



(RESEARCH ARTICLE)



## Cervicovaginal detection of microorganisms in patients with type 2 diabetes

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### Abstract

The purpose of the present investigation was to report the presence of cervicovaginal microorganisms most frequently found in cervicovaginal exfoliative smears (Papanicolaou) of patients with type 2 diabetes. Cervical-vaginal exfoliative cytologist was performed on an open population to all patients who attended from March 2010 to March 2020 in the within the framework of the early cancer detection program, gynecological interrogations were applied to 1587 patients who, after taking cell samples, were processed using the Papanicolaou staining technique modified by the same for subsequent microscopic diagnosis.

Of the results obtained from the 1587 patients studied, 148 (9.32%) suffer from type 2 diabetes mellitus and of these only 130 (87.83%) showed at least one microorganism under microscopic observation, being *Candida* spp., the most found microorganism in samples from patients with type 2 diabetes. In conclusions, type 2 diabetes is a disease that predisposes to the appearance of microorganisms and cervicovaginal infections, particularly by *Candida* spp., therefore, there is a need for surveillance guidelines and efforts to reverse this disease and its complications.

**Keywords:** Cervicovaginal microorganisms; Diabetes; Exfoliative cytology; Microscopic diagnosis

### 1. Introduction

Within primary health care in our country, care for chronic non-communicable metabolic diseases and gynecological disorders is a priority, since they represent one of the common problems in women, from the epidemiological point of view [1].

Diabetes mellitus or type 2 diabetes is a chronic metabolic disorder characterized by the presence of hyperglycemia accompanied by alterations in the metabolism of carbohydrates, proteins and lipids that appear when the pancreas does not secrete enough insulin or when the body does not efficiently use the insulin that produces [2-5]. This disease represents a health and socioeconomic problem of the first magnitude. In 2014, 8.5% of people over 18 years of age had diabetes and, in 2019, this disease directly caused 1.5 million deaths [6].

Type 2 diabetes has, in turn, been associated with an increase in the rates of infections, mainly bacterial and fungal, in different organs, including emphysematous infections of the biliary tree, bones, soft tissues, eyes, brain, urinary and genital, the latter being an anatomical site that has implicated relevance in recent years [7-9].

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Hyperglycemia carries a persistent risk for complicated infections through various humoral defense mechanisms, including the variety of neutrophil functions such as: adhesion, chemotaxis, and phagocytosis [10]. Among the specific immune aberrations are an elevated T-helper 2 lymphocyte response and a T-helper 1 response, in addition to impaired oxidative destruction and phagocytosis capacity, thus preventing the timely elimination of pathogens present in patients with diabetes. Type 2 [11,12]. Another of the mechanisms associated with type 2 diabetes is the binding of glucose to the biochemically active site of the third complement component C3, which inhibits its binding to the microbial surface and therefore impairs opsonization [13,14]. Thus, several pathogens possess unique mechanisms of virulence that are prominent in the hyperglycemic environment [15].

On the other hand, cervicovaginal infections can occur at any stage of life and are among the first 20 most frequent causes of disease [16]. Of the infectious processes that occur in the female genital tract, vulvovaginitis is the most common and is exacerbated in patients with type 2 diabetes [17]. This originates due to an alteration of the vaginal microbiota, with a reduction in the concentration of lactobacilli and, consequently, an increase in vaginal pH and secretion, as well as the presence of *Gardnerella vaginalis*, *Bacteroides*, *Mobiluncus* and *Peptostreptococcus* [18,19]. The purpose of this study was to report the presence of cervicovaginal microorganisms found in cervicovaginal exfoliative smears (Papanicolaou) from patients with type 2 diabetes.

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## 2. Material and methods

Cervicovaginal exfoliative cytology were performed on an open population of 1587 patients in the period 2010-2020 in the early cancer detection program and gynecological interrogations were applied, after taking the cell samples they were processed using the Papanicolaou staining technique modified by the same for its subsequent microscopic diagnosis. In addition, each patient underwent a potassium hydroxide (KOH) or Whiff (amines) test, as well as a vaginal pH assessment. Patients with an active sexual life who reported suffering from type 2 diabetes were included in the study, non-diabetic patients were excluded.

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## 3. Results

From the total of the participants (1587), 148 (9.32%) reported having type 2 diabetes, to the gynecological questioning and 1439 (90.67%) patients did not report having it. Regarding the total number of patients with type 2 diabetes, the presence of at least one microorganism on microscopic interpretation was reported in 130 patients (87.83%).

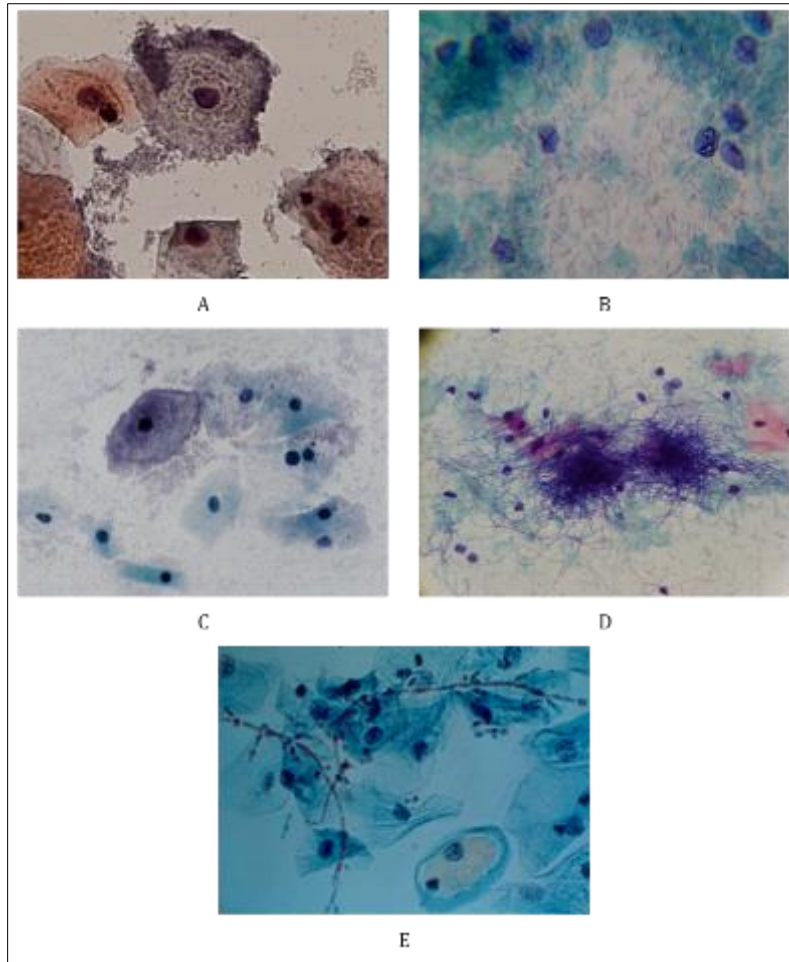
The microorganisms found in the 148 patients with type 2 diabetes were *Candida* spp. (32 patients), coccoid flora in excess (26 patients), *Lactobacillus* spp., in excess (14 patients), *Leptothrix actinomyces* (6 patients) and *Gardnerella vaginalis*. (6 patients), it should be noted that 46 patients showed "mixed flora", that is, they presented more than one microorganism to the microscopic interpretation: excess coccoid flora and *Candida* spp., (16 patients), excess coccoid flora and *Gardnerella vaginalis* (16 patients) and coccoid flora and *Lactobacillus* spp., in excess (14 patients) (Figure 1), and only in 18 patients was no presence of any microorganism found.

In addition, of the 130 patients with the presence of cervicovaginal microorganisms and type 2 diabetes, the following clinical data are presented: 50 patients (38.46%) presented alkaline pH > 5, 32 (24.61%) had an amino odor, 55 (34.61%) had leucorrhea and 44 (33.84%) some type of genitourinary symptoms such as: vulvar pruritus, dyspareunia, dysuria, or vaginal dryness. It should be noted, based on clinical impression, that 36 patients (27.69%) showed erosions in various parts of the cervical neck and 12 patients (9.23%) showed leukoplakia (Figure 2). Also, of the 55 patients who presented leucorrhea and according to the results of the microscopic interpretation, 28 were associated with *Candida* spp., 20 associated with *Gardnerella vaginalis* and 7 associated with mixed flora.

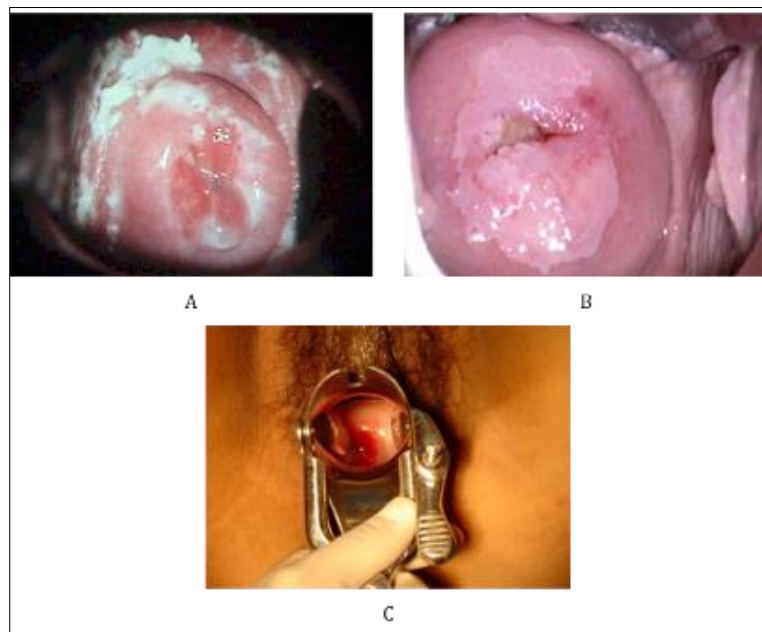
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## 4. Discussion

According to various investigations, cervicovaginal infections represent one of the most common gynecological problems in our country. Taking into account that the presence of *Lactobacillus* spp. and coccoid flora occurred frequently, the prevalence of symptomatic cervicovaginal infections associated with patients with type 2 diabetes and reports of microorganisms upon microscopic interpretation was detected in 87.83% of patients; therefore, it is essential to implement diagnostic strategies for female genital tract infections at the first level of care, which include inviting the entire female population to perform a Pap smear, since it is a tool whose purpose, in addition to timely detection of atypia cells in the cervix, is to reduce the incidence of infections and establishment of cervicovaginal microorganisms, especially in diabetic patients and without cervicovaginal symptoms [20].



**Figure 1** Microorganisms associated with patients with type 2 diabetes. (A) *Gardnerella vaginalis* clue cells, (B) *Lactobacillus* spp., (C) coccoid flora, (D) *Leptothrix actinomyces*, (E) *Candida* spp.



**Figure 2** Pathologies observed in patients with type 2 diabetes. (A) Leucorrhoea attributable to *Candida* spp., (B) Leucoplakia and *Candida* spp., (C) Cervical erosion

The immunological deficit, chronic inflammatory states, and hyperglycemia, are linked to a significant imbalance in the vaginal microbiota, especially *Lactobacillus* spp. In diabetics, the hyperglycemic state and glucose-rich vaginal secretions favor the polymicrobial presence that colonizes the vaginal cavity, especially yeasts, which occupy glucose as a nutrient and facilitate their adhesion to the epithelium. Specifically, the fucose receptor of the vaginal cells favors the adhesion of *Candida* spp. to the cells of the vaginal tissue. In addition, the activity of hydrolytic enzymes increases the pathogenicity of this microorganism, causing the development of vulvovaginal candidiasis. Specifically, the microorganism most found in the samples analyzed was *Candida* spp., considering that immune reduction and conditions such as type 2 diabetes are the most important risk factors for presenting vulvovaginal candidiasis [21].

On the other hand, current research has shown that infection by *Candida* spp., in prepubertal patients is rare, this due to low estrogen levels during childhood that results in a microbiota with anaerobic microorganisms that inhibit *Candida* spp., therefore, the present study was conducted in patients who met the inclusion criteria. There are other studies that indicate the relationship between the *Candida* complement receptor (ICAM-1) and vaginal epithelial cells in an environment with a high concentration of glucose [22]. In this way, patients with poorly controlled type 2 diabetes, glycosuria, and increased glucose concentrations in vaginal secretions, favor the appearance of signs and symptoms of cervicovaginal infections, therefore, it is common for women with type 2 diabetes to present the possibility of developing symptomatic and recurrent cervicovaginal infections [23].

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## 5. Conclusion

Type 2 diabetes is a disease that predisposes to the establishment of microorganisms that cause cervicovaginal infections, particularly *Candida* spp. Therefore, there is a need to create surveillance guidelines for the early detection of this disease, as well as efforts to reverse its complications. in the short and long term. Being necessary to consider the existence of an association that favors the appearance of cervicovaginal infections in patients with type 2 diabetes, since this information can alert the intentional search when performing a gynecological examination and when vaginitis is suspected and timely identify infections cervicovaginal in patients without cervicovaginal symptoms.

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## Compliance with ethical standards

### *Acknowledgments*

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### *Disclosure of conflict of interest*

The authors have no conflict of interest to declare.

### *Data confidentiality*

The authors declare that they have followed the protocols of their work center regarding the publication of patient data.

### *Statement of ethical approval*

Ethical approval is stated to have been provided by the department of cell biology of the medical faculty.

### *Statement of informed consent*

Informed consent obtained from each of the total participants in the present investigation.

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