Content of Tissue Activator of Plasminogen in Monkey Tissues

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In 1947 Astrup and Permin (6) demonstrated that the fibrinolytic activity attributed to various human and animal tissues was effected by a stable tissue activator which could convert an inactive precursor, plasminogen, into an active proteolytic, enzyme, plasmin. Recently Astrup and Albrechtsen (4) have devised a quantitative method which enabled them to express the content of the tissue activator in units of a standard preparation per gram of fresh tissue. Using this method, Albrechtsen (1, 2) demonstrated that human tissue, in general, possessed much higher concentrations of tissue activator than did tissues from animals.

We have investigated the tissue activator content in various Rhesus and Java monkeys in an attempt to find out if the monkey resembled the human more closely than the lower animals.

Methods

The tissue activator was extracted and isolated by the selective and quantitative method of Astrup and Albrechtsen (4) and the activity was estimated by the fibrin plate method of Astrup and Müllertz (5). The bovine thrombin used for clotting was kindly supplied by the Løvens kemiske Fabrik, Copenhagen. Our thanks are due to Drs. Herdis and Preben von Magnus of the Polio Department of the State Serum Institute for kindly supplying the monkey corpses.

Results

The results are depicted in Table 1. It is seen that the highest concentration of tissue activator occurred in the periosteum (322 units), meninges (282 units), epididymis (167 units), prostate (161 units), and trachea (145 units). Lower, but still rather high concentrations of activator content were found in such tissues as the uterus (100 units), cecal mucosa (85 units), and vagina (65 units). Skeletal muscle, brain, thymus, lymph node, heart muscle, testes, skin, urinary bladder epithelium, ovaries, smooth muscle, intestinal epithelium, and lung showed low activator activity ranging from 17 to 58 units. Activator activity in the ureter, arteries, gallbladder, pancreas, pericardium, and peritoneum were also low.

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Content of tissue activator in monkey tissue estimated by the method of Astrup and Albrechtsen

Tissue Sample	No. Sam.	Units per Gram Tissue Highest	Lowest	Average
Periosteum	5	438	95	322
Meninges	2	381	184	283
Epididymis	3	190	133	167
Prostate	1	161	—	161
Trachea	8	230	58	145
Uterus	4	334	6	100
Cecal Mucosa	4	161	5	85
Vagina	2	115	16	65
Skeletal Mus.	8	121	11	58
Brain	3	70	37	50
Thymus	2	46	30	38
Lymph Nodes	2	61	8	35
Heart Mus.	6	72	4	31
Testes	2	33	25	29
Skin	7	69	2	28
Bladder Epithelium	6	45	0	25
Ovaries	4	95	6	25
Smooth Mus. (esophagus stomach intestine)	11	60	0	24
Intestinal Epithelium (esophagus stomach small intest.)	13	72	0	20
Lung	6	54	0	17
Spleen	6	5	0	1
Cartilage	5	3	0	1
Tendon	1	2	0	2
Liver	7	0	0	0
Bone	4	0	0	0

Extracts of bone, cartilage, liver, spleen, and tendon, revealed little or no demonstrable activator activity.

Our findings did not indicate a difference in the activator content in the Java and Rhesus monkey tissues. Since we used the same method and standard preparation as Albrechtsen, our results may be directly compared with his results. Whereas Albrechtsen (1) found very high activator activity in the human uterus (720 units), lymph nodes (378 units), prostate (334 units), and ovaries (210 units), we found much lower results in the monkey with only the uterus and prostate approaching the values reported for the human organs. On the other hand, concentrations of the tissue activator in the monkey, with some exceptions, are comparable to the concentrations of tissue activator occurring in the pig, horse, ox, dog, guinea pig, cat, mouse, rat, and rabbit tissue (2). Like Albrechtsen, we noted wide variations in the concentrations of tissue activator between the same tissues from the same species. In some cases

this variation was great, but not great enough to prevent grouping the tissues into those which contained a high, medium or low tissue activator content. At present these variations are unexplained, and although part of the difference might be due to methodical and technical difficulties, ist seems more likely that the variations represent the true physiological picture.

It is also interesting to note that the monkey periosteum, meninges, and trachea contain impressive amounts of activator activity. Heretofore, these tissues have not been quantitatively estimated, although Lewis and Ferguson (7) did observe a high tissue activator content in the meninges of the dog. Recently, it has been demonstrated that human periosteum and meninges, and ox meninges also possess high amounts of tissue activator (H. R. Roberts and P. Moltke: unpublished observations).

At the present time it is difficult to ascribe a definite physiological function to the tissue activator. It may be of local significance in resolving fibrin deposits in traumatized tissue as opposed to the more general action of the labile blood activator (3). It has also been suggested that the tissue activator may play a causative role in some of the hemorrhagic diatheses accompanying pregnancy. A full elucidation of these problems awaits further investigations.

Summary

The content of the tissue activator of plasminogen in various organs from monkey is generally lower than in the corresponding human organs and approaches the concentration in the organs of other animals.

Résumé

La concentration de l'activateur tissulaire du plasminogène dans les différents organes du singe est en moyenne plus basse que dans les organes correspondants de l'homme; par contre, cette concentration est identique chez les autres espèces animales examinées.

Zusammenfassung

Die Konzentration des Gewebeaktivators des Plasminogens in den verschiedenen Organen des Affen ist durchschnittlich niedriger als in den entsprechenden Organen des Menschen, und kommt der bei anderen Tieren gefundenen gleich.

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