the 100 points in the HTSS on which patients are scored, 15 points are dedicated to psychological and social acceptance across three domains: social behavior, physical intimacy, and body image. The categories assess comfort with the hand, feeling 'whole' and being able to socialize without feeling self-conscious, all of which can be considered markers of psychological health and resilience. Another section measures patient satisfaction, general well-being, and QoL. This instrument attempts to gauge whether the patient perceives an improvement in QoL. One criticism of the HTSS is that it lacks detail and a balance between what is objectively versus subjectively scored. The authors also note that subjective measures will likely remain central to assessing QoL.

All 22 manuscripts described different psychological/psychiatric assessment methods and strategies; thus, no standardized psychological evaluation protocol could be identified. One manuscript described a standardized evaluation protocol and the use of a specific assessment battery for RHT [9].

The psychosocial assessment of RHT patients in the past

While there is a general consensus that the psychosocial assessment of RHT patients is essential [22], there are no standardized criteria used across centers. It has been recommended that the evaluation be 'in depth', 'thorough', and 'comprehensive' [9]. A number of questionnaires and different psychosocial outcomes were included (Table 1) [1–22].

Among the relative psychiatric/psychological contraindications reported in the literature, active smoking and past or current alcohol abuse have been noted [50]. Absolute contraindications include a history of nonadherence, a current psychiatric disorder and/or history of a 'significant' psychiatric disorder, and inability to engage in a rigorous rehabilitation program [13].

The majority of papers used subjective reports of outcome spanning three domains: body image, QoL, and overall satisfaction with outcome. In terms of body image, reports described that patients have 'incorporated' the hand [7,12], 'psychically appropriated' the hand, and refer to the hand as their 'own' [4], indicating that patients have psychologically integrated the hand. Patients also feel a sense

Table 1. Psychosocial outcomes assessed by questionnaires in manuscripts on the assessment of patients for and after RHT.

			Psychosocial outcomes									
Source	Assessment method	General standardized/ validated instruments	Psychological function	Social function	Adherence	Motivation	Decision-making	Body image and self-concept	Substance abuse	QoL	Transplant effects	Unilateral versus bilateral impairment
Breidenbach *et al.* [1]	Psychosocial interview and evaluation as described by Klapheke [8]	Rorschach, TAT	2,4	2	2	2	2	2	0	2	2	(…)
Breidenbach *et al.* [2]	Unspecified psychological screening by a committee of psychologists, psychiatrists, and social workers	None	2	2	1	0	0	0	0	1	1	(…)
Carta *et al.* [3]	Standardized psychological assessment protocol (including projective psychological testing, personality questionnaires, and interviews)	Rorschach, Cattel 16 Pf Test, Raven's PM 38 matrices	3,4	2	1	2	2	0	0	2	0	✓
Cavadas *et al.* [14]	Unspecified psychosocial assessment	DASH, HTSS	2	1,4	0	0	0	4	0	4	1,3	(…)
Cavadas *et al.* [15]	Unspecified psychiatric screening, global function	DASH	2	1,4	0	0	0	0	4	4	1,3	(…)
Dubernard *et al.* [4]	Unspecified psychiatric screening	None	2	0	1	0	0	1	0	1	1	(…)
Dubernard *et al.* [5]	Unspecified psychiatric and psychological screening	None	2	0	1	0	0	0	0	0	1	(…)
Hautz *et al.* [6]	iRT-PSP interview*	Audit-C, FTND, BIQ-20, GAD-7, MESI, SF-36, PHQ-9, REM-71, SPWB, SOC-13, TxEQ	3,4	3,4	3,4	3	3	3,4	3	3,4	3,4	✓
Jablecki *et al.* [7]	Standardized, not specified psychological evaluation protocol	Rorschach, Cattel 16 Pf Test, IQ-assessment	3,4	2	1	2	2	1	0	1	1	(…)
Jones *et al.* [16]	Unspecified psychosocial assessment, global function	None	1	1	1	1	1	1	1	1	1	(…)
Kaufman *et al.* [17]	Unspecified psychosocial assessment, global function	None	1,2	1	1	1,2	0	0	0	1,2	1,2	(…)
Klapheke *et al.* [8]	Structured telephone interview, projective psychological testing	Rorschach	3,4	3	3	3	3	3	0	3	3	✓

Table 1. continued

Source	Assessment method	General standardized/ validated instruments	Psychosocial outcomes									
			Psychological function	Social function	Adherence	Motivation	Decision-making	Body image and self-concept	Substance abuse	QoL	Transplant effects	Unilateral versus bilateral impairment
Kumnig *et al.*, 2012 [9]	iRT-PSP interview†	Audit-C, FTND, BIQ-20, GAD-7, MESI, SF-36, PHQ-9, REM-71, SPWB, SOC-13, TxEQ	3,4	3,4	3,4	3	3	3,4	3,4	3,4	3,4	✓
Landin *et al.* [10]	Psychiatric evaluation consisted of an interview to evaluate the emotional and cognitive preparedness for the transplant	None	2	0	2	2	2	2	0	2	1	(…)
Margreiter *et al.* [18]	Unspecified psychosocial assessment, global function	None	1	0	0	0	0	0	0	1	1	(…)
Petruzzo *et al.* [19]	Unspecified psychosocial assessment, global function, QoL	DASH, IRHCTT Score	4	4	0	0	0	4	0	4	1,3	(…)
Petruzzo *et al.* [20]	Unspecified psychosocial assessment, global function, QoL	DASH, IRHCTT Score	4	4	0	0	0	4	0	4	1,3	(…)
Ravindra *et al.* [21]	Unspecified psychiatric assessment	None	2	2	2	2	2	0	0	0	1	(…)
Schuind *et al.* [11]	Unspecified psychosocial assessment, global function	DASH	1,2	1,4	0	1,2	0	4	0	1,4	1,3	(…)
Schuind *et al.* [12]	Unspecified psychosocial assessment, global function	DASH	1,2	1,4	1	0	0	1,4	0	1,4	1,3	(…)
Tobin *et al.* [22]	Standardized psychiatric interview protocol, additional psychological testing	Not further specified psychological tests	3	3	3	3	3	3	0	3	3	(…)
Zhu *et al.* [13]	Unspecified psychological/ psychiatric assessment	None	1,2	0	1	0	2	1	0	1	1	(…)

QoL, quality of life; RHT, reconstructive hand transplantation; Rorschach, Rorschach Psychological Testing; TAT, Thematic Apperception Test; Cattel 16 Pf Test, Cattel's 16 Personality Factors Test; Raven's PM 38 matrices, Raven's Standard Progressive Matrices; DASH, Disabilities of the Arm, Shoulder and Hand Questionnaire; HTSS, Hand Transplantation Score System by Lanzetta *et al.* [56]; Carroll Test, Carroll Quantitative Test for Upper Extremity Function; MHQ, Michigan Hand Questionnaire; Audit-C, Alcohol Use Disorders Identification Test; FTND, Fagerström Test for Nicotine Dependence; BIQ-20, Body Image Questionnaire; GAD-7, Generalized Anxiety Scale; MESI, Medication Experience Scale for Immunsuppressants; SF-36, Short Form Health Survey; PHQ-9, Patient Health Questionnaire; REM-71, Response Evaluation Measure; SPWB, Scales of Psychological Well-Being; SOC-13, Sense of Coherence Scale; TxEQ, Transplant Effect Scale; IRHCTT, International Registry on Hand and Composite Tissue Allotransplantation [55].

Inter-rating protocol for the assessment of psychosocial outcomes: 0 = not applicable; 1 = clinical observation; 2 = interview; 3 = (semi-)structured interview protocol; 4 = standardized questionnaires. If different methods are used, a multiple assessment is possible for each psychosocial outcome.

Ellipses (…) indicate not available.

✓Assessment protocol differentiated between uni- versuss bilateral impairment.

*Former version of the structured interview protocol by Kumnig *et al.* [9].

†Structured interview protocol for the assessment of RHT candidates by Kumnig, Jowsey [9].

of reparation and report feeling 'whole', 'repaired', 'balanced' [1]. One paper reported that patients who underwent bilateral transplantation were 'only slightly more satisfied than patients who underwent unilateral transplantation' [6]. Although the evaluation of QoL was not standardized in most assessment and postoperative changes were primarily evaluated by clinical observations and interviews, most papers reported that patients demonstrated a high degree of satisfaction.

However, patient dissatisfaction has also been reported. Patients reported less function than hoped for, side effects of medications, and dismay over the length of rehabilitation and recovery [11–13]. Additionally, situational anxiety [4] and depression [1] were documented as postoperative side effects. One paper reported a suicide attempt in a patient with a psychiatric history [11].

Cognitive and behavioral stress management was an area of focus in the literature. How the patient coped with adversity in the past was viewed to be a good indication of whether their coping skills are adaptive or maladaptive and how likely they are to cope with adversity in the future. It is critical to assess how RHT patients have coped with the trauma of the amputation. A 'healthy' denial can be a marker of psychological resilience, for instance when patients overcompensate for the loss in a positive manner [8]. Recent studies indicate that patients who have lived longer with the amputation appear to have a higher level of physical and psychological adaptation to the loss and may have learned to cope and integrate the loss to a greater extent than those with recent injury [9,23].

How motivated the patients are to adhere with the treatment plan, including medical follow-up and adherence with immunosuppressive, is also critical to the psychosocial assessment, and the majority of the papers reviewed commented on this although no standardized assessment of compliance was noted. Nonadherence may result in rejection leading to graft loss, necessitating amputation [51].

Pain has been identified as one of the most acutely stressful aspects of traumatic injuries [52]. No pain scales were reported. It is important to assess phantom limb pain which occurs in over 60% of amputations [23] and is a potential risk factor for poor postamputation adaptation [24,52]. Particularly, patients with high pretransplant phantom limb pain were at higher risk of comorbid phantom pain that persisted after RHT [6].

No paper noted the potential impact of the RHT on the patient's family and the potential need for family system intervention, although cases of divorce and separation after RHT have occurred at one of the author's centers [9]. There is a need for ongoing monitoring of family relationships, and potential stress of national and international media attention for both, the patient and the family, should be addressed.

In summary, half of the papers give a detailed account of the psychosocial assessment of RHT patients. Ten papers reported the use of psychometric and projective instruments to complete the diagnostic evaluation [3,6,7,9,11, 12,15,19,20,53], and four papers reported the use of projective tests, including the Rorschach and Thematic Apperception Test [1,3,7,8]. Most papers outline broad areas generally considered important to assess, but variability exists across transplant centers. Half of the reports ($n = 10$) [2,4,5,10,13,16–18,21,22] are descriptive in nature and there is a lack of quantifiable data.

Lessons learned: essentials for the psychosocial assessment of RHT patients

The psychosocial assessment is an essential component of the evaluation of RHT patients, and it is at least as important as in solid organ transplantation, because of the visible nature of the graft in RHT [8]. In addition to assessment of depression, anxiety, personality disorders, substance abuse, and social support, several areas have been identified as unique to the psychosocial assessment of RHT patients including the level of body image adaptation to the trauma; the cognitive preparedness of the candidate; the candidate's expectations of the surgery; the potential for psychological regression; the coping skills of the candidate; and motivation and adherence [9].

The hand plays an integral role in body image, identity, and autonomy [8]. Loss of one's hand can affect each of these domains. Bodily integrity is critical to one's personal identity and sense of self. Hence, amputation can result in a distortion of body image, which can in turn lead to a distortion in the sense of self [54]. A recent paper finds that bodily integrity may be more severely affected in patients with proximal amputations than distal amputations [7]. Regardless of the level of amputation, it is important to assess the psychological impact of the trauma and the potential impact of the transplantation [24,52].

The skin graft is visible, with suture lines clearly delineating donor from recipient. Hair and skin color patterns may be different and may complicate the psychological integration of the donated limb. The patient will be able to appreciate visible signs of rejection, leading to psychological ramifications. Cognitive preparedness encompasses the patient's 'anticipated level of comfort' with the donor hand [54]. It is important to assess whether the patient will be able to assimilate the transplanted hand into his or her body image and self-image; in other words, whether the patient will develop 'ownership' of the hand. An inability to psychologically integrate the transplanted hand may result in nonadherence with medications, which in turn will lead to rejection and may necessitate amputation [55].

The potential for psychological regression refers to how vulnerable the patient is to utilize primitive coping strategies in the face of stress. If the patient is unable to integrate the transplanted hand or accept ownership of the hand, the patient is at risk of regression which could lead to immature coping including nonadherence with medication or avoidance of needed medical care. This is particularly salient in RHT patients [54]. A number of stressors can precipitate regression including graft failure, rejection, and the need for reamputation. If the patient has not fully grieved the loss of the limb prior to transplantation, a likely outcome will be the higher risk of psychiatric complications in the event of graft failure [8]. Also, if a patient does not have an integrated personality structure at baseline, as can occur in patients with a borderline personality disorder, the patient may be at increased risk of psychological regression in the face of stressors. These patients may cope with more primitive defenses and engage in self-destructive behaviors [54].

It is also important to assess the patient's expectations of the surgery. Studies indicate that patients hope to regain a sense of normalcy, to feel 'whole' and 'complete' again, to be able to express intimacy with their loved ones, and to regain functionality [54]. Recent papers indicate that expectations may be different for unilateral versus bilateral amputees, with unilateral amputees motivated more by body image concerns and bilateral amputees motivated more by the hope of improved function [6]. It is important to assess whether the patient has realistic expectations of the outcome, which incorporates an understanding of the potential risks of the surgery. Unlike solid organ transplantation, hand transplantation is neither lifesaving nor a medical imperative. Patients need to adhere to lifelong immunosuppression with the potential for medication side effects, including infection, metabolic disturbances [56–59], organ toxicity [59–62], and malignancy [58,59,61–64]. It is equally important to consider the patient's motivation to engage in long-term physical therapy and rehabilitation and to ensure that the patient understands that there is a protracted recovery and rehabilitation process which requires perseverance [56].

By considering all relevant psychosocial factors of reviewed evaluation protocols, Table 2 summarizes the positive and negative psychological factors in prognosis of RHT patients and that need to be considered in future protocol development.

Therefore, a standardized assessment protocol is essential to collect and investigate objective data [65]. The psychological assessment should ensure that standardized psychological screening procedures and continuous follow-up ratings of the patients for unilateral/bilateral RHT [50]. Additionally, standardized assessment protocols should ensure a thorough decision-making process identifying at-risk patients and the need for supportive psychological treatments. This could also support the development of behavioral recommendations that help at-risk candidates become more appropriate RHT candidates [9].

Discussion

This comprehensive review summarized all available literature on the psychosocial implications of RHT. The 22 manuscripts were published over 13 years and included recipients from transplant centers around the world, who had different operative experiences and who faced variable assessment procedures [1–22].

It is noteworthy that the 17 articles that did assess patients postoperatively were more likely to report post-transplant outcomes [1,2,4–7,10–15,17–21]. These assessments were often made after RHT, and preoperative data were missing. Standardized screening and follow-up procedures are essential to allow for continuous assessments.

The suitability of questionnaire-based assessments also requires examination. Most assessment procedures used investigator-developed questionnaires and tools. Only 12 protocols used standardized instruments [1,3,6–9,11,12, 14,15,19,20] that allow comparisons to be made with other patient populations. Furthermore, surveys were administered in different settings and in different fashions.

Psychosocial assessment and counseling are crucial for the evaluation and optimization of the suitability of transplant patients and may help to minimize psychological morbidity. A variety of additional issues require clinical and empirical attention in the future. These include the need to document psychosocial outcomes in understudied groups, especially patients before and after RHT. Findings regarding these issues will allow the process by which potential candidates are evaluated, educated, and counseled before RHT to become more useful and more likely to ensure positive psychosocial outcomes [26]. Further investigations should assure that RHT programs develop thoughtful and well-planned clinical research protocols that address unique aspects of RHT.

Future research: the 'Chauvet Protocol'

To address the difficulty in studying small populations of RHT patients in this emerging field, we have developed a collaborative process originating at the Innsbruck Medical University and the Mayo Clinic Rochester named the 'Chauvet Protocol' (named after the French cave showing prehistoric hand prints). We propose for other interested hand transplant centers the multicenter research approach currently shared by the Innsbruck Medical University and the Mayo Clinic Rochester which would allow for the development of international guidelines on the

Table 2. Positive and negative psychological factors in prognosis of hand transplant patients.

Psychological factors in prognosis of hand transplant patients	
Positive	Negative
No relevant psychiatric history and missing ongoing severe psychiatric disorders	History of psychiatric pathology and/or ongoing severe psychiatric disorder
High compliance and adherence with treatment plan, including medical follow-up and adherence with immunosuppressants	History of nonadherence and anticipated noncompliance because of postoperative treatment plan
Strong motivation for reconstructive hand transplantation (RHT) and evaluated stability of decision-making process and scope of personal choice	Not completed decision-making process and insufficient motivation for RHT
Reduced quality of life (QoL), psychological well-being, and restricted activities in daily living that motivate for RHT	High QoL, psychological well-being, and independent scheduling of day-time activities despite hand loss
Adequate self-image and body image (high body image adaption)	Self-image and body image disorders (low body image adaption, potential inability to psychologically integrate the graft)
Reduced or missing pretransplant phantom limb pain	High pretransplant phantom limb pain
Ability to engage in rehabilitation program	Inability to engage in rehabilitation program
Adaptive coping, no traumatic reactions because of the hand loss	Maladaptive coping, traumatic reactions because of the hand loss
Realistic appreciation of post-transplant results and anticipated level of comfort (e.g., regain of physical functionality meets individual expectations)	Unrealistic appreciation of the post-transplant results and anticipated level of comfort (e.g., unrealistic requirements regarding postoperative functional and aesthetical aspects)
Knowledge about RHT, realistic appreciation of the risk–benefit ratio	Missing knowledge about RHT, unrealistic appreciation of the risk-benefit ratio
Adequate anxious beliefs toward RHT and positive personal surgical experiences	Increased anxious beliefs toward RHT and negative personal surgical experiences
Cognitive preparedness and good cognitive level	Cognitive impairments and intellectual disabilities
Adequate affective function level	Affective disorders
No chemical dependence history	Chemical dependence history
No history of suicide attempt	History of suicide attempt
Social and family support	Missing social and family support
Restricted social behavior because of hand loss	Unaffected social behavior despite hand loss
Anticipated adequate psychological development after RHT	Potential regressive psychological development after RHT (e.g., primitive defenses and self-destructive behavior in patients with borderline personality disorder)

psychosocial assessment in reconstructive transplantation medicine and that is supported by a data sharing platform that may be used worldwide and is described below. The components of the iRT-PSP assessment (the 'Innsbruck Psychological Screening Program for Reconstructive Transplantation') are described elsewhere and were developed at the Innsbruck Medical University [9]. By assessing psychosocial factors, pre- and post-transplant, we will better understand which components of the pretransplant assessment identify higher risk candidates. New approaches to data sharing utilizing web-based data capture (www.project-redcap.org) [66] which are created to meet current confidentiality requirements in research will allow pooled data from multiple centers which may help in obscuring identifying characteristics in this visible form or transplantation coming from relatively small programs.

This collaborative approach can advance with participation from multiple centers in a similar fashion to the collaborative efforts that underpin the success of other transplant-related consensus processes. The following steps will help to ensure successful collaboration and program development (based upon the concept for international collaboration of the 'Banff Protocol' by Solez *et al.* [67]): (i) consensus agreement on a protocol based on a review of the literature and sharing of cases; (ii) multidisciplinary stakeholders (inviting all disciplines that are essential to establish a hand transplant program); (iii) a shared evaluation approach which for this project will include a common set of evaluation instruments with the storage of the data in a shared database; (iv) annual meetings to review findings and discuss emerging concepts in the field; (v) seminar leadership will rotate annually with an emphasis on international participation and inclusion of early career seminar leaders; and (vi) authorship will rotate between the members of this research collaboration group.

A multicenter study, representing the 'Chauvet' research collaboration, has already begun to gain detailed empirical data on fundamental psychological processes using a shared assessment approach, which can be adapted to advance current transplant programs by allowing for sharing of data across centers.

Study limitations

Despite a thorough analysis of the literature, the lack of relevant published information in the psychosocial domain of transplanted patients is a significant limitation of this overview. The majority of articles do not address the psychosocial assessment in any greater than passing detail, so the conclusion that can be made from these highly descriptive, mostly empiric studies in the current literature is limited. Additionally, we found differences between the evaluation protocols of the different transplant centers, but we could not evaluate cultural and/or country-specific assessment strategies.

Conclusion

Further investigations are needed to ensure that transplant programs develop thoughtful and well-planned psychosocial evaluation protocols that address unique aspects of RHT including all relevant psychosocial aspects on patient selection and outcomes, including also potential cultural differences between countries/cultures in psychosocial assessment.

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