

SURVIVAL OF EMBRYOS IN RELATION TO THE VASCULATURE OF IMPLANTATION PLACES IN LABORATORY MICE¹

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Summary. Implantation places of intrauterine embryos were analysed in this experiment. Three different types of vasculature of the implantation places were found. Embryos implanted in a vasculated place with a single blood vessel die more frequently than those rested on other types of vasculature. These embryos are characterized by smaller placentae and body weight.

For the last two decades there have appeared numerous publications analysing the influence of prenatal factors on the embryo weight and survival in multifetal animals. The most important of them are : ovulation rate for a given horn of uterus, the number of embryos in the horn, places of their implantation and losses of embryos.

Barr (1970) reports that the embryo weight depends on the number of embryos in a horn. Early resorption occurring in the same horn exerts an additional influence on the embryo weight increase. The place of implantation in the uterus horn has also an effect on the embryo weight and the survival rate. Barr (1970), Bruce and Norman (1975) claim that the embryos implanted in the middle part of the uterus horn are the heaviest, whereas those from the vaginal part mostly die (Barr 1970). On the other hand, McLaren (1963, 1965) obtained the heaviest embryos in the ovarian and vaginal parts of the uterus. She links this phenomenon with the size of the placentae and the sequence of arteries reaching the uterus. According to her, the middle part of the uterus horn is the least suitable place for survival and development of embryos.

Noyes (1961) reports that different implantation time results in different size of embryos. It is of interest that Kerry and Bruce (1980) do not agree with the existence of such a dependence stating that the occurrences of late resorption are the cause of retarded implantation.

The present paper is an attempt to study the relationship between the survival, embryo and placenta weight, and the vasculature type of implantation places in the uterus.

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MATERIAL AND METHODS

The experimental material consisted of laboratory mice from the 4th litter of the VIIth generation of the Brw; PGC1 stock conducted by the Hanoverian System. Sixty 2-3-month-old females after mating were tested for the presence of a copulation plug. The day of the plug was determined as the first day of pregnancy. On the 18th day of pregnancy the females were killed and the number of corpora lutea on the both ovaries as well as the number of living and resorbed embryos were estimated. On the basis of the arrangement of the blood vessels attaining the uterus horns, the sequence of implantation places was established. The sex of embryos and their body weight as well as the weight and size (height and diameter) of the placentae were determined. Then the dimensional index (relation of height to diameter) was computed. Further calculations were based on the dimensional index. Finally the obtained results were statistically treated.

RESULTS AND DISCUSSION

The performed studies permitted to find on the average 16 implantation places in the uterus horn. In order to determine implantation places the blood vessel attaining the uterus horn were calculated, assuming that each single vessel (or branching at the horn) constitutes one place. In cases of vessels branched below their half-length, each branching was determined as a consecutive place, which is shown in Fig. 1.

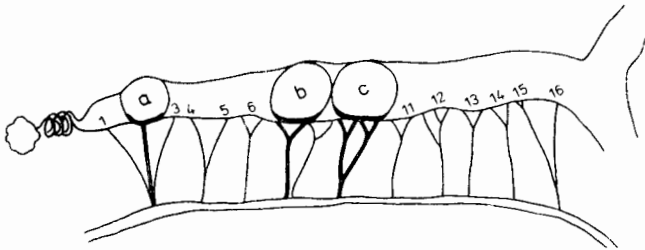


Fig. 1. A scheme of determination of the embryo implantation places in the uterus horn and the types of vasculature of implantation places:

a — single blood vessel ($1n$), *b* — single with assistance ($1\frac{1}{2}n$), *c* — double ($2n$)

Three vasculature types of implantation places were established: a) single, b) single with assistance, c) double, designating them further on as $1n$, $1\frac{1}{2}n$ and $2n$ (Fig. 1). Using this criterion it was found that considerably more embryos die in the $1n$ vasculated places than in other types of vasculature, irrespective of the part of the uterus horn.

As follows from Table 1, in the implantation places with a single blood vessel there die almost twice as many embryos as in the double vasculated places. The number of implantations on the two types of vasculature was similar. It is interesting that

the smallest number of dead embryos was observed in the places designated as $1\frac{1}{2}n$ (about 2%).

Individual types of vasculature are not typical of any part of the uterus horn. It seems that the frequency of individual types of vasculature has a genetic basis.

Table 1. Distribution of live and dead embryos depending on the vasculature type of their implantation places

Type of vasculature	Embryos			
	number of			losses (in %)
	total	live	dead	
Single blood vessel	318	266	52	17.35
Single blood vessel with assistance	91	89	2	2.20
Double blood vessel	261	236	25	9.58

An analysis of the embryo body weight and weight and dimensions of placentae in relation to the vasculature type was made and the results were summarized in Table 2. As follows from this table the lowest weight is characteristic of embryos with the $1n$ vasculature type. The differences between this group of embryos and others are statistically significant ($P \geq 0.01$ for Duncan test). There were no differences between the placenta weights of the $1n$ and $1\frac{1}{2}n$ vasculature types. The placentae of the $2n$ vasculature type were heavier, but that difference was not sta-

Table 2. Relationships between the type of vasculature of implantation places and the embryo weight and placenta weight and placenta size

Vasculature type	Embryo weight			Placenta weight			Placenta size		
	\bar{x}	$S_{\bar{x}}$	n	\bar{x}	$S_{\bar{x}}$	n	\bar{x}	$S_{\bar{x}}$	n
Single blood vessel	876.16	2.06	131	113.18	0.97	131	0.324	0.005	131
Single blood vessel with assistance	902.63	9.67	73	113.56	1.88	73	0.325	0.004	73
Double blood vessel	894.33	8.12	73	116.19	1.70	73	0.323	0.002	73

tistically confirmed. The dimensional index for placentae from the double — vasculature places is statistically significantly larger than the remaining indices (significant $P \geq 0.01$). In this experiment no relationship was found between the embryo sex and the weight of embryos and placentae.

CONCLUSIONS

The following conclusions may be drawn from the presented results:

1. The type of vasculature of implantation places affects the survival of embryos. Embryos implanted in places with a single blood vessel die more frequently than those in places with other vasculature types.

2. The vasculature type of the implantation places significantly affects the embryo weight and placenta dimensions, but has no influence on the weight placenta.

3. The adopted scheme of determination of implantation places can be used in studies of the maternal influence on the weight and survival of embryos.

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PRZEŻYWALNOŚĆ ZARODKÓW W POWIĄZANIU Z UNACZYNIENIEM MIEJSC IMPLANTACYJNYCH U MYSZY LABORATORYJNYCH

Streszczenie

W doświadczeniu analizowano miejsca implantacyjne zarodków w macicy myszy laboratoryjnych. Stwierdzono trzy różne typy unaczynienia miejsc implantacyjnych. Zarodki implantowane w miejscu unaczynionym przez jedno naczynie krwionośne zamierały częściej niż przy innych typach unaczynienia. Zarodki te miały również mniejszą masę i mniejsze łożyska.

ВЫЖИВАЕМОСТЬ ЗАРОДЫШЕЙ В ЗАВИСИМОСТИ ОТ ВАСКУЛЯРИЗАЦИИ ИМПЛАНТАЦИОННЫХ МЕСТ У ЛАБОРАТОРНЫХ МЫШЕЙ

Резюме

В эксперименте анализировались имплантационные места зародышей в матке лабораторных мышей. Обнаружено три типа васкуляризации имплантационных мест. Зародыши имплантированные в месте с одним кровеносным сосудом умирали чаще, чем при других типах васкуляризации. Зародыши эти имели также меньший вес и меньшие придатки.