The information in this booklet is given as a guideline only and is not intended to be exhaustive. It in no way binds bioMérieux S.A. to the diagnosis established or the treatment prescribed by the physician.
**Anatomophysiologial summary**

The genital tract is divided into two compartments:
- **the upper genital tract**, which is bacteriologically sterile,
- **the lower genital tract**, which is continuously contaminated by flora from the skin and digestive tract.

During their genital activity period, the vaginal flora of women is composed of:
- Döderlein flora (Gram + lactobacilli),
- and many other bacterial species from vaginal colonization.

**Vaginal commensal flora**

In the absence of infection, for a woman during the genital activity period, the quantity of bacteria per gram of secretions is $10^6$ to $10^9$.

The isolation frequency of the various species is summarized below:
The vaginal ecosystem is influenced by **hormonal factors** which vary during the major stages of genital life (puberty, pregnancy, menopause, etc.) or are caused by an endocrine disease.

**The vaginal commensal flora is abundant and varied. This makes specimen interpretation particularly difficult when commensal bacteria that have become pathogenic are concerned.**

---

**Female genital infections: pathogenic and clinical aspects**

The analysis of a vaginal specimen consists in identifying, within the flora present:
- the organisms normally absent,
- the organisms normally present, but for which the relative quantity is abnormal. This is referred to as dysmicrobism.

**Upper tract infections**
- endometritis,
- salpingitis

**Lower tract infections**
- **Diffuse**: vulvitis, vaginitis, vaginosis, cervicitis.
- **Localized**: genital ulcers, hard chancre, soft chancre (*H. ducreyi*), donovanosis (*C. granulomatis*), vesicles (Herpes), condyloma, Papillomavirus.

* not discussed in this document.
## Table of female genital infections

### UPPER TRACT INFECTIONS

<table>
<thead>
<tr>
<th>Pathologies</th>
<th>Infectious agent</th>
<th>Clinical signs</th>
<th>Context</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>endometritis, salpingitis, etc.</td>
<td><em>Chlamydia trachomatis</em> <em>Neisseria gonorrhoeae</em></td>
<td></td>
<td>• <strong>primary infections:</strong> following an ascending infection <em>(Chlamydia, gonococci, anaerobes, mycoplasmas)</em></td>
<td>+</td>
</tr>
<tr>
<td></td>
<td><em>Bacteroides fragilis</em> and <em>Prevotella bivia</em></td>
<td></td>
<td>• <strong>iatrogenic infections:</strong> surgical context <em>(endouterine examination, postpartum, curettage, IUD)</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>(E. coli.)</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Less frequent: streptococci B and other</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>β-hemolytic and non β–hemolytic Streptococci,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Enterococci, Staphylococci, <em>Ureaplasma spp</em>,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Mycoplasma hominis,</em> <em>Mycoplasma genitalium</em></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### DIFFUSE LOWER TRACT INFECTIONS

<table>
<thead>
<tr>
<th>Pathologies</th>
<th>Infectious agent</th>
<th>Leucorrhea</th>
<th>Clinical signs</th>
<th>Context</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>vulvovaginitis</td>
<td><em>Candida albicans</em></td>
<td>whitish, granular</td>
<td>pruritus, vaginal burning, dyspareunia, vulvovaginal edema</td>
<td>oral contraception, antibiotic therapy, pregnancy, diabetes, local washing with antiseptic (acidic)</td>
<td>+++</td>
</tr>
<tr>
<td></td>
<td><em>Trichomonas vaginalis</em></td>
<td>greenish, malodorous</td>
<td>burning, dyspareunia, dysuria</td>
<td>sexual transmission, low estrogen (alkalinization of vaginal environment)</td>
<td>+</td>
</tr>
<tr>
<td>vaginosis</td>
<td><em>Gardnerella vaginalis</em> alone or associated with</td>
<td>grayish, foamy, malodorous</td>
<td>few inflammatory signs</td>
<td></td>
<td>++</td>
</tr>
<tr>
<td></td>
<td>anaerobes <em>(Mobiluncus, Bacteroides and Prevotella</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>in 80% of cases) and <em>Mycoplasma hominis</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cervicitis, cervicovaginitis</td>
<td><em>Chlamydia trachomatis</em></td>
<td>blood-tinged if present</td>
<td>often asymptomatic, hemorrhagic cervicitis</td>
<td>• <strong>STI (sexually transmitted infection)</strong></td>
<td>++</td>
</tr>
<tr>
<td></td>
<td><em>Neisseria gonorrhoeae</em></td>
<td>yellowish if present</td>
<td>often asymptomatic</td>
<td>• systematic examination</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Mycoplasma genitalium</em></td>
<td></td>
<td></td>
<td>• detected due to complication <em>(salpingitis, sterility evaluation, etc.)</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• infected partner</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• risk factor <em>(age, change of partner, multiple partners)</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **+++** indicates a high frequency.
- **++** indicates a moderate frequency.
- **+** indicates a low frequency.
- **rare** indicates an infrequent occurrence.
When to take a cervicovaginal specimen

In the presence of clinical signs of infection
- signs of vulvovaginitis: leucorrhea, pruritus, dyspareunia, dysuria, etc.
- suspected upper tract infection: pelvic pain, with or without fever, metrorrhagia.
- systematic gynecological examination showing signs of infection: cervicitis, etc.

In pregnant women to detect bacteria causing materno-fetal and neonatal infections
- systematic screening for carriage of Group B Streptococci (GBS) is recommended in the late stages of pregnancy, between 34 and 38 weeks of amenorrhea.

For systematic screening
in the case of an STI-carrying partner or at-risk behaviour.

How to take a cervicovaginal specimen

As a general rule, it is important to note that the reliability of a cervicovaginal specimen result depends on compliance with the sampling procedures, the shipping conditions of the specimen to the laboratory and the information provided by the prescribing physician. (see diagram on pages 8 and 9)

Sampling sites:
These are determined by the clinical signs and must include at least the vagina and endocervix. Depending on the context, the specimen may also be taken from the vulva, urethra, anus, Skene's and Bartholin's glands, etc.

Vaginal specimen:
- on vaginal wall and in posterior cul-de-sac,
- sample as much of the secretions as possible.

Endocervical specimen:
- after thorough cleansing of the exocervix with a sterile compress soaked in saline solution.
- insert the swab into the endocervical cavity.

Important recommendations

- In the event of antibiotic therapy, observe an interval of:
  - 4 weeks for C. trachomatis,
  - 1 week for other micro-organisms, before sampling. If this is not possible, inform the laboratory.
- Refrain from washing in the 24 hours before sampling.
- Avoid menstrual periods.
- Sample with a speculum, without lubricant.
- Note: the appearance of the leucorrhea, cervix and vaginal mucosa.
- Use 2 swabs (alginate or Dacron) per site
  - one for the direct examination,
  - the other for the cultures (transport medium).
- Send to laboratory without delay.
- Specify the sampling site on the prescription and any specific medical context.
Cervicovaginal sampling

All cervicovaginal specimens not collected in a laboratory must be shipped in a transport medium. Accompanied by 2 smears on non-fixed slides, they must be shipped without delay.

Specimen collection 1

In vagina (posterior cul-de-sac)

Mucosal secretions or swabbing

Aerobic and anaerobic commensal bacteria

Vaginosis-related bacteria
(G. vaginalis, M. hominis…)

Pyogenic bacteria in abnormal quantities

Yeast

Trichomonas

C. trachomatis

N. gonorrhoeae

Specimen collection 2

In endocervix

Endocervical secretions and cells after elimination of endocervical secretions and scraping of mucosa

Specific detection of C. trachomatis, N. gonorrhoeae and M. genitalium and according to context (upper tract infection, pathological pregnancy): Ureaplasma spp. and M. hominis

This transport medium must be able to keep the organisms alive for the time required for their culture, e.g.:

PORTAGERM AMIES AGAR + SWAB
- 24 hours to 48 hours for a large number of micro-organisms,
- 24 hours for fastidious bacteria such as Neisseria gonorrhoeae, Streptococcus pneumoniae and anaerobes.

UROGENITAL MYCOPLASMAS
(R1 reagent: resuspension fluid):
- 5 hours at 18-25°C
- 48 hours at 2-8°C
- > 48 hours at -70°C
How to interpret a cervicovaginal specimen

Reading a cervicovaginal specimen result should make it possible to:
- confirm infection,
- identify the causative infectious agent(s),
- determine, if required, the antibiotic susceptibility of the organism involved.

1 Cytology

Direct examination is an essential stage. Fresh mounting and May-Grünwald-Giemsa (MGG) staining are used to observe *Trichomonas*. The nature and quantity of the cells present must be taken into consideration.

- Polynuclear cells indicate infection if present in an abundant quantity (vaginitis or vulvovaginitis).
- Epithelial cells show the presence of desquamation, frequently detected in vaginosis in the form of "clue cells" (bacteria-coated epithelial cells).
- *Trichomonas vaginalis*.

2 Identification of infectious agent

- Gram staining is used to:
  - evaluate the Döderlein flora, its abundance or replacement by a more or less polymorphous flora,
  - observe any dysmicrobism,
  - assess the presence of specific species, such as *Mobiluncus*,
  - observe the presence or absence of yeasts (and assess their abundance), and filaments,
  - observe intraleukocytic Gram-negative cocci (*N. gonorrhoeae*).  
- Cultures, or specific detection by gene amplification, are used to isolate or identify the infectious agents: bacteria and yeasts.

If an infectious agent normally absent from the vaginal flora is detected, it must always be taken into consideration, irrespective of the quantity: *Neisseria gonorrhoeae*, *Chlamydia trachomatis* and *Mycoplasma genitalium*.

For other organisms, identification is only significant when associated with their quantification and predominant presence.
- pneumococci, group A and B streptococci, *S. aureus*, *N. meningitidis*, *M. hominis* $> 10^4$ CCU (color-changing unit)/ml.
Antibiotic susceptibility testing

- **Essential** for some pathogenic species such as *Neisseria gonorrhoeae* due to the frequency of antibiotic resistance. β-lactamase testing must be performed systematically for this species.

- **May also be determined by the clinical context:**
  - Urogenital mycoplasmas (susceptible to tetracyclines, macrolides and related antibiotics as well as fluoroquinolones).
  - Group B streptococci (80% cycline-resistant strains, 5% macrolide-resistant strains).
  - *M. hominis*: naturally resistant to 14- and 15-member ring macrolides.
  - *Ureaplasma* spp.: naturally resistant to lincosamides

- **Not performed for:**
  - *C. trachomatis* (susceptible to tetracyclines, macrolides and fluoroquinolones),
  - *M. genitalium*,
  - *Gardnerella vaginalis* (susceptible to imidazoles), *Mobiluncus*.

As a general rule, any strain considered to be pathogenic must undergo antibiotic susceptibility testing in order to guide or validate the treatment or for epidemiological purposes.

Bibliography

### Culture media

<table>
<thead>
<tr>
<th>N. gonorrhoeae</th>
<th>Streptococcus / Staphylococcus</th>
<th>Gardnerella vaginalis</th>
<th>Enterobacteriaceae &amp; Non-Enterobact.</th>
<th>Yeasts</th>
<th>Mycoplasma</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chocolate + PolyViteX VCAT3</td>
<td>Columbia CNA + 5% sheep blood</td>
<td>detection of GB Streptococcus, S. aureus and Listeria monocytogenes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chocolate + PolyViteX</td>
<td>Columbia or Trypcase-Soy + blood chromID™ S. aureus</td>
<td>Columbia or Trypcase-Soy + blood</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gonoline DUO 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Identification and Resistance testing

#### API/ATB

<table>
<thead>
<tr>
<th>N. gonorrhoeae</th>
<th>Streptococcus / Staphylococcus</th>
<th>Gardnerella vaginalis</th>
<th>Enterobacteriaceae &amp; Non-Enterobact.</th>
<th>Yeasts</th>
<th>Mycoplasma</th>
</tr>
</thead>
<tbody>
<tr>
<td>API NH</td>
<td>API® 20 STREP</td>
<td>API® 20 STREP</td>
<td>API 10 S</td>
<td>API CANDIDA</td>
<td>Mycoplasma IST 2</td>
</tr>
<tr>
<td>RAPID ID 32 STREP</td>
<td>API CORYNE</td>
<td>RAPID 20 E</td>
<td>ID 32 C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>API STAPH</td>
<td>RAPID ID 32 STREP</td>
<td>RAPID 20 E</td>
<td>ID 32 E</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ID 32 STAPH</td>
<td></td>
<td>ATB G-5</td>
<td>ATB FUNGUS 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ATB™ STREP 5</td>
<td></td>
<td>ATB UR 5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ATB ENTEROC 5</td>
<td></td>
<td>ATB PSE 5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ATB STAPH 5</td>
<td></td>
<td>RAPID ATB E 4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NCCLS Standard</td>
<td></td>
<td>NCCLS Standard</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### VITEK® 2

<table>
<thead>
<tr>
<th>NH Identification card</th>
<th>GP Identification card</th>
<th>NH Identification card</th>
<th>GN Identification card</th>
<th>YST Identification card</th>
</tr>
</thead>
</table>

### Culture media

<table>
<thead>
<tr>
<th>Anaerobes</th>
<th>Haemophilus</th>
<th>Listeria</th>
<th>Group B Streptococcus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schaedler + blood</td>
<td>Haemophilus Chocolate 2</td>
<td>Columbia CNA + blood</td>
<td>Todd Hewitt broth + antibiotics chromID™ Strepto B, Granada agar and tubes</td>
</tr>
<tr>
<td></td>
<td>Chocolate PolyViteX agar</td>
<td>Columbia or Trypcase-Soy + blood</td>
<td></td>
</tr>
</tbody>
</table>

### Identification and Resistance testing

#### API/ATB

<table>
<thead>
<tr>
<th>Anaerobes</th>
<th>Haemophilus</th>
<th>Listeria</th>
<th>Group B Streptococcus</th>
</tr>
</thead>
<tbody>
<tr>
<td>API 20 A</td>
<td>API NH</td>
<td>API LISTERIA</td>
<td>API 20 STREP RAPID ID 32 STREP</td>
</tr>
<tr>
<td>RAPID ID 32 A</td>
<td></td>
<td></td>
<td>RAPID 32 STAPH</td>
</tr>
<tr>
<td>ATB ANA</td>
<td>ATB HAEMO</td>
<td></td>
<td>ATB STREP 5</td>
</tr>
<tr>
<td>NCCLS Standard</td>
<td>NCCLS Standard</td>
<td></td>
<td>ATB ENTEROC 5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ATB STAPH 5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>NCCLS Standard</td>
</tr>
</tbody>
</table>

#### VITEK® 2

<table>
<thead>
<tr>
<th>NH Identification card</th>
<th>GP Identification card</th>
</tr>
</thead>
</table>

### Other Identification Tests

#### Chlamydiae

- Chlamydia direct IF

#### Molecular Offer

- NucliSENS® tests use real-time NASBA® amplification technology and nucleic acid BOOM® extraction technology
- NucliSENS Easy Q® HSV
- NucliSENS Basic Kit for home-brew real-time NASBA applications (www.basickit-support.com)