Liquid based cytology

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Definition:

- Liquid-based cytology (LBC) is a thin-layer or monolayer slide preparation technology that has been introduced as a potential solution to overcome the shortcomings of conventional Papanicolaou (Pap) smears in cervical cancer screening.
- Liquid-based cytology from gynecologic samples uses a collection fluid that fixes, homogenizes, and rinses the cells.

Aim:

- To improve the transfer of cells from the collection device to a microscope slide
- To provide uniformity of the cell population in each sample.

Disadvantages of PAP smears:

- Despite the demonstrated ability of cervical cytological screening to reduce cervical cancer, incidence and mortality, the conventional Pap test is ***less sensitive*** than is generally believed. The ***false-negative rate*** of the conventional Pap test has been reported to be up to 50%.

Disadvantages of PAP smears:

- Approximately 67% of false-negative results are attributable to ***improper sampling techniques or the poor quality of slides***. Sampling errors may result when a slide does not contain a representative sample of the cells from the cervix, or the ***cells are obscured by mucous or blood***, or are ***inadequately preserved***.

Disadvantages of PAP smears:

- Common findings on conventional Pap smears, includes:

  -***thicker and thinner smeared areas***

  -***air-drying artifact***

  -variety of artifacts, such as ***"nuclear feathering"***

Technique of LBC

I) Collecting devices:

- ***1) Ayre spatula (wooden or plastic):*** **Because wooden spatulas are porous, only about 20% of the exfoliated cells which are obtained are transferred to the Pap test slide. The plastic Ayre spatula has been shown to have a better transfer rate.**

  Ayre spatula *is the <u>least effective device</u>* for collecting cells from the endocervix.

Technique of LBC

I) Collecting devices (cont.):

- ***2) A saline-moistened, cotton-tipped applicator:*** **has been used with *moderate success* to improve the adequacy of the sample.**

- ***3) Endocervical brush, or the cytobrush sampling*** **of the endocervix *has improved the specimen adequacy*.**

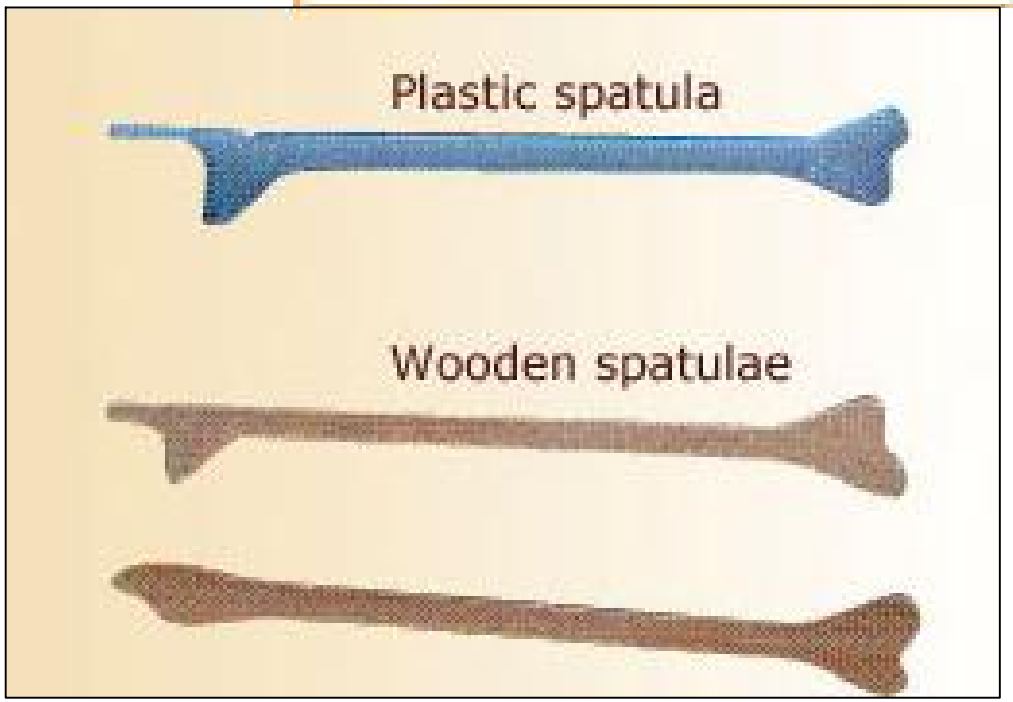
Technique of LBC

I) Collecting devices (cont.) :

- ***4)Another collecting device, the broom***, **was recently introduced. However, subsequent studies revealed *inadequacy of the endocervical component when only* the broom was used.**

5)A combination of the broom and the cytobrush **is the *most effective sampling technique* to collect exocervical and endocervical cells.**

Different types of sampling device



Cervical brush

Cervical broom

Technique of LBC

II) Steps of LBC:

- 1) The sample is collected in the same manner as is used in the conventional Pap test, using either a ***broom-type device or a plastic spatula and an endocervical brush***.
- 2) However, rather than smearing the cytological sample directly onto a microscope slide, the sample cells are ***suspended in a methanol-based fixative solution.***

Technique of LBC

II) Steps of LBC . cont :

- 3)The ***ThinPrep Processor*** disperses the sample to separate mucous and debris from the cells.

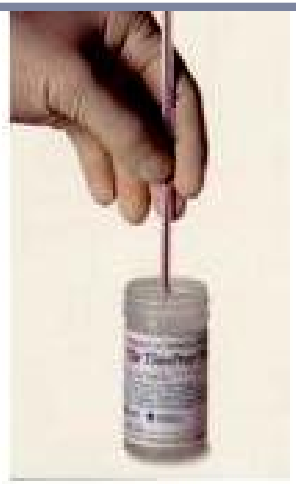
- 4)Cells are collected onto ***a filter with a vacuum and transferred to a microscope slide*** for cytological interpretation.

Technique of LBC

III) Automated, liquid-based sample preparation system:

After collection of the cervical sample, the tip of the brush is placed into a vial of ethanol-based preservative. The sample is then processed on the AutoCyte PREP System using a density gradient that removes a large portion of blood, mucus, and other potentially obscuring debris from the sample. The majority of cells collected are transferred by cytospin to a slide and stained.

Technique of LBC



Advantages of LBC

- 1) Provide ***a more representative cervical sampling*** than conventional smearing of the cervicovaginal specimen on a glass slide.

- 2)Because cytological samples are fixed immediately after collection, there are ***fewer artifacts in cellular morphology*** e.g.nuclear feathering artifact has not been reported when a liquid-based sampling technique is used.

Advantages of LBC (cont.)

- 3) The process ***reduces obscuring inflammatory cells and mucous, blood and debris***
- 4) The cells are deposited on the slide in a ***monolayer***.
- 5) Clinical studies of the ThinPrep method have shown that ***test sensitivity is improved compared with conventional Pap tests***.

Advantages of LBC (cont.)

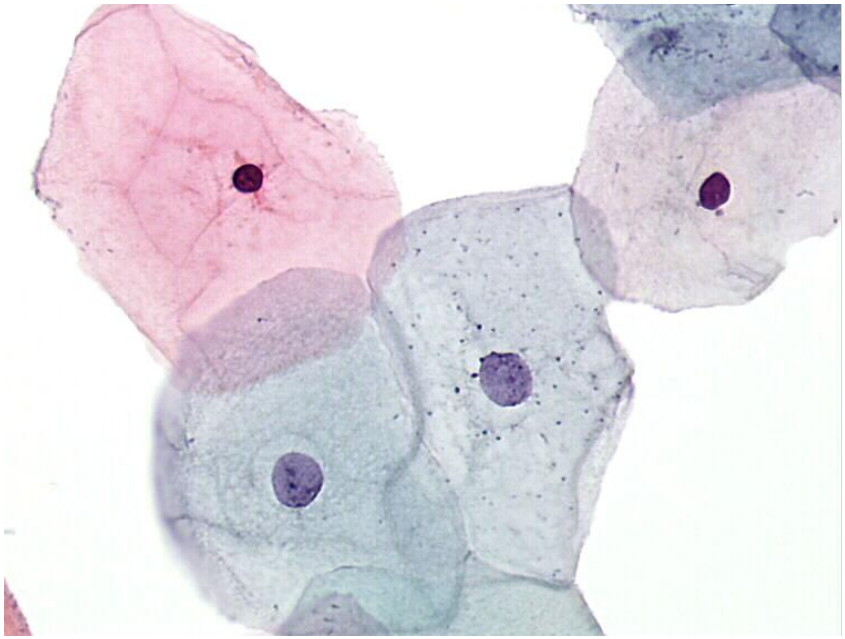
- 6) In addition, this method provides representative residual ***material in collection media that can be used for additional/adjunctive testing (e.g., HPV testing).***

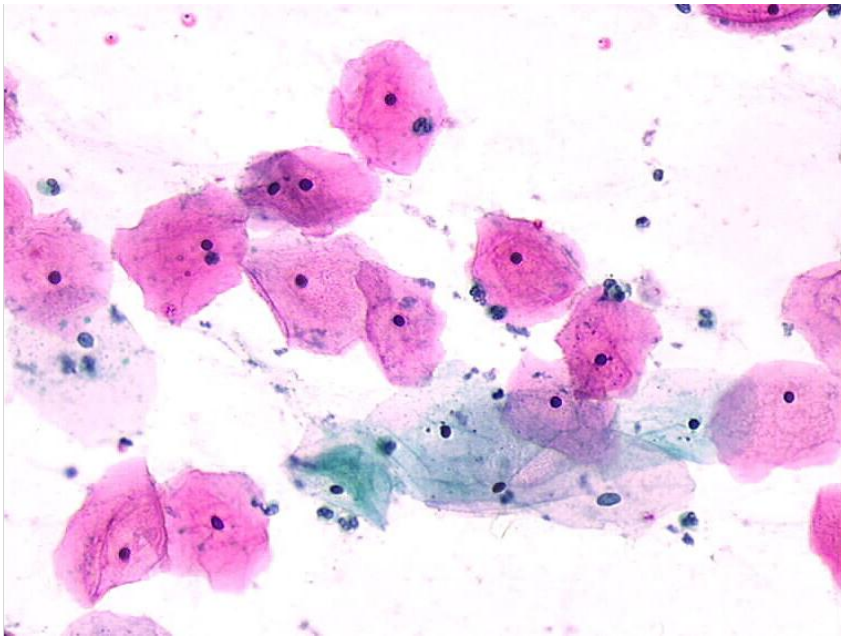
- 7) The cells do not lie in thick layered deposits or in streaks of mucus. The ***mechanical distortions sometimes associated with smearing are missing***.

Advantages of LBC (cont.)

- 8) *Histochemical analysis* of a cyto-spin sample taken from the original vial, ***immunohistochemical analysis of liquid-based preparations*** or eventually, solution-based screening tests that would be suitable to ***exfoliated cells obtained by self-testing (cyclin E and an HPV antibody***).

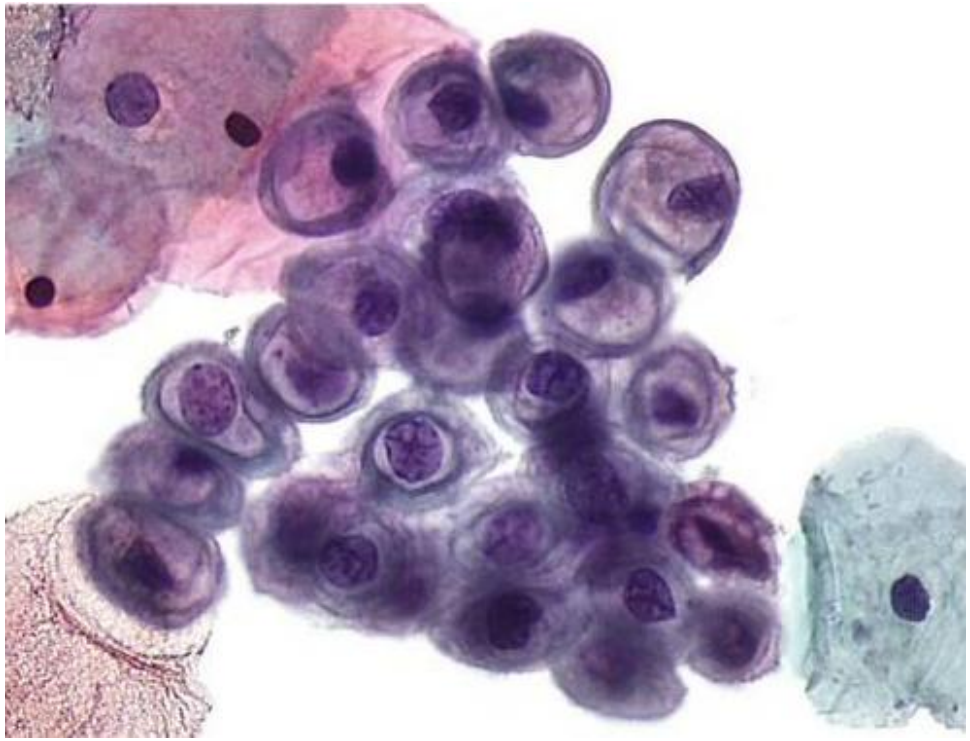
Liquid-based cytology microscopic features :





Liquid based preparation normal intermediate and superficial squamous cells (left); conventional Pap smear showing normal superficial eosinophilic cells. Note debris in the background (right).

Liquid-based cytology microscopic features :



Cervical specimen: Group of squamous metaplastic cells with perinuclear clearing; Pseudokoilocytes.

Disadvantages of LBC

- On LBC slides, ***cell nuclei often take on a more vesicular, delicate appearance.*** In addition, the LBC specimen has fewer landmarks than conventional Pap smears to guide the human eye during the screening process and can be more challenging and ***time-consuming*** per unit area to review. Liquid-based collection methods may cause ***some epithelial cells to round up and appear smaller***.

Disadvantages of LBC (cont.)

- The rounding up of the cells will make the ***nuclear-to-cytoplasmic ratio appear altered in favor of the nucleus***. Diagnostic groups and background clues (eg, tumor diathesis) are retained. Patterns such as ***cytolysis and atrophy may look different than they do on conventional Pap smears***, but can be easily identified once recognized on the LBC.

Other uses of LBC

LBC ThinPrep system has found broad acceptance in **non-gynecologic cytopreparation** such as:

- **Thyroid cyst** fluid examination.
- **Oral pathology**: diagnostic for various types of oral lesions.
- Many laboratories have successfully applied this technique to **body fluids** (e.g. **urine, pleural effusions**), **brushing samples** (e.g. **gastrointestinal tract, lung**) and **fine-needle aspiration.**


Thank You