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THE MAIN TYPES OF GRANULATION IN THE ELECTRON-MICROSCOPIC PICTURE

J. SAMOHÝL, J. ŠŤASTNÁ

The most diverse surgical procedure may be accompanied by the rise of granulating skin defects. These defects always mean the prolongation and complication of the healing. Successful therapy requires an entirely individual approach to them and regulation of the treatment by the actual condition not only of the defect but also of the whole organism of the patient.

The most important component of such a wound is the granulation tissue. Both in clinical practice and in the literature, however, there are many contradictions, confusions and insufficiencies in evaluating the condition of granulations and in the methods of their treatment [Demjén 1958, Karfík 1956, Knobloch 1965, Kubáček 1960, Zoltán 1962, and others].

On the basis of the data gained through the confrontation of the clinical appearance of the granulations with their microscopic picture, we tried to remove some incorrections in the evaluation of granulations and in one of the former works (Samohýl and Feit 1966, Samohýl 1968) we proposed a method of their more precise classification. We recommended the differentiation between two main types of granulation according to the amount of mature collagen fibres at the base of the wound and a number of subgroups according to the degree of acute inflammatory changes in the surface layers of granulations.

Histological investigations of structures (i.e. at microscopic level) do not yet provide sufficient information, however, about what really takes place in the individual cells of the granulation tissue and their extracellular areas, and we have therefore decided to investigate granulation tissues submicroscopically. In the first stage we concentrated, above all, upon the difference between the first and second group of granulations according to our classification and with special regard to the fibroblasts and the composition of the extracellular material.

MATERIAL AND METHODS

Up to the present we have investigated three dermatic defects containing granulations of the first type (fig. 1) — the age of granulation from 16 to 22 days — and three defects containing granulations of the second type (fig. 2) — the age of granulations from one half to three quarters of a year.

The granulation tissue was removed by a planary excision. The samples were fixed in 1% OsO₄ after Millonig, and embedded in the usual way in Epon 812. Ultrathin sections were contrasted by using uranyl acetate solution and lead citrate solution according to Reynolds. Sections were examined using a Tesla BS 242 D and a Tesla BS 413 A electron microscopes.

OBSERVATIONS AND DISCUSSION

In the electron-microscopic picture both the main types of granulation tissue differ from each other substantially, both in the structure of fibroblasts and in the composition and arrangement of the extracellular material.

GRANULATION TISSUE OF THE 1st TYPE

The appearance of the fibroblasts here is considerably variable and depends, to a great extent, on the degree of the differentiation of these cells and their functional condition at the moment. The most numerous are fibroblasts with a ramified system of rough endoplasmic reticulum, the inner areas of which are sizably dilated, especially at the site of the connections of individual cisternae, and filled with finely granular, medium-osmiophilic material (fig. 3). An analogous appearance of the rough endoplasmic reticulum was described by Giesecking (1963) in the fibroblasts of the chicken embryo. A very characteristic component of the cytoplasm of these fibroblasts are the vacuoles, often very numerous, containing amorphous material of variable density (fig. 3). We presume that these vacuoles are related to the production of mucopolysaccharides. The participation of the fibroblasts in the synthesis of mucopolysaccharides is testified by the evidence of PAS positive granules in their cytoplasm (Gersch and Catchpole 1949). Later on this finding was confirmed by other authors.

More uncommon in the granulation tissue of the 1st type are the fibroblasts with conspicuous signs of proteosynthetic activity, as described by Fitton-Jackson (1956), Giesecking (1959, 1960), Moore and Schoenberg (1960), Karrer (1960), Kajikawa (1961), Ross and Benditt (1961), Champman (1961), and others.

The main component of their cytoplasm is a richly ramified endoplasmic reticulum (fig. 4); we did not notice here the extensive dilatations of its inner areas, common in the preceding type. In the fibroblasts of this type the Golgi apparatus is, as a rule, more extensive and is remarkable for a considerable amount of minute vesicles. Cytoplasmic vacuoles, so characteristic of the preceding type, are lacking.

In view of the fact that the fibroblasts of the 1st type of the granulation tissue are very young, the extracellular material also is highly immature. The fibrillar component is mostly represented by delicate filaments without periodic

banding (fig. 3); periodically banded fibrils are present only in a very small amount. Besides this, the extracellular material contains a considerable amount of amorphous substance, probably to a great extent of mucopolysaccharide character.

GRANULATION TISSUE OF THE 2nd TYPE

In this type of granulation tissue the second of the described forms of fibroblasts singularly prevails, i.e. the fibroblasts to which, in the literature, an active participation in the synthesis of collagen proteins is ascribed (fig. 4). At the base of the granulation tissue of the 2nd type there are fibroblasts in a state of rest, both the rough endoplasmic reticulum and the Golgi apparatus of which are considerably reduced (fig. 5).

Conspicuous in the extracellular material is the fibrillar component, represented both by delicate filaments and periodically banded fibrils of various diameters (fig. 4, 5). The thickest of them are over one thousand Å.

The above-mentioned results extend and give precision to our conceptions of the fibroblasts and the extracellular material in both the two main types of granulation tissue. The fundamental difference between both of them stands out distinctly.

While the fibroblasts of the 1st group of granulations produce, to a great degree, mucopolysaccharides — as we think — the fibroblasts of the 2nd group are more mature and are more directed towards the synthesis of collagen proteins. Also the composition of the extracellular material corresponds to the level of the differentiation of fibroblasts in both types of granulation tissue.

In the 1st group, above all a great amount of amorphous material emerges in which mucopolysaccharides predominate also according to our previous findings [18] (this is further confirmed, too, by our first chemical investigations of both the main types of granulations). The collagen fibrils here only gradually form and have the appearance of thin filaments without the typical periodic banding.

In the 2nd group of granulations the extracellular areas contain on the one hand, filaments, and, on the other hand an increasing number of typical banded collagen fibrils. According to their age these fibrils are of various diameters, mostly less than $0.2\ \mu$. All of them are then practically of submicroscopic dimensions.

On the basis of the data thus gained we can more precisely explain how it is possible that the granulations of the 1st group very sensitively and heterogeneously react upon individual lesions, while the response of the granulations of the 2nd type is substantially more stereotyped. The reduced reactivity of the granulations of the 2nd type is not caused only by the increased amount of matured collagen tissue at their base, as we imagined on the basis of the histological findings, but is already provided by the selfsame higher degree of differentiation of fibroblasts and collagen fibrils in their extracellular material.

We believe that in the future we shall be able to approach by means of this method — under simultaneous chemical, histochemical and other investiga-

tions — the actual metabolic and physiological changes in the individual types of granulation. Only then will it be possible to consider the introduction of really rational treatment and the employment of all modern knowledge on collagenous network (e.g. Chvapil 1967, Peacock 1967, 1968) and its treatment.

SUMMARY

By means of EM investigation the method of classifying types of granulation tissues in skin defects in accident cases as it was proposed by the first of the authors, is further elaborated and substantiated.

It was seen that in granulation tissue with a small amount of collagen deposit at the base (the 1st group of granulations according to the proposed classification) we find fibroblasts directed to a great extent towards the synthesis of mucopolysaccharides. In the extracellular material we then find amorphous material (mucopolysaccharides) and collagen filaments.

In granulation tissue with a greater amount of collagen at the base (the 2nd group of granulations according to the proposed classification) we find fibroblasts in which all signs of proteosynthetic activity are well expressed, including their participation in the production of collagen. In the extracellular material there is a number of filaments without periodic banding and also of more mature banded fibrils of various diameters.

The results have provided further material confirmation of the proposed classification of granulations, and enable deeper understanding of the entirely different clinical properties of both the suggested main groups of granulation tissues.

RÉSUMÉ

Les types des bourgeons charnus dans l'image électromicroscopique

J. Samohýl, J. Štastná

Les auteurs ont réalisé à l'aide de EM la manière de distinction des types variés des bourgeons charnus dans des défauts traumatiques de la peau tels qu'ils ont été déjà décrits par les auteurs.

Les données ont montré que chez les bourgeons charnus à la base possédant trop peu du tissu collagèneux la Ière groupe des bourgeons charnus à après la classification des auteurs il y a des fibroblastes servant le plus souvent à la synthèse des mucopolysaccharides. Dans la matière intercellulaire se trouve un matériel amorphe (des mucopolysaccharides) et les protofibrilles collagèneux.

Les bourgeons charnus à la base possédant une grande quantité du tissu collagèneux (la IIème groupe des bourgeons charnus d'après la classification des auteurs) il y a des fibroblastes montrant très expressivement tous les signes de l'activité protéosynthétique, leur participation dans la création du collagène y compris. Il y a même une grande quantité des protofibrilles sans stries transversales et des formes plus mûres des fibrilles striées à la coupe variées dans la matière intercellulaire.

Les données ont présenté un matériel de soutien à la classification des bourgeons charnus et ils permettent de comprendre les qualités cliniques différentes des deux groupes du tissu granuleux, telles qu'elles ont été présentées par les auteurs.

ZUSAMMENFASSUNG

Haupttypen der Granulationsgewebe im elektron-mikroskopischen Bild

J. Samohýl, J. Štátná

Mittels elektron-mikroskopischer Untersuchung wird die Methode der Typenklassifikation der Granulationsgewebe in Unfallhautdefekten, die von dem ersten der Autoren vorgeschlagen wurde, weiter bearbeitet und begründet.

Es hat sich herausgestellt, dass beim Granulationsgewebe mit geringer Menge des kollagenen Gewebes an der Basis (I. Gruppe der Granulationen nach der entworfenen Klassifikation) Fibroblaste vorgefunden werden, die im wesentlichen Ausmass auf die Mukopolysaccharidsynthese eingestellt sind. In der Interzellulärsubstanz wird amorphes Material (Mukopolysaccharide) und kollagene Protofibrillen vorgefunden.

Im Granulationsgewebe mit grösserer Menge des kollagenen Bindegewebes an der Basis (II. Gruppe der Granulationen nach der entworfenen Klassifikation) werden Fibroblaste vorgefunden, bei welchen alle Merkmale der proteosynthetischen Aktivität einschliesslich ihrer Beteiligung an der Kollagensynthese gut ausgedrückt sind. In der Interzellulärsubstanz befindet sich hier eine Anzahl von Protofibrillen ohne Querstreifung, und auch von reiferen gestreiften Fibrillen von verschiedenem Durchmesser.

Durch die Ergebnisse wurde weiteres Material gewonnen, welches die vorgeschlagene Klassifikation der Granulationen unterstützt und ein tieferes Begreifen der vollständig unterschiedlichen klinischen Eigenschaften der zwei vorgeschlagenen Hauptgruppen der Granulationsgewebe ermöglicht.

RESUMEN

Tipos principales del tejido de granulación en el cuadro del microscopio electrónico

J. Samohýl, J. Štátná

Por medio del EM examen se continúa en tratar y razonar el modo de la clasificación de los tipos de tejidos de granulación en defectos de accidentes de la piel, como fue propuesto por el primer de los autores.

Se vió, que en el tejido de granulación con una pequeña cantidad de los ligamentos colagénicos en la parte inferior (el primer grupo de las granulaciones según la clasificación propuesta) encontramos los fibroblastos enfocados en abundancia la síntesis de los mucopolisacaridos. En la substancia intercelular encontramos entonces un material amorfo (mucopolisacaridos) y las protofibrillas colagénicas.

En el tejido de granulación con una cantidad más grande de los ligamentos colagénicos en la parte inferior (el segundo grupo de las granulaciones según la clasificación propuesta) encontramos los fibroblastos, en los que se expresan bien todas las muestras de la actividad proteosintética con inclusión de su participación en la formación del colágeno. En la substancia intercelular están aquí muchas protofibrillas sin listas transversales y también las fibrillas cebradas más maduras de los diámetros diferentes.

Los resultados ofrecieron otro material confirmando la clasificación propuesta de las granulaciones y hacen posible el entendimiento más profundo de las propiedades clínicas completamente diferentes de los dos grupos principales propuestos de los tejidos de granulación.

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DYNAMICS OF MORPHOLOGICAL CHANGES AFTER HOMOGRAFTS OF TENDONS PRESERVED IN ANTICYTOLYTIC SOLUTIONS

U. V. BERINGER, U. N. DARKSHEVICH

The possibility of replacing damaged tendons by homografts is of great theoretical and practical importance especially in the flexors of the fingers. According to both data in the literature and personal observations, homotransplants of preserved tendons are a fully adequate biological material for grafting. However, the method of conservation is by no means irrelevant as it is, to a considerable extent, decisive for the results of the operation.

Tissues are most simply preserved in liquid media but prolonged action of the current preservation media has an unfavourable influence on the biological and physical properties of homotransplants.

It is, therefore, logical to use for preservation materials with bactericidal and bacteriostatic properties which are able to prevent the histolysis of tissues and the production of histamines. Substances of the phenothiazine series — diprazin, propazin, etizin and some others — are most effective.

The two following samples were prepared and tried out experimentally: No. 1 (AGDM) which contained aminocrovin 85,0; glycerine 15,0; diprazin 1,0; micerin 300,000 I.U. and No. 2 (RGDM) in which Ringer-Locke solution was used instead of aminocrovin. Tendons of rabbits calf muscles were preserved in these solutions at +2 and +4° C. for 30—60 days. During this time the physical properties of the tendon tissue were fully preserved, i.e. colour, consistence, elasticity etc. Sterility of the transplants and the solutions was preserved for 18 months.

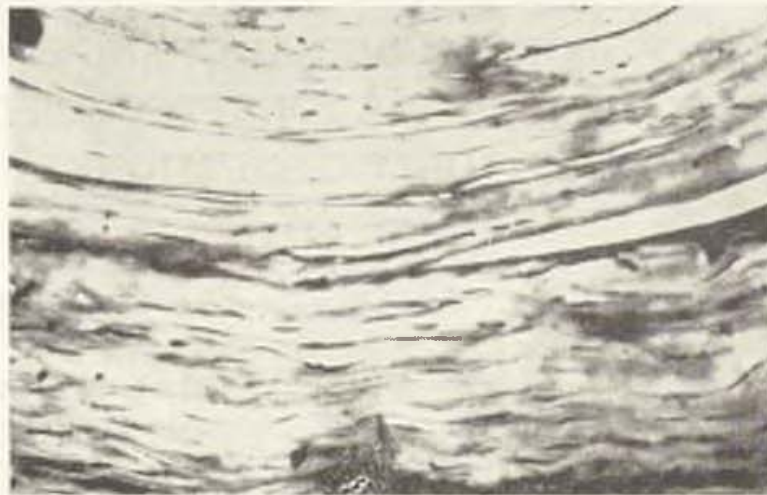
The experimental follow-up was carried out in 4 series of experiments on 70 rabbits and consisted in repairing the surgical defect in the tendon of the calf muscle with a preserved homotransplant.

The further fate of the homotransplant and the regeneration of the tendon tissue is also of great theoretical and practical importance. One group of authors — Krivorotov, Nikolayev, Lokshina, Teneff and Fonda and others —

found that the tendon defect is replaced by regenerating connective tissue. Others (Degtyareva and Lavrishcheva, Voronin, Amosova, Graham, Cordrey) assume the possibility of the actual regeneration of tendon tissue.

There are only a few studies dealing with morphological changes in grafted tendon homotransplants conserved in liquid media. This problem is, however, of great importance as the transplant tissue is chemically influenced by these methods of preservation.

The follow-up of morphological changes in transplants was carried out after 3, 7, 14, 30 and 60 days, and after 3 and 6 months. The material was fixed



Photomicrograph 1. Preparation no. 519 (7 X 40). The transplant was preserved for 30 days in solution No. 1. Observation on the third day. Structure of tendon fascicles and tendon cells is distinctly stained.

in 10 percent solution of formol. A part of the specimens was embedded in celoidine-paraffin after a passage through alcohols in increasing concentration. Preparations were, more over, prepared on a freezing microtome. They were stained according to Van Giesson and in hematoxyline-eosine.

During this time the transplants fully preserved their physical properties — colour, consistence, elasticity etc.

Before analysing the essence and dynamics of morphological changes of the preserved homotransplants following substitution of a tendon defect, we shall first deal with some data which were brought forth by the observation of our own material.

Based on the results of histological examination we are able to state that, independently on the time of preservation (30—60 days) of the transplants in solutions No. 1 and 2, the tendon tissue, from the morphological standpoint, preserved permanently its characteristic histo-typical properties. We also studied the characteristic distribution of the cells through-out the length of the transplant. They preserved their typical staining properties, their distribution and normal chromatine structure of their nuclei.

We did not find any essential morphological differences in transplants preserved in solution No. 1 as compared with the tissue of an unpreserved tendon. Owing to the staining intensity of the nucleus chromatine and the basic substance of fascicles of the first and second order, it may be supposed that in preserving the tendon in solution No. 1 necrobiotic processes are slower than in solution No. 2. Analysis of morphological data does not allow to suppose an essential and fundamental difference in the further evolution of re-



Photomicrograph 2. Preparation no. 301 (10 X 9). The transplant was preserved for 60 days in solution No. 2. Observation on the 14th day. Ingrowth of proliferating cells of the surrounding connective tissue into the terminal part of the transplant between its tendon fascicles.

paratory processes dependent on the length of transplant preservation. But the degree and rate of these processes is more evident in experiments with the grafting of homotransplants preserved in solution No. 1. After the grafting of transplants preserved in solution No. 2 these processes are undoubtedly characterized by a similar sequence and order, but they are less pronounced. In all experimental series, on the third day after the grafting, a heavy swelling of the fibrillar connective tissue appeared in the operated area.

It was marked in a fairly extensive area on the peritendon and it spread to the endo- and perimysium of the muscles in the vicinity. The swelling, which gradually diminished from the centre to the periphery, usually reached as far as the subcutaneous connective tissue. In the vicinity of the transplant we often found congestion, focal haemorrhages (per diapedesim) and, not unfrequently, thrombosis of small blood vessels (usually in the area where the transplant was connected with the end of the cut tendon). In the same areas there was a very conspicuous infiltration with histiogenous and hematogenous cells with a great number of giant mononuclear macrophages around the transplant.

On the 7th day, and still more evidently on the 14th day, the circulatory disorders showed to a lesser degree. On the 14th day the exudative reactions in the tissue surrounding the tendon anastomosis in the form of swelling and infiltration by cells of the haemopoietic series diminished and it was replaced by proliferative processes issuing from local histiogenous cells of the connective tissue. In all experimental series, and even in long-term observations (6 months), proliferation of endo- and peritenonium cells was not accompanied by formation of fibrous connective tissue.



Photomicrograph 3. Preparation no. 650 (5 X 9). The transplant was preserved for 60 days in solution No. 2. Observation on the 45th day. Terminal part of the transplant. Ingrowth of proliferating cells along preserved "skeleton" of the transplant between fascicles of the first, second, and third order and formation of normal structure of the tendon tissue.

Independent of the duration of transplant conservation and the kind of solution used (No. 1 or No. 2), the greater part of the grafted transplants preserved, on the third day after operation the typical distributional structure of tendon fascicles of both the first and second order and, owing to the beginning caryolysis, it was devoid of its own cells. Only in the vicinity of sutures at the ends and, less conspicuously, in individual spots on the peripheries of the transplant along its entire length it was possible to observe still preserved nuclei of tendon cells. In the peripheral parts there were few cells, nuclear chromatine was slightly stained by basic dyes. In the terminal parts of the transplant the tendon cells were preserved in the peripheral and central parts, they stained conspicuously and were normally distributed in the shape of columns. (Photomicrograph 1.) The nucleus structure, even as soon as on the 7th day after the operation, is distinct only in that part of tendon cells which are near the sutures at the ends of transplants preserved in solution No. 1. In spite of such long survival of nuclei in a part of transplant cells, no mitotic figures were found in them. Therefore the possibility of tendon cells regeneration

in the transplant and their share in reparatory processes of tendon tissue after homoplasty is doubtful. Later on it is not possible any more to find any tendon cells in the transplant.

Contrary to the comparatively rapid progress of nuclear lysis in the transplant tendon cells no fundamental changes take place in the structure and distribution of the tendon fascicles (in all experimental series). Tendon fascicles of the first and second order are usually stained with acid dyes almost through the entire length. But the intensity of staining is not the same in different parts and, in long-term experiments, it is slightly weaker. Only in the extreme parts of the transplants preserved in solution No. 1, on the third day and to a lesser degree on the 7th day the tendon fascicles are slightly basophilic.

This suggests, apparently, an increased number of acid polysaccharides in these parts of the tendon. It is well known that this increase frequently accompanies the activation of proliferative processes in the mesenchym. However, we shall not deal with problems of histochemistry characteristics, they



Photomicrograph 4. Preparation no. 41 (7 X 3). The transplant was preserved for 30 days in solution No. 1. Observation after 6 months. New-formed tendon. Orsilon sutures in the centre of the newformed tendon, neither incapsulation nor scars occurred.

being the object of special studies. Together with the pronounced nuclear lysis of the transplant tendon cells we observed in the terminal parts of the cut tendon analogous and, at the same time, more pronounced changes. Necrosis of the cells progressed through the entire thickness of the tendon but did not reach the same distance from the cut. Tendon fascicles of the first and second order showed mostly an oxyphilic stain and, on the 3rd and 7th day respectively they showed an imbibition and thickening. In the terminal parts of the receiver's tendon a pronounced proliferation of endotenon cells between the fascicles of the first and second order is apparent already on the third day. Proliferation of the peritenon cells is very conspicuous too. These areas are characteristic by a great number of elongated cells of the same type which are close to each other and arranged as stripes parallel with the course of tendon fascicles. The nuclei of proliferating cells are enlarged and mostly of an elongated, oval shape with a distinctly stained, fine chromatine structure. In the cells there are frequent mitotic figures; mitotic activity is higher in cells distributed near the place of their ingrowth into the necrotic tendon tissue and into the proliferating tendon connective tissue in the anastomosis area.

Cells which form these fascicle-shaped complexes are morphologically quite identical, and it is practically impossible to ascertain the identity of cells individually removed from these complexes according to their accurate histotypical class. Morphologically they are quite identical with the proliferating tendon cells which are distributed through the entire thickness of the cut tendon to a considerable distance from its end, as well as with young connective tissue cells which are between the end of the tendon and the transplant.



Photomicrograph 5. Preparation no. 321 (7 X 20). The transplant was preserved for 30 days in solution No. 1. Observation after 6 months. New-formed tendon consisting of little differentiated tendon fascicles (above). Normal tendon (below).

It is necessary to emphasize that the individual cells of the formed cell complexes are in the shape of fascicles, that they are arranged parallelly with the tendon fascicles and penetrate into the periphery of the transplant. Their ingrowth may be observed from the third day and increases during the time of the experiment. The cells that grow into the transplant are parallel with its plane and they are always situated only between the tendon fascicles of the first and second order.

From the 3rd to the 7th postoperative day, the proliferating connective tissue cells penetrate obliquely from the peritenonium into the peripheral parts of the transplant and grow further in the direction of the tendon fascicles. The cells grow from complexes situated in the anastomosis area and penetrate between the tendon fascicles of the terminal parts of the transplant but they have not the direction characteristic of "cell bundles" which they were derived

from. Especially during the first 15 days, it is evident that the ingrowth of the cells between fascicles of the first order is much less pronounced than between those of the second and third order; in the latter case it is always more conspicuous. The spaces between fascicles of the second and third order contain, therefore, a greater number of cells distributed in several rows. Cells between fascicles of the first order grow, in this period, only in a single file.

In the early stage of the experiment the ingrowth of the proliferating cells and blood capillaries is intensive from the terminal parts into the transplant periphery. In its centre the infiltrative regeneration growth of proliferating histiogenous cells is, for a long time (till 30—45 days), considerably smaller (Photomicrograph 2.)

Owing to the different rate of infiltrative growth of histiogenous cells between fascicles of the first and second order in the first 15 postoperative days, it seems as if the transplant, particularly in the periphery, were divided by the ingrowing cells into individual fascicles of the second order. (Photomicrograph 3.)

These fascicles, ususally difficult to distinguish, appear very conspicuously in the transplant during this time, which can be explained by structural peculiarities of the tendon tissue. Normally, fascicles of the first order are close to each other and separated only by one layer of flattened tendon cells. Between fascicles of the second and third order, which are in a less close contact, there are collagenous and precollagenous fibres besides the cells of blood vessels. It is therefore to assume that these areas of the transplant are more favourable for infiltrating cell growth and for blood vessels ingrowth. This type of growth is characteristic for young, little differentiated cells the nuclei of which are, compared with mature cells, always enlarged. At this stage of the reparatory processes it is, therefore, natural for the layers between fascicles of the first and second order to become more distinct. In the course of rapidly progressive reparatory processes, accompanied by increasing infiltration of the transplant by histiogenous cells, the characteristic structure of fascicle distribution in the tendon tissue disappears in these areas in consequence of cell infiltration not only between the fascicles of the second and third order but between those of the first order as well. The basic substance of fascicles of the first order gradually loses, proportionally with the cell penetration, its oxiphilic staining and it begins to take up a slightly basophilic stain. At the same time fascicles of the first order become attenuated in their entire thickness, they are hardly to be distinguished between the stripes of ingrowing cells. Already on the 30th experimental day the nuclei of many cells in these areas are getting narrower, elongated, and they get an undulous shape reminding of the usual shape of tendon cells. In the same period, independently on the preservation time and composition of the solution, the terminal parts of the transplant in the entire thickness were replaced by ingrowing cells in some of the preparations. The cells were placed so closely together that the border-line between the tendon fascicles of the first order was sometimes hardly distinguishable. It is interesting that, during the infiltration of the transplant by proliferating cells, the sutures,

surrounded during the early experimental stages by macrophages and leucocytes, were now isolated from the cell complexes only by nuclear detritus, while the cell fascicles which surrounded them kept their normal course. Incapsulation of sutures by fibrous connective tissue does not occur after 3—6 months. The sutures are at the exterior of the newly-formed tendon, or inside it, in such a way that they are encircled by a part of the fascicles which does not change its characteristic arrangement. (Photomicrograph 4.)

Ingrowth of proliferating histiogenous cells into the transplant and the substitution of its structural elements comes from all directions, but mostly from the end parts. The infiltration of cells from the peripheral parts deep into the transplant stops at about the 15th day. In such a way the transplant is gradually substituted by cells growing into it from all directions. Tendon fascicles of the first order which preserved their characteristic distribution can be seen in the central parts only. About the 30th day one fourth to one third of the transplant is substituted by ingrowing cells.

Proportionally with the duration of experiment the cell complexes growing from both ends of the transplant towards each other proceed in one plane along the preserved transplant "skeleton" between the fascicles of the first order. In about 3 months time two thirds, or the whole, of the transplant are substituted by stripes of proliferating histiogenous cells. After 6 months the transplant is entirely substituted by cells and the substitution of the tendon defect is finished. At the same time the newly-formed tendon tissue is, between the 3rd and 6th month, considerably thinner than the transplant. This attenuation of the transplant proportionally with the gradual ingrowth of cells may be explained by the disappearance of the basic substance in the tendon fascicles of the first order, i.e. the cells do not use it as plastic material in the time of proliferation and infiltrative growth in the transplant. Attention is called also to the evident differentiation of the elements growing into the transplant in the course of 3 months. Between the 3rd and 6th month the number of cells decreases in the ingrowing "stripes". The nuclei of many cells are getting an elongated and slightly sinuous shape, they become flatter and show a greater resemblance with the typical tendon cells. Their distribution changes simultaneously with their structural changes. The cells gradually group themselves one after the other in a single file, between the neighbouring rows a narrow layer of basic substance is found which is identical with tendon tissue fascicles of the first order. But about the 6th month these processes of element differentiation into typical, mature tendon tissue are not yet finished. This requires, probably, a much longer time. By the 6th month, however, the full substitution of the tendon defect replaced by homotransplant is finished, without the appearance of fibrous connective tissue. (Photomicrograph 5.)

In fact, new little differentiated tendon tissue appears. It is impossible to ascertain, taking in account the given period of observation, when this differentiation is completed and irreversible. But the lack of encapsulation and scars in the areas of contact between the cut tendon and the transplant, and the characteristic structure of the new tissue which is morphologically identical

with young tendon tissue could be used as basis to the assumption that the substitution of the cut tendon by homotransplant preserved in liquid media takes the same course after the plasty as when healing per primam.

SUMMARY

1. Physical properties of tendon transplants are not changed by conservation in solutions No. 1 (AGDM) and 2 (RGDM) for 30 and 60 days respectively.

2. The tissue of the grafted preserved tendon transplant keeps its fundamental histotypical structure, and full substitution of the tendon defect is made feasible because the receiver's cells grow into the transplant without incapsulation or scar formation.

3. Based on favourable results of experimental and preliminary morphological studies, solutions No. 1 (AGDM) and 2 (RGDM) are recommended for preservation of tendon transplants and their ensuing use in clinical practice.

RÉSUMÉ

La dynamique des changements morphologiques en suite d'homoplastie des tendons conservés à l'aide des solutions anticytolytiques

U. V. Beringer, U. N. Darkchevitch

1. La conservation dans des solutions No 1 (AGDM) et No. 2 (RGDM) durant la période de 30—60 jours ne change pas les qualités physiques des transplants tendineux.

2. Le tissu d'homotransplant tendineux de conservation transplanté conserve sa structure histotypique fondamentale rendant ainsi possible un remplacement complet du défaut tendineux par le fait que les éléments cellulaires du récipient pénètrent dans le transplant sans être incapsulés ou bien encore sans former des cicatrices.

3. Les résultats favorables des expériences jusqu'alors obtenus de même que les données morphologiques précoces nous permettent de recommander les solutions No 1 (AGDM) de même que No 2 (RGDM) comme moyen de conservation des transplants tendineux pour le praxis clinique.

ZUSAMMENFASSUNG

Die Dynamik der morphologischen Veränderungen nach der Homoplastik von Sehnen, die in antizytolytischen Lösungen konserviert waren

J. V. Beringer, J. N. Darkschevitsch

Durch 30 oder 60 Tage dauernde Konservierung in Lösung Nr. 1 (AGDM) und Nr. 2 (RGDM) werden die physikalischen Eigenschaften der Sehnentransplantate nicht geändert.

Das Gewebe übertragenen Sehnentransplantates behält seine histologische Grundstruktur und ermöglicht vollen Ersatz des Sehnendefektes dadurch, dass die Zellelemente des Empfängers in das Transplantat ohne Kapsel- oder Narbenbildung hineinwachsen.

Die gewonnenen günstigen Ergebnisse der experimentellen morphologischen Untersuchungen erlauben uns die Lösungen Nr. 1 (AGDM) und Nr. 2 (RGDM) zur Konservierung der Sehnentransplantate und ihrer Anwendung in der klinischen Praxis zu empfehlen.

RESUMEN

Dinámica de los cambios morfológicos después de la homoplástica de los tendones conservados en los soluciones anticitolíticas

U. V. Beringer, U. N. Darkchevich

Conservación en las soluciones No. 1 (AGDM) y No. 2 (RGDM) durante 30 y 60 días no cambia las propiedades físicas de los trasplantes de tendones.

El tejido del homotransplante trasladado conservado de tendón conserva su estructura histiotípica fundamental y hace posible el reemplazo completo del defecto de tendón así que los elementos celulares del receptor crecen en el trasplante sin incapsulatio o creación de los costurones.

Los resultados favorables ganados en los exámenes morfológicos experimentales y preliminares nos permiten recomendar las soluciones No. 1 (AGDM) y No. 2 (RGDM) para la conservación de los trasplantes de tendón y su aprovechamiento próximo en la práctica clínica.

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AUTOPLASTY AND HOMOPLASTY OF EXTENSIVE DEFECTS OF THE VAULT

Experimental Research

M. N. PAVLOVA, V. V. VYALCEV

Repair of extensive defects of the skull, in spite of many methods and materials suitable for cranioplasty, has still several pitfalls which force the surgeons to continue their research in this field.

Great success in reconstructive and plastic surgery was attained by using bone transplants preserved at low temperature. Conservation of bone tissue by freezing is, at present, the most widely used method (Kovalenko 1951, 1957; Panova 1960—1961; Imamalyev 1962, 1964 and others).

The best results were attained with conservation of tissue by the deep-freeze method at -70°C , and the following storage of this tissue at -25°C . It was found that the preliminary treatment of the bone tissue with low temperatures had a positive effect on the grafting properties of the transplant and, therefore, furthered a first-rate substitution of the transplant tissue by new-formed bone.

White (1948), Elliot and Scott (1951), Sicard (1951), Odom et al. (1952), Abbot (1953), Bryk (1959), Streli (1960), Kovalenko (1961), Vyalcev (1964), Busarev, Kostandyan (1965), Zvonkov and Priluchnaya (1965), who studied experimentally the peculiarities of the regenerative processes in the bones of the vault, pointed out that in extensive defects of the bones of the vault the reparative processes were atypical, i.e. development of fibrous connective tissue was predominant in the process of regeneration, and the defect of the skull was not substituted by bone, but by thin fibrous membrane.

Friedenberg and Lawrence (1962) studied experimentally this problem in 20 adult dogs by cutting circular defects, 7, 12, 17, 19 and 24 mm. in diameter respectively, in the bones of the vault by means of a burr or trephine. The authors found that in dogs with skull defects 24 mm. in diameter only about 20% of the area at the rim of the defect was substituted by new-formed bone tissue. In wounds of smaller diameter (17 and 19 mm.) about 40% of the area of the defect was thus substituted.

The authors emphasized that the localisation of the skull defect influenced in no substantial way the progress and degree of the regeneration process. Richani et al. (1963) were of the same opinion.

METHOD

Forty five experiments were carried out in 24 dogs. The experiments were divided into 5 series. The sex and colour of the animals were not registered. Characteristics of the experimental series are shown in a table.

Table

Series	Kind of transplant used in cranioplasty	Number of experiments
1 (Control)	Without covering the skull defect by transplant	4
2	Fresh autotransplant	9
3	Frozen autotransplant	6
4	Fresh homotransplant	10
5	Frozen homotransplant	16

The animals were operated on in morphine-hexenale or morphine-barbamile narcosis. After a thorough shaving of the head and cleaning the operation field with benzine, alcohol and iodine longitudinal incisions were performed on the crown of the head parallelly with, and 3 cm. distant from, the sagittal line on both sides. Aponeurosis of the temporal muscle was incised and the muscle fibres were divided by blunt preparation. The bones of the vault were set free with a raspatorium.

The trephining end of a circular fraise 24 mm. in diameter was applied, on both sides, in the area of the occipital protuberances. The diameter of the cut-out bone fragment was, however, 2 mm. smaller than the trephine aperture (the difference was due to the thickness of the fraise walls).

The bone fragments were used as auto- and homotransplants respectively, according to the individual experimental series. Transplants for conservation by freezing were prepared in the same way. The bone fragments were put into sterile glass vessels with cut-glass stoppers. The freezing was carried out in thermos or in special containers with dry ice at -70°C for 24 hours. The transplants were then stored at -25°C for a period between 20 days and 6 months. Before the transplantation the graft was left for 30—45 minutes in saline with penicilin at room temperature.

To find out the role of dura in the regeneration process of the bones of the vault and its influence on the speed and degree of the substitution of the transplant by new-formed bone tissue, the dura was removed on one side, usually on the right, in the entire area of the skull defect and the transplant was placed directly on the brain tissue. On the other side of the skull, the defect was covered by the transplant which was placed on the intact dura. The wound was firmly sutured in layers. Sutures were removed after 7—9 days. In all operated animals the wounds healed per primam, no local or systemic reactions were observed.

Roentgenological control of the site of transplantation, and the evaluation of the transformation process in the days following operation, was not feasible. The peculiarities of the skull architecture in dogs, with a great number of bones of different thickness, did not permit to get clear roentgenograms. For this reason the morpho-

logical method remained the only feasible one for objective evaluation of the fate of the transplant in substituting defects of the bones of the vault.

The operated animals were killed 1, 3, 7, 10, 11, 12, 13, and 18 months respectively, and one dog 25 months, after cranioplasty.

For the morphological study a block 40 × 40 mm. in size was cut out, in the centre of which was the transplant. The tissue was fixed in 10% neutral formaline, decalcified in 5% solution of nitric acid and embedded in celoidine. The sections were stained with picrofuchsin and hematoxylineosine.



Fig. 1. Skull defect 24 mm. in diameter 18 months after operation was not covered with the bone transplant but only with fibrous tissue.

RESULTS

The results of this experimental study confirmed other author's data about the weak regeneration faculty of the skull bones. In these experiments the skull defect, 24 mm. in diameter, remained covered only with fibrous tissue even after 18 months (Fig. 1).

AUTOPLASTY

If the defect was covered with a fresh autotransplant this became loosely fixated to the rims of the defect within a month. The gap between the transplant and the skull bones was filled with fibrous tissue. Necrosis and necrobiosis of the cells appeared in the transplant. The blood vessels in the transplant got obliterated.

The inner surface of the bone plate of the transplant was uneven, mostly due to resorption of the bone and to its usuration. The outer surface of the transplant, under the muscles, kept its even original contour. A thin layer of new bone tissue appeared only on the inner surface of the transplant and along the extended cavities where the blood vessels were situated. New-formed

bone tissue was found also around the bone splinters which remained on the surface of dura under the transplant. At the same time dura thickened considerably, the number of great fibroblasts and collagenous fibres increased.

Histological study showed that the removal of the dura had neither a significant influence on the character of changes taking place in the transplant nor on the regeneration of the bone tissue on the outer surface of the transplant.

After a year the macropreparation of the transplant had the shape of an irregularly thinned plate loosely fixated to the edges of the bone defect.

The same phenomena appeared also in microscopic observations. The transplant tissue devoid of osteocytes was substituted by new bone tissue.



Fig. 2. Twelve months after transplantation of a fresh autotransplant: tissue devoid of osteocytes was partially substituted by new bone tissue which formed on the surface of, as well as inside, the transplant along the blood vessels.

New-formed tissue was on the surface of the transplant, and inside it especially along the blood vessels (Fig. 2). Bone as well as fibrous tissue appeared between the transplant and the skull bones. Bone tissue in the gap formed a narrow compact strip covered with muscles. The uneven formation of bone tissue at the rims of the transplant and the sporadic predominance of fibrous tissue in the fissure was the causes of the insufficiently firm fixation of the transplant to the edges of the defect.

In transplantation of frozen autotransplants observations 3 months after operation showed that not only the structure and thickness of the bone plate of the transplant were preserved, but also its bulk was increased by new bone tissue. The transplant was covered on the surface as well as at the edges by a narrow layer of bone tissue. The appearance and accumulation of a considerable number of big osteoblasts and formation of bone tissue originated from

inter-osseous space of the bones of the skull along the edge of the defect. At this time the fissure was filled up with bone as well as with fibrous tissue the quantity of which depended on the width of the gap. The bone tissue of the transplant differed distinctly by being devoid of osteocytes and by its structure.

Dura adhered firmly to the transplant. In its superficial layers there was an accumulation of a great number of osteoblasts and, occasionally, of fragments of bone splinters surrounded by osteoblastic cells and new-formed bone tissue.

After a year the macropreparations showed a firm bony connection of the transplant with the skull bones. In some places it was not even possible to distinguish the border between the transplant and the edge of the defect.



Fig. 3. Frozen autotransplant 12 months after transplantation. New-formed bone tissue filled the gap and secured firm bone connection between the transplant and the edge of the receiver's bone.

Microscopic observation brought forth that the transplant tissue devoid of osteocytes kept its lamellar structure with wide inter-osseous gaps filled up with fibrous tissue. The tissue devoid of osteocytes was substituted by new-formed bone near the edges of the transplant and, less often, inside it. The new-formed bone filled up the gap and served as a firm bony connection between the edges of the transplant and the skull bones (Fig. 3). From the dura and periosteum the new bone tissue formed a narrow layer and, in some places, grew into the deeper layers of the transplant. Inside the transplant there were big islands of new bone tissue. Many vessels of the transplant were obliterated.

In this way, at the end of the year, the frozen autotransplants were firmly connected with the edges of the defect by bone tissue. On the surface of, and even inside, the transplant the bone tissue was partially resorbed and substituted by new tissue.

HOMOPLASTY

In transplantation of a fresh homotransplant on the defect of skull bones firm fixation of the transplant to the rims of the bone defect was observed on macropreparations 1—3 months after operation.

Microscopic follow up showed that the gap between the transplant and the edge of the defect was substituted by fibrous tissue and vessels in a month's time. The edges of the defect and the bone splinters were surrounded by a layer of osteoblastic tissue and by a narrow layer of new bone.



Fig. 4. A year after transplantation of a fresh homotransplant. New-formed bone tissue partially filled the gap between the transplant and the surrounding bone of the receiver.

Osteocytes in the bone tissue of the transplant were necrotic, the vessels obliterated, necrotic bone marrow remained in the inter-osseous spaces.

After 3 months the surface of the incisions in the receiver as well as in the transplant was covered with a narrow layer of new bone tissue. The fissure was filled up with fibrous tissue but osteoblastic tissue predominated near the bone incisions.

The transplant was resorbed and substituted, especially at the cut edges and on the inner surface, i.e. on the side of the dura.

If the dura was removed a layer of thin fibrous tissue appeared under the transplant containing osteogenous cells.

Wide resorbed cavities were formed on the surface of the transplant as well as inside it. In some places a narrow layer of new bone smoothed down the uneven, usurated surface and filled the dilated blood vessels of the transplant.

Towards the end of the 11th—13th month the incision area at the rims of the transplant was covered with new bone tissue which filled up the gap and,

without any sharp borderline, continued into the bone tissue of the receiver [Fig. 4].

However, bone connection at the rims of the transplant did not take place always. It was observed that in some places firm fibrous tissue, substituting a part of the resorbed transplant, remained at the edges of the defect for a long time (more than 18 months).

Vascularisation of the transplant and the development of osteogenous tissue took place within 11—13 months only in the superficial layers of the transplant, while a great part of the tissue devoid of osteocytes inside the transplant remained intact.

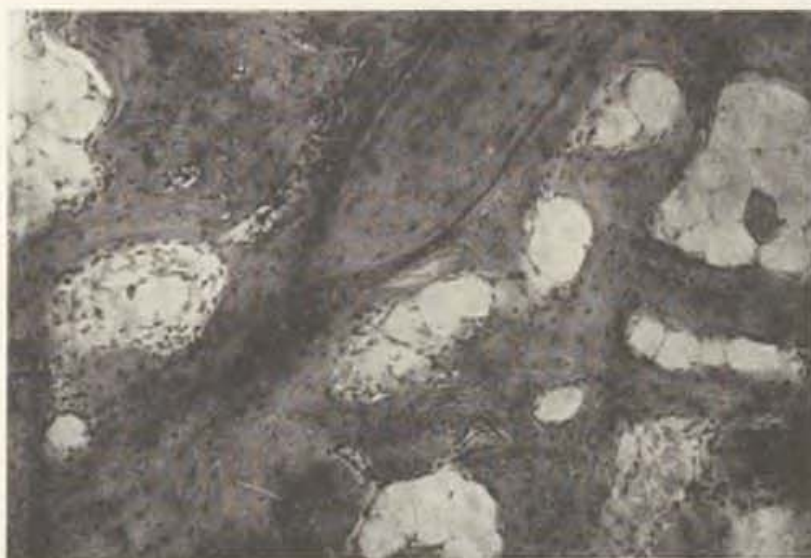


Fig. 5. A month after transplantation of a frozen homotransplant. A broad layer of new-formed bone tissue covered the surface of the incisions and the bone fragments of the remaining splinters.

Thus resorption predominated over reparative processes during the substitution of the fresh homotransplant; wide resorption cavities appeared on the inner surface of, and inside, the transplant without being accompanied by formation of bone tissue in these areas. This resulted in inferior substitution of the transplant by new-formed bone tissue. Some parts of the transplant remained substituted by firm fibrous tissue even 18 months after the plasty.

In transplantation of a frozen homotransplant the transplant tissue was quite devoid of osteocytes after a month. Inter-osseous spaces and dilated vessels were filled up with thin cellular fibrous tissue. Mitotic figures were to be found in the big fibroblasts.

The fissure between the incision surface of the transplant and the incision surface of the skull-bone was filled up with cellular fibrous tissue, vessels, small haemorrhages and bone splinters. A broad layer of new-formed bone tissue covered the surface of the incisions and of the bone fragments of the remaining splinters [Fig. 5].

After 3 months a firm bone and fibrous connection was established between the transplant and the receiver's bone which surrounded the graft.

Resorption and formation of new bone tissue took place, for the moment, only on the surface of the transplant. At the end of month the resorbed tissue of the transplant was substituted not only on the surface but in the interior of the transplant as well. The new bone tissue formed a broad layer in the lumen of the vessels and around the meshwork of the spongy layer of the transplant.

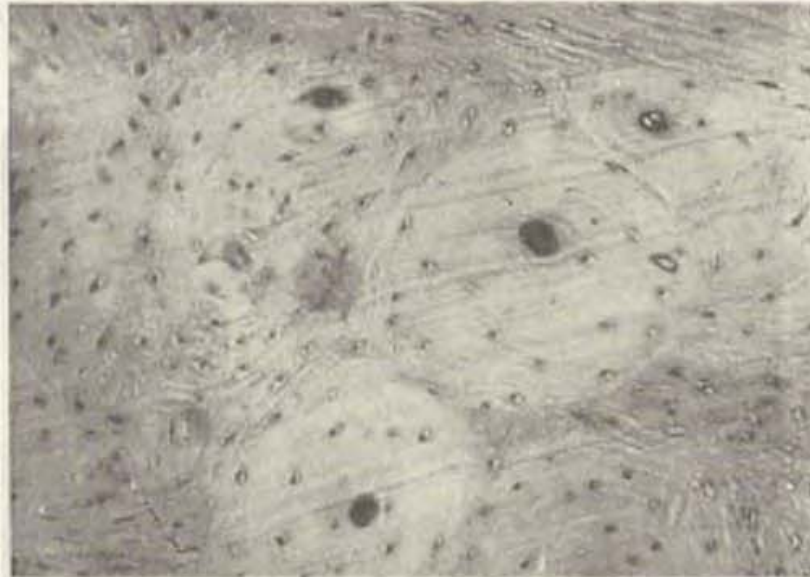


Fig. 6. The frozen homotransplant was fully substituted by new-formed bone tissue 18 months after transplantation.

After 10—13 months the transplant was partially substituted by new bone. The transplant tissue (devoid of osteocytes) was preserved, especially inside the transplant, in the shape of interstitial lamellae between young bone tissue. The new-formed bone tissue on the inner surface of the transplant was much thicker than on the outer side under the muscles.

After 18 months firm bone connection was established between the transplant and the receiver's bones. The borderline of the fusion was indistinct. Thickness of bones and of the surrounding tissue at the site of the former defect was approximately the same as originally.

Microscopically it was apparent that the transplant tissue was being substituted by new bone tissue to full extent (Fig. 6). There remained only individual islands or small areas of tissue devoid of osteocytes. In this way the bone transplant, stored at low temperature, was ready to be substituted by bone tissue of the receiver within 18 months after the transplantation.

COMMENT

Morphological experiments, carried out in dogs, brought forth data on the process of transformations in bone transplants and on the peculiarities of the

regeneration process in connection with conservation of bone tissue by freezing. They enabled an objective evaluation of auto- and homoplastic material and, at the same time, cleared up the effect of low temperatures on the grafting properties of bone grafts transplanted on skull defects.

By covering defects of identical sizes with bone transplants it was possible to ascertain bone connection between the graft and the edges of the defect of the skull bones and formation of new bone in place of the resorbed transplant tissue.

The investigation showed that the intensity of formation of new bone tissue at the site of the defect substituted by a transplant was determined by the quality and characteristics of the transplant.

Grafting of a fresh autotransplant resulted in a very weak formation of bone tissue at the rims of the defect on the part of the receiver's bones. The gap between the narrow areas at the edge of the transplant and the defect, therefore, filled up mainly with fibrous tissue, and only to a lesser degree with bone tissue. The firm fixation of the transplant in the defect, which prevented mechanical irritation and the presence of biostimulators, and perhaps also the presence of necrohormones, could possibly have caused the low reparative activity of bone tissue on the part of the receiver. Good vascularisation of the transplant secured, at the same time, formation of new bone tissue inside and on the surface of the graft during the transformation.

In substituting the defect by autotransplant stored at low temperature the reparative property of the receiver's bone tissue was of a different character. After a year a firm bone connection appeared between the edges of the defect and the transplant. Substitution of its tissue devoid of osteocytes by a new bone was, however, not sufficiently manifested. The greater part of the transplant remained, therefore, intact for a long time. Stimulation of regenerative processes in grafting a frozen autotransplant into the defect could be explained mostly by the activity of necrohormones which were formed and accumulated in the bone tissue during the autolytic processes that took place during the storage of the transplant at low temperature.

In transplantation of a fresh homotransplant reparative processes were concentrated in the area bordering on the incision line of the receiver's bone. During the first months already, the gap between the transplant and the edge of the defect was filling up with new-formed bone trabeculae and with cellular fibrous tissue. Later this forming bone tissue secured firm bone connection between the transplant and the edge of the defect. Active osteogenous process was confirmed also by the formation of new bone tissue in the receiver's bone in the vicinity of the defect.

Simultaneously with this process formation of bone tissue in the defect itself was not sufficient and a small part of the defect remained intact for a long time [up to one year]. Besides, it was possible to observe active resorption of the transplant. This led to formation of extensive resorption foci filled with cellular fibrous instead of bone tissue.

If frozen transplants were used, the same as in grafting of fresh bone homotransplants, bone connection between the edges of the transplant and the rims of the defect took place within 3 months. The difference was that in transplants conserved by freezing the osteogenous processes were active not only in the incision areas at the rims but also inside the grafts. Ingrowth of vessels and of new-formed bone tissue was observed in the areas of resorption. After 18 months, therefore, the resorbed transplant was completely substituted by new bone tissue which was firmly connected with the edges of the defect.

Analysis of the results of these observations confirmed the advantages of frozen transplants as compared with fresh ones. This applied in the same way to homotransplants as well as to autotransplants.

CONCLUSIONS

1. Conservation of skull bones at low temperature of -70°C influenced positively the grafting properties of both auto- and homotransplants of the skull bones.

2. If a fresh autotransplant was grafted the connection between the graft and the edge of the defect was formed by bone as well as by fibrous tissue and therefore firm fixation of the transplant in the bone bed was lacking for a long time.

3. A fresh homotransplant grew together with the edge of the bone defect at the end of the third month by means of new-formed bone tissue of the receiver. Substitution of the graft tissue by the receiver's bone was mostly connected with resorption and could result in secondary defects of the skull.

4. Contrary to fresh grafts, frozen auto- and homotransplants became connected with the edges of the defect by bone tissue. The transplant tissue was not transformed for a long time and kept the shape of a bone fragment, devoid of osteocytes, firmly connected by new-formed bone with the edge of the bone defect.

5. Frozen auto- and homotransplants were substituted by new bone tissue of the receiver simultaneously with their resorption. Synchronisation of these two processes led to a gradual, but full, substitution of the grafted frozen auto- and homotransplants by new-formed bone tissue.

SUMMARY

The paper brought data on covering of extensive defects of vault bones in dogs by bone auto- and homotransplants. Fresh bones were used for grafting as well as frozen bones conserved by freezing at -70°C and stored at -25°C .

Results of the investigations showed that in substituting the defect by a bone transplant of the same size connection of the transplant with the edge of the defect took place and new bone tissue was formed in place of the resorbed tissue of the graft. The intensity of formation of new bone tissue at the

site of the defect was determined by the characteristics and quality of the graft.

Contrary to fresh grafts, frozen auto- and homotransplants formed a much firmer bone connection along the entire rim of the defect. Processes of resorption of the transplant and its substitution by new bone tissue of the receiver took place synchronously, and thus secured a full restitution of the integrity of the bone at the site of the defect.

R É S U M É

L'auto et homoplastie des grands défauts du crâne

M. N. Pavlova, V. V. Vialcev

Le travail décrit des données touchant la correction des grands défauts du crâne chez les chiens par les auto et homotransplants osseux. Pour couvrir, on a employé et des os frais et ceux conservés à l'aide du froid à la température de -25°C et tenus ensuite sous la température de -70°C .

Les données des expériences ont montré que, dans des cas de remplacement des défauts osseux par le transplant osseux de la même grandeur le transplant s'unisse avec le bord du défaut du crâne et un nouveau tissu osseux se forme à la place du tissu osseux transplanté qui est soumis à la résorption. Cette formation du nouveau tissu osseux dans la place du défaut au cours de son remplacement par le transplant osseux dépend de spécialités et de la qualité du transplant respectif.

En différence des transplants frais, ceux refroidis — auto de même que homo-présentent une jonction osseuse beaucoup plus compacte le long de tout le bord du défaut. Les procès de la résorption du transplant et sa substitution par le nouveau tissu osseux du récipient sont synchrones, la restitution de l'ensemble osseux dans le défaut étant ainsi la plus parfaite.

Z U S A M M E N F A S S U N G

Auto- und Homoplastik umfangreicher Defekte der Calva

M. N. Pavlova, V. V. Vialcev

Es werden Erkenntnisse angeführt, die bei der Deckung umfangreicher Defekte der Scheitelsknochen von Hunden mit Knochenauto- und Homotransplantaten gewonnen wurden. Zur Deckung benützten die Autoren frischen oder tiefgekühlten Knochen, der bei -25°C bearbeitet und bei -70°C aufbewahrt wurde.

Die Untersuchungsergebnisse haben gezeigt, dass beim Ersetzen eines Defektes mit einem Knochentransplantat gleicher Grösse das Transplantat mit dem Rand des Schädelknochendefektes zusammenwächst und dass es zur Bildung eines neuen Knochengewebes an Stelle des resorbierten Transplantatgewebes kommt. Die Intensität der Bildung des neuen Knochengewebes im Raum des Defektes bei seiner Ersetzung mit einem Transplantat wird durch die Sondereigenschaften und durch die Qualität des Transplantates bedingt.

Im Gegensatz zu frischen Pfropfen bilden die tiefgekühlten Auto- und Homotransplantate eine weit festere Knochenverbindung am gesamten Defektrand. Die Prozesse der Resorption des Transplantates und seiner Substituierung mit neuem Knochengewebe des Empfängers verlaufen synchron und gewähren dadurch eine möglichst vollwertige Restituierung der Knochenintegrität an der Defektstelle.

RESUMEN

Auto- y homoplástica de los defectos grandes de la calva

M. N. Pavlova, V. V. Vialcev

En la obra se indican los conocimientos tocando la cobertura de los defectos grandes de los huesos de coronilla de los perros por los auto- y homotransplantes de huesos. Para la cobertura se usó el hueso fresco y congelado, labrado por el fresco con -25°C y conservado con -70°C .

Los resultados de las investigaciones indicaron que en el reemplazo del defecto por un trasplante de hueso de la misma dimensión ocurría el crecimiento del trasplante con el borde del defecto del hueso de la calavera y la formación del nuevo tejido de hueso en lugar del tejido resorbido del trasplante. La intensidad de la formación del nuevo tejido de hueso en el puesto del defecto en su reemplazo por el trasplante es condicionada por las especialidades y por la calidad del trasplante.

A diferencia de los injertos frescos, los auto- y homotrasplantes congelados forman la unión de huesos mucho más firme en todo el borde del defecto. Los procedimientos de la resorción del trasplante y su sustitución por un nuevo tejido de hueso del receptor pasan sincrónicamente, lo que asegura la más valiosa restitución de la integridad del hueso en el puesto del defecto.

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THE GILLIES FAN FLAP

Restoration of Substance for Partial Loss of Upper Lip (Case Report)

G. S. PAP

A 59 year old woman arrived at Rockford Memorial Hospital 2½ hours after a car accident. She had sustained multiple injuries. The maxillofacial injury consisted of extensive lacerations — avulsions of the face. Her consciousness had returned. She required a tracheotomy and blood transfusion. A few hours later after her vital signs were stable, she was taken to surgery following discussion with other consultants. Under general anesthesia the extensive facial lacerations were irrigated, hemostasis obtained and repair done in layers. The subtotally avulsed nose was returned to its normal position. After a tarsorrhaphy



Fig. 1. Extent of facial injuries on admission. — Fig. 2. Deformity accentuated with upper denture in place

of the eyelids on the right side, a skin defect in the medial portion of the right upper eyelid was repaired by a split-thickness skin graft. The traumatic loss of the right half of the upper lip was handled by suture of the mucous membrane to the skin of the cheek and remnants of the upper lip. Simultaneously the attending orthopedic surgeon applied casts to the right elbow and right



Fig. 3. Temporary result following the first operative procedure; the lip is tight

ankle. The patient was edentulous in the upper jaw. Her denture was recovered at the scene of the accident.

The immediate as well as the late postoperative course of this patient was rather complicated. An aortogram done on the second day, was negative for

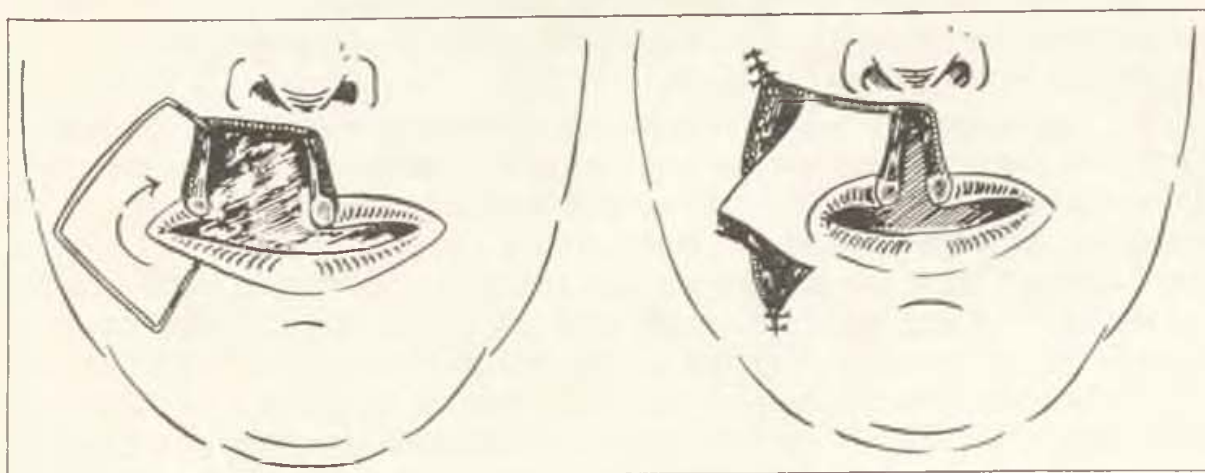


Fig. 4. Original design of the Gillies Fan Flap



aortic arch injury. A stress ulcer of the duodenum led to near exsanguination during the fourth week, but this was successfully treated by operation.

When the patient recovered from her injuries a tentative plan was made for reconstruction of the residual facial deformities, in this sequence of priority:

1. Correction of the traumatic ectropion of the right upper eyelid.
2. Reconstruction of the upper lip.
3. Revision or rhinoplasty for the traumatic nasal deformity.



Fig. 5. The one sided Fan Flap provided adequate tissue. The scars in the nasolabial fold were revised at a later date

The major problem was the restoration of the large tissue loss of the upper lip, involving almost the whole of its right half. Insertion of the upper denture accentuated the deformity. She was unable to masticate solid foods because the denture would not stay in place.

For the reconstruction of this defect, several methods were considered. I felt from the beginning that the most suitable solution for repair of the upper lip would be an Estlander Flap. But she refused this procedure because of her dread for the three week period during which time her mouth would have to remain closed. As a compromise she did accept a procedure as recommended by Jerome P. Webster (2) in which crescent shape sections were removed laterally around the alar bases and the lip advanced medially. But after healing the lip was tight, the red margin irregular. Although her denture would stay in place, she had difficulty with it. While not satisfied with the result at this point she was still not anxious to submit to a multistage procedure using pedicle flap tissue brought from a distance.

Several months later a satisfactory solution was achieved despite her refusal of the other alternatives mentioned above. A Gillies (1) Fan Flap was carried out on the right side according to the original description. The one sided Fan Flap the tip of which was led beneath the columella produced adequate fullness and symmetry of the upper lip. A deep labial sulcus and good fit for her upper denture was also provided.

When seen one year later the patient seemed to be satisfied with her appearance and had minimal self-consciousness.

SUMMARY

Use of the Gillies Fan Flap for restoration of full-thickness partial loss of the upper lip proved adequate for this patient for whom other alternatives for repair were not available. Attention is directed to the importance of the "back cut" at the base of a Fan Flap which permits extreme rotation and advancement in an area with rich blood supply.

RÉSUMÉ

Le lambeau en éventail de Gillies

S. Pap

Le lambeau en éventail de Gilles se montre très efficace dans des cas de reconstruction de perte partielle de l'épaisseur totale de la lèvre supérieure chez une malade ou l'emploi d'une autre méthode de reconstruction était exclu.

L'auteur souligne l'importance de soit dite «incision en arrière» à la base du lambeau en éventail. Cette incision permet la rotation et la transposition en maximum dans la région à la vascularisation exprimée.

ZUSAMMENFASSUNG

Fächerförmiger Lappen nach Gillies

S. Pap

Der fächerförmige Lappen nach Gillies bewährte sich bei der Ersetzung für den Teilverlust der gesamten Dicke der Oberlippe, bei welcher keine anderen Ersatzmethoden angewendet werden konnten. Hervorgehoben wird die Wichtigkeit des „Rückschnittes“ bei der Basis des fächerförmigen Lappens, der in der reichlich blutversorgten Gegend ein Maximum an Rotation und Bewegung möglich macht.

RESUMEN

Lóbulo en abanico de Gillies

S. Pap

Lóbulo en abanico de Gillies se acreditó en el reemplazo de la perdida parcial del todo espesor del labio superior en la enferma, en la que no fue posible usar de otros métodos de reemplazo. Se acentua la importancia de „la cortadura atrasada“ cerca de la base del lóbulo en abanico, lo que permite la rotación máxima y el desplazamiento en la zona con una reserva rica de sangre.

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ANNOUNCEMENT

In this year was established a Society of German Plastic Surgeons.

The address of the Society is: Vereinigung der Deutscher Plastischen Chirurgen, 67, Ludwigshafen-Oggersheim (DBR), Phenningsweg 13 (Tel. 0621/6890328), Sekretär: Dr.Dr. P. R. Zellner.

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Dates: October 14—22, 1969 (Following the meeting of the American College of Surgeons in San Francisco, October 6—10, 1969).

Place: Honolulu, Hawaii.

Program: The scientific program will consist of some 300 speakers in all surgical specialties. Concurrent meetings will be held in Colon and Anorectal Surgery, General Surgery, Neurosurgery, Obstetrics & Gynecology, Ophthalmology, Orthopedics, Otolaryngology, Plastic Surgery, Thoracic-Cardiovascular Surgery and Urology. Included in the program will be meetings in Anesthesiology and Radiology.

Schedule: All scientific meetings will be held in the morning, leaving afternoons free for sightseeing and social events. It is strongly recommended, therefore, that you bring your family with you to take advantage of this combined scientific meeting and family holiday.

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PRACTICAL METHOD OF SPEECH EVALUATION IN ADULT PATIENTS WITH CLEFT LIP AND CLEFT PALATE

I. ŠURINA, A. KRÁL

Speech is physiologically determined by breathing, formation of the voice on vocal cords and by its transformation into acoustic communication symbols. Purposeful regulation of breathing, of the voice-formative system, of the palato-laryngeal sphincter, and configuration of the resonant articulation spaces is determined by reflex activity of the cerebral cortex. With development this activity becomes automatic and stereotype. The sensorial and motor part of speech develop simultaneously and potentiate each other by coordination of the circuits of sensory analyzers. Realization of impulses by human senses together with analysis of the external and internal actions by the cerebral cortex results in synthesis [5, 7, 10, 14].

The development of normal speech is determined by a healthy central nervous system, good function of the sensory analyzers, and by the healthy voice-formative and speech organ.

In evaluating speech disorders the character is taken into account of the deviation from the basic scheme of development of healthy speech [2, 6, 13, 15].

Speech disorder may occur if one of the basic conditions of normal speech development is pathologically changed, or it may be due to combination of several pathological conditions and compensations [3, 16].

One of the typical developmental disorders of the peripheral speech organ is the cleft of the primary or secondary palate, or of both, in different forms [18].

Incorrect articulation in people with a cleft of the speech organ is called, according to literature, palatolaly. Deformation of the sound of speech is called rhinophony [14, 16, 18, 10, 5, 6]. The most common one is open rhinophony.

All groups of specialists concerned with care of a person afflicted with a cleft try to express objectively and to characterize the pathological speech of a patient with cleft lip and cleft palate. The problem of diagnosis and evaluation of the speech quality is not simple. The extent of the speech disorder

in a patient with cleft lip and cleft palate depends on the character of the cleft, or of the parts which participate in articulation, although the type of this disorder is not always determined by the local condition. In practice we are met with paradox manifestation of disorders of the secondary function. Speech defect depends further on the intellect of the person, his hearing and, last not least, on care and results of radical or conservative corrections and rehabilitation methods. In evaluating the quality of speech in a patient with cleft lip and cleft palate, it is necessary to keep in mind that usually the resonant-acoustical and articulation components may be involved. Dynamics and melodiousness of speech are often disturbed. There is a deformation of the segmental and suprasegmental speech elements. The voice of these patients is often changed in consequence of abnormal muscle activity of articulation organs which is connected with articulation difficulties in finding an appropriate articulation area, and with compensatory phenomena. The vocal-cord pitch is either lower or higher, the voice is sometimes forced and therefore dysphonic. Non-rhythmical breathing is no rarity as well as a disability to form a correct breathing support [8].

Abnormalities in the anatomy of the speech organs lead to dissimulation, substitution of some sounds, compensatory shifting of articulation areas, and to formation of new articulation stereotypes. The patients try to compensate for the articulation shortcomings also by non-speech factors, such as mimics and gesturing. But pathological speech may be also the reason for stubborn silence, or telegraphic brevity and global shortening of conversation.

In compensation of disordered speech the intellect of the patient, his hearing and motor ability and the activity of the articulation muscles are very important factors. Evaluating the speech quality of a patient it is necessary to register, and express in a comprehensible way, all these factors so that the evaluation may serve as indicator for radical and conservative therapeutic procedures.

The degree of disorders of the individual sounds, which actually is in relation to the blurred speech, depends on objective articulation conditions and on articulation substance of sounds. Disorders of speech are, therefore, very differentiated [1, 2].

Evaluating the patients speech it would be best to start with the acoustic part of the speech signal. The speech signal is in fact an auditive manifestation as an acoustic phenomenon. Only, today, it is not yet possible in each patient to apply to the acoustic part of speech also exact measurements which would be generally available in phoniatic diagnostics. Evaluation of the articulation in the speech signal seems to be of use for this purpose. It divides the speech signal according to the lingual structure of the given language [1, 2, 4, 7, 8, 9, 11, 12, 17].

Speech signal as a physical phenomenon, which mediates communication by transmission of information about the lingual composition of the communicated contents, reflects, to a certain degree, the lingual structure. There is a certain parallel between its organisation and the lingual organisation of

the communicated contents. Therefore, it is possible, the same as with lingual organisation, to divide it into segments which are called sounds.

Different aspects and features of these segments have been studied in detail by the phonetics especially at the articulation and acoustic level of the speech signal. Since the articulation aspect of speech is more accessible to the phoniatric problems we may start with the articulation phonetic classification of sounds. The process has the advantage that it does not necessitate any complicated switch-over system to phoniatric terminology for the phonetic terminology of articulation is derived from the anatomy and physiology of the articulation organs.

The incidence of sounds in the speech signal is determined by statistical laws. The moment it is found out which sounds were affected by a certain anatomical deformity, which sounds were deformed in their articulation and acoustics, it is possible to define the extent of functional disorder of speech with numerical data on its frequency in the given language. For instance, the consonant -p- occurs x times in 100 sounds in Slovakian; the disorder in pronouncing this sound will represent a pronunciation defect in the value of x. Because speech disorders involve usually a whole chain of sounds, the final calculation of the extent of disorder will be obtained by adding up numerical data on the frequency of all affected sounds.

Further it is necessary to calculate the other dimension of the disorder — the degree of deformation of these sounds, that is the degree of the disorder which is actually characteristic for incomprehensible speech. Only, it is very difficult to define this dimension quantitatively. It is a matter approximation, of the examiner's subjective assessment. In our proposal, presented in this paper, we followed our own practice in evaluating patients with a cleft. We found that the approximation may be made more precise by using quotients as multipliers of the numerical data on the extent of the disorder. These quotients are defined as follows:

q - 1 {pronunciation of sounds or sound combinations in a test without open, closed or mixed rhinophony, without defect of the intensity of the voice — speech, or with small compensative tension of the sound, without laryngeal admixture of the voice}.

q - 2 {disorder in pronunciation of sounds manifested by sporadic disorder of the resonant and acoustic component of hypernasality which sometimes changes into open rhinophony. Laryngeal part of the voice is expressed, the tension of the test sounds is weakened}.

q - 3 {medium disorder of the resonant and acoustic component of the speech manifested by open, closed or mixed rhinophony}.

q - 4 {serious disorder of the resonant and acoustic component of the speech — serious open rhinophony}.

q - 5 {speech deformed to incomprehensibility}.

Evaluation of the quality of speech was carried out in the following way:

1) The number of erroneous sounds was ascertained. The word texts were identical in each patient.

2) This number was defined in calculation according to the frequency (height of the incidence of the sound in Slovakian).

3) The sounds were multiplied by the quotient of the disorder extent, which means actually by the quotient of incomprehensibility.

4) The calculation of scores expressed the extent (character) of the speech disorder.

The result of evaluation was supplemented by the evaluation of supra-segmental elements from connected speech (reading aloud a given text). From this reading conclusions may be drawn on the dynamics, melody and rhythm of the speech, and the esthetic impression may be evaluated.

The quality of breathing was also given attention to. Disorders of breathing regulation were especially registered.

Finally the relation between the character of the speech and the pathological influence was defined to be sure what kind of disorder it was, and how it could be, radically or conservatively, healed or improved.

To try out this practical method we chose a comparatively homogenous group of patients from this clinic who were operated on by the Kilner method at the age of two to three years with cleft of the secondary palate (the group consisted of 50 patients), and a corresponding group of patients with combined clefts of primary and secondary palate operated on by the same method at the same age (50 patients).

The average score in this evaluation was corresponding to the quality of speech in patients with cleft and agreed with a parallel research by X-ray cinematography (9) and electromyography (17).

The average score in evaluation of the quality of speech in group R-II. (cleft of secondary palate) was 76 points, and in group R-III. (combination of cleft of primary and secondary palate) it was 91 points. However, it was necessary to define comprehensibly the character of speech disorder to other specialists, interested in the problem of care of patients with cleft lip and cleft palate. This classification was evaluated as follows:

0 points represent healthy and comprehensible speech without esthetic defects,

400—455 points represent incomprehensible speech,

1—100 points represent good speech,

100—250 points represent comprehensible speech,

250—400 points represent hardly comprehensible speech.

SUMMARY

The authors pointed out a large scale of pathological influences, and their compensations, on the development of speech in patients with cleft lip and cleft palate. It was necessary to define them diagnostically so that they might serve as an indicator and guide for radical and conservative treatment of the speech organ.

Uniform and, as far as possible, complete characterization of the speech defect, i.e. of the quality of the patient's speech, might be regarded as another clue to the rehabilitation program for the patient, as well as to the control of therapeutic procedures. This was considered as the main contribution of laying down the practical method for evaluating the quality of speech.

An objective judgment of a patient's speech after radical and conservative treatment, and rehabilitation in general, is as important for the surgeon, as for the maxillary orthopaedist, phoniatrist, logopaedist, and phonetician. At the same time, it may serve as an objective evaluation criterion in comparing therapeutic results between individual departments.

R É S U M É

Une méthode pratique de l'évaluation de la parole chez les adultes souffrant du bec-de-lièvre

J. Šurina, A. Král

Les auteurs ont montré une large palette des influences pathologiques et leur compensation quant au développement de la parole chez le malade au bec-de-lièvre et à la fente du palais, qu'il faut remarquer dans le diagnostic pourqu'elles soient et les conducteurs et les appuis des interventions radicales et conservatives sur l'organe de la parole.

Un autre guide pour la réhabilitation et sa contrôle du malade en question et une caractéristique du défaut de la parole complète et uniforme de même que la possibilité de parler et de s'exprimer du malade respectif. Là il y a la valeur principale de la méthode pratique de l'évaluation de la parole.

Cette évaluation de la parole objective en suite d'une intervention radicale et conservative est nécessaire non pas seulement pour le chirurgien, l'orthodontiste, le phoniatre, le logopède, le phonétique et de même, elle peut servir en tant que comparaison des résultats thérapeutiques des différents cliniques.

Z U S A M M E N F A S S U N G

Praktische Methode zum Auswerten der Sprache bei erwachsenen Kranken mit Lippen- und Gaumenspalte

J. Šurina, A. Král

Die Autoren verwiesen auf die breite Skala der pathologischen Einflüsse und die Kompensation derselben auf die Sprachentwicklung des Kranken mit Lippen- und Gaumenspalte, die in der Diagnose erfasst werden müssen, um den Anhaltspunkt und die Stütze der radikalen sowie konservativen Eingriffe am Sprachorgan zu bilden.

Als weiterer Anhaltspunkt des Rehabilitationsprogrammes des Kranken und als Kontrolle der Behandlung dient die einheitliche und möglichst komplette Charakteristik der Sprachstörung, beziehungsweise der Sprachleistung des Kranken. Hierin beruht der Hauptbeitrag der praktischen Methode zur Auswertung der Sprachqualität.

Einer objektiven Beurteilung der Sprache des Kranken nach radikaler oder konservativer Behandlung und nach der Rehabilitation benötigt sowohl der Chirurg als auch der Orthodontist, Phoniater, Logopädist und Phonetiker; gleichzeitig kann sie auch als ein objektives Zeichen für die Auswertung der therapeutischen Erfolge zwischen einzelnen Arbeitsstätten dienen.

RESUMEN

Método práctico de la valorización del lenguaje en los pacientes adultos con lagrieta del labio y la del paladar

J. Surina, A. Král

Los autores indicaron la escala extensa de las influencias patológicas y su compensación al desarrollo del lenguaje del paciente con la grieta del labio y del paladar, las que es necesario describir en la diagnosis, para servir de norte y guía y sostén de las intervenciones radicales y conservadores en el órgano de lenguaje.

Otra pauta del programa de rehabilitación del paciente, así como el control de los rendimientos es la característica única y ser posible completa del defecto de lenguaje, respectivamente la del desempeño de lenguaje del paciente. Ahí está la aportación principal de la estipulación del método práctico de la valorización de la calidad de lenguaje.

El dictamen objetivo de lenguaje del paciente después de un tratamiento radical y conservador y el de la rehabilitación en general, necesita el clujano así como el odontólogo, el foniatra, el logopedista, el fonetista y al mismo tiempo puede servir de indicio objetivo de la valorización de los resultados terapeuticos y entre los lugares de trabajo.

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PEDAGOGIC PROBLEMS IN THE REHABILITATION OF PATIENTS WITH CLEFT

R. BECKER

Among the measures taken in the rehabilitation of patients with cleft, pedagogy, particularly remedial speech instruction, is given a most responsible task. It aims at making the patients suffering from cleft capable of normal communication with their environments. This aim should be set with immediate regard to the age of the patient. In children with cleft, speech rehabilitation is directed at making the patient capable of attending a normal school, which should give him the chance of unimpeded education and, with it, of uninhibited incorporation into human society. The result of these efforts not only entails the happiness of the individual, but also his or her usefulness for society.

Realization of this aim — in accordance with the opinion of Bethmann (1) — depends, of course, on certain conditions which may be summed up into the following two groups of factors:

1. Conditions inherent in the child and
2. Conditions to be created in the environments of the child.

Both these groups of factors are in reciprocal relation to each other with regard to the patient's attainable degree of rehabilitation. The first group of factors comprises the psycho-physical state of the child, and, with regard to this, the type of cleft is most important in each case. Apart from the condition of the organ itself, we pedagogues are, of course, most interested in the psychological capacities of the patient. According to various studies (Haym 2), most children with cleft show normal intellectual faculties, i. e. present the teacher with favourable conditions for tuition and education.

Among the factors of the second group, remedial and among those, surgical measures are considered the most important. In the last thirty years, these latter have made continuous and remarkable progress. Orthodontic treatment, too, developed ever higher efficacy. This made it possible that, in dependence on the type of their deformity and its early surgical treatment, some patients with cleft have attained normal speech even without logopaedic aid. Unfortunately, these cases are, in comparison with the total number of patients, relatively rare. This goes to show that surgical measures, inspite of the re-



markable results achieved by them, have but a limited effect on the solution of the whole problem. Gutzmann {3} formulated this as follows:

"Supposing the cause has been . . . liquidated by an operation, nothing more has been done than that the obstacle to articulation has been removed, but normal articulation has thus not yet been established, because this is an art to be learnt which only after removal of the obstacle may be cultivated. Though the organs have become normal, they are not yet ready to practise the art, in the same way as anyone with normal fingers is not capable of playing the harp."

This strongly emphasises the necessity of taking logopaedic measures in these cases. If the above mentioned aim of rehabilitation should be reached in the largest possible number of patients with cleft, a well concerted teamwork of all branches concerned is imperative.

The following will deal with some problems of pedagogy in more detail, whereby they will be looked at from the angle of early treatment. We are, however, going to concentrate less on the generally known questions of remedial speech instruction in patients with cleft aimed at attaining correct movements on articulation and phonation, because experience in this respect has already been reported on in numerous papers. It may be more interesting to deal with the question of why the results of remedial speech instruction often greatly differ in children with the same or nearly the same defect in their organs of speech. We think it worth-while to pay attention to the following considerations:

Quite frequently, hearing defects are found in patients with cleft. Audiometric examinations which we carried out in children with cleft at school age, showed in almost 30% of cases reduced hearing to a minor or major degree. Similar studies in the literature (Arnold 4) confirm these values. We, therefore, think early ENT examination or, if required, treatment should be carried out in order to improve or normalize hearing in given cases as soon as possible thus giving subsequent speech instruction the maximum chance of success.

As a rule, clefts in the region of the lip are closed by operation in the course of the first year, those in the soft palate and partly also of the maxilla in the second year and those of the hard palate between the fourth and sixth year of life (Mühler 5). Usually, after the operation, remedial speech instruction begins. In the severe cases, this starts with the patient entering school; in the more favourable cases there are approximately two years prior to entering school which may be used for speech instruction. The period of intensive speech development (between the first and third year of life) has, however, passed by then in both cases and false speech habits have already been fixed. Underdevelopment of speech naturally manifests itself differently in different patients. Its highest degree is found in the unintelligible speech similar to that in cleft palate with its faulty articulation and vocal expression, sometimes even accompanied by false movements of the facial muscles.

Since the child acquires speech by imitation, speech development must be considered a process of learning, and the child suffering from cleft must

develop speech with its abnormally shaped and functioning organs of speech. It takes pain to make its own pronunciation sound as near to that of the word it perceives being uttered in its environments, thereby employing all sorts of compensatory and supplementary functions. Afterwards, these false functions can only be suppressed with difficulty, because habit as a factor has acted upon the child before actual speech instruction has started.

Unfortunately, the difficulties a child with cleft has to cope with when learning to speak, are not limited to pronunciation only. Speech comprises both impressive and expressive aspects thereby including peripheral and central processes. The two aspects influence one another, and this mutual effect becomes greatly significant in the development of speech, because, during this period, the association chains of hearing, understanding and speaking are formed and fixed. The disorder in pronunciation, therefore, constitutes an impediment to the development of the psychical capacities in a child suffering from cleft. According to our observations, faulty articulation also becomes detrimental to developing the capacity of phonematic differentiation even if hearing itself is not reduced. Since, according to Setchenov (6), acoustic perceptions "are, from early childhood, closely associated with the muscle sensations originating . . . in the larynx, tongue and lips", the child suffering from cleft links up its faulty pronunciation with the respective false sound pattern. It — so to say — hears its faulty pronunciation as though it was proper articulation. The child is then not, or only after long training, capable of differentiating between its own pronunciation and that of normal people and thus of controlling the former. The child with cleft is, therefore, in the same position as many sigmatics (Seeman 7) who hear their faulty sibilants as though they were pronounced correctly. That is why training of hearing in children with cleft is considered so very urgent (Lambeck 8, Schleuss 9, Weinert 10, and others).

From this it follows that children with cleft may also show impediment in their semantic-lexical development. Their vocabulary, i. e. the pool of conceptions and words, does not always reach the level corresponding to the age, because they lack the capacity of exact pronunciation and phonematic differentiation, faculties which are essential for the capacity of differentiating the meaning.

The inhibitive or promotive effect of the environments with regard to the acquisition of the means of speech should only be remarked upon at this place. Psychical retardation may, of course, also act as an impediment.

From this lay-out of problems, some conclusions for pedagogic measures may be drawn. It seems necessary to pay more attention to the beginning of speech development in patients with cleft. The child ought to be guided and supervised. This, however, can only be accomplished by way of instructing the mother. These measures aim at reducing the retardation in speech development of such children. The idea is by no means new. Some decades ago, the French physician Trelat (11) already stressed this necessity by writing: "The children to be operated on (for cleft) must be educated and supervised from the moment

they try their first word until the operation and immediately after the operation speech instruction should be taken up again. This is the best way of avoiding disorders and accelerating functional recovery”.

Realization of these suggestions may come up against some, e. g. personal difficulties, but these should never obliterate the principle postulates.

From the point of organization, instruction of mothers may, for instance, be coordinated with the early orthodontic treatment of the children with cleft. These instructions should consist of the following:

1. Always present to the child an example of perfect speech (slow and distinct pronunciation, simple sentences, etc.).

2. Stimulate the child's desire to talk and communicate and train its hearing (with music, singing, musicals, etc.).

3. Induce and then develop attention and perseverance (by choosing the right toys and creating ever new situations for play).

4. Make the child exercise preparatory to actual speech instruction in a pleasurable, playlike way (lip movements aimed at loosening up and strengthening the upper lip which sometimes is too short and often rather rigid due to scarring, breathing exercises, exercises in directing the current of air escaping from the mouth, etc. and all this done by means fit for child's play, such as flakes of cotton wool, scraps of paper, etc.).

5. Promote formation of conceptions.

As an example, Burkhardt (12) directed and then described the development of speech in his own grandchild who suffered from cheilo-gnatho-palato-schisis.

Naturally, it may hardly be possible to win every mother over to cooperate in this respect. The realization of this good intention may often be handicapped by some mother's lack of time, of capability or of interest. On the other hand one should never give up appealing to the mothers, many of whom are willing and capable of cooperating in our sense and thus of making good use of the available time for the speech development of their defective children.

The speech instruction proper starts at the pre-school age of three to six, so as to optimally develop all faculties for speech prior to the child's entering school. With respect to this aim, care must be taken to start as early as possible, i.e. with the age of three. The fact that this usually takes place between stages of the surgical treatment, because, for instance, a palatine cleft has not yet been closed, should never constitute a motive for postponement. We should like to quote Berndorfer (13) as representing the opinion of other specialists, who even stressed the value of speech instruction in this interoperative period. He writes: "This preliminary work is the main condition of good functional result after the operation."

The tasks of interoperative speech instruction may be summed up in the following essential points:

1. Making the child conscious of the speech movements.

2. Training the child's hearing in differentiating speech sounds, the so-called phonematic differentiation. (At the beginning, the ear does not contribute to the treatment; it must first be trained).

3. Strengthening the child's muscles of speech.

4. Training the child in the correct position and movements of the organs of speech on phonation.

5. Training the child in transposing articulation to the anterior part of the oral cavity.

6. Training the child in correctly directing the current of air.

It seems important not to neglect the training of hearing over the efforts at attaining proper sound formation and voice modulation, because hearing enables the patient to control phonation by way of external back-feeding thus making pronunciation safe and fixed.

Speech instruction must never deteriorate into mechanical exercise. It must always act as a factor of tuition and education. Strictly speaking, this holds good for pronunciation, but from a broader aspect, it is also valid for perception, understanding, the production of speech and, entirely, for the acquisition of knowledge and skill. The pattern and meaning of speech must form an entity. To achieve this, suitable methods using words and sentences whose choice and structure will correspond to the age of the child, must be applied, so that the child's pool of conceptions and words may steadily increase and its morphologico-syntactic capacities be fixed or promoted. Correct pronunciation must not only be ensured on uttering an isolated sound or word, but also during coherent speech. It can frequently be observed that the patient articulates well as long as he only pronounces words; when speaking sentences, he usually is not so successful.

In order to prevent children with cleft from being refused to enter normal school or from having to postpone the term of entering, it often seems necessary to utilize existing reserves (as one nowadays speaks of in the branch of economy). In our opinion, these are the following:

1. Systematic early treatment including guidance of speech development should be well organized.

2. The methods of speech instruction including the training of hearing as well as fixation and further development of the vocabulary should be constantly improved upon and perfected.

3. Rehabilitation of the child suffering from cleft should be complex, i. e. should be based on the team-work of all branches concerned.

The demand for these measures is the more justified, because the demands of society upon the individual are increasing constantly. Rehabilitation of the patient, therefore, must comply with these social requirements.

S U M M A R Y

The aim of remedial speech instruction in patients with cleft is to make them capable of normal communication up to their age of entering school. This requires close cooperation of all branches of rehabilitation.

The question arises as to why the results of speech instruction are frequently different in children with identical or nearly identical defects of their organs of speech. The cause of this may, for instance, be reduced hearing which is found in many cases, speech instruction having started too late, i. e. when false speech habits had already been established, defective phonematic differentiation and semantic-lexical development (the pool of words and conceptions) or/and environments unfavourable to education. Pedagogic measures necessary to counteract these adverse factors are, for instance, instructing the mothers of children with cleft in the early guidance of speech development, starting remedial speech instruction in time, etc.

R É S U M É

Les problèmes pédagogiques au cours de la réhabilitation des enfants souffrant de bec-de-lièvre

R. Becker

Le but des actions pédagogiques touchant la restitution de la parole est représenté par la normalisation de la possibilité de communication de l'enfant souffrant de bec-de-lièvre au moment de la fréquentation scolaire. Le but ainsi formé exige la collaboration exacte des membres de tous les ressorts faisant partie de la réhabilitation.

Une question s'impose, même celle prourquoi les résultats d'enseignement de la parole chez les enfants avec la même ou bien encore à-peu-près la même qualité facultative des organes sont-ils tellement différents? En tant que cause on peut compter par exemple: l'ouïe abaissée assez souvent, l'enseignement de la parole trop tard réalisé ayant comme suite des habitudes inconvenables quant à la prononciation, les défauts de la différenciation fonétique de même que de l'évolution sémantique et lexicale (le fonds des mots et des, idées), et, enfin, un milieu favorable quand à l'éducation de l'enfant. De ces données on peut faire des conclusions pédagogiques telles que: l'enseignement précoce de la parole chez les enfants souffrant de bec-de-lièvre à l'aide de la mère sous instruction, la thérapie corrective de la parole dans la période juste etc.

Z U S A M M E N F A S S U N G

Pädagogische Probleme bei der Rehabilitation der Spaltträger

R. Becker

Es ist Ziel der sprachheilpädagogischen Massnahmen, eine normale Kommunikationsfähigkeit des Spaltträgers bis zum Schulbeginn zu erreichen. Diese Zielstellung erfordert die Zusammenarbeit aller an der Rehabilitation beteiligten Fachvertreter.

Es wird die Frage aufgeworfen, warum die Ergebnisse des Sprachunterrichts bei Kindern mit gleicher oder annähernd gleicher Organbeschaffenheit oftmals unterschiedlich ausfallen. Dafür können als Grund z. B. in Betracht kommen: häufige Hörminderungen, zu spät beginnender Sprachheilunterricht und damit verbundene Gewöhnung an falsche Sprechgewohnheiten, Mängel in der phonematischen Differenzierung und der lexikalisch-semantischen Entwicklung (Wort- und Begriffsschatz), erziehungsunünstiges Milieu. Daraus lassen sich Schlussfolgerungen für pädagogische Massnahmen ableiten wie z. B. frühzeitige Lenkung der Sprachentwicklung der Spaltträger durch Anleitung der Mütter, rechtzeitige Sprachheilbehandlung usw.

RESUMEN

Problemas pedagógicos en la rehabilitación de los niños con la grieta

R. Becker

El objetivo de las medidas pedagógicas de la enmienda de lenguaje es el conseguir de la capacidad normal de las comunicaciones del niño con la grieta hasta el principio de la asistencia escolar. Pero el objetivo de este modo propuesto supone la colaboración de los representantes de todas esferas que toman parte en la rehabilitación.

La cuestión está planteada aquí, por qué los resultados de la enseñanza de lenguaje en los niños con la misma o aproximadamente misma capacidad de los órganos salen con frecuencia diferentes. Se pueden tomar en consideración por ejemplo estas causas: las limitaciones del oído que aparecen frecuentemente, la enseñanza de la enmienda de lenguaje tarde comenzada y con eso está relacionado el acostumbrarse a los hábitos incorrectos en el lenguaje, las deficiencias en la diferenciación fonemática y en el desarrollo léxico-semántico (el vocabulario y la reserva de concepciones), el ambiente educativamente favorable. De esto es posible hacer conclusiones para el procedimiento pedagógico, como por ejemplo la dirección hecha a tiempo en el desarrollo de lenguaje en los niños con la grieta por la instrucción de la madre, et tratamiento de la enmienda de lenguaje en el período exactamente escogido etc.

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COMPLICATIONS OF BURNS

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Apart from the lesions produced by causal agents and shock phenomena, the gravity of burns is also reflected in the complications that develop. Some are inherent to severe burns (shock, metabolic disorders); others to the present limitations of therapy (local infection) or to defective care (distal infections, bedsores, faulty cicatrices).

In the present paper, we have attempted to determine the moment when different complications develop; their extension in terms of early care given in a burns unit or at a later stage; the relationship between the onset and number of complications and the severity of the burn. Finally, we have tried to establish the cause of death in fatal cases.

MATERIALS AND METHODS

398 patients, admitted in 1964, were chosen for the present study. Cases admitted 2 months after injury were excluded from the study.

The number of male patients was 238 (60%) and that of female patients 160 (40%). The patients age ranged from 5 to 84 years (table I).

Patients were divided into four groups: group I, patients admitted within 6 hours after the accident; group II, patients admitted 6 hours to 3 days after the accident; group III, patients admitted 3 to 21 days after the accident; group IV, patients admitted 21 days to 2 months after the accident.

This is in agreement with our conception according to which there are four calendrical stages in the evolution of burns (1): 1 (the first 3 days), the period of shock; 2 (day 3 to 21), the period of metabolic disorders and potential infection; 3 (day 21 to 60), the elective, anabolic period for grafting; 4 (after 2 months), the period of "chronic shock".

Table I — Age groups

Age	0—10	11—20	21—30	31—40	41—50	51—60	61—70	71—80	81—90
Number of patients	2	46	118	89	45	59	20	15	4

Table II — Number of patients with complications in the four groups studied

	Group I	Group II	Group III	Group IV
Number of patients	263	46	59	30
With complications	165	30	54	30
%	62,7	65,2	91,5	100

In our study, we have included in a separate group the patients admitted within 6 hours after the burn, since only this group is considered as having had primary treatment in our clinic.

The following complications were studied:

a) *Renal involvement*, comprising quantitative or qualitative urine volume alterations, such as the presence of pathologic elements in the urine (albuminuria, hemoglobinuria, hematuria, cylindruria) with or without increase in azotemia, and up to severe renal failure.

b) *Infections*.

Local infection.

Distal infections including carbuncles, phlegmons, suppuration of the donor areas, arthritis, conjunctivitis, cystitis, etc.

A diagnosis of *septicemia* was established on the basis of clinical signs and positive blood cultures and, in the fatal cases, post mortem evidence of multiple abscesses or bacterial endocarditis.

Bronchopneumonia was diagnosed clinically or at the postmortem examination.

c) *Thrombo-embolic accidents*: peripheral thrombosis and pulmonary embolism.

d) *Acute pulmonary oedema*.

e) *Gastro-intestinal hemorrhages*.

f) *Hepatic involvement* recognizable by the jaundice or by marked alteration of the liver functional tests, phenomena of biliary stasis, biliary vomiting.

g) *Bedsore*s.

Manifestations such as shock, protein metabolism and hydro-electrolytic imbalance, and blood alterations (anemia, etc.) have not been included in the present paper, since they form part of the symptomatology of severe burns and cannot be considered as true complications.

In this study we analysed: 1. The interval of time between burning and the onset of the different complications.

2. The dependence of complications upon the gravity of the burn, appraised by the prognostic index.

Table III. Ratio of complications in the four groups

Type of complications	Per cent of patients				
	Group I (%)	Group II (%)	Group III (%)	Group IV (%)	Average of total patients (%)
Renal impairment	21	22	20	32	26
Local infections	50	63	92	100	61
Infections with other localisation	22	20	24	37	23
Septicemia	1,5	6,5	9,5	17	4,3
Bronchopneumonia	3	2	1,5	6,6	4,7
Venous thrombosis and pulmonary embolism	6	6,5	3	14,5	6
Acute pulmonary oedema	0,3	2	0	0	0,5
Gastro-intestinal haemorrhage	3	4,5	1,5	3,5	3
Hepatic impairment	10	11	15	32	13
Bedsore	2	4,5	10	20	6

The prognostic index was calculated according to Franck [2], modified as follows:

The total of each degree of burn multiplied by burned body-surface is calculated. For instance, a patient with 12% burn of the 1st degree, 21% burn of the 2nd degree, 17% burn of the 3rd degree and 8% burn of the 4th degree, has the following prognostic index (PI):

$$PI = 1 \times (12) + 2 \times (21) + 3 \times (17) + 4 \times (8) = 137.$$

Theoretically, the PI may range from 1 to 400.

The 4 degrees of the depth of a burn are described as follows: 1st degree, erythema; 2nd degree, phlyctena with a clear content; 3rd degree, phlyctena with a sanguinolent content; 4th degree, white or brown insensitive plaques.

3. As some of the patients had several complications, their number was calculated proportionally in terms of the prognostic index for the total number of patients and for each of the 4 groups studied.

4. We tried to establish the cause of death, on the basis of the clinical data and post mortem examinations.

RESULTS

The frequency of complications increases as the interval of time before admission increases, reaching 100 % in cases admitted after 21 days (Table II). The higher incidence of complications in groups III and IV were statistically significant ($p = 0,01$), as compared to groups I and II. The difference between groups I and II was not significant.

The most frequently encountered complications were sepsis, and renal and hepatic involvement (Table III). In the patients in group III thromboembolic diseases and bedsores also appeared.

1. The dynamics of the appearance of the complications in burned patients.

A. Complications developing within 2 months after the burn.

Group I: patients admitted within 6 hours after the accident. This group comprised 263 patients (159 males and 104 females), whose age ranged from 13 to 84 years.

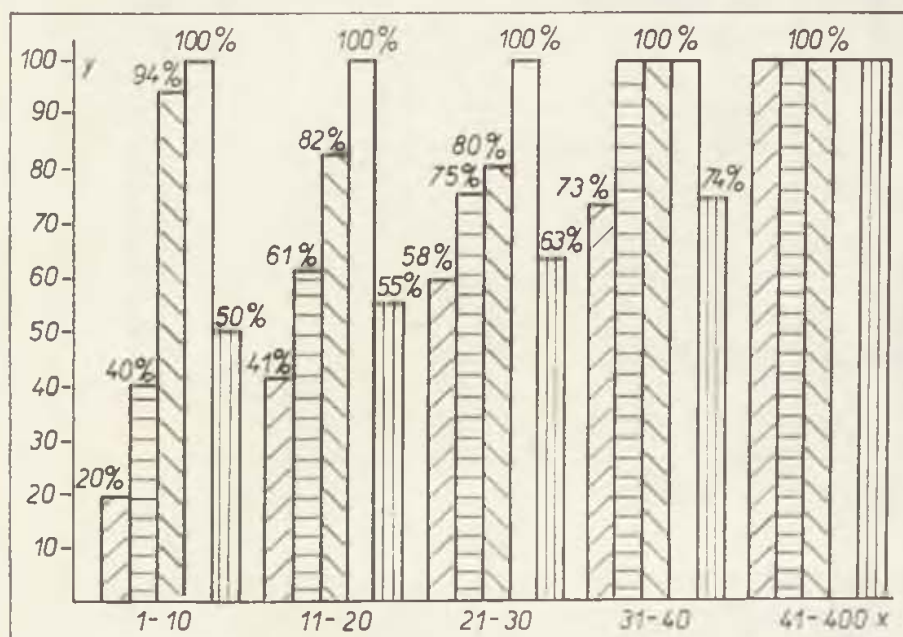


Fig. 1. Incidence of complications with respect to the prognostic index.

The earliest complication, that appeared in the first day in 12,6% of the patients, was renal involvement corresponding to the acute stage of thermal shock. Already on the second day after the burn, the number of patients with this complication visibly fell to less than half (5%) and from the third day sporadic cases alone appeared up to the eleventh day, in a proportion that did not as a rule exceed 1% of the remaining patients.

Likewise, on the 1st day, but to a lesser extent, there were cases of hepatic involvement (1,8%) or gastro-intestinal hemorrhages (1,5%), particularly in the patients with severe burns. Patients with signs of hepatic involvement were also encountered on the following days, within the first two weeks after the burn. Later (after 30 days) only rare cases were noted.

Local infection of the burn generally appears on the second day but starting with the 3rd day the proportion of infections increases and reaches a peak on the 5th day (11%), after which the number of new infected cases gradually diminishes up to the 10th day. New cases of local infection no longer appear.



Distal infections closely follow upon local infection, in a lower proportion, but new cases may be continuously recorded up to the end of the 3rd week.

Venous thrombosis develops in the course of the first two weeks starting from the 4th day (0,5%) and is usually localized in the catheterized vein. Pulmonary embolism is encountered later, in the 4th week. Within the same period bedsores begin to appear in a small number of the patients confined to bed (1,5%).

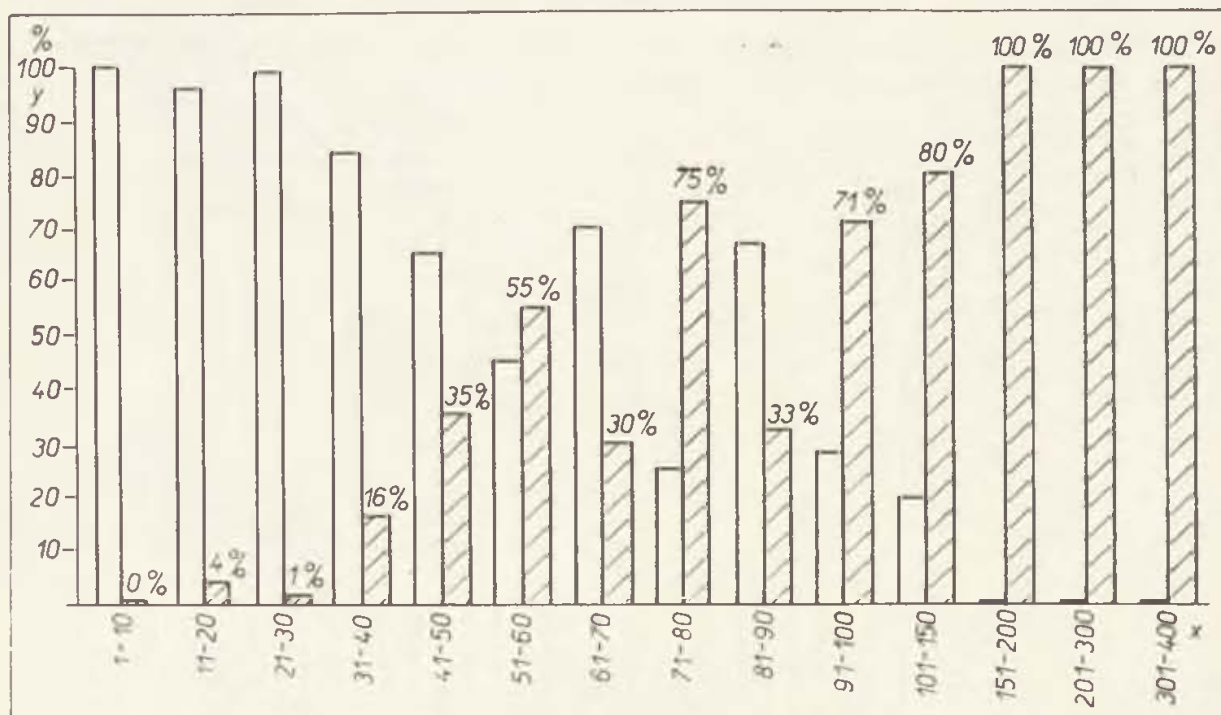


Fig. 2. Incidence of renal impairment with respect to the prognostic index.

Group II: patients admitted within 6 hours to 3 days after the accident.

This group comprised 46 patients (29 males and 17 females), aged 14 to 82 years. The difference between this and the former group consists in that the primary shock was not treated from the beginning in a speciality unit for burns.

Within the first two days hepatic damage appeared in an increased proportion (6,5%). Local infection reached a maximum evident from the 2nd day and new cases occurred in a higher proportion up to the 8th day, affecting 63% of the group.

Distal foci of infection were detected at a slight interval, starting from the 3rd day, and in the patients with a length of hospitalization care of over 21 days, late distal infections were encountered in a higher proportion.

Starting from the 4th week, the hazard of venous thrombosis and pulmonary embolism is very high (4,4%). The other complications are more frequent within the first 10 days after the accident, a period in which most of the fatal cases are recorded.

Group III: patients admitted within 3 to 21 days after the accident.

There were 59 cases in this group (34 males, 25 females) aged 5 to 80 years. Complications were constantly recorded, in approximately equal proportions, up to the end of the 6th week.

Table IV — Ratio of the prognostic index to patients with more than one complication reported

Prognostic index	Number of complications						
	1 (%)	2 (%)	3 (%)	4 (%)	5 (%)	6 (%)	7 (%)
1— 10	40	10					
11— 20	45	6	3		1		
21— 30	51	12					
31— 40	32	29	12	3			
41— 50	40	20	30	10			
51— 60	33	22	16	16	5		
61— 70	40	10	30	20			
71— 80		25	12	37	12		12
81— 90	28	28	28				
91—100		42	42	14			
101—150		6	21	46	13	6	
151—200	13	13	13	26	20	13	
201—300	45	12	12	7		12	
301—400	55	22		11		11	

Local sepsis is impressive within the first 5 days of hospitalization. Bearing in mind that 28% of the patients were already infected at the moment of admission, it will be seen that within the 1st week after the accident (up to the 8th days) almost all the patients (92%) had infected burns. The development of sepsis in burns, in such a high proportion, is due to their massive colonization with bacteria prior to admission.

Distal focal infection appeared within the first days of hospitalization but also developed sporadically, later on.

Within the first two weeks after the burn, new cases of renal involvement were encountered in a comparatively high proportion (2.7% on the 10th day).

Septicemia, hepatic involvement and bedsores were recorded daily, up to the end of the first month.

Group IV: patients admitted within 21 days to 2 months after the accident.

This group comprised 30 patients (16 males and 14 females) aged 8 to 60 years. It was characteristic of this group that the patients, who had exceeded the period of shock and metabolic disorders, were brought late to our Clinic, with postcombustion granular wounds, malnutrition, hypoproteinemia, anemia and a tendency to "chronic shock", due either to nonspecialized care or to the exceptional gravity of the burn and especially to sepsis which slowed down the process of recovery and increased the depth of the wounds.

Table V — Ratio of the prognostic index to patients with

Prognostic index	Group I							Group II						
	1 %	2 %	3 %	4 %	5 %	6 %	7 %	1 %	2 %	3 %	4 %	5 %	6 %	7 %
1— 10	13	6	1					40						
11— 20	34	6	1					39	11	11				
21— 30	48	10						25	50					
31— 40	33	29	11						100					
41— 50	35	29	36											
51— 60	23	30	15	32				50				50		
61— 70	42		42	16										
71— 80		50	25	25							100			
81— 90	100													
91—100		33	33		33				100					
101—150			16	84										
151—200	28	28		28	16				33	33			33	
201—300	55	18	18			9				100				
301—400	43	28		14		15		100						

The occurrence of complications in these patients took on a different aspect. Our data clearly show that in the first three groups complications no longer appeared after 30 days, whereas in group IV they were encountered up to 60 days. All the patients of this group were referred to our Clinic with infections.

The other complications constantly developed and in higher proportions.

B. Complications appearing after two months.

Patients admitted within the first 3 days after the accident. Of the total number of 309 patients admitted to hospital within the first 3 days, 33 were still in hospital after 2 months, i.e. a proportion of 10.7%. During this period, the proportion of complications in these 33 cases was of 27.2%.

Patients admitted more than 3 days after the accident. Of the total number of 89 patients admitted after more than 3 days, 40 were still in the hospital 2 months after the burn, i.e. a proportion of 45%. During this period, the proportion of complications was of 67.5%.

2. Dependence of the appearance of complications on the gravity of the burn.

As may be seen from fig. 1, with increased gravity of the burn, appraised by calculation of the prognostic index, the likelihood of complications was correspondingly greater. With a prognostic index of over 40, all the patients had at least one complication.

The patients admitted late presented a higher proportion of complications, a fact made evident by each prognostic index group.

With slight fluctuations, the proportion of renal involvement (fig. 2) definitely increases with an increase in the prognostic index. In severe burns with a prognostic index of over 150, more or less severe involvement of the renal function is the rule.

more than one complication in the four groups

Group III							Group IV						
1 %	2 %	3 %	4 %	5 %	6 %	7 %	1 %	2 %	3 %	4 %	5 %	6 %	7 %
81 77 80	13			5			100 86 100 50 66	14					
			100							50			
100 33	33		33						34 100				
										33	33		33
	20	100 40 25	20 25	20 50				50 50	50 50 25	25	25	25 100	
					100								

Local infection (fig. 3) is present, even in the milder cases. Sepsis usually accompanies the deeper burns so that with an equal prognostic index, extensive but superficial burns may remain uninfected whereas deeper but less extensive burns become infected in most cases. At a prognostic index of 40 to 150, in over 90% of the patients the burns are infected; in some categories this proportion may reach 100%. In the very severe cases there is an apparent paradoxical decrease in the number of septic cases, accounted for by early death in such cases.

Similar aspects were also encountered in distal infections, venous thrombosis, pulmonary embolism and bedsores.

Septicemia, bronchopneumonia, gastro-intestinal hemorrhages and acute pulmonary oedema are only encountered in severe burns.

3. Patients with several complications.

Table IV and V indicate the factors responsible for the appearance of several complications concomitantly or in different stages of the evolution of a burn.

Table IV comprising the total number of patients observed shows that the proportion of patients with several complications increases with increase in the gravity of the burn. Although in very severe burns (prognostic index of over 200) patients with up to 6 complications are encountered, the proportion of those with a single complication increases owing to the short period of evolution often ending in death.

In table V, the material is divided into four groups with respect to the time of admission, showing that the appearance of several complications depends not only upon the severity of the burn but also upon early, speciality care.

Table VI — Mortality and the age of patients

Age	0—10	11—20	21—30	31—40	41—50	51—60	61—70	71—80	81—90
Mortality %	0	11	7,6	9	13,3	15,3	35	40	50

4. Complications as a cause of death in burns.

There were 52 death in the 398 cases of our material, i.e. a general mortality rate of 13%. The highest mortality occurred within the first week of the burn, the number of deaths then gradually decreasing (fig. 4).

In the first week the mortality rate is very high in the patients with severe burns or in the elderly patients with a state of irreversible shock.

An important factor in burns is the patients' age (table VI) that influences the mortality rate and must be kept account of in the interpretation of the prognostic index.

The importance of the severity of the burn evaluated by calculation of the prognostic index is indicated in table VII.

If the deaths caused by irreversible shock within the first days, in burns of extreme gravity, are eliminated, it will be noted that death is due in the first place to septic complications (septicemia, bronchopneumonia), then to renal, hepato-renal and cardiorespiratory failure. In the causation of later deaths (more than 20 days after the burn) septic and thromboembolic complications are of primordial importance.

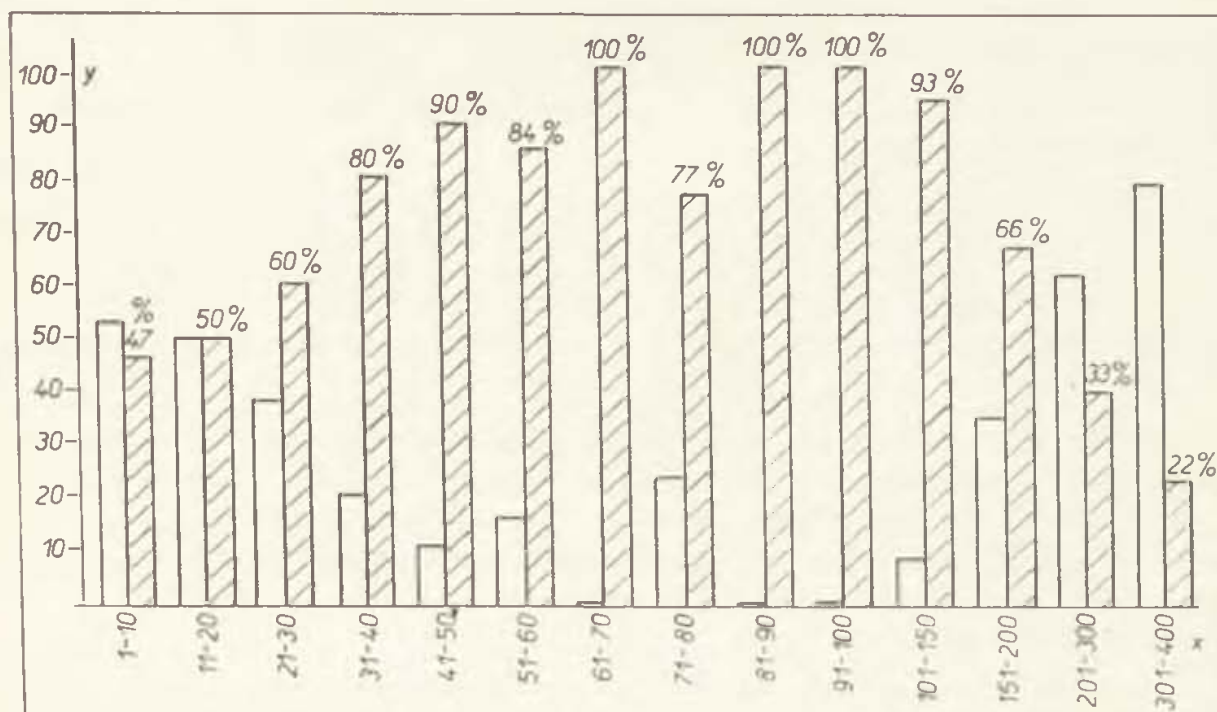


Fig. 3. Incidence of local infection with respect to the prognostic index.

DISCUSSION

The data obtained does not exhaust the problem of complications in burns. Each separate complication, the onset conditions, the direct and contributing factors, the physiopathologic mechanisms and their early detection, have in turn been the subject of numerous investigations (3). Our study aimed at appraising the onset of complications in terms of time, the critical moment when complications may alter the evolution of the burn, the temporal relationship between the different complications and the dependance of the latter upon the gravity and care of the patients in a speciality unit.



Fig. 4. Mortality distribution with respect to the time after burn.

A number of factors, such as the age of the patients, the existence of certain preexisting diseases, localization of the burn (involvement of the respiratory tract) have an unquestionable prognostic value and, moreover, influence the moment when the complications appear (4, 5). However, the main elements are the gravity of the burn and the moment when the patient receives specialized care.

The later the patient is admitted to hospital the higher is the general incidence of complications or of each separate complication. Irrespective of

Table VII — Mortality with respect to the prognostic index

Prognostic index	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-150	151-200	201-300	301-400
Mortality %	0	0,83	2	0	5	22	10	37	0	0	53	93	100	100

the moment of admission, complications develop in 100% of the patients with a prognostic index of over 40.

At a lower prognostic index the dependance upon the time of admission is evident. The role of the gravity of the burn in the development of the complications has been stressed by a number of authors: Sevitt (6), Birke et al. (7). Artz and Reiss (4) for infection; Creyssel et al. (8) for renal involvement; Gilmore and Fozzard (9) and Gregora (10) for hepatic involvement; Sevitt and Gallagher (11) for venous thrombosis and pulmonary embolism.

Our cases are demonstrative in this sense. Thus, complications such as septicemia, bronchopneumonia, gastro-intestinal hemorrhages and acute pulmonary oedema are only encountered in the patients with a high prognostic index values. Moreover, with other complications, the proportion met with runs parallel to increase in the gravity of the burn. The apparent diminution in the incidence of certain complications, such as local or distal infection, thromboembolism or bedsores in the patients with a prognostic index of over 100—150 is due to the higher proportion of early deaths among these patients, in whom these complications have no longer time to develop.

These findings also stand true for the number of complications in one patient (table IV and V), a fact that has not been sufficiently stressed by other investigators. The evident conclusion is that the more severe is the burn and the later the admission, the greater is the hazard of more complications.

The moment of which the complications appear is dependant to a lesser extent upon the gravity of the burn. In general, from this standpoint, the first two weeks likewise represent the critical period. Renal involvement occurs very early, from the first day, and is integrated in the manifestations of primary shock. Local and distal infections appear within the first days and are due to self-colonization (7, 12), whereas late infections are due to exogenous colonization, which is almost impossible to prevent. Of particular interest is the constant change of the bacterial flora during the evolution of burns (13), a phenomenon observed by us especially following the use of specific immunotherapeutical methods (14). Septicemia was rare during the first days, in agreement with the opinion of Converse (5) and in opposition to that of Artz and Reiss (4). Important in the onset of septicemia is the depth rather than the surface area of the burn. Hepatic involvement also represents an early complication, demonstrated by clinical investigations and by biopsy puncture (10, 15).

Thrombo-embolic complications, bedsores and certain distal foci of infection appear much later.

This dynamic aspect of the onset of complications is valid for patients followed up from the beginning in the clinic (groups I and II). In these groups the late appearance of certain complications is exceptional and only in the cases with a protracted evolution. In the patients admitted with a great delay, especially those referred to hospital more than 21 days after the burn, this succession in the onset of the complications can no longer be observed, the complications developing continuously, in increasing proportions up to the end

of the 3rd month, then sporadically in the patients necessitating longer hospitalization care.

Death, which may be considered the supreme complication of burns, occurred in 13% of the cases, in agreement with other authors (4, 16).

The factors influencing the mortality rate are the date of admission, the patients age and the gravity of the burn, to which Birke et al. (17), also draw attention. Among the causes of death, excluding early irreversible shock, are infections upon which Sevitt (6), on the basis of pathologic findings, also insists. Septicemia is not so frequent; the cases encountered were always of particular gravity and on the critical borderline.

A series of practical conclusions may be drawn from our cases. In the care of burned patients account should be kept of the different stages, since each stage sets its own therapeutic problems (1).

The moment at which complications appear must be well known in order to be able to apply the necessary preventive measures.

In the first 3 days, the treatment should have in view the control of shock and its side effects on the renal function, the earliest complication of severe burns.

Since perfusion with large amounts of fluid demands repeated and prolonged puncture of the accessible veins, responsible to a great extent for the appearance within the first week of thromboembolic complications, a preventive anticoagulating therapy (heparin) should be applied. In the 3rd week when the risk of embolism is still greater, a further series of preventive measures, such as mobilisation of the patient, correction of the biologic constants, survey of blood coagulability, represent efficient therapeutical measures when the patient is within the "alarm zone".

The control of infection and general microbial invasion (bronchopneumonia, septicemia) begins with the primary local treatment, which must be continued as long as the wound is open.

As shown in a previous work (14) specific immunotherapy has given good results in the anti-infectious therapy of burns.

The moment of skin grafting, essential in the treatment of burns, must be chosen according to the evolution of the burn, since it is the best means of controlling sepsis.

Special attention should be paid to the patients with a high prognostic index and to the aged patients, in whom the hazard of complications, their number and the mortality rate is still very high.

SUMMARY

Investigations were carried out on the complications of burns in 398 patients, with respect to the moment of admission and the gravity of the injury, appraised by the prognostic index.

A certain succession was noted in the onset of the complications. The patients admitted late are more exposed to the risk of complications, which

appear in a greater number and may also develop in the later periods of evolution.

A close relationship exists between the gravity of the burn, and the incidence and number of complications.

Complications, as a cause of death are discussed together with other factors, such as the gravity of the burn, the patients age and the quality of the treatment applied.

Practical conclusions are drawn.

R É S U M É

Complication des brûlures

A. Ionescu, V. Petrovici

Une analyse de complications dans 398 cas de malades brûlés a été réalisée par rapport au délai de l'admission et la gravité de la blessure qui a été évaluée à l'aide de l'indice de pronostics.

On a établi un certain ordre chronologique dans l'apparition des complications qui se présentent dans un plus grand nombre et qui peuvent aussi surgir ultérieurement chez les malades admis tardivement!

Il existe une certaine relation entre la gravité des brûlures et l'apparition, ainsi que le nombre des complications. L'article traite des complications en tant que cause directe de la mort, simultanément avec d'autres facteurs — comme la gravité de la brûlure, l'âge du blessé et la qualité des soins donnés. On y tire également des conclusions importantes pour l'application pratique.

Z U S A M M E N F A S S U N G

Komplikationen der Verbrennungen

A. Ionescu, V. Petrovici

Es wurde eine Analyse der Komplikationen bei 398 verbrannten Patienten durchgeführt, im Bezug auf die Aufnahmezeit und die Schwere der Verletzung, die mittels des prognostischen Index geschätzt wurde.

Es wurde eine gewisse Reihenfolge im Auftritt der Komplikationen festgestellt.

Die spät aufgenommenen Patienten sind mehr dem Risiko der Komplikationen ausgestellt, welche in grösserer Anzahl auftreten und sogar auch in späterer Periode entstehen können.

Es existiert ein gewisser Zusammenhang zwischen der Schwere der Verbrennung und dem Entstehen und der Zahl der Komplikationen.

Es werden die Komplikationen als Ursache des Todes zusammen mit anderen Faktoren, wie die Schwere der Verbrennung, das Alter des Patienten und die Qualität der Behandlung diskutiert.

Es sind die Richtlinien für die Praxis angegeben.

R E S U M E N

Las Complicaciones de las quemaduras

A. Ionescu, V. Petrovici

Ha sido realizado un análisis de las complicaciones en 398 pacientes con quemaduras con respecto al tiempo de la admisión al hospital y a la gravedad de la lesión que fue estimada por un índice pronóstico. Ha sido determinado un cierto orden en la aparición de las complicaciones.

Los pacientes que fueron ingresados tarde están más expuestos al riesgo de las complicaciones, las cuales pueden manifestarse con mayor frecuencia y pueden presentarse en el período ulterior.

Hay cierta relación entre la gravedad de la quemadura y el origen y la frecuencia de las complicaciones.

Se discuten las complicaciones como causa de muerte a la par con otros factores como la gravedad de la quemadura, la edad del paciente y la calidad de la asistencia. Se especifican las conclusiones para el uso práctico.

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SOME NOTES ABOUT TREATMENT OF BURNS IN GREAT BRITAIN

R. KÖNIGOVÁ

When working abroad, one is immediately reminded of the old truth that there exist many various concepts of treatment, not only of burn injuries, but in medicine as a whole. Particularly striking are such diversities in G. Britain, where one cannot help being amazed by different paradoxes in almost every sphere of life. While in social life and arts one is often astonished by fundamental differences, in medicine the old competes with the new but the basic principle does not change: the well-being of man remains the main criterion. Its prerequisite is mutual respect among people — deep-rooted in G. Britain — which in medicine is reflected in humane approach towards patients and in their absolute confidence in the doctor. As far as the physical state of patients is concerned, their well-being is secured by means of modern technical facilities and by taking full advantage of general anaesthesia. In burn injuries this particular care is regarded as a matter of course.

The modern burn units in G. Britain that have been established recently, comprise never more than 15 to 20 beds. For example, the burn unit in Odstock Hospital near Salisbury, in East Grinstead's Queen Victoria Hospital or in Bangour Hospital near Edinburgh are all constructed on a similar pattern. All appear to have some advantages — let's say psychological:

1. the chief of the unit is interested particularly in burns,
2. nursing staff is selected on a voluntary basis,
3. the unit is situated in a lovely countryside (great value of a nice view from the windows as well as of the fresh air is considered),
4. the concept of open wards (i.e. visitors free when gowned properly) prevents patients from getting crazy,
5. no i.v. intake forced, feeding per mouth starts as soon as possible, free choice of diet (within certain limits, of course),
6. television screens in all rooms, dayroom for walking patients, and playroom for children with possibility of being in the garden.

With respect to material advantages, the technical facilities and monitory equipment do not differ from each other in the units mentioned above. Apart from rooms with 4 ordinary beds — usually — there are 4 single cubicles

(resuscitation rooms) with Stoke-Mandeville's turn-over bed or with Stryker frame. All rooms are furnished with:

1. observation panel to corridor (not between rooms),
2. intercom-point to the resuscitation room from corridor and from nursery room,
3. each bed has at the patient's own disposal a panel for oxygen, suction, control of temperature and ventilation,
4. resuscitation trolley, i.v. trolley with cut down set and drip-stand, catheterisation trolley, dressing trolley and sterile packets.

Operation theatre and treatment room comprise separately the following equipment:

1. 4 dressing trolleys, 1 table, 1 Habart tank,
2. monitory equipment for pulse rate, blood pressure, temperature, ECG,
3. 2 anaesthetic points, 2 suction points, 2 electric points,
4. X-ray viewing box, weighing machine.

Professor Wallace, chief of the Plastic Surgery Unit in Bangour General Hospital, proclaims the principle: cool, dry, daylight! — which means he does not require air-conditioning, and prefers fresh air through big windows in high and big rooms to dilute the infection. His patients lie on a frame with polyethylene net, covered with "gamgee", to get air from below the burnt surface. From above, a bed cradle is covered with a sterile sheat. Fans provide for air circulation and they also dry up the bandages if they have been applied to the extremities. His concept of exposure is based on the theory of Watson Cheyne [1885]: "... discharges dry up and become more concentrated i.e. unfit soil for the growth of bacteria. Also the oxygenation appears to be important..."

Prof. Wallace recommends restraint in applying antibiotics routinely and prefers giving hyperimmune serum for raising antibodies. Even though he suggests to produce a synthetic albumine (no danger of hepatitis), he believes in the virtue of fresh blood in burns, because plasma protein solution and synthetic albumine are deficient in clotting factors and in gamma-globulins with a consequent loss of protective factors against microbial infection. According to his opinion "...the best antiseptic is the living tissue cell..." he persuades his medical staff to use homo- and hetero-grafting performed together with necrectomy in one stage. He presumes that the biological dressing by its enzymes dissolves all dead tissue and enables the epithelium to grow underneath the homo- or hetero-grafts.

He used to say that the importance of the highest standard of general nursing care can never be overemphasised. No monitory equipment, for example, can ever register some signs of improvement in burns such as colour, warmth of skin in different spots (nose), moist tongue, the patient's interest in his surroundings etc. Thorough treatment of pressure areas every 2 hours, positioning, turning, as well as oral hygiene, bathing eyes — all these tasks require personal contact, which gives the patient a feeling of security. On the contrary,

a feeling of alienation is necessarily evoked in a patient who is observed by means of TV screen.

Prof. Wallace's way of thinking reminds me of the words of Sir William Gull ("The Study of Medicine"):

"... Medicine requires not only the intellectual cultivation of a science but the patience and practical skill of an art... When the Art of Medicine is needed by the suffering and the dying it is no question of mere theoretical knowledge and extraneous acquirement. To practice it successfully, we must have made our home at the bedside, and have lived with disease, observing it in all its forms and changes..."

I am sorry to say there still exist burn units without proper technical equipment and lacking that necessary touch between patient and his doctor and nurse. Burn are often regarded merely as a sideline to plastic work, and proper attention is not paid to the mental or physical condition of patients. From the theoretical point of view this is a tremendously complicated problem, and practical work often appears too hard and frequently depressing. Francis D. Moore, professor at Harvard Medical School, describes the burn as a dynamic continuing injury with a continuous general and local response.

A. B. Wallace, C. B. E., M. Sc., F. R. C. S., professor at the University in Edinburgh, did not become founder and general secretary of "The International Society for Burn Injuries" by mere chance. His integrity as well as his scientific level are remarkable. They certainly guarantee that the aims of the Society — helping the developing countries by teams of specialists in burn injuries — will be achieved.

He organized the last International Congress in Edinburgh in September 1965, where Prague was chosen as the site of the next IIIRD International Congress for Research in Burns in September 1970. He defined his own task at the Prague Congress by the following words:

"... I have to marry culture and friendship and the need for international good understanding..."

R É S U M É

Les notes du traitement des brûlés dans la Grande Bretagne

R. K o n i g o v á

Les notes du séjour du travail dans la Grande Bretagne touchent non pas seulement la dotation matérielle de quelques-unes des stations des brûlés modernes, mais de même la valeur des progrès technique pour le bien du malade. L'auteur cite les principes médicaux anciens faisant base des pensées du hon. prof. Wallace, chef de Plastic Surgery Unit, Bangour General Hospital près d'Edinburgh. Sa conception du traitement des brûlés est fondée sur quelques-uns des principes cités dans le travail:

1. le médecin en chef de la station des brûlés doit s'intéresser rien que des brûlés,
2. l'anesthésie totale dans tout le traitement douloureux chez les brûlés est obligatoire,

3. le traitement exposé des brûlés comporte le principe du froid, de la sécheresse et de la lumière du jour,

4. l'application automatique des antibiotiques n'est pas admise et la transplantation précoce à l'aide des auto, homo et même hétéro-transplants est faite dans une session avec la nécrectomie,

5. l'importance du niveau le plus haut des soins infirmières est très soulignée.

La personne du hon. prof. Wallace elle-même garantie le succès du dit «The International Society for Burn Injuries» dont les congrès prochain international aura lieu à Prague au mois du septembre 1970.

ZUSAMMENFASSUNG

Anmerkungen über die Brandwundenbehandlung in Grossbritannien

R. Königová

Die Anmerkungen aus dem Arbeitsaufenthalt in Grossbritannien erfassen einerseits den Stand der materiellen Ausstattung einiger modernen Brandwundenbehandlungszentren, und führen andererseits zu Erwägungen über die Vorteilhaftigkeit der technischen Errungenschaften für das Wohl des Kranken. Erwähnt werden hier die alten medizinischen Grundsätze, welche die Gedanken von Prof. Wallace, des Vorstandes der Plastic Surgery Unit, Bangour General Hospital in Edinburgh durchdringen. Seine Konzeption der Brandwundenbehandlung beruht auf einigen Prinzipien, die in der Arbeit erörtert werden:

1. der leitende Arzt der chirurgischen Brandwundenbehandlungseinheit soll sich besonders und vor allem um Brandwunden interessieren,

2. Allgemeinanästhesie ist eine Selbstverständlichkeit bei allen schmerzvollen Verfahren,

3. offenes Brandwundenbehandlungsverfahren beruht auf drei Prinzipien: Kälte, Trockenheit, Tageslicht,

4. er lehnt das routinemässige Verabreichen von Antibiotica ab und empfiehlt frühzeitige Transplantation (Auto-, Homo- sowie Heterotransplantate) in einer Zeit mit der Necrektomie,

5. er betont die Wichtigkeit des möglichst hohen Niveau der Krankenpflege bei Verbrannten.

Die Persönlichkeit von Prof. Wallace bürgt für die erfolgreiche Tätigkeit der International Society for Burn Injuries, deren nächster internationaler Kongress in Prag im September 1970 stattfinden soll.

RESUMEN

Las anotaciones sobre la asistencia de las quemaduras en Gran Bretaña

R. Königová

Las anotaciones de la estancia de trabajo en Gran Bretaña describen por una parte el estado del equipo material de algunas unidades modernas de quemaduras, por otra parte dan origen a consideración sobre la ventaja de los progresos técnicos en bien del paciente. Se recuerdan aquí los principios viejos de medicina, que se adentran en los pensamientos del profesor Wallace, jefe de Plastic Surgery Unit, Bangour General Hospital cerca de Edinburgh. Su concepción de la asistencia de quemaduras se basa en algunos principios que se desenvuelven en la obra:

1. El médico jefe de la unidad de las quemaduras tiene que interesarse especialmente y en primer lugar sobre las quemaduras.
2. La narcosis general es natural en todas operaciones dolientes.
3. El tratamiento abierto de las quemaduras se basa en el principio: ¡el fresco, la sequedad, la luz diurna!
4. Rechaza el ofrecer de rutina de los antibióticos y aconseja a la transplatación temprana (auto-, homo- y heterotransplantes) en un tiempo con la necrectomia.
5. Acentua la importancia del más alto nivel de la asistencia curativa en los quemados.

La personalidad del profesor Wallace garantiza la actividad fructífera de „The International Society for Burn Injuries“, el congreso próximo de la cual se realizará en Praga en setiembre 1970 con participación internacional.

Dr. R. Königová, Praha 10, Šrobárova 50, Czechoslovakia

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SURGICAL CORRECTION OF SEX IN MALE PSEUDOHERMAPHRODITISM TO FEMALE TYPE

G. A. SAVICKIJ

Male pseudohermaphroditism is a disease connected with a disturbance in sex differentiation. It occurs usually in genetic males who have a normal chromosomal pattern 44A + XY as individuals of male sex and two gonads with histological structure showing different degrees of testis differentiation (Alexander, Ferguson-Smith 1961, Kika et al. 1957, Morris, Manensh 1965, Molinoff, Armstrong 1962, Iliga et al. 1965).

Lately, this condition was described in subjects with karyotype XY/XYY/XXY, XY/XO (Forsberg et al. 1965, Grouchy et al. 1963).

The development of symptoms characteristic for male pseudohermaphroditism depends on the degree of the endocrine insufficiency of the embryonal testicles (Studer 1963, Pion et al. 1965, Dux 1955, Hammerstein 1958, Bergman 1963, Salasso et al. 1961).

These authors suppose that, after differentiation of the primary gonad in the organism of male embryo, two "organizing substances" are formed, one of which calls forth the involution of Müller's ducts while the second one enhances the development of Wolf's ducts. In male pseudohermaphroditism usually only one "organizing substance" is formed, responsible for the involution of Müller's ducts. If the "organizing substance" is not produced the vesicular glands do not develop. Ductus deferens is either lacking or only rudimentary. In about the 12th week of foetal development starts the formation of the external genitals the type of which depends on the presence of an appropriate level of androgens in the organism. If this level is insufficient the development of external genitals in embryos of male sex proceeds towards the female type, or its masculinisation is insufficient (Morris, Manensh 1965, Molinoff, Armstrong 1962).

During puberty the testicles of these patients may produce estrogens in a quantity resulting in feminisation; frequently they produce a sufficient

quantity of androgens which leads to virilisation; sometimes the testicles produce so few hormones that an eunuchoid phenotype develops (Studer 1963, Hammerstein 1958, Pion et al. 1965).

In this way the differences in hormone activity of the testicles influence during puberty the formation of different phenotypes in a male pseudohermaphrodite.

Some data were made recently available, pointing to a hereditary origin of this disease which is transmitted along the maternal line (Taillard, Prader 1957, Ford 1961). Three hypotheses were proposed for explanation of the heredity mechanism of the condition: 1. recessive, sex-linked heredity, 2. the existence of autosomal gene causing resistance of receptors against androgen hormones, 3. inconstant cleavage of the X-chromosome.

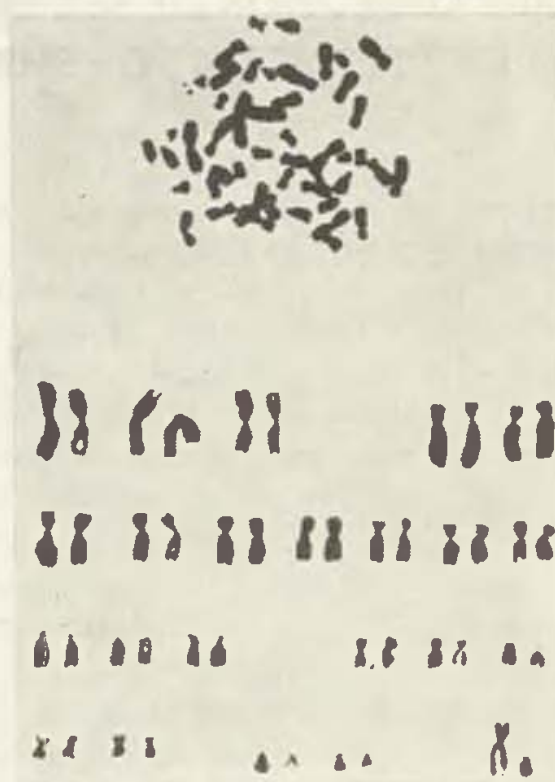


Fig. 1. Karyotype of a patient with spurious male hermaphroditism (44A + XY)

Persons with insufficient masculinisation or with feminisation of the external sex organs and male pseudohermaphrodites are usually recognized for official purposes as individuals of female sex. This influences the conditions of their bringing up and social environment and decides the character of their psychosexual orientation. Combination of the psychosexual orientation with the indication of female sex in personal documents explains the behaviour of spurious male hermaphrodites in the family and in society. The majority of these patients regard themselves as women and appear as such in legal and in psychological respect.

The nosologic diagnosis in these cases cannot be a reason for a change of the official designation of sex. In spurious male hermaphrodites, designed as females with regard to social conditions, any change would be undesirable at any age and in any form of the disturbance. Attempts at a change of the female psychosexual orientation frequently result, in these subjects, in serious psychic disturbances requiring psychiatric treatment (Stoller 1964, Hampson 1955, 1961). Undoubtedly these patients are able to come to terms with life as women and this adaptability can be explained by the anatomical and physiological peculiarities of the condition. Functionally "it is much easier to make a woman out of a male hermaphrodite than a man" (Prader 1957, Oles 1958, Laurila 1965, Silva 1964, Musset 1963).

However, there are in the literature also other opinions on the advisability of changing the sex to male, in male hermaphrodites who are officially of female sex (Savchenko 1962, Zhukovskij et al. 1967, Belichova, Golubeva 1967).

These authors are disturbed by the female "social sex" in these subjects. "Girls with testicles in their abdomen should be changed into boys without much ado" (Savchenko 1962). Belikhova and Golubeva allow for the change of sex "on the operating table" without any preliminary psychological preparation. All these authors report on isolated cases of successful change of sex from female to male. From the standpoint of method these tactics arise from the concept of the "true sex", e. g. the sex of the gonads and genotype.

We observed 18 patients with male pseudohermaphroditism. They showed the following breakdown according to age: up to 10 years of age — 2 cases, between 11—15 — 1 case, 16—20 years — 5 cases, 21—25 years — 2 cases, 26—30 years — 5 cases, 31—35 years — 2 cases, over 35 — 1 case. The youngest patient was 7, the oldest 42 years old.

All cases underwent a specialized medico-psychological check-up in which all patients showed a well-formed and irreversibly fixated female psychosexual orientation. According to official personal documents all subjects were registered as women, and in the legal and psychological sense they really were women. Three of them had normal sexual life as women and had normal sexual perception. The main complaints of these patients were: amenorrhoe, sterility (!), inability to sexual intercourse, hypertrichosis, lack of breasts, morphology of the external genitals not conforming with the psychosexual orientation. The last disturbance was a cause of serious psychological privation. All patients considered men as the opposite sex and as soon as they reached a certain age they felt a sufficiently conspicuous affinity towards men. They considered the anomaly of their sexual development as a disease.

Cytogenetic examination was carried out in all these subjects and it showed the presence of a normal male karyotype 44A + XY (Fig. 1).

The gonads were in 10 cases represented by testicles situated in scrotal folds, in 5 cases one testicle was in the abdominal cavity while its fellow was situated extraperitoneally, in 3 cases the testicles were found in the abdominal cavity at the internal orifice of the inguinal channels.

Histological examination of the removed testicles showed that they were composed of shallow seminal channels seldom more than 50—70 microns in diameter and covered with Sertoli type epithelium at various stages of development. The channels frequently degenerated and they never showed spermatogenesis. Sertoli cells covered the lumen of channels of the 1st order. Between the channels there were clumps of typical polygonal Leydig's cells. Perivascular



Fig. 2. Virile form of male pseudohermaphroditism. Patient, 16 years old: hypertrichosis, male stature, considerable virilisation of the external genitals. Social sex — female. — Fig. 3. Eunuchoid form of male pseudohermaphroditism. Patient, 23 years old: eunuchoid stature, lack of secondary sex marks, external genitals developed to female type, rudimentary vagina. Sexual life since 21, oversexed. Social sex — female

fibrosis was frequently observed. It was interesting to note that the more conspicuous was the development of interstitial tissue (hyperplasia) the stronger were the manifestations of virilisation in the phenotype. In one half of the patients (in 9 out of 18) tumours were found in the testicles — androblastomas; one malignancy — seminoma — was included in this number. In 4 patients nodes of tumour tissue were found in both testicles, in 6 out of 9 patients there were several tumours.

According to the differences in phenotype our patients may be divided into three clinical groups:

1. Virile form: the patients showed a male type of physique, had a well developed musculature, hypertrichosis in varying degrees. Breasts were not developed. The external sex organs showed usually symptoms of virilisation



Fig. 4. Syndrom of testicular feminisation — feminized form of male pseudohermaphroditism. Patient 30 years old: well developed breasts, lack of secondary hairs, external genitals developed to female type, aplasia of vagina. — Fig. 5. External genitals of spurious male hermaphrodite in virilisation of these organs: hypertrophy of clitoris, scroto-labial folds, urogenital sinus

[clitoris hypertrophy, presence of sinus urogenitalis, developed scrotal folds (Fig. 2 and 3)] this type of disturbance occurred in 12 patients.

2. Eunuchoid form: patients with a typical eunuchoid phenotype lacking any secondary sex attributes. The external sex organs had a female appearance with the presence of urogenital sine. The patients had no breasts and the secondary hairs were lacking (Fig. 4). This type of disturbance was met with in 2 cases.



3. Feminized form: the patients had a typical female phenotype (Fig. 5). The external sex organs were developed into the female type. We found 4 patients with the syndrome of testicular feminisation.

As all the patients were women from the social standpoint and they insisted on any treatment "to make them as other girls and women", we did not see any reason for a change of the social sex to male, the more so as 6 patients made suicidal attempts under the influence of such an advice (given elsewhere). We were not able to find any reasons substantiating such a change from the medico-biological standpoint as:

1. The testicles in these patients were deficient in the morphogenetic as well as hormonal sense. They were sterile and tumours, even malignant, appeared in them quite frequently. The last circumstance was especially important as, in males with this disease, there might occur sooner or later the problem of castration for oncologic indications. There was therefore no sufficient reason to classify the dysgenetic testicles of a male hermaphrodite as a "normal male gonad".

2. In a part of the patients the external genitals were morphologically similar to the female type and even with virilisation it was impossible to be certain that a fully effective male copulation organ could be created with surgical methods.

In our opinion the change of sex to male is not expedient in male pseudohermaphrodites having female "social" sex either from the biological or from the social standpoint; in these cases there are biological and social reasons for correction of the existing developmental anomalies into the female type.

The correction of sex into female type in male pseudohermafrodites has the following aims: 1. surgical reconstruction of the anomalous genitals, and 2. corrections of some parts of the phenotype.

The first task consists of surgical reconstruction of the vulva and vagina. The extent and rational method of surgery in these cases depends on the character of the anomaly present. It is necessary to note that there does not yet exist any serious clinical and surgical classification of the anomalies of the external genitals and vagina in spurious male hermaphrodites. The existing classification is too general, it does not give the surgeon the necessary details of all basic data and it divides all patients into groups with feminized or masculinized external genitals (Elias 1959, Prader 1957, Hauser 1961, Philip 1965, Teter 1966).

The necessity of such classification is connected with the immediate needs of the practice. On the one hand — knowledge of the variants of anomalies of the external genitals may help to prevent the still very frequent diagnostic errors, on the other hand — it may help to work out a rational system and optimal extent of surgical procedures. Having this aim in mind we propose a clinical and surgical classification of anomalies of the vulva and vagina in male hermaphroditism:

Ist variant: Male pseudohermaphrodite with feminized external genitals.

Group A: The external genitals have morphologically the female type. There is a rudimentary vagina in form of a cul-de-sac the depth of which does not exceed the depth of the lower third of the vagina of a healthy woman.

Group B: External genitals are morphologically of the female type. Aplasia of vagina.

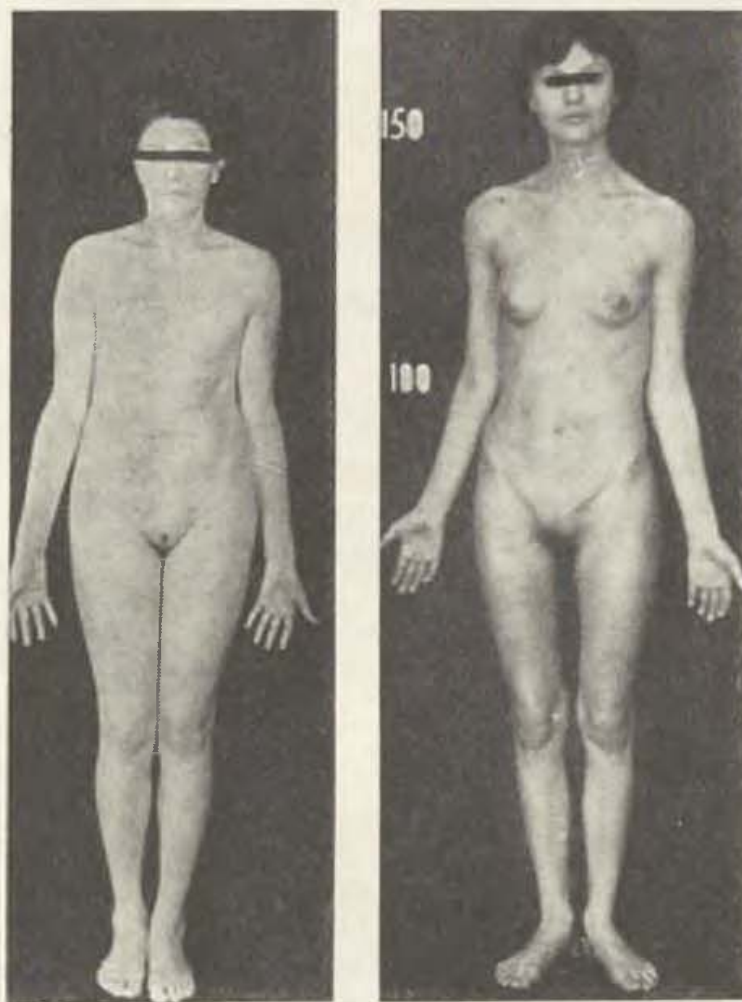


Fig. 6. Syndrom of prepuberty castration — pseudoeunuchoid form of male pseudohermaphroditism. Patient 16 years old: eunuchoid phenotype — complete lack of secondary sex marks. External genitals developed in female type, Urogenital sinus is present. Social sex — female. — Fig. 7. Medicamentous feminisation of a castrated male pseudohermaphrodite (microfollin administered 6 months). Surgical reconstruction of vulva and vagina. The patient has sexual life

IInd variant: Male pseudohermaphrodite with insufficient feminisation of the external genitals.

Group A: The great labia are in shape similar to scrotolabial or scrotal folds. The urogenital sinus is present and in it is situated the orifice of a shallow rudimentary vagina and the orifice of the urethra.

Group B: Hypertrophy of clitoris, having the appearance of penis. The great and small labia are hypoplastic. The orifice of vagina has a normal shape, the vagina is short.

Group C: Hypertrophy of clitoris, having the appearance of penis. The great labia have the shape of scrotal folds. The urogenital sinus is present and contains the orifice of urethra and of rudimentary vagina.

IIIrd variant: Male pseudohermaphrodite with conspicuous masculinisation of the genitals.

Group A: The penile part of urethra is formed. Vagina is short and has a common orifice with the urethra into the urogenital sine which is prolonged forwards and is a part of the posterior wall of clitoris, which is similar to penis. The great labia are similar to scrotum.

Group B: The great labia are similar to scrotum. Clitoris is hypertrophic and similar to penis. Vagina is aplastic.

The proposed classification of anomalies of the external genitals and vagina in male pseudohermaphrodites is based on the evaluation of the predominant phenomena of masculinisation of the genitals which is undesirable in subjects with female social sex.

Surgical reconstruction of vulva and vagina in these anomalies has to count with three independent operations:

1. amputation of the hypertrophic clitoris — either isolated or connected with removal of scrotal folds;
2. formation of the urogenital sine and the orifice of vagina;
3. vaginoplasty and kolpopoiesis.

The final task of surgical reconstruction of vulva and vagina in these patients is the formation of a functioning copulation apparatus of the female type.

With the first variant, in group A there may arise the situation that in surgical reconstruction of sex it will be necessary to use vaginoplasty for rudimentary vagina, or kolpopoiesis in case of its absence. With the second variant amputation of the hypertrophic clitoris is necessary, often combined with removal of scrotal or scrotolabial folds, opening of the urogenital sinus, formation of the vagina orifice, and widening of its spaciousness with vaginoplasty or kolpopoiesis operation. In the third variant amputation of the hypertrophic clitoris is necessary, connected with the indispensable removal of scrotal folds, opening of the urogenital sinus (group A) and, ususally, with formation of an artificial vagina. Experience showed that in these cases sigmoidal kolpopoiesis is most feasible.

If the peculiarities of hormonal function of the testicles in a male pseudohermaphrodite actually do not influence the structure of the external genitals after the patient's birth then, in puberty, they are the main factor in formation of some important peculiarities of the phenotype [secondary sex marks]. If it proves difficult to foretell the hormonal properties of the testicles in the prepuberty period then gonadectomy, carried out at this age, may be the method

of aimed correction of phenotype for it helps to avoid undesirable virilisation during puberty. According to our observations removal of the testicles in puberty leads to formation of a neutral pseudoeunuchoid phenotype (Fig. 6). The following substitution therapy with estrogens determines sufficiently feminisation of the subject (Fig. 7 and 8). Prophylactic extirpation of testicles in these patients is indicated also from the oncologic standpoint. Cases of tumour malignancy in dysgenetic testicles are not rare in this disease (Henrion 1963,



Fig. 8. Medicamentous feminisation of a castrated male pseudohermaphrodite (microfollin administered 8 months)

Linquetta 1965, Teter 1960 and others]. Incidence of tumours in testicles in spurious male hermaphrodites is, according to literary data, high, about 20% of these patients are, after having attained the age of 20 years, in danger of malignancy of tubular adenomas and androblastomas (Teter 1960, 1965, Henrion 1963 and others).

Tumours (androblastomas) were found in 9 out of our 18 operated patients, in these cases is included one malignant tumour. So that, in fact, gonadectomy in male pseudohermaphrodites not only has as its main aim the correction of phenotype but serves, at the same time, as prophylaxy against tumours in dysgenetic testicles.

Having in mind some principal standpoints, pointed out above, we treated surgically 18 patients with male pseudohermaphroditism who had female social sex. Gonadectomy was carried out in all of them, and in those who attained the age of 10—11 years substitution therapy with estrogens was started. At

present there is a peroral estrogen — microfolin — available. In virilisation of external genitals we carried out reconstruction of vulva and formation of a functioning vagina in the presence of special indications (11 patients who came of age and wished to start sexual life). Psychological results of the therapy were very obvious. The patients learned, worked, and felt themselves normal girls and women. Their former, often serious, psychological reactions disappeared. Six patients got married and have been leading normal sexual life. One patient adopted, after having married, two children so that — at the age of 42 years — her lifelong dream came true.

SUMMARY

Surgical corrections of sex in male pseudohermaphrodites who have female social sex (personal documents and female, firmly fixed psychosexual orientation) consist of surgical reconstruction of vulva, formation of a functioning vagina, and of gonadectomy with following substitution therapy with estrogens. In these patients tumours often appear in dysgenetic testicles (in 9 out of 18 patients androblastomas were found, including one malignancy). Results of sex correction carried out according to the above principles in 18 patients were satisfactory from the psychological as well as functional viewpoint: the patients got rid of psychopathological reactions, were living a full life, learned, worked, were getting married and led sexual life.

RÉSUMÉ

La conversion chirurgicale au type féminin dans le cas de pseudohermafroditisme masculin

G. A. Savickij

La conversion chirurgicale du sexe chez les pseudohermafroditisme masculin aux symptômes sociaux du sexe féminin (les documents féminins, et l'orientation psychosexuelle féminine innée) est réalisé par la reconstruction chirurgicale de la vulve, de vagine à fonction satisfaisante, et de gonadectomie suivi de thérapie substitutionnelle à l'aide des estrogènes. Dans les testicules dysgénétique de ces malades on a très souvent observé l'apparition des tumeurs (dans neuf cas des dix-huit on a trouvé des androblastomes et, en surplus, une malignisation). Les résultats de conversion du sexe réalisé d'après les principes cités chez 18 des malades sont satisfaisants quand à l'égard psychologique de même que de celui de fonction; les malades sont délibérés des réactions psychopathologiques, ils suivent une vie normale, ils apprennent, ils travaillent, ils se marient et mènent une vie sexuelle normale.

ZUSAMMENFASSUNG

Chirurgische Geschlechtskorrektur auf den weiblichen Typus bei männlichem Pseudohermaphroditismus

G. A. Savickij

Die Geschlechtskorrektur bei männlichen Pseudohermaphroditen mit weiblichem sozialen Geschlecht (Frauendokumente und weibliche, fest fixierte psychosexuelle Orientierung) besteht aus chirurgischer Rekonstruktion der Vulva, Bildung einer funk-

tionierenden Vagina und aus Gonadektomie mit nachfolgender Substitutionstherapie mit Oestrogenen. In dysgenetischen Hoden dieser Kranken entstehen häufig Geschwülste (bei 9 von 18 Kranken wurden Androblastome einschliesslich eines Malignisierungsfalles festgestellt). Die Ergebnisse der Geschlechtskorrektur, die nach den angeführten Grundsätzen bei 18 Kranken durchgeführt worden ist, sind sowohl vom psychologischen als auch funktionellen Standpunkt befriedigend: die Kranken werden der psychopathologischen Reaktionen los, leben ein vollwertiges Leben, lernen, arbeiten, heiraten und leben ein Geschlechtsleben.

RESUMEN

Corrección quirúrgica del sexo al tipo femenino en pseudohermafroditismo masculino

G. A. Savickii

Corrección quirúrgica del sexo en los pseudohermafroditas masculinos que tienen el sexo social femenino (documentos femeninos y la orientación psicosexual femenina firmemente fijada) se compone de la reconstrucción quirúrgica de la vulva, de la formación de la vagina que funciona y de la gonadectomía con siguiente terapéutica de sustitución con estrogénos. En los testículos disgenéticos en estos enfermos se forman frecuentemente los tumores (en 9 de 18 se comprobaron los androblastomas con inclusión de una malignización). Los resultados de la corrección del sexo, realizada según los principios mencionados en 18 enfermos son satisfactorios tanto desde el punto de vista psicológico como desde el punto de vista de función: los enfermos se desprenden de las reacciones psicopatológicas, viven con una vida plenamente valiosa, aprenden, trabajan, se casan y viven de la vida sexual.

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Vlth International Course on Hand Surgery (Dr. Marc Iselin)

The course will take place at the I.N.A.I.L. Centre for Traumatology and Orthopaedics in Rome from 24th to 29th November 1969 under the auspices of the International League for the Saving of the Hand.

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BOOKS

Dr. J. Krenar: **Plastic Surgery in Gynaecology**. Published by SZdN (State Medical Publishing House) in Prague, 1968. 224 pages, 142 illustrations.

This neat and very well designed book resulted from the co-operation of the author, a member of the staff of the Clinic of Plastic Surgery, with the I. Obstetric and Gynaecological Clinic of Jan Ev. Purkyně University in Brno. The author dedicated it with gratitude to the memory of Prof. Dr. Havlásek who had been an ardent initiator of this highly useful co-operation between the two specialties.

The book is divided into a general and a special part, and comprises a survey of the existing, but — not only in this country but also abroad — exceptional, co-operation between gynaecology and plastic surgery, and a chapter on the division of tasks and the method of work. It is supplemented by a Czech and English summary, a list of references and by an index.

The general part is, for those who are seeking information, very expedient because it describes clearly and concisely the methodical approach, principles of physiological surgery, as they had been established by Academician Burian years ago in his, today classical book which is nowadays unavailable, especially to the members of the younger generation. It deals also with those means and methods of plastic surgery necessary for reconstructive procedures in gynaecology, beginning with Z plasty, sliding and advancement of tissues from the vicinity and from remote localities, and ending with free skin grafting on the surface as well as into cavities.

In the special part, the result of the author's experiences, a detailed description of methods and procedures is given of plastic surgery in the repair of gynaecological posttraumatic and postoperative deformations, in the plasty of the wall of vagina, in anterior colporrhaphy, in the repair of vesicovaginal fistula and damage to the urethra, and in congenital aplasia of the vagina. A very important chapter deals with prevention of unfavourable sequelae of scarring after radical vulvectomy. On cases operated on by a team — plastic surgeon and gynaecologist — the author describes, and demonstrates with illustrations, the techniques, evaluates the methods used by gynaecologists until now, points out many important, but often neglected, technical details, and proposes new approaches. He analyzes the cause of complications and failures to gather new data and ideas for a better approach.

These essential parts are logically supplemented by a chapter on operation of the venter pendulus which he, as a plastic surgeon, is very experienced in and may, therefore, share these experiences with those who perform these operations together with another gynaecological surgery, or as an independent intervention.

The book is written lucidly, in a fine language and tersely; the terseness, however, not being to the detriment of the content. Documentation is first-rate. The author, a very gifted draughtsman, drew his own vivid illustrations; clear photographs of conditions before, during and after surgery were supplied by the staff of the Clinic of Plastic Surgery. By its technical and graphic get-up, its arrange-

ment and good paper, the book is one of the best that appeared recently in SZdN.

Though it was written primarily for gynaecologists, the book will find attention and acclaim among other specialists as well who, in their surgical practice, face the necessity of using methods worked out and used in plastic surgery. The publication shows the advantages of co-operation between two surgical fields, enriches both of them with knowledge, new data and ideas, and is a dignified fulfillment of the legacy of Academician F. Burian, the founder of Czech plastic surgery. Let us hope it will not be the last one and will give rise to co-operation of further specialties with plastic and reconstructive surgery.

Prof. Dr. H. Pešková, Clinic of Plastic Surgery, Prague, Czechoslovakia



Surgery of the Hand. Group of Authors.

At the end of 1968 the Bulgarian publishing house "Medicine and Physical Culture" brought out the monograph "Surgery of the Hand". The publishing of this book was of great importance for medical circles for it filled a gap in publications concerning problems of plastic surgery in Bulgaria.

The book was written with great care by a group of surgeons under the leadership of Meritorious Physician of the Republic Professor Dr. Boychev in co-operation with experts known by their contribution to the problem of hand surgery, such as Professor Dr. Kholevich, Ass. Professor Dr. Paneva-Kholevich, Ass. Professor Dr. Ranov, Dr. I. Matev, and Dr. Brozhkov.

The monograph opens with chapters on surgical anatomy of the hand, on preparation of the hand for surgery, and on specific features of operation technique in hand surgery. The next chapter, one of the largest, deals with traumatic damage to the hand and its treatment. All kinds

of injuries are dealt with and classified into cut wounds, contusions and stab wounds. Another chapter discusses the general principles of primary surgical treatment, of primary suture, and of primary skin plasty. Diagnostic methods and treatment of tendon and nerve injuries are dealt with separately.

Burns of the hand — thermic, electric, X-ray and chemical — are described in a separate chapter not only from the standpoint of the mechanism of the injuries but also of the specific peculiarities of these injuries and their treatment.

The second part of the book deals with diseases of the hand which comprise purulent processes, inflammations of the tendons, chronic inflammations of the joints, Dupuytrène's contracture etc.

Tumors of the hand and their treatment are discussed by Prof. Boychev in the third part.

It is only to be regretted that the authors' good intention to give a detailed and full picture of hand diseases and their surgical treatment could not have been entirely realized because of the limited extent of the book. Therefore, problems of reconstructive surgery following injuries are limited to a small chapter on reconstructive surgery after amputations, and problems of congenital anomalies and of rehabilitation are reduced merely to generalities.

Comparison of different surgical methods with the authors' clinical experiences is of great value. The list of references, supplementing each chapter, is also comprehensive.

The book is rather modest in its get-up, the reproduction of many illustrations is, unfortunately, indistinct. It would be also necessary to furnish the second edition with summaries in foreign languages.

To conclude, the book "Surgery of the Hand" is a great contribution and an agreeable surprise in the Bulgarian medical literature.

Dr. Troshev, Varna, Bulgaria

J. Samohýl, J. Šťastná

THE MAIN TYPES OF GRANULATION IN THE ELECTRON-
MICROSCOPIC PICTURE



Fig. 1. Clinical picture of granulations with small amount of collagen at base and some less acute inflammatory changes in the surface layers (1st group, 1st subgroup)



Fig. 2. Clinical picture of granulations with greater amount of collagen at base and with less acute inflammatory changes in the surface layers (2nd group, 1st subgroup)

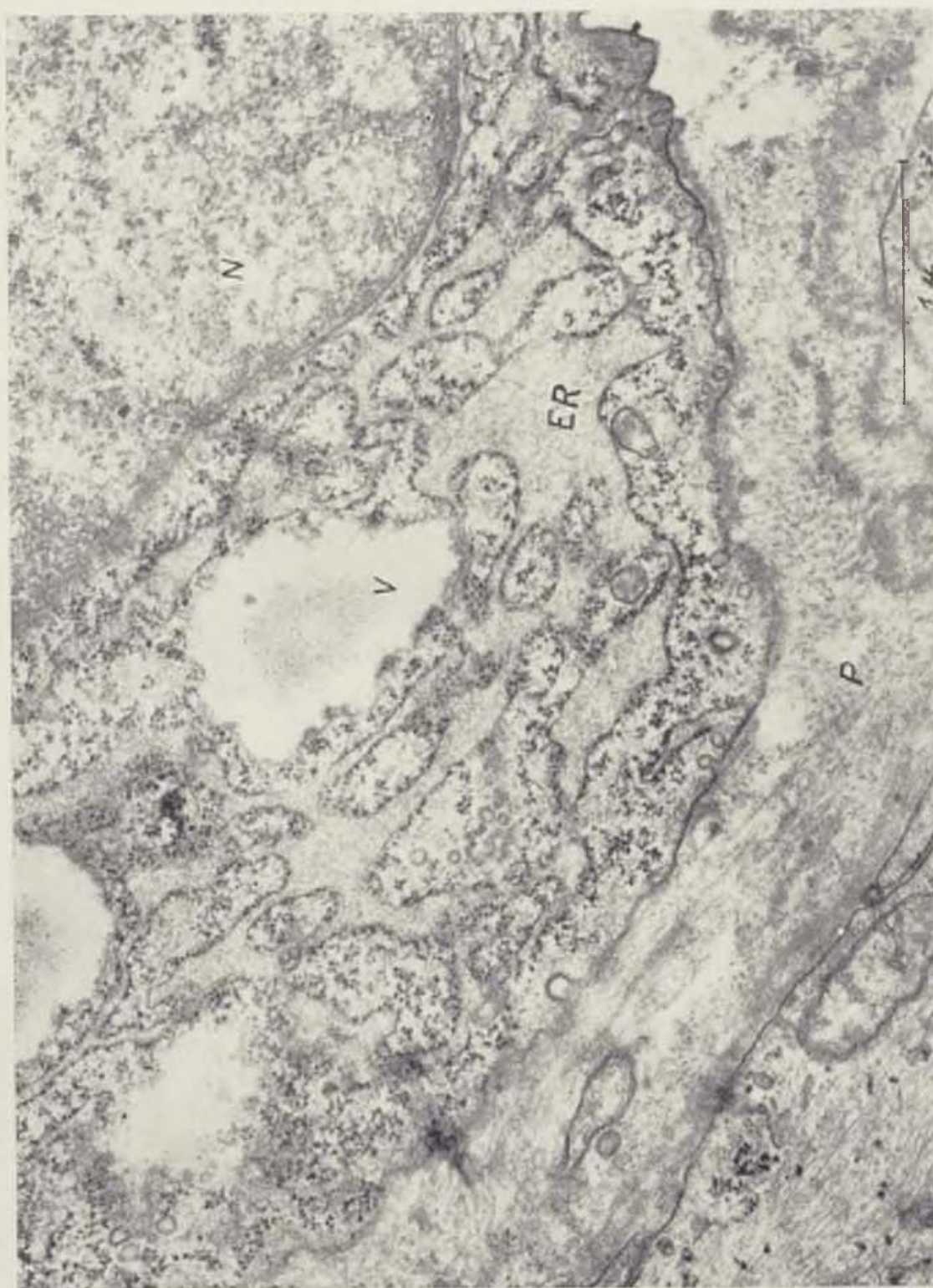


Fig. 3. Part of fibroblast and of extracellular material from granulation tissue of the 1st type. Nucleus (N), cisternae of the rough endoplasmic reticulum (ER), vacuoles (V), filaments (P) in the extracellular material

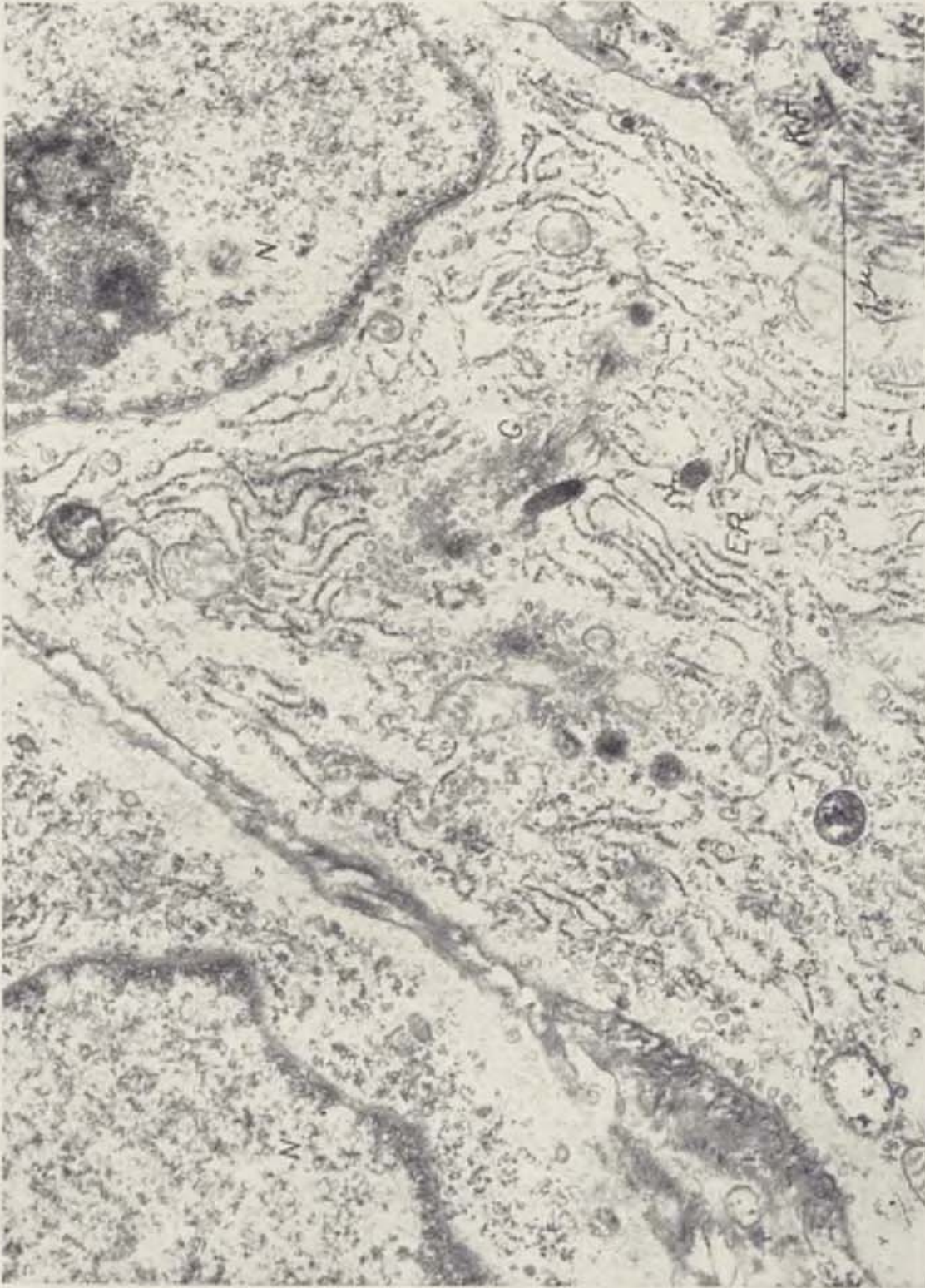


Fig. 4. Fibroblasts and extracellular material from granulation tissue of the 2nd type. Nucleus (N), granulation endoplasmic reticulum (ER), the Golgi apparatus (G), collagen fibrils (KF)

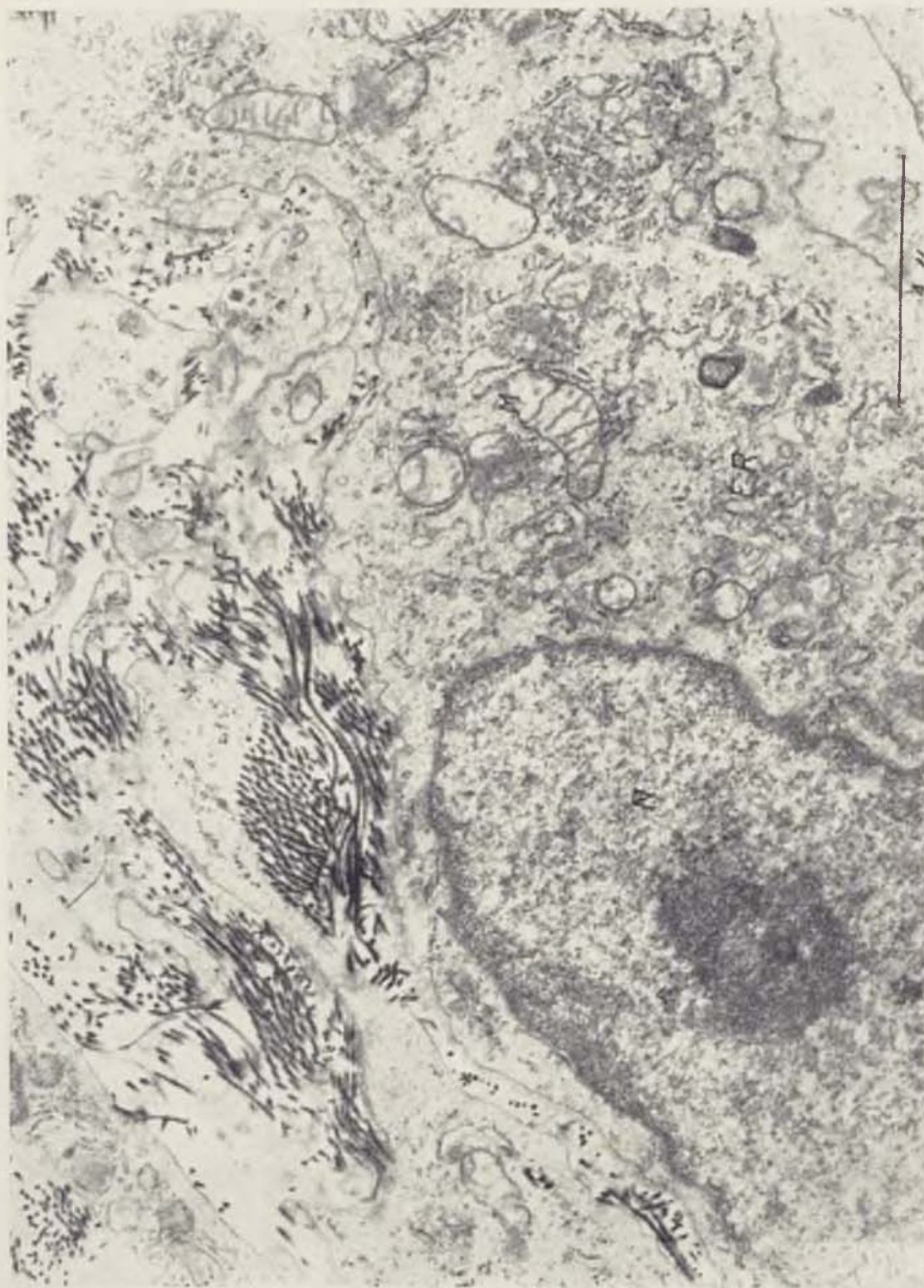


Fig. 5. Part of fibroblast with surrounding tissue from granulation of the 2nd type. Nucleus [N], mitochondria [M], rough endoplasmic reticulum [ER], collagen fibrils [KF]

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