

Runner's Bladder: Exercise-Induced Hematuria With Lower Urinary Tract Pathology

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Submitted November 16, 2010 - Accepted for Publication January, 6, 2011

ABSTRACT

Exercise-induced hematuria is an uncommon clinical entity experienced by long-distance runners and participants in other sports. The source and mechanism of bleeding have been debated. We explain the pathology in a 54-year-old male using cystoscopic evidence. The patient had multiple episodes of painless gross hematuria that occurred immediately after long-distance running. Cystoscopy performed 3 days after an episode revealed multiple erythematous lesions of the posterior bladder wall and prostatic urethra. There was shaggy prostatic urethral mucosa. After a 2-week period without long-distance running, repeat cystoscopy revealed nearly complete resolution of the bladder and prostatic urethral lesions. Transurethral bladder and prostatic urethral biopsies identified no malignancy or dysplasia. This is one of the few known cases of exercise-induced gross hematuria with evidence of bladder and prostatic abnormalities on cystoscopy. A complete work-up for gross hematuria must be performed to avoid missing an underlying abnormality that presents incidentally or secondary to exertion.

KEYWORDS: Hematuria; Runner's bladder; Cystoscopy; Bladder injury; Urothelium; Cystitis cystica

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CITATION: *UroToday Int J.* 2011 Apr;4(2):art 19. doi:10.3834/uij.1944-5784.2011.04.01

Abbreviations and Acronyms

CT, computed tomography

FISH, fluorescence in situ hybridization

INTRODUCTION

Exercise-induced hematuria has been recognized as a clinical entity for more than 50 years. It is most frequently associated with long-distance running, but it also occurs with a variety of other contact and noncontact sports including rowing, cycling, and swimming. Both microscopic and gross hematuria have been described. Microscopic hematuria appears to be more common than gross hematuria, although the incidence of both varies. Patients are usually asymptomatic and hematuria typically resolves within 48 to 72 hours [1].

There is debate over the source of hematuria as well as the mechanism of bleeding in patients with exercise-induced

hematuria. A renal (glomerular) origin has been supported by the finding of dysmorphic red blood cells on urinalysis [2]. Ischemic injury to the nephron and increased intraglomerular pressures have also been proposed [3]. "Nut-cracker syndrome" or *aorto-mesenteric renal vein entrapment syndrome* is another proposed mechanism. Compression of the left renal vein in the fork between the abdominal aorta and the proximal superior mesenteric artery result in left renal venous hypertension and development of collateral veins with intrarenal and perirenal varicosities. This leads to hematuria if the thin-walled septum separating the veins from the collecting system ruptures [4]. A lower urinary tract source of exercise-induced hematuria has also been proposed, which could be concomitant to an intrarenal

source of bleeding. Bladder injury due to repeated impact of the posterior bladder wall against the bladder base has been postulated as a primary mechanism [5].

Few reports have described actual cystoscopic findings related to exercise-induced hematuria. Furthermore, there have been only a few case reports of exercise-induced hematuria in women, suggesting that the prostate may be a source of the hematuria [6]. However, there are no known cystoscopic reports of prostatic urethral abnormalities in the setting of exercise-induced hematuria. We report one of the few cases in the literature of running-related gross hematuria with both extensive bladder and prostatic urethral abnormalities seen on cystoscopy.

CASE REPORT

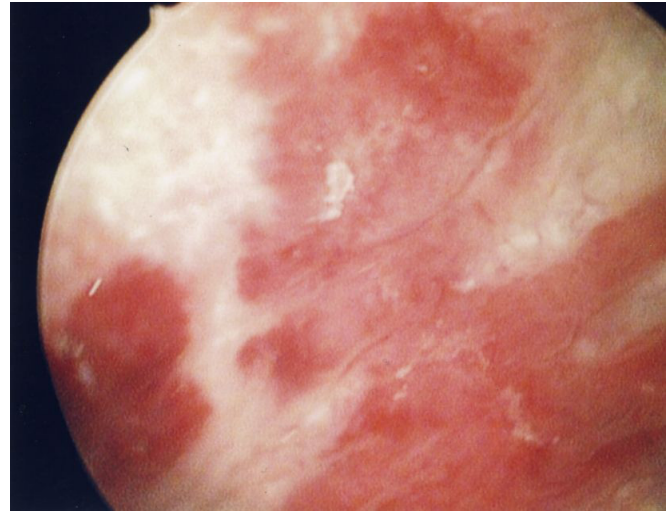
A previously healthy 54-year-old man developed painless gross hematuria with small clots after an approximately 15-mile run while training for a marathon. The hematuria resolved spontaneously within a few hours after 2-3 voids. Another episode of transient painless gross hematuria occurred several days later after a shorter run. He then remained free of gross hematuria for some time, including after the completion of a marathon. However, 1 week after the marathon he again developed painless gross hematuria following an 8-mile run. Urologic evaluation was obtained and cystoscopy was performed 3 days after this episode.

The patient had no significant past medical history and took no medications. He had no constitutional symptoms. He was afebrile and vital signs included a blood pressure of 134/62 mmHg with a pulse of 48 beats per minute. The physical examination was normal. Serum creatinine, basic metabolic panel, complete blood count including platelet count, and prothrombin and partial thromboplastin times were within normal limits. A urinalysis 3 days after his hematuria resolved was negative, including no hematuria or proteinuria. He also had a voided urine culture, urine cytology, and UroVysion assay (Vysis Inc, Downers Grove, IL, USA) via urine fluorescence in situ hybridization (FISH); all of these tests were normal. Cytology and FISH were used as diagnostic tests for transitional cell carcinoma. The prostate specific antigen level was 1.26 ng/mL. A computed tomography (CT) urogram identified mild asymmetric thickening of the bladder wall and an apparent small filling defect to the left of the midline posteriorly in the bladder, which did not enhance on nephrographic phase imaging. Bilateral kidneys were normal in appearance with no evidence of papillary necrosis.

Cystoscopy revealed several erythematous patches on the left

Figure 1. Intraoperative local cystoscopy image of the posterior bladder wall three days after an episode of gross hematuria following long-distance running.

doi: 10.3834/uj.1944-5784.2011.04.01f1

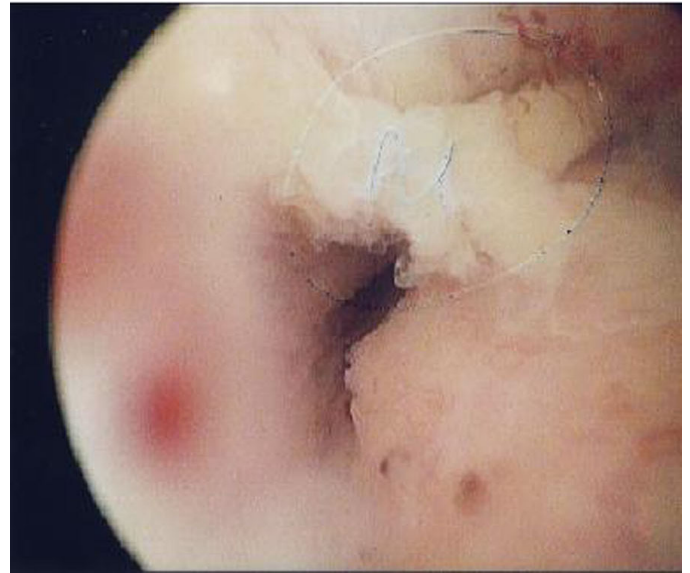
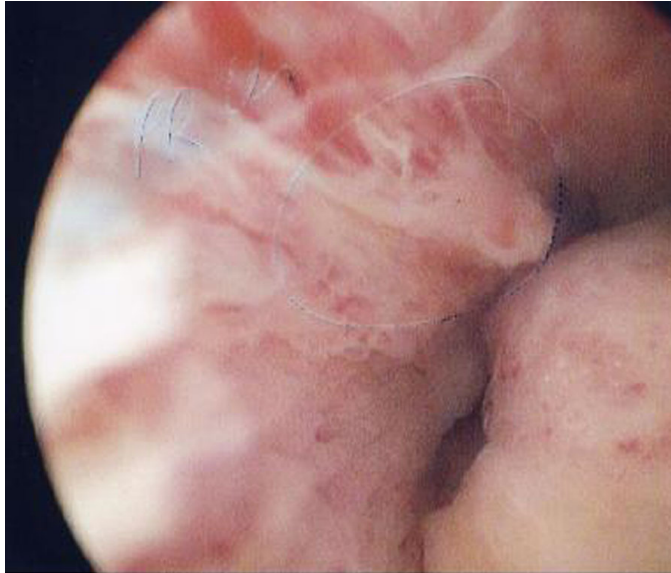


posterior and left posterolateral walls of the bladder. These areas appeared to have an appearance of submucosal hemorrhage (Figure 1). There were no other papillary masses, nodules, or ulcerated lesions in the bladder. Biopsies were not obtained because the procedure was performed under local anesthesia. The prostatic urethra contained areas of erythematous mucosa with the appearance of submucosal hemorrhage and areas of shaggy mucosa (Figure 2). Urine cytology and the UroVysion FISH assay collected by bladder wash during cystoscopy were normal.

The patient discontinued running for 2 weeks but continued low-level aerobic exercise and limited weight lifting without recurrence of gross hematuria. Following this period, cystoscopy was performed with general anesthesia. This revealed nearly complete resolution of the abnormalities seen at the first cystoscopy, with only 2 very small erythematous areas remaining in the bladder (Figure 3). There was also resolution of the prostatic urethral submucosal hemorrhage and the shaggy mucosa was improved. Transurethral cold-cup bladder biopsies of the erythematous lesions were performed. These confirmed benign urothelium with cystitis cystica, focal hemorrhage, and occasional hemosiderin-laden macrophages in the lamina propria without dysplasia or carcinoma. A prostatic urethral cold-cup biopsy revealed benign urothelium with focal hemorrhage and congestion in the lamina propria with no dysplasia or carcinoma.

Figure 2. Two intraoperative local cystoscopy images of the prostatic urethra 3 days after an episode of gross hematuria following long-distance running.

doi: 10.3834/uij.1944-5784.2011.04.01f2

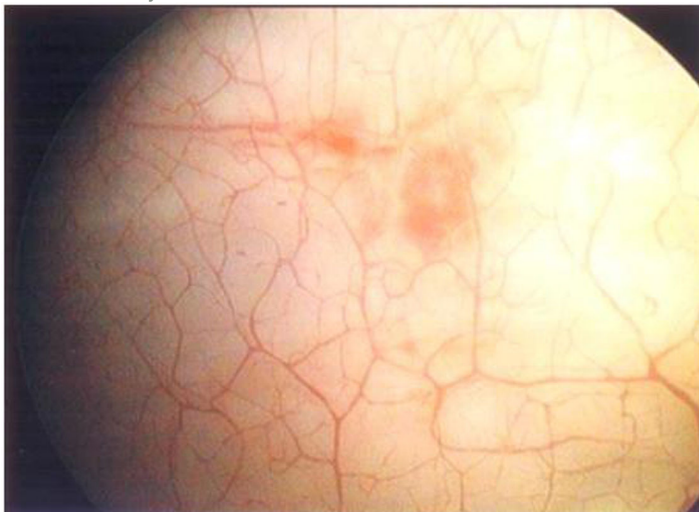


DISCUSSION

This case of “runner’s bladder” occurred in a patient who experienced several episodes of asymptomatic painless gross hematuria after running, with resolution of hematuria

Figure 3. Intraoperative sedation cystoscopy image of the posterior bladder wall 2 weeks after cessation of long-distance running.

doi: 10.3834/uij.1944-5784.2011.04.01f3



This image was taken in the same area of the posterior wall as the initial cystoscopic image in Figure 1.

within hours after exercise. Cystoscopic examination revealed erythematous patches and submucosal hemorrhages of the bladder that correlated with the small filling defect of the left posterior bladder wall seen on a CT urogram. There were also findings of prostatic submucosal hemorrhage and a “shaggy” urothelial lining.

Numerous theories have been proposed of the mechanism leading to bladder injury and gross hematuria after extensive physical activities such as long-distance running. Observations of short-lived gross hematuria in patients with cystoscopic findings of bladder contusions have led to theories of injury from repeated impact of the flaccid bladder wall against the bladder base. The bladder lumen may be nearly empty during exertion, leading to apposition of the surfaces. Thus, inconsistency of episodes of hematuria may be secondary to the variability of the individual’s urine volume [5]. It should be noted that the present patient routinely voided prior to running. It is unclear whether this mechanism also contributes to prostatic injury.

Cystoscopy in the patient reported here revealed almost complete resolution of any identifiable abnormalities on cystoscopy after a 2-week period without running. During this period there was no recurrence of hematuria, which supports a physical force mechanism of injury. However, it is unclear if direct apposition of bladder surfaces is the actual or only mechanism involved in lower urinary tract injury. Bladder biopsy in this patient identified benign urothelium with

cystitis cystica and focal hemorrhage of the lamina propria. To our knowledge, this is the first reported instance of cystitis cystica associated with runner's bladder. The prostatic urethral biopsy also revealed benign urothelium and the presence of focal hemorrhage and congestion in the lamina propria with no dysplasia or carcinoma. This suggests that exercise-induced injury to the prostate may also be a source of (or contributor to) hematuria. Further studies such as cadaver bladder experiments or computerized models simulating pelvic forces during exercise may help elicit the mechanism of lower urinary tract injury and show potential ways to prevent recurrence.

Although biopsies of the erythematous lesions in this patient identified no dysplasia or malignancy, we believe that a complete work-up for gross hematuria must be performed. Without this work-up, the examiner may miss an underlying abnormality that presents either incidentally or secondary to exertion. There have been rare instances of exercise-induced hematuria leading to a diagnosis of bladder carcinoma and other significant urologic abnormalities [6]. Prior studies have shown that biopsy of red patches of urothelium that are commonly seen during cystoscopy performed for various indications may yield significant findings of malignancy [7]. We recommend a complete work-up including cytology, cystoscopy, and upper tract evaluation for any patient with exercise-induced hematuria.

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