

Perspectives and Editorials

Editorial Commentary

Schrader SM, Breitenstein MJ, Clark JC, Lowe BD, Turner TW. Nocturnal penile tumescence and rigidity testing of bicycle patrol officers. *J Androl.* 2002;23:927–934.

Bicycle riding is a public health paradox (Andersen and Bovim, 1997; Ricchuti et al, 1999; Marceau et al, 2001; Sommer et al, 2001a,b). On the one hand, bicycle riding is a popular form of transportation, encouraged by physicians for positive cardiovascular benefits and used for recreation, adventure, relaxation, aerobic exercise, and weight loss. On the other hand, bicycle riding is a physical activity associated with significant compression of perineal contents, leading in some men and women to permanent and irreversible sexual dysfunction. A recent population study (Marceau et al, 2001) found the age and cardiovascular risk-adjusted relative risk of erectile dysfunction in men aged 40–70 who rode bicycles for 3 or more hours per week was 1.72. With particular attention to sexual dysfunction, bicycle riders tend to be younger, healthier, and more athletic than traditional patients with sexual impairment, and the implications and psychologic impact of their sexual dysfunction may be more profound.

Schrader et al (2002) bring a new, fresh “occupational” perspective to the dilemma of bicycle-riding-associated sexual dysfunction. The National Institute for Occupational Safety and Health (NIOSH) is the federal agency entrusted with occupational health assessments. This novel research paper investigates the sexual health consequences of members of a bicycling police unit, a classic example of individuals who spend a majority of their day straddling bicycle saddles and then complain of perineal numbness. As an aside, we have seen numerous bicycle-riding policemen as patients with sexual dysfunction and have observed, in some, restoration of erectile capabilities following microvascular arterial bypass surgery. One critical, resourceful, and innovative contribution from Schrader et al (2002) is the measurement of the pressure of the cyclist’s perineum on the bicycle saddle. This ingenious determination was made using a thin profile, resistance-based pressure measurement mat with sensors having a spatial resolution of 1.6 cm². Figure 1 in

Schrader et al (2002) illustrates the ultimate predicament of bicycle riding. The perineal pressure distribution while sitting on a chair is borne by the ischial tuberosities; the perineal pressure distribution while straddling a bicycle saddle (upright or pursuit position) is borne by the perineal contents, including the common penile artery, pudendal nerve, and penile crurae. Schrader et al (2002) documented an occupational sexual health consequence in bicycle-riding policemen. During sleep, bicyclists had significantly fewer erection events than nonbicyclists.

On the basis of published literature and clinical experience, if bicycle saddles were “chemical substances” rather than “mechanical devices,” it is likely that there would be established standards of safety exposure. Examples of such safety exposure include a NIOSH criteria document, a federal government-established Permissible Exposure Level (PEL), and an American Council of Government Industrial Hygienist (ACGIH)-established time-weighted average—threshold limit value. More likely than not, there would also exist a state and municipal ban on occupations (bicycle-riding policemen, couriers, etc) using traditional narrow bicycle saddles.

This paper represents another milestone in the effort to document the sexual health hazards of bicycle riding, and there is strong agreement about the need for innovative bicycle saddle design.

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Editorial Commentary

Erectile Function of Bike Patrol Officers

Schrader SM, Breitenstein MJ, Clark JC, Lowe BD, Turner TW. Nocturnal penile tumescence and rigidity testing of bicycle patrol officers. *J Androl.* 2002;23:927–934.

The association between cycling and erectile dysfunction (ED) remains an incompletely defined one. Experts on both sides of this controversial question have very strong convictions. The potential risk of genitourinary problems, such as voiding dysfunction and ED, as a consequence of a potentially beneficial aerobic activity like cycling requires careful assessment with thoughtful experimental design prior to the release of patient recommendations. The important study by Schrader et al (2002) uses innovative methodology to evaluate subjective and objective measures of erectile function (EF) among a small group of patrol officers who cycle at work, compared to a small noncyclist cohort. Previous studies have evaluated a number of physiologic and subjective parameters of sexual functioning, including questionnaires, penile oxygen, and Doppler blood flow recordings in various positions and states of exercise. Studies have compared runners to cyclists and high-performance athletes to recreational cyclists. To date, a definitive statement concerning the absolute risk of cycling is not available; however, many authors have expressed concern about the relationship between extended exposure to cycling and ED.

The clear strengths of this report rest on the authors' ability to measure the perceived amount of ED (via RigiScan and questionnaires) and the objective pressure measurements obtained in different seating positions of the study populations.

The weaknesses of this report are significant and limit the authors' conclusions. The method through which the affected population was selected provides us with little insight into how prevalent this condition is among general cyclists. The self-selective nature of their study populations may provide an exaggerated estimate of how commonly cycling affects EF. The control group for this study is almost 5 years younger than the "experimental"

group and consists of a number insufficient to provide meaningful comparisons. The authors state clearly in their "Results" section that a very weak negative association was seen between time on the bike, days/wk ridden, and average seat pressure with RigiScan-documented nocturnal penile tumescent events. No statistical differences were measured using the RigiScan for erectile quality.

Use of the International Index of Erectile Function (IIEF) to evaluate EF is an accepted sensitive and specific psychometrically validated tool. In the present study, both cyclists and control-group members rated within the normal range (>25 points in the EF domain). Although one could argue that these results may represent very early ED, a large cohort of subjects chosen at random and evaluated for the variables in this study may provide a more meaningful assessment of the role played by cycling in EF.

Because of these limitations, a definitive statement concerning the etiology of erectile difficulties among cycling patrol officers is not possible. The association between sleep time tumescence, hours on the bike, and perineal pressure is very tenuous. This association may have changed (either positively or negatively) had more nights of RigiScan testing been performed or a greater number of subjects been evaluated.

In spite of these shortcomings, this study provides us with novel insights into the potential impact of chronic perineal pressure and EF. I concur with the authors' statements that 1) it seems reasonable to recommend breaks out of the saddle, particularly when genital numbness is experienced, and 2) the use of saddles without protruding noses should be considered. New saddle design may be optimized through the use of the methodology described in this study in order to evaluate the location and amounts of perineal pressure. Definitive patient-cycling guidelines

and recommendations will require larger, detailed investigations based on objective evidence establishing a clear physiologic basis to cycling-associated ED. Until that information is available, common sense approaches toward the patient concerned about ED, such as those outlined above, seem reasonable.

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Response to Commentaries

Schrader SM, Breitenstein MJ, Clark JC, Lowe BD, Turner TW. Nocturnal penile tumescence and rigidity testing of bicycle patrol officers. *J Androl.* 2002;23:927-934.

We wish to thank Drs Brock and Goldstein for their commentaries on our study of nocturnal penile tumescence and rigidity testing of a police bicycle patrol unit. The effect of bicycling on male sexual function is a health issue that affects recreational and sport cyclists in addition to those for whom bicycling is an integral part of their occupation. Police patrol cycling is only one example of occupational bicycle use, but it is an important one. There are more than 2000 police bicycle units in the United States that average 9 officers each (International Police Mountain Bike Association, <http://www.ipmba.org/factsheet.htm>). Because police patrol officers often spend the majority of their workday "in the saddle" (5.4 hours per day was reported in our study), they are hypothesized to be at greater risk of erectile dysfunction (ED) from chronic perineal compression by the bicycle saddle than recreational/sport cyclists, if a relationship between chronic perineal compression and ED exists.

Dr Goldstein's supportive commentary is appreciated. While we concur with Dr Goldstein that narrow saddles with protruding "noses" appear to result in greater pressure on the perineum, more research is needed before definitive statements can be made regarding the relative risk of impaired sexual function attributable to the use of specific saddle designs. However, the myriad number of new bicycle saddle designs available to cyclists suggests that saddle manufacturers are aware of problems with the traditional bicycle saddle design.

From *Androlog*

Note: Postings to *Androlog* have been lightly edited for grammar and usage before publication.

Among men presenting with obstructive azoospermia, many suffer from epididymal blockage from a variety of etiologies. There exists, however, a population of men who have suffered iatrogenic injury to the vas deferens, emphasizing the need to obtain a thorough history from male fertility patients. A very informative discussion took place on *Androlog*

Dr Brock's primary criticism of our study appears to stem from the self-selective nature of our participant recruitment, which he indicates may exaggerate the prevalence of ED among general cyclists. This criticism is unwarranted, because our study focused on a specific occupational group, a bicycle police patrol unit, and the study was not intended to make inferences regarding the prevalence of ED in the general cycling population. In addition, we believe correlations between both time in the saddle and saddle nose pressure with the percentage of sleep time with an erection would not be exaggerated by participant self-selection. We believe that the relationship between bicycle saddle usage and male sexual function is mediated by a host of variables that include the weight and anthropometrics of the cyclist, the saddle design and cushion material properties, the geometry of the bicycle and its fit to the cyclist, the type of cycling, etc. We concur with Dr Brock that large randomized cohort studies are needed to examine the influence of these variables on ED.

Respectfully,
 Brian D. Lowe
 Steven M. Schrader
 Michael J. Breitenstein
 John C. Clark
 Terry W. Turner

Androlog regarding the potential for vasal occlusion among men who have undergone hernia repair using mesh. Unlike patients in whom injury to the vas deferens was identified at the time of surgery, the resulting impairment to fertility may be "silent" and likely is unknown until a semen analysis is performed. The current popularity of using mesh in hernia repair makes this a particularly important topic.

Dr Eugene Fuchs posed the initial question:

Colleagues, does anyone have any information or experience with Marlex mesh causing vas obstruction after an inguinal hernia repair? I recently saw a 33-year-old man who is known to have had an adequate sperm count several years ago but who never sired an offspring. Two years ago, he had bilateral inguinal hernia repairs using Marlex mesh. About 6 months ago, he was found to be azoospermic. His hormone levels were normal, and a testicular biopsy showed normal spermatogenesis. A vasogram showed obstruction at or near the internal inguinal ring. Exploration revealed dense scarring encompassing the vas. It was difficult to dissect the vas from the fibrous tissue. The vas was intact but did appear atretic, as if devascularized within the scar. I was able to repair one side, but on the other side, so much vas was damaged that I was unable repair without taking apart the hernia repair, which I was unwilling to do. Is this an isolated case? Should we be warning our general surgical colleagues that this is a potential problem? Has this been documented in the surgical literature? I will appreciate your thoughts on this matter.

Eugene F. Fuchs, MD, Oregon Health Sciences University

Dr Andy Meacham had a similar case to report:

Regarding Dr Fuchs' note pertaining to Marlex mesh used in hernia repair leading to vasal scarring—I saw such a patient in my clinic today. He has unilateral left testicular atrophy that occurred following inguinal surgery in the remote past. He subsequently fathered 3 children without difficulty and then underwent contralateral (right) hernia repair with the use of Marlex. He is now azoospermic. His exam shows epididymal induration consistent with vasal occlusion on the right side. On the basis of the presence of only 1 nonatrophic testis and the challenges associated with vasal repair in such a setting, we are focusing our discussion on sperm retrieval rather than reconstruction. I'll be interested in hearing other *Androlog* comments.

Dr Jacqumin Didier expressed his opinion on this topic, citing medical-legal issues:

This is one of the usual causes of obstructive-acquired azoospermia. It is not often mentioned because sperm analysis is not performed systematically before hernia repair. The procedure has to be bilateral. This is a case in which frequently patients are asking the urologist for advice before going to the law court.

Jacqumin Didier, MD, Hopitaux Universitaires de Strasbourg, France

Dr Nina Davis felt this to be a well-recognized phenomenon and cited experimental data:

In response to Dr Fuchs' inquiry about mesh used in hernia repair and compromise of the vas deferens, this is a well-documented phenomenon, although much of the material is in the urologic/andrologic literature as opposed to the general surgical literature. One particularly nice study that demonstrates Dr Fuchs' observation was done by Marc Goldstein's group at Cornell (*Journal of Urology*, April 1999). They performed canine herniorrhaphies using mesh and demonstrated a significant reduction in luminal size in the vasa of the treated animals. This resulted from the exuberant fibrotic reaction induced by the mesh. So, in answer to Dr Fuchs' query, it would seem appropriate to pub-

lish and/or present something on this subject in a major surgical journal or at a major meeting to bring it to the attention of our general surgical colleagues.

Nina S. Davis, MD, MCP-Hahnemann University

Dr Marc Goldstein reported his own clinical and experimental data and gave advice for using mesh in hernia repair:

I have seen at least 3 cases of vasal obstruction associated with Marlex mesh hernia repair. These cases were included in a larger series of iatrogenic vasal injuries, of which 30 were from hernia repair. As was Gene Fuchs' experience, the injuries associated with Marlex mesh repair were almost impossible to reconstruct. One testicle atrophied after attempted repair due to transection of a testicular artery embedded in the mesh. The best results were when the other vas was okay and associated with an atrophic testis or obstructed epididymis, and we could do a crossed venovenous and avoid digging around in the mesh. Because of these experiences, we did a study of mesh repair in dogs. Although all 12 vasograms were patent, there was significant luminal narrowing and severe reaction around the vas and in the cord. Some of the dogs had impaired spermatogenesis, perhaps from arterial narrowing or injury. One dog had a traumatic neuroma. No sutures were used to sew in the mesh, so injury from suturing could be excluded as a cause. One problem in sorting this out is that most surgeons use nonabsorbable sutures to sew in the mesh. Therefore, we don't know if the injury is from the mesh or from entrapment of the vas in one of the sutures. I suspect that mesh hernia repair is associated with a small but significant risk of injury to the cord structures. I do hernia repairs with mesh; however: 1) I avoid nonabsorbable sutures; 2) I avoid putting plugs in the internal ring where they would directly push on the cord; 3) I use only plugs for direct hernias and cover the plug with a flat patch; and 4) I use preformed patches (from Bard) with a large keyhole (about 1.5 cm in diameter) for the cord to exit through.

(Sheynkin YR, Hendin BN, Schlegel PN, Goldstein M. Microsurgical repair of iatrogenic injury to the vas deferens. *J Urol*. 1998;159:139–141.

Uzzo RG, Lemack GE, Morrissey KP, Goldstein M. The effects of mesh bioprosthesis on the spermatic cord structures: a preliminary report in a canine model. *J Urol*. 1999; 161:1344–1349.)

Sincerely, Marc Goldstein, MD, The New York Hospital, Cornell Medical Center

Dr James Barada noted that general surgeons should be made aware of this important issue:

Excellent case presentation. Was the Marlex used as a sheet to reinforce the floor or the Plug (parachute) reduction method or hernia reduction/fixation? Marlex is known for its intense fibroblastic response with tissue incorporation (thus, localized inflammation), which may have contributed to the obstruction. Given the way that the Marlex inguinal hernia repair has proliferated, along with the copious amounts of mesh being used, I would imagine that this will be coming up more often. Basic research in this area is warranted. For now, I would make the general surgeons aware of this serious potential complication. I would suggest that, in this case, cord skeletonization may be a factor.

James H. Barada, MD, FACS, Center for Male Sexual Health

Dr Stan Honig also reported clinical experience with this topic:

I also had such a case last week with bilateral inguinal vasal injury. The vasal injury from childhood was reconstructible; however, the side with the Marlex mesh-related vasal injury (hernia repair 2 years ago) was fibrotic, scarred, and not reconstructible. Maybe we can combine these cases for a more valuable study.

Stanton C. Honig, MD, University of Connecticut

Dr Sidney Glina also reported experimental data regarding the use of Marlex mesh in animals:

Regarding Dr Fuchs' note pertaining to Marlex mesh used in hernia repair leading to vasal scarring, we used the Marlex mesh just underlying the right vas in 10 rabbits and a sham operation on the left side. We got a vas obstruction in 9 of them. The inflammatory reaction went over the

epididymis in 6 animals. The lesion was due to the contact between the mesh and the vas, as we did not use sutures.

Sidney Glina, MD, Hospital Israelita Albert Einstein

Finally, Dr Stewart McCallum reported that he had seen a similar patient in his clinic:

I also had such a case a couple of months ago of a young man with a solitary right testicle, his cryptorchid left testicle having been removed years earlier. He had blood in his ejaculate after his surgery and was advised that there was nothing to worry about and that it would go away. He subsequently had a semen analysis that demonstrated very poor semen parameters, and on a follow-up, he was azoospermic. We opened the hernia repair, but he had extensive scarring of his vas and was also unreconstructible.

Stewart McCallum, MD, Stanford University and Medical Center

*Randall B. Meacham, MD
University of Colorado School of Medicine*