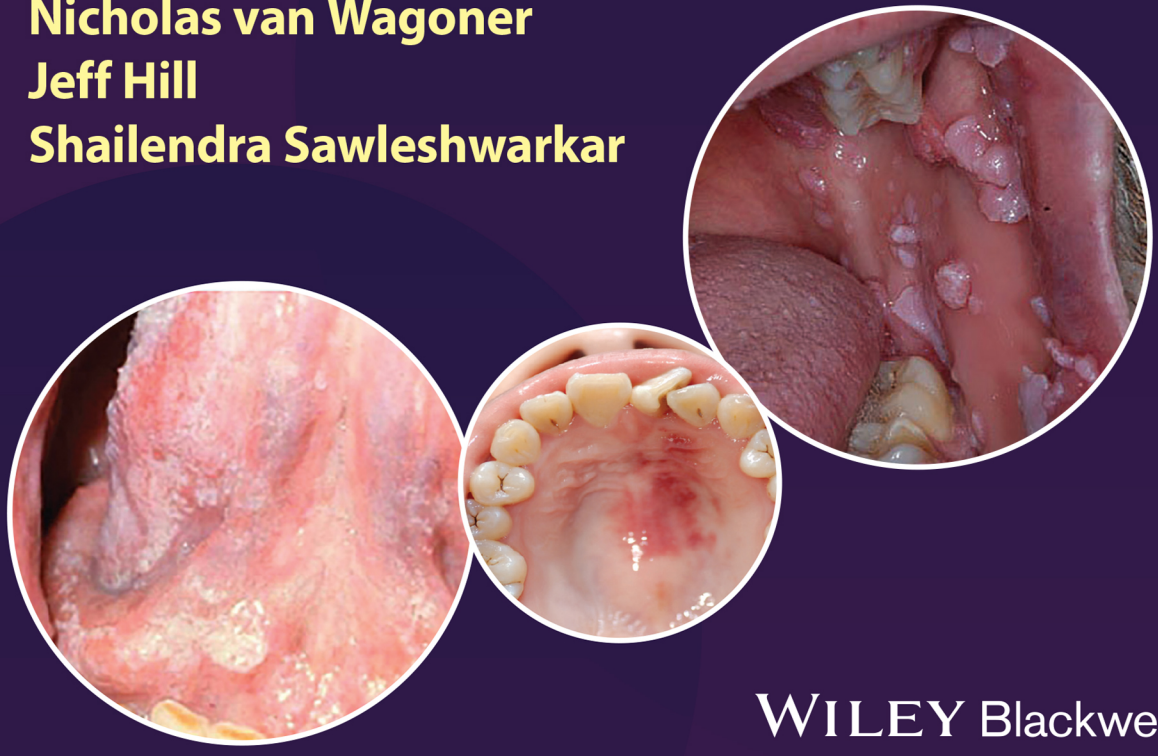
Sexually Transmissible Oral Diseases

Editor

S.R. Prabhu

Section Editors

Nicholas van Wagoner
Jeff Hill
Shailendra Sawleshwarkar



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Editor:

S.R. Prabhu
BDS; MDS (Oral Path); FFDRCSI (Oral Med) FDSRCS(Eng); FDSRCS(Edin); FDSRCPS (Glas); FFGDPRCS(UK); FICD
Honorary Associate Professor, University of Queensland, School of Dentistry, Brisbane, Australia

Section Editors:

Nicholas van Wagoner, MD; PhD
Associate Professor of Medicine, Department of Infectious Diseases, UAB Heersink School of Medicine, Birmingham, Alabama, USA

Jeff Hill, DMD
Professor of Restorative Sciences, UAB School of Dentistry and Director HIV/AIDS Dental Clinic, Department of Infectious Diseases, UAB Heersink School of Medicine in Birmingham, Alabama, USA

Shailendra Sawleshwarkar, MD; PhD
Associate Professor, Sexual Health, Sydney Medical School, Faculty of Medicine and Health, The University of Sydney, Sydney, Australia

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To Victims of Covid-19 pandemic and all those frontline healthcare workers who are engaged in the fight against the disease with utmost dedication and courage

Contents

Foreword

It is a pleasure and a delight for me to pen this message for the inaugural edition of the '*Sexually Transmissible Oral Diseases*' edited by Professor Prabhu.

Even from ancient times it was known that sexually transmitted diseases (STDs) manifested in the mouth. For instance, syphilis and its gummatous manifestations of the oral cavity were known even during Roman times, though the infectivity and presentation of other STDs such as papilloma virus infections leading to oral cancers were a relatively recent finding. These and a plethora of other STDs well described in the book, are now known to manifest intraorally. This comprehensive compendium which brings together the relevant details of all such diseases in a practical, comprehensive and an easily assimilable format, in a single tome is likely to be a wellspring of information for dental practitioners, undergraduate students and postgraduates alike.

The book is timely from three different perspectives. First, due to the sexual promiscuity and the rampant narcotic and drug abuse, there has been an alarming increase in STDs particularly gonorrhoea and syphilis, mainly in the developing world. Second, the gradual realisation that oral health is a key to systemic health, and the importance of the oral-systemic axis by the health professions in general, and finally, the fundamental conceptual realisation that dentists are not only oral surgeons but also oral physicians who are able to advice, diagnose, care and prevent systemic diseases through a number of avenues available to them including the rapidly developing field of salivomics. Such expanded repertoire of dentistry means a deeper understanding of aetiopathogenesis of common STDs, and hence, this book will be a welcome addition to the libraries of all dental practitioners and dental schools.

In closing, I wish to congratulate the team led by Professor Prabhu, for this excellent initiative that fills a relatively big void in the oral medicine and pathology literature and

wish the book the success it so well deserves. It will be essential reading for all young practitioners, in particular, who will step into a transformative world where dentists play a key role in delivering general as well as oral healthcare.

Lakshman Samaranayake
DSc (hc), FRCPath, DDS (Glas), FDSRCS (Edin), FRACDS,
FDS RCPS, FHKCPath, FCDSHK
Professor Emeritus (Microbiomics),
and Immediate-past Dean
Faculty of Dentistry, The University of
Hong Kong, Hong Kong
Editor-in-Chief, International *Dental Journal of*
the FDI World Dental Federation

May 2022

Preface

Oral manifestations are a common feature of some sexually transmitted diseases (STDs). In such situations, the majority of patients have no knowledge of the possible link between underlying sexually acquired diseases and their presenting oral signs or symptoms. It is also likely that dental practitioners who treat these patients lack adequate knowledge of links between the underlying diseases and their oral presentation. It is important, therefore, that dental practitioners have adequate knowledge of the nature of STDs, their clinical presentations, progression, and impact upon oral and systemic health. They will need, in consultation with the patient's physician, to provide appropriate management of the oral condition.

The extant literature contains a number of case reports and review articles dealing with oral manifestations of some STDs but a single source that provides a comprehensive account of oral manifestations of a wide range of these diseases is not available. Textbooks on oral diseases and on oral medicine do not always deal with STDs in detail. *Sexually Transmissible Oral Diseases* aims to fill this gap by providing oral healthcare providers with a single source designed to be useful in everyday practice. The main purpose of this book is to improve competence of dental practitioners in the recognition and management of oral manifestations of STDs. The book is structured to help dental and medical practitioners work closely, with a holistic approach, in caring for their patients.

This book has 18 chapters grouped in three sections. The first provides an overview including the global STD burden, its impact of on public health and the role of healthcare professionals in the prevention of STDs. Section 2 deals with oral and genital mucosa with respect to their structure and associated microbiota, and highlights the impact of risky sexual behaviours such as oral sex on oral and general health. Section 3 provides detailed information on the oral manifestations of sexually transmissible diseases and those opportunistic infections and neoplasms commonly encountered in human immunodeficiency virus (HIV) disease. Though oropharyngeal infectious mononucleosis and oral candidosis are not primarily sexually transmitted, they are included in Section 3 because of their frequent co-presentation.

We believe this book is the first of its kind targeted at oral healthcare professionals worldwide. This multi-author work has contributors drawn from many parts of the world with expertise in infectious diseases, community medicine, sexual health, dermatology, oral pathology, microbiology and clinical oral medicine. Editor, section editors and chapter contributors hope that this publication will contribute to the missions of global organisations such as the FDI World Dental Federation, the World Health Organisation, Centres for Disease Control and Prevention, and the International Association of Dental Research in promoting health through oral health.

We believe that this publication is a timely addition to the world's dental and medical literature and will be of value to dentists, oral health therapists, dental hygienists, undergraduate and postgraduate dental students, medical practitioners, dermatologists and other healthcare providers.

May 2022

Editor:
S.R. Prabhu, Brisbane
Section Editors:
Nicholas van Wagoner, Alabama
Jeff Hill, Alabama
Shailendra Sawleshwarkar
Sydney

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I wish to acknowledge the unconditional support offered by my wife, Uma Prabhu, during the Covid-19 work from home period during which a significant part of this book was carried out.

May 2022

S.R. Prabhu
Editor

List of Contributors

Amanda Oakley
Dermatologist
Waikato District
Health Board and Adjunct
Associate Professor
Department of Medicine
University of Auckland
New Zealand

Ana L.O.C. Roza
Department of Oral Diagnosis
Piracicaba Dental School
Universidade Estadual de Campinas
Piracicaba
Brazil

Andrea B. Moleri
Department of Oral Medicine
School of Dentistry
Universidade Federal Fluminense
Niterói
Brazil

Anura Ariyawardana
Associate Professor
School of Medicine and Dentistry
Griffith University, Gold Coast
College of Medicine and Dentistry
James Cook University, Cairns
Clinical Principal
Metro South Oral Health
Queensland Health, Brisbane
Australia

Chythra R. Rao
Associate Professor
Department of Community Medicine
Kasturba Medical College
Manipal
India

David H. Felix
Postgraduate Dental Dean and
Director of Dentistry
NHS Education for Scotland
Edinburgh and Honorary Professor
School of Medicine Dentistry and Nursing
University of Glasgow
UK

Henry Fan
Menzies Health Institute Queensland &
School of Medicine and Dentistry
Griffith University
Gold Coast
Australia

Jeff Hill
Professor of Restorative Sciences
UAB School of Dentistry and Director
HIV/AIDS Dental Clinic
Department of Infectious Diseases
UAB Heersink School of Medicine in
Birmingham, Alabama
USA

Jeremy Lau
Registrar Oral Medicine
University of Western Australia
Dental School
Perth
Australia

Mário J. Romañach
Department of Oral Diagnosis and Pathology
School of Dentistry
Universidade Federal do Rio de Janeiro
Rio de Janeiro
Brazil

Newell W. Johnson
Professor Emeritus
Menzies Health Institute Queensland &
School of Medicine and Dentistry
Griffith University
Gold Coast
Australia

Nicholas van Wagoner
Associate Professor of Medicine
Department of Infectious Diseases
UAB, Heersink School of Medicine
Birmingham
Alabama
USA

Norman Firth
Adjunct Associate Professor
University of Queensland School of Dentistry
Brisbane, Australia
and
Oral Medicine Specialist Capital and Coast District Health Board
Wellington
New Zealand

Pallavi Hegde
Senior Resident
Department of Dermatology
Kasturba Medical College
Manipal
India

Raghavendra Rao
Professor and Head
Department of Dermatology
Kasturba Medical College
Manipal
India

Ramesh Balasubramaniam
Associate Professor
University of Western Australia
Dental School
Perth
Australia

S.R. Prabhu
Honorary Associate Professor
University of Queensland
School of Dentistry
Brisbane
Australia

Samuel Sprague
Menzies Health Institute Queensland &
School of Medicine and Dentistry
Griffith University
Gold Coast
Australia

Shailendra Sawleshwarkar
Associate Professor
Sexual Health, Sydney Medical School
Faculty of Medicine and Health
The University of Sydney
Sydney, Australia

Sue-Ching Yeoh
Oral Medicine Specialist
The Chris O'Brien Life house
Camperdown NSW
Australia

Sujitha Reddy
Junior Resident
Department of Dermatology
Kasturba Medical College
Manipal
India

Vidya Pai
Professor
Department of Microbiology
Yenepoya Medical College
Mangaluru
India

Vijayasarathi Ramanathan
Lecturer in Sexual Health
Faculty of Medicine and Health
The University of Sydney
Sydney
Australia

Yasmin Hughes
Registrar, Western Sydney Sexual Health Centre
Western Sydney Local Health District
Parramatta
New South Wales
Australia

Glossary

Ab	antibody
Ag	antigen
AIDS	Acquired immune deficiency syndrome
ALT	alanine aminotransferase or alanine transaminase
ANA	antinuclear antibody
Anilingus	oro-anal sex
Anti-HAV IgM	antibody to HAV IgM – signifies recent exposure to HAV
Anti-HAV IgG	antibody to HAV IgG – signifies past exposure to HAV or successful vaccination
Anti-HBIgM	antibody to hepatitis B core antigen – signifies recent exposure to HBV
Anti-HBc IgG	antibody to hepatitis B core antigen – signifies past exposure to HBV
Anti-HBe	antibody to hepatitis Be antigen
Anti-HBs	antibody to hepatitis B surface antigen - associated with non-replicative phase or successful vaccination
Anti-HCV	antibody for HCV – indicates infection with HCV has occurred
Anti-HDV	IgG and IgM antibody to the hepatitis D virus
APTT	activated partial thromboplastin time
ART	antiretroviral therapy
ASMA	anti-smooth muscle antibody
AST	aspartate aminotransferase
AZT	azidothymidine, also called zidovudine
B-cell	a type of immune cell
Balanitis	inflammation of the glans penis
Balanoposthitis	vinflammation of the glans penis and the prepuce (foreskin)
BBV	blood-borne virus
BCG	Bacille Calmette-Guerin (tuberculosis vaccine)
Bd	bid twice daily

BV	bacterial vaginosis, a common complex syndrome resulting in a change in the vaginal ecosystem with raised vaginal pH; often asymptomatic but sometimes associated with an abnormal vaginal discharge
CAH	chronic active hepatitis
cART	combination antiretroviral therapy
C & S	culture and sensitivity
CCR5	chemokine co-receptor on the surface of cells which may be used in HIV-cell fusion CD4 cell a helper T-cell which carries the CD4 surface antigen. CD4 cells are the primary target of HIV and CD4 cell numbers decline during HIV disease
CD8	cell a killer or cytotoxic T-cell which carries the CD8 surface antigen
Chancre	the painless ulcer of primary syphilis
Chancroid	a tropical STI caused by *Haemophilus ducreyi*
CIN	cervical intraepithelial neoplasia
Circumcision	removal of the prepuce (foreskin)
CMV	cytomegalovirus
Condylomata acuminata	genital warts
Condylomata lata	moist warty growths occurring in perineum in secondary syphilis
Contact tracing	the following-up, diagnosis and (where possible) treatment of all sexual partners of a patient infected with an STI. Also called 'partner notification'
CRP	C-reactive protein
CT	computed tomography
Cunnilingus	oral sex – mouth to vulva
DGI	disseminated gonococcal infection
DILI	drug-induced liver injury
Dipping	vaginal or anal sex without a condom for varying periods of time prior to ejaculation, i.e. the condom is only applied when the insertive partner is getting near ejaculation
DNA cccDNA	deoxyribonucleic acid covalently closed circular DNA
Donovanosis	a rare STI of great chronicity causing considerable destruction of genital structures if untreated.
DRE	digital rectal examination
EBV	Epstein–Barr virus
EIA	enzyme immunoassay: an immunoassay in which an enzyme, such as a peroxidase is used as a marker to indicate the presence of specific antigens or antibodies (as in treponemal EIA, a specific serological test for syphilis)
ELISA	enzyme linked immunosorbent assay
Epididymo-orchitis	inflammation of epididymis primarily, spreading secondarily to testis

FBC	full blood count
FDA	US Food and Drug Administration
Fellatio	oral sex – mouth to penis
Fisting sexual act	where fist and forearm are inserted into vagina or ano-rectum
Fomites materials	(e.g. towels, sheets etc) which, once contaminated with a microbiological or virological agent, allow transmission of that infection to another individual
FTA-ABS	fluorescent treponemal antibody absorbed serology test, a specific serological test for syphilis
Genital herpes	infection of ano-genital region with sexually transmitted HSV-1 or HSV-2
Genital warts	exophytic clinical manifestation of sexually transmitted ano-genital HPV infection
GGT	gamma glutamyl transferase
GI	gastrointestinal
GIT	gastrointestinal tract
GP	general practitioner
gp120	glycoprotein on the surface of HIV which binds to the CD4 receptor
gp41	glycoprotein on the surface of HIV involved in fusion between HIV and the CD4 cell
GUD	(ano)-genital ulcerative disease
HAART	highly active antiretroviral therapy
HAV	hepatitis A virus
HAVAb	hepatitis A antibody test (IgM or IgG)
HBcAb	see anti-HBc
HBcAg	hepatitis B core antigen
HBeAb	see anti-HBe
HBeAg	HBV 'e' antigen – a marker of viral replication and infectivity
HBIG	hepatitis B immunoglobulin
HBsAg	hepatitis B surface antigen – a marker of current infection which persists in individuals who become carriers
HBsAb	see anti-HBs
HBV	hepatitis B virus
HCC	hepatocellular carcinoma
hCG	human chorionic gonadotropin
HCV	hepatitis C virus
HDV	hepatitis D virus
HHV-8	human herpesvirus-8 – associated with Kaposi's sarcoma
HIV	human immunodeficiency virus
HPV	human papillomavirus
HSIL	high grade squamous intraepithelial lesion
HSV	herpes simplex virus

HVS	high vaginal swab
IDU	injecting drug user
IFN	interferon
Ig	immunoglobulin
INR	international normalised ratio – a test of blood clotting
IRIS	immune reconstitution inflammatory syndrome
IV	intravenous
IVD	*in vitro* diagnostic medical devices
IU	international unit(measurement)
KS	Kaposi's sarcoma
Latency	the situation where an infection enters a quiescent asymptomatic phase and is only detectable by appropriate testing
LFT	liver function test
LGV	lymphogranuloma venereum - a tropical STI caused by *C. trachomatis* serovars L1–L3, now becoming endemic among highly sexually active men who have sex with men
LSIL	low grade squamous intraepithelial lesion
µl	microlitre
ml	millilitre
mmol	millimole
MRI	magnetic resonance imaging
MSM	men who have sex with men
NAAT	nucleic acid amplification test
NNRTI	non-nucleoside reverse transcriptase inhibitor
NPEP	non-occupational post-exposure prophylaxis
NRTI	nucleoside / nucleotide reverse transcriptase inhibitor
NSU	nonspecific urethritis - urethritis where exhaustive laboratory testing fails to find a specific cause (a non-gonococcal, non-chlamydial, non-herpetic, non-trichomonal urethritis)
OCP	ova, cysts, and parasites - looked for on microscopy of faecal specimens
OI	opportunistic infection
Oral sex	use of the mouth in sexual activity (i.e. anilingus, cunnilingus or fellatio)
p24	a core HIV protein
Pathogenicity	the ability of a micro-organism to cause disease in its host
PCP	Pneumocystis pneumonia, also known as Pneumocystis jiroveci pneumonia
PCR	polymerase chain reaction
PEP	post-exposure prophylaxis
pg/ml	picogram per millilitre
PH	primary HIV infection
PI	protease inhibitor

PID	pelvic inflammatory disease
Pili	hair like appendages found on the surface of some bacteria (especially *N. gonorrhoeae*)
PMTCT	preventing mother-to-child transmission of HIV
POCT	point of care testing
PrEP	pre-exposure prophylaxis
Prepuce	foreskin
Proctitis	inflammation of rectal mucosa
Pubic lice	an infestation of body and pubic hair caused by *Pthirus pubis*, usually sexually transmitted in adults
PWID	people who inject drugs
Qd	once daily
Qds, qid	four times daily
RF	rheumatoid factor
Rimming	anilingus, oro-anal sex
RNA	ribonucleic acid
RPR	rapid plasma reagin test – a non-specific quantitated serological test for syphilis
RT	reverse transcriptase
Scabies	skin infestation caused by Sarcoptes scabiei, often sexually transmitted in adults
Screening	testing for the presence of an asymptomatic condition in an apparently healthy individual
Seroconversion	process whereby a serological test for a given microbiological or virological agent changes from non-reactive to reactive, coinciding with recent infection
Serology	diagnostic identification of antibodies (usually), sometimes antigens, in serum
Serovar	group of closely related microorganisms distinguished by a characteristic set of antigen
STI	any infection which is mainly transmitted from one individual to another by sexual activity

Section 1

Sexually Transmitted Diseases: A Global Issue

1

Sexually Transmitted Diseases: An Overview

Yasmin Hughes[1] *and Shailendra Sawleshwarkar*[2]

[1]*Western Sydney Sexual Health Centre, Western Sydney Local Health District, Parramatta, New South Wales, Australia*
[2]*Sexual Health, Sydney Medical School, Faculty of Medicine and Health, University of Sydney, Sydney Australia*

Introduction

Sexually transmitted infections (STIs) spread predominantly by sexual contact, including vaginal, anal and oral sex. Some STIs can also be transmitted from mother to child during pregnancy, childbirth and breastfeeding. The World Health Organisation (WHO) report reveals that more than 30 different bacteria, viruses and parasites are known to be transmitted through sexual contact. Eight of these pathogens are linked to the greatest burden of sexually transmitted disease (STD). Of these STIs, bacterial infections such as syphilis, gonorrhoea, chlamydia and trichomoniasis, a protozoal infection, are currently curable, whereas viral infections such as herpes simplex virus (HSV), human immunodeficiency virus (HIV), human papilloma virus (HPV) and hepatitis B virus infections are incurable [1].

Diagnosis of STIs requires a detailed history, thorough clinical examination, and appropriate investigations. Since many STIs are asymptomatic, screening for common STIs in at-risk populations, regardless of symptoms, is important for STI control and to prevent onward transmission.

Bacterial STIs

Syphilis

Syphilis is an STI caused by the spirochete bacterium, *Treponema pallidum*. The spirochete is transmitted by direct contact with an infectious lesion, gaining access through microabrasions in the skin during vaginal, anal and oral sex. Syphilis earned the name of 'the great imitator' due to its vast array of clinical presentations, including many oral manifestations, which may mimic other conditions. The infection progresses through clinical stages,

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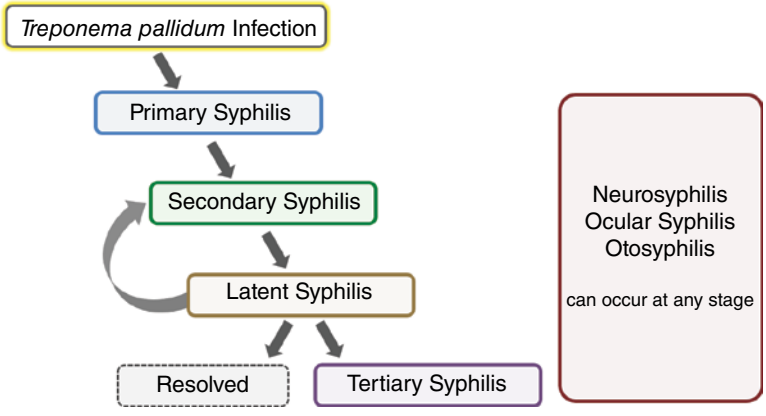

Figure 1.1 Natural history and clinical staging of syphilis. Source: Reproduced with permission from Spach and Mirchandani [2].

known as primary, secondary, latent and tertiary syphilis (Figure 1.1) [2]. The primary, secondary and tertiary phases have all been associated with oral lesions. It is therefore prudent for oral health practitioners to be familiar with the natural history of this infection and its associated oral manifestations.

Epidemiology

Syphilis continues to cause morbidity and mortality worldwide. WHO estimates that 7.1 million new cases of syphilis occurred among adolescents and adults aged 15–49 years worldwide in 2020 [1, 3].

Bacteriology, Risk Factors and Transmission

The etiologic agent in syphilis is *T. pallidum*. *Treponema* belongs to the spirochete class and is a corkscrew-shaped, motile microaerophilic bacterium that requires a live rabbit-model system for culture and cannot be viewed by normal light microscopy. This spirochete bacterium is thin (0.1–0.18 μm in diameter) and 6–20 μm in length with typical corkscrew motion on dark-field microscopy (Figure 1.2) [2, 4].

The major routes of transmission for *T. pallidum* are sexual (during the primary and secondary stages of syphilis) and haematogenous (in utero via transplacental spread to a foetus) [2, 5]. During sexual transmission, *T. pallidum* enters the body via breaches in skin and mucous membranes. Although sexual transmission of *T. pallidum* usually results from contact at genital mucous membranes, it can also occur at other body areas, including the mouth, anorectal areas and cutaneous lesions. Maternal transmission predominantly occurs via transplacental passage of *T. pallidum* during maternal spirochetemia; less often, transmission can occur if the newborn has contact with maternal genital lesions at the time of delivery [2, 5].

Clinical Features

Primary Syphilis

Primary syphilis occurs around the time of initial infection with *T. pallidum* when it penetrates the mucosa, forming an infectious lesion, the chancre, at the site of inoculation within 9–90 days. The lesion is typically a painless, but may be painful, firm, round

Figure 1.2 *Treponema pallidum*: dark-field microscopy. This photomicrograph shows the typical spiralled 'corkscrew' appearance of several *T. pallidum* spirochetes with the dark-field microscopy technique. Source: Renelle Woodall, 1969, Center for Disease Control (CDC) – PHIL/Public domain.

indurated ulcer lasting from approximately three to seven weeks, which heals without scarring. They may be single or multiple ulcers and occur on the genitalia or other sites of contact such as extra genital sites including the lips, tongue and oral mucosa (see Chapter 12). These lesions are highly infectious and may go unnoticed by the patient before they heal. Left untreated, the infection enters the second stage.

Secondary Syphilis

Within 10 weeks of inoculation, haematogenous and lymphatic spread of the spirochetes may result in clinical features of secondary syphilis, which can affect every system including the central nervous system. Patients with secondary syphilis may present with an array of non-specific features including fever, generalised lymphadenopathy and non-pruritic rash, typically affecting the palms of the hands and soles of the feet. Oral lesions occur in a third of cases of secondary syphilis and can be diverse and non-specific. These include pharyngitis, glistening plaques and oral ulcers [6] (see Chapter 12). The classical lesion, known as the mucous patch, is a shallow, irregular grey-white plaque with an erythematous base. They are usually bilateral, often involving the tongue and may extend to 1 cm in diameter. Snail track ulcers describe multiple mucous patches becoming confluent [6].

Latent Syphilis

Latent syphilis is a stage of syphilis characterised by the persistence of *T. pallidum* organisms in the body without causing signs or symptoms [2]. Clinical signs and symptoms of secondary syphilis may resolve spontaneously, and, if left untreated, the infection enters a latent phase. Patients with latent syphilis typically remain infectious for the first two years of infection, termed early latent, followed by late latent syphilis of variable duration which

is usually non-infectious. While some patients will remain in the latent phase, a third of patients undiagnosed and untreated will enter the tertiary phase, which may occur decades after the initial infection [7].

Tertiary Syphilis

Without treatment, approximately 30% of patients will progress to the tertiary stage at 2–50 years after the original infection [2, 7, 8]. Lesions of tertiary syphilis manifest as locally destructive granulomatous lesions with a necrotic central core affecting the skin, mucous membranes, neural tissue, bone and/or any visceral organ. Oral gummata are rare but may affect the tongue or palate and may range in size to more than 1 cm (see Chapter 12). Perforations of the nasal cavity or the maxillary sinus may complicate palatal gummata [9]. Tertiary syphilis can present as an interstitial glossitis where the tongue appears erythematous with a loss of surface papillae and can become fissured and lobulated [9]. If there is any suspicion of syphilis in a patient presenting for dental care, referral to a medical healthcare provider is necessary. Dental treatment should be deferred, and reasonable infectious disease precautions taken as syphilitic lesions in the first and second stages of disease are highly infectious.

Congenital Syphilis

T. pallidum can be transferred via the placenta from an infected mother to the developing foetus in utero. Untreated syphilis in pregnancy is associated with poor obstetric outcomes including foetal and neonatal death, and congenital syphilis [10, 11]. Clinical manifestations of congenital syphilis include perforation of the hard palate and Hutchinson's triad consisting of interstitial keratitis, vestibulocochlear nerve deafness and Hutchinson teeth. Developmental processes of enamel-forming cells are hindered by *T. pallidum* [12]. Later, formation of the crowns is disrupted, with characteristic semilunar notches on the incisal edges (Hutchinson teeth) [13] (see Chapter 12). Malformation of the enamel of permanent molars results in mulberry molars and doming of the first permanent molars causes Moon's molars. Congenital syphilis may also lead to premature loss of deciduous teeth with resultant delay in speech development and problems with eating [9]. If a child is suspected of having congenital syphilis, referral to a paediatrician with an interest in infectious disease is urgently required.

Diagnosis

Diagnosis of syphilis relies on detailed history, including a sexual history, clinical examination and laboratory investigations. As *T. pallidum* is too fragile for an organism to be cultured, diagnosis is made by direct visualisation of the organism or indirect evidence of infection. For primary chancres, dark ground or dark-field microscopy may be performed, in specialised centres, on exudate obtained from the lesion for direct visualisation of the spirochete. When this is not available, and for cases of secondary syphilis, where lesions are often dry, laboratory diagnosis relies on nucleic acid amplification testing (NAAT) of DNA extracted from infectious lesions and on serological testing of syphilis antibodies. Direct methods have the advantage, in some cases, of detecting infection before a patient has mounted a measurable antibody response that results in a reactive serology result. Serological tests are of two types: treponemal tests and non-treponemal tests. Treponemal tests include

syphilis enzyme immunoassay (EIA), *T. pallidum* haemagglutination (TPHA) or fluorescent treponema antibody (FTA) tests, which are specific for *T. pallidum*. FTA is the most sensitive test for detecting early disease. Treponemal serology remains reactive for life and cannot, therefore, be used to distinguish between new and past infections. Non-treponemal tests include Venereal Diseases Research Laboratory (VDRL) or rapid plasma reagin (RPR) which are non-specific cardiolipin antibody tests. Non-treponemal tests are used to identify reinfection or/and to monitor response to treatment. RPR and VDRL are reported as a 'titre'; a high titre is a marker of disease activity with titres reducing with successful treatment. False-positive test results can occur with non-treponemal tests due to other conditions such as hepatitis, infectious mononucleosis, collagen diseases (e.g. systemic lupus erythematosus), pregnancy or ageing. Gummata of tertiary syphilis are diagnosed by clinical evaluation including biopsy and demonstration of *T. pallidum* using silver staining. Patients with confirmed gumma should be screened for other complications of tertiary syphilis including neurosyphilis, ocular syphilis and cardiovascular complications.

Treatment

Penicillin G, administered parenterally, is the preferred drug for treating all stages of syphilis. The preparation(s) of penicillin used (e.g. benzathine, aqueous procaine or aqueous crystalline), the dosage and the length of treatment depend on the stage and clinical manifestations of the disease [2]. A single intramuscular injection of long-acting benzathine penicillin G (2.4 million units administered intramuscularly) will cure a person who has primary, secondary or early latent syphilis. Three doses of long-acting benzathine penicillin G (2.4 million units administered intramuscularly) at weekly intervals are recommended for individuals with late latent syphilis or latent syphilis of unknown duration [14]. Neurosyphilis as well as ocular and otosyphilis is treated with aqueous crystalline penicillin G 18–24 million units per day for 10–14 days (administered intravenously) [14].

Chlamydia

Chlamydia is an STI caused by the bacterium *Chlamydia trachomatis,* an obligate intracellular pathogen which depends entirely on the host cell's adenosine triphosphate for its energy [15]. The bacterium infects columnar epithelium at mucosal sites. Transmission of *C. trachomatis* occurs during ano-rectal sexual intercourse; however, transmission during oral sex and autoinoculation to cause conjunctivitis can occur.

Epidemiology

Chlamydia is the most prevalent bacterial STI in the world. Based on the STI surveillance from WHO, global estimation of new chlamydia cases in 2020 was 129 million [1, 3].

Aetiology/Risk Factors/Transmission

C. trachomatis is an obligate intracellular bacterium with a cell wall and ribosomes similar to those of Gram-negative organisms [16]. Sexually acquired *C. trachomatis* is highly transmissible with adolescents and young adults at increased risk for infection. Risk factors associated with acquisition of chlamydial infection include recent partner change,

multiple sexual partners, past history of STI and unprotected sexual intercourse. Transmission of *C. trachomatis* can also occur from mother to infant via the genital tract during birth [17].

Clinical Features

C. trachomatis causes a wide range of clinical manifestations and complications, including cervicitis, urethritis, pelvic inflammatory disease (PID), tubal infertility, pelvic pain and perihepatitis in women, and urethritis and epididymo-orchitis in men. Other manifestations in men and women may include conjunctivitis, oropharyngeal infection, proctitis/proctocolitis and reactive arthritis. Infants born to mothers with untreated *C. trachomatis* infection may develop conjunctivitis, pneumonia and urogenital infection [17]. Complications of such as epididymitis and epididymo-orchitis may result in men and PID from untreated ascending infection from the cervix in women. A different serovar of *C. trachomatis* can cause lymphogranuloma venereum, which presents as genital ulceration, lymphadenopathy and/or proctitis.

There are no specific oral manifestations of chlamydial infection, but asymptomatic infection of the throat occurs in those performing oral sex [18]. Oropharyngeal infection with *C. trachomatis* is most frequently asymptomatic in both men and women. It can also present as acute tonsillitis, acute pharyngitis or abnormal pharyngeal sensation syndrome (see Chapter 16). When clinical signs and symptoms are described, the presentation can range from minimally symptomatic disease (i.e. dry or pruritic throat) to exudative tonsillopharyngitis. Chlamydial tonsillopharyngitis is marked by generalised pharyngeal and tonsillar hyperaemia with possible addition of swollen anterior pillars and uvula, as well as diffuse purulent exudate on the tonsils [17].

Diagnosis

The *C. trachomatis* cell wall is unique in that it contains an outer lipopolysaccharide membrane but lacks peptidoglycan, meaning that conventional Gram staining is not useful in its detection. Diagnosis of *C. trachomatis* relies on nucleic acid amplification of DNA detected from anogenital or oropharyngeal specimens using NAAT. In most circumstances, the preferred diagnostic method for chlamydial infection is with a *C. trachomatis* NAAT, on urine samples, rectal and throat samples, clinician-collected endocervical and urethral samples, and self-collected vaginal swabs. Pharyngeal sampling is used to screen those who are at risk of asymptomatic throat infection [17]. The clinical significance of oropharyngeal *C. trachomatis* infection is unclear, and prevalence is low, even among populations at high risk. However, when gonorrhoea testing is performed at the oropharyngeal site, chlamydia test results might be reported because certain NAATs detect both bacteria from a single specimen.

Treatment

The recommended first-line treatment of chlamydial infections in non-pregnant women and all men is with a *doxycycline*, 100 mg twice daily, for seven days, with an alternative treatment option of single-dose *azithromycin* [14].

Gonorrhoea

Gonorrhoea is an STI caused by *Neisseria gonorrhoeae,* a Gram-negative bacterium that infects the columnar epithelium of the lower genital tract, rectum, pharynx and conjunctiva [15].

Epidemiology

In 2020, the WHO estimated the pooled global prevalence of urogenital gonorrhoea to be 0.8% in women and 0.7% in men, and in 2020, there were an estimated 82 million gonorrhoea cases worldwide [3].

Bacteriology, Pathogenesis and Transmission

N. gonorrhoeae is a Gram-negative kidney-bean-shaped coccus bacterium that is divided by binary fission and thus usually appears as pairs (diplococci) (Figure 1.3) [19]. The organism is able to attach itself to epithelial cells via several structures located on its surface, allowing it to infect mucosal surfaces, such as the urogenital epithelium, oropharyngeal tract and conjunctival tissue [20, 21]. It also has several virulence factors that facilitate immune evasion [20, 21]. Infection with *N. gonorrhoeae* generates limited immunity allowing repeated infections in an individual [22]

Transmission of *N. gonorrhoeae* can occur from the urethra in a person with gonorrhoea to the vagina or rectum, the vagina or rectum in a person with gonorrhoea to the urethra in a person without gonorrhoea, anogenital tract of a person with gonorrhoea to the pharynx of a person without gonorrhoea or via oral–genital or oral–anal contact; and from the pharynx of a person with gonorrhoea to the urethra of a person without gonorrhoea during fellatio [19]. Perinatal transmission (from mother to infant) can occur during vaginal delivery when a mother with gonorrhoea has not been treated during the perinatal period.

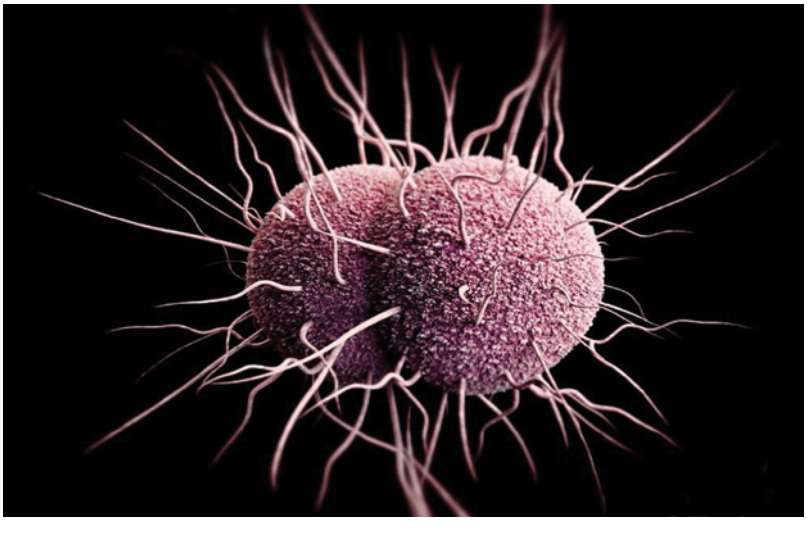

Figure 1.3 *Neisseria gonorrhoeae* [19]. Source: James Archer, 2013, Center for Disease Control (CDC) – PHIL/Public domain.