



Severe epididymal orchitis and total testicular infarction induced by *Pseudomonas aeruginosa* infection, and assessment of testicular endocrine function: A case report

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ABSTRACT

Epididymal orchitis is a common urological condition for which medical management is the primary treatment strategy. Although *Pseudomonas aeruginosa* is a common cause of nosocomial urinary tract infections, it rarely causes acute epididymal orchitis in adolescence and is difficult to treat. Furthermore, it may progress to potentially fatal complications such as global testicular infarction and late atrophy. Urinary tract infection(s) can harm the gonads and is a well-known cause of male infertility. This case study involved a 13-year-old boy with acute epididymal orchitis caused by *P. aeruginosa* infection, which led to testicular infarction. Testicular volume, and anti-sperm antibody, reproductive hormone, and serum inhibin B levels were monitored for six months, which revealed that left testicular volume was 1/20 of that of the right. Anti-sperm antibodies were negative, oestradiol level was elevated, but serum inhibin B level declined. This case report emphasises the importance of early treatment by implementing the use of antibiotic(s) to maximise the opportunity for testicular rescue. Testicular function on the healthy side must be monitored when testicular necrosis is detected.

1. Introduction

Epididymal orchitis, also known as epididymo-orchitis, is a moderately common urological condition that affects the scrotum and manifests as unilateral discomfort and swelling. Pathogens mainly arise retrogradely from the urinary tract [1]. A diagnosis can be made based on medical history, physical examination, and ultrasonography. Mainstay therapy consists of antibacterial and anti-inflammatory medications, scrotal elevation, and local physiotherapy. Although *Pseudomonas aeruginosa* infection is a prevalent cause of nosocomial urinary tract infections, it is an unusual cause of acute epididymal orchitis [2], which is rare in adolescents and difficult to cure. Epididymal orchitis can lead to testicular infarction and, although extremely rare, can have lethal consequences. Infections can injure the gonads, and urinary tract infections are well-known causes of male infertility [3]. Thus, gonadal function should be investigated in individuals with suspected acute epididymal orchitis, particularly those who present with testicular infarction. We report a case of testicular infarction in a patient with acute epididymal orchitis caused by infection with *P. aeruginosa*.

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Testicular volume was quantified, and anti-sperm antibody, reproductive hormone, and serum inhibin B levels were used to assess gonadal function.

2. Case report

A 13-year-old boy presented to the authors' emergency department with complaints of a five-day history of left scrotal soreness and oedema. The patient experienced no lower urinary tract symptoms nor did he have a major relevant medical or surgical history. Based on penile characteristics, the patient was diagnosed with occult penis. Other congenital anomalies of the genitourinary tract were excluded based on magnetic resonance imaging and cystography findings. Test results for coronavirus disease-2019 were negative after two days. Urine analysis was negative, and blood workup revealed mild leukocytosis ($18.5 \times 10^9/L$). Doppler ultrasonography revealed an enlarged left testis with a heterogeneous echo pattern, enhanced vascularity, and retained testicular blood flow, which was diagnosed as epididymal orchitis. Cefotiam (1 g twice daily) and dexamethasone sodium (10 mg once daily) were started. Two days later, left scrotal pain worsened, and sonography indicated a heterogeneous echotexture in the left testis and epididymis, as well as a mild whirlpool sign with hyperechogenicity in the inguinal area. Scrotal investigation revealed an enlarged testis, epididymis, and infected appendages; no torsion was evident in the sperm vessels; however, purulent foci were visible on the surface of the vessels, and their texture was tough and inseparable. Blood supply to the testis was assessed according to the three-level scoring system proposed by Arda et al. [4]. A part of the tunica albuginea was cut, with no significant blood outflow; however, pus overflowed from convoluted tubules. The pus was collected, and the incision was closed and covered with a sheath capsule. The patient's family opposed left orchiectomy but agreed to excision of the appendix of the testis and right orchiopexy. *P. aeruginosa* isolated from pus cultures was susceptible to ceftazidime and ofloxacin. Pathological analysis indicated haemorrhagic infarction of the left testicular appendage and the presence of fibrocystic-like tissue with inflammatory cell infiltration. The antibiotic was changed from cefotiam to ceftazidime, and dexamethasone sodium was discontinued after two days. By postoperative day 6, the left scrotal surgical wound became dehiscent and infected, and was treated daily with sterile gauze dressings. On hospital day 10, blood workup, urine Gram staining, and culture results were all negative. The patient was transitioned to oral levofloxacin 200 mg twice daily for 1 week before discharge on day 15. Serum anti-sperm antibodies were negative 1-, 60-, and 180-days post-discharge. In addition to sonography, serum reproductive hormone and inhibin B levels were measured at 0, 3, 6, 10, and 25 weeks (Table 1). At 60 days, magnetic resonance imaging of the left testicle revealed atrophy (Fig. 1).

3. Discussion

Epididymal orchitis is a common bacterial or inflammatory condition that responds favourably to antibiotic therapy, but can also develop into segmental or total testicular infarction. Singh et al. reported a case involving a young boy with acute epididymal orchitis due to *P. aeruginosa*, presenting with severe bronchopneumonia and acute respiratory distress syndrome [6]. Rajagopal described acute Pseudomonas epididymo-orchitis with testicular abscesses in a young adolescent [7]. Papadakis reported a case involving a young paraplegic man undergoing chronic intermittent catheterisation who presented with acute epididymo-orchitis due to *P. aeruginosa* [8]. Mittermeyer documented 610 cases in which the testicular infarction rate was 3–5% [9]. Eisner and Keat reported bilateral testicular infarction induced by bilateral epididymo-orchitis, resulting in testicular loss and lifelong testosterone replacement therapy [10,11]. Various causes have been proposed, including compartment syndrome (increased pressure within a restricted space, with inflammatory infiltration producing spermatic cord compression), thrombosis related to venous congestion, and/or bacterial exotoxins [12]. Unilateral vas deferens blockage or damage can induce considerable impairment of the bilateral testes, with serum anti-sperm antibodies playing a critical role. Flickinger et al. investigated the effect of serum anti-sperm antibodies in juvenile rats during vasectomy and anastomosis ligation (reconnecting the severed ends of the vas deferens) at various time points and reported a significant reduction in anti-sperm antibodies immediately after anastomosis ligation [13]. On days 1, 66, and 188, serum anti-sperm antibody findings were negative. This suggests that anti-sperm antibodies did not emerge following unilateral testicular infarction in adolescent children, necessitating sperm testing. According to the Tanner staging system [14], the patient was stage G4P4; therefore, reproductive hormone

Table 1
Changes of serum reproduction hormones, INH B and Testicular volume.

Time (week)	0th	3rd	6th	10th	25th
HFSH(mIU/ml)	9.29	10.24	6.46	15.39	13.42
HLH (mIU/ml)	4.5	2.11	1.11	5.8	3.86
PRL (ng/ml)	3.66	3.58	3.1	8.47	46.61
ESTRDL (pg/ml)	42.56	46.6	56.24	62.99	35.93
PROG (ng/ml)	0.21	0.21	0.22	0.39	0.49
TESTO (ng/dl)	215.22	180.14	204.15	353.93	294.41
INH B (pg/ml)	134.2	104	56.6	68.9	72.6
LTV (ml)	6.63	2.45	0.61	0.46	0.36
RLV (ml)	4.66	5.26	5.25	6.26	7.15

HFSH: Serum follicle-stimulating hormone; **HLH:** Serum luteinizing hormone; **PRL:** Serum prolactin; **ESTRDL:** Estradiol; **INH B:** Serum inhibin B; **LTV:** left testicular volume; **RTV:** right testicular volume.

Testicular volume (ml) = $\pi/6 \times (\text{length} \times \text{width} \times \text{height})$ [5].

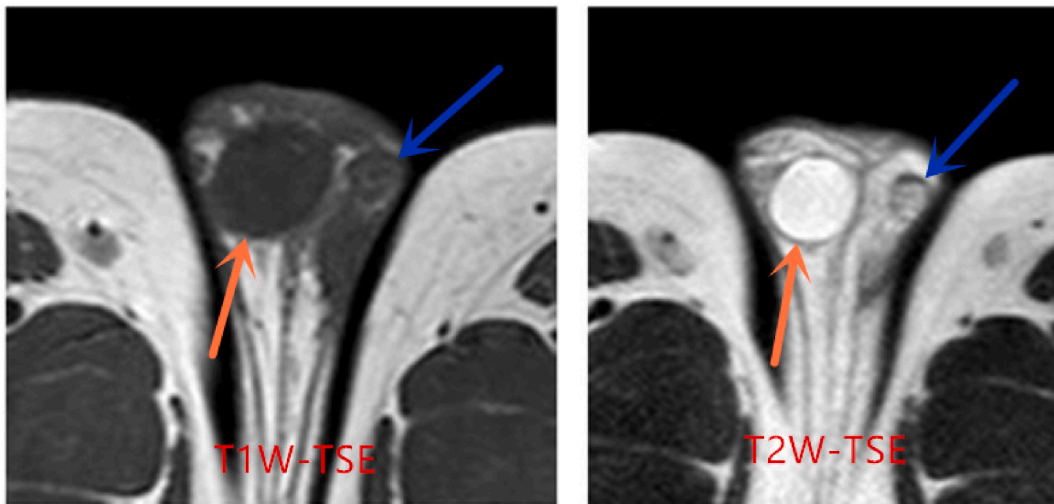


Fig. 1. The red arrow was the right testis and the blue arrow was the left testis; the left testis showed no enhancement in T2, indicating the disappearance of the left testis. MR testing time was at 2022-10-5 MR ZJ Ningbo Women and Children Hospital. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

levels were examined. According to our reproductive hormone monitoring results, oestradiol levels increased at onset, peaked at 10 weeks, and returned to normal by 25 weeks. We speculate that oestradiol protects against testicular ischaemia-reperfusion injury, although the exact protective mechanism is unclear and requires further investigation [15]. Inhibin B secretion is predominantly regulated by gonadotropins, which interact with inflammatory cytokines [16]. Owing to the substantial link between inhibin B and testosterone levels after challenge tests, testosterone is recommended as a reliable biomarker to assess prepubertal testicular function [17]. According to our monitoring data, inhibin B reached its nadir at week 6, and then increased slowly from weeks' 10 to 25. However, these values remained below those observed in the first week. This implies that, following testicular damage, there is a process of contralateral testicular function impairment and recovery. At week 25, right testicular volume was 20 times greater than that on the left, indicating that the left testis had undergone compensatory expansion to maintain normal spermatogenesis, whereas the right testis had undergone necrotising alterations.

4. Conclusion

P. aeruginosa-related epididymal orchitis developed into segmental infarction of the testes within five days. Thus, the symptoms did not significantly improve after three days of treatment. We recommend performing a quick testicular examination and increasing the grade of antibiotic(s). Results of dynamic monitoring revealed that the healthy testis underwent a process of injury and recuperation, and it is vital to monitor its influence on future fertility. Consequently, it is vital to monitor the gonads of patients with epididymal orchitis and to implement the appropriate intervention(s) when needed.

Ethical declaration and informed consent statement

Informed consent was obtained from the patients and their guardians for the publication of the article.

Data availability

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

CRedit authorship contribution statement

Yan Li: Writing – review & editing, Writing – original draft. **Qiang Chen:** Supervision, Software, Methodology. **Meng Zhao:** Investigation, Data curation. **Hongji Zhong:** Supervision, Project administration. **Zhengyuan Tan:** Supervision, Data curation.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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