**MLS 532**

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1. Exfoliative cytology is the microscopic examination of shed or desquamated cells from the epithelial surface usually the mucous membrane. It also includes the study of those cells that have been collected by scraping the tissue surface or collected from body fluids such as sputum, saliva, etc.

Diagnostic cytology female genital tract (FGT) is based on the fact that cells exfoliated or collected from the cervix and the vagina reflects features of the tissue from which they arise. The main application of cytology to the FGT is in the early diagnosis of precancerous and cancerous lesions.

The cytological specimens that can be obtained from FGT include; cervical smear, vaginal smear, aspiration from posterior fornix of vagina (vaginal pool smear) and endometrial smear.

Sampling devices:

Several methods of obtaining cytologic material from the uterine cervix are available however use of cotton swab for collection of cervical smear is discouraged in view of drying artifacts and loss of cells which is caused by this method. Smears collected with Ayre’s spatula are often easier to screen. Wooden spatulas are preferred to plastic spatula because of its widely rough surface which allows it to collect more sample material than the plastic spatula. Other sampling devices include; the cervix brush, the endocervical brush, and the cyto brush.

Patient Preparation/Instructions

1. The patient should NOT make an appointment for her Pap test during her menstrual period. The preferred time for the examination is two weeks after the first day of her last menstrual period.
2. The patient should be instructed NOT to use vaginal medications, vaginal contraceptives, lubricants, or douches for 48 hours before her appointment. Intercourse is not recommended the night before the examination.

Smear preparation:

Cervical smear; performed by opening the vaginal canal with a speculum and collecting cells at the outer opening of the cervix at the transformation zone (where the outer squamous cervical cells meet the inner glandular endocervical cells). Care is taken to obtain both ectocervical and endocervical cells.

Vaginal smear; introduce an unlubricated speculum, scrape the lateral wall of the vagina at the level of the cervix with the spatula. The broad and flat end of the spatula is used for this purpose. The cellular material is rapidly and gently smeared on a glass slide and fixed immediately.

Vaginal pool smear; the aspiration can be performed after the introduction of an unlubricated speculum. The technique allows for collection of cells under direct vision from the posterior fornix. When the speculum is not employed, the pipette is gently introduced into the vagina until resistance is felt. It is important to compress the suction bob of the pipette before introducing it in order to avoid collection of cellular material from the lower vaginal origin. The cellular material collected is applied on a glass slide and fixed.

Endometrial aspiration smear; after preliminary visualization and cleaning of the cervix, a sterile cannula is introduced into the uterine cavity and aspiration is then carried out with a syringe. The specimen is squirted on a clean glass slide and rapidly fixed.

Sources of error:

Sampling error;

1. Failure in sampling the abnormal area
2. Failure in obtaining adequate cellular component for diagnosis
3. Excessive blood, traumatized cells, mucus or inflammation
4. The lesion fails to exfoliate despite adequate sampling.

Transfer error;

1. Layering of cells
2. Air-drying of slide
3. Fixation artefacts.

Laboratory error;

1. Smear of poor quality
2. Cells distorted by air-drying
3. Scanty material for interpretation.

Hormonal cytology is a non-invasive method which uses the state of the epithelium of the female gynecological tract to determine the hormonal status of an individual. This is carried out by the determination of certain indices which can be derived from a Pap smear test.

Indices derived from Pap smear test:

1. Eosinophilic index; expresses percentile relationship of mature squamous cells with eosinophilic cytoplasm to all mature squamous cells, regardless of the status of the nucleus.
2. Cornification index; relationship between the superficial cells and all other cells.
3. Maturation index; ratio obtained by performing a random cell count of three major cell types shed from the vaginal squamous epithelium (superficial, intermediate and parabasal cells). Maturation index is reported as relative percentages of these cells and written as a ratio.
4. Folded cell index; expresses the relationship of mature squamous cells with folded cellular borders to all mature squamous cells without cytoplasmic folding.
5. KPI (karyopyknotic index); an expression of the percentage of intermediate and superficial cells from squamous cells of vagina epithelium which have pyknotic nuclei.
6. The human respiratory system is a series of organs responsible for taking in oxygen and expelling carbon dioxide. The primary organs of the respiratory system are the lungs, which carry out this exchange of gases as we breathe. In humans, the anatomy the respiratory system is the respiratory tract which is divided into the upper and a lower respiratory tract. The upper tract includes the nose, nasal cavities, sinuses, pharynx and the part of the larynx above the vocal folds. The lower tract includes the lower part of the larynx, the trachea, bronchi, bronchioles and the alveoli.

Respiratory diseases, or lung diseases, are pathological conditions affecting the organs and tissues that make gas exchange difficult in air-breathing animals. They include conditions of the respiratory tract including the trachea, bronchi, bronchioles, alveoli, pleurae, pleural cavity, and the nerves and muscles of respiration. Respiratory diseases range from mild and self-limiting, such as the common cold, to life-threatening diseases such as bacterial pneumonia, pulmonary embolism, acute asthma and lung cancer.

Pneumonia is the inflammation and consolidation of the lung tissue as a result of infection, inhalation of foreign particles, or irradiation. Many organisms, including viruses and fungi, can cause pneumonia, but the most common causes are bacteria, in particular species of Streptococcus and Mycoplasma. Although viral pneumonia does occur, viruses more commonly play a part in weakening the lung, thus inviting secondary pneumonia caused by bacteria. Symptoms of some of these pneumonias include runny nose, decreased appetite, and low-grade fever, usually followed by respiratory congestion and cough. Pneumonia occurs due to impairment of normal defense mechanisms or lowered host resistance. Normal defense mechanisms are nasal clearance (sneezing, blowing, swallowing), tracheobronchial clearance (mucociliary action) and alveolar clearance (alveolar macrophages). Impairment is due to primary or acquired immunosuppression, suppression of cough reflex (drugs, virus, coma, and anesthesia), injury to mucociliary apparatus (smoking, virus, and Kartegeners syndrome), injury to macrophages (tobacco, alcohol, anoxia), pulmonary congestion / edema or accumulation of secretions (cystic fibrosis).

Coronavirus disease 2019 (COVID-19) also called novel coronavirus pneumonia is an infectious respiratory disease caused by a novel coronavirus which can be located in the upper respiratory tract in mild disease and in the bilateral lobes of the lungs in more severe disease. Symptoms include; Fever, which occurs more frequently in adults, Cough, Dyspnea, Fatigue and myalgias are frequent. Some patients present with acute respiratory distress syndrome, acute cardiac injury, acute kidney injury and shock; up to 15% of them had fatal outcomes.

Spike surface glycoprotein of the virus binds to the host via receptor binding domains of the angiotensin converting enzyme 2 (ACE2), which is most abundant in type II alveolar cells. After a SARS-CoV-2 attaches to a target cell, the virion releases RNA into the cell, initiating replication of the virus which further disseminates to infect more cells. SARS-CoV-2 produces several virulence factors that promote shedding of new virions from host cells and inhibit immune response.

Gross description;

1. From pulmonary edema to lung consolidation Increased lung weight
2. Pleurisy (pleural inflammation) may be seen
3. First reports described unusual and excessive sticky liquid on cut surface
4. Purulent inflammation, if secondary infection superimposed

Histopathological description

1. Pulmonary changes are the most significant, although nonspecific
2. Findings of diffuse alveolar damage corresponding to the phase of disease
3. Exudative phase: hyaline membrane formation, desquamation of pneumocytes, cellular or proteinaceous exudates, alveolar hemorrhage, fibrinoid necrosis of small vessels
4. Organizing phase: interstitial and intraalveolar proliferation of fibroblasts, lymphocytic infiltration, type II pneumocyte hyperplasia, fibrin deposition
5. Findings representing the fibrotic phase (e.g. dense collagenous fibrosis, architectural remodeling) are not reported so far
6. Viral infection changes
7. Multinucleated enlarged pneumocytes with large nuclei, amphophilic cytoplasm and prominent nucleoli in alveolar spaces
8. Intranuclear inclusions
9. Bacterial pneumonia may be superimposed
10. Extrapulmonary changes: various levels of cell injury and microvascular disorders in parenchymal organs
11. Pathological findings are primarily based on minimally invasive autopsies

Cytopathological analysis can be carried out by obtaining a bronchoalveolar lavage. Findings could include;

1. Abundant activated plasma cells, as per a single case report
2. Alveolar macrophages may feature nuclear clearing or intranuclear cytopathic inclusions