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ORIGINAL ARTICLE

Quality of life and hormones after sex reassignment surgery

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Abstract
Background Transpeople often look for sex reassignment surgery (SRS) to improve their quality of life (QoL). The hormonal therapy has many positive effects before and after SRS. There are no studies about correlation between hormonal status and QoL after SRS.
Aim To gather information on QoL, quality of sexual life and body image in transpeople at least 2 years after SRS, to compare these results with a control group and to evaluate the relations between the chosen items and hormonal status.
Subjects and methods Data from 60 transsexuals and from 60 healthy matched controls were collected. Testosterone, estradiol, LH and World Health Organization Quality of Life (WHOQOL-100) self-reported questionnaire were evaluated. Student's *t* test was applied to compare transsexuals and controls. Multiple regression model was applied to evaluate WHOQOL's chosen items and LH.
Results The QoL and the quality of body image scores in transpeople were not statistically different from the matched control groups' ones. In the sexual life subscale, transwomen's scores were similar to biological women's ones, whereas transmen's scores were statistically lower than biological men's ones ($P = 0.003$). The quality of sexual life scored statistically lower in transmen than in transwomen ($P = 0.048$). A significant inverse relationship between LH and body image and between LH and quality of sexual life was found.
Conclusions This study highlights general satisfaction after SRS. In particular, transpeople's QoL turns out to be similar to Italian matched controls. LH resulted inversely correlated to body image and sexual life scores.

Keywords Quality of life · Hormonal treatment · Sex reassignment surgery · Transsexualism

Abbreviations

GD	Gender dysphoria
SRS	Sex reassignment surgery
HT	Hormonal treatment
QoL	Quality of life
WHOQOL-100	World Health Organization Quality of Life
LH	Luteinizing hormone
SD	Standard deviation

Introduction

Gender identity and gender role are aspects of psychosexuality. Gender identity indicates the persistent sense of self as a man or a woman. Gender role, a social construct that depends on cultural context, is the outward expression of gender identity: everything a person does to show others and itself the degree of its femininity, masculinity or ambivalence. Gender identity and gender role are usually mutually consistent and they can correlate in different ways.

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Transsexualism has been defined as extreme Gender Dysphoria (GD) and refers to a discomfort of the intimate sense of self with unhappiness related to the biological sex.

The quality of life (QoL) is defined as "the individuals' perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns. It is a broad ranging concept affected in a complex way by the person's physical health, psychological state, level of independence, social relationships, personal beliefs and relationship to salient features of their environment" [1, 2].

It is well known that sex reassignment surgery (SRS) is able to allow transpeople to live in the full gender role they feel to belong to and, for this reason, it has been considered the main possible treatment for these subjects. Literature data show that SRS and hormonal treatment (HT) improve QoL, general functioning and body image perception (even if in some studies HT dosages were not standardized and hormonal status not evaluated); according to some authors they may also reduce the risk of suicidal attempts [3–13].

However, changing to the opposite gender should not be necessarily assumed as the final goal for all gender-nonconforming individuals and medical approach should be flexible, depending on patient aspirations [14–16].

An important review highlighted the importance of investigating and taking care of the sexual life issues, which represent a relevant mental health factor [17].

In 2001, Slabbekoorn et al. [18] showed the importance of emotional changes during hormonal treatment in relation to sexuality. Other authors have recently confirmed that female-to-male have an improvement in sexual functioning during testosterone treatment [19].

In Western countries, transsexuals undergo cross-sex therapy to achieve phenotypical modifications; cross-sex therapy is paired with regular follow-up with mental health professionals. Most of the transsexuals followed by medical gender teams ask for SRS. After SRS, these subjects are not always compliant with the yearly follow-up, like any other hypogonadal patient must do [7]. Most transsexuals who underwent SRS some years ago, especially in Italy, are not aware that HT is a life-long substitution and they have the misconception that after surgery they can stop such therapy [4, 19, 20]. Mental health professionals and endocrinologists have the responsibility to encourage, support and guide transsexuals through HT [21]. The youngest transsexuals, followed in the recent years by our team, are better informed and better compliant with HT.

Physicians who have functioning relationships with their patients can support them [22].

It is well known that sex steroids play an important role in brain functions, both directly and indirectly, through some effects on neurotransmitters [23–27].

Hormonal status could affect QoL through biological and psychological aspects which might be assessed by psychological tests [18].

The purposes of this observational study, carried out at the Interdipartimental Center for Gender Dysphoria in *AOU Città della Salute e della Scienza di Torino" – Turin - Italy* (*C.I.D.I.Ge.M.*), are:

1. To gather information on QoL, quality of sexual life and body image in a group of transsexual subjects who underwent SRS at least 2 years prior to the beginning of this study.
2. To compare all these aspects with a control group.
3. To evaluate the relation among hormonal status and QoL, quality of sexual life and body image.

Materials and methods

Participants

Out of 68 screened transsexuals, only 60 agreed to participate (response rate 88 %). Sixty subjects without GD were recruited as controls. The enrollment was performed from October 2012 to December 2013. These subjects were matched by age, marital status, and educational level, and were recruited via local community and university advertisement. The control group was composed by 45 females and 15 males who were given a detailed description of the study and screened for inclusion criteria.

About half of transsexuals was single, 40 % had a stable relationship (18 % married, 25 % cohabitant), 5 % was divorced and 2 % was widow. The mean educational level was 11.26 years (most had secondary school or high school diploma). 95 % did not have children.

The social-demographic characteristics of all subjects are reported in Table 1.

All transsexual subjects (46 transwomen: 45 caucasians, 1 hispanic; 14 transmen: all caucasians) had undergone SRS at least 2 years prior to enrollment in the study (with a maximum of 33 years prior). Among the 46 transwomen, 25 had been already followed during hormonal treatment in our center, while 21 were followed at our center after SRS performed elsewhere; among the 14 transmen 9 had been followed from the beginning of the transitioning path in this center, while 5 of them were referred to us after SRS performed elsewhere.

Seven transwomen subjects got the new vagina with a bowel segment procedure, the remaining underwent a flap procedure following different techniques (according

Table 1 Social-demographic characteristics of the whole sample

	Transpeople ($n = 60$)	Control group ($n = 60$)
Sex and number	Transwomen 46 (77 %)	Biological women 45 (75 %)
	Transmen 14 (23 %)	Biological men 15 (25 %)
Mean age, years (±SD)	39.0 (±8.8)	40.2 (±9.4)
Marital status number (%)		
Single	30 (50 %)	32 (53.3 %)
Married } stable relationship	11 (18 %)	8 (13.3 %)
Cohabitatant } stable relationship	15 (25 %)	16 (26.7 %)
Divorced	3 (5 %)	4 (6.7 %)
Widow	1 (2 %)	0 (0 %)
School education		
Mean number of years (±SD)	11.26 (±3.94)	10.73 (±3.44)
Children		
Yes	3 (5 %)	4 (6.7 %)
No	57 (95 %)	56 (93.3 %)

Data are expressed as mean ± SD or as absolute number and percentage when categorical

to the experience of the surgical team they referred to). Thirty-eight transwomen underwent mastoplasty, whereas 8 obtained a good breast development with HT alone. Eleven transmen underwent a phalloplasty and only 6 of them had subsequently implanted a penile inflatable prosthesis.

All transmen were gynophilic; 91 % of transwomen was androphilic, 7 % gynophilic and 2 % bisexual.

Inclusion criteria

We enrolled subjects aged 18–65 years. All participants had no severe psychiatric disorders as they underwent a psychiatric evaluation which excluded any lifetime history of organic mental disorders, mental retardation, psychotic disorders, bipolar disorders, substance abuse and severe Axis II psychopathology (cluster A personality disorder, antisocial personality disorder and borderline personality disorder) according to DSM-IV-TR (the IV-TR version of DSM was the latest at the time of the diagnosis) [28].

Subjects who referred to our center after SRS performed elsewhere have been included in a standardized clinical procedure with a multidisciplinary (endocrinological, psychological and psychiatric) evaluation.

The control group (45 biological women and 15 biological men), aged 18–65 years, had no severe psychiatric disorders such as lifetime history of organic mental disorders, mental retardation, psychotic disorders, bipolar disorders, substance abuse, severe Axis II psychopathology and above all dysmorphophobia and sexual dysfunctions according to DSM-IV-TR. The enrolled control group was matched for age, educational level and marital status with transpeople.

Table 2 Hormonal levels in transwomen and transmen: values are expressed as median and (IQR)

	Transwomen ($n = 46$)	Transmen ($n = 14$)
LH (mIU/ml)	11 (3.675)	9.95 (2.79)
E2 (pg/ml)	75.95 (36.25)	–
T (ng/ml)	–	5.05 (4.55)

All subjects signed a written informed consent to participate to the study.

Hormonal treatment

All subjects, since being taken in charge at our center, were treated as follows: transwomen with estradiol (oral 2–4 mg daily; or transdermal 1.5–3 g daily) and transmen with testosterone (intramuscular long-acting testosterone undecanoate: 1000 mg every 3 or more months; or transdermal gel: 50 mg/sachet daily) in a replacement dose, i.e., a plasmatic level of estradiol in the female range (50–150 pg/ml) or of testosterone in the lower male range (3–5 ng/ml).

Clinical and hormonal status

All subjects underwent clinical assessment of hormone replacement therapy by evaluating: clinical signs and serum levels of testosterone, estradiol and LH (Table 2).

Serum LH and estradiol/total testosterone were evaluated the same day of WHOQOL administration. Serum LH was measured using a chemiluminescent immunoassay. Estradiol and testosterone was measured with an electrochemiluminescence immunoassay.

QoL, quality of sexual life and quality of body image

The World Health Organization Quality of Life (WHOQOL-100) [29] self-reported questionnaire was administered the same day of the hormonal assessment.

The WHOQOL-100, that has been validated also for the Italian population [30], is a questionnaire developed by the WHO and is composed by 6 domains: physical–psychological freedom, physical safety and security, social relationship, environment, spirituality, religion and personal beliefs.

Each domain includes one or more subdomains. The subjects answer each item giving a score from 1 to 4 and from 1 to 5 on a Likert scale [31]. The order of importance of the domains is not cross culturally influenced.

We considered as specific outcomes:

- the general QoL score
- the quality of sexual life score (*items F15.1, F15.2, F15.3, F15.4, Imp 15.1*)
- the quality of body image score (*items F7.1, F7.2, F7.3, F7.4, Imp 7.1*).

Statistical analysis

All analyses were performed using the Statistical Package for Social Science (SPSS v.15.0 software). Distribution is summarized through means and standard deviations (mean ± SD) or median and interquartile range (IQR).

Student's *t* test for independent sample was applied to evaluate differences between the transsexuals group and control group and between transwomen/transmen compared, respectively, with biological women and men.

LH was divided into four classes according to the quartile values. A multiple regression model was applied to evaluate the association between WHOQOL's chosen items and LH quartiles adjusted for "biological gender" and "presence of a partner". All analyses are referred to the highest quartile. Genal Linear Model followed by Bonferroni post hoc comparison ($P < 0.05$) was applied. Statistical significance was accepted at the two-tailed $\alpha = 0.05$ significance level.

Results

For what concerns the WHOQOL-100 test, the QoL score in transsexuals sample was not statistically different from the control group: transwomen scored 67.87 ± 13.71 versus biological women 69.49 ± 17.51 and transmen scored 69.21 ± 12.58 versus biological men 69.83 ± 15.03 (P = n.s.).

Concerning the sexual life subscale, transwomen's value (65.85 ± 20.27) was not significantly different from the biological women's one (66.28 ± 21.62) while the transmen's mean value (54.21 ± 16.29) was statistically lower than the biological men's one (71.53 ± 13.66) ($P = 0.003$).

The quality of body image did not show any significant difference between the transsexuals sample and the control group: transwomen scored 64.64 ± 20.37 and biological women scored 65.47 ± 12.49 (P = n.s.); transmen scored 67.91 ± 18.04 and biological men 70.82 ± 12.63 (P = n.s.).

In Table 3, we report the comparison between transwomen and transmen subgroups: quality of sexual life scored statistically lower in transmen versus transwomen.

In Table 4, we reported estradiol or testosterone levels in transwomen and transmen, respectively, subdivided according to LH quartile. The ANOVA F test for LH quartiles

Table 3 WHOQOL-100 test: male-to-female versus female-to-male analyzed with student's *t* test for independent sample

WHOQOL-100 test	Male-to-female	Female-to-male	*P*	*t*
Quality of life score	67.87 ± 13.71	69.21 ± 12.58	Ns	0.33
Quality of sexual life	65.85 ± 20.27	54.21 ± 16.29	0.048	2.01
Quality of body image	64.64 ± 20.37	67.91 ± 18.04	Ns	0.21

Table 4 Mean WHOQOL-100 scores subdivided in LH quartiles and univariate ANOVA test

	LH quartiles				*P**
	<3	3–10	10–23	>23	
Quality of body image	77.5 (14.4)	66.4 (16.1)	66.8 (21)	50.8 (18.6)	0.002[a]
Quality of sexual life	65 (19)	61.7 (16.9)	58.8 (18)	52.1 (22.1)	0.302
QoL	71.8 (9.5)	68 (17.4)	71.3 (12.9)	61.6 (11)	0.136

* Test *F* univariate ANOVA

[a] LH difference mean between group <3 and >23 is statistically significant after Bonferroni correction

Table 5 Linear regression estimation of relationship between WHO-QOL-100 scores (as dependent variable) and LH hormonal levels adjusted for "presence of partner" and "biological gender"

	b	es	*p*
Quality of body image			
Intercepts	76.24	6	<0.0001
LH score	−0.74	0.17	<0.0001
Partner	2.29	4.65	0.62
Female	−1.51	5.48	0.78
Quality of sexual life			
Intercepts	60.01	6.58	
LH score	−0.38	0.18	0.04
Partner	1.81	5.1	0.72
Female	5.21	6	0.39
QoL			
Intercepts	72.11	4.58	<0.0001
LH score	−0.24	0.13	0.06
Partner	0.48	3.55	0.89
Female	−0.84	4.18	0.84

showed a significant difference in body image score but not in the general QoL nor in quality of sexual life scores. The Bonferroni test showed a significant difference among mean scores of extreme quartiles in body image subscale.

Considering LH as a continuous variable, we found a significant inverse relationship between LH and body image score ($b = -0.74$; $P < 0.0001$) and between LH and quality of sexual life score ($b = -0.38$; $P = 0.04$), while a nearly significant relationship between LH and QoL ($b = -0.26$; $P = 0.06$) was observed (Table 5). The "presence of a partner" and "gender" variables did not interfere in the relationship between QoL and LH levels.

Discussion

In this study, we evaluated transsexuals' QoL, quality of sexual life and body image, the last two being representative parameters of subjective well-being [2] in a group of subjects who underwent SRS at least 2 years prior to the enrollment in the study.

Our results show a satisfying QoL in the whole sample, with no differences between transwomen and transmen, between transwomen and biological women and between transmen and biological men matched for age, educational level and marital status.

The majority of follow-up studies on sexual and physical health, carried out with no superimposable methods, indicates an improvement in QoL and in psychological health after SRS even if the level of evidence is very low [8, 32–34].

Usually after SRS, transsexuals show further improvement in their gender incongruence and in their QoL with less uncertainty concerning their gender role and more self-confidence about their body image. This implies an overall improvement in social functioning [8, 35].

The already quoted systematic review by Murad concluded that approximately 80 % of transsexuals reported subjective improvement in terms of GD, QoL and psychological symptoms [8].

On the other hand, Swedish data reported that improvement in GD after SRS is too small to consider treatment as an option [32].

Factors predicting a positive outcome after SRS are not fully known but some criteria for a good prognosis have been identified. These include personal traits, characteristics related to the social environment and outcomes connected to the SRS itself. In particular, the biological female sex, early onset of GD, absence of personality disorders, high social functioning before surgery, personal stability, presence of social and psychological support and absence of any surgical shortcomings and complications are predictors of a positive outcome after SRS [36, 37].

Concerning the importance of psychological aspects before SRS, we emphasize that the subjects evaluated in our study came from very different *"life experiences"* (not all were followed by our Gender Team from the beginning of the HT).

We decided to consider transpeople at least 2 years after SRS since the first year after surgery has been considered by De Cuypere et al. as a sort of honeymoon period, therefore not representing a realistic picture of long-term emotional stability, sexual and psychological status [34].

Data about psychiatric morbidity after SRS are conflicting: many studies reported psychiatric and psychological improvement [5, 38, 39], while others reported persistent psychiatric morbidity and suicidal attempts [32, 34, 40].

We would like to highlight that our study excluded psychiatric patients; this may have removed possible strong interfering factors on the therapeutic compliance and on the QoL.

In Italy, nowadays, SRS is mandatory for editing Registry documents, which allows transpeople to better adapt in social and professional environments. Also, this aspect may have a considerable impact on QoL.

For transpeople it is of particular importance to be able to reach a satisfying body image [41].

Body image represents a part of self-expression; moreover, it allows transsexuals to negotiate their transgendered self in a world that sees gender as binary, this resulting in a tension between desire, authenticity and avoidance of stigma [42].

In our study, the quality of body image was positively perceived both by transwomen and transmen and it did not seem to be different from their respective control group.

Even if we have no data about QoL before SRS, it is possible that if body image is congruent with gender and identity role it has an impact on general QoL, regardless of other relevant aspects such as surgery outcomes. This concept is expressed also by transpeople during the regular follow-up psychological interviews.

Until today only few studies evaluated sexual functioning after SRS, due to the lack of a specific and validated test not only able to evaluate sexual functioning in the transgender population, but also to take into account the HT and genital surgery variables. We focused on how quality of sexual life was perceived from the transpeople at least 2 years after SRS.

Post surgical quality of sexual life may have an impact on psychological well-being and can lead to significant distress when inadequate [43].

Our results show that quality of sexual life was similar between transwomen and biological women, as found by most authors [17].

The transmen subgroup scores were significantly lower than transwomen's and biological males'one. Nevertheless, transmen's average scores in the quality of sexual life scale were not in a pathologic range (>50).

The quality of sexual life is related both to the SRS outcomes and to the psychological aspects linked to them. Furthermore, sexual functioning is related both to the endocrine environment and to the presence of functioning genitalia [34, 44, 45].

In our Italian experience, SRS outcomes seem to hinder the psychological well-being particularly in transmen because of the complexity of surgical procedure and the possibility of complications, especially in relation to phalloplasty [46, 47]. However, many other factors, not necessarily related to the surgical outcome, may have an impact on quality of sexual life and this might explain why the scores in the sexual life scale are not pathologic. In particular, some studies reported in transmen after SRS an increase in frequency of masturbation, sexual arousal and ability to achieve orgasm with a change in orgasmic feeling towards a more powerful and shorter orgasm [48–50].

A large number of studies examined the effects of HT and SRS from different points of view [4, 32–34].

We correlated the psychometric evaluations with hormonal values. To our knowledge, this is the first assessment of the role of hormonal treatment both on sexual life and body image after SRS.

The effects of the sex steroids on the brain are widely known. Some studies have suggested that hormonal therapy may have a positive effect on anxiety and depression [51, 52] and other non-specific emotional effects [53] which influence the sexual functioning too [19, 54–56].

We evaluated the endocrine condition by assaying sexual steroids and LH plasmatic levels.

LH was chosen as a marker of chronic replacement therapy considering that all these subjects are agonadic: LH values directly correlate to the compliance to HT, in other words to the regular assumption of the gonadic steroid.

Other authors have described a correlation between LH and some biological conditions [57, 58].

LH values display a great dispersion, related to the subjects' different gonadic hormonal levels.

We subdivided LH into quartiles to stratify the relationship between hormonal and WHOQOL parameters. LH proved to be a predictor of body image with a significant negative correlation.

Different mechanisms may be hypothesized to explain our results: the compliance to HT can be both the cause and/or consequence of better body image [14, 59–61].

On the other hand, LH proved not to be a good predictor of quality of sexual life in transsexuals. We decided to evaluate the possible influence of SRS outcomes on the quality of sexual life only in the transwomen subgroup, as our experience suggested that transmen had worse genital outcomes. In transwomen, a significant difference between the lower and higher LH quartile was found: to the highest LH level corresponds a worse quality of sexual life.

Finally, no significant correlation was found in the whole transsexual group nor in transwomen between LH and the general QoL. This result could be due to a greater conditioning by external factors, such as familial and social ties or working and economic situations [62].

Along these lines, QoL in transsexuals proves to be fulfilling and not always significantly related to hormonal status. Certainly, many other factors strongly influence this parameter and weaken the correlation with LH. We nevertheless emphasize the importance of administering estradiol or testosterone according to the Endocrine Society clinical practice guidelines [20], to the WPATH Standards of Care [22] and to the Italian SIAMS-ONIG consensus statement [21]. Moreover, it is probably necessary to continue such treatment after SRS for a long period, perhaps throughout life, even if the actual endocrinological guidelines are not yet conclusive on this aspect. Thus, a positive relationship with an expert endocrinologist, able to evaluate yearly benefits an eventual risks in maintaining hormonal treatment, for transpeople aged 50 and over, is essential.

An emerging issue is represented by transsexuals who after SRS refer to an endocrinologist having discontinued HT for several years. In our experience, these subjects show a low QoL; this condition is more common in transwomen. In such transwomen estrogenic treatment may produce an increased thrombogenic risk, particularly when smoking,

dyslipidemia or hypertension coexists [37]. This might be similar to what described in women who underwent HRT several years after menopause (HERS study) [63].

We decided to treat these subjects with low doses of transdermal estradiol along with heavy lifestyle modifications (e.g., stop smoking).

In accordance with all these considerations, we stress the bio-psychological importance of hormonal replacement therapy after SRS: this therapy is the centerpiece for well-being. How to make this point clear to transsexuals is still a matter of debate.

In our experience, transpeople seem to be more concerned about social aspects of their new life than about their own biological wellness and they do not appreciate to be medically treated for a long period of time.

Further studies with longer follow-up periods and on wider samples should be performed to confirm these results; we are waiting for an European data collection about transsexuals follow-up, especially now that the European Professional Association for Transgender Health has been founded (http:/www.epath.eu).

In conclusion, this study highlights general satisfaction in QoL, quality of sexual life and body image in transpeople after SRS. In particular, transpeople's QoL turns out to be similar to Italian matched controls' one.

It is our belief that offering a multidisciplinary take in charge to transpeople is the key pillar to obtain a good compliance to HT and therefore positive life outcomes. Indeed, an adequate HT is connected to improvement of body image and perception both due to the physical changes HT produces and to its positive influence on brain and internal organs functioning.

Compliance with ethical standards

Funding This research did not receive any specific grant from any funding agency in the public, commercial or not-for profit sector.

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval All procedures performed in this study, involving human participants, were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki declaration and its later amendments.

Informed consent An informed consent was obtained from all participants/controls. To maintain privacy, all data were coded. All transsexuals' data were collected as part of the clinical and psychological routine procedures.

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