

3-mercaptopyruvate sulfurtransferase and rhodanese activities in human myometrium and leiomyomas of the uterus

Julian Frendo, Maria Wróbel¹ and Kazimierz Wąs²

Background. 3-mercaptopyruvate sulfurtransferase (EC 2.8.1.2) and rhodanese (thiosulfate: cyanide sulfurtransferase, EC 2.8.1.1) participate in L-cysteine desulfuration – the main source of metabolically active sulfane sulfur atoms, which possibly influence the proliferation of malignant cells. It has been demonstrated that 3-mercaptopyruvate sulfurtransferase and rhodanese activity can decrease in some transplanted neoplasms.

Aim. To examine tumour tissue of the human uterus and to investigate the myometrium from which the growth developed.

Methods. The activity of 3-mercaptopyruvate sulfurtransferase and rhodanese was assayed in myometrium and leiomyoma samples immediately after hysterectomies.

Results. The activities of two sulfurtransferases are higher in the leiomyoma than in the myometrium.

Conclusion. An increase in the activity of both sulfurtransferases in leiomyomas of the uterus is surprising in light of present day understanding of sulfur compound metabolism in neoplasms, and may be due to the fact that leiomyoma is a benign neoplasm.

Aktywność transferazy siarkowej 3-merkaptopirogronianu i rodanazy w mięśni i mięśniaku macicy ludzkiej

Transferaza siarkowa 3-merkaptopirogronianu (EC 2.8.1.2) i rodanaza (transferaza siarkowa tiosiarczany: cyjanek, EC 2.8.1.1) uczestniczą w procesie desulfuracji L-cysteiny, prowadzącym do tworzenia związków zawierających metabolicznie aktywną zredukowaną siarkę, tak zwaną siarkę sulfanową, mającą wpływ na proliferację komórek nowotworowych. W przypadku niektórych tkanek nowotworowych obserwowano znacznie obniżoną aktywność transferazy siarkowej 3-merkaptopirogronianu i rodanazy, jak również śladową ilość siarki sulfanowej. Podjęto badania porównawcze aktywności obydwu enzymów w tkance mięśniaka ludzkiego oraz mięśnia macicy, z którego się rozwinął. Oznaczenia wykonywano natychmiast po otrzymaniu tkanek, uzyskanych w trakcie zabiegu chirurgicznego usuwania nowotworu. Niespodziewanie stwierdzono, że aktywność obydwu badanych enzymów jest wyższa w mięśniaku, w porównaniu do tkanki niezmięnionej nowotworowo, co można tłumaczyć tym, że jest to nowotwór łagodny.

Key words: 3-mercaptopyruvate sulfurtransferase; rhodanese; leiomyoma; myometrium

Słowa kluczowe: transferaza siarkowa 3-merkaptopirogronianu; rodanaza; mięśniak macicy

Introduction

Many animal tissues are able to convert 3-mercaptopyruvate, a product of L-cysteine transamination, into pyruvate (Figure 1). The enzyme involved in this process is known as 3-mercaptopyruvate sulfurtransferase (3-MPST, EC 2.8.1.2). It is different from rhodanese (thiosulfate: cyanide sulfurtransferase, EC 2.8.1.1), which exhibits particular affinity towards certain sulfur donors of either inorganic (e. g. thiosulfate) or organic (e. g., polysulfides,

such as thiocystine, persulfides, e.g. thiocysteine) origin and effects transfer of a sulfur atom to various nucleophilic acceptors via an enzyme-sulfane "transition state" [1]. Thus, it participates in cyanide detoxification [2], iron-sulfur (FeS) clusters formation [3] or enzymatic activity regulation through a mechanism that involves the incorporation of sulfur [4] (Figure 1). In rats the highest activity of 3-MPST was found in the liver and kidney [5]. 3-MPST is present in the mitochondria and cytosol, as opposed to rhodanese, which, in mammals is found only in the mitochondria [6]. The activity of 3-MPST in man has only been examined in red blood cells, whereas rhodanese has been examined in other tissues [7, 8]. Acc. to Jarabak and Westley catalysis by this enzyme involves a single-displacement mechanism: a sulfur atom from 3-

¹Institute of Medical Biochemistry, ²Chair and Department of Gynecology and Obstetrics, Jagiellonian University, Collegium Medicum, Cracow, Poland

A decrease in 3-mercaptopyruvate sulfurtransferase activity can lead to an accumulation of 3-mercaptopyruvate in cells, which, as already demonstrated, can in turn lead to polyploidy [19]. The process of L-cysteine desulfuration is the main source of metabolically active sulfane sulfur (Figure 1). The biological role of reduced sulfur, such as sulfane sulfur, is not completely understood, although according to Toohey (1989) malignant cell proliferation may be related to a deficiency of sulfane sulfur and the uncontrolled operation of a set of enzymes normally inactivated by sulfane sulfur.

Demonstrating an increase in the activity of 3-MPST in leiomyomas of the uterus is surprising, in light of the present understanding of the metabolism of sulfur compounds within the neoplasm. The difference in activities of 3-MPST and rhodanese in leiomyomas and fast growing transplanted neoplasms, may be caused by the fact that leiomyoma is a benign neoplasm. Examining enzyme activity in sarcomas, a malignant neoplasm, should prove to be interesting. On examining one case of this neoplasm, the authors found trace activity of both enzymes.

The works of Maggivilli, Gustafson, Rector and Hilf [20] on enzyme activity in carbohydrate metabolism is interesting. Myometrium and leiomyoma samples were examined and no substantial difference in activity was found. Therefore no generalization of enzyme activity in leiomyomas of the uterus can be made.

Prof. Julian Frendo M.D., Ph.D.

Institute of Medical Biochemistry, Jagiellonian University,
Collegium Medicum,
ul. Kopernika 7, 31-034 Kraków, Poland
E-mail: mbwrobel@cyf-kr.edu.pl

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