

BIO-MEDICAL RESEARCH
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EXPERIMENTAL DATA ON THE BLASTOMOGENIC EFFECT OF COUMARONE AND POLYVINYL CHLORIDE PLATES

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Translation of: "Eksperimental'nyye Dannyye O Blastomogennom Vozdeystvii Kumaronovykh i Polikhlorvinilovykh Plastinok," Frachebnoye Delo. 11, pp. 106-114, 1962.

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In recent years a number of experimental studies of Soviet (A. Kh. Kogan, L. M. Shabad) and foreign (Drukrey, Norddurft, Oppenheimer, Turner et al.) authors have been published indicating the development of tumors in animals upon introducing polymer plates into them.

Among the tumors induced by polymer plates or metals, fibrosarcomas predominate (Yu. M. Vasil'yev). Data on the morphological changes of connective tissue which precede the appearance of sarcomas in experiments with polymer plates are extremely scattered (A. Kh. Kogan and I. T. Raykhlin, L. V. Ol'shevskaya).

In the party program adopted at the XXII Congress of the Communist Party of the Soviet Union, mention was made of the fact that the production of synthetic resins and plastics in the coming 20 years will be increased by approximately 60 times.

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Exceptionally wide application will also be found by plastics in living quarters; plastics will be used as floor covering materials. Among the most widespread plastics both in the USSR and abroad are polyvinyl chloride and coumarone plates and polyvinyl chloride linoleum.

Plastics have also been widely introduced into home economics and medicine. In connection with this, it becomes absolutely necessary to make a biological study of plastics with respect to their blastomogenic effect.

This report is devoted to an experimental study of the blastomogenic properties of polyvinyl chloride and coumarone plates employed as floor coverings.

The experiments were conducted on 310 albino rats weighing from 120 to 150 grams. All the animals were maintained on an ordinary diet in cages in a single room. The experimental animals were subdivided into four series.

With regard to the absence of experimental models, near the conditions of [TR note: word blurred] investigations on people, a method of parenteral implantation was employed. The plastics were implanted subcutaneously and [TR note: rest of sentence blurred] space.

The first series of experiments included animals in whom glass plates were implanted. The second series of experiments included animals with implanted polyvinyl chloride plates, and the third series animals which were implanted with coumarone plates. The fourth series served as the control (intact animals). The first three series of experiments included 70 rats each and the fourth - 100 rats.

The sizes of the implanted plates were as follows: subcutaneous -- 2.5 cm X 0.8 cm X 0.2 mm; those near the kidney -- 2.0 cm X 1.2 cm X 0.2 mm.

Prior to introduction into the animal's organism, the plates were sterilized in 70° alcohol solution for a period of 5-7 days.

Administration of the implants to the rats was carried out under sterile conditions under ether anesthesia. The plates were implanted subcutaneously in the region of the right shoulder. Implantation in the abdominal cavity was carried out via [TR note: word blurred] section in the region of the right [word blurred]. After introducing the plates, the incision was closed with 2-3 catgut stitches. The surface of the incision was [TR note: 4 or 5 words blurred].

After the beginning (9, 10, 11 and 12 months) of the experiment the animals were killed by means of decapitation.

From studying the effect of the implants, pathohistological investigations of the selected internal organs and tissues surrounding the plates were carried out. At autopsy of the experimental rats the implanted plates were removed together with the connective tissue capsules surrounding them.

The connective tissue capsules as well as the internal organs (lungs, heart, spleen, liver, stomach, small and large intestines, kidneys) were fixed in 10% formalin. After this the capsules and sections cut from the organs [TR Note: several words not readable]. [TR Note: rest of paragraph not readable]

The histological investigations (consultants V. S. Vitchenko and Professor M. K. Dalya) established that the capsules consist of fibrose connective tissue. In their histological structure all of the investigated capsules could be divided into two types. A significant majority of them -- 123 of 157 -- belonged to the first type. The capsule has a clearly defined fibrose structure. In it one can distinguish three zones: the inner zone, the mid zone and the outer zone. The inner zone, directly adjacent to the plate, consists of fibrose connective tissue containing a large number of fibrocytic cellular elements. The mid zone of the capsule also has a fibrose structure, but is more coarse than the inner structure and consists of tubrous bundles, hyalinized to a significant extent, composed throughout the length of the capsule of fibers and a small number of fibrocytic cells. The outer zone has a finely fibrose structure; delicate collagen bundles are distributed in the pericapsular lipid tissue over varying lengths. Vascularization in most capsules of the first type is well defined only in the outer zone. The content of cellular elements is occasionally extremely varied in individual regions. In most capsules one notes lymphoid cellular elements, histiocytes, and significantly less frequently, leucocytes and clots of hemosiderin either diffusely scattered or in adjacent accumulations, occasionally taking the form of infiltrates.

The remaining 34 capsules are of the second type with respect to histological structure. They also have a fibrose connective tissue structure. However in differentiation from capsules of the first type, the structure of these capsules is not so orderly: fibrose bundles of different thickness are located in random fashion; in parts of the capsules and even along the course of individual fibrose bundles of the same capsule, there are different numbers of fibrocytic cellular elements. The lipid tissue through which these bundles pass is in places significantly sclerotic. Vascularization, in view of the porous structure of the capsule, is pronounced in most of these quite well. The inflammatory infiltration is similar to that in the capsules of the first type.

The two structural variants of capsules which were established as existing about the plates are probably due to the individual degree of reactivity of the organism to the experimental animals and the character of the inflammatory reaction to foreign bodies.

No clear cut histomorphological difference in overall structure between capsules in experimental animals killed after 9, 10, 11 and 12 months was detected.

However during the microscopic investigation of preparations from the capsules of different series of experiments these characteristics were noted.

In the series of experiments with implantation of glass plates (subcutaneous implantation) 42 capsules were investigated; of these 36 were investigated 11 months, and 6 after 1 year. Twenty capsules were of the first structural type and 22 of the second. Mild proliferation of fibroblasts at the 11th month of the experiment occurred in 5 of the animals with localization in the inner and mid portions or only in the mid portions, while in the mid regions of two capsules proliferation of fibroblasts occurred a year after the beginning of the experiment.

In the experiments in which glass plates were placed in the abdominal cavity near the kidney, 16 capsules were investigated; one after 10 months, 8 after 11 months (in one observation proliferation of fibroblasts was noted in the internal zone), and 7 after 1 year. Twelve capsules were of the first type and 4 were of the second type with respect to histological structure.

In the series of experiments with implantation of polyvinyl chloride plates (the plates were introduced into the subcutaneous tissue), 32 capsules were investigated, of which 4 came from rats after 10 months, 14 after 11 months, and 14 after 12 months. Thirty capsules were of the first type of structure and 2 of the second type. In 20 capsules significant proliferation of fibroblastic cellular elements was noted, while in 6 of these there was cellular polymorphism. The proliferative processes in half the animals were localized in the internal zone, and in 5 capsules they encompassed the inner and mid zones (Figure 1), in 5 others they only included the mid region of the capsule. It was characteristic that in rats with implantation of the given type of plate, over the course of 10 months proliferation of fibroblasts was observed in the inner zone of 1 capsule; with an implantation time of 11 months proliferation was also noted only in the inner zone of 7 capsules. After 12 months the spread of fibroblasts was noted in the inner and mid regions of 4 capsules. In four rats the wall of the capsule was found to contain malignant tumorous growth in the form of sarcoma, in 2, polymorphiocellular (Figure 2) and in 2, cells having a spindle shape (Figure 3). The first two appeared in the inner zone of the capsules

in animals in the 11th month of the experiment; 2 were localized in the mid zone as well as in the inner zone. In one experiment, at the 10th month of observation, a sarcoma weighing 99 grams had developed surrounding the implanted plate; this sarcoma had a structure with very few polymorphic cellular elements [TR note: about 3 words not readable] in the 11th month from the beginning of the experiment [TR Note: about 3 or 4 more words missing] in another animal of the same observation series.



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Figure 1. Photomicrograph. Magnification 10 X 15. Pronounced proliferation of fibroblastic cellular elements encompassing the inner and mid zones.

With the administration of polyvinyl chloride plates in the abdominal cavity lipid tissue, 32 capsules were investigated. They were all of the first type with respect to histological structure. The capsules were investigated after 10 months in one rat, after 11 months in 25 rats, and after 12 months in 6 rats. Proliferation of fibroblastic cellular elements without polymorphism was noted in 4 capsules after 11 months: in 2 it was noted in the inner zone and in 2 in the mid zones; after 12 months observation indicated this development in one capsule in all zones. All three zones of the capsule were invaded by sarcoma in one spindle cell capsule (after 11 months) and in one capsule consisting of polymorphous cells in regions characteristic of fibrosarcoma (after 11 months) [TR Note: part of sentence was not included in the copy and am sort of lost at this point]; there was one polymorphous capsule with regions characteristic of fibrosarcoma (after 12 months).

In the series of experiments with implantation of coumarone plates (plates were introduced into the subcutaneous tissue), 21 capsules were investigated. Of these 16 were of the first type and 5 of the second type; 9 months after the beginning of the experiment capsules were removed from 14 rats, 10 months after the beginning of the experiment from 1 rat and 12 months after the beginning of the experiment from 6 rats. In three of the capsules removed after 9 months significant proliferation of fibroblastic cellular elements was noted twice in the mid zone, and in one capsule -- in the inner zone. In one capsule after 12 months the inner and mid zones had developed a spindle cell sarcoma which in places had the form of fibrosarcoma.

In the experiments with implantation of coumarone plates in the abdominal tissue, 14 capsules were investigated. With the exception of 1 capsule, all the capsules were of the first type [TR Note: a significant portion of text missed because of poor copy]. In two capsules after 12 months the inner zone had a copious proliferation of fibroblastic cellular elements; in one capsule after 12 months (with the involvement of the mid zone as well), there was also copious proliferation of fibroblastic cellular elements. [TR note: More text missing.]

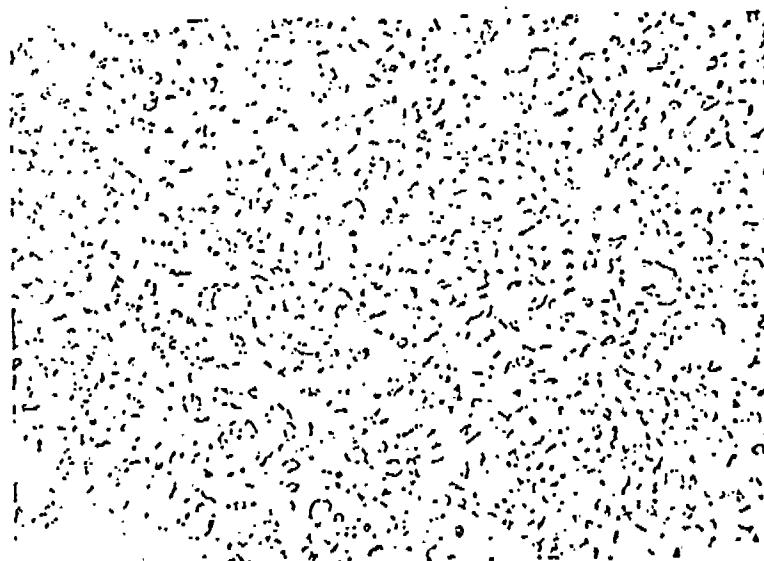


Figure 2. Photomicrograph. Magnification 20 X 15.
Polymorphous Cellular Sarcoma.

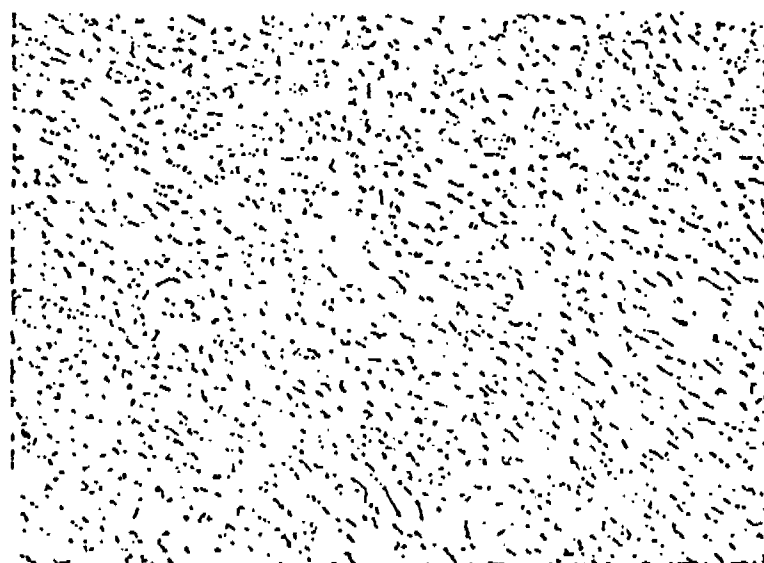


Figure 3. Photomicrograph. Magnification 20 X 15.
Spindle Cell Sarcoma.

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The proliferation of fibroblastic cellular elements which occurred in 39 capsules of all experimental animals in which were noted in 18 only in the inner regions were noted in 9 in the inner and mid regions simultaneously. Apparently, [TR note: Text cannot be read -- text completely cut off on right margin and some of the words are illegible from about the midpoint of the page to the right margin. Most of the page (page 113) cannot be translated and I am discontinuing it here].

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