

NUCLEO-CYTOPLASMIC AND NUCLEOLO-NUCLEAR RATIOS IN ACINAR CELLS OF THE REGENERATING PANCREAS

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The nucleo-cytoplasmic and nucleolo-nuclear ratios were analyzed in acinar cells of the regenerating pancreas of rats 6 and 12 h and 1, 2, 3, 5, 15, 30, 90, and 180 days after partial pancreatectomy. At the beginning of regeneration the nucleo-cytoplasmic ratio rises while the nucleolo-nuclear ratio falls. In the later stages these ratios return to normal.

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The nucleo-cytoplasmic ratio is an important characteristic of the vital activity of cells [1, 2, 4-6]. Since cell activity in regenerating organs undergoes considerable changes, determination of the area of the cells occupied by nucleoli, nucleus, and cytoplasm is of definite importance.

The object of this investigation was to study the acinar cells of the regenerating pancreas from the standpoint of a detailed analysis of nucleocytoplasmic and nucleolo-nuclear ratios.

EXPERIMENTAL METHOD

Experiments were carried out on male albino rats weighing 110-116 g. Pancreatectomized (removal of 50% of the pancreatic tissue) and control animals were sacrificed in groups of 20 at various times (6 and 12 h, 1, 2, 3, 5, 15, 30, 90, and 180 days) after the operation. The material was fixed in Carnoy's fluid. Paraffin sections were stained with hematoxylin-eosin by the method of Ross and Flaherty. The area of the nucleoli, nuclei, and cytoplasm of the acinar cells was determined by tracing their outlines on paper, cutting them out, and weighing them. The number of nucleoli per nucleus was calculated and the nucleolo-nuclear and nucleo-cytoplasmic ratios were determined in the acinar cells. The results given below are statistically significant.

EXPERIMENTAL RESULTS

The nucleo-cytoplasmic ratio in the acinar cells of the regenerating pancreas was increased on the 2nd, 3rd, 5th, 15th, and 30th days of the experiment (Table 1). Analysis of changes in the mean area of the cytoplasm separately revealed, first, an increase in the mean area of the nucleus on the 2nd, 3rd, 5th, 15th, and 30th days of the experiment and, second, an increase in the area of the cytoplasm on the 15th day after partial pancreatectomy. On the 15th day of the experiment the area of the nucleus was increased by 31%, but the area of the cytoplasm was increased by only 8%. The nucleo-cytoplasmic ratio reached a maximum at this time because of the sharp increase in size of the nucleus. The increase in mean area of the nucleus coincided with intensive mitotic division of the acinar cells observed at this period [3].

To make a closer analysis of the observed phenomena, the nucleolo-nuclear ratios were studied in the acinar cells of the regenerating pancreas. As the same table shows, this parameter was reduced on the 15th and 30th days of the experiment. The area of the nucleolus was increased on the 3rd, 5th, and 15th days of the experiment. Meanwhile, on the 2nd, 3rd, 5th, 15th, and 30th days of the experiment, as mentioned above, the mean area of the nucleus was increased. On the 3rd and 5th days of the experiment the nucleolo-nuclear ratio was unchanged because of the identical rate of change in area of the nucleus and nucleolus. The observed decrease in the nucleolo-nuclear ratio on the 15th and 30th days of the experiment

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TABLE 1. Nucleo-Cytoplasmic and Nucleolo-Nuclear Ratios in Acinar Cells of the Pancreas in Partially Pancreatectomized and Control Rats

Time of observation	Group of animals	Mean area (in μ^2)				Ratio				No. of nucleoli per nucleus			
		of nucleolus		of nucleus		of cytoplasm		nucleolo-nuclear		nucleo-cytoplasmic			
		numerical value	P	numerical value	P	numerical value	P	numerical value	P	numerical value	P		
6 h	Experimental	3,6	1	18,4	0,844	79,8	0,768	0,20	1,000	0,23	1,000	1,06	0,556
12 »	Control	3,6		18,3		79,1		0,20		0,23		1,05	
	Experimental	3,6	1	18,2	0,493	80,1	0,844	0,20	1,000	0,23	1,000	1,05	1,000
1 day	Control	3,6		18,1		79,6		0,20		0,23		1,05	
	Experimental	3,6	0,092	18,6	0,380	79,7	1,000	0,19	1,000	0,23	1,000	1,05	1,000
2 days	Control	3,5		18,4		79,0		0,19		0,23		1,05	
	Experimental	3,6	1	20,9	0	77,5	0,434	0,17	0,438	0,27	0,01	1,06	0,844
3 »	Control	3,6		18,5		79,2		0,19		0,23		1,05	
	Experimental	3,8	0	20,9	0	78,7	0,623	0,18	0,106	0,27	0,001	1,05	1,000
5 days	Control	3,5		18,1		79,9		0,19		0,23		1,05	
	Experimental	4,0	No transgression	22,2	No transgression	83,0	0,331	0,18	0,091	0,27	0,001	1,10	0,008
15 »	Control	3,5		18,0		80,2		0,19		0,22		1,06	
	Experimental	4,1	The same	24,1	The same	86,0	0,008	0,17	0,008	0,28	0,002	1,08	0,010
1 mo.	Control	3,5		18,3		79,7		0,19		0,23		1,06	
	Experimental	3,7	0,02	21,5	» »	82,8	0,151	0,17	0	0,26	0	1,06	1,000
3 mos.	Control	3,6		18,6		79,6		0,19		0,23		1,06	
	Experimental	3,6	1	19,2	0,006	79,3	0,921	0,19	1,000	0,24	1,000	1,06	1,000
6 mos.	Control	3,6		18,6		79,7		0,19		0,23		1,06	
	Experimental	3,6	0,08	18,4	0,556	79,6	0,768	0,19	1,000	0,23	1,000	1,06	1,000
	Control	3,5		18,3		80,0		0,19		0,23		1,06	

was associated with the greater increase in mean area of the nucleus. It is interesting to note that on the 5th and 15th days of the experiment the number of nucleoli per nucleus was increased. However, this index cannot give a true picture of the phenomena without a separate analysis of changes in the mean size and number of nucleoli and the mean size of the nucleus.

From analysis of the nucleocytoplasmic and nucleolo-nuclear ratios in the acinar cells of the regenerating pancreas it is clear that the course of regenerative processes in this organ is complex. The results described in this paper show that at the beginning of regeneration the nucleoli, nuclei, and cytoplasm in the acinar cells of the regenerating pancreas are increased in size, but later they return to normal.

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