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Guideline

AAUS guidelines 2021 revision sexually transmitted infection (STIs) diagnostic strategy for STI

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1. Introduction

World Health Organization (WHO) declared STI as "one of five types of disease for which adults around the world most commonly seek medical help." According to WHO report, there were several key facts in Sexually Transmitted infection (STI) More than one million STI occur every day, an estimated 376 million chlamydia, gonorrhea, syphilis and trichomoniasis infections occur each year. In 2016, the total incidence of STI was 376 million per year, including 127 million chlamydia cases, 87 million gonorrhea cases, 156 million trichomoniasis cases and 6 million syphilis cases, showing an increase compared to that reported by Rowley et al. [1,2]More than 500 million people have genital infection with herpes simplex virus (HSV1 or HSV2) [3]. Approximately 300 million women have a human papilloma virus (HPV) infection and this number is likely similar in men [4]. The majority of STIs occur without symptoms. Some STIs can increase the risk of HIV acquisition three-fold or more. STIs can have serious consequences beyond the immediate infection itself, through mother-to-child transmission of infections or conditions such as infertility and cervical cancer. Drug resistance for gonorrhea is a major threat to control this STI worldwide [5].

STIs are caused by different pathogen such as virus, bacteria, parasites and the symptoms and lesions appear in various parts of the human body. Most STIs have typical symptoms, signs and lesions by disease. However, symptomatic STI as well as asymptomatic carriers and asymptomatic carriers are important because they can be transmit the infection to other people [6]. So in the case of STI, it can be said that the specific screening test is important. The strategies for diagnosis of STIs in Asian countries are very important for the following reasons: curable STIs are frequently found in Asians; STIs can result in serious physical complications in some patients; and deplete a middle- or low-income countries' economic reservoir for controlling the infections [7]. Practically, untreated early syphilis will result in a stillbirth rate of 25% and be responsible for 14% of neonatal deaths. Untreated gonococcal and chlamydia infections in women will result in pelvic inflammatory disease in up to 40% of cases. One in four of these cases will result in infertility [8].

STIs are not only medical problems, but also social, political, behavioral and economic problems [9–11]. Tests with high accuracy are widely used in high-income countries, and are also very useful in detecting asymptomatic infections. However, in the low-income and middle-income countries, many parts of the examination are impractical because they are expensive or geographically inaccessible. Therefore, proper treatment through accurate diagnosis may take time and money in such countries. For a number of reasons, there are many efforts to reduce the cost of tests and increase their convenience to perform these screening or confirmatory tests. For example, tests such as rapid dual HIV/syphilis blood test and single rapid test for syphilis are accurate through 15–20 min to confirm the results and the examiner does not require high proficiency. To solve these complicated and entangled problems, we must explore more comprehensive approaches as follows; international cooperation, national supports or international supports, and governmental or community supports. Furthermore, the strategies for detection of STIs should be designed within one's national ability or budget [8].

Clinical guidelines must be based on evidence and be of value to medical practitioners. From the review of previous guidelines, we can

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Table 1
Potential factors influencing choice of tests for STIs.

Purpose of testing	Test-specific considerations
• Surveillance • Quality assurance • Evaluation of syndromic diagnosis • Diagnosis • Screening • Antimicrobial susceptibility testing	• Performance (sensitivity, specificity, predictive value) • Specimen collection and transportation requirements • Prevalence • Associated morbidity • Resources • Financial • Personnel • Infrastructure (utilities, etc.) • Relative importance among other priorities

find that the ideal guidelines are not often practice [12–22]. Additionally, while there are very good STI guidelines around the world, STIs still thrive today.

The basic concept of a guideline is one rule for one fact with limited exceptions. However, a universal or multi-national guideline must capture the diversity of people across the Asian countries. To get an ideal STI guideline for Asian people, we must review some discrepant parts.

Accurate diagnostic tests for STIs are widely used in high-income countries but in low- and middle-income countries, the diagnostic tests are largely unavailable. So inexpensive and rapid result for STI is needed and especially in resource-limiting environment. Several rapid tests for STIs are under development which can be potentially efficient tests for STI diagnosis and treatment, especially in resource-limited settings [23].

2. Which target is more appropriate for the diagnostic strategy

2.1. Asymptomatic or symptomatic?

In STI, sexually trasmitred infections include asymptomatic and symptomatic infections. In general, in the case of symptomatic infections, treatment can be carried out through a confirmatory test, but in the case of asymptomatic cases, the actual causative agent exists in the human body and there is a risk of transmission, but there are no symptoms, so diagnosis and treatment are difficult. Therefore, it is important to evaluate the risk and block transmittion through screening tests in high-risk groups. However, there are many limitations in screening and testing these asymptomatic STI patients, such as cost, facilities, and trained personnel. The medical or social costs are very expensive because we would require highly sensitive laboratory or screening tests to detect non-symptomatic pathogens by qualified personnel after adequate training for performing technically demanding procedures. Therefore, diagnostic tests for STI differ in suitability according to the socioeconomic status of each country. The high-income country can use various tests but the low-to-mid income country has limitations on the tests. There are many methods for etiological diagnosis of STIs. While the standard bacterial culture method for *Neisseria gonorhoeae(NG)* or *Trichomonas vaginalis(TV)* are well established around the world, the culture method for cryptic organisms such as Chlamydia trachomatis (CT) or Mycoplasma genitalium are difficult to set up, time-consuming, and demanding highly qualified cell culture techniques. Many health care facilities in Asian countries may lack the cell culturing equipment and trained personnel for STI approaching. The screening tests on the base of pathogens, nucleic acid amplification technique (NAAT), can be alternative method for etiological detection of STIs. Though it is customized and the whole procedures can be automatically performed, the cost is expensive to cover all person who wants

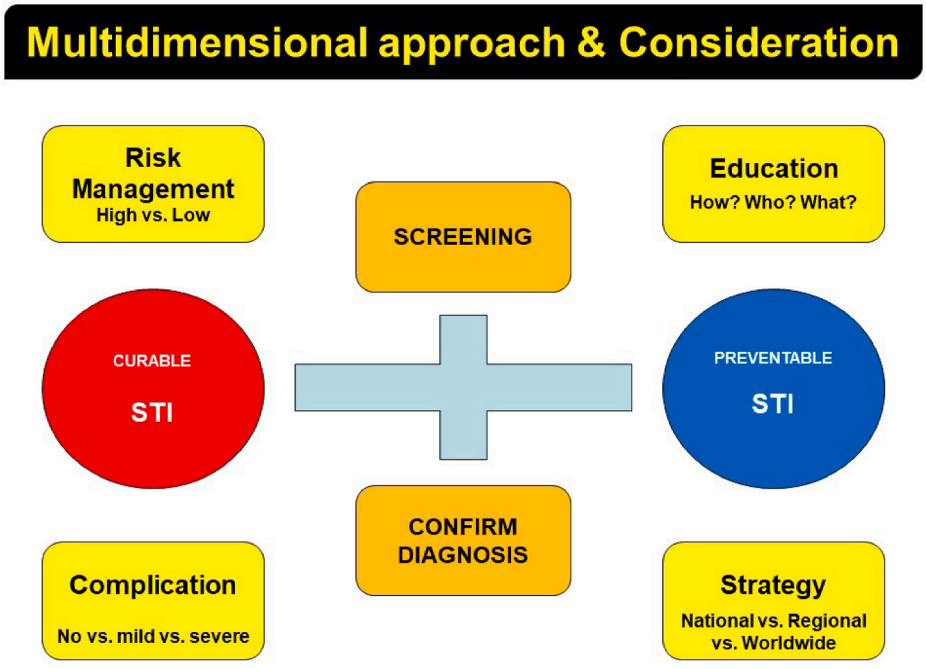

Fig. 1. Multidimensional approach & Consideration for establishing diagnostic strategy in STIs.

Table 2
Risk factors for gonorrhea, chlamydia, and syphilis by population.

Population	Risk Factors
Women	Prior CT or GC infection, particularly in the past 24 mo
	>1 sex partner in the past year
	Partner with concurrent partners
	New partner in the past 3 mo
	Partner with STI
	Transactional sex (eg, drugs, money, housing)
	Inconsistent condom use and not in mutually monogamous relationship
	Intravenous (IV) drug users and/or partners who are IV drug users
	High-prevalence population, such as incarcerated, military recruit, public STI clinic
MSM	Multiple or anonymous partners
	IV drugs use
	Sex in conjunction with illicit drug use, including methamphetamine
	Receptive or insertive anal sex
	Oral sex with partners who have syphilis sores or lesions
	Partners who engage in the above activities
Men who have sex with women	Prior infection (in past 24 mo)
	IV drug use
	High-risk setting such as Adolescent clinics
	Correctional facilities
	STD clinics
	National job training programs

to check for STIs. Practically, wide use of NAAT is not acceptable in less developed Asian countries. However, we cannot overlook serious complications of asymptomatic STIs in Asian countries. Screening test was strongly recommended that the STIs core group or people with potentially serious risks after STIs infection should be tested with STIs screening tests regardless of symptoms. We should provide the NAAT for all symptomatic patients whatever the risk for STIs [24–26]. To successfully implement this concept, we must decide "Who should be tested for screening tests in each country?" and "Who are the STI core groups in each country?"

2.2. Choice of tests for STIs

There is no single or independent test to diagnose the causative agent that causes STI. However, there are some considerations for each country and region in selecting various tests. Various considerations exist, including the cost of the examination and the prevalence of STIs in specific region. Table 1 shows considerations for each test [27].

2.3. Multidimensional approach and consideration

There are many things to consider about STI. It is necessary to distinguish whether it is a treatable STI or a preventable STI. Depending on each, an appropriate selection should be made between screening and confirm diagnosis. In addition, it is necessary to distinguish whether it is high risk or low risk through risk management, and for complications of STI itself, priority should be given to diagnosis by considering no complication, mild complication, severe or irreversible complication. Education for disease prevention, diagnosis, treatment, etc. also has many points to be considered depending on how and what is delivered to whom. Education that considers all aspects such as national characteristics, demographic characteristics, and economic and social characteristics is necessary. In addition, in establishing a strategy based on these considerations, it is important to establish a strategy for each country or administrative unit, but international, regional and global strategy must be considered and established (Fig. 1).

2.4. Screening of STI

Screening for STI in a specific population can be very helpful [6,28]. A large number of untreated STIs cause complications such as genitourinary infection, infertility, pelvic inflammatory disease, cervical cancer, and chronic infection, and may also cause transmission to others. Symptomatic STI can be tested for diagnosis according to the symptoms, but in the case of asymptomatic STI, it is difficult to confirm if screening is not performed, and asymptomatic infection leads to complications and disease spread. Ideally, screening should be performed on all people at risk for developing STIs. However, these screening tests inevitably incur costs, and some tests may incur costs and may have location limitations.

In the case of high-income countries, capital and administrative measures such as these screening tests are sufficiently implemented, and medical access is excellent, so there will be few restrictions on testing. However, in middle-income or low-income countries, sufficient national medical expenses may not be invested or policy measures may not be taken, there is a limit to available medical resources, and not everyone has easy access to medical care. It is necessary to designate a high-risk group such as a specific age and a specific occupation, and to conduct a screening test on a minimum number of subjects.

The screening of curable STI is summarized by the CDC US Preventive Service Task Force (USPSTF) in 2019. The CDC and USPSTF classify risk groups for *Chlamydia*, *Neisseria gonorrhea*, *Syphilis*, and HIV, respectively, and divide risk groups by sex and specific situation, and recommend screening in each (Table 2). The screening recommendations for each disease are summarized as follows for each disease [6] (See Tables 3, 4, 5).

2.4.1. Chlymadia Trachomatis and Neisseria gonorrhoeae

Table 3
Screening for chlamydia and gonorrhea: summary of recommendations.

Gender	Population	Recommendation	Screening Frequency	Comments
Women	Sexually active <25 y	Screen for chlamydia and gonorrhea	Annually	Screen more frequently for those at increased risk
	Sexually active ≥25 y	No routine screening		Targeted CT/NG screening for women with risk factors
	HIV positive	Screen all HIV positive women up to 64 y of age	Annually	Repeat according to level of risk
	Pregnant	Screen all pregnant women (vaginal, cervical, or urine)	First trimester	Repeat screening in third trimester if at increased risk
Men	Heterosexual men	No recommended routine screening		Targeted screening for CT in high-risk settings
	MSM	CT and GC(Urine)	Annually	Repeat screening every 3–6 mo, as indicated by risk
		CT and GC (rectal)	Annually (if exposed)	
		GC (pharyngeal)	Annually (if exposed)	
	HIV positive	CT and GC(Urine)	Annually	Repeat screening every 3–6 mo, as indicated by risk
		CT and GC (rectal)	Annually (if exposed)	
		GC (pharyngeal)	Annually (if exposed)	

*For women, in addition to vaginal, cevical swab and urine, which were previously performed, pharyngeal and rectal swab must be performed as screening tests.

2.4.2. Syphilis

Table 4
Screening for syphilis: summary of recommendations.

Gender	Population	Recommendation	Screening Frequency	Comments
Women	Pregnant women	Screen at first prenatal visit	Every Pregnancy	Use RPR Retest early in the third trimester and at delivery if at high risk
	Sexually Active	No routine screening		Targeted screening for women with risk factors
	HIV positive	Screen all women up to age 64	Annually	May screen more often depending on risk factors
Men	Heterosexual men	No routine screening		Targeted screening in high-risk settings or risk factors
	MSM	Screen if sexually active	Annually	Repeat screening every 3 mo, as indicated by risk
	HIV positive	Screen	Annually	Repeat screening every 3 mo, as indicated by risk

2.4.3. Human Immunodeficiency virus

Table 5
Screening for human immunodeficiency virus: summary of recommendations.

Gender	Population	Recommendation	Screening Frequency	Comments
Women	Nonpregnant sexually active 13–65 years old	One-time screening	Once	Consider screening more frequently if at increased Risk
	Pregnant women	Screen at first prenatal visit	Every pregnancy	Repeat testing in the third trimester if increased risk of HIV
Men	Sexually active heterosexual men 13–65 years old	One-time screen	Once	Consider screening more frequently if at increased Risk
	MSM	Screen	Annually (if sexually active)	Screen more often if more than one partner since most recent HIV testing

2.5. Another important issue is that "Which STIs we should impose the weight"

There are many defined STIs in the literatures. The common pathogens or diseases are bacterial vaginosis, Chlamydia trachomatis (CT), genital herpes, Neisseria gonorrhoeae (NG), hepatitis B and C viral infections, human papillomavirus, HIV/AIDS, pubic lice, syphilis, and Trichomonas vaginalis (TV) [29]. The three pathogens (CT, NG, TV) are very well known organisms for male urethritis.

Today, we can definitively add on Mycoplasma genitalium as a urethritis pathogen as in the USA CDC classification as one of the definitive pathogens of male urethritis, while there are many disputes that the Ureaplsma pavum or Ureaplasma urealyticum can be pathogens for urethritis [30–33]. In a review article recently published in the Europe STI guideline Editorial Board [34], Mycoplasma genitalium is a definite pathogen of male urethritis. Other Mycoplasma hominis, Ureaplasma urealyticum, and Ureplasa parvum are difficult to see as 'true STI', Routine testing in both symptomatic and asymptomatic men and women is not recommended.

In the urology area, urethritis can be performed as a confirmation test, and in the obstetrics area, vaginitis can be mainly targeted for examination, and these diseases can be said to be curable. So, from the next paragraph, we will examine various test methods for Tricomonas/Chlamydia trachomatis/Neisseria gonorrhoea/Mycoplasma genitalium.

3. Diagnostic methods for urethritis pathogens

We need valid laboratory assays to confirm STIs from the symptomatic patients, to detect infections in asymptomatic high STIs risk individuals, and to investigate the cases of resistance to empirical treatment or to monitor the changes of antibiotics resistance patterns. The ideal diagnostic methods for STIs must be simple to perform, highly sensitive and highly specific, reproducible, rapid, and inexpensive. There may be differences between tests performed for diagnosis and tests for screening. The urethral swab was not recommended to avoid pain for screening, but urethral swab is essential for diagnosis. In addition, cervical swab should be performed for women, and recently, rectal swab or pharyngeal swab is also required depending on the situation. However, there is no one rule for covering all pathogens.

Medical practitioners must understand the feasibility and weakness of each test for each pathogen within their national ability or budget. In recent years, new methods have been developed, using molecular biology techniques. Even though the newly developed NAATs meet the criteria of optimal test for STIs, they also some disadvantages for general use in Asian countries. Additionally, we must understand the limitation of not validated in-house NAATs in Asian markets. Furthermore, the genetic sequence mutations in the target area are a critical issue or serious limitation for NAATs [35]. Interestingly, some old fashioned tests are still valid and used as a gold standard for detecting the STIs pathogens.

Table 6
Diagnostic methods for Trichomonas vaginalis.

	Wet smear	Culture	NAAT
Sensitivity	38–82%	98%	Unknown
Specificity	100%	100%	Unknown
Sample	Urethral discharge	Urethral discharge	Urethral discharge Urine
Target	Motile *Trichomonas*	*Trichomonas*	DNA
Advantage	Rapid	Sensitive	Viable or non-viable Extremely sensitive Variable samples
Disadvantage	Very low sensitivity	Takes 3–4 days	Require expertise Amplification inhibitors
Performance	Easy	Easy	Extensive
Cost	Cheap	Cheap	Expensive

3.1. Trichomoniasis

3.1.1. Direct microscopic examination

Direct microscopic examination by medical exporters is made from a swab or urethral discharges. One drop of a physiological saline is placed into a sample on slide and immediately examined under a light microscope (×100).

3.1.2. Culture

A swab of secretions is taken from the urethral orifice within 6 h of sample collection to inoculate a tube of Diamond's modified medium. The culture is incubated at 35 °C for 3–4 days with daily examination by wet prep for motile trichomonas. Recently, a culture system with a two-chambered bag is available [36].

3.1.3. NAAT

Even though some assays are commercially available, the feasibility has not scientifically evaluated (Table 6).

3.2. Chlamydia trachomatis

3.2.1. Culture

Chlamydia culture is labor-intensive, time-consuming and expensive. It also needs considerable technique to perform. For these reasons, culture techniques are not generally recommended for clinicians. Practically, some national research laboratories may be required for monitoring of antibiotics resistance or genetic mutations.

3.2.2. DFA (Direct immunofluorescence assay)

The urethral secretion is collected with cotton swabs, and rolled on glass slides. Fixed and stained with fluorescein-labelled antibodies for major outer membrane protein of CT.

The stained CT can be detected with immunofluorescence microscopy by the trained person.

3.2.3. EIA (Enzyme immunoassay)

The common target of EIA for diagnosing the CT is chlamydial genus-specific lipopolysaccharide (LPS) antigen. Because of sharing the structure of LPS in chlamydial genus or other Gram-negative bacteria, blocking process are needed for enhancing the specificity. The basic equipments for successful performance are commercial kits by certain companies and a microwell plate reader.

3.2.4. Rapid test

The main advantage for rapid test is simple and rapid in chlamydial detecting process. In addition, rapid detection and onsite treatment can be an ideal method to stop spreading the infection. However, major drawback of this test is very lower sensitivity. Furthermore, the cost for doing the test is expensive. For these reasons, we do not recommend the test for diagnosing chlamydia infection before.

Recently, the shortcomings of rapid test have been improved a lot recently. In addition, the time required to check the results of the NAAT test is drastically reduced, showing a speed that does not deteriorate compared to the rapid point-of-care test. In particular, in the case of the Point-of-Care test, it is said that it can be used when it is necessary to quickly check the result in many literatures, etc. by supplementing the low sensitivity and dramatically shortening the time to check the test result. But As rapid NAAT tests have recently come out with improved sensitivity, NAATs such as Gene Xpert have been recommended as rapid tests. However, rapid test are still not thought to be effective for diagnosing chlamydia in men of reproductive age and nonpregnant women because of a high false-negative rates [37].

3.2.5. NAAT

Today, the NAAT for CT is a newly developed gold standard for detecting the infection. While the major disadvantage of the NAAT is a complicated procedure, requiring training or expertise for successful operation; today, the drawback has been solved with a semi or full automated format. With high sensitivity for detecting the organisms, we can use various clinical samples such as urine, tampons, swabs, and direct smeared samples. With the multiple targeting ability, we can detect many STIs pathogens in one sample. However, we still consider the disadvantages of NAATs for molecular diagnosis of STIs. First of all, the cost is very expensive for routinely performing in under middle- or low-income countries. Second, we must consider the technical failure with amplification inhibitors and cross-over contamination. Finally, if genetic mutation in the targeted area happens during genetic evolution, we cannot detect the infection with NAATs system (Table 7).

Table 7
Diagnositc methods for Chlamydia trachomatis.

	DFA	EIA	Rapid	NAAT
Sensitivity	80–85%	60–80%	52–85%	Unknown
Specificity	99–100%	97–99%	>95%	Unknown
Sample	Urethral discharge	Urethral discharge	Urethral discharge	FVU, urethral discharge, swab (cervical, urethral, vulvovaginal, anal, conjunctival, pharyngeal).
Target	Chlamydia LPS Chlamydia MOMP	Chlamydia LPS Chlamydia MOMP	Chlamydia LPS Chlamydia MOMP	DNA
Advantage	Rapid	Rapid	Rapid	Viable or non-viable Extremely sensitive Variable samples
Disadvantage	Require expertise Fluorescent microscope	Require expertise Microwell plate	Insensitive Expensive	Require expertise Amplification inhibitors
Performance	Moderate expensive	Moderate	Easy	Extensive
Cost	Cheap	Cheap	Expensive	Expensive

3.3. Neisseria Gonorrhoea

3.3.1. Gram staining

A direct Gram staining on the urethral discharge and examining under an oil immersion (×1000) has been a traditional laboratory test for NG detection. The presence of Gram-negative diplococcic inside polymorphonuclear leukocytes is a significant diagnostic criteria for NG infection. The main advantages of Gram staining are rapid and inexpensive. This is the first recommended evaluation test for the male urethritis.

3.3.2. Culture [38]

Inoculating the urethral secretion on NG selective media such as Thayer-Martin or blood agar plate is the next step after a direct Gram smear. Typical colonies are tested with Gram-stain, oxidase and catalase and/or superoxal tests for presumptive identification of NG. Additionally, the minimal inhibitory concentration (MIC) of antibiotics such as cefixime, ceftriaxone, fluoroquinolone, azithromycin, spectinomycin and et al. are determined to establish the antimicrobial susceptibility of the strain.

3.3.3. NAAT

The NAATs systems are designed to combo types for detecting NG and CT. Target genes are both DNA and RNA, and the molecular techniques are polymerase chain reaction (PCR) and ligase chain reaction (LCR). However, in the case of transcription-mediated amplification

Table 8
Diagnostic methods for Nesisseria Gonorrhoea [14].

	Gram smear	Culture	NAAT
Sensitivity	90–95%	81–100%	98–100%
Specificity	95–100%	100%	98–100%
Sample	Urethral discharge	Urethral discharge swab as for NAAT	specimen: swab urethral, cervical, vulvovaginal, anal, conjunctival, pharyngeal, FVU
Target	Gram-negative diplococci in PMN	N. gonorrhoeae	DNA RNA
Advantage	Rapid, inexpensive	Drug resistance	Viable or non-viable Extremely sensitive Variable samples
Disadvantage	Lower sensitive in asymptomatic people	Stringent handling requires up to 3 days	Require expertise Amplification inhibitors
Performance	Easy	Moderate	Extensive
Cost	Cheap	Cheap	Expensive

*TOC: clinical/culture 3–7 days post treatment; NAAT 2 weeks post treatment.
*During menstruation, intracervical swabs for culture are more reliable.

(TMA) testing during NAAT, the target is pathogen RNA [39]. Please see the section of Chlamydia trachomatis for understanding advantages and disadvantages.

3.3.4. Antibiotics-resistance NG

Recently, interest in gonorrhea has been increasing worldwide. This not only increases the incidence, but also reports the appearance of ceftriaxone resistant organisms and treatment failure. Therefore, in the case of NG, the need for culture and antimicrobial susceptibility testing is increasing. It is not necessary to perform this in all countries and in allregions, but in countries where resistant strains have been reported, culture and susceptibility tests may be helpful in treatment [15]. In these areas, if necessary, diagnostic culture is appropriate for endocervical, urethral, rectal, oropharyngeal and conjunctival specimens but not for urine or vaginal swabs. Ideally, all gonococcus-positive individuals diagnosed by NAAT should have cultures performed before initiation of gonorrhoea treatment to permit antimicrobial resistance (AMR) testing and surveillance to be performed. Selective culture media containing antimicrobials such as vancomycin, colistin, nystatin, and trimethoprim are recommended (Table 8).

3.4. Mycoplasma genitalium [31]

Only culture and NAAT method can detect the organism for diagnosis of this infection. However, unfortunately, the culture method is very difficult, time-consuming, and expensive. In addition, while there are many NAATs methods for detecting the organism, we do not have authorized commercial kits to diagnose the infection [27]. Mycoplasma genitalium has ability for genetic mutation under evolutional pressure. One of frequent mutation sites is determining areas for antimicrobial resistance. For this reason, we must consider unique national laboratory research center for tracking the mutation and antimicrobial susceptibility. If it is not available due to either some technical problems or national medical budget problems, we can consider one or two Asian reference centers.

4. How to evaluate the male urethritis patient? [40,41]

4.1. Symptomatic patients

All male patients with urethral discharge must examine the gonococal infection. The first step is a Gram smear that is simple and rapid test. If Gram-negative diplococci in PMN cells are detected, we should do Neisseria Gonorrhoea culture. NAATs can be available to detect STIs from various samples. If NAATs test are positive in gonococal infection, we must do Neisseria Gonorrhoea culture.

4.2. Asymptomatic people or risk groups

Screening tests for STIs can be indicated in pregnant women, sexually active adolescents, persons in correction facility, homeless adolescents, and sex workers. While they have not shown symptoms, the risk of vertical STIs infection transmission is underestimated. In addition, the potential risk of STIs core groups for spreading the infections into bridging people must be considered.

Even among the at-risk groups, syphilis screening, including rapid syphilis testing, will be necessary for all pregnant women in middle-income and low-income counties.

To establish good Asian STIs guideline, we must consider the heterogeneous characteristics of Asian countries, and the draft must be reviewed by wide spectrums of national specialists to adjust their performance. In near future, we should set up regional or international central laboratories to support the diagnosis and treatment of STIs.

5. Conclusion

Sex is essential component of all human. But more than 1 million sexually transmitted infections occur every day. Diagnosis of disease is important for both treatable and non-curable diseases. Whether it is a confirmation test or a screening test should be applied differently according to the socioeconomic status of each region or country, and where the focus is placed will also vary. Early diagnosis and early treatment are also important for STI. Also, STI is a simple not only national problem, but also regional and worldwide.

Declaration of competing interest

None of authors have any conflict of interests.

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Abbreviations

WHO	World Health Organization
STD	Sexually Transmitted Disease
STI	Sexually Transmitted Infection
TV	Trichomonas Vaginalis
CT	Chlamydia Trachomatis
NG	Neisseria Gonorrhoeae
HSV	Herpes Simplex Virus
HPV	Human Palilloma Virus
HIV	Human Immunodeficiency Virus
USPSTF	U.S. Preventive Service Task Force
CDC	Center for Disease Control and Prevention
MIC	minimal inhibitory concentration
PCR	polymerase chain reaction
LCR	ligase chain reaction

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