Application of the urine-prostate-semen test in accurate diagnosing etiologically in the patients with chronic prostatitis-like symptoms

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Research Article

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Abstract

Background: In diagnosis and differential diagnosis of chronic prostatitis-like symptoms, the prostatic secretion was considered to be the most important and even only specimen, little attention has been paid to other genital organ infections. This may be one of important factors affecting treatment effect of chronic prostatitis.

Methods: We used a urine-prostate-semen test (U-EPS-S test) to collect the specimens of urine, prostatic secretion and semen from 200 patients with chronic prostatitis-like symptoms. The specimens were inoculated respectively into a suitable media culture for the bacteriological localization detection and observe the number and their distribution of colonies in each isolation culture.

Results: All of the patients had an infection of the internal genital organs (infection rate = 100%). Of these, prostatic secretion positive isolation cultures were obtained in 66 cases (33%), semen positive isolation cultures were obtained in 34 cases (17%), and prostatic secretion and semen positive isolation cultures were obtained in 100 cases (50%).

Conclusion: The U-EPS-S test is useful to identify the pathogens and contaminatives in isolation cultures, and accurate diagnose and differential diagnose the multiple microbial infection (MMI) and the multi-organ infection (MOI) in patients with chronic prostatitis-like symptoms.

Background

The patients with prostatitis-like symptoms have been divided into four distinct categories, in which the categories II, III and IV are considered to be the prostate disease that most common and difficult cure or non-curable [1-6]. According to the researches [1-3,7-10], the chronic inflammation in prostate tissue can not only cause many serious symptoms of the patients, but also cause some serious complications complications related to abnormal expression and secretion of cytokines and abnormal inflammatory response. In recent years, by the animal experiments and clinical observation, it showed the prostatic secretions of patients with chronic bacterial prostatitis can contain different kinds or strains of microorganisms with different drug sensitivities, and almost all kinds of antibiotics can diffuse into the tissues and secretions of normal and inflammatory prostates at a high enough concentration to kill or inhibit the drug-sensitive strains of pathogens [11-19]. It suggested that missed or misdiagnosis of etiological examination may be one of important factors affecting the treatment of chronic prostatitis. Here, we describe a urine-prostate-semen test, it was used to systematically collect specimens of genitourinary tract from the patients with chronic prostatiti-like symptoms and isolate and identify the pathogens from these specimens.

Methods

Patients

200 patients with chronic prostatitis-like symptoms from the clinic services of hospitals in China were selected for this study, they ranged in age from 20 to 85 years (mean 46.9 years).

The urine-prostate-semen test

The patients who had stopped the antimicrobial treatment for more than 3 days had the specimens collected by the urine-prostate-semen test (U-EPS-S test, Figure 1) .

Bacteriological localization detection

0.1 mL of these specimens were respectively inoculated on blood agar plates, Sabouraud agar plates and mycoplasma agar plates, the isolation cultures were identified by the routine bacteriological/fungal methods and/or the gene assay [14,21-23]. The pathogens and the contaminative microbes were distinguished according to the relative number of each kind of growths on each plate and their distribution in each isolation culture (Figure 2, Figure 3 and Table 1).

Post-therapy pathogen re-detection

After patients finished a course of treatment and had stopped the usage of antimicrobials for at least three days, the IU, TU, RU-EPS, and S were collected and used for pathogen detection according to the methods before therapy.

Results

Isolates and their diagnostic value

All of these patients were shown positive isolation cultures of internal genital organs, of which 66 cases (33%) were RU-EPS positive isolation culture and semen negative isolation culture, 34 cases (17%) were semen positive isolation culture and RU-EPS negative isolation culture, and 100 cases (50%) were both RU-EPS and semen positive isolation culture. Of these patients, two or more kinds of microbes were detected in 52.5% of patients.

468 strains of microorganisms were isolated from the RU-EPS and semen specimens of these patients (Table 2). Of samples that contained only one microbial species 36 were prostatic secretions (18%), 20 were semen samples (10%), and 39 were prostatic secretion and semen samples (19.5%); of those containing two microbial species 30 were prostatic secretions (15%), 14 were semen samples (7%), and 60 were prostatic secretion and semen samples (30%); and those containing three microbial species were isolated from one prostatic secretion and one semen sample (0.5%). The bacterial isolates had different drug sensitivities or multidrug resistance (Table 3).

Laboratory findings after antimicrobial therapy

Post-therapy pathogen detection showed that a significant reduction or disappearance of bacteria in the isolation cultures (Fig. 2D).

Discussion

The patients with chronic bacterial prostatitis have similar clinical manifestations to that of the patients with the chronic prostatitis of other categories, they all have similar “chronic prostatitis-like symptoms” [1]. Therefore, many of them could often have been diagnosed with chronic prostatitis (CP), chronic bacterial prostatitis (CBP), chronic nonbacterial prostatitis (CNP) or chronic pelvic pain syndrome (CPPS) if only based on the bacteriological test of the EPS and/or the expressed prostatic secretion routine test (EPSRT). Our this work showed that many of the patients with chronic prostatitis-like symptoms did not be a simple prostate infection or simple prostatitis, most of them multi-organ infection (MOI) or other internal genital organ infection that caused by the causative agents with different drug sensitivities and even multidrug resistance. This finding seems to be able to explain why the symptoms of patients with chronic prostatitis are often not characteristic, and why the treatment of many patients is still unsatisfactory even according the results of routine bacteriological tests of prostatic secretions.

Unlike the Meares-Stamey 4-glass urine test [1,3]，the urine-prostate-semen test dose not ask the patients to take any antibiotic and also no need the clean and sterilization their glans penis before the specimens were collected because it would affect the isolation culture of microbes in specimens. The past researches shown that the gram-negative bacteria, especially *Escherichia coli,* cause approximately 75 to 80% of episodes in chronic bacterial prostatitis, and the other aerobic gram-negative rods, such as *pseudomonas*, have a high detection rate in these patients [1-3,5-7]. However, in our the work, it was shown that most of the isolation cultures from the patients with chronic prostatitis-like symptoms were gram-positives, especially the *Staphyloccus* species not the gram-negatives. The diagnostic value of these isolation cultures or their association with the patient's disease can be further verified by the improvement or change in symptoms of the patient who undergo treated with the antimicrobial agent according the drug sensitivity test *in vitro,* and also the post-therapy pathogen detection.

Conclusions

The multiple microbial infection (MMI) and the multi-organ infection (MOI) are widespread in patients with chronic prostatitis-like symptoms, they can be accurate diagnosed and differential diagnosed by the U-EPS-S test.

Declarations

Ethics approval and consent to participate

This protocol had been evaluated and approved by the ethics committee of Guizhou Medical University. The development of project strictly complied with the bioethical principles of benefcence, nonmalefcence, autonomy, justice, dignity and privacy, and was in compliance with the Declaration of Human Rights, Chinese Ministry of Health's 《Methods for Ethical Review of Biomedical Research Involving Human Beings (Trial)》and the relevant provisions of the Helsinki Declaration on biological human testing. All patients were informed verbally through an information sheet and signed the informed consent. All data collected were confdential, the privacy of each of the participants were respected at all times. Participation in the study may be interrupted by the patient at any time, if desired, and without negative consequences for him.

Consent for publication

Not applicable.

Availability of data and materials

Not applicable.

Conflict of interest

All authors declare that they have no conflicts of interest.

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Author’s contributions

H. Wang conceived and designed the research, drafting of the manuscript and had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis; H.Wang and DN.Wang managed data collection, analysis and interpretation of data and critical revision of the manuscript for important intellectual content. All authors have reviewed the manuscript and approved submission.

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Tables

TABLE 1. Samples collected by the U-EPS-S test and their respective significance in diagnostics

	Collected specimens	Depicted as	Volume	To represent
The urinary stream	initial of the urinary stream	IU	1-10 mL	microbiologic flora of lower urinary tract
	third of the urinary stream	TU	1-10 mL	microbiologic flora of upper urinary tract
Prostatic secretion	expressed prostatic secretion	EPS	no or yes	cytology of the prostate
	urine after prostatic massage	RU-EPS	1-5 mL	microbiologic flora of the prostate
Semen	seminal fluid	S	whole	microbiologic flora of the deferent duct and the other internal genitals

TABLE 2. Isolates from the internal genital organs of patients with chronic prostatitis-like symptoms

Category of microorganism (isolation rate, %)		Genus or family (%)	The species identified by routine bacteriological/fungal methods (isolation rate, %)
BACTERIA(88.5)	Gram-positives (91.1)	*Staphylococcus* (64.2)	*S.epidermidis*(46.7), *S.aureus*(3.7), *S.hominis*(4.0), *S.cohnii*(3.4), *S.capitis*(1.3), *S.saprophyticus*(1.9), *S.simulans*(1.3), *S.haemolyticus*(0.8), *S.intermedius*(0.3), *S.xylosus*(0.5), *S.wayneri*(0.3),
		Streptococcus (12.5)	β-hemolytic streptococci(0.3), *S.faecalis*(9.5), *S.durans*(1.6), *S.faecium*(0.8), *S.bovis*(0.3),
		Corynebacterium (22.0)	*C.psudodiphtheriae*(12.5), *C.xerosis*(6.6), *C.bovis*(1.3), *C.pseudotuberculosis*(0.5), *C.genitalium*(0.5), *C.equi*(0.3), *C.kutscheri*(0.3)
		Others (1.3)	*Lactobacillus spp.*(1.3)
	Gram negatives (8.9)	Enterobacteriaceae (62.2)	*E.coli*(21.7), *P. Vulgaris*(10.8), *Acinetobacter spp.*(8.1), *Moraxella spp.*(5.4), *K.pneumoniae*(5.4), *Citrobacter spp.*(5.4), *E. aerogenes*(2.7), *P. aeruginosa*(2.7)
		Neisseria (37.8)	*N.gonorrhoeae(5.4),N.mucosa(8.1),N.cinerea(8.1),N.subflava(5.4),N.sicca(5.4),N. Lactamica (2.7), N.polysaccharea (2.7)*
FUNGI (2.6)	Yeast (75.0)	*Candida* (75.0)	*C.albicans* (33.4), *C.krusei* (25.0), *C.paapsilosis* (8.3), *C.stellatoidea* (8.3)
	Filamentous fungi (25.0)		*A.flavus* (16.7), *Penicillium spp.*(8.3)
MYCOPLASMA (8.5)			*U.urealyticum* (92.5), *M.genitalium* (5.0), *M.hominis* (2.5)
CHLAMYDIA (0.4)			*Chlamydia* spp.

TABLE 3. Drug sensitivities of bacterial species from patients with chronic prostatitis-like symptoms

antibacterials	*Staphylococcus spp.*			*Enterococcus spp.*			*Corynebacterium spp.*			enterobacteriaceae *spp.*		
	Tested strains (n=)	Sensitive strains (n=)	Drug-resistant rate (%)	Tested strains (n=)	Sensitive strains (n=)	Drug-resistant rate (%)	Tested strains (n=)	Sensitive strains (n=)	Drug-resistant rate (%)	Tested strains (n=)	Sensitive strains (n=)	Drug-resistant rate (%)
Piperacillin	17	0	100	9	1	88.9	4	0	100	1	0	100
Cefazolin	87	54	37.9	24	13	45.8	25	10	60	0	0	0
Cefuroxime	71	36	49.3	23	13	43.5	23	12	47.8	5	0	100
Cefotaxime	10	0	100	10	3	70	7	1	85.7	2	0	100
Ceftriaxone	22	4	81.8	8	0	0	6	2	66.7	5	0	100
Cefoperazone/ sulbactam	88	60	31.8	24	15	37.5	6	5	16.7	5	5	0
Amikacin	53	33	37.7	21	5	76.2	19	12	36.8	3	0	100
Ciprofloxacin	48	6	87.5	22	4	81.8	14	0	100	4	1	75
Levofloxacin	61	18	70.5	18	4	77.8	12	1	91.7	2	2	0
Fleroxacin	7	0	100	7	0	100	5	0	100	3	0	100
Lomefloxacin	5	0	100	0	0	0	4	0	100	1	0	100
Minocycline	73	60	17.8	23	18	21.7	20	15	25	5	2	60
Fosfomycin	84	41	51.2	29	11	62.1	20	3	85	5	2	60
Imipenem	55	51	7.3	23	21	8.7	17	15	11.8	4	4	0

Figures

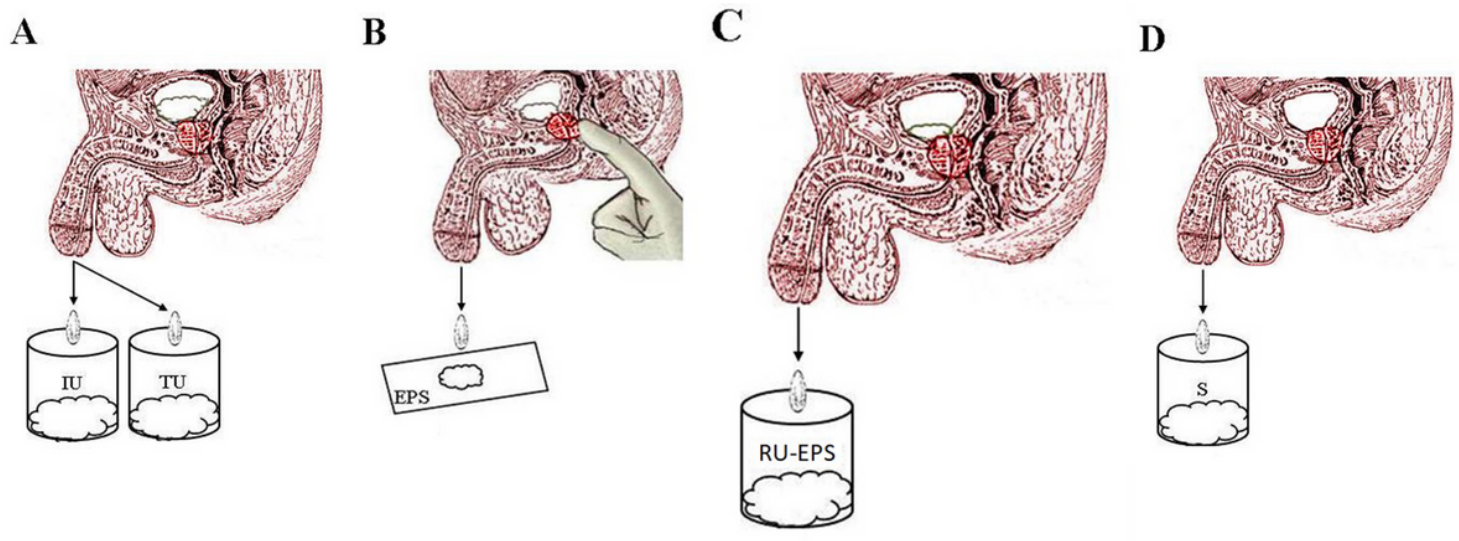

Figure 1

The urine-prostate-semen test used for patients with prostatitis-like symptoms. (A) Initial urinary stream (IU) and third part of the urinary stream (TU) (1-10 mL each) were collected into different sterilized containers and used for the microbiological test. (B) By prostatic massage, the expressed prostatic secretion (EPS) overflowed from the urethral orifice onto a glass slide that was used for the routine test. (C) The EPS within the urethra was collected into a sterilized container by urinating about 1-5 mL of residual urine (RU), the mixture of EPS and RU (RU-EPS) was used for the microbiological test. (D) Semen (S) collected by masturbation, sexual intercourse or another method was used for the microbiological and routine tests.

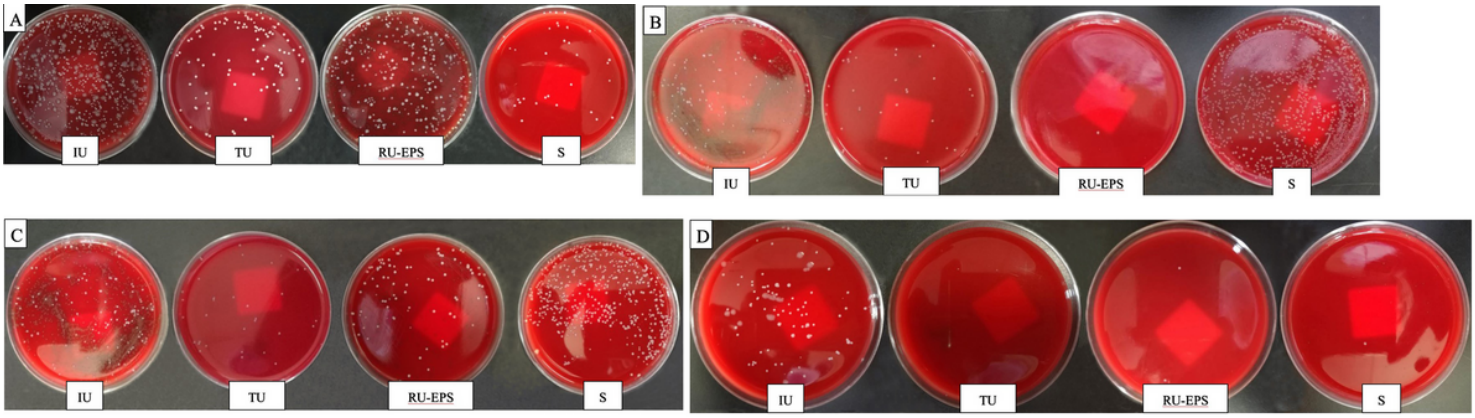

Figure 2

The diagnostic value of isolation cultures in samples from patients with prostatitis-like symptoms. (A): the prostate infection and the multiple microbial infection (MMI) of the prostate; (B): the deferens tract and/or other internal genital organ infection but the prostate no infection; (C): both the prostate and the deferens tract and/or other internal genital organ infection, and the multiple microbial infection (MMI) and the multi-organ infection (MOI) of the prostate and other internal genital organs; (D): the prostate and the other internal genital organs no infection, and it can also indicate that the patient has been cured if it is the result of post-therapy pathogen detection. All of these patients had the multiple microbial infection (MMI) of lower urinary tract.

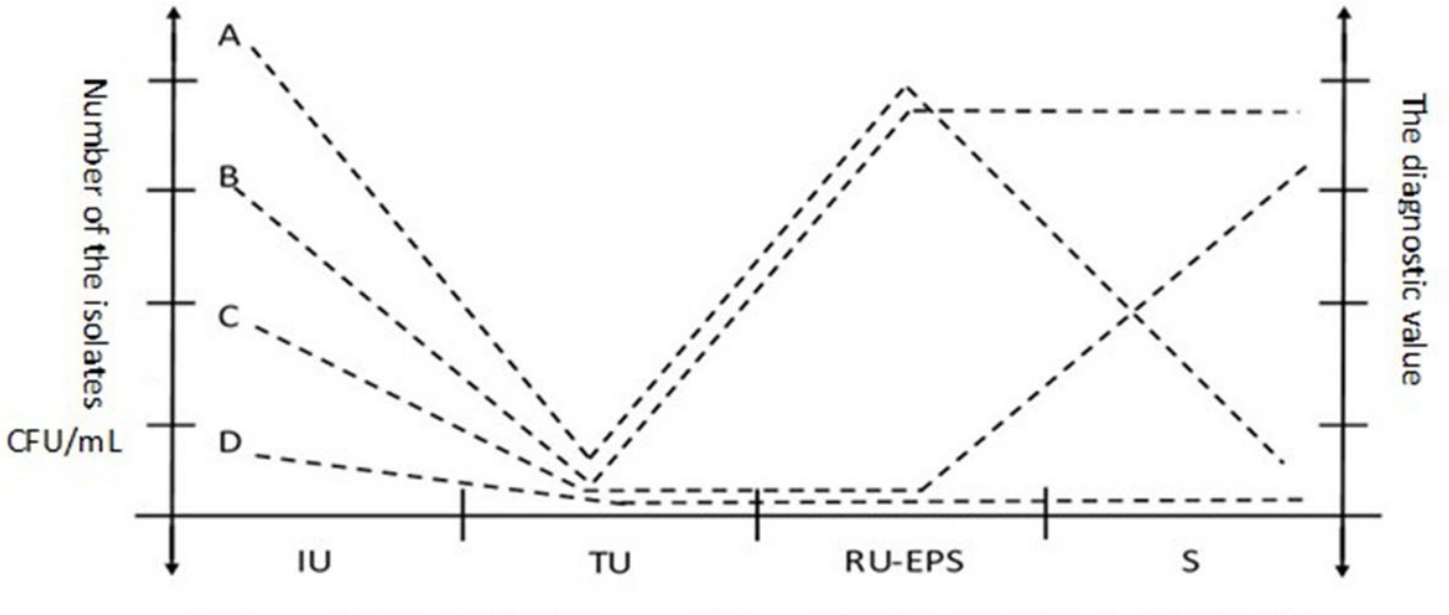

Figure 3

Value of diagnostic diagnosis of the number and distribution of an isolation culture in the samples for a patient with prostatitis-like symptoms. A: Simple prostate infection; B: infection of the prostate gland and other genital organs; C: no infection of the prostate gland but infection of other genital organs; D: no infection of the prostate gland or other genital organs. A-C also had an infection of the lower urinary tract.