

Genital asymmetry in men

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This study examined genital asymmetry in a large sample of men. The probands were 6544 non-delinquent men who were interviewed by the Kinsey Institute for Research in Sex, Gender and Reproduction from 1938 to 1963. The measures were four indicators of penile and scrotal asymmetry, along with self-reported handedness, from Kinsey's interview protocol. Most men reported some degree of lateral asymmetry in their flaccid penis and in their testicles; less asymmetry was reported for their erect penis. The asymmetry typically occurred in the left direction, and this pattern occurred in both right- and nonright-handers. However, this 'leftward' pattern was significantly less pronounced in nonright-handers. The results are discussed in relation to previous findings of genital asymmetry in men, the possible relationship of genital asymmetry to functional cerebral asymmetry, and recent data suggesting genital asymmetry may predict patterns of cognitive performance and genital/sexual organ cancers.

Key words: genital asymmetry/handedness/Kinsey/men

Introduction

Genital asymmetry has been reported in lower animals, including the gonads of horseshoe bats (Mathews, 1937), oxen (Jost *et al.*, 1972) and chicks (Mittwoch, 1975) and the penises of certain flies, i.e. *Drosophila melanogaster* (Morgan, 1977). In humans, reports have been restricted largely to the gonads. Evidence from hermaphrodites indicates that growth favours the development of the testes on the right and ovaries on the left (Mittwoch and Mahadevaiah, 1980). In human fetuses, the right testicle seems to develop more quickly than the left (Mittwoch, 1975, 1977; Mittwoch and Kirk, 1975). Finally, Chang *et al.* (1960) found that while the left testicle generally hangs lower than the right, the right testicle is larger than the left; recent reports have confirmed this testicular size difference (Short, 1984; Mittwoch, 1988; Kimura, 1993).

As mentioned, relatively little research exists on penile deviation in normal human populations. However, the urological literature contains reports of pathological curvature of the penis (e.g. Correa, 1971; Gavrell, 1974; Cutjar, 1979; Cendron and Melin, 1981; Yachia *et al.*, 1993). When such curvature does occur as result of, for example, congenital

penile curvature, the lateral curvature is predominantly to the left. This curvature may occur because of the right corpus cavernosum — the spongy erectile tissue of the penis — being larger than the left, which forces a leftward lateral inclination of the penis (Fitzpatrick, 1976). In addition, Ben-Ari *et al.* (1985) observed that normal male newborns, when they have some lateral asymmetry of the shaft of their penis, are more likely to have a left rather than a right inclination. Finally, Kimura (1992), in a preliminary report, indicated that 67% of 111 university men reported that they had a leftward inclination of their flaccid penis.

Such body asymmetry, including genital asymmetry, may vary as a function of handedness. In general, body asymmetry known to occur in right-handers tends to be less pronounced or reversed in left-handers. For example, right-handed men tend to have a larger right foot, whereas the opposite pattern may occur for left-handed men (Levy and Levy, 1978; but see Mascie-Taylor *et al.*, 1982). Right-handers also tend to have a larger right hand and arm than left hand and arm; left-handers have also been shown to have a larger right hand than left hand, but the difference may be less pronounced (see Garn *et al.*, 1976; Plato and Woods, 1980; but see Means and Walters, 1982).

With regard to genital asymmetry, Chang *et al.* (1960) found that the left testicle is lower in right-handers, whereas the opposite pattern occurs in left-handers. No published reports have assessed whether penile asymmetry varies as a function of handedness. This is not surprising because, as mentioned, there is relatively little research on penile deviation in normal populations. However, in one unpublished report (J.A. Wada and E. Strauss, unpublished data), investigators sought out undergraduate men at a university pool/aquatic centre. They approached men who they observed to have a flaccid penile angulation of >30% beyond the midline and then later inquired about their handedness; left-handers were over-represented in the left deviation group. While suggestive, this study may be limited for a number of reasons, including the restriction to fairly large penile deviations (i.e. 30% beyond midline of the penis), the use of only undergraduates and the use of only one measure of genital asymmetry: flaccid penile angulation. Moreover, this sample may be too small (i.e. <25 nonright-handers) to establish genital asymmetry and handedness trends reliably. More data from a large sample is needed to address this issue.

One of the world's largest databases on human sexuality—the Kinsey Institute for Research in Sex, Gender and Reproduction — contains information on male genital asymmetry (and handedness). This study analysed a sample of men from these data. The large degree of power afforded by this sample

provides a unique opportunity to investigate genital asymmetry in men and whether such asymmetry varies as a function of handedness.

Materials and methods

Probands

From 1938 to 1963, 17 502 case histories were recorded by the Kinsey Institute for Research in Sex, Gender and Reproduction (KIRSGR) using the interview schedule devised by Alfred C. Kinsey (Gebhard and Johnson, 1979). These data are currently stored in several files. The files containing White postpubertal males with no convictions for felonies or misdemeanours (other than traffic violations) comprise 6102 cases; a similar file for non-white males contains 442 cases. The combined sample, containing a total of 6544 cases, served as the database for the present investigation. No female files were included in these data because, unfortunately, no female genital/sexual organ (e.g. breasts) asymmetry measures exist in the Kinsey data (see Gebhard and Johnson, 1979).

Demographics

The probands were assessed on a number of demographic variables, including age, year of birth, year of interview and parental socioeconomic status (SES). Parental SES was used instead of the proband's educational level because many of Kinsey's subjects were still in college/university when they were interviewed and their current educational level would not necessarily reflect their ultimate educational level.

Genital asymmetry

Kinsey's interview protocol included four questions that addressed male genital asymmetry. One question concerned which testicle was lower (i.e. 'Which testicle hangs lower?'; see Gebhard and Johnson, 1979; KIRSGR, 1985, 1991). Three responses were recorded: 'left', 'right' or 'both equal'. A second question addressed the lateral inclination of the flaccid penis (i.e. 'On which side of the central seam in your pants do you keep your penis?'; see Gebhard and Johnson, 1979; KIRSGR, 1985, 1991). Three responses were recorded: 'right of central seam', 'left of central seam' and 'no habitual position or more or less central'. A third question addressed the lateral inclination of the erect penis (i.e. 'If you were standing up and had an erection, if you looked down at the penis, would it be pointing straight ahead or pointed somewhat to the right or left?'; see Gebhard and Johnson, 1979; KIRSGR, 1985, 1991). Three responses were recorded: 'none, straight out from body', 'inclined to the right' and 'inclined to the left'. Finally, a fourth question concerned curvature of the penis while erect (i.e. 'When you have an erection, is the shaft of the penis straight or does it curve up, down, right or left?'). Nine responses were recorded: 'none', 'up', 'down', 'right', 'left', 'up and right', 'up and left', 'down and right' and 'down and left'. To facilitate the presentation of laterality for this question, 'right', 'up and right' and 'down and right' were collapsed into one 'right' category; 'left', 'up and left', and 'down and left' were collapsed into one 'left' category; and 'straight', 'up' and 'down' were collapsed into one 'no left/right curvature' category. The men were asked to check the position of their genitals if they were uncertain of their responses. However, most men responded, after time to reflect, without much ambivalence or uncertainty and thus were not requested to verify their responses (P. Gebhard, personal communication).

Handedness

Hand preference is often assessed with a number of unimanual (e.g. brushing teeth) and/or bimanual (e.g. threading a needle) items that

the examinee mimes or responds to using self-report (e.g. Annett, 1970; Kimura, 1973). However, the Kinsey interviewers used a simpler classification system based on a question of 'overall' hand preference (i.e. 'Are you right or left handed?'; see Gebhard and Johnson, 1979; KIRSGR, 1985, 1991). Note that this method probably results in a conservative estimate of adexterity. Four responses were recorded: 'right-handed', 'left-handed', 'ambidextrous' and 'right-handed, retrained from left-handed'. Despite the relatively simple classification system, the rates of nonright-handedness in the Kinsey data are similar to published norms for adults (e.g. ~90% right-handed; see Bogaert and Blanchard, 1996).

Results

Table I presents demographic data, broken down by handedness (i.e. right- versus nonright-handers). Note that the two groups did not differ in any of the demographic characteristics, including age, parental SES, year of birth and year of interview.

Tables II–V present the genital asymmetry data, again broken down by handedness (i.e. right- versus nonright-handers). Interestingly, most men reported some degree of deviation in their flaccid penis and in their testicles; less asymmetry was reported for their erect penis. When deviation did occur, it was predominantly in the left (rather than right) direction, and this predominantly 'left pattern' occurred in both right- and left-handers. However, this 'leftward' pattern seemed to be less pronounced in the nonright-handers. To confirm this, four χ^2 tests were performed. Two of the four tests (lateral inclination of the flaccid penis and lateral inclination of the erect penis) were significant ($P < 0.05$), and one (i.e. which testicle hangs lower) was marginally significant ($P < 0.07$). Given that some previous research (i.e. Chang *et al.*, 1960) suggests nonright-handers are less likely than right-handers to have a lower left testicle, a directional (one-tailed) *t*-test for proportions was performed on this variable (i.e. which testicle hangs lower). As expected, a significant difference was observed ($P < 0.05$). Thus, a small but observable relationship seems to occur between genital asymmetry and handedness in men.

Discussion

The results suggest that a degree of genital asymmetry occurs in adult men, with much of this asymmetry in a leftward direction. Testicular asymmetry (i.e. which testicle hangs lower) has been noted before (e.g. Chang *et al.*, 1960), including in standard anatomy textbooks (e.g. Gray, 1958), but the penile deviation in normal adult men is relatively novel (except for those who are familiar with the marginal tabulations in the Kinsey data; see Gebhard and Johnson, 1979; see also a brief preliminary report by Kimura, 1992). Thus, genital asymmetry seems to occur in human males, as it typically has been found to occur in many species of the animal kingdom (e.g. Mittwoch, 1975, 1977).

Testicular asymmetry (e.g. left testicle hanging lower) has been attributed to more well-developed and greater flexion of the muscles on one side of the lower abdomen relative to the other side (Chang *et al.*, 1960) and/or the different length, angle and source of the blood vessels supplying the two

Table I. Descriptive statistics for right- and nonright-handers

Variable	Group				<i>t</i>	df	<i>P</i> ^a
	Right-handers		Nonright-handers				
	Mean	SD	Mean	SD			
Age	28.9	10.9	28.1	11.2	1.8	5150	NS
Parental SES	4.8	1.4	4.8	1.4	0.6	5035	NS
Birth year	1916.8	10.6	1917.6	10.8	1.6	5147	NS
Year of interview	1946.1	2.7	1946.0	2.9	1.3	5150	NS

SES = socio-economic status.

^aTwo-tailed test.

Table II. Testicle asymmetry (*n* = 4333) in right- and nonright-handers

	Right-handers		Nonright-handers	
	<i>n</i>	%	<i>n</i>	%
Lower testicle				
Right	809	21.1	105	21.2
Left	2375	61.9	285	57.5
Both equal	654	17.0	105	21.2

χ^2 (2, *n* = 4333) = 5.684; *P* < 0.07. Standard question: 'Which testicle hangs lower?' (Table 87, Gebhard and Johnson, 1979).

Table III. Position of flaccid penis (*n* = 4948) in trousers in right- and nonright-handers

Position of penis	Right-handers		Nonright-handers	
	<i>n</i>	%	<i>n</i>	%
Right of central seam	758	17.3	120	20.9
Left of central seam	3504	80.1	429	74.7
No habitual position or more or less central	112	2.6	25	4.4

χ^2 (2, *n* = 4948) = 11.402; *P* < 0.005. Standard question: 'On which side of the central seam in your pants do you keep your penis?' (Table 84, Gebhard and Johnson, 1979).

Table IV. Lateral inclination of the erect penis (*n* = 4794) in right- and nonright-handers

Position of penis	Right-handers		Nonright-handers	
	<i>n</i>	%	<i>n</i>	%
Inclined to the right	275	6.6	43	7.7
Inclined to the left	1179	28.1	127	22.8
None, straight out from body	2739	65.3	386	69.4

χ^2 (2, *n* = 4794) = 7.238; *P* < 0.05. Standard question: 'If you were standing up and had an erection, if you looked down at the penis, would it be pointing straight ahead or pointed somewhat to the right or left?' (Table 75, Gebhard and Johnson, 1979).

testicles (e.g. Antliff and Shampo, 1959). Interestingly, varicoceles, when they occur in men, are also usually left-sided, a pattern that has been attributed to the characteristics of the blood vessels supplying the two testicles (Sherins and Howards, 1986). The source of the penile deviation is less well considered. However, a number of factors may be important, including possible slight differences in the relative sizes of the

Table V. Curvature of the erect penis (*n* = 4879) in right- and nonright-handers

Curvature of penis	Right-handers		Nonright-handers	
	<i>n</i>	%	<i>n</i>	%
Curved to right ^a	118	2.7	23	4.7
Curved to left ^b	499	11.6	60	10.5
No left/right curvature ^c	3693	85.7	486	85.4

χ^2 (2, *n* = 4879) = 3.432; not significant. Standard question: 'When you have an erection, is the shaft of the penis straight or does it curve up, down, right or left?' (Table 76, Gebhard and Johnson, 1979).

^aIncludes 'right', 'up and right' or 'down and right'.

^bIncludes 'left', 'up and left' or 'down and left'.

^cIncludes 'straight', 'up' or 'down'.

right and left corpora cavernosa, more well-developed and increased flexion of the muscles on one side of the abdomen relative to the other (see Chang *et al.*, 1960; J.A.Wada and E.Strauss, unpublished report) or even possible local effects of surgery in some men (e.g. circumcision).

Genital asymmetry also varied, to a small degree, as a function of handedness. Like right-handers, nonright-handers were more likely to have a left inclination than a right inclination, but this trend was not as pronounced. These data are consistent with previous observations that nonright-handers may be less pronounced in some lateral body asymmetry relative to right-handers (e.g. Garn *et al.*, 1976; Plato and Woods, 1980; but see Means and Walters, 1982).

Interestingly, this trend also occurred for which testicle hangs lower. Chang *et al.* (1960) also found that the left testicle hangs lower in right-handed men but, in contrast to the present study, found a reversal of the pattern for nonright-handers relative to right-handers, such that the right testicle was lower in nonright-handers. This discrepancy for nonright-handers may be due to the difference in racial/ethnic composition of the two samples: Chang *et al.* (1960) used Chinese men from Hong Kong, and the present sample from the Kinsey data used predominantly White Americans. Asian/Oriental populations have been reported to have testicles substantially smaller than Whites/Caucasians (Short, 1984; Diamond, 1986; Mittwoch, 1988). Whether such a size difference, along with additional differences in genital morphology that may occur across race/ethnicity, accounts for these differences is unknown. Interestingly, the present Kinsey sample of nonright-handers is more consistent with an earlier study, which found similar

rates of testicular asymmetry (i.e. which testicle hangs lower) for both right- and nonright-handers on a small sample of White Americans (Antliff and Shampo, 1959). Perhaps both the Antliff and Shampo (1959) and the Chang *et al.* (1960) handedness data should be viewed with some caution because each used <40 nonright-handers; the present analysis of the Kinsey data may be more reliable because it employed >500 nonright-handers.

The leftward penile deviation in both right- and left-handers seems to partially contradict J.A.Wada and E.Strauss (unpublished data), who found that left-handers were more likely to have a large leftward inclination of the flaccid penis than right-handers. However, the J.A.Wada and E.Strauss data should be viewed with some caution because their sample contained <25 left-handers, their penile deviation was probably atypically large, their asymmetry measure was different from those used in the present study, and their recruiting procedures probably under-sampled men with leftward deviations (see J.A.Wada and E.Strauss, unpublished report).

Despite the present study's large sample size, some may have concerns about the accuracy of the self-report genital asymmetry measures. However, it is important to note that random measurement error should be less (and not more) likely to lead to reliable (and predicted) effects; all four genital measures, when asymmetry occurs, reveal a leftward inclination, suggesting a consistent and (genuine) trend; the findings are similar to those gathered by trained clinicians when the measure (e.g. which testicle hangs lower) and the group (Whites) are the same (e.g. left testicle lower in 61% in the Kinsey data versus left lower in 65% in Antliff and Shampo, 1959); and, finally, self-report measures are often better than scholars believe, particularly if the questions do not have an obvious desirable answer (e.g. Furnham, 1986).

Given that the present study seems to establish a small relationship between handedness and genital asymmetry, some discussion of functional cerebral asymmetry may be in order. Functional cerebral asymmetry refers to the left and right hemispheres of the brain having a differential processing of language and non-verbal skills (e.g. spatial/mathematical) respectively. Although handedness is not perfectly related to cerebral asymmetry, it is often used as an indirect index of hemispheric specialization, where right-handers are overwhelmingly left hemisphere dominant for language and non-right-handers are either right dominant for language or are more bilateral in language representation. Not surprisingly, handedness has, at times, been related to specific patterns of language and non-verbal skills (e.g. Benbow and Stanley, 1983). Given that genital asymmetry seems to be related to handedness, such measures may also be used as indicators of cerebral asymmetry, and thus, perhaps, related to patterns of cognitive skills. Recently, differences in testicular size have indeed been related to cognitive skills, where, for example, men with a larger right testicle were found to perform better on certain spatial tasks than men with a larger left testicle (Kimura, 1994). It would be interesting to see whether the genital asymmetry measures in the current data similarly predict patterns of cognitive performance. If so, all of these measures of 'asymmetry' (e.g. handedness, cerebral asymmetry, genital

deviation) may, in part, reflect a common prenatal hormonal origin (see, for example, Geschwind and Galaburda, 1987; McManus and Bryden, 1991).

Establishing a relationship between handedness and genital/sexual organ asymmetry may also be important because of sexual/reproductive health issues. Cancer of the breast in women and testicular cancer in men may reflect lateral bodily asymmetry, where the larger breast or testicle may be, on average, more likely to be affected by cancer than the smaller one (see Spitz *et al.*, 1986; Hsieh and Trichopoulos, 1991). Interestingly, it has also been reported that handedness may influence the laterality of breast cancer (e.g. Hsieh and Trichopoulos, 1991). To my knowledge, no research has addressed whether handedness influences the laterality of testicular cancer. In addition, it is unknown whether infertility relates to these genital asymmetry (and handedness) findings, although it is instructive to note that varicoceles have been linked to male infertility (Sherins and Howards, 1986) and are, as mentioned, very one-sided. Future research should explore these issues by continuing to study sexual organ/genital asymmetry (and handedness) in both men and women.

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