

The 50 Million Missing Women

Gautam N. Allahbadia¹

Submitted March 14, 2002; accepted April 1, 2002

The epidemic of gender selection is ravaging countries like India & China. Approximately fifty million women are “missing” in the Indian population. Generally three principle causes are given: female infanticide, better food and health care for boys and maternal death at childbirth. Prenatal sex determination and the abortion of female fetuses threatens to skew the sex ratio to new highs. Estimates of the number of female fetuses being destroyed every year in India vary from two million to five million. This review from India attempts to summarize all the currently available methods of sex selection and also highlights the current medical practice regards the subject in south-east Asia.

KEY WORDS: Sex selection; fetal sex determination.

Application of technology should be in consonance with the laws of nature.

—Dr A.P.J. Abdul Kalam
Director
Defence Research & Development
Organization, India

INTRODUCTION

We are not talking about long-range nuclear-tipped missiles here, but this quote applies to the epidemic of gender selection that is ravaging countries such as India and China. Approximately 50 million women are “missing” in the Indian population. Generally three principal causes are given: female infanticide, better food and health care for boys, and maternal death at childbirth. The situation is similar in China and other Asian and Middle Eastern countries. Prenatal sex determination and the abortion of female fetuses threatens to skew the sex ratio to new highs—with unknown consequences. Various methods now exist for attempting to choose to have a baby

of a desired sex. In a male-oriented society such as India, the commonest methods employed by the vast majority of the populace, usually after two female children is ultrasound directed fetal sex determination at 13/14 weeks gestational age and in more affluent urban areas the chorionic villus sampling technique at 8/9 weeks. Sex selection has become a national crisis in India and China, where cheap mobile ultrasound clinics travel the countryside testing pregnant women. Women who discover that their fetus is female often opt for legal abortions referred to as MTPs (Medical Termination of Pregnancy). Estimates of the number of female fetuses being destroyed every year in India vary from two million to five million. This practice has reportedly skewed sex ratios from the natural 106 boys to 100 girls to as high as 130 boys to 100 girls. Such results led both China and India to ban ultrasound testing for the purpose of sex selection. Recognizing and seeking to control this perilous trend, the government of India outlawed prenatal sex determination on January 1, 1996. The new law makes it illegal to advertise or perform the tests (with a few exceptions) and punishes the doctor as well as relatives who encourage the test and the woman herself with fines from 10 to 50 thousand rupees and jail terms from 3 to 5 years. But all that this act did was to bring about an entirely new

¹ Rotunda – The Center For Human Reproduction, 672 Kalpak Gulistan, Perry Cross Road, Near Otters Club, Bandra, Mumbai 400 050 India; e-mail: gautam@rotundaivf.com.

underground market for sex determinations. Doctors now charge a premium for the services. In a bureaucratic administrative setup, this gave corrupt government officials a lucrative business opportunity to extort bribes from flourishing sex selection clinics across the country.

HISTORICAL DEVELOPMENTS

Attempts to select children's sex have a long history, from the herbal nostrums recommended by traditional healers to more recent therapists' advice about which forms of intercourse are allegedly likely to produce girls or boys. The selection of gender has been a quest of couples for as far back as recorded history allows. Early drawings from prehistoric times suggest that sex selection efforts were being investigated by our earliest ancestors. Later history shows intense interest in sex selection by early Asian, Egyptian, and Greek cultures. Anaxagoras, a fifth century B.C. Greek philosopher, believed that semen from the right testicle produced sons, while semen from the left testicle resulted in the birth of a daughter. Believing the same theory, men in the Balkans would squeeze the right side of their scrotums in the hope of increasing the odds of having a son. A misconception that persisted till as late as the sixteenth century was that male babies developed in the right side of the uterus. *The Perfumed Garden*, written by Shaikh Nefwazi, recommended turning the woman on her right side after the man had ejaculated. The *Charaka Samhita*, a manual written around 800 B.C. in India, advised prospective parents who expressed a preference for sons that they should "abstain from intercourse for a week, gazing every morning and evening upon a majestic white bull or stallion, being entertained by pleasant tales, and feeding their eyes on men and women of gentle looks." Mistaking vaginal secretions for semen, ancient Greek, Hebrew, and Indian literature stated that both men and women produced semen. Sons were born when the male semen was predominant. Masturbation after a period of sexual abstinence usually results in the ejaculation of a greater amount of semen. Based on this observation, sexual abstinence was recommended for men who wanted sons. An ancient Chinese birth chart predicts sex of the child based on the age of the mother at conception and the month of conception. This is followed by documented scientific efforts beginning in the 1600s to sway the chances of achieving a pregnancy by a variety of methods. Research and work carried out in the 1980s and 1990s have finally provided methods offering the chance of

obtaining a desired pregnancy gender outcome that ranges from excellent to virtually guaranteed.

Some natural gender selection methods are based on the observation that a conception attempt, relative to ovulation, is more likely to result in the conception of a specific sex. Attempts to time conception for a specific sex relative to ovulation have been made by measuring hormonal levels, basal body temperature, and cervical mucus observations. Other natural methods include radical diets, frequency and positions of intercourse, vaginal douching, etc. These methods are commonly used throughout the world, but the effectiveness of these natural gender selection methods have not been well documented.

MORE RECENT DEVELOPMENTS

Timing intercourse for gender selection is based on the life and mobility of sperm; it has been suggested that the androsperm (Y-bearing sperm) are stronger and faster but do not survive for very long. Gynosperm, (X-bearing sperm), on the other hand, are slower but have greater staying power, consequently a longer life span (1). Intercourse position is also based on the mobility of sperm, with shallow penetration (missionary position) favoring the conception of a baby girl, with deep penetration (rear entry) favoring the conception of a baby boy (1). The Whelan Method is in complete disagreement with the Shettles method and suggests the opposite (2). Whelan says to have intercourse 4–6 days so as to conceive a boy before your basal body temperature goes up. To conceive a girl, intercourse should occur 2–3 days before ovulation.

In 1984, the World Health Organization published a study that failed to confirm gender predominance when timing conception relative to ovulation (3). Unterburger had made observations with respect to alkalinity and acidity and gender predetermination (4). Women recommended to use an alkaline douche (for overcoming fertility problems) conceived a higher than usual number of boys (4).

Langendoen and Proctor first published *The Pre-Conception Gender Diet* in 1982, on the basis of results reported by Stolkowski and Lorrain in 1980 (5). The theory is that by altering your diet to include and exclude certain foods, the conditions in the reproductive tract will be directly affected, increasing the odds of conceiving a particular sex. This theory is also consistent with the oriental philosophy that everything has a yin or yang quality and the foods supplied in the boy diet (boys and alkaline) are all yang and the

foods supplied in the girl diet (girls and acid) are all yin. Claims of 80% accuracy, based on one clinical trial of only 260 women, the results were published in the *International Journal of Gynaecology and Obstetrics* in 1980 (5). The girl diet is high in calcium but low in salt and potassium, containing acid-forming foods. The boy diet is high in salt and potassium but low in calcium and magnesium and contains alkali-forming foods.

The majority of the artificial sex selection methods work by separating X- and Y- bearing sperm and require artificial insemination. The Ericsson Method was developed about 25 years ago and has been in clinical use for the last 20 years. Currently, there are over 40 Sperm Centers using this procedure in the world, and over 2000 healthy babies have been born using the albumin treatment, the great majority of them in the United States.

The treatment for conception of a boy involves running the husband's sperm sample through columns containing human serum albumin solutions of different concentrations by which Y-bearing sperm can be separated through a filtering process (6). In January 1998, Hong Kong researchers who used the Ericsson method (7) published a paper. They did DNA studies on the supposedly X-rich and Y-rich samples produced by the separation and found that each sample still contained the original 50% ratio of X-bearing to Y-bearing sperm. Many have claimed success at this type of sperm separation, but few have been able to back up their claims with hard data.

There have been several reports in the scientific literature recently which suggest that sperm subjected to a swimup procedure and used for artificial insemination can increase the chances of conceiving a male by between 80 and 90%. In one study carried out in 1993, 23 of 26 births were male claiming a success rate of about 88.5% for male sex selection (8). Two recent studies suggest that the Percoll density gradient method is effective in both separating the X and Y sperm and also skewing the birth sex ratio in humans (9,10).

A 1996 study suggested that bottom (X) fraction sperm, derived from the eight-layer discontinuous Percoll gradient, have higher motility, progression, and hyperactivation when compared with top (Y) fraction sperm. The bottom (X) fraction sperm have greater longevity in motility and have shorter tails, supporting earlier hypotheses of sex differences in sperm parameters (9). In the Percoll procedure, the sperm sample is layered on top of a Percoll density gradient consisting of many layers of Percoll at dif-

ferent concentrations, and the Y and X sperm are believed to be partially separated at low speed inside a centrifuge by their differential sedimentation velocities. The rationale to this treatment is that the X sperm is believed to be bigger and heavier than the Y sperm and it will sediment down the Percoll gradient quicker under centrifugation. If sperm collected at the bottom of the Percoll gradient are used for artificial insemination, the chances for conceiving a girl should be greater.

With the recent advent of Microsort (flow cytometric separation of X and Y sperm) and preimplantation genetic diagnosis (PGD), couples no longer have an excuse to employ abortions to select sex. The Microsort method is an expensive approach to gender selection involving the separation of the X sperm from the Y sperm. This method uses a technique known as flow cytometry where seminal fluid is filtered and then forced through a long, thin tube under pressure. At the other end, the tube divides, and there is a fluorescence-based switch, designed to direct the larger X sperm into one direction, and the smaller Y sperm into a different direction. The desired X-rich or Y-rich sperm samples can then be used for artificial insemination (11).

CULTURAL ISSUES

The problem with trying to prevent couples from aborting female fetuses is that cultural traditions die hard, and a particularly powerful one is that boys are infinitely more desirable than girls. The reason is simple: when parents marry off a daughter, society expects them to give a huge dowry to the boy's family. This represents an enormous burden that often wipes out a family's entire savings. Recent advertisements in the national press and on the internet extolling the "highly effective" gender selection kit marketed by a U.S. company has created a hornet's nest. The government is naturally perturbed about the ramifications of such advertisements and its potential to skew the already-tilted female-male birth ratio in the country. Recent editions of *India Abroad*, a weekly newspaper for Indian expatriates in the United States and Canada, are carrying sex preselection ads by companies to promote their products to one of the country's fastest growing ethnic groups. And the target market is immigrants from India, where sex-determination tests were outlawed 8 years ago in a still unsuccessful effort to thwart the widespread practice of aborting female fetuses. Such ads would be illegal in India, which has struggled for years to discourage women from

exploiting medical technology to assure themselves of giving birth to boys. Now, Indians in the United States and Canada find themselves being courted by American companies that promise to help do just that.

In India and China, female infanticide is both socially sanctioned and undeserving of mourning. Yet, one should consider it repugnant to kill the fetus by way of abortion, especially when only done to abort a girl fetus. This would appear even more the case in our country where women deities are worshipped in various forms. In both Karnataka and Bengal the deities of the state is a goddess.

Few of India's states show the political will to enforce the century-old law prohibiting female infanticide. A ritual which originated amongst certain of Rajasthan's tribal communities, the murder of the girl infant, is morally cleansed by the reasoning that killing takes place before the ritual bath, 7–10 days after birth, which grants an infant "human status." This is further upheld by superstitions maintaining that the act enhances the chance of the next born being the preferred son.

The killing of the infants, when born with deformities of face and limbs, soon after the birth, is a frequent occurrence in India. The culprits are the dais (traditional birth attendants) and old ladies who attend to child birth in rural communities. They, in their own way, protect the family from the financial expenses and social stigmas associated with bringing up such a child in a country where a lack of social education prevents these unfortunate infants from living a full life and rehabilitating them. The problem has taken monstrous proportions in just the past two decades.

Prenatal techniques for sex determination were introduced into India only in the early 1970s. Although touted officially as an aid in reducing genetic defects, much of the Indian public has turned to these tests to find out if "It's a boy" or not. The effects of these developments on sex ratio can be observed in every class of the society. An awareness program going right to the grass-roots level and effective deterrent punishment to doctors who flout the law may be a solution.

The proliferation, and increasingly reported abuse, of prenatal testing has forced an impassioned debate throughout India. Those fighting against the tests cite studies which suggest that a further skewing of the sex ratio may only make worse the status of women, with an obvious negative impact on the whole nation. On the other hand, there is a great deal of public support in India from proselective abortion advocates who feel that these tools are helping families to cope with intransigent problems, especially dowry. Health clin-

ics, buoyed by record profits, are aggressively selling their wares. One clever economic pitch blares from tens of thousands of billboards through the country—*Pay five hundred rupees [US\$14.00] now rather than five lakhs [Rs 500,000 or \$14,000] later.* Poor families, fearing expensive dowries that can cripple a family, willingly undergo the tests. Coming on top of more than a century of female infanticide in regions where sons are preferred, medical technologies of amniocentesis, ultrasound, and chorionic biopsy have compounded the problem of "missing females" over the past two decades. Despite the 1994 Prenatal Diagnostic Techniques (Regulation and Prevention of Misuse) Act in India and China's Human Reproductive Technology Ordinance of 2000, sex determination for purposes of aborting female fetuses is presently a highly profitable medical industry. In India, the act is an "on-paper-only" law which has proven to be a toothless tiger in the face of blatant abuse by elements of the medical fraternity. Some go so far as to suggest that they are helping curb the population explosion. Others defend their lucrative business, saying it offers women a less barbaric means than female infanticide of doing away with their daughters. Needless to say, not a single legal case has been registered in India or China against those peddling their technological misogyny.

Not surprisingly, proselective abortion activists feel that selective abortion has several merits important for the good of the general Indian public. For example, advocates argue that selective abortion is the answer to population control. Perhaps they feel that in a country where families are willing to have child after child until they have their desired number of sons and daughters, sex selective abortions would allow women to choose the makeup of their family while keeping the family size small. Another argument in terms of population control is that families should be balanced; selective abortions will allow families to balance their desire for a daughter with one for a son. It's a gut-wrenching fact that in a patriarchal country like India, where sons are prized and daughters devalued in society for a variety of reasons, it is likely that couples will choose to abort only females.

RECENT CHANGES

In India, requests for medically assisted sex selection are very common; for example, one fertility clinic in Mumbai used to receive about 250–300 requests for Y-enrichment with intrauterine inseminations each

year till the time the Prenatal Diagnosis Act was extended in 2002 to include sex selection using sperm separation techniques as well. Imprisonment for up to 3 years is the deterrent used by the Union government against medical practitioners who continue to do sex determination tests. As I write this paper, the scenario truly appears to change, and in 2002 the government seems serious and has really clamped down on clinics offering sex selection or sex determination. Every ultrasound machine manufacturer has to furnish a list of the doctors to whom their units have been sold, and these doctors now have to compulsorily register with the government and put up boards outside their clinics proclaiming that *This clinic does not perform any sex determination.*

PGD FOR SEX SELECTION

There is a very affluent trader community in India whose religious beliefs do not allow medical termination of pregnancy. It is this rich, male-oriented community that has spawned a whole new breed of fertility clinics attempting to offer PGD-IVF for selective transfer of male embryos. Each attempt of PGD-IVF for transfer of male embryos can cost as much as US\$5000 even in a “developing” country such as India, where more than 50% of the populace lives below the poverty line. Sex selection may, therefore, become more acceptable to some couples, and requests for clinics to provide it may become more common.

IVF techniques for gender selection began with a single cell being removed from an eight-cell embryo under the microscope. The cell was then analyzed for genetic disorders and/or gender by FISH (Fluorescence in situ hybridization). The FISH technique utilizes fluorescent probes which are specified for chromosomes. This technique is used for sex determination and for structural chromosomal abnormalities and allows to select only the chromosomally normal embryos with the desired sex for embryo transfer (8). At the 8- or 16-cell stage, embryos can be sexed very reliably by removing one or two cells and sexing these with FISH or PCR methods (12). Once the genders of all the embryos have been determined, the embryos (normally between two and four are transferred depending on the woman’s age) of the desired sex are then replaced in the uterus. By combining the IVF method with sperm sorting, using Microsort technology, the number of male or female embryos could be greatly enhanced, and those embryos that are not replaced can be frozen and be used

in subsequent treatment cycles. This has advantages in both reducing the cost of further treatment and minimizing greatly the number of unwanted embryos.

Sex selection is controversial because it is the first example of genetic selection for a nondisease trait. Being a boy or a girl is not a disease. So should parents be permitted to select traits other than the sex of their children? Few aspects of human development are more significant than one’s sex; it’s a central fact of one’s identity as a human being. If it is ethically permissible for parents to make that choice, the case for letting them make less significant genetic choices for their offspring is already made. In an ethical statement issued last year, the American Society for Reproductive Medicine concluded that if Preconceptional Sex Selection is found to be safe and effective, “physicians should be free to offer pre-conception gender selection in clinical settings to couples who are seeking gender variety in their offspring” (13). Some others see the use of preimplantation sex selection as a slippery slope to eugenics, since the same techniques can be used to test for other genetic traits.

They might want to ponder the story of 6-year-old Molly Nash, who suffered from the fatal genetic disease, Fanconi anemia. The only cure for Molly’s disease is a bone marrow transplant from a compatible donor. Her parents used preimplantation genetic testing to help them bear a sibling who would be a perfect genetic match for her. Using IVF, Molly’s parents produced 30 embryos that were tested for the disease gene and for transplant compatibility. Only five had the right genetic makeup. The fourth attempted pregnancy resulted in the birth of Adam Nash in August 2000. His umbilical cord blood stem cells were used to replace Molly’s defective marrow, and now both children are healthy. Few people would regard what Molly’s parents did as immoral. After all, genetic testing in this case resulted in two valued and healthy children.

Therefore, I strongly believe that it is sometimes ethical to let parents choose their children’s sex.

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