Reasons for Rejecting Potential Donors from a Sperm Bank Program

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Purpose: Recruiting donors to a sperm bank program is difficult and slow because of high dropout rates and high rejection rates. The profile of successful and unsuccessful donors was determined at our sperm bank.

Methods: A total of 199 men was screened from 1986 to 1994 in the anonymous sperm bank donor program; 174 (87%) men dropped out or did not meet minimum guidelines. The study included 25 accepted donors and 20 rejected men (of 52 rejected donors, only 20 donors who came for two consecutive semen analyses were selected). Sperm quality variables and demographic data were compared between the groups.

Results: Accepted donors had significantly better semen quality in motility, velocity, linearity, and ALH than did rejected donors ($P < 0.01$). More rejected donors than accepted donors were single ($P < 0.01$). A higher percentage of accepted donors consumed caffeine ($P < 0.001$), and they were more likely to have college degrees ($P < 0.03$).

Conclusions: These results indicate that loss of interest and poor semen quality were the major reasons for rejection of donors in our anonymous donor sperm bank program.

KEY WORDS: computer-assisted semen analysis; cryopreservation; donor sperm bank; semen.

INTRODUCTION

Infertility is the inability to conceive after 1 year of unprotected intercourse. Male factors alone are responsible for infertility in 30% of infertile couples. The first documented human artificial insemination with donor (AID) spermatozoa was accomplished in 1884

(1). Artificial insemination with frozen donor semen is now offered to couples when the husband's semen quality is inadequate, especially to couples who have undergone extensive medical and surgical treatment without success. Therapeutic insemination of sperm from a healthy donor is now a widely accepted treatment procedure for untreatable male factor infertility. An estimated 30,000 pregnancies occur each year from donor insemination in the United States (2). Recent developments in assisted reproductive techniques such as intracytoplasmic sperm injection (ICSI) have allowed most infertile men (except azoospermic) to regain fertility. However, these new treatments are too expensive for many middle-class couples, and until less expensive treatments for male infertility are developed, donor insemination will remain an important adjunct in the treatment of infertility.

The risk of transmitting various infectious and genetic diseases by inseminating donor semen has been highlighted in the past decade (3–5). Some of these diseases, such as acquired immunodeficiency syndrome (AIDS), are lethal (3). Before semen donors were screened for human immunodeficiency virus (HIV) beginning in 1985, the HIV virus was being transmitted to inseminated patients. An estimated 1 million donor inseminations occurred in the United States between 1975 and 1985, when the HIV virus was probably being transmitted in semen but had not yet been identified (3). With the increased knowledge of the risks of donor insemination, precautionary measures for AID are growing (6,7). In addition to examining the semen quality (prefreeze and postthaw), donors are matched for race, blood groups, Rh incompatibility, and general health. Donors are now also screened for HIV, hepatitis B, and other sexually transmitted diseases. The use of only cryopreserved semen for donor insemination was recommended by the American Society for Reproductive Medicine (ASRM) in 1986 (8). Currently, the only semen specimens that can be used

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for insemination are those that have been quarantined for at least 6 months. Increased screening costs and the long quarantine period of semen have doubled the cost of treatment and reduced pregnancy rates. Artificial insemination with donated cryopreserved semen, however, is still a fraction of the cost of the latest assisted-reproduction technologies such as gamete intrafallopian transfer, in vitro fertilization and embryo transfer, subzonal sperm injection, and intracytoplasmic sperm injection used for treating severe male-factor infertility.

One of the major problems for many donor insemination centers is the recruitment of donors who are healthy, are free of transmissible genetic disorders, and free of sexually transmitted diseases (including AIDS), and have good quality semen (9). Although the number of centers recruiting donors has increased in recent years, the supply of donors has not increased (10). Controversial legislation in some European countries prohibits paying sperm donors (9) and allows donor-inseminated offspring to obtain identifying information concerning their biological father on reaching maturity (11). The legislation has consequently reduced the availability of semen donors (12). Because of the controversy surrounding these laws, more people have become aware of semen banking, which has resulted in an increase in the number of potential donors after an initial decline in some clinics (11). The present study was undertaken to determine the reasons for donor rejection in a sperm bank program and to identify the profile of a typical acceptable donor.

MATERIALS AND METHODS

Screening Procedure

Potential semen donors were recruited with advertisements at area professional schools, universities, and hospitals. A total of 199 men was screened from 1986 to 1994 in the donor sperm bank program of our tertiary care hospital. The study included 25 accepted donors and 20 rejected men (of 52 rejected donors, only 20 donors who came for two consecutive semen analyses were selected). Callers were screened according to the guidelines of the ASRM for Anonymous Semen Donors (8,13,14) and of the Standards of the American Association of Tissue Banks (15) (Fig. 1).

Prospective donors were queried during initial phone inquiry for their interest in our donor program, as well as for their long-term availability as a prospective donor. Qualifying candidates were then mailed an

Fig. 1. Steps in the screening of potential sperm bank donors.

in-depth questionnaire (14). The return of the completed questionnaire prompted an interview with the Andrology Laboratory director. These men were questioned about their marital status, occupation, religion, and ethnic origins. Any reported pathologic or genetic abnormalities were evaluated from the answers to the questionnaire which included histories of their personal, immediate, and extended families up to the fourth generation. After a satisfactory evaluation, the men were advised of the requirements of the donor program at our center. They were asked to make an appointment to produce a semen sample in the following week, thereby giving them a chance to review their decision to proceed as a donor. Semen samples were collected on-site by masturbation for complete semen analysis after an abstinence period of 48 to 72 hr. Semen samples were evaluated manually and by computer-assisted semen analysis (Motion Analysis, Cell-Trak, Model VP 110, Version 4.22B, Santa Rosa, CA) for the following criteria (16): semen volume, >1.0 ml; sperm concentration, $\geq 40 \times 10^6/\text{ml}$; motility, $\geq 50\%$; sperm morphology by World Health Organization criteria, $\geq 30\%$; white blood cells (granulocytes), <1.0

$\times 10^6/\text{mL}$; bovine cervical mucus penetration test, ≥ 30 mm/120 min; hypoosmotic swelling, $\geq 60\%$ tail swelling; and cryosurvival, $\geq 40\%$ motility. An aliquot of semen was cultured for *Neisseria gonorrhoeae*. Semen was also examined for extraneous cells and *Trichomonas vaginalis*. For cryopreservation, semen was slowly mixed with an equal volume of TEST-egg yolk buffer (Irvine Scientific, Santa Ana, CA) and 2-ml aliquots were frozen in polypropylene vials using a three-stage freezing procedure: exposure to -20°C for 10 min, -100°C nitrogen vapors for 2 hr, and immersion in liquid nitrogen. An aliquot of the specimen was thawed after 24 hr to test for cryosurvival (17).

Any potential donor meeting the minimum semen quality standards on two consecutive semen specimens was scheduled for a physical and psychological examination by our primary care physician. A culture for chlamydia was obtained by urethral swab, and blood was drawn for viral testing for human T lymphocyte virus, human immunodeficiency viruses I and II, herpes simplex, hepatitis C, hepatitis B surface antigen, hepatitis B core antibody, and cytomegalovirus. If all tests were negative, the laboratory started to bank semen specimens from the donor. Donors were scheduled for sperm collection as frequently as possible, with 48 to 72 hr of abstinence before each sample was collected. All samples for cryopreservation were produced on-site, in a hospital collection area and in specimen cups, to prevent sample-switching (18). Aliquots were tested every month for *Neisseria gonorrhoeae* and quarterly for Group B *Streptococcus* before cryopreservation. The donors were retested for the above-mentioned pathogens after all of their specimens were banked. The semen was quarantined for 6 months and released after donors tested negative for HIV antibodies.

Statistical Analysis

The results of semen analysis and demographic information on accepted and rejected donors were compared with Student's *t* test or the Wilcoxon rank-sum test. A *P* value of <0.05 was considered to be significant. All tests were two-tailed. All analyses were performed with the SAS statistical software package (SAS Institute, Cary, NC). -

RESULTS

A total of 199 men between 18 and 45 years of age responded to the advertisement for semen donation

between 1986 and 1994 (new donor recruitment was terminated at the end of 1994). Of these, 173 (86.9%) either withdrew or were rejected for a variety of reasons (Fig. 2). None of the potential donors tested positive for HIV-related viruses, *Neisseria gonorrhoeae*, or syphilis.

There were no significant differences in age, race, religion, occupation, smoking, alcohol, or drug use between the accepted donors ($n = 25$) and the rejected donors ($n = 20$). Drug (marijuana) use was similar in both accepted (10/25; 42%) and rejected donors (9/20, 45%) (Table I). More rejected donors were single (90 vs 56%; $P < 0.01$). A higher number of accepted donors (21/25; 84%) had a regular sexual partner (>1 year) compared to rejected donors (10/20; 50%). More accepted than rejected donors drank coffee (72 vs 20%; $P < 0.001$). Also, 100% of accepted donors were college-educated, compared to 80% of rejected donors ($P = 0.03$).

The ejaculate volume of the two groups was similar. The percentage changes in semen quality after cryopreservation (prefreeze minus postthaw divided by pre-

Fig. 2. Causes of rejection of donors in a sperm bank program.

Table I. Demographic and Lifestyle Characteristics of Accepted and Rejected Donors in a Sperm Bank Program

Characteristic	Accepted donors (n = 25)	Rejected donors (n = 20)	<i>p</i> ^a
Age	27.4 ± 5.1	25.8 ± 3.7	0.15
Race: white	24 (96%)	18 (90%)	0.58
Marriage status: single	14 (56%)	18 (90%)	0.012
Education: college or more	25 (100%)	16 (80%)	0.033
Occupation			
Student	10 (40%)	13 (65%)	0.095
Professional	14 (56%)	5 (25%)	
Other	1 (4%)	2 (10%)	
Smoking: yes	2 (8%)	2 (10%)	0.99
Alcohol	19 (78%)	13 (65%)	0.83
0/wk	6 (24%)	3 (16.7%)	
1-6/wk	13 (52%)	11 (61%)	
7-12/wk	6 (24%)	3 (16.7%)	
13-18/wk	0 (0%)	1 (5.6%)	
Caffeine: yes	18 (72%)	4 (20%)	0.001
Drug use: yes	10 (42%)	9 (45%)	0.82
Marijuana	10 (42%)	9 (45%)	
Marijuana + hallucinogens	0 (0%)	2 (10%)	
Marijuana + cocaine	1 (4%)	0 (0%)	
Sexual history			
Frequency of sexual intercourse			0.59
0 to <1 time/3 wk	6 (24%)	9 (45%)	
<1/wk	3 (12%)	4 (20%)	
>1/wk	16 (64%)	7 (35%)	
Regular sexual partner	21 (84%)	10 (52%)	0.024
Religion			
Atheist	2 (8%)	4 (20%)	0.41
Buddhist	0 (0%)	1 (5%)	
Catholic	11 (44%)	9 (45%)	
Jewish	2 (8%)	0 (0%)	
Protestant	11 (40%)	6 (30%)	
Abstinence time (hr)			
≤24	0 (0%)	1 (5.3%)	0.99
24-48	10 (59%)	10 (53%)	
48-72	7 (41%)	8 (42%)	

^a *P* < 0.05 considered significant.

freeze × 100) were similar in the two groups (Table II). Accepted donors had significantly better semen quality than rejected donors (*P* < 0.05).

DISCUSSION

An estimated one in six couples of childbearing age may be infertile (19). Severe male-factor infertility can be treated with newer micromanipulation techniques such as ICSI (20) but the high cost of these procedures and genetic concerns (21) are barriers to their widespread acceptance. Artificial insemination by donor insemination is an inexpensive treatment of choice

for those infertile couples when the husband's semen quality is inadequate even after medical and surgical treatment.

The typical accepted donor in our program was a young male in his late 20s or early 30s with at least a bachelor's degree. The majority of these donors was professionals or college students, rather than blue-collar workers, a finding similar to that reported for two London clinics (22). More accepted than rejected donors drank coffee. The caffeine in the coffee may be linked with better semen quality. The effect of caffeine as a stimulator of sperm motility is wellknown (23,24). There were no significant differences in age,

Table II. Semen Quality Before and After Cryopreservation of Accepted and Rejected Donors from a Sperm Bank Program (Values Are Medians and Interquartile Ranges)

Sperm characteristic	Accepted donors (n = 25)	Rejected donors (n = 20)	P ^a
Volume (ml)	3.1 (1.8) ^b	3.1 (1.7) ^b	0.97 ^c
Motile sperm count (×10 ⁶)			
Prefreeze	130.0 (92.3 to 156.0)	42.5 (32.9 to 67.4)	0.0001
% Change ^d	-46.5 (-58.9 to -27.8)	-51.2 (-62.7 to -37.7)	0.22
Motility (%)			
Prefreeze	64.8 (54.5 to 81.0)	54.0 (44.5 to 70.5)	0.052
% change	-38.3 (-52.2 to -31.6)	-44.3 (-54.5 to -38.8)	0.28
Curvilinear velocity (μm/sec)			
Prefreeze	47.4 (41 to 54)	33.5 (28.4 to 49.1)	0.016
% change	-18.9 (-27.8 to -7.7)	-17.0 (-43.8 to 3.2)	0.91
Linearity (%)			
Prefreeze	53.5 (44.7 to 59.0)	42.0 (38.8 to 45.4)	0.001
% change	5.1 (-13.2 to 11.9)	6.6 (-0.40 to 18.7)	0.27
Amplitude of lateral head displacement (μm)			
Prefreeze	2.7 (2.3 to 3.1)	2.1 (1.8 to 2.9)	0.013
% change	-10.0 (-27.3 to -4.0)	-15.4 (-37.1 to 9.5)	0.71

^a P < 0.05 considered significant by Wilcoxon rank-sum test.

^b Mean and standard deviation.

^c Student's *t*-test; P < 0.05 considered significant.

^d Change from prefreeze to postthaw.

race, religion, smoking, alcohol, or drug use between the accepted and the rejected donors.

Although the number of centers recruiting semen donors has increased in recent years, along with the number of prospective donors, the supply of acceptable donors or donated semen has not increased proportionately. This reduced supply is caused by a higher proportion of potential donors failing the screening process as a result of increased stringency in these procedures (25). Increasing awareness that life-threatening infectious and genetic diseases can be transmitted from semen (4,26-28) has resulted in thoroughly revised and elaborated selection criteria and screening procedures (7,14,15). The screening of donors for artificial insemination is likely to become even more stringent and rigorous as knowledge of genetic or infectious disease increases and it becomes possible to screen for a greater number of disorders with modern biological techniques.

Screening eliminates a large percentage of men who express a desire to donate semen. The proportion of donor candidates finally selected in our donation program was smaller (13%; 25/199) than the 20 to 30% acceptance rate reported by other centers (10,19,28). However, the percentage of donors selected after interview with the laboratory director and further screening (32%; 25/78) in our center was comparable with earlier reports (4) but lower than the results reported

from licensed centers in the United Kingdom (10). Therefore, in order to recruit a sufficient number of donors, at least three to four times more volunteers than the number needed need to be screened. The majority of potential donors was eliminated early in the screening process as a result of lack of interest in the program or insufficient time. About 11% of the potential donors (21/199) dropped out after their interview with the laboratory director and after semen analysis. This rate is comparable to the 15% dropout reported by others (28). Another probable reason for leaving the program was the need to produce the semen sample by masturbation in the laboratory.

The proportion of men rejected for any specific reason in a particular sperm bank depends to some extent on the order in which screening and testing procedures are carried out. The results of our study support those of earlier reports suggesting a substantial loss of potential donors as a result of poor sperm quality (29). In a majority of the centers, poor semen quality resulted in rejections of more than 10%, and in some 66%, of potential donors screened (11). Other investigators have reported donor rejection rates of 26 to 50% as a result of poor semen analysis (7,28,29). In our study, 13% of donors (25/199) were rejected because of poor semen analysis. The higher rejection rates reported by others may be caused due to a different screening protocol where semen analysis was done

before the detailed interview and medical examination (7,29). Poor sperm count and motility in otherwise acceptable donors were the most common reasons for rejection of potential donors. Similarly, for poor cryo-survival the rejection rate of otherwise acceptable donors in our program was comparable to that reported by others (10). Poor cryosurvival also reduces the number of donors (30). The percentage changes in semen quality after cryopreservation were similar in both accepted and rejected donors, suggesting that the effect of freezing and thawing on sperm quality is not different between the two groups (31).

None of the donors in our study tested positive for *Neisseria gonorrhoeae* at any time or showed evidence of sexually transmitted bacterial or viral diseases. Our results suggest an overall low incidence of sexually transmitted pathogens in our donor population.

The effect of prefreeze or postthaw donor sperm characteristics on the pregnancy rate is controversial. The motile sperm count in subfertile patients correlated with the pregnancy outcome (32), while no such correlation was seen in the presence of greater than 50% normal morphology (33). Others reported that donor specimens with better postthaw motion characteristics result in a higher pregnancy rate (34). In our program, comparison of semen characteristics of specimens resulting in pregnancy to those that did not in a previous cycle of the woman, using a semen specimen from the same donor, showed a lack of correlation between semen characteristics and pregnancy outcome (unpublished observation). We feel that there are no specific semen characteristics in good-quality semen which make some donors potentially better at producing pregnancies. Good-quality semen is an essential prerequisite for achieving pregnancy but may not be the only factor. Female factors of infertility probably have more influence on the pregnancy rate in the presence of good-quality donor semen.

Prefreeze semen quality is one of the important factors for rejecting prospective donors from a sperm bank program. Centers wishing to establish a pool of donors should be aware of the low proportion of men who qualify to be sperm donors. Large-scale screening of prospective donors is not cost-effective for smaller reproductive centers. Laboratories offering donor insemination services to a smaller number of patients should consider buying frozen donor semen from large commercial sperm banks that meet the necessary guidelines and quality control standards.

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