

Hypospadias: Psychosocial, Sexual, and Reproductive Consequences in Adult Life

Minireview

ROGER MIEUSSET* AND MICHEL SOULIÉ†

*From the *Human Fertility Research Group, Paule de Viguier Hospital, and †Urology and Andrology Department, Rangueil Hospital, Toulouse, France.*

Hypospadias is a developmental anomaly that, in boys, is associated at birth with 1) an ectopic opening of the urethral meatus on the ventral aspect of the glans or penis or in a scrotal or perineal position; 2) abnormal distribution of the penile skin, lacking on the ventral aspect and abundant on the dorsal aspect; and 3) sometimes ventral curvature, or chordee, of the penis.

The etiology of most hypospadias not linked to intersex disorders or identifiable syndromes is unknown. However, a consensus exists that genetic, developmental, endocrine, and environmental factors are probably involved in its pathogenesis to varying degrees. Hypospadias is a malformation that occurs in approximately 1 to 250 to 1 to 300 total live births (boys and girls). The prevalence of hypospadias markedly increased, in fact doubled, between 1970 and 1990 in Europe (Hungary, England and Wales, Denmark, Norway, Sweden) and in North America (United States, Canada) (Congenital Malformations Worldwide, 1991; Paulozzi, 1999). The causes of this increase are as yet unclear.

In most cases, hypospadias is diagnosed at birth (Zaontz and Packer, 1997); it can also be diagnosed prenatally by ultrasound (Sides et al, 1996). Although clinical diagnosis is easy in the severe forms, it is not so in minor forms. Analysis of meatal location in adult men without a history of hypospadias admitted to the hospital for either treatment of benign prostate hyperplasia or superficial bladder cancer ($n = 500$) or general examination for health insurance ($n = 1244$) showed a meatus located in the distal third of the glans in 55% and 96.3%, respectively, and in the proximal third in 13% and 0.2% of men (Fichtner et al, 1995; Uygur et al, 1999). After diagnosis, management of hypospadias is surgical and aims

to 1) enable voiding in a standing position, 2) allow a normal sexual life, and 3) obtain a penis with as “normal” a cosmetic appearance as possible (Mureau et al, 1997).

In practice, there are 3 populations of patients with hypospadias: those operated on in childhood, those operated on when adults, and those for whom surgery is not considered necessary. Within this classification, the consequences of hypospadias and its treatments can be divided into psychosocial problems, sexuality, and the effect on reproduction.

Patients Operated on in Childhood

Psychosocial and Sexual Development—Publications on the psychological, social, and sexual development of patients operated on for hypospadias are still rare and the results are somewhat discordant. The possible explanations for these discrepancies are mainly methodological, with too small series, low rates of response to questionnaires, study populations of different ages, and above all the absence of a control group, which prevents any comparison of the results with those of a reference population. However, certain studies have compared data on the sexuality of populations with hypospadias with that of the general population (Avellan, 1976) or control populations (Berg et al, 1981; Mureau et al, 1995a, 1995c; Aho et al, 2000; Mondaini et al, 2002).

A comparative study of psychosocial and sexual adjustment (Berg et al, 1981) showed that 34 adult men operated on for hypospadias had less satisfactory psychosocial adjustment than 36 age-matched patients operated on as children at the same age for appendicitis. The hypospadiac patients were more timid and embarrassed as children and were shyer and more socially isolated as adults. They had lower self-esteem, decreased capacity for social or emotional relationships, and less qualified occupations.

In 1989, a study of 69 children (6 to 10 years old) with a history of hypospadias showed that they had more behavior problems and lower social skills than children of the general population (Sandberg et al, 1989). The same authors repeated the study with a larger series ($n = 175$ children, 6 to 10 years old) and included a control group matched for age and place of school attendance. It was found that 1) social competency was significantly less in the children with hypospadias but that there was no difference in school performance, 2) children with hypospa-

This study received no support in the form of financial aid, grants, or equipment.

Correspondence to: Dr Roger Mieusset, Human Fertility Research Group, Urology and Andrology Department, Paule de Viguier Hospital, TSA 70034, 31059 Toulouse Cedex 9, France (e-mail: mieusset.r@chu-toulouse.fr).

Received for publication August 6, 2004; accepted for publication September 17, 2004.

dias were less likely to externalize their problems, and 3) poor cosmetic appearance of the external genitals was associated with worse school performance (Sandberg et al, 2001).

In the 1990s, a study of the psychological adjustment of 116 children and adolescents (9 to 18 years old) and 73 adults (18 to 38 years old) after reconstructive surgery for hypospadias was performed in comparison with an age-matched control group of 88 children and adolescents and 50 adults who had been surgically treated for inguinal hernia (IH) (Mureau et al, 1995a, 1995b, 1995c, 1997). The psychosocial adjustment of hypospadiac patients was not found to differ from that of the comparison subjects, a result that is contrary to the results of previous studies (Berg et al, 1981, 1982; Sandberg et al, 1989, 2001). However, as the authors (Mureau et al, 1997) point out, only daily life was taken into account. Concerning more intimate areas involving nudity, inhibition appeared much greater in hypospadiac patients than in controls (Mureau et al, 1995a, 1995c). In addition, although sexual debut did not differ between children with hypospadias and comparison subjects, inhibition in seeking sexual contacts was significantly more frequent (24% vs 12%); moreover, as the children with hypospadias became more sexually mature, the fear of sexual contact increased, 16% at 9 to 10 years of age, 24% at 13 to 18 years of age, and 33% after 18 years (Mureau et al, 1995a, 1995c, 1997), a tendency that has been evoked in other studies (Avellan, 1976; Berg et al, 1981). Lastly, disturbances of psychosocial function were not more frequent in severe forms of hypospadias than in minor forms (Berg et al, 1982; Mureau et al, 1997; Sandberg et al, 2001).

In a questionnaire-based study, the authors (Aho et al, 2000) compared the results of an investigation on the social and sexual life of adult patients operated on during childhood for hypospadias ($n = 46$; response rate, 75%) or phimosis ($n = 43$; response rate, 68%) at similar ages (mean \pm SD age, 3.6 ± 1.9 years vs 4.2 ± 2.1 years). The 2 groups gave similar replies, ie, they did not differ where success in sexual and social life were concerned. However, patients with hypospadias were more dissatisfied with the cosmetic results of their surgery than circumcised patients (33% vs 5%) and were more likely to have problems of micturition (80% vs 46%). Follow-up of the patients with hypospadias had been discontinued at a mean age of 7 years, whereas 40% of these patients would have preferred follow-up to have been continued until the age of 15 to 18 years (Aho et al, 2000).

Psychosexual development at adulthood was evaluated in 42 men with a history of hypospadias and 500 controls without hypospadias during medical and psychological examination of 11 649 men aged 18 years during Italian national service (Mondaini et al, 2002). Socioeconomic status did not differ between the 2 groups. However, hy-

pospadiac patients were significantly more inhibited in seeking sexual contacts, and, similarly, a significantly lower proportion of hypospadiac patients had already had full sexual intercourse. Men with hypospadias were also significantly more likely than control subjects to have a negative appraisal of their genital organs (Mondaini et al, 2002).

Patients and surgeons had differing opinions, that is, patients might not be satisfied with a cosmetic result considered satisfactory by the surgeon, but patients with a cosmetic result considered not very satisfactory by the surgeon may themselves be satisfied. Overall, patients were less satisfied than surgeons. The authors of this study of satisfaction (Mureau et al, 1996) suggested that children who had been operated on should be followed up during adolescence by the surgeons to inquire about their degree of satisfaction and to inform them of the possibilities for cosmetic or functional improvement, especially because patients treated for hypospadias rarely seek a consultation of their own accord, even when they have problems (Bracka, 1989, 1999; Mureau et al, 1995a, 1995c; Aho et al, 2000).

Erection, Ejaculation, and Sexuality—During the 1970s, several publications already observed somewhat perturbed sexual function during adulthood. More precisely, of 40 patients who had already had sexual relations among 60 hypospadiac patients operated on during childhood and reviewed in adulthood (older than 17 years), 15% reported difficulties (mechanical or pain) and one third had abnormal ejaculation, either “dribbling” (65%) or delayed with passing of semen after orgasm (35%) (Sommerlad, 1975). Kenawi (1976) found the same results in 16% of 63 patients (18 to 35 years old) operated on during childhood who replied to a questionnaire, including 5 patients with erection problems and 5 with ejaculation problems.

In a more recent study (Aho et al, 2000), despite overall positive “sexual success,” it is noteworthy that 11 (24%) of 46 hypospadiac patients complained of erection problems compared with 3 (7%) of 43 circumcised patients, a statistically significant difference ($P < .01$); in addition, 6 hypospadiac patients (13%) presented ejaculation problems. In fact, the data in the literature (Sommerlad, 1975; Kenawi, 1976; Berg et al, 1981; Svensson and Berg, 1983; Bracka, 1989; Aho et al, 2000) show that difficulty in sexual relations, such as pain or dissatisfaction, were reported by 6% to 24% of patients.

Concerning ejaculation, 6% to 37% of patients reported a variety of problems, such as weak or dribbling ejaculation, retained ejaculation having to be expressed after orgasm, delayed ejaculation with a quantity of semen passing after intercourse, or anejaculation with or without orgasm (Sommerlad, 1975; Kenawi, 1976; Berg et al, 1981; Bracka, 1989; Aho et al, 2000).

Patients Operated on During Adulthood

Psychosexual Aspects—The studies that reported on series of dozens of patients are the work of specialized teams in the United States and in certain countries of the Mediterranean basin. Their treatment of these patients was often delayed for cultural, religious, or sociodemographic reasons. Hypospadias was of the usual proximal or distal type (Secrest et al, 1993; Hensle et al, 2001; Moudouni et al, 2001; Senkul et al, 2002). None of these studies provide any information on the psychosocial development or sexual function, whether before or after surgical correction, of patients operated on during adulthood, except that before surgery 40% of patients did not have sexual relations (Moudouni et al, 2001).

Adult Nonoperated on Patients

Psychosexual Aspects—Data on the psychosexual development and adult sexual life of nonoperated on hypospadiac patients are practically nonexistent. In the previously mentioned article by Bracka (1989), the author makes no specific comment on the psychosexual development or sexual life of the group of 17 nonoperated on men (8%). Of the 42 hypospadiac patients identified during medical and psychological examination of 11 649 men aged 18 years during Italian national service (Mondaini et al, 2002), 6 (14%) had never been operated on, 19 (45%) had undergone a single surgical procedure, and 17 (41%) had undergone at least 2 operations. Difficulty in initiating contact with the opposite sex was significantly greater in the nonoperated on group (4 [67%] of 6) than in the group operated on once (3 [16%] of 19, $P = .03$), the group operated on at least twice (2 [12%] of 17, $P = .02$), or the operated on men as a whole (5 [14%] of 36, $P = .01$). Although confirmation is required in a larger series, the authors suggest that hypospadias in itself, rather than the surgical procedure, may perturb psychosexual development, and they recommend that hypospadiac patients be followed up during adolescence whatever the severity of their genital malformation so that those with psychosexual difficulties can be detected as soon as possible (Mondaini et al, 2002).

Hypospadias and Reproduction

History of Hypospadias and Spermatogenesis—The development of spermatogenesis in children born with hypospadias is little documented. The approach to this question is all the more difficult, since in the absence of a known cause, because of the multiplicity of factors potentially implicated in the occurrence of hypospadias, it is not possible a priori to exclude concomitant involvement of the testes and/or the internal genital tracts and/or adnexal glands, as suggested by certain experimental studies in animals (Kojima et al, 2002).

It has been suggested that antisperm antibodies occur

in the peripheral blood of children born with hypospadias. The only methodologically valid study, concerning 14 prepubertal children (1 to 12 years old), of whom 8 had undergone repair (3 to 5 years old) and 6 had not, and 100 age-matched control subjects, found that a single hypospadiac child had antibodies vs none in the control group (Sinisi et al, 1997). Therefore, hypospadias, whether the patients are operated on or not, does not appear to be associated with the presence of antisperm antibodies in the prepubertal child.

In addition, hypospadias is frequently associated with other developmental anomalies. These anomalies affect various organ systems, mainly the musculoskeletal, cardiac, and gastrointestinal systems, but involvement of the urogenital system is the most frequent and is found in 17% to 30% of patients (Fallon et al, 1976; Khuri et al, 1981; Kulkarni et al, 1991; Wu et al, 2002). Among the latter, testicular maldescent (TMD) and IH are the anomalies most frequently reported.

Although the frequency of the various types of hypospadias (glandular, penile, or penoscrotal and perineal) varies widely in the populations investigated, most studies report a frequency of TMD between 7% and 13% (Table), whereas 2 studies found a rate of 4% and 5% (Fallon et al, 1976; Bauer et al, 1979). For IH, frequencies range from 4% and 9% (Table), with the exception of a recent study that reported a frequency of 12% (Wu et al, 2002). Some authors consider that the frequencies of TMD and IH may be higher in the severe forms of hypospadias, with 31% of TMD and 17% of IH for the penoscrotal, scrotal, and perineal forms vs 5.5% of TMD and 7.5% of IH in the distal or proximal penile forms (Khuri et al, 1981). This tendency has recently been confirmed for TMD but not for IH (Wu et al, 2002).

The frequency of TMD in the population of men operated on for hypospadias in childhood is thus greater than the rate of 3% to 5% observed at birth in the general population (Thonneau et al, 2003), but it is similar to the rates of 5% to 10% of history of TMD found in infertile men (Carizza et al, 1990; Mieusset et al, 1995). This high frequency of TMD is a potential risk factor for the fertility of the population of patients operated on for hypospadias in childhood. The frequency of IH, which is 4% to 9% of hypospadiac patients operated on during childhood (Table), appears to be higher than the rate of 3% reported in the control population of a study of risk factors for testis cancer (United Kingdom Testicular Cancer Study Group, 1994). Lastly, testicular atrophy, another risk factor of infertility, was only sought in a few studies, which reported a frequency ranging from 0.2% (Khuri et al, 1981) to 6.6% (Shima et al, 1979).

In a study of 33 patients older than 20 years and operated on for hypospadias during childhood and 34 matched controls operated for appendicitis (Berg et al,

*Anomalies of the genital tract associated with hypospadias**

Source	No. of Patients	Age Range, y	Testicular Malescent, %	Inguinal Hernia, %	Hydrocele, %	Degree of hypospadias, %†
Sweet et al, 1974	113	NR	8	8	16	G = 87 P = 10 PS = 3
Kenawi, 1976	92	18–35	7.3 (bilateral = 67%)	3.7 (congenital)	1.2 (congenital)	G = 28 P = 57 PS = 15
Fallon et al, 1976	200	1–37	4	8	NR	G = 44 P = 35 PS = 17
Devine et al, 1978	70‡	NR	7.1	8.6	NR	G = 6.5 P = 37 PS = 43.5
Bauer et al, 1979	177	NR	5.1	6.8	NR	G = 29 P = 56 PS = 15
Shima et al, 1979	272	2–36	13.2	4.1	2.9	G = 11 P = 27 PS = 55
Khuri et al, 1981	1076	NR	9.2	8.8	NR	G = 66 P = 16.5 PS = 16
Kulkarni et al, 1991	130	1–11	6.9	3.9	NR	NR
Wu et al, 2002	356	NR	7.3	12.4	NR	G = 34 P = 23 PS = 43

* NR indicates not reported; G, glandular or subcoronal or coronal; P, penile; and PS, penoscrotal or scrotal or perineal.

† When G plus P plus PS is less than 100%, a percentage is missing, which indicates chordee without hypospadias.

‡ Patients who have had failure of primary repair with complications severe enough to require more than a simple procedure.

1983), 3 patients had abnormally high serum follicle-stimulating hormone levels (9%), which could reflect impaired spermatogenesis, but 2 of these 3 also had elevated luteinizing hormone and low androgen levels (testosterone and dihydrotestosterone). Recent findings in 32 children (0 to 9 years) with isolated hypospadias indicated that none of the patients presented an enzymatic abnormality of testosterone biosynthesis or partial androgen insensitivity (Feyaerts et al, 2002).

In 1988, Jugenburg and Kipikasa (1988) reported the results of testicular biopsies performed on 33 patients between the ages of 13 and 38 years who had been operated on for hypospadias in childhood. Eight (24%) of these patients had hypospadias associated with unilateral (n = 6) or bilateral TMD (n = 2). The histological findings in 30 of these patients, including the 8 with TMD, showed that 27% of patients with isolated hypospadias had abnormal testicular histological test results, suggesting hypospermatogenesis, and 75% of patients with hypospadias and TMD had the same results. Although the histological abnormalities observed in hypospadias associated with TMD concord with those usually observed in the latter, those found in isolated hypospadias suggest that one quarter of patients with isolated, operated on hypospadias pre-

sent with impaired spermatogenesis, which is a high proportion.

Among a population of 213 patients with hypospadias (of whom 196 had been operated on during childhood) reviewed at the age of 15 to 24 years (mean age, 22 years), 169 agreed to provide a sperm sample (Bracka, 1989). Of the 32 men who had fathered children, only 1 (3%) had a sperm count of less than 20 million/mL, whereas 40 (29%) of the 137 men whose fertility was not proven had sperm counts of less than 20 million/mL (Bracka, 1989).

History of Hypospadias and Fertility—There is no methodologically adequate study of the fertility of men born with hypospadias, whether surgically corrected or not. In an evaluation of the social and sexual impact of surgery (Aho et al, 2000), adult men (n = 48; mean \pm SD age, 29.9 \pm 4.8 years) who had been operated on for hypospadias during childhood (mean \pm SD age, 3.6 \pm 1.9 years) were less likely to live with a partner (62% vs 75%) than those who had been circumcised (n = 43; mean \pm SD age, 29.9 \pm 4.8 years) during childhood (mean \pm SD age, 4.2 \pm 2.1 years), and they had fewer children (0.8 vs 1.1). Although these differences are not statistically significant, these results could suggest hypo-

fertility, a tendency already found in other studies (Berg et al, 1981). A questionnaire-based study in 1976 (with a low response rate, 24%) found 3 unsuccessful attempts at paternity in 18 married hypospadiac patients operated on during childhood (16%) (Kenawi, 1976).

Conclusion

Numerous surgical techniques have been used to repair the anomalies due to hypospadias. Follow-up and medium and long-term evaluation have often been insufficiently rigorous because of subjective and widely varying criteria. However, during the last 5 years, some teams have proposed more objective appraisal of the outcome of surgical correction, either simply from the cosmetic viewpoint by photographs taken before and after treatment (Baskin, 2001) or by an approach taking into account the cosmetic aspect and the urinary and sexual function by using a scoring system (Holland et al, 2001).

Patients Operated on During Childhood

Psychosocial and Sexual Development—Psychological and social development, as assessed by professional or socioeconomic success, was not modified in most of the studies. However, behavior during childhood was more reserved and less outgoing (children's timidity or parental overprotection). Lastly, there was no correlation between the severity of hypospadias and disturbances of psychosocial development or function. Adolescence is associated with difficulties in undressing "in public," during sports activities for instance, due to a feeling of shame or fear of showing oneself naked (because of "difference"), which is a corollary of the patients' opinion that their genital organs do not have a satisfactory or normal appearance.

Sexuality—Although sexual maturation and debut are normal in adolescents operated on for hypospadias in childhood, on the other hand greater difficulty in making contacts with the opposite sex or even delayed initiation of full sexual activity is often reported. Follow-up until late adolescence is often demanded by patients operated on in childhood and reviewed as adults, which reflects to some extent the psychosocial and sexual difficulties that result from hypospadias.

In adulthood, although some studies conclude that sexuality is satisfactory overall, there is a high incidence of problems of erection, which may be linked to the persistence of penile curvature but also to sensitive scars or a "soft" glans. Problems of ejaculation are also often reported, such as dribbling, retained or delayed ejaculation, or absence of ejaculation. These anomalies may be secondary to dilations of the reconstructed urethra, in the case of retained or delayed ejaculation. Dribbling ejaculation, which seems to be the most frequent anomaly, may be similar to dribbling antegrade ejaculation, which oc-

curs in men with spinal cord injury, especially since these hypospadiac patients also report leaks or drops of urine after micturition (Bracka, 1989). Briefly, dribbling ejaculation suggests abnormal emission of sperm, raising the question of the functional integrity of the nerve pathways.

Patients Operated on During Adulthood

There are no data on the sexuality of these patients before or after surgical repair.

Nonoperated on Patients

Patients born with hypospadias and in whom surgery had not been considered necessary do not seem to differ from patients operated on during childhood where voiding problems and sexuality are concerned. However, studies more specifically devoted to such patients seem necessary to confirm these incomplete findings and to investigate fertility.

Reproduction

It is clear that the hormones involved in testicular function (gonadotrophins, androgens) are not generally affected in either children or adults. However, data reveal epidemiological, clinical, and biological factors that may constitute a risk for fertility: high incidence of disorders of testicular migration, abnormal testicular histological test results such as hypospermatogenesis, and high incidence of low spermatozoa concentration. Lastly, there has been as yet no evaluation of the incidence of infertility in populations of patients with hypospadias who were either operated on in childhood or who did not undergo surgical repair.

References

- Aho MO, Tammela OK, Somppi EM, Tammela TL. Sexual and social life of men operated in childhood for hypospadias and phimosis. *Eur Urol*. 2000;37:95-101.
- Avellan L. The development of puberty, the sexual debut and sexual function in hypospadiacs. *Scand J Plast Reconstr Surg*. 1976;10:29-44.
- Baskin L. Hypospadias: a critical analysis of cosmetic outcomes using photography. *Br J Urol Int*. 2001;87:534-539.
- Bauer SB, Bull MJ, Retik AB. Hypospadias: a familial study. *J Urol*. 1979;121:474-477.
- Berg R, Berg G, Edman G, Svensson J, Aström G. Androgens and personality in normal men and men operated for hypospadias in childhood. *Acta Psychiatr Scand*. 1983;68:167-177.
- Berg R, Berg G, Svensson J. Penile malformation and mental health: a controlled psychiatric study of men operated for hypospadias in childhood. *Acta Psychiatr Scand*. 1982;66:398-416.
- Berg R, Svensson J, Aström G. Social and sexual adjustment of men operated for hypospadias during childhood: a controlled study. *J Urol*. 1981;125:313-317.
- Bracka A. A long-term view of hypospadias. *Br J Plast Surg*. 1989;42:251-255.
- Bracka A. Sexuality after hypospadias repair. *Br J Urol Int*. 1999;83(suppl 3):29-33.

- Carizza C, Antiba A, Palazzi J, Pistono C, Morana F, Alarcon M. Testicular maldescent and infertility. *Andrologia*. 1990;22:285-288.
- Congenital Malformations Worldwide. *A Report From the International Clearinghouse for Birth Defects Monitoring Systems*. New York, NY: Elsevier Science Publishers; 1991:113-118.
- Devine CJ, Franz JP, Horton CE. Evaluation and treatment of patients with failed hypospadias repair. *J Urol*. 1978;119:223-226.
- Fallon B, Devine CJ Jr, Horton CE. Congenital anomalies associated with hypospadias. *J Urol*. 1976;116:585-586.
- Feyaerts A, Forest MG, Morel Y, et al. Endocrine screening in 32 consecutive patients with hypospadias. *J Urol*. 2002;168:720-725.
- Fichtner J, Filipas D, Mottrie AM, Voges GE, Hohenfellner R. Analysis of meatal location in 500 men: wide variation questions need for meatal advancement in all pediatric anterior hypospadias cases. *J Urol*. 1995;154:833-834.
- Hensle TW, Tennenbaum SY, Reiley EA, Pollard J. Hypospadias repair in adults: adventures and misadventures. *J Urol*. 2001;165:77-79.
- Holland AJ, Smith GH, Ross FI, Cass DT. HOSE: an objective scoring system for evaluating the results of hypospadias surgery. *Br J Urol Int*. 2001;88:255-258.
- Jugenburg I, Kipikasa A. Fertility in patients with hypospadias. *Acta Chir Plast*. 1988;30:86-93.
- Kenawi MM. Sexual function in hypospadiacs. *Br J Urol*. 1976;47:883-890.
- Khuri FJ, Hardy BE, Churchill BM. Urologic anomalies associated with hypospadias. *Urol Clin North Am*. 1981;8:565-571.
- Kojima Y, Hayashi Y, Mizuno K, Mogami M, Sasaki S, Kohri K. Spermatogenesis, fertility and sexual behavior in a hypospadiac mouse model. *J Urol*. 2002;167:1532-1537.
- Kulkarni BK, Oak SN, Patel MP, Merchant S, Borwankar SS. Developmental anomalies associated with hypospadias. *J Postgrad Med*. 1991;37:140-143.
- Mieusset R, Bujan L, Massat G, Mansat A, Pontonnier F. Clinical and biological characteristics of infertile men with a history of cryptorchidism. *Hum Reprod*. 1995;10:613-619.
- Mondaini N, Ponchiotti R, Bonafè M, Biscioni S, Di Loro F, Agostini P, Salvestrini F, Rizzo M. Hypospadias: incidence and effects on psychosexual development as evaluated with the Minnesota Multiphasic Personality Inventory Test in a sample of 11,649 young Italian men. *Urol Int*. 2002;68:81-85.
- Moudouni S, Tazi K, Nouri M, Koutani A, Hachimi M, Lakrissa A. L'hypospadias de l'adulte. *Prog Urol*. 2001;11:667-669.
- Mureau MA, Slijper FM, Nijman RJ, van der Meulen JC, Verhulst FC, Slob AK. Psychosexual adjustment of children and adolescents after different types of hypospadias surgery: a norm-related study. *J Urol*. 1995a;154:1902-1907.
- Mureau MA, Slijper FM, Slob AK, Verhulst FC. Genital perception of children, adolescents and adults operated on for hypospadias surgery: a comparative study. *J Sex Res*. 1995b;32:289-298.
- Mureau MA, Slijper FM, Slob AK, Verhulst FC. Psychosocial functioning of children, adolescents, and adults following hypospadias surgery: a comparative study. *J Pediatr Psychol*. 1997;22:371-387.
- Mureau MAM, Slijper FME, Slob AK, Verhulst FC, Nijman RJM. Satisfaction with penile appearance after hypospadias surgery: the patient and surgeon view. *J Urol*. 1996;155:703-706.
- Mureau MA, Slijper FM, van der Meulen JC, Verhulst FC, Slob AK. Psychosexual adjustment of men who underwent hypospadias repair: norm-related study. *J Urol*. 1995c;154:1351-1355.
- Paulozzi LJ. International trends in rates of hypospadias and cryptorchidism. *Environ Health Perspect*. 1999;107:297-302.
- Sandberg DE, Meyer-Bahlburg HF, Aranoff GS, Sconzo JM, Hensle TW. Boys with hypospadias: a survey of behavioral difficulties. *J Pediatr Psychol*. 1989;14:491-514.
- Sandberg DE, Meyer-Bahlburg HFL, Hensle TW, Levitt SB, Kogan SJ, Reda EF. Psychosocial adaptation of middle childhood boys with hypospadias after genital surgery. *J Pediatr Psychol*. 2001;26:465-475.
- Secrest CL, Jordan GH, Winslow BH, Horton CE, McCraw JB, Gilbert DA, Devine CJ. Repair of the complications of hypospadias surgery. *J Urol*. 1993;150:1415-1418.
- Senkul T, Karademir I, Iseri C, Erden D, Baykal K, Adayener C. Hypospadias in adults. *Urology*. 2002;60:1059-1062.
- Shima H, Ikoma F, Terakawa T, Satoh Y, Nagata H, Shimada K, Nagano S. Developmental anomalies associated with hypospadias. *J Urol*. 1979;122:619-621.
- Sides D, Goldstein RB, Baskin L, Kleiner BC. Prenatal diagnosis of hypospadias. *J Ultrasound Med*. 1996;15:741-746.
- Sinisi AA, D'Apuzzo A, Pasquali D, et al. Antisperm antibodies in prepubertal boys treated with chemotherapy for malignant or non-malignant diseases and in boys with genital tract abnormalities. *Int J Androl*. 1997;20:23-28.
- Sommerlad BC. A long-term follow-up of hypospadias patients. *Br J Plast Surg*. 1975;28:324-330.
- Svensson J, Berg R. Micturition studies and sexual function in operated hypospadiacs. *Br J Urol*. 1983;55:422-426.
- Sweet RA, Schrott HG, Kurland R, Culp OS. Study of the incidence of hypospadias in Rochester, Minnesota, 1940-1970, and a case-control comparison of possible etiologic factors. *Mayo Clin Proc*. 1974;49:52-58.
- Thonneau PF, Gandia P, Mieusset R. Cryptorchidism: incidence, risk factors, and potential role of environment; an update. *J Androl*. 2003;24:155-162.
- United Kingdom Testicular Cancer Study Group. Aetiology of testicular cancer: association with congenital abnormalities, age at puberty, infertility, and exercise. *BMJ*. 1994;308:1393-1399.
- Uygur MC, Ersoy E, Erol D. Analysis of meatal location in 1,244 healthy men. *Pediatr Surg Int*. 1999;15:119-120.
- Wu WH, Chuang JH, Ting YC, Lee SY, Hsieh CS. Developmental anomalies and disabilities associated with hypospadias. *J Urol*. 2002;168:229-232.
- Zaontz MR, Packer MG. Abnormalities of the external genitalia. *Pediatr Clin North Am*. 1997;44:1267-1297.