Pathology of the respiratory system and especially lung pathology has multiple implications in the daily forensic activity and represents a challenging domain of research as well.

In the general part of the research work I present the most important data from the literature concerning lung anatomy and histology, elementary lung morphologic lesions, histomorphology of shock lung, physiopathology of burn lesions and of the respiratory trauma after smoke inhalation, pulmonary and vascular pulmonary microscopic changes in hypoxic states, elements of drug-related deaths and physiopathology of drug intoxication.

The second part of the study has three chapters and includes a general overview of the pulmonary pathology in the forensic autopsies, a study of the pulmonary lesions in drug-related deaths and a study of lung modifications following burns and heat-related deaths.

**Part I**

**Aim** of the study was to achieve an outline about the pulmonary pathology found in forensic autopsies. **Material and method**: we investigated retrospectively the forensic autopsy cases performed in Mures County during the year 2007 and recorded parameters like sex and age, macroscopic and microscopic diagnostics concerning the lungs, nature of death and the medical cause of death; we used statistical parametrical methods and calculated the mean, median and modal values for the age, interquartile range and standard deviation in order to describe the spreading. **Results**: from a total of 646 autopsies investigated, 426 (65.9%) were violent deaths and 220 (34.1%) were non-violent deaths. At least one pulmonary diagnostic was found in 295 of the cases, meaning 45.66% of the total autopsies performed. We studied the group of age 0 – 1 year separately and revealed that in 75% of the cases the cause of death was SIDS (sudden infant death syndrome) and lung dystelectasia was the most frequent diagnostic in this age group (68.8%). Within the second group, the mean age was 49.5 years, with an interquartile range of 37 – 65 years and diagnostic complex bronchopneumonia-obstructive bronchiolitis-pulmonary edema was noted in 9.8%, while associations of each two of the previous diagnostics occurred in 13.8 – 17.1% of the cases. Pulmonary lesions had thanatogenetic role in 98 cases (35.6%). **Discussions**: pulmonary infection occurs in an important number of forensic cases with lung pathology due to the permanent exposure of the respiratory tract to the environment, this fact becomes important in patients with critical conditions. Experiments in humans and animals showed that
inflammatory reaction is mainly compartmented in lungs (Brouge et al., 1997). In case of infant deaths, thanatogenesis remains in many cases obscure, we believe dystelectasia is more a result of functional disturbances originating at other levels.

**Part II**

**Aim** of the study was revealing and description of pulmonary lesions that could suggest drug consumption and a possible drug-related death. **Material and method:** we performed a retrospective study on a number of 100 cases of drug-related deaths using the archive of the Institute of Legal Medicine from Freiburg, Germany. We recorded parameters like sex, age, involved drug(s), pulmonary weight separate for left and right lung, diagnosis concerning the lungs; we examined the microscopic slides from the lungs and interpreted qualitatively and semiquantitatively the lesions and then analyzed acquired data using non-parametric statistical techniques, significance tests and bivariate analysis. **Results:** the mean age of the persons died as a result of drug intoxication was 28.2 years, while the interquartile range was 23 – 31 years. We analyzed the lung weights separately for the heroin-morphine intoxications compared to intoxications with other drugs and found in the first group significant higher weights both in right and left lungs (p<0.01) while no relevant differences where noted among males and females. Pulmonary edema was present in half of the cases in the heroin group but in only 20% of the cases from the second group (p<0.05), but no significant differences was found concerning the type of the edema. Incidence of pulmonary hemorrhage was the same in both groups-60% of the cases but massive hemorrhage was present only in the heroin group, in 15 (18.75%) cases. Hemorrhagic and desquamative alveolitis was studied in pure heroin intoxications compared to methadone intoxications, with no significant incidence differences, but within the heroin group high concentrations of drug seem to determine more likely this type of lesion. Factors responsible for extreme pulmonary weight elevation (cases above the third quartile Q3 for both left and right lung) were mainly edema and hyperemia (64.7%), in some cases associated with hemorrhage or bronchopneumonia. **Discussions:** Pulmonary edema may be a result of modified capillary permeability or capillary pressure due to hypoxia, of liquid transfer into the alveolar space due to central stimulation effect of the drugs, or of a direct toxic effect. Edema liquid is rich in proteins and the areas of edema alternate with emphysema. We found raised pulmonary weights in heroin intoxications similar to data published by Grellner et. al. (1996), in addition we mentioned the left and right lung weight separately and identified the factors related to extreme weight elevation.

**Part III**

**Aim** of the study was to describe macroscopic lung changes and to identify microscopic pulmonary lesions associated with vital heat trauma caused deaths. **Material and method:** we analyzed 133 autopsy cases with heat trauma implications, from the Institute of Legal Medicine Tirgu Mureş and Freiburg and we selected two subgroups depending on the moment of action of heat: vital or postmortal. We examined the carboxyhemoglobin (COHb) concentrations, the lung weights and the microscopic lesions in both subgroups and compared them by using statistical tests like Mann-Whitney U, Student and Fischer’s exact test. Immunohistochemical reaction was carried out for revealing the heat-shock protein in bronchial structures, in alveolocytes, macrophage cells. **Results:** Pulmonary edema was significantly associated with vital burns but there was no relationship found between COHb concentration and occurrence
of edema. Moderate and severe edema was present in both vital and postmortem subgroups. Soot deposits in alveoli were noticed exclusively in vital heat trauma cases (17.3% of them) and there is evidence for a relationship between COHb concentration and incidence of soot deposits. Aspiration of blood and/or gastric content was more frequent in the postmortem subgroup (78.9% vs. 10.66%) and therefore indicates another cause of this finding, most likely a traumatic condition. Immunohistochemical reaction for HSP in alveolocytes revealed significant differences between groups, but macrophages presented positive reaction regardless of vital or postmortem exposure to heat. 

**Discussions:** pulmonary edema in heat shock and following smoke inhalation results from the elevation of the extravascular liquid volume, the raise of pulmonary water content and raise of pulmonary shunt fraction. But, pulmonary edema should be interpreted carefully because it may be the expression of other pathological conditions as well. Soot deposits are confident signs of vitality; hyperthermia may induce multiplication of heat-shock proteins and examination of certain cells in the pulmonary parenchyma may contribute to the diagnosis of vitality in heat-related deaths.

**CONCLUSIONS**

In forensic pathology there is a frequent pulmonary diagnostic complex namely bronchopneumonia – obstructive bronchiolitis – pulmonary edema, in almost 10% of the cases with lung modifications; in addition, the two by two associations of the complex, have an incidence between 13 and 17% each.

In drug-related deaths, there is an increase in lung weight of 40% compared to normal values from the literature, mainly due to the combination of edema – hyperemia and edema – hyperemia – hemorrhage. We established a correlation between the left and right lung weight, the linear regression formula is \( y = 32.2 + 0.857x \). Massive pulmonary hemorrhage was present only in heroin intoxications.

Fibrosis is a lesion that suggests chronic drug administration and foreign body granulomas are rare findings related to adulterants embolization.

Soot deposits are confident signs of vitality in burn traumas but their occurrence is below 20% and their frequency of appearance seems related to COHb concentration.

HSP expression is a valuable vitality sign in burned bodies if confirmed in pulmonary structures like alveolocytes, endothelial cells and red blood cells.