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FNA Based Diagnosis of Head and Neck Nodal Lymphoma

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A B S T R A C T

Fine-needle aspiration (FNA) biopsy has become a well established technique in the diagnosis, staging, and follow-up of patients with head and neck lesions. As in lymphoma diagnostics, FNA serves as a screening method in evaluating potentially affected lymph node for open or core biopsy. According to the World Health Organization classification of lymphoid neoplasms, today it is important to recognize cell morphology and reveal its phenotype, then combine it with different genotypic information and clinical data to provide appropriate therapy. The aim of this study was to assess the efficacy of FNA and immunocytochemistry based lymphoma diagnostic in head and neck region. We conducted a retrospective study during a period of three years where cases with either FNA diagnosis or clinical suspicion of newly recognized or relapsing lymphoma were reviewed. In the study were included patients that were referred to our laboratory from hematology department, in whom head and neck lymphadenopathia was found and lymph node FNA preceded other procedures. Two hundred eighty-five aspirations from 248 patients fulfilled study criteria. Adequate specimens were diagnosed as lymphoma in 100 cases (36%), in 65 male and 35 female patients, 76 in patients with newly discovered disease and 24 in patients with prior lymphoma diagnosis. Overall sensitivity of FNA specimens in the diagnosis of head and neck lymphomas was 90%, specificity 88%, predictive value of a positive result 97%, and predictive value of negative result 61%. Based on our results FNA corroborated with immunophenotyping by immunocytochemistry can be method of choice in primary lymphoma diagnosis as a method complementary to histopathology in lymphoma diagnostics.

***Key words**: fine needle aspiration, lymphoma, head and neck, WHO*

Introduction

Fine-needle aspiration (FNA) biopsy has become a well established technique in the diagnosis, staging, and follow-up of patients with head and neck lesions. Clinicians use FNA to provide rapid diagnostic information regarding palpable masses of lymph nodes, thyroid gland and salivary glands. Whether it is a palpable or deeply seated lesion, where ultrasound guidance is necessary, lymph node FNA has been used for the diagnoses of inflammatory and reactive conditions, as well as lymphomas and metastases. In general, FNA is a first-line diagnostic procedure in evaluating benign from malignant lesion that requires further diagnostics. As in lymphoma diagnostics, FNA serves as a screening method in evaluating potentially affected lymph node for open or core biopsy. The role of FNA as a definitive diagnostic procedure in diagnosing lymphoma is somewhat controversial, although today the accepted World Health Organization (WHO) classification defines lymphoid diseases with combination of morphologic, immunologic, genotypic and molecular features, putting less emphasis on histopathology as a sole determination of lymphoma subtype. WHO classification recognizes three major categories of lymphoid neoplasms: B cell neoplasms, T/NK cell neoplasms and Hodgkin lymphoma, where B and NK/T cell lymphomas are further divided into precursor and peripheral or mature neoplasms[1]. Although not included in the WHO classification, terms such as indolent, aggressive and very aggressive lymphomas are commonly used

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in daily practice. They refer to the natural history and biologic behavior of the lymphoid neoplasms, and treatment strategy is similar for the entities within each group[2,3]. Different types of small B-cell lymphomas, nodular lymphocyte predomination Hodgkin lymphoma (NLPHL) and cutaneous T-cell lymphomas have indolent clinical course, while diffuse large B-cell lymphomas (DLBCL), peripheral T-cell lymphomas (PTCL) and classical Hodgkin lymphoma (cHL) tend to behave aggressively. Burkitt lymphoma (BL) and lymphoblastic lymphoma (LBL) are very aggressive lymphomas. Today it is important to recognize cell morphology and reveal its phenotype, then combine it with different genotypic information and clinical data to provide appropriate therapy.

FNA accuracy for lymphoma diagnosis may be improved using ancillary techniques, such as immunocytochemistry or cytogenetic analyses, in addition to aspiration cytomorphology. In our institution, FNA is a first--line diagnostic procedure for the initial evaluation of head and neck lymphadenopathy, while immunocytochemistry is being used on a routine basis. We speculated that analysis of FNA specimens coupled with detailed immunophenotypic analysis might enable us to reliably distinguish different lymphoma types. The aim of this study was to assess the efficacy of FNA in that region and to evaluate its sensitivity regarding lymphoma diagnostics.

Patients and Methods

Study design

We conducted a retrospective study during a period of three years (from January 2005 until December 2007), where cases with either FNA diagnosis or clinical suspicion of newly recognized or relapsing lymphoma were reviewed. In the study were included patients, regardless of gender and age that were referred to our laboratory from hematology department, in whom head and neck lymphadenopathia was found and lymph node FNA preceded other procedures. Patients with newly recognized lymphoma underwent surgical biopsy and histopathologic examination of the same lymph node site within a time interval of 1 month. Patients with prior diagnosis of lymphoma were biopsied in the same period of time in cases where last cytotoxic treatment ended at least 6 months ago. Patients with FNA diagnosis of reactive lymphoid hyperplasia were generally not biopsied, except in cases in which the clinical suspicion remained strong despite a negative cytomorphologic finding.

FNA

All FNAs were performed at least twice on each node with a 22 Gauge needle and 10 ml plastic syringe using the reverse Y method (as described by Zajicek)[4]. Smears were air dried, part of them were stained with the May--Grünwald-Giemsa (MGG) stain using the standard method. Residual smears were put aside and fixed in cold acetone (4 °C) for further immunocytochemical analyses. Smears were evaluated for following features: cell size, chromatin pattern, nuclear membrane irregularities, pre sence and shape of nucleoli, presence of mitotic figures and homogeneity of cell population. Four experienced cytomorphologists performed aspirations and analyzed each smear. In dubious cases consensus diagnosis was reached if three out of four cytomorphologists agreed.

Immunocytochemistry

In cases diagnosed on MGG stained smears as newly discovered lymphoma, in order to subtype individual cases, immunocytochemical stainings were performed with alkaline phosphatase labeled avidin-biotin method (LSAB+System-AP, DakoCytomation, Glostrup, Denmark), according to the protocol described by Dako[5]. The primary panel consisted of antibodies against CD3, CD20, and CD43. Depending on positive reactions and cell morphology, further analyses were performed. If B-cell lymphoma was suspected antibodies against CD5, CD10, CD19, CD23, BCL2, BCL6 and BCL1 were used. In cases with suspected T-cell lymphoma CD2, CD7, and CD4/CD8 were used. If Hodgkin's lymphoma or anaplastic T-cell lymphoma (ALCL) were suspected, the panel of antibodies consisted of anti- CD15, CD30, CD45, CD20, EMA and ALK (DakoCytomation, Glostrup, Denmark) to differentiate between classical Hodgkin's lymphoma (cHL), nodular lymphocyte predomination Hodgkin lymphoma (NLPHL) and ALCL. If lymphoblastic lymphoma (LBL) was suspected the antibody against TdT was added[6]. Results were evaluated semi-quantitatively, estimating percentage of cells staining positively with a given marker. The reaction was considered positive if 75% of cells were reactive with given antibody, partially positive if 25–75% of cells were reactive, and negative if less than 25% were stained with the antibody. Lymphomas were classified based on the WHO classification. No distinction was made between follicular lymphoma grade 1, 2 and 3A[7]. We differentiated NLPHL and cHL, without subclassification of its subtypes. The cytomorphological diagnosis of lymphoma and classification were established by cytomorphologists unaware of the histopathological diagnosis.

Histopathology

The lymph node biopsies were processed routinely with hematoxylin and eosin. Immunohistochemistry was performed on 4-μm-thick deparaffinized tissue sections using a streptavidin-biotin peroxidase method with antibodies against CD20, CD3, CD15, CD30, CD43, CD45RO, CD68, EMA, ALK1, TdT (DakoCytomation, Glostrup, Denmark), CD2, CD4, CD5, CD7, CD8, CD10 (Novocastra, Newcastle, Great Britain). Diagnoses were made by experienced hematopathologists.

Statistics

FNA specimens were classified as diagnostic of lymphoma, negative of lymphoma, and inadequate specimens. Sensitivity, specificity and predictive values were calculated according to standard methods.

Ethics

Before undergoing FNA, patients gave informed consent. This study was approved by the Ethical Committee of the School of Medicine, University of Zagreb.

Results

Between January 2005 and December 2007 we performed 924 lymph node aspirates. Two hundred eighty-five aspirations from 248 patients fulfilled study criteria. There were 128 men and 120 women, whose age ranged from 9 months to 95 years (median 44 years). In 37 patients ultra-sound guided aspiration was performed. FNA yielded adequate material in 277 of the 285 specimens (97%). Specimens that were inadequate for diagnosis consisted of peripheral blood or fragments of fibroadipose tissue. Adequate specimens were diagnosed as lymphoma in 100 cases (36%), in 65 male and 35 female patients, 76 in patients with newly discovered disease and 24 in patients with prior lymphoma diagnosis. Specimens diagnosed as benign changes (176 cases, 63%), were interpreted as reactive changes in 164 cases, granulomatous inflammatory processes in 9 cases, and changes consistent with necrosis in 3 cases. One specimen was interpreted as metastatic seminoma. Immunocytochemical analyses were performed in 73 cases of newly diagnosed lymphomas, and gave technically satisfactory result in 67 cases (91%). The cytomorphologic subclassification of the lymphoma specimens is given in Table 1. Overall sensitivity of FNA specimens in the diagnosis of head and neck lymphomas was 90%, specificity 88%, predictive value of a positive result 97%, and predictive value of a negative result 61%.

TABLE 1
CYTOMORPHOLOGIC SUBCLASSIFICATION OF LYMPHOMA SPECIMENS

Cytomorphologic diagnosis	No. of cases (%)
SLL	32
FL	11
LPL	2
NMZL	2
DLBCL	11
BL	1
BUCL*	13
TLBL	2
PTCL, NOS	3
MF	1
ALCL	1
cHL	19
NLPHL	2
total	100

SLL – small lymphocytic lymphoma/chronic lymphocyte leukemia, FL – follicular lymphoma, LPL – lymphoplasmacytic lymphoma, NMZL – nodal marginal zone lymphoma, DLBCL – diffuse large B-cell lymphoma, BL – Burkitt lymphoma, BUCL – undifferentiated B-cell lymphoma, PTCL, NOS – peripheral T-cell lymphoma, MF – mycosis fungoides, TLBT – lymphoblastic T-cell lymphoma, ALCL – anaplastic large cell lymphoma, not otherwise specified, cHL – classical Hodgkin lymphoma, NLPHL – nodular lymphocyte predomination Hodgkin lymphoma
* histopathologically diagnosed as undifferentiated B-cell lymphoma of low malignancy

Comparison with biopsy specimens

Biopsy specimen from the same lymph node site was available for comparison purposes in 62 cases. Core biopsy was performed in two cases and open biopsy in the rest of the cases. Both methods gave the same diagnoses in 56 out of 62 cases (90%). Lymphoma was present in 53 out of 62 biopsy specimens, benign changes in 8 specimens, and metastatic seminoma in one specimen. Matching FNA specimens were diagnosed as lymphoma in 48 cases (88%), benign changes in 7 cases, metastatic disease in one case, while three cases were non-diagnostic due to material inadequacy (Table 2). There was one false positive case, where FNA specimen diagnosed as undifferentiated B-cell lymphoma (B-UCL) proved to be reactive lymphoid hyperplasia on biopsy specimen. Two false negative cases that were diagnosed as benign changes, proved to be follicular lymphoma (FL) on biopsy specimen. Two out of three inadequate FNA specimens were diagnosed as Hodgkin's lymphoma on biopsy material, and one as diffuse large B-cell lymphoma (DLBCL). Exact diagnostic agreement was found in diagnosing benign changes, as well as in diagnosing metastatic disease.

TABLE 2
OVERALL AGREEMENT BETWEEN FNA AND BIOPSY DIAGNOSES

Biopsy	FNA		
	Pozitive	Negative	Inadequate
Lymphoma 53	48	2	3
Benign changes 8	1	7	0
Other malignancy 1	1	0	0

Accuracy of lymphoma subclassification

Diagnostic agreement of concurrent FNA and biopsy specimens in both lymphoma diagnosis and subclassification was found in 40 (75%) cases (Tables 3, 4 and 5). Diagnosis but not lymphoma subclassification was rendered in 8 cases, mostly among small B-cell lymphomas, where 5 of histologically proven nodal marginal zone lymphomas (NMZL) were falsely diagnosed as FL (2 cases), B-UCL (2 cases) and lymphoplasmacytic lymphoma (LPL). One histologically diagnosed follicular lymphoma was on FNA specimen diagnosed as DLBCL. Two histologically diagnosed angioimmunoblastic T-cell lymphomas (T-AIL) were on FNA specimens diagnosed as two cases of PTCL, not otherwise specified (PTCL, NOS). Major diagnostic discrepancy was found in 5 cases, two patients underwent biopsy despite negative cytomorphologic findings, and were later diagnosed as follicular lym-

TABLE 3
ACCURACY OF FNA BASED LYMPHOMA SUBCLASSIFICATION IN CONCURENT FNA AND BIOPSY SPECIMENS REGARDING B-CELL LYMPHOMAS

Biopsy specimen	FNA			
	EA(%)	D	FP	FN
SLL 5	5	0	0	0
FCC 9	7	1	1	1
NMZL 7	2	5	0	0
DLBCL 11	9	1	0	1
BL 1	1	0	0	0
BUCL 2	2	0	0	0
Total 35	26(73)	7	1	2

SLL – small lymphocytic lymphoma/chronic lymphocyte leukemia, FL – follicular lymphoma, NMZL – nodal marginal zone lymphoma, DLBCL – diffuse large B-cell lymphoma, BL – Burkitt lymphoma, BUCL – undifferentiated B-cell lymphoma, EA – exact agreement, D – disagreement, FP-false positive, FN – false negative

TABLE 4
ACCURACY OF FNA BASED LYMPHOMA SUBCLASSIFICATION IN CONCURENT FNA AND BIOPSY SPECIMENS REGARDING HODGKIN´S LYMPHOMA

Biopsy specimen	FNA			
	EA(%)	D	FP	FN
cHL 11	7	2	0	2
NLPHL 2	2	0	0	0
Total 13	9(84)	2	0	2

cHL – classical Hodgkin lymphoma, NLPHL – nodular lymphocyte predomination Hodgkin lymphoma, EA – exact agreement, D – disagreement, FP – false positive, FN – false negative

TABLE 5
ACCURACY OF FNA BASED LYMPHOMA SUBCLASSIFICATION IN CONCURENT FNA AND BIOPSY SPECIMENS REGARDING T-CELL LYMPHOMA

Biopsy specimen	FNA			
	EA(%)	D	FP	FN
TLBL 2	2	0	0	0
TAIL 2	0	2	0	0
ALCL 1	1	0	0	0
Total 5	3(60)	2	0	0

TLBL – lymphoblastic T-cell lymphoma, TAIL – angioimmunoblastic T-cell lymphoma, ALCL – anaplastic large cell lymphoma, EA – exact agreement, D – disagreement, FP – false positive, FN – false negative

phomas. In three specimens that were inadequate for analysis fragments of fibrous tissue were found. One was histologically diagnosed as DLBCL, and the other two as Hodgkin's lymphoma. One specimen was falsely diagnosed as FL but proved to be benign on biopsy.

Discussion

In the current practice of medicine, which is both cost-conservative and minimally invasive, FNA serves as an excellent preliminary diagnostic measure in the evaluation of patients with lymphadenopathy. Question remains, could it be used as an alternative morphologic method in lymphoma diagnostics, as a part of general evaluation of lymphoma patients that includes cytogenetic, molecular and clinical findings. Although histologic evaluation of affected lymph node has documented advantages for the lymphoma classification, sometimes it differentiated from biologic and clinical behavior of the lymphoma. According to widely accepted WHO classification, it is more important to identify the cell morphology and immunophenotype, along with genetic and clinical features, than to diagnose lymphoma by pattern of lymphoma cell growth.

Approximately one fourth (27%) of patients that came to our laboratory with lymphadenopathia had enlarged lymph node in head and neck region, where clinical assessment of masses is highly challenging owing to the complex anatomy of this region. In 37 cases with deeply seated lesions, FNA was ultra-sound guided. The sensitivity of FNA for the diagnosis of lymphoma has been reported to range between 66% and 95%[8–12]. In comparison, our diagnostic sensitivity was 90% with predictive value of positive tests of 97%, and specificity of 88%. Predictive value of negative tests was rather low, yielded 61%, mostly due to specimen inadequacy which proved to be major diagnostic limitation of FNA lymphoma diagnostics. In some cases, the inherent characteristics of lymphoma (i.e. fibrosis in cHD) prevent cytomorphologists from obtaining enough material for several analyses. Two of our non-diagnostic specimens due to specimen inadequacy were histologically diagnosed as cHL. Therefore, in the presence of a clinically suspicious lymph node an aspirate with scant cellularity is a significant finding, and demands further investigation (usually surgical biopsy). Thus results like that can be diagnosed as suspected lymphoma. Excluding inadequate FNA non-diagnostic specimens diagnostic sensitivity raises to 96%, and predictive value of negative tests to 80%. Two cases of FL were diagnosed as negative of lymphoma. Review of the clinical data showed that patients were present with lymph node conglomerates, which may contain reactive lymph nodes as well as those with lymphoma. Since aspiration was not ultrasound guided in those patients, specimen from reactive lymph node was probably obtained. Although we observed no significant difference in obtaining adequate specimen between palpation- and ultrasound-guided FNA, visualizing lymph node changes may help to choose the right aspiration area and overcome problems with partial fibrotic changes in affected lymph node.

Based on a cytomorphology and immunophenotyping by flow cytometry (FC) recent reports suggest that 63% to 77% cases can be correctly subclassified according to WHO classification when compared with histopathology diagnoses[13–15]. Simsir et al. reported that in 78 FNA spec-

imen and 28 effusions that were submitted for immunophenotyping because of clinical suspicion of lymphoma, in 85% of specimen both immunocytochemistry and flow cytometry was performed and results correlated in 98% of cases[16]. We used immunocytochemistry for immunotyping which has the advantage of preserving cellular morphology. When only few atypical cells among a mixed cellular infiltrate are present, like in T-cell lymphomas or in cases of necrosis, the possibility to visualize positive cells may enable diagnosis. A potential pitfall in diagnosing DLBCL by FC might be lack of light chain restriction. Analyzing FNA specimen may lead to diagnosis in those cases. Also, judicious use of antibodies may overcome the relative scarceness of material and help cytomorphologists to make the proper diagnosis in cases where material is not abundant enough for FC to administer appropriate battery of antibodies. As in other studies, the majority of cases in our study comprised of mature B-cell neoplasms, mostly FL and DLBCL, followed by cHL, while lymphoid neoplasms of T-cell type were relatively uncommon. We also obsereved male predominance (male to female ratio 1,8:1), except in cases with cHL, where ratio was 1,1:1, probably due to the fact that cHL of nodular sclerosis type, as one of the commonest types of cHL, ussualy affects young females[17,1]. Chhieng et al. reported 85% correlation rate between cytomorphology and histopathology in diagnosing B-cell lymphomas with predominantly small cells, compared with histopathology, and Zeppa et al. reported that subclassification of small and medium sized B-cell lymphoma showed 63% sensitivity[18,12]. Our results showed exact agreement in both FNA and histopathology diagnoses in subclassification of nodal B-cell lymphomas in 73% of cases. The accuracy varied among subtypes. Lymphoma subtypes with characteristic cytomorphology and specific immunophenotype, such as small lymphocytic lymphoma (SLL), LPL, and BL were diagnosed and subclassified with high accuracy. NMZL and FL have cytomorphologic features that overlap with benign processes. Since cell morphology of NMZL overlap also with other small cell lymphoma subtypes, especially with FL and LPL, it is not unusual to misdiagnose it, as we did in our cases. Surface marker analyses are not helpful in cases of NMZL (they might just be CD20 positive), so diagnosis is made by exclusion. These were minor discrepancies occurring in the group of indolent lymphomas that had no impact on the treatment strategy. Since surface markers diagnostic of a monoclonal T-cell proliferation have not yet been found, cytomorphologic findings of a polymorphous pattern and atypical lymphocytes with convoluted nuclei strongly suggest lymphoma, especially if they express one dominant T-cell phenotype. As Al Shauqeety et al. and Mayall et al. agreed in their reports, diagnosis of peripheral T-cell lymphomas can be achieved by FNA in the majority of cases through close analysis of the cytomorphology[19,20]. Yao et al. had 77% correlation with histopathology results analyzing 33 cases of various peripheral T-cell lymphomas[21]. We had a total of just 5 cases of histologically proved T-cell lymphomas. Two cases had initial FNA diagnosis of PTCL, NOS, two of LBL and one of ALCL, but exact diagnostic agreement was obtained in 60% of cases. However, this is of no clinical significance, since the treatment approach is similar for these cases. As in the other studies where FNA diagnosis of Hodgkin lymphoma was evaluated, we did not differ between subtypes of cHL because it has less impact on the management and prognosis. We differentiated NLPHL because it is a CD20 positive entity which has slow disease course and an excellent prognosis compared with the other subtypes of cHL. Specimen inadequacy is the major problem in diagnosing cHL, since nodular sclerosis accounts for approximately 70% of cHL. It is characterized with fibrosing process and thickening of a lymph node capsule, so aspiration may be insufficient to produce enough material to analyze. Inadequate specimens comprised 15% of our cHL specimens, yet the agreement between cytomorphology and histopathology was 84%. Chhieng et al. reported 11% of specimens as non-diagnostic due to inadequte cellularity, and Friedman et al. 23%[22,23]. Zhang et al. proposed on-site evaluation of specimen adequacy and specimen triage[24]. As we already pointed out, sampling error, as major cause of specimen inadequacy, may be minimized by image guidance using ultrasound, and in our opinion every patient with clinical suspicion of Hodgkin lymphoma has to be aspirated under ultrasound guidance.

Conclusion

In summary, FNA based lymphoma diagnosis will remain challenge for cytomorphologists, in trying to evade possible pitfalls of the method. FNA based diagnosis can not replace histopathologic diagnosis, because there will always be cases impossible to diagnose on smears only (i.e. composite lymphoma, panniculitis like T-cell lymphoma, extensive fibrosis of lymph node in nodular sclerosis subtype of cHL). Based on our results, sensitivity of 90% and specificity of 88%, FNA corroborated with immunophenotyping by immunocytochemistry can be method of choice in primary lymphoma diagnosis, and not just in cases where affected lymph nodes are deeply seated as intraabdominal or intrathoracic masses, or patient is to risky surgical candidate, or clinical course is so malignant that there is no time left for surgical biopsy. Although based on a small number of cases, in our opinion nodal lymphomas with distinct cytomorphologic characteristics, such as SLL, LPL, mantle cell lymphoma (MCL), BL, DLBCL, LBL, ALCL, NLPHL and cHL can be accurately diagnosed by FNA. In cases of FL grades 1–3, NMZL, PTCL, TAIL and some cases of cHL further diagnostic procedures are necessary. FNA can routinely provide samples that are adequate for molecular analyses, which can be helpful in diagnosis of selected lymphoma subtypes (i.e. t(14;18) is present in approximately 80% of FL, t(11;14) is useful in distinguishing NMZL, in situ hybridization for Epstein-Barr virus can serve as a marker in diagnosis of T-AIL)[25–27]. FNA offers preliminary diagnosis in the investigation of patients with lymphadenopathy, as a procedure causing minimal trauma

to the patient. When aspirations is performed with experienced operator using ultrasound guidance, lymph nodes that are appropriate for sufficient material aspiration may be visualized, which can lower numbers of negative diagnoses. Furthermore, additional usage of cytogenetics and molecular techniques, together with immunocytochemistry makes cytomorphology valuable diagnostic tool in lymphoma diagnostics enabling it to be used as a method complementary to histopathology.

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CITOMORFOLOŠKA DIJAGNOZA LIMFOMA U PODRUČJU GLAVE I VRATA

SAŽETAK

Citomorfološka analiza uzorka dobivenog punkcijom tankom iglom neizostavna je metoda u dijagnostici i praćenju liječenja promjena u području glave i vrata. U dijagnostici limfoma citomorfološka analiza uzorka služi kao metoda probira za odabir zahvaćenog čvora za otvorenu ili biopsiju širokom iglom. Prema Klasifikaciji limfoidnih novotvorina Svjetske zdravstvene organizacije danas je potrebno prepoznati staničnu morfologiju, te uz nalaze imunofenotipizacije i genetičkih analiza, kao i kliničkih pokazatelja odlučiti o terapiji odgovarajućoj za pojedinog bolesnika. Cilj ove studije bio je utvrditi učinkovitost citomorfološke i imunocitokemijske analize u dijagnostici limfoma u području glave i vrata. U retrospektivnom istraživanju pregledali smo sve slučajeve tijekom trogodišnjeg perioda, sa citomorfološkom dijagnozom ili kliničkom sumnjom na novootkriveni limfom ili relapsom već postojeće bolesti. U studiju su bili uključeni pacijenti upućeni u našu ambulantu od hematologa, sa povećanim limfnim čvorom u području glave i vrata, kojima je citomorfološka analiza prethodila ostalim dijagnostičkim postupcima. Učinjeno je 285 aspiracijskih punkcija u 248 pacijenata koji su ispunili uvjete za studiju. Uzorci adekvatni za citomorfološku analizu dijagnositicirani su kao limfom u 100 slučajeva (36%), kod 65 pacijenata i 35 pacijentica, 76 kod pacijenata sa novo-otkrivenom bolešću, 24 kod bolesnika s prijašnjom dijagnozom limfoma. Osjetljivost citomorfološke analize u dijagnostici limfoma u području glave i vrata iznosila je 90%, specifičnost 88%, prediktivna vrijednost pozitivnog testa 97%, prediktivna vrijednost negativnog testa 61%. Prema našim rezultatima citomorfološka analiza, upotpunjena imunocitokemijskim određivanjem limfatičnih biljega može postati metoda izbora u primarnoj dijagnostici limfoma, kao metoda komplementarna patohistološkoj analizi.