

Psychological Vulnerability of Singleton Children After the ‘Vanishing’ of a Co-Twin Following Assisted Reproduction

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We test the hypothesis that parents who conceived twins by assisted reproduction technology (ART), but experienced loss of one twin, have a different parental–child relationship compared with ART parents following a singleton pregnancy. We used the 1994–2005 ART database of the Centre for Infertility of the Arcispedale Santa Maria Nuova in Reggio Emilia, Italy to identify families of 53 singleton births after the ‘vanishing’ twin syndrome. The controls comprised 106 families who conceived and delivered singletons, matched for gestational age ($\geq 28 \leq 31$, $\geq 32 \leq 36$, ≥ 37 weeks), maternal age (< 35 , $\geq 35 \leq 40$, > 40 years), child’s age (1–3, 4–6, and 7–11 years) and child’s gender. We completed 3 tests: a sociodemographic questionnaire, the QUIT — Italian Questionnaires of Temperament — motor scale, and the Child Vulnerability Scale. We found that children in the study had significantly more difficulties at the beginning of nursery school ($p = .002$) and kindergarten ($p = .0005$), with more frequent anxiety of separation from the parents (nursery school, $p = .009$; kindergarten, $p = .001$). We found a lower mean QUIT motor score for the 7- to 11-year-old children when compared to the general Italian normative values, suggesting that parents perceived their children as having more motor difficulties. In contrast, analysis of the Child Vulnerability Scale showed that significantly more parents (15.1%) from the controls perceived their child as vulnerable compared to those from the study group (3.8%), $p = .034$. We conclude that despite the perceived motor difficulties and the difficulties in the process of individuation–separation that appear at the beginning of the different educational circumstances, parents of singletons following the ‘vanishing’ twin syndrome perceive their children as ‘invincible’, and thus less vulnerable compared to controls.

The ‘vanishing’ twin syndrome, referring to embryonic loss of one twin and survival of its cotwin, was first documented more than 2 decades ago in the early days of

ultrasonography (Landy et al., 1982; Landy & Keith, 1998). Neither the true prevalence of this entity, nor its etiology is known at present. This is primarily because first trimester ultrasonography is not universally performed, and so an unknown proportion of twin pregnancies that end as singletons are not recorded. In addition, some confusion exists regarding the sonographic definition of the ‘vanishing’ twin syndrome. (Landy & Keith, 1998) As expected, the estimated prevalence of the syndrome among spontaneous conceptions is based on relatively small sample size and is likely to differ from the prevalence among pregnancies following assisted reproduction, where first-trimester ultrasonography is an integral part of the cycle assessment (Landy & Keith, 1998). A recent Scandinavian study suggests that 10.4% of all singletons following in vitro fertilization (IVF) are survivors of the ‘vanishing’ twin syndrome (Pinborg et al., 2005).

Once the diagnosis is made, parents may wish to know the risk associated with this kind of embryonic loss. As early as 1997, Pharoah and Cooke (1997) postulated that the ‘vanishing’ twin syndrome may be implicated in the etiology of cerebral palsy in singletons, as is frequently the case in single embryonic death in monochorionic twin pregnancies that occurs in late pregnancy. This view was seriously questioned (Blickstein, 1998), and indeed, recent data have not shown an excess risk of neurological sequelae in survivors of a ‘vanishing’ co-twin versus the singleton cohort, although the OR of cerebral palsy was 1.9 (95% CI 0.7–5.2), and a correlation was demonstrated between onset of spontaneous reduction and the risk of neurological sequelae (Pinborg et al., 2005). In addition, a more recent British small-scale study (Anand et al., 2007) found that when cases with

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definite ‘vanishing’ twin syndrome are considered, a significant difference exists in the prevalence of cerebral impairment between the survivors of ‘vanishing’ twin syndrome and the singleton group (RR 6.1; 95% CI 1.5–8.3). However, this RR was derived from very few cases ($n = 2$) among study and control subjects.

A similar uncertainty exists about whether ‘vanishing’ twin syndrome affects other outcomes. Pinborg et al. (2007) recently evaluated 642 survivors of a vanished co-twin, 5237 singletons and 3678 twins, and found a significantly higher rate of small for gestational age (SGA) infants in survivors than in singletons (OR 1.50, 95% CI: 1.03–2.20), and a significant inverse correlation between SGA and gestational age at the time of vanishing. These data were not corroborated by the study of La Sala et al. (2006), who found that survivors of ‘vanishing’ twin syndrome, which occurred in dichorionic twins only, and singletons that began as singletons, had similar mean gestational duration and birth weights, as well as similar frequencies of maternal and neonatal complications. This similarity persisted when conventional IVF and IVF plus intracytoplasmic sperm injection (ICSI) cases were evaluated separately.

The uncertainties about outcomes of survivors of ‘vanishing’ twin syndrome may further complicate the already existing complex parental psychological attitude towards the child conceived after demanding infertility treatments (Baor et al., 2004; La Sala et al., 2004). Whereas the parent–child psychological relationship has been studied in families following ART pregnancies (Baor et al., 2004), the potential psychological exposure of children who had a ‘vanished’ co-twin was not evaluated in these studies. In the latter circumstance, the bereavement process associated with the lost twin, as well as the concerns — apparent or perceived — regarding the surviving twin may have a direct influence on psychological morbidity of the surviving child.

Our null hypothesis was that parents who have undergone the stress of longstanding infertility, conceived twins by ART (Baor & Blickstein, 2005), and eventually experienced early pregnancy loss of one of their twins, have a different parental–child relationship compared with ART parents with a single child following a singleton pregnancy. We focused on the psychological aspects related to maternal perceptions regarding the surviving child, and on the presence of behavioral changes in the child that might be associated with the parental perceptions.

Patients and Methods

Sample

We screened our database of children conceived after ART and born during the period 1994–2005 at the Centre for Infertility of the Arcispedale Santa Maria Nuova in Reggio Emilia, Italy. We identified 68 singleton births after the ‘vanishing’ twin syndrome, 15 of

which were lost for follow-up. For comparison with the study group cases ($n = 53$), we selected 106 (2:1 ratio) control families who conceived and delivered singletons. Controls were selected from 628 singleton births following ART conceptions during the same period, and matched for gestational age at birth ($\geq 28 \leq 31$, $\geq 32 \leq 36$, ≥ 37 weeks), maternal age (< 35 , $\geq 35 \leq 40$, > 40 years), child’s age (1–3, 4–6, and 7–11 years), and child’s gender. The study was approved by the hospital’s ethical committee before initiation.

Assessment Procedure

Initially, the director of the Center sent a letter to the families to inform them about the project and of a future invitation to participate in the study. After allowing enough time for the letters to arrive, the families were telephoned by the research team psychologists, and consent to participate was requested. Thereafter, we administered 3 questionnaires: a socio-demographic questionnaire, the QUIT — Italian Questionnaires of Temperament — motor scale (Axia, 2002), and the Child Vulnerability Scale (Forsyth et al., 1996).

Instruments

The three main instruments were:

Sociodemographic Questionnaire. This questionnaire was specifically constructed in order to evaluate demographic variables, as well as to obtain the most significant obstetrical data and information about the health history and education of the children. Variables included gestational age at birth, mode of delivery, use of anesthesia, birth weight, neonatal and post-neonatal admissions (duration and diagnosis), the people with whom the child lives, beginning of nursery and kindergarten (age at enrolment and encountered problems), and beginning of primary school (age at enrolment and encountered problems, school performance, relationship with classmates and teachers, sports). Familial issues included the number, gender, and age of brothers and sisters; parents’ age, profession, and education; region in Italy from where the parents’ family came, the person who primarily took care of the child in his/her first few months of life, the age of the child when the mother started working again (if she worked), and the person who took care of the child after the mother started working again. This questionnaire has been validated on numerous occasions and confirmed as a reliable and useful tool to examine socio-demographic variables.

The QUIT Motor Scale (Italian Questionnaires of Temperament, Axia, 2002). This questionnaire measures the temperament of children at four stages, namely 1 to 12 months, 13 to 36 months, 4 to 6 years, and 7 to 11 years. It may be used in research, diagnosis, and follow-up of children with different problems (pediatric, neurological, educational, and psychosocial), as well as for the organization of groups of children of preschool and school age. The theoretical model of QUIT has six dimensions, three of which

relate to adaptation in general (motor activity, attention, and inhibition to innovations), and three which relate to specific adaptation to the social world (social orientation, positive, and negative emotionality; Axia, 2002). Because of the nature of the interview, only the temperament scale related to motor activity was used in this study.

The Child Vulnerability Scale (Forsyth et al., 1996). This scale is an instrument consisting of 8 items, constructed to be used in a face-to-face interview as well as by telephone, and deemed useful for the identification of children perceived as vulnerable. The two principal variables which contribute to this perception, according to the theoretical construction of the test, are a child's actual vulnerability determined by an illness, and a parent's past fear that the survival of their child could have been at risk. The first variable could make a child actually vulnerable, but the parent's anxieties tend to dissolve once the child's condition improves. For the second variable, perceived vulnerability is a lasting and continuous process that gives the parents a vision of the child as different. The original Child Vulnerability Scale (Perrin et al., 1989) consists of 12 items with a 5-point response scale ranging from strongly agree to strongly disagree for each item, whereas the revised version used in this study, consists of 8 items, each with a score ranging

between 0 and 3, making it a 4-point scale, with a final score (obtained by adding all scores) range between 0 and 24. A cut-off score of 10 or more was used to classify children as being perceived as vulnerable (Forsyth et al., 1996).

Statistical Analysis

Statistical analysis was performed using SPSS statistical package for Windows version 12.0 (SPSS, Inc, Chicago, IL). A *p* value of < .05 was considered statistically significant, and Pearson's χ^2 analysis was used to compare distributions of socio-demographic characteristics (transformed into categorical data) between the two samples. Differences of means of the scores of the QUIT Motor Scale were analyzed with the use of Student's *t* test for independent samples. For the Child Vulnerability Scale, the comparison of distribution, between the two samples, of scores higher than the cut-off score of the test, was analyzed with the use of Pearson's χ^2 .

Results

The total sample comprised 159 children, with a gender ratio (male:female) of 28:25 in the study group and 58:48 among the controls. No significant differences were observed between the parents in the two groups, except for the level of socio-economic status which was higher in the study group (*p* = .009, Table 1).

Table 1
Sociodemographic

	Study group 53		Control group 106	
	Fathers	Mothers	Fathers	Mothers
Age (yrs)	38.0 ± 5.9	35.0 ± 3.6	36.1 ± 3.8	34.5 ± 3.9
≤ 35	21 (39.6)	29 (54.7)	44 (41.5)	68 (64.1)
Primiparas	—	39 (73.6)	—	76 (71.7)
Province of origin				
North	30 (56.6)	30 (56.6)	60 (56.6)	58 (54.7)
Center	9 (17.0)	10 (18.9)	27 (25.5)	23 (21.7)
South	14 (26.4)	11 (20.7)	18 (17.0)	19 (17.9)
Non-Italian	—	2 (3.8)	1 (0.9)	6 (5.7)
Education				
Primary school	—	—	1 (0.9)	2 (1.9)
Middle school	20 (37.7)	17 (32.1)	43 (40.6)	24 (22.6)
Professional school	16 (30.2)	16 (30.2)	36 (34.0)	43 (40.6)
High school	8 (15.1)	11 (20.7)	13 (12.3)	18 (17.0)
University	9 (17.0)	9 (17.0)	13 (12.3)	19 (17.9)
Profession				
Independent	16 (30.2)	10 (18.9)	32 (30.2)	12 (11.3)
Employee	27 (51.0)	26 (49.1)	59 (55.7)	62 (58.5)
Factory worker	8 (15.1)	4 (7.5)	15 (14.1)	9 (8.5)
Housewife	—	13 (24.5)	—	22 (20.7)
Retired	2 (3.8)	—	—	—
Unemployed	—	—	—	1 (0.9)
Socioeconomic level (entire family)				
High	14 (26.4)	30 (28.3)		
Medium	26 (49.1)	64 (60.4)		
Low	13 (24.5)	12 (11.3)		

Note: Data presented as *N*(%) or mean ± *SD*.

The characteristics of the two groups of children were similar (Table 2). However, the quantity and quality of initial problems at school were different: children from pairs with a vanished co-twin had more difficulties at the beginning of nursery school ($p = .002$) and kindergarten ($p = .0005$), with problems more frequently associated with anxiety about separation (nursery school, $p = .009$; kindergarten, $p = .001$) from the parents (Table 3).

Table 4 compares the QUIT motor scale between the study and control samples and the mean values of the scores achieved for the Italian population at large (Axia, 2002). The data indicate a lower mean score for the 7–11 years old age groups when compared to the Italian normative values, suggesting a greater motor inhibition for ART children once they reach school age. Also, the study group tends to have lower scores compared to controls, suggesting that the ‘vanished’ twin variable may amplify the effect of ART alone on the QUIT scores.

Finally, the analysis of Child Vulnerability Scale showed similar results. Overall, significantly more

Table 2

Demographic Characteristics of the Children

<i>N</i>	Study group 53	Control group 106
ART therapy		
IVF	26 (49.1)	51 (48.1)
IVF + ICSI	27 (50.9)	55 (51.9)
Weeks' gestation (Mean ± SD)		
≥ 37	40 (75.5)	84 (79.2)
≥ 32 < 36	11 (20.7)	20 (18.9)
≥ 31 < 28	2 (3.8)	2 (1.9)
Mode of delivery		
Cesarean	26 (49.1)	54 (51.0)
Gender		
Male	28 (52.8)	58 (54.7)
Birthweight, g (mean ± SD)		
≥ 2500	46 (86.8)	94 (88.7)
≥ 1500 < 2500	5 (9.4)	9 (8.5)
≥ 1000 < 1500	1 (1.9)	3 (2.8)
< 1000	1 (1.9)	-
Neonatal admissions (d)		
No admission	39 (73.6)	81 (76.4)
< 7	5 (9.4)	9 (8.5)
≥ 7 < 28	7 (13.2)	14 (13.2)
≥ 28	2 (3.7)	2 (1.8)
Post-neonatal admissions (d)		
No A admission	40 (75.5)	78 (73.6)
< 7	9 (17.0)	18 (17.0)
≥ 7 < 28	4 (7.5)	10 (9.4)

Note: Data presented as *N*(%) or mean ± SD

No significant differences were found.

Table 3

Study Results of the Children

<i>N</i>	Study group 53	Control group 106
Age group		
12-36 mo	15 (28.3)	23 (21.7)
3-6 yrs	22 (41.5)	49 (46.2)
7-11 yrs	16 (30.2)	34 (32.1)
Beginning of nursery school^a		
Easy	19 (35.8)	46 (43.4)
Difficult ^b	10 (52.6)	37 (80.4)
Separation	9 (47.4)	9 (19.6)
Adaptation	7 (36.8)	7 (15.2)
Adaptation	2 (10.5)	2 (4.3)
Beginning of kindergarten^c		
Easy	39 (73.6)	79 (74.5)
Difficult ^d	25 (64.1)	67 (84.8)
Separation	14 (35.9)	12 (15.2)
Separation	8 (20.5)	6 (7.6)
Adaptation	6 (15.4)	6 (7.6)
Beginning of primary school		
Easy	18 (34.0)	42 (39.6)
Difficult	14 (77.8)	38 (90.5)
Separation	4 (22.2)	4 (9.5)
Separation	—	—
Adaptation	4 (22.2)	4 (9.5)
School performance		
Good	14 (77.8)	37 (88.1)
Sufficient	4 (22.2)	3 (7.1)
Difficult	—	2 (4.8)
Relationship with classmates		
Good	16 (88.9)	36 (85.7)
Sufficient	2 (11.1)	4 (9.5)
Difficult	—	2 (4.8)
Relationship with teachers		
Good	17 (94.4)	39 (92.9)
Sufficient	1 (5.6)	2 (4.8)
Difficult	—	1 (2.4)
Sport activities		
Yes	15 (83.3)	38 (90.5)

Note: Data presented as *N*(%)

^a $p = .002$; ^b $p = .009$; ^c $p = .0005$; ^d $p = .01$

Table 4

Results of the QUIT Motor Activity Scale

Age group	Entire Italian population ¹² (mean ± SD)	Study group	Control group
1–3 yrs	3.47 (0.73)	<i>N</i> = 15 3.44 (0.76)	<i>N</i> = 23 3.62 (0.58)
4–6 yrs	3.66 (0.46)	<i>N</i> = 22 3.44 (0.79)	<i>N</i> = 49 3.58 (0.79)
7–11 yrs	3.95 (0.82)	<i>N</i> = 16 3.18 (1.03) ^a	<i>N</i> = 34 3.56 (0.94) ^b

Note: ^a $p = .009$

^b $p = .02$

parents (15.1%) from the controls perceived their child as vulnerable compared to those from the study group (3.8%), $p = .034$. Breakdown for age groups showed 13.0% versus 6.7%, $p = .5$ (for ages 1–3 years), 22.4% versus 4.5%, $p = .06$ (for ages 4–6 years), and 5.9% versus 0%, $p = .5$ (for ages 7–11 years).

Discussion

The 'vanishing' twin syndrome creates a special situation where, for some unknown reason, one embryo-fetus prevails and survives the early stages of pregnancy. When this happens after prolonged infertility, and following a physically and psychologically demanding treatment, a rather complex psychological parent-child relationship would not be surprising.

The vulnerability of children following complex ART conceptions has been studied (Baor et al., 2004). It is logical to suppose that some of the progress of these children through developmental steps might be affected by biological background (i.e., related to the medical aspects of the ART conception) or sociopsychological background (i.e., related to the psychological state of the parents). La Sala et al., (2004) showed that ICSI-conceived children develop normally and, when assessed by the Bayley Scales of Infant Development and the CARE-Index, differences in quality of development and social interaction observed at 1 year of age had no negative effect on the overall level of development. Rather, the differences appeared to be related to the developmental processes of the entire family unit, as opposed to ICSI-related biological effects. Accordingly, observed differences dissipated with familial adaptation, and were not present at 2 years of age.

In the present study, comparisons were made between the QUIT motor scale scores of the Italian Normative Sample and those obtained on the same scale by the study, as well as by the control samples, within the 3 age groups used by the test (Table 4). Parental perception of vulnerability in children associated with an overprotective parental attitude tended to increase in cases following infertility, pregnancy complications, preterm birth, and low socioeconomic status. The QUIT motor scale was considered best to evaluate the motor development of the sample at large and also to compare the results with standards for the entire Italian population.

Because our sample comprised children born following ART to couples with infertility who are likely to have a complicated pregnancy and to deliver preterm, the Child Vulnerability Scale was used to assess the psychological aspects in the study versus the control group. Our present analyses show how children who had a vanished co-twin are perceived by their parents as having lower scores at a motor level compared with those who were singletons from the outset. Moreover, the 'surviving' children present more initial difficulties at school, from nursery to primary school, compared to singleton ART babies,

and these difficulties are particularly associated with anxiety about separation (nursery school and kindergarten), and adaptation to the educational environment (primary school). At the same time, however, parents of the 'surviving' children perceive their children as less vulnerable compared to the controls. Within the ART group, the greater parental perception of vulnerability of the child can be explained by the 'premium' connotation, in which the child is perceived in the minds of the parents, and particularly in that of the mother, as being the result of a complex and emotional project. (Baor et al., 2004) This cognitive and emotional representation also permeates the relationship between the parent and the 'surviving' child. However, the cumulative traumas of mourning for his/her infertility, amplified by mourning for the diagnosed loss, can be defensively negated because the loss is not 'visible', unlike losses that occur in later pregnancy. In this way, the 'surviving' children became vulnerable ART children and, at the same time 'invincible' because they survived the loss compared to their co-twin.

Such ambiguous representation does not facilitate the processes of individuation and learning, as it complicates the infant's development with a double message. The emotional and cognitive development needs the 'ghosts in the nursery' to have a clear representative in adulthood. This concept was introduced by Fraiberg and her colleagues (1975) to describe how parents transmit child maltreatment from one generation to the next. The concept of 'ghosts in the nursery' emerges from the parents' own unremembered early relational experiences of helplessness and fear.

For this reason, all ART journeys should be accompanied by medical as well as psychological guidance before, during, and after the process. Evidently, the mother who loses one twin in cases of the 'vanishing' twin syndrome may deserve special guidance to help her realize that she will have to deal with joy on one hand and loss on the other. Whereas the medical outcome may remain still predictable, the symbolical (and hence the psychological) level may represent for the mother an emotional breakdown, which cannot reverberate in the intersubjective parent-child relationship.

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