Tall Girls

The Social Shaping of a Medical Therapy

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During the latter half of the 20th century, estrogen therapy was administered to prevent otherwise healthy girls with tall stature from becoming tall adults by inhibiting further linear growth. We explore how decisions to treat tall girls with estrogen were influenced by both scientific knowledge and sociologic norms. Estrogen therapy represented the logical application of scientific knowledge regarding the role of estrogen for closure of the growth plates, but it also reflected prevailing societal and political beliefs about what it meant to be a tall girl. We discuss the rise and fall in popularity of this therapy and suggest that insight into the present-day treatment of short stature can be gained by comparing the use of estrogen therapy for tall girls with the use of growth hormone therapy for short boys. We suggest that this case study illustrates how scientific knowledge is always created and applied within a particular social context. *Arch Pediatr Adolesc Med. 2006;160:1035-1039*

The therapeutic use of sex steroids dates back to the late 19th century, when medical practitioners such as midwives used ovarian extracts to treat a variety of female disorders. For example, the filtered juice of guinea pigs' ovaries was used for women with hysteria, debility, and abnormal menstruation. Thus, even prior to the discovery of specific substances derived from the ovaries, practitioners attempted to harness their therapeutic potential.[1,2]

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Changes in scientific understanding led to the concept of hormones, substances that were produced in a particular organ but acted throughout the body in a complex web of interactions. By the 1930s, scientists had identified specific hormones produced by the ovaries and testes.[3] The pharmaceutical industry soon began manufacturing ovarian and testicular preparations, and physicians began exploring a wide range of therapeutic applications.[2]

One such application in the pediatric arena was the use of sex steroids for influencing growth. By the 1940s, physicians began to understand hormonal influences on the growth plate through 2 important clinical observations. First, they observed that children with early exposure to sex hormones due to precocious puberty had premature epiphyseal closure and developed short stature as adults. Physicians also found that children with pituitary disease who lacked sex hormones had open epiphyses with a prolonged period of growth.[4] Based on these clinical observations, it was postulated that gonadal steroids were responsible for closing the epiphyses.[5]

Children at risk for tall stature due to acromegaly thus became the first recipients of estrogen and testosterone therapy for prevention of excess growth during the 1940s.[6] Clinical trials revealed that estrogen preparations, in contrast to testosterone preparations, were particularly successful for preventing tall stature in children with acromegaly. As a consequence, physicians naturally considered

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whether the same treatment could be applied in other settings. Girls with constitutional tall stature represented a potential group of patients for whom hormone therapy might prevent further growth, an outcome that some considered desirable.

In 1946, a brief abstract was published about the clinical experience of estrogen treatment in tall girls who were "becoming alarmed and unhappy about the extremes to which their exuberant, albeit normal growth was carrying them."[5] A decade later, Goldzieher[7] published the first formal clinical study of the use of estrogen therapy for the treatment of constitutional tall stature in girls. Goldzieher cast his research in terms of the application of new scientific advances; he claimed that estrogen treatment of girls destined to be tall as adults was a logical next step following the estrogen treatment of children with acromegaly and hence represented "no novelty." In his initial case series, 14 girls aged 9 to 16 years were treated with oral forms (2 mg daily of stilbestrol or 2.5-5.0 mg daily of premarin) or injected forms (1.6 mg of estradiol monobenzoate every 5 days) of estrogen for anywhere from 3 months to 5 years. Criteria for treatment included a current height of 168 cm (66 in) with open epiphyses or a current height less than 168 cm (66 in) but with a predicted height 10 cm (4 in) above the average. In his article, Goldzieher concluded that growth was successfully arrested based on his observation that the majority of girls had growth of no more than 5 cm (2 in) from the start of therapy.

SCIENTIFIC AND SOCIAL RATIONALE FOR STANDARD THERAPY FOR TALL GIRLS

These observations appear to have attracted considerable interest within the scientific community. Two years after Goldzieher's initial article, an article by Freed entitled "Suppression of Growth in Excessively Tall Girls" was published in *JAMA* in 1958.[8] Freed noted that "some tall young girls are self-conscious about their height because of the great difference between them and their classmates and friends. By bringing this procedure to the attention of physicians, it is hoped that girls whose height is embarrassing to them may receive medical aid in preventing continued rapid growth."[8] The topic appears to have continued to interest *JAMA* readers (and editors), for in 1959[9] and again in 1961,[10] queries about the treatment of girls with excessive height were published in the "Questions and Answers" section of the journal, a section that offered expert medical opinion to the practicing clinician. By 1962, a scientific review[11] referencing these 3 *JAMA* articles emphasized that the "problem of excessive height in otherwise normal girls is evident,"[11] highlighting the legitimacy of this medical condition while at the same time documenting the efficacy of the treatment. This review was followed by the publication of a number of scientific articles about the treatment in the mid to late 1960s[12-16] that supported a consensus within the medical community that estrogen therapy was a standard treatment for tall girls. These articles scarcely mentioned the treatment of tall boys.

Why was this therapy seen to be useful and interesting enough to attract multiple articles and scientific reviews? It represented newfound knowledge regarding the effects of sex hormones on human growth and development and—perhaps most important—the power to use that knowledge to alter the appearance of potentially tall girls. Many articles detailed how estrogen treatment could bring tall girls' height into or closer to the normal range. But, why should tall girls be made shorter? And, why was the treatment almost exclusively focused on girls but not boys?

The scientific literature details that parents were concerned about the social implications of their daughters being too tall, including difficulty and expense in finding clothes that fit, lack of interest in schoolwork and play, and future difficulty in finding employment in some careers, such as air hostess, classical ballet dancer, or military or airline pilot.[17] There was also discussion of the negative psychosocial effects of excessively tall stature, which included depression, social withdrawal, and even "kyphosis [from] an effort to appear smaller and more like the others."[18]

However, the single most commonly cited social reason for reducing the height of tall girls was social attractiveness. Part of those concerns were contemporaneous with childhood; parents worried about how tall stature was contributing to their daughter's self-consciousness and shyness[9] or that her size might "jeopardize her social contacts."[10] But, tall girls usually became tall women, and the biggest concern seemed to be that tall women would have a hard time fitting in, being comfortable in social situations, and perhaps most important, finding permanent male partners. As one article stated:

> Some girls feel so embarrassed with boys shorter than themselves that they believe that their choice of male companions, both in the immediate future and as adults, will be seriously jeopardized.[17]

If we want to understand why this rationale for treatment had the sort of widespread resonance it did in the 1950s and early 1960s and why the treatment was for girls but not boys, we need to look at the importance of heterosexual marriage for American society in that period.

SOCIAL CONTEXT

In the 1950s, the most important "career" for women to pursue was that of homemaker and mother. Individuals who did not marry were considered "immoral, selfish, or neurotic,"[19] and even Federal Bureau of Investigation director J. Edgar Hoover suggested that women should marry early and have children to fight "the twin enemies of freedom—crime and Communism."[20] Popular magazines such as *Life* emphasized homemaking for women as a full-time profession, home economics textbooks offered women practical advice about how to be a good wife,[21] and Hollywood movies reinforced the sentiment that "marriage is the most important thing in the world"[22] to women. If a woman's ideal goal was to be successful at marriage, girls who became excessively tall and who did not embody the feminine ideal would have difficulty in finding marriage partners.

A 1954 psychology study by Beigel[23] gives insight into cultural assumptions regarding height and female attractiveness. When 410 persons were surveyed about what

characteristics made up a good mate, 59% of the individuals made references to body height as an important and desirable characteristic. Beigel explained the observation that men are almost always taller than women among lovers and married couples by the fact that "most men do not feel attracted to taller women."[23] In this study, desirable women were almost never described as tall and attractive men were almost never described as short.[23]

This was a relational view of height in which women's height was seen in relation to men's height. These sorts of norms were reflected in the medical rationale for estrogen treatment of girls but not boys. Tall girls were said to be dissatisfied with the "prospect of towering over the average male."[24] They were "less attractive than their shorter, more graceful sisters."[25] Thus, physicians were charged with preventing excess growth to increase a girl's physical desirability and her chances of a successful marriage.

INCREASING SCIENTIFIC KNOWLEDGE ABOUT ESTROGEN THERAPY

Published scientific literature[5,11-18,24,26-35] written mostly by prominent pediatric endocrinologists about "tall girl therapy" proliferated in the 1960s and peaked in the 1970s. Case reports and physician surveys from the United States, Australia, and Europe discussed the administration of estrogen therapy to girls aged 9 to 16 years (mean age, 12 or 13 years) until fusion of the epiphyses was documented, which occurred for most girls at age 15 or 16 years.[5,11-18,24,26-35] Diethylstilbestrol was 1 of the estrogens initially used, at a dose of 1 to 10 mg/d.[5,28] However, the discovery of the association of maternal diethylstilbestrol treatment during pregnancy with vaginal carcinoma in teenaged daughters in 1969 gave way to the use of other estrogen preparations, including conjugated estrogens (0.3-20 mg/d), ethinyl estradiol (0.02-0.5 mg/d), and intramuscular estradiol, which were prescribed as interrupted courses, continuous estrogen therapy, or estrogens in combination with progesterone.[5,28]

Most articles suggested that if administered until fusion of the epiphyses was achieved, estrogen treatment was efficacious, with a diminution of height that ranged anywhere from 3.6 to 7.1 cm (1.4-2.8 in).[14,17,18,24,26,34] Patients who initiated treatment earlier had a greater reduction in height compared with patients who initiated treatment later with regard to chronologic age[11] and pubertal stage.[26] However, the lack of controlled clinical trials led some to doubt its effectiveness. Some studies noted particular difficulty in accurately predicting the adult heights of girls.[35] One study[12] did not find statistically significant differences between predicted and observed adult height, suggesting that individual variations could be misinterpreted as therapeutic results, although the small numbers in this study caused some[17] to question its findings.

Reported positive effects of the therapy included rapid slowing of linear growth, improved self-confidence and self-image, improved performance in school and sports, and disappearance of acne.[5,18,32] However, only slowing of linear growth was formally documented.

Physicians carefully commented on the adverse physiologic events associated with the treatment, including mild adverse effects such as nausea, headaches, weight gain, and breakthrough bleeding as well as more potentially serious adverse effects such as mild hypertension, benign breast disease, ovarian cysts, posttherapeutic amenorrhea, and rare events of thromboembolism. Although there were no reports of malignancy in treated girls, the potential role of estrogen in carcinogenesis was mentioned by a number of studies[5,18,25] and may have subdued some of the initial enthusiasm for estrogen treatment.

CHANGING DEFINITION OF TALL STATURE

Near the end of 1977, a Conference on Estrogen Treatment of the Young was held in California.[27] The existence of this conference may be taken as a marker of both the maturity of the field and the presence of a critical mass of people doing work in the area. The 1980s and 1990s saw fewer articles extolling the values of estrogen therapy,[36-44] and the literature about estrogen therapy changed, marked by a much more critical commentary.[45-47] Prior to the 1980s, discussions were fairly typical of the literature for most new therapies. Articles discussed whether the therapy worked as indicated, detailed the adverse effects, and explained different medications or dosages that might help improve results while minimizing adverse effects. Later, the debate changed from whether the therapy was effective and how practitioners could minimize its adverse effects to whether tall girls ought to be treated at all. Rather than debating the scientific merit of the practice, critics were increasingly skeptical about the ethics.

One physician wrote in response to a report of estrogen treatment:

> One has to question seriously the right of physicians or parents to determine the ultimate height of a girl. One wonders whether women do not have the right to be tall, just as boys have the right to be short.[47]

Another article concluded that although estrogen therapy would probably work, it should be attempted in a "small number of very tall girls" for whom losing an inch or two in their final height would be a "great comfort."[33] Still others called the procedure "the height of medical hybris" and suggested that the procedure be discontinued.[47] Articles became much more cautious and called for more work in what was now termed an unsettled area.[25] New scientific literature suggesting a link between estrogens and breast and uterine cancer in postmenopausal women[48,49] raised theoretical concerns of an increased risk of cancer due to estrogen treatment, which was highlighted both in the medical literature[5] and in popular newspapers such as the *New York Times*.[50,51]

This skepticism may have led to a diminishing interest in the estrogen treatment of tall girls, which was reflected in physician surveys. A 1977 survey of the Lawson Wilkins Pediatric Endocrine Society found that 50% of respondents reported having treated tall girls with estrogen therapy, with 34% treating only rarely.[28] This contrasts with a 1999 survey of respondents from the same pediatric endocrine society that found that only 23% of respondents had treated tall girls in the previous 5 years and only 1% had treated more than 5 cases.[52] Another marked change was a continuous rise in the predicted

height of girls thought to need therapy. For the initial clinical report from 1956, a height prediction of approximately 175 cm (5 ft 9 in) was an indication for treatment,[7] whereas in 1977, therapy was indicated for a predicted adult height of 180 cm (5 ft 11 in) according to the majority of clinicians.[28] In comparison, by 1999, some clinicians required a predicted adult height of 188 cm (6 ft 2 in) before starting therapy.[52]

The increasing reluctance of physicians to prescribe the therapy may have also been mirrored by decreasing requests for therapy from parents and girls, likely influenced by changing societal definitions of tall stature. For example, when girls being seen in a clinic for possible estrogen therapy were asked by their physicians, "How tall is too tall?" the response most frequently given was 173 cm (5 ft 8 in) during the mid 1960s, which rose to 178 cm (5 ft 10 in) during the late 1960s and to 183 cm (6 ft) in the 1970s.[5]

Therefore, just as the rise in estrogen treatment of tall girls was influenced by the social context in which the science was discovered, the decline in prescribing patterns was also influenced by changing societal norms regarding girls, women, and height. Those changing norms had much to do with the cultural upheavals and changing ideas about gender in the 1960s and 1970s.

The feminist movement in particular had a transformative effect on American society. Leaders of the feminist movement exhorted women to assert their own identity, questioning the centrality of the traditional nuclear family and encouraging women to not define their success in terms of male partners. Organizations such as the National Organization for Women actively supported women's participation in the workforce.[53] Work outside the home gave many women a potential for independence that they had not experienced before and enabled them to define their success in terms other than marriage.

The number of women working outside the home in the United States doubled from 15% to 30% between 1940 and 1960.[54] In 1950, 12% of women with preschool-aged children were employed outside the home; by 1995, that percentage was 65%.[55] With this changing demographic, new magazines such as *New York Woman*, *Self*, and *Working Woman* appeared in popular culture, aimed at the young working woman and exhorting the professional woman to adopt a "tailored male look" signaling authority and power,[56] a look that was not inconsistent with being tall.

Increasing opportunities for tall girls also expanded into the athletic arena. Enacted in 1972, Title IX required that federally funded educational organizations such as universities allocate resources equally by sex, which led to increased women's participation in sports and increased media coverage of female athletes. Being tall, once seen as a problem, is now a key part of increasingly successful collegiate athletic enterprises such as volleyball and basketball.[57] Tall women may pursue professional sports careers such as playing for the Women's National Basketball Association, whose players have an average height of 180 cm (5 ft 11 in), with the tallest player measuring 218 cm (7 ft 2 in).[58]

Sociologic studies are also now confirming that tall women are finally reaping the benefits of their stature, at both personal and economic levels. Recent studies show that height positively influences character perception of women; compared with their shorter counterparts, taller women were rated to be more intelligent, affluent, assertive, and ambitious.[59] Just as is the case for men, tall women now enjoy higher incomes than shorter women.[60]

IMPLICATIONS FOR FUTURE ALTERATION OF HEIGHT IN CHILDREN

Although estrogen therapy for tall girls appears from our early 21st-century vantage point to be largely a therapeutic experiment of the past, it was once considered an appropriate application of scientific progress. Newfound knowledge about the role of estrogen in growth plate physiology led to its therapeutic application to modify height. Estrogen was first used in children with abnormal forms of tall stature, such as acromegaly, and then primarily in otherwise healthy tall girls to prevent them from becoming tall adults.

The use of growth hormone (GH) therapy for short stature has followed a similar pattern thus far. The discovery of the instrumental role of GH for normal statural growth led to the use of cadaveric human GH extracts or recombinant GH for children with abnormal forms of short stature due to GH deficiency,[61] with exclusive treatment of children with the most severe forms of GH deficiency.[62,63] However, with the wide availability of recombinant GH and the recent Food and Drug Administration approval of GH therapy for idiopathic short stature in 2003,[64] GH is now being used for otherwise healthy short children to prevent them from becoming short adults.[63]

The most striking difference between the use of estrogen for tall stature and the use of GH for short stature is sex. Whereas mostly girls were evaluated for tall stature and were treated with estrogen in the past, twice as many boys than girls are evaluated for short stature and are treated with GH today.[65,66] In his book *Better Than Well: American Medicine Meets the American Dream*, philosopher Carl Elliott argues that one of the sociologic reasons for the use of estrogen in tall girls and the use of GH in short boys relates to the topic of sexual partners.[67] He states that "neither tall girls nor short boys . . . can compete successfully for mates,"[67] asking the critical question that gets to the heart of the debate about stature, "In the great homecoming dance of life, how does a short boy get a date with the head cheerleader?"[67]

Although the increasing social value of height for girls as well as the increasing concern about the adverse effects of estrogen therapy likely influenced the decline in the use of estrogen therapy, the use of GH therapy for short males has replaced estrogen therapy as a means for preventing what was and might still be considered the union most offensive to taste: the union of a tall woman with a short man.[23] In essence, GH treatment of short stature in boys could be considered the 21st-century counterpart to estrogen treatment of tall stature in girls.

As we continue to explore the powers of science for modifying height for both boys and girls, we should keep in mind historical examples such as estrogen treatment for tall girls. These examples should help us realize that scientific advances are always applied within a specific

social context, and within that context, idealized gender relations may be as important as scientific studies in determining what we will do as practicing clinicians.

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