

# European Respiratory Society Annual Congress 2012

**Abstract Number:** 3310

**Publication Number:** P1231

**Abstract Group:** 11.1. Lung Cancer

**Keyword 1:** Lung cancer / Oncology **Keyword 2:** Cell biology **Keyword 3:** Experimental approaches

**Title:** The effect of methylene blue in the photodynamic therapy on A549 lung cancer cell lines

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**Body:** Background: Methylene blue (MB) is a safe and cheap chemical widely used in the medical fields for a long time. MB was recently known to act as a photosensitizer and some clinical trials of using it in the photodynamic therapy on the tumor cell lines were reported. In this study, we investigated the effects of MB as a photosensitizer on the A549 lung cancer cell lines. Methods: After pretreatment of A549 cells with MB in the concentrations of 1  $\mu$ /ml and 2  $\mu$ /ml, respectively, Diode LASER of 650 nm wavelength was used with the energy of 30, 60 and 120 J/cm<sup>2</sup> respectively. Cytotoxicity was evaluated with MTT, and the formation of ROS was checked with DCFH. To evaluate the mechanism of apoptosis, the activation of Caspase family was checked, and the fragmentation of PARP-1 was studied by the western blotting method. Results: By the increases of the concentration of MB and the energy of Diode LASER, the level of apoptosis of cell lines and ROS synthesis were significantly increased. Pretreatment with antioxidant suppressed these findings. In the induction of apoptosis, the activation of Caspase 3, 8 and consequent fragmentation of PARP-1 was observed. Conclusion: MB induced apoptosis in the A549 lung cancer cell lines as a photosensitizer, and its effect was increased by the concentration of MB and the energy of Diode LASER.