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Narrow band imaging technology and argon plasma coagulation in treatment of preneoplastic lesions in a 45-year-old male

Case Report

Dragan Keser[1,2*], Edin Zukić[1], Edin Jusufović[1], Zarko Santic[3], Svjetlana Radovic[4], Ajna Hukić[4]

[1] *Polyclinic for lung diseases, Healthcare Center Tuzla, Tuzla 75 000, Bosnia and Herzegovina*

[2] *Medical faculty, University Tuzla, Tuzla 75 000, Bosnia and Herzegovina*

[3] *Medical faculty, University Mostar, Mostar 88 000, Bosnia and Herzegovina*

[4] *Department of pathology, Medical faculty, University Sarajevo, Sarajevo 71 000, Bosnia and Herzegovina*

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Abstract: Early detection and treatment of preneoplastic lesions represents an obvious option to reduce morbidity and mortality from lung malignancies. Until now, radiological detection, sputum cytology, and autofluorescence have shown limited effectiveness as screening methods. Novel technologies such as Narrow Band Imaging (NBI) are showing promising results, but new studies are still needed to evaluate their use as screening methods. Together with early detection, adequate methods of lesion treatment, such as argon plasma coagulation, are needed. This case report concerns a 45-year–old man who was referred for bronchoscopy after his annual checkup. Using NBI technology, a preneoplastic lesion was identified, and treated using argon plasma coagulation. Our experience has shown us that both NBI screening and argon plasma coagulation are very promising, easily implemented, methods.

Keywords: *Narrow band imaging • Video bronchoscopy • Preneoplastic lesion • Lung carcinoma in situ • Argon plasma coagulation*

1. Introduction

As with many other malignant epithelial diseases, lung cancer is assumed to develop after multiple pathological changes occur, including changes in both the genome and phenotype. Normal epithelial cells of bronchia undergo a series of changes—hyperplasia, then metaplasia, followed by dysplasia and carcinoma in situ—that finally evolve into fully developed lung cancer. The difference between dysplasia and metaplasia is that in dysplasia changes are transferred to daughter cells; dysplasia initiates a series of successive changes in the genome that can finally produce an invasive cancer [1]. There are several types of preneoplastic lesions of the bronchial epithelium: squamous dysplasia and carcinoma in situ (CIS) progress into invasive atypical hyperplasia (AAH); diffuse idiopathic lung neuroendocrine cell dysplasia (idiopathic pulmonary neuroendocrine cell hyperplasia, DIPNECH) precedes a carcinoid tumor [2]. Evaluation of preneoplastic lesions must distinguish between mild, moderate, and severe dysplasia, and CIS as well. Cancer in situ lacks only two phenotypic characteristics to become an invasive form of cancer: the capability for angiogenesis and subsequent metastasis. Therefore, it is not unusual that a significant number of CIS lesions, but only a small number of dysplasias, advance to invasive cancer. In some cases, preneoplastic lesions do not become

* *E-mail: dragan.keser@untz.ba*

Figure 1. Different wavelengths of light reflecting from capillary network and veins.

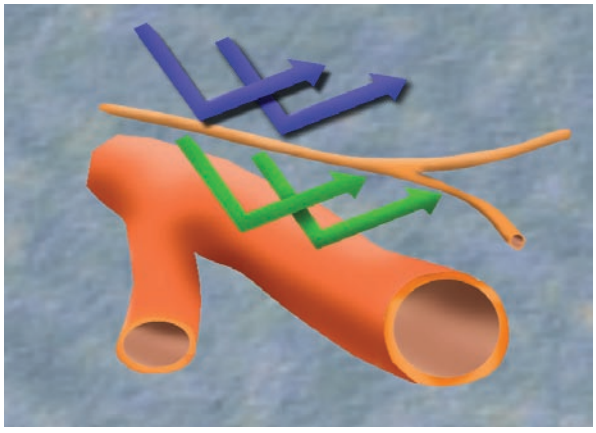
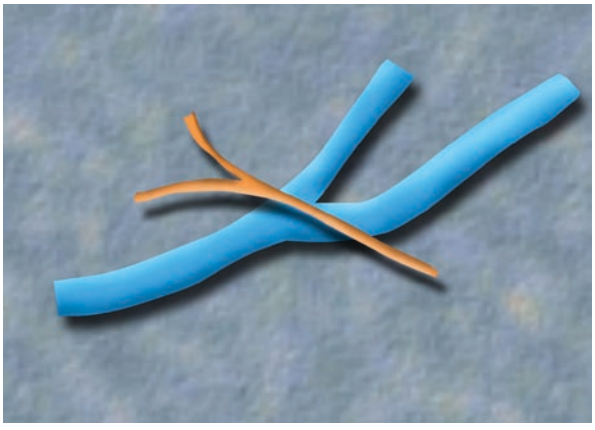


Figure 2. NBI technology shows capillaries (brown) and veins (purple).



cancerous and, instead, regress; however, cancer can occur without any previous preneoplastic base. There are a few factors that determine whether the lesion will regress or evolve into invasive cancer. In that regard, Breuer et al. demonstrated that p53 immunostaining is associated with bronchial cancer and might have additive value to predict the biological behavior of pre-neoplastic endobronchial lesions [3]. Other factors include telomerase activity and the Ki-67 antigen. It is thought that detection and staging of preneoplastic changes are important to make adequate treatment possible. But for lung cancer, early detection of precancerous lesions has always represented a problem. Even using techniques like autofluorescent bronchoscopy, only limited results have been achieved: K Häußinger et al. concluded that the potential of autofluoroscent bronchoscopy for detection of precancerous lesions and its role in screening of lung cancer remain unclear [4].

The combination of autofluoroscence and white light in bronchoscopy also demonstrates certain advantages in detection of preneoplastic lesions, but its use as a screening method has not been demonstrated.

Narrow band imaging (NBI) is a relatively novel bronchoscopic technique that uses optic filters to show fine capillary networks, veins, and other minute changes in mucous membranes. NBI uses a light source that emits at wavelengths of 415 nm (blue light) and 540 nm green light (Figure 1).

Blue light visualizes superficial capillaries that appear brown on the monitor, while green light penetrates more deeply and shows the veins in purple (Figure 2).

Detection of preneoplastic lesions using NBI technology is based on detection of changes in neovascularization. Neovascularization appears in inflammatory processes, dysplasia, and carcinoma in situ, and especially in cases of invasive cancer. Fisseler-Eckhoff et al concluded that in preneoplastic lesions there are qualitative and quantitative changes in blood vessels below the basement membrane, and in buds of endothelial cells in the epithelium [5].

2. Case Report

During a routine exam, the chest X-ray of a 45-year–old male showed an enlarged left hilus. The patient was previously healthy and asymptomatic. A video bronchoscopy was performed, which showed that the lumen of the trachea was oval and contained some purulent content. The tracheal carina was slightly dilated. The left bronchus was filled with seromucous content typical of chronic bronchitis. The first section of the left main bronchus demonstrated edematous stenosis of the membranous part. The hilus of the left lobe was also edematous and stenotic. The hilus of the intermediary bronchus was scarred and stenotic, with only the lower hilus filled with purulent mucus. A forceps biopsy performed on the lesion showed chronic inflammatory changes without the presence of neoplastic changes. The bronchoscopy was repeated with a cytopathologist present. Using NBI technology, we were able to visualize pathological changes in epithelium 2 mm in size localized in the carina of the right upper lobe. The NBI technology made the lesion more clearly identifiable (Figure 3).

A needle biopsy was performed with cytopathologist present during the procedure (Figure 4).

The preliminary findings pointed to the presence of inflammatory cells, squamous metaplasia, atypia, and mild dysplasia. Additional needle biopsies were performed in the area surrounding and below the lesion to verify the histological spread of the cells. After direct observation of the biopsy specimens, the cytopathologist found that the surrounding tissue was not affected by the lesion. The lesion was effectively treated

Figure 3. Preneoplastic lesion visualized using white light (left frame) and NBI technology (right frame).

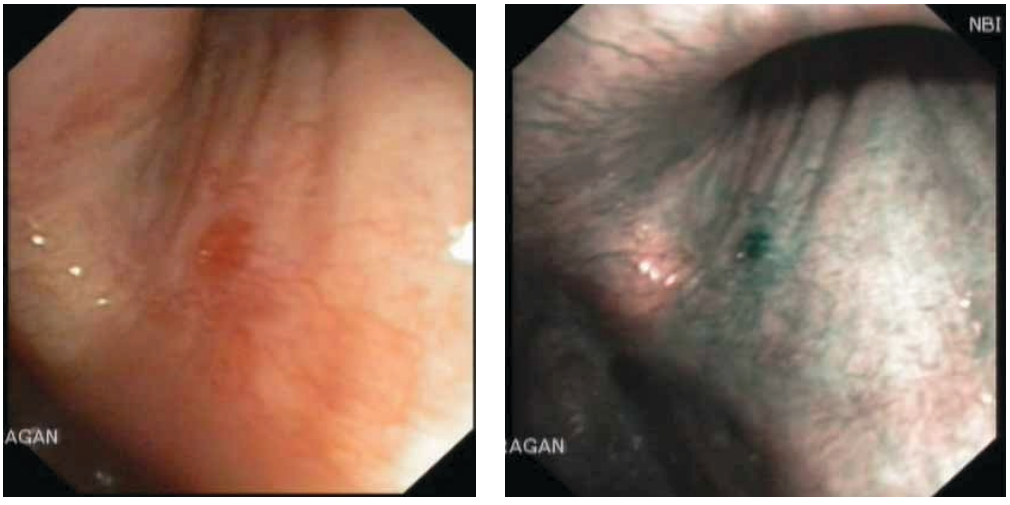


Figure 4. Needle biopsy being performed on the site of lesion.

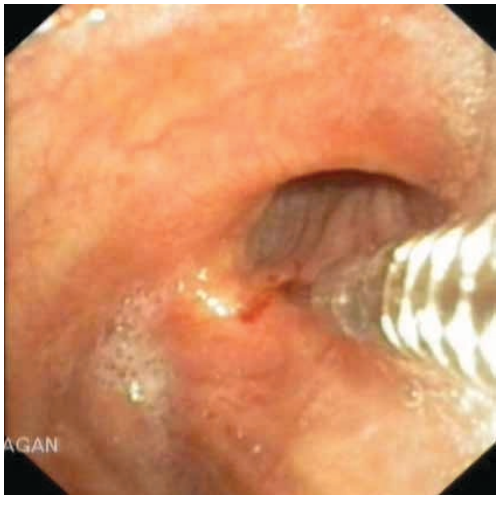
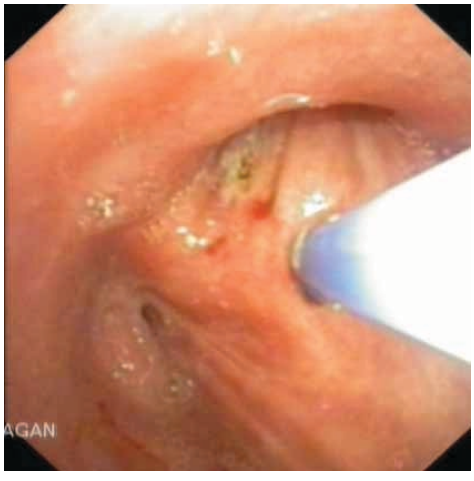


Figure 5. The coagulated lesion is shown in middle of the picture, with the argon plasma probe on the right.



using argon plasma coagulation without damaging deeper structures (Figure 5).

Follow-up bronchoscopy was performed six months later, together with brush and needle biopsies of the previously affected area. There were no new macroscopic lesions that could be verified, either by white light or NBI technology. The needle and brush biopsies were negative for dysplasia.

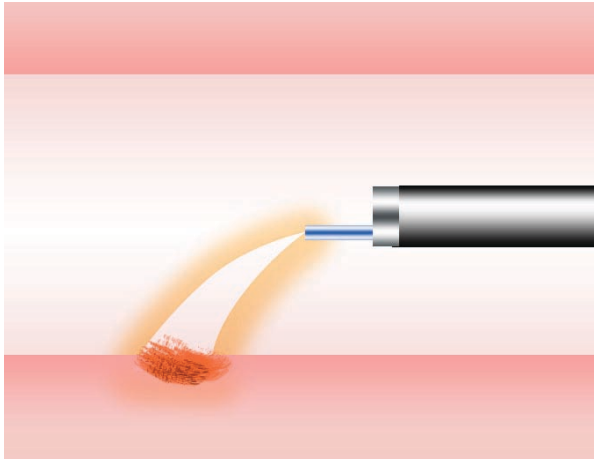
3. Discussion

Initial studies have shown that NBI technology used together with white light bronchoscopy represents a significant improvement in detection and successful biopsy of preneoplastic lesions, particularly dysplasias. Vincent et al have used NBI technology to identify dysplasias or cancer in about 26% of patients, whereas bronchoscopy with all-white light showed no pathological changes. However, they concluded that additional investigation is needed to establish the efficiency of this technology for screening high risk groups [6].

The preneoplastic lesions that have been detected require adequate treatment. Photo- or electro-coagulation is usually preferred. Plasma coagulation has only recently come into frequent use. Argon plasma coagulation is an endoscopic method used for hemostasis and tissue destruction on a sensitive region. The method uses stream of ionized argon that transfers high frequency electricity to the target tissue (Figure 6).

The advantages of this system are that the effect is achieved without tissue contact, and that the depth of penetration can be controlled within a few millimeters, thereby limiting the damage to the surface. Argon plasma coagulation has proven to be easy to perform, rapidly effective, safe and well tolerated by the

Figure 6. Probe with high frequency electricity being passed through the jet of argon.



patient, even after repeated application [7]. Previously Schuurman B. et al demonstrated the feasibility of treating radiographycally occult lung cancer using a combininaton of autofluorescence bronchoscopy and argon plasma coagulation [8]. The combination of NBI technology and argon plasma coagulation produces an efficient modality for detection and treatment of preneoplastic lesions.

4. Conclusion

NBI technology is a promising diagnostic method for detection of preneoplastic lesions. Its role in early screening for lung cancer is subject to further investigation. Our experience demonstrates that both NBI technology and argon plasma coagulation are simple to use and give very encouraging results.

Clinical implications

Lesions detected at an early stage can easily be treated by argon plasma on an outpatient basis.

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