Enzyme activities in mesothelial cells

Science, Biology

Most previous studies have focused on DNA repair in bacteria. Asbestos has been found to increase the production of 8-hydroxydeoxyguanosine (8OHdG), a modified DNA nucleoside. Conversion to 8OHdG has been attributed to oxidative stress. Inheritance of damaged DNA can result in permanent mutation, leading to disease, and cell proliferation. 8OHdG can be removed by DNA base excision repair enzyme systems in mammals and through the action of AP endonuclease (APE), which acts similarly to E. coli exonuclease III and endonuclease IV. AP endonuclease excises the modified base on a segment of the DNA strand. The lacking base is then replaced through the action of other members of the DNA repair system, restoring the original, correct sequence of the DNA.

This paper was also the first to show that a carcinogen that is associated with oxidant stress in normal lung cells induces AP endonuclease. The results obtained from the research can be used in designing new studies that will lead to a higher understanding of the role of AP endonuclease in DNA damage repair and its subsequent effects like cancer and diseases that are due to DNA mutations.

The main objective of the study was to evaluate and understand how asbestos-induced DNA repair is carried out. The experiment was performed by exposing rat mesothelial pleural cells, which form the membrane surrounding the lungs, to non-toxic levels of crocidolite asbestos, a potent agent of mesothelioma in humans. After 24 to 72 hours of exposure to asbestos, cells were removed from the medium. Cell viability was determined, and nuclear and mitochondrial extracts were prepared to determine APE protein levels, mRNA concentrations, and enzyme activity.

Immunologic techniques (Western and Northern blot analyses) and imaging (confocal laser microscopy) were used to measure levels of the different analytes. Techniques were described in detail, which makes it easy for other researchers to replicate the methodology used.

The results show that non-toxic levels of 1. 25 and 2. 5 µg/cm2 asbestos increased AP endonuclease gene expression, enzyme activity and protein concentration in a dose-dependent manner. Further, confocal laser microscopy was utilized to show that AP endonuclease was present, not only in the nucleus but also in the mitochondria. This is significant because asbestos appears to produce oxidative stress in other organelles as well, which could result in multiple cellular injuries.

The conclusions were based on the data as presented in several figures and graphs in the paper. These conclusions appear to be valid because the techniques used were standard procedures and have been performed for similar studies in the past. For example, Northern blotting is the standard procedure for gene expression analysis, even until now despite the availability of newer techniques like real-time PCR. The initial data obtained were also validated by subsequent measurement. This was demonstrated when after determining mRNA/gene expression, the mRNA levels were determined using phosphorimager. Moreover, the data was consistent, because the increased gene expression or mRNA levels of APE was accompanied by increased protein levels and enzyme activities. Imaging techniques also come up with reliable results, and are useful in determining organelle compartmentation of metabolic processes. Due to these validations, I understood the contents of the paper and believe that the facts

presented are true and can be used as the basis for other similar researches.

The paper, however, was only able to demonstrate the activation of AP endonuclease in detached cells exposed to non-toxic asbestos concentrations. It would be interesting to study APE’s activation in vivo and how its actions could be affected by higher concentrations of different types of asbestos.