



Original Article

Effective reduction in inadequate Pap smears by using a saline-lubricated speculum and two glass slides

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ARTICLE INFO

Article history:

Accepted 19 November 2019

Keywords:

Pap smear
Saline lubrication
Glass slide
Inadequate smear
Insufficient cellularity

ABSTRACT

Objective: The aim of the study was to propose a method using saline lubrication and two glass slides to reduce the proportion of inadequate Pap smears.**Materials and methods:** This was a retrospective study of patients at a medical center in eastern Taiwan that performs 5000–6000 Pap smears annually. The extracted data only detailed the number and percentage of inadequate Pap smears. We applied two modifications to the conventional Pap smear technique. The first modification was lubricating the speculum with normal saline instead of jelly. The second modification was performing the smear on two glass slides instead of just one. We used the modified technique beginning in January 2017. Therefore, we collected data from 2016 (before the modified technique was employed) and 2018 (after the modified technique was employed). The categorical data are presented as numbers (percentages). The differences in the number and percentage of inadequate smears resulting from both techniques were assessed using the Chi-square test.**Results:** During 2016 and 2018, 28 and 2 women received inadequate Pap smears among the total of 594 and 613 women who received Pap smears, respectively. The proportion of inadequate Pap smears was 4.71% and 0.33% in 2016 and 2018, respectively ($P < 0.001$).**Conclusions:** The use of this modified technique effectively reduced the percentage of inadequate Pap smears.© 2020 Taiwan Association of Obstetrics & Gynecology. Publishing services by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Introduction

Pap smear is a widely used screening tool for cervical cancer. A study reported that the sensitivity and specificity of Pap smears were 92% and 67%, respectively [1]. However, pathologists face difficulties accurately interpreting the smear because of limitations such as the collection of inadequate cells from the smear and obscuration of the epithelial cells caused by blood, mucus, inflammatory cells, or lubricants.

The current guidelines of the Australian National Cervical Screening Program define an unsatisfactory conventional Pap smear as one with less than 10,000 well-preserved and well-visualized squamous epithelial cells (or less than 5000 for liquid-based preparations). A retrospective study reported unsatisfactory

conventional Pap smear (CPS) rates of 0.05% (30/61,787), 0.08% (47/60,379), 0.02% (20/85,857), and 0.02% (23/118,274), respectively, from 2007 to 2012 [2]. A prospective study in Korea reported an unsatisfactory CPS rate of 3.31% ($n = 38,956$) from July 2014 to January 2015 [3].

The aim of our study was to propose a simple method that uses a saline-lubricated speculum and two glass slides to reduce the proportion of inadequate smears obtained.

Materials and Methods

This was a retrospective study of patients at a medical center in eastern Taiwan that performs 5000–6000 Pap smears annually. The protocol of the study was approved by the Research Ethical Committee of Hualien Tzu Chi Hospital (IRB 108-132-B). We reviewed the results of Pap smears conducted in 2016 and 2018 by Dr. Ding. The extracted data only details the number of inadequate Pap smears. The reasons for inadequate Pap smears include insufficient cellularity (very few squamous cells), poor fixation, more than 50% of cellular material obscured by blood or other things, and

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smear too thickly spread [4]. The most common cause of inadequate smears in our hospital is insufficient cellularity. Because of the high percentage of inadequate smears, we modified the conventional technique to reduce the number of inadequate smears. The conventional technique and the modifications are detailed below (Fig. 1).

Conventional technique

A woman is prepared in the lithotomy position. A sterile speculum is inserted into the vagina by using a jelly lubricant, and the woman is positioned such that visualization of the cervical os and ectocervix is facilitated. Full exposure of the cervix was suggested. Cells from the exocervix and endocervix are extracted using a brush (Fusin Corp., Taipei, Taiwan), and the brush is rotated 360° twice to extract a sufficient number of cells (the inner part of the brush to collect endocervical epithelial cells and the outer part of the brush to collect ectocervical epithelial cells). Then, the brush is immediately smeared over a labeled glass slide in a rotary manner, and the slide is fixed in 95% ethyl alcohol in a Coplin jar. After fixation, the glass slide is sent to the Department of Pathology.

Modified technique

We applied two modifications to the conventional technique. First, the speculum is lubricated with normal saline. Second, the smear is performed on two glass slides instead of one.

We have been using the modified technique since January 2017. Therefore, we collected data in 2016 (before the modified technique was implemented) and 2018 (after the modified technique was implemented). To avoid data problems arising from differences in the execution of the techniques between doctors, we only considered Pap smears conducted by Dr. Ding.

The categorical data are presented as numbers (percentages). The differences between the two techniques were assessed using the Chi-square test. The statistical analyses were performed using SPSS (Version 21.0; IBM Corp, Armonk, NY), and P values <0.05 were considered statistically significant.

Results

Study participants

In 2016 and 2018, 28 and 2 women received inadequate Pap smears among the 594 and 613 women who received Pap smears, respectively (Table 1).

The proportion of inadequate Pap smear

In our hospital, the proportion of inadequate Pap smears was 4.71% and 0.33% in 2016 and 2018, respectively ($P < 0.001$; Table 1). In Taiwan, the proportion of inadequate Pap smear was 1.66 and 2.33% in 2016 and 2018, respectively (Table 1).

Discussion

In 1943, George Papanicolaou and Dr. Herbert Traut published their landmark book *Diagnosis of Uterine Cancer by the Vaginal Smear*, which described physiological changes in the menstrual cycle and the influence of hormones and malignancy on vaginal cytology [5]. Since then, Pap smears have been widely used to screen women for precancerous cervical lesions and cervical cancer. However, accurate interpretation of Pap smears by pathologists is crucial to the procedure's efficacy. In this study, we used two simple and low-cost methods to reduce the inadequate rate of cells collected in Pap smears. The inadequate Pap smear rate in our hospital was even lower than that of Taiwan (0.33% vs. 2.33%, Table 1).

After reviewing previous studies, we found some results similar to those of our study; these studies used liquid-based cervical (LBC) samples to reduce the unsatisfactory smear rate of Pap smears. Gupta et al. compared split samples ($n = 1000$), only CPS smears ($n = 1000$), and only LBC samples ($n = 1000$) [6]. The unsatisfactory smear rate was considerably less in only LBC samples (1.2%) than in only CPS samples (10.5%). The main reason for the unsatisfactory cervical smears in this study was low cell count (37.2% in CPS, 58.8% in LBC). Another prospective study by Singh et al., in 2015 presented similar results [7]. They determined that LBC smears yielded a significant reduction in the unsatisfactory smear rate because of

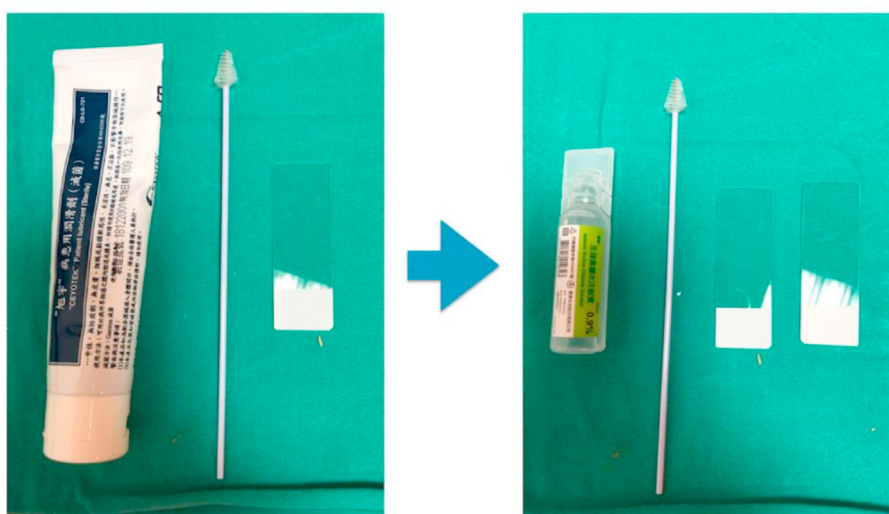


Fig. 1. Conventional and modified Pap smear steps.

Table 1

Percentages of unsatisfactory Pap smears before (2016) and after (2018) technique modification in our hospital and compared to Taiwan data.

| Year | 2016 | 2018 | P-value ^a |
|--------------|--------------------|---------------------------|----------------------|
| Our hospital | | | |
| Inadequate | 28 (4.71%) | 2 (0.33%) | <0.0001 |
| Adequate | 566 (95.29%) | 611 (99.67%) | |
| Total | 594 | 613 | |
| Taiwan | | | |
| Inadequate | 39,090 (1.66%) | (2.33%) | |
| Adequate | 2,315,742 (98.34%) | (97.67%) | |
| Total | 2,354,832 | Numbers are not available | |

^a Chi-square test.

better clarity, the uniform spread of smears, less time for screening, and better handling of hemorrhagic and inflammatory samples. A total of 4.3% and 1.7% unsatisfactory cervical smear cases were noted in CPS and LBC samples, respectively. Another study identified 7.1% and 1.6% unsatisfactory Pap smears in CPS and LBC samples, respectively [8]. The unsatisfactory Pap smear rate in LBC samples can be controlled to less than 2% [9]. One study showed that LBC smears could improve the unsatisfactory Pap smear rate of CPS from 4.3% to 1.7% [10]. Another study also showed that a lower unsatisfactory Pap smear rate was noted in LBC than in CPS samples (0.33% vs. 1.11%) and that this result was associated with increasing age [11]. One study found an extremely low percentage of unsatisfactory Pap smears in both methods (0.55% in CPS and 0.22% in LBC), with significance [12]. Another study revealed a lower unsatisfactory Pap smear rate in LBC samples than in CPS samples (1.6% vs. 6.6%) [13]. Taken together, the unsatisfactory Pap smear rate of LBC samples was lower than that of CPS samples.

Contrary to our study results, some studies found no difference in the unsatisfactory smear rate between CPS and LBC methods. Kituncharoen et al. reviewed a total of 23,030 cases of cervical cytology performed at King Chulalongkorn Memorial Hospital during 2012–2013 and found no difference in unsatisfactory smear rates between the CPS and LBC methods (0.1% vs. 0.1%, $P = 0.84$) [14]. Another study also identified no difference between the CPS and LBC methods (8% and 7% in CPS and LBC, respectively) [15]. A systemic review also revealed a difference of only 0.17% between the CPS and LBC methods [16]. Above all, there is no significant difference between the two methods.

Compare to the conventional pap smear, we used saline to replace the jelly. The previous report showed no difference between water and lubricants used in speculum insertion in the inadequacy of pap smear [17,18]. However, the lubricants used in liquid-based pap tests would affect the sample adequacy [19]. To avoid the influence of jelly lubricants, we used saline water to lubricate speculum.

Usually, the cervical brush rotated 360° twice is enough to extract a sufficient number of cells. However, for patients with the dry vagina or too much mucus in the cervix, the collected cell number could be insufficient. The expert suggested we could rotate two more times to collect sufficient cell numbers and one glass slide may be enough.

In this study, we improved the CPS technique at our hospital and achieved cytological results similar to those attained through the use of LBC. We contend that the difference in the results between the previous studies might be attributable to the Pap smear technique.

This study had some limitations. First, our sample size was small. According to the National Health Insurance Research Database of Taiwan, in 2016, 2,243,286 women received Pap smears (2,354,832 smears in total). The unsatisfactory smear rate in 2016 was 1.7%. Compared with this result, we only had 594 women

receiving Pap smears and an unsatisfactory smear rate of 4.71%. Second, the data were collected from procedures performed by only one gynecologist in one medical center. We cannot conclude whether our method could be applied by other gynecologists or could be generalizable to other countries with similar results.

According to our study results, we found two simple and low-cost methods—the use of saline lubrication and two glass slides—to effectively improve the number of cells collected, the inadequacy of which is the main reason for the unsatisfactory smear rate. However, more data are required to prove that our methods can be applied to other gynecologists or populations.

Conclusion

The use of this modified technique can effectively reduce the percentage of inadequate Pap smears.

Author contribution

CJC: acquisition, analysis, and interpretation of data; statistical analysis; and drafting the manuscript; MKH: method design; DCD: study concept and design; acquisition, analysis, and interpretation of data; drafting and final approval of the manuscript.

Funding

None.

Declaration of competing interest

None to declare.

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