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Comparison of ThinPrep and conventional smears in head and neck fine needle aspiration cytology

Baş ve boyun kitlelerinin ince iğne aspirasyon sitolojisinde konvansiyonel yaymalar ve ThinPrep'in karşılaştırılması

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ABSTRACT

Aim: The ThinPrep Processor has gained popularity as a collection and preparation technique for fine needle aspiration cytology in addition to Papanicolaou smear test. The aim of this study was to compare the various cytologic features of ThinPrep and conventional smear in head and neck masses.

Material and Methods: We reviewed 71 consecutive fine needle aspiration cytology specimens and the conventional smear and ThinPrep slides diagnosed without knowledge of histopathologic diagnosis. Statistical analysis was performed by ANOVA test on SPSS program.

Results: There was no statistical difference between the two groups as regard to the presence of monolayer cells, cell architecture, and nuclear details ($p>0.05$). Cellularity, informative background and cytoplasmic details were statistically significant in conventional smear group ($p<0.05$). However, in ThinPrep preparations there were no blood and necrosis masking the findings ($p<0.05$).

Conclusion: Combined use of conventional smear and ThinPrep preparation provides the best results for fine needle aspiration cytology.

Key words: Aspiration cytology, head and neck masses, ThinPrep

ÖZET

Amaç: ThinPrep Processor, Papanicolaou yayma tekniğine ilaveten ince iğne aspirasyonu için preparat hazırlama tekniği olarak kullanılan popüler bir yöntemdir. Bu çalışmanın amacı baş boyun kitlelerinde ThinPrep ve konvansiyonel yaymada çeşitli sitolojik özellikleri karşılaştırmaktır.

Materyal ve Metod: Ardışık olarak 71 ince iğne aspirasyon sitolojisi materyali değerlendirildi. Histopatolojik tanıları bilinmeksizin konvansiyonel yaymalar ve ThinPrep preparatları değerlendirildi. İstatistiksel değerlendirme SPSS programında ANOVA testi ile yapıldı.

Bulgular: Tek tabaka hücreler, hücre yapısı ve nükleer detayların varlığına göre her iki grupta da istatistiksel olarak anlamlı fark yoktu ($p>0.05$). Hücresellik, bilgilendirici zemin ve sitoplazmik detaylar konvansiyonel yayma grubunda istatistiksel olarak daha iyi idi ($p<0.05$). Bununla beraber ThinPrep preparatlarda kan ve nekroz yoktu ($p<0.05$).

Sonuç: Konvansiyonel yayma ve Thin Prep preparatların birlikte kullanımı ince iğne aspirasyon sitolojisi için en iyi sonucu sağlayacaktır.

Anahtar sözcükler: Aspirasyon sitolojisi, baş boyun kitleleri, ThinPrep

INTRODUCTION

For many clinicians, fine needle aspiration cytology (FNAC) is well established and first diagnostic step in evaluating head and neck masses (1,2,3,4). Inadequate smears, hypocellularity of the specimen, rupture of cells and poor fixation may be the causes of inaccurate diagnosis which is especially true in inexperienced hands (5).

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Different new techniques have been developed recently to improve the quality and performance of screening programs for cervical cancer. These new techniques (so-called liquid-based systems) are bringing different modifications of the initial Pap smear collection (6). ThinPrep involves a new technique for the preparation of cervical cytology specimens (7). Its usefulness in cervical smears has been studied since 1996 and it has been found to perform favorably, with an increased detection rate of abnormal cervical cytological specimens (7,8).

Several studies reported a sensitivity and specificity rate greater than 90% when nongynecological specimens were prepared by the ThinPrep (TP) technique alone. Many of these publications which endorse this new approach for specimen preparation have rated the quality of TP slides to be superior to the slides prepared with conventional techniques (direct smear and cytospin methods) (9,10,11). Only a few studies have addressed its usage regarding head and neck FNAC prepared by TP (5,12).

The aim of this study was to compare the cytomorphologic characteristics of TP and conventional smear (CP) preparations on FNAC material by a semiquantitative scoring system for head and neck masses.

MATERIALS and METHODS

We reviewed 71 consecutive FNAC specimens that were obtained from head and neck masses. All FNACs were performed by cytopathologists in the Cytology Unit of the Department of Pathology of our University.

Aspirations were performed by pathologists using a 23-27 gauge needle, 10-ml syringe and pistol handle (Comeco, Sweden). First aspirate was directly smeared and following alcohol fixation, stained with Papanicolaou (PAP) and hematoxylin-eosin (HE). Other slides were air-dried and stained with May Grünwald Giemsa (MGG) stain. Following this first procedure the mass was again aspirated in the same manner and the aspirate was processed in the "TP 2000 Processor" alcohol-based-preservative solution (Cytolyt, Cytyc Corp, UK) and stained with PAP technique.

Cytological diagnosis was classified as nondiagnostic, benign, suspicious and malignant. Representative slides of CS and TP were compared for cellularity, obscuring background material (blood and necrotic material), cell architecture, informative background (such as colloid, myxoid matrix, stromal fragments, lymphoglandular bodies etc.) and presence of monolayer cells in addition to nuclear and cytoplasmic details by semi quantitative scoring system (Table 1). Statistical analysis was performed by ANOVA test on SPSS program.

Table 1. Semiquantitative Scoring System.

Cytologic features	Score 0	Score 1	Score 2	Score 3
Cellularity	Nil	Scanty	Adequate	Abundant
Background (Blood, cell debris)	Nil	Occasional	Good	Abundant
Informative background	Absent	Present	-	-
Monolayer cells	Absent	Occasional	Many	-
Cell architecture	Not recognized	Partially recognized	Well recognized	-
Nuclear detail	Poor	Fair	Good	Very good
Cytoplasmic detail	Poor	Fair	Good	Very good

RESULTS

The patients' ages ranged between 7-85 years. Forty-two of them were male and 29 female. Number of slides for CS were between 2-10 (mean: 5) and 1 for TP. The aspiration sites were lymph nodes (n=27), soft tissue (n=20), thyroid (n=13) and salivary gland (n=11). The number of nondiagnostic, benign, suspicious and malignant cases that were diagnosed by CS and TP were 1, 37, 4, 29 and 6, 35, 7, 23, respectively (Table 2). The overall nondiagnostic rate was 9.8% (7/71).

There was no statistical difference between the two groups as regards to presence of monolayer cells, cell architecture, and nuclear details ($p>0.05$). Cellularity, informative backgrounds and cytoplasmic details were statistically more significant in CS group ($p<0.05$). However, TP preparations were superior to CS as for absence of blood and necrosis ($p<0.05$) (Fig 1a-b) (Table 3). In TP, there was a significant elimination of the obscuring background including blood and necrosis. TP smear preparations were also easier to interpret because the cells are in small areas, with clean backgrounds. The cells were more evenly distributed in the slides, with less overlapping in TP. But informative background including myxoid matrix in salivary gland neoplasms and colloid in thyroid aspirates were less prominent in TP (Figure 2a-b). Lymphoglandular bodies were not seen in the background of TP.

Histopathological correlation could be done only for 25 cases (35.2%) out of 71. Distribution of cytohistological diagnoses was presented in Table 4. The CS and TP preparations of these 25 patients demonstrated nondiagnostic, be-

Table 2. Comparison of diagnostic categories by ThinPrep and conventional preparations.

	NDC		BC		SC		MC		Total	
Histopathological correlation (HC)	**CS**	**TP**	**CS**	**TP**	**CS**	**TP**	**CS**	**TP**	**CS**	**TP**
Benign	-	1	-	1	-	1	-	1	-	1
Malign	-	1	-	1	-	1	-	1	-	1
Follow up	-	-	-	-	-	-	-	-	-	-
No HC	1	4	1	4	1	4	1	4	1	4
Total	1	6	1	6	1	6	1	6	1	6

NDC: Nondiagnostic cytology
BC: Benign cytology
SC: Suspicious cytology
MC: Malignant cytology
CS: Conventional smears
TP: ThinPrep

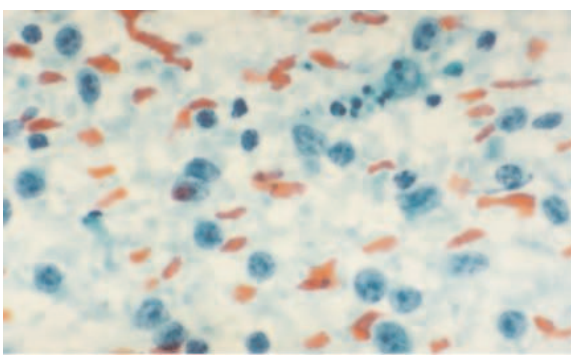

Figure 1a. Atypical lymphoid cells on direct smear with erythrocytes at the background (PAP/100x1.25 oil).

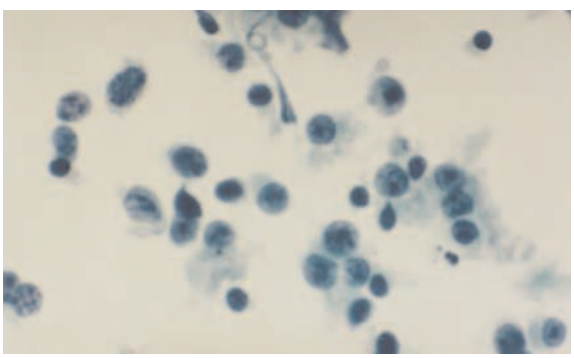

Figure 1b. Atypical lymphoid cells on ThinPrep preparation (PAP/100x1.25 oil).

Table 3. ANOVA table and mean-standard deviation of the two techniques.

	Cellularity	Blood, necrosis	Informative background	Monolayer cells	Cell architecture	Nuclear detail	Cytoplasmic detail
CS	2.35 (± 0.72)	2.28 (± 0.70)	0.63 (± 0.48)	1.33 (± 0.69)	1.74 (± 0.46)	1.97 (± 0.69)	1.95 (± 0.76)
TP	2.06 (± 0.79)	0.41 (± 0.62)	5.88 (± 0.23)	1.16 (± 0.68)	1.60 (± 0.57)	1.86 (± 0.75)	1.69 (± 0.83)
F	5.250	273.499	77.712	2.271	2.599	0.720	3.869
P	0.023	0.000	0.000	0.134	0.109	0.398	0.051

CS: Conventional Smears
TP: ThinPrep

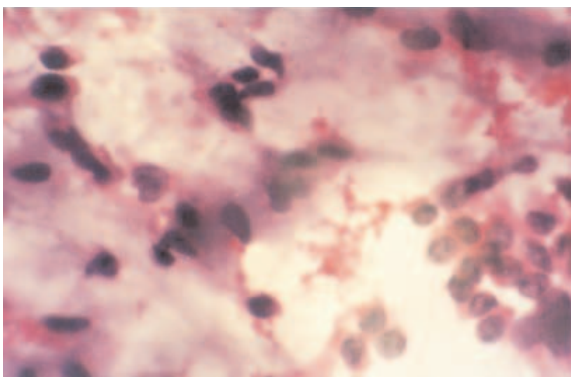

Figure 2a. Ductal epithelial cells and myoepithelial cells embedded in a fibrillary myxoid matrix on direct smear (MGG/100x 1.25 oil).

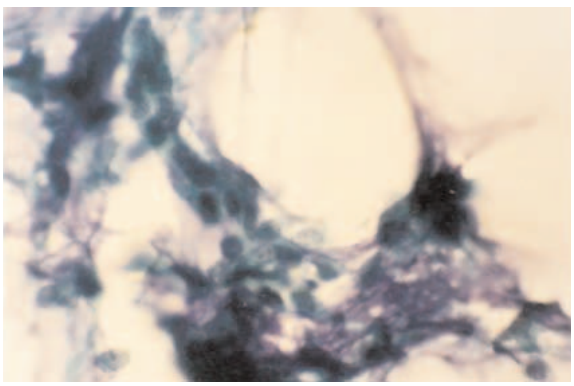

Figure 2b. Ductal epithelial cells and condensed myxoid matrix on ThinPrep preparation (PAP/100x 1.25 oil).

Table 4. Cyto-histopathological correlation for head and neck masses' FNAC.

	Histopathologic diagnosis	n	CS	TP
Lymph node	Metastatic carcinoma	5	5MC	4MC, 1SC
	Malignant lymphoma	3	3MC	2MC, 1SC
	Hodgkin lymphoma	2	1BC, 1MC	1BC, 1MC
	Granulomatous inflammation	2	2BC	2BC
	Total	12		
Thyroid	Nodular goitre	3	3BC	2BC, 1NDC
	Total	3		
Salivary gland	Pleomorphic adenoma	2	2BC	2BC
	Warthin's tumor	1	1BC	1BC
	Indifferentiated carcinoma	1	1MC	1SC
	Normal salivary gland	1	1SC	1SC
	Total	5		
Soft tissue	Epithelial malignant tumor	2	2MC	2MC
	Monotonous tumoral infiltration	2	2MC	2MC
	Granulomatous inflammation	1	1BC	1BC
	Total	5		

NDC: Nondiagnostic cytology
BC: Benign cytology
SC: Suspicious cytology
MC: Malignant cytology
CS: Conventional smears
TP: ThinPrep

nign, suspicious and malignant cytologies in 0, 10, 1, 14 and 2, 9, 4, 10 cases respectively. Metastatic carcinoma (20%) and nodular goitre (12%) were the most common diagnoses. Tab-

Table 5. Sensitivity and specificity of diagnosing head and neck masses based on both methods.

Preparation	Sensitivity	Specificity	Accuracy	PPV	NPV
Conventional smear	93.33	92.30	92.85	93.33	92.30
ThinPrep	92.85	91.66	92.30	92.85	91.66

PPV: Positive predictive value
NPV: Negative predictive value

le 5 summarizes diagnostic sensitivity and specificity of head and neck masses on both methods in addition to histopathological confirmation (25 cases). The sensitivity and specificity were 93.3% and 92.3%, for CS and 92.8% and 91.6%, for TP cases, respectively.

DISCUSSION

The TP 2000 Processor is a slide-preparation device that prepares a monolayer of cells on a glass slide from cells collected in an alcohol-based preservative solution (9,10). TP 2000 Processor is said to limit or remove excess blood, mucus, inflammatory exudate or debris, hence improving cytomorphology (13,14). TP has enjoyed favorable reports of evaluations from a number of studies involving both gynecologic and nongynecologic specimens. In these studies, based on limited numbers of cases, authors have attributed benefits such as increased cellularity, lack of obscuring background material, improved morphology and a decrease in the rate of unsatisfactory or less than optimal specimens relative to conventional cytopreparatory techniques to TP methods (9-17). We objectively compared various cytological features of TP and CP on FNAC material by a semiquantitative scoring system.

In our study; by TP method, only one glass slide per case is prepared, and the cells are confined within a circle of 20 mm diameter on the TP slide; by CP, at least two slides per case are prepared, and the cells are dispersed over a wider area. Luna et al. reported that they had prepared 7 slides for every case at an average and cellular components had changed from one area to other (15). In this study, number of slides per CS were between 2-10 (mean: 5) whereas 1 for each TP preparation.

Nondiagnostic materials were encountered more frequently in TP preparations than CS. In our study, air-dried smears were stained with a MGG and examined on site to assess for specimen adequacy. The possibility of evaluating the cellularity in cytology unit just after the aspiration is an advantage of CS. Not having similar chance for TP accounts higher amount of nondiagnostic material.

There were 4 suspicious cytology in the CS group whereas 7 in TP group. A slightly higher number of suspicious materials in TP preparation can be explained as lack of experience in evaluation of TP technique and inability to detect higher cellularity on TP slides. Lee et al. reported the need of experience for the correct TP interpretation (12).

In TP method, a mucolytic and hemolyzing solution is used so that the red blood cells and mucus are lysed, and inflammatory cells are dispersed throughout the specimen. However, stroma, colloid, etc., which may be helpful in diagnosis, are also removed and may make the diagnosis problematic (9). Assessment of the amount of colloid in the background plays an important role in the diagnosis of follicular lesions of the thyroid (9,11). Our study showed that the amount of colloid on TP was diminished. Colloid tended to appear dense, markedly fragmented or in droplets in all thyroid cases. None of the cases in our study showed diffuse watery colloid, which was probably lost during the TP processing. Biscotti et al. highlighted this problem in their study of TP and CS on FNACs of thyroid lesions (16). Conversely, Lee et al. found that background material is kept slightly better on TP slides (12).

Al-Khafaji et al. reported that there are cytological artifacts as reduction and irregularity in the extracellular and stromal elements on TP preparations (17). Similarly in the study of

Michael and Hunter, it was reported that quality and quantity of background matrix change in the TP preparations (18). Parfitt et al. reported that there were discrepancies between CS and TP of the FNAB of submandibular gland, especially relating to stromal and morphological features (19).

In our study we realized the change of the quality of the myxoid matrix in the salivary gland masses on TP slides. Fibrillary and myxoid matrices were condensed and fragmented on TP slides. It is well known that extracellular material is evaluated more correctly with MGG stain. The amount and the quality of extracellular material were better in CS slides when compared with PAP stained CS and TP slides. The usage of both stain techniques in CS is the major advantage.

All FNACs were done by the same pathologist in this study. Therefore it is clear that there is less air-drying artifact and mechanical distortion in CS preparations. Most experienced (cyto) pathologists prefer direct smears of aspirated material rather than smears prepared from material rinsed in a fixative (12). For clinicians who perform FNAC infrequently or without the assistance of a (cyto) pathologists, the use of fluid fixatives for cell collection and later preparation of the smear in the laboratory are other alternatives

In this study, there was no statistical difference between the two groups as regards to the presence of monolayer cells, cell architecture, nuclear and cytoplasmic details ($p>0.05$) (Table 3). Cellularity and informative background, cytoplasmic detail were statistically more significant in CS group ($p<0.05$). But, Dey et al. objectively compared various cytological features of TP and CS on FNAC materials; and they found that TPs were superior to CS with regard to clear background, monolayer cells and cell preservation (11). In the study by Ford et al, TP is equal to the CS in terms of the degree of monolayer detail and cellular yield provided (5). We found that the major advantages of the TP method were the staining caused by the lysis of blood. Since the lymphoglandular bodies are only a feature of air-dried specimens and could not be seen in wet-fixed PAP-stained slides whether prepared with TP or CS, in lymph node FNACs, lymphoglandular bodies were easily found in the background of the CS. For this reason, we think that it would be difficult to evaluate the samples from the lymph nodes on TP preparations. Ford et al. highlighted the fact that lymphoid cells have a tendency to aggregate which might erroneously be thought as epithelial cells (5). We didn't observe similar aggregations in TP preparations.

ThinPrep technique is easier to apply. TP preparations are superior to CS with regard to clear background, specifically in terms of eliminating background of blood and necrosis. However, we observed that the amount of colloid and myxoid matrix on TP is diminished and therefore, it is difficult to estimate its quantity.

In our study only limited number of histopathologic diagnoses were available. When specificity, sensitivity, accuracy, negative and positive predictive values were taken into consideration, there was no superiority between the two techniques. When background and minimal nonspecific dye features are important in the diagnosis, combined use of CS and TP preparation provides the best result for FNA cytology.

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