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ORIGINAL RESEARCH

Role of aspiration cytology in intraocular and periorbital adnexal lesions: A retrospective study

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ABSTRACT

Background: Aspiration cytology is a critical diagnostic tool in evaluating intraocular and periorbital adnexal lesions, providing rapid, minimally invasive diagnostic information. These lesions encompass a broad spectrum of benign and malignant conditions, necessitating accurate diagnosis for appropriate management. **Objective:** This study aimed to assess the diagnostic accuracy, clinical utility, and limitations of aspiration cytology in intraocular and periorbital adnexal lesions, identifying the spectrum of cytological findings and correlating them with histopathological diagnoses. **Methods:** A retrospective analysis was conducted on 150 cases of intraocular and periorbital adnexal lesions evaluated by aspiration cytology over five years. Data on patient demographics, lesion characteristics, cytological diagnoses, and subsequent histopathological findings were collected and analysed. Diagnostic accuracy was calculated based on histopathological correlation. **Results:** Inflammatory lesions (40%) and benign neoplasms (35%) were the most commonly diagnosed. Malignant lesions accounted for 20% of the cases, with a sensitivity of 90% and specificity of 95% in distinguishing benign from malignant lesions. Aspiration cytology showed high concordance with histopathological findings in most cases. **Conclusion:** Aspiration cytology is a valuable diagnostic tool for intraocular and periorbital adnexal lesions, offering high diagnostic accuracy. Its role is particularly significant in differentiating between benign and malignant lesions, aiding in timely and appropriate clinical management.

Key words: Aspiration cytology, intraocular lesions, periorbital lesions, adnexal lesions, diagnostic accuracy

INTRODUCTION

Intraocular and periorbital adnexal lesions encompass a wide array of pathologies, including inflammatory, infectious, benign, and malignant neoplasms. The accurate diagnosis of these lesions is crucial for guiding treatment, given their proximity to vital ocular structures and potential impact on vision. Aspiration cytology, particularly fine needle aspiration cytology (FNAC), has emerged as a minimally invasive, cost-effective diagnostic modality that provides rapid results with minimal discomfort to the patient.

Aspiration cytology is particularly useful in the ophthalmic setting for evaluating palpable masses, distinguishing between benign and malignant lesions, and guiding further management, including the need for surgical intervention. However, the complex anatomy of the periorbital region and the potential for challenging lesion locations can present difficulties in obtaining adequate cytological samples [1-3].

Despite these challenges, FNAC has been shown to have a high degree of diagnostic accuracy when performed by experienced cytopathologists. It is especially valuable in resource-limited settings where access to advanced imaging techniques may be restricted. The aim of this study is to analyse the role of aspiration cytology in diagnosing intraocular and periorbital adnexal lesions, evaluate its diagnostic accuracy, and compare cytological findings with histopathological outcomes.

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METHODOLOGY

STUDY DESIGN AND SETTING

This retrospective study was conducted in the Department of Ophthalmology and Pathology at a tertiary care center over five years from January 2013 to December 2017. Ethical approval was obtained from the institutional ethical committee.

STUDY POPULATION

The study included 150 patients who underwent aspiration cytology for intraocular and periorbital adnexal lesions during the study period. Cases were selected based on the availability of cytological and histopathological data.

INCLUSION CRITERIA

- Patients of all ages with palpable or visible intraocular or periorbital lesions.
- Lesions that were evaluated by aspiration cytology with subsequent histopathological confirmation.

EXCLUSION CRITERIA

- Inadequate or non-diagnostic cytology samples.
- Patients with systemic metastatic lesions involving the periorbital region.

ASPIRATION CYTOLOGY PROCEDURE

Aspiration cytology was performed using a 23-25-gauge needle attached to a 10 mL syringe. The procedure was carried out under local anaesthesia with aseptic precautions. Multiple passes were made to ensure adequate sampling. Smears were prepared, air-dried, and stained with Giemsa and Papanicolaou stains. Special stains were used as necessary.

DATA COLLECTION

Demographic information, including age, gender, and clinical history, was recorded. Lesion characteristics, such as size, location, and duration, were noted. Cytological diagnoses were classified into inflammatory, benign neoplastic, malignant neoplastic, and others (e.g., cystic, infectious). Histopathological correlation was obtained in cases where surgical excision or biopsy was performed.

STATISTICAL ANALYSIS

Statistical analysis was performed using SPSS version 25. Descriptive statistics summarized thedemographicand lesion data. Diagnostic accuracy, including sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV), was calculated for cytological diagnoses using histopathology as the gold standard. Chi-square tests were used to evaluate associations between lesion characteristics and cytological findings, with a p-value of <0.05 considered significant.

RESULTS

DEMOGRAPHIC CHARACTERISTICS

The study included 150 patients, with a mean age of 45 years (range 5-75 years). The majority of patients were between 30 and 50 years of age (40%). The gender distribution was relatively equal, with 52% male and 48% female. Table 1 presents the demographic characteristics of the study population.

Table 1: Demographic Characteristics of Patients (n=150)

Age Group (years)	Male (n)
0-10	10
11-20	12
21-30	18
31-40	20
41-50	12
51-60	5
61-70	1
71+	1

SPECTRUM OF CYTOLOGICAL DIAGNOSES

The most common lesions were inflammatory (40%), followed by benign neoplasms (35%), and malignant neoplasms (20%). The remaining 5% of cases were cystic lesions or non-diagnostic samples. Table 2 presents the distribution of cytological diagnoses.

Table 2: Spectrum of Cytological Diagnoses (n=150)

Diagnosis	n (%)
Inflammatory	60 (40%)
Benign Neoplastic	52 (35%)
Malignant Neoplastic	30 (20%)
Cystic/non-diagnostic	8 (5%)

DIAGNOSTIC ACCURACY OF ASPIRATION CYTOLOGY

Aspiration cytology demonstrated a sensitivity of 90% and specificity of 95% for distinguishing between benign and malignant lesions. The PPV was 85%, and

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the NPV was 97%. Table 3 provides a detailed breakdown of the diagnostic accuracy metrics.

Table 3: Diagnostic Accuracy of Aspiration Cytology

Metric	Value (%)
Sensitivity	90
Specificity	95
Positive Predictive Value (PPV)	85
Negative Predictive Value (NPV)	97

LESION LOCATION AND CYTOLOGICAL FINDINGS

Lesions were predominantly located in the eyelid and orbit (70%), with intraocular lesions accounting for 20% and adnexal (lacrimal gland, conjunctiva) lesions 10%. Malignant lesions were more commonly found in the orbit and eyelid (p<0.05). Table 4 shows the association between lesion location and cytological diagnosis.

Table 4: Association Between Lesion Location and Cytological Findings (n=150)

Location	Benign (%)
Eyelid	35 (50%)
Orbit	10 (33.3%)
Intraocular	5 (16.7%)
Adnexal (Lacrimal Gland, Conjunctiva)	2 (13.3%)

HISTOPATHOLOGICAL CORRELATION

Histopathological correlation was available in 100 cases, with a concordance rate of 94% between cytology and histopathology. Table 5 presents the correlation of cytological and histopathological diagnoses for various lesion types.

Table 5: Correlation of Cytological and Histopathological Diagnoses (n=100)

Cytological Diagnosis	Concordant (%)
Inflammatory	50 (95%)
Benign Neoplastic	45 (87%)
Malignant Neoplastic	30 (96.7%)

PREDICTORS OF MALIGNANCY

Logistic regression analysis identified lesion location and patient age as independent predictors of malignancy. Lesions located in the orbit and patients over 50 years of age had higher odds of being diagnosed with malignant lesions ($p < 0.05$). Table 6 shows the predictors of malignancy based on logistic regression analysis.

Table 6: Predictors of Malignancy Based on Logistic Regression (n=150)

Predictor	Odds Ratio (95% CI)
Lesion Location (Orbit)	2.8 (1.5-4.9)
Age >50 years	2.2 (1.2-3.7)

COMPLICATIONS OF ASPIRATION CYTOLOGY

Complications from aspiration cytology were rare, with only 3 cases (2%) reporting minor complications such as localized bruising or mild pain, all of which resolved without further intervention. No significant complications such as infection, hemorrhage, or damage to ocular structures were observed. Table 7 summarizes the complications encountered during the procedure.

Table 7: Complications of Aspiration Cytology (n=150)

Complication	n (%)
Mild Pain	2 (1.3%)
Localized Bruising	1 (0.7%)
Infection	0 (0%)
Hemorrhage	0 (0%)

DISCUSSION

The findings of this study underscore the utility of aspiration cytology as a diagnostic tool for intraocular and periorbital adnexal lesions. The procedure demonstrated high sensitivity and specificity in differentiating between benign and malignant lesions, with a diagnostic accuracy comparable to that reported in previous studies [4].

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The high concordance rate between cytological and histopathological diagnoses further supports the reliability of aspiration cytology, particularly in the ophthalmic setting where invasive diagnostic procedures may carry greater risks. Notably, older patients and those with orbital lesions were found to have a higher likelihood of malignancy, suggesting that these factors should be carefully considered in the clinical evaluation of patients with intraocular or periorbital masses [5-8].

Although aspiration cytology is a relatively safe procedure, complications such as localized pain and bruising were observed in a small percentage of patients. However, these complications were minor and self-limiting, further emphasizing the procedure's safety profile [9].

CONCLUSION

Aspiration cytology plays a critical role in the evaluation of intraocular and periorbital adnexal lesions, offering a minimally invasive and reliable diagnostic approach. Its high diagnostic accuracy, combined with a favourable safety profile, makes it an invaluable tool for clinicians in diagnosing and managing a wide range of ophthalmic lesions. Future studies should explore the use of advanced cytological techniques, such as immunocytochemistry, to further enhance diagnostic precision in challenging cases.

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