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VIABILITY OF SKIN AND CORIUM GRAFTS IN RATS

J. POSPÍŠILOVÁ, V. KUBÁČEK, J. SAMOHÝL, M. KAFKOVÁ

INTRODUCTION

The healing of skin grafts was investigated by several authors (Gillman et al. 1954, Cramer and Hinshaw 1965, Klein and Rudolph 1972). Most studies deal with morphological changes of the tissue followed by histological methods. Only in the period of advancement of knowledge about collagen (Bornstein 1974, Diegelmann et al. 1975, Bailey and Robins 1976, Kivirikko and Risteli 1976), attention is paid to investigation of collagen metabolism in the grafts (Zika et al. 1973). The importance of collagen metabolism (and its changes depending on different internal and external conditions) for healing of the grafts as well as for healing generally is described in detail in two summary publications (Fundamentals of Wound Management in Surgery 1976 and 1977).

A study of changes of the contents of fundamental components of collagenous tissue in the grafts and their closest surroundings was the subject of our preceding paper (Pospíšilová et al. 1978). The present paper describes dynamic changes in the course of metabolism of the connective tissue. The viability of skin and corial grafts, i.e. the ability of cells to synthesize collagen in various periods of graft healing, was tested in experiments with animals. A method of incorporation of labelled metabolic precursors of cells and collagen was used, which was modified so that collagen synthesis could be followed also in clinical praxis.

MATERIAL AND METHODS

The experiments were carried out with male rats of the strain Wistar 12 weeks old of average weight 185 ± 10 g. Each experimental group contained 8–10 animals. One autograft of dimensions 20×15 mm was sewn on the shaved back of each animal under total thiopental narcosis. The autograft was obtained from the same place, split into either thin or thick dermoepidermal graft or corium graft. When transplanted, the graft was rotated by 180° . The treatment of the grafts is described in detail in the preceding communication (Pospíšilová et al. 1978). Viability of the transplants was checked in the course of healing on the 1st, 4th and 8th day after operation.

Animals were sacrificed on given days, grafts excised and cut in frozen state into small pieces of tissue. They were immersed in an incubation solution (3 ml of Krebs—Ringer solution, pH 7.4, containing 22.4 mM glucose and 2.8 mM proline) and preincubated at 37 °C for 30 min. Afterwards radioactive precursors were added: 100 μ Ci [3 H] thymidine for investigation of the activity of cell division and 20 μ Ci [14 C] proline for investigation of synthetic activity of fibroblasts. The incubation continued on air at 37 °C for next 3 hours. Isotope incorporation was stopped by quick freezing to -20 °C.

Samples were homogenized in liquid nitrogen and nonincorporated radio-nuclides were removed by repeated washing with 80 % ethanol (up to loss of its activity). They were dried by ether, weighed and divided into aliquots. In some aliquots collagenous proteins were estimated after separation from the non-collagenous proteins by repeated gelatinization (at 130 °C under pressure for 3 hours). The amount of collagen was determined as hydroxyproline and its radioactivity was measured by a scintillation spectrometer Mark II (Nuclear Chicago) using the procedure described previously (Pospíšilová, Tykva, Hurych, in press).

Nitrogen of non-collagenous proteins was determined in the sediment after gelatinization and its activity was measured too.

In other aliquots DNA mass and activity were determined after DNA isolation (described in the same communication).

RESULTS

Changes in cell content, in their division activity and in the amount of synthesized hydroxyproline (collagen) per cell in the course of 8 days' healing

Table 1. Average values (\pm S. E.) of DNA content (in μ g/mg tissue wet weight) and its specific activity (in d. p. m./mg of DNA) in different skin grafts

			DNA				HYPRO/ DNA
			Amount		Spec. activity		
			Age (days)	$\mu\text{g}/\text{mg w. w.}$ \pm S. E. $\cdot 10^{-3}$	%	DPM/ $\mu\text{g} \cdot 10^{-2}$	%
Skin grafts	Thin	1	305 ± 10	= 100	370	= 100	6.8
		4	1100 ± 79	360	240	65	1.3
		8	222 ± 12	73	1050	283	5.1
	Thick	1	360 ± 17	= 100	420	= 100	0.9
		4	381 ± 5	106	10	23	0.7
		8	187 ± 8	52	550	130	2.6
Corium grafts		1	90 ± 10	= 100	50	= 100	67.8
		4	60 ± 7	67	40	80	15.0

of various grafts are shown in Table 1. The highest increase in the number of cells is in a thin dermoepidermal autograft taken on the 4th day, in other grafts the number of cells decreases. The most intense synthesis of DNA from the labelled precursor takes place also in the thin autograft on the 8th day. It also increases after preceding considerable decrease in a thick autograft, but the increase is relatively lower. In the 4 days' corium autograft the incorporation decreases, the older grafts were inactive.

Collagen synthesis per cell is also the most intensive in the thin autograft after 8 days' healing. The high synthetic activity of cells of the corium autograft in the course of the first day of experiment is remarkable.

Collagen content and rate of [^{14}C] proline incorporation into hydroxyproline of connective tissue of the autografts are shown in the next Table. Collagen content decreases absolutely as well as relatively in all three types of autografts; the decrease is the highest in the corium autograft and the lowest in the thick dermoepidermal one. Specific activity of hydroxyproline increases from initial values up to the 8th day of healing. The initial values after one day of healing are different. The highest value was observed in the thin autograft, the lowest one in the corium autograft, in which the highest relative increase occurs, however. The thick dermoepidermal graft undergoes the smallest changes in the synthetic activity of cells as well as in the decrease of collagen mass.

Content of non-collagenous proteins in autografts of different age (Table 3) and changes in their activity indicate dynamics of the inflammatory re-

Table 2. Average values (\pm S. E.) of total hydroxyproline content (in $\mu\text{g}/\text{mg}$ tissue wet weight) and its specific activity (in d. p. m./mg of hydroxyproline) in different skin grafts

			Hydroxyproline			
			Amount		Spec. activity	
Age (days)			$\mu\text{g}/\text{mg w. w.}$ \pm S. E.	%	DPM/mg \pm S. E.	%
Skin grafts	Thin	1	19.1 ± 1.9	= 100	305.9 ± 32.0	= 100
		4	21.3 ± 2.8	111	368.6 ± 27.9	121
		8	12.8 ± 2.2	67	1244.2 ± 52.8	408
	Thick	1	29.8 ± 3.8	= 100	122.6 ± 11.6	= 100
		4	22.9 ± 2.0	77	122.7 ± 20.9	100
		8	21.7 ± 5.5	73	216.1 ± 41.9	177
Corium grafts		1	33.3 ± 3.1	= 100	16.5 ± 1.6	= 100
		4	23.7 ± 3.3	81	80.9 ± 3.6	505
		8	16.4 ± 3.5	49	111.6 ± 10.2	697

Table 3. Average values (\pm S. E.) of nitrogen content (in $\mu\text{g}/\text{mg}$ tissue wet weight) and specific activity (in d. p. m./mg of nitrogen) in different skin grafts

			Nitrogen			
			Amount		Spec. activity	
			$\mu\text{g}/\text{mg w. w.}$ \pm S. E.	%	DPM/mg \pm S. E.	%
Skin grafts	Thin	1	98.9 ± 4.2	= 100	2039.9 ± 237.3	= 100
		4	91.1 ± 9.9	92	12748.0 ± 929.7	625
		8	65.7 ± 6.1	66	16850.2 ± 1413.7	867
	Thick	1	61.4 ± 3.1	= 100	4245.5 ± 18.5	= 100
		4	128.6 ± 7.2	209	9188.9 ± 1046.4	216
		8	100.4 ± 11.8	163	9457.8 ± 450.9	223
Corium grafts		1	16.1 ± 0.3	= 100	9986.7 ± 651.7	= 100
		4	14.7 ± 0.8	92	53262.2 ± 3564.3	450
		8	16.1 ± 2.2	100	61420.5 ± 3548.7	519

action. In the thin graft, at relatively high initial content of the proteins, their low specific activity was demonstrated, which increases in the course of healing. In the thick graft the changes of both investigated values are less pronounced as compared with the preceding case. In the corium grafts the content of non-collagenous proteins is initially low and changes only little, but their activity is high and continues to increase.

DISCUSSION

Healing is the normal response of organism to an injury. Since it belongs to basic biological properties, many attitudes to its investigation and evaluation exist. The essence of the whole mechanism of healing is certain equilibrium state, which occurs between degradation and synthesis of the basic structural glycoprotein of connective tissues — collagen. Collagen is formed in fibroblast cells, which belong among facultative phagocytes. These cells survive even under less suitable external conditions. They are demanding only in the period of division, when they require optimum of oxygen. The synthesis of collagen of various types proceeds in fibroblasts according to the genetic code similarly to synthesis of other proteins. Some peculiarities of biosynthesis of collagen are described by several authors (Miller and Matukas 1972, Jackson and Bentley 1975, Kivirikko and Risteli 1976) and aid to the investigation of collagen metabolism. One of them is intracellular hydroxylation of proline to hydroxyproline, which is an amino acid typical for connective tissues.

The other, equally important process is collagen degradation. Collagen is degraded by lysosomal enzymes of macrophages. This process accelerates if the basic protein is denatured. Under certain conditions the denaturation takes place even at body temperature, at 38—39 °C.

In the process of healing of autografts a suitable equilibrium state between synthesis and degradation of connective tissue represents a very important phase. The connective tissue which substitutes the denatured and damaged one must be synthesized in such amount so that the graft may be firmly connected with the wound bed. An excess of the connective tissue causes a deformation of the graft, its deficiency leads to a release of the graft.

From this point of view the thin dermoepidermal autograft exhibited best response in our short-termed experiments in rats. It did not contain such amount of damaged collagen so that the healing process might be burdened by its degradation (as in the thick or corium grafts). The number of cells and especially their division activity were high. The content of collagen per cell was higher than in the thick graft and had an increasing tendency. The initial high content of collagen in the corium autografts was reduced to one half in the course of 8 days. Collagen synthesis and its deposition as determined by means of specific activity of hydroxyproline proceeds also at the absolutely highest rate in the thin grafts. These grafts exhibit high metabolic readiness and perhaps also an adequate inflammatory reaction thanks to the high activity of non-collagenous proteins. The thick graft is little active from this point of view. The corium graft is burdened by degrading a great amount of old damaged collagen, but has at least an advantage in the beginning of the healing process in the high effectiveness of its cells in collagen synthesis (the ratio hydroxyproline/DNA). However, if it is not epithelized, it cannot become a permanent cover.

SUMMARY

A radioisotope method enabling to study the viability of fibroblasts also in clinical praxis was tested in experiments on animals.

Good clinical experience with the use of thin dermoepidermal grafts was confirmed by comparing dynamics of metabolic processes connected with synthesis and degradation of connective tissue in different types of autografts.

RÉSUMÉ

Durée de service de la peau et des coriogreffons sur des rats

Pospíšilová J., Kubáček V., Samohýl J., Kafková M.

Pendant des expériences des animeaux on a vérifié la méthode radioisotopique permettant de suivre la durée des fibroblastes aussi dans la pratique clinique.

Pendant les comparaisons de la dynamique des processus métaboliques liés à la synthèse et à la désintégration des ligaments dans de différents autogreffons, une bonne expérience clinique de l'application des greffons dermoépidermiques fins a été attesté.

ZUSAMMENFASSUNG

Lebensfähigkeit der Haut und der Koriumtransplantate bei Ratten

Pospíšilová J., Kubáček V., Samohýl J., Kafková M.

In Tierversuchen wurde eine Radioisotopmethode geprüft, die es möglich macht, die Lebensfähigkeit der Fibroblaste in klinischer Praxis zu verfolgen.

Beim Vergleich der Dynamik der mit der Synthese und dem Abbau des Bindegewebes verbundenen Stoffwechselprozesse in verschiedenen Autotransplantaten hat sich die gute klinische Erfahrung mit der Anwendung dünner Dermoeypidermtransplantate bestätigt.

RESUMEN

Persistencia de los trasplantes de piel y de corion en las ratas

Pospíšilová J., Kubáček V., Samohýl J., Kafková M.

En los experimentos realizados con animales fue comprobado el método de radioisótopos, que posibilita estudiar la persistencia de los fibroplastos incluso en la práctica clínica.

En la comparación de la dinámica de los procesos metabólicos relacionados con la síntesis y la reducción de los ligamentos en diversos autotransplantates se corroboró la buena experiencia clínica del uso de delgados trasplantes dermoepidérmicos.

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CLINICAL GENEALOGY OF INBORN DEVELOPMENTAL DEFECTS OF UPPER EXTREMITIES

Š. GUZANIN

A great many specialists have for years been trying hard to learn more about the aetiology of inborn defects, including defects of the extremities, particularly those affecting the hand as man's most important working organ. A great many expert studies have been published in Czechoslovak and foreign literature analyzing the causes of the development of inborn defects in the upper extremities.

Opinion has varied as to the participation of such causes. In the ancient past, the birth of a child affected by some sort of malformation used to be put in connection with all sorts of natural phenomena. Later on, any anomaly or malformation found at the birth of a child used to be put down to accidental, absolutely unconditioned and unalterable defects of sex cells. This latter opinion was characteristic of the period of up to the 19th century with the principle of heredity predominant in explanations of the causes of inborn defects. The foundation of genetics — the science of heredity — were laid by Gregor Mendel as early as 1865 but the results of his experimental studies failed to attract the attention of the scientific world until the year 1900. It was only at the beginning of this century that the explosive development of genetics started for real.

The 19th century also saw the beginnings of experimental teratology though its real development did not start until the middle of the 20th century. The results of animal experiments and clinical observations made some of the specialists swing to the other extreme in that they regarded external factors as the main and decisive cause of inborn errors while, at the same time, underrating genetic factors.

At the beginning of the last century, Béchet (1829), quoted according to Tomo et al. [7], added a great deal to the study of different malformations of the extremities by making use of the embryological knowledge of the time. Later on, Harlin (1921), Schultz (1922), Scot (1923), quoted according to Simun et al. [6], devoted their works to elucidating problems of the specific types of heredity in syndactyly and polydactyly while in their own original studies, based on detailed investigations of 88 probands with hand mal-

formations, they were able to state that in 30 % of the children under observation there were records of similar inborn errors running in the families. Nejedlá [1952] described 10 cases of children with malformations of the upper extremities, but was able to ascertain hereditary involvement in merely 2 of the cases; she quoted Warkany [1947], who was specially concerned with the aetiological problems of limb malformations.

In an effort to explain the origin of inborn errors affecting the extremities, Swanson et al. [5] believed most of the limb malformations to be conditioned by embryonal differentiation disturbances due to individual genetic predisposition. According to Kučera [1944] the aetiology of inborn errors is an extremely complex problem, probably a manifestation of failure or inadequacy of the adaptation abilities of maternal and foetal organisms. Slabý [1968] believes that most of the inborn defects can be put down to a simple disorder of morphogenesis in the early stages of development. Vršanský et al. [8] reason in their work that provided inborn errors of extremities are hereditary they must be of the autosomal dominant type. Polívka et al. [3] make distinction between two groups of defects: one with limb malformations developing on a hereditary basis, the other due to external noxae active in the stage of organogenesis of intrauterine development. The problems involved in explaining the causes of inborn defects of the upper extremities were also dealt with by: Andrianov et al. [1], Brunecký [2], Revazov et al. [4], Woolf et al. [9], Wynne-Davies [10], Hoefnagel et al. [1966], Černý [1967], Sagerová et al. [1968], Gross et al. [1968], Comings et al. [1970], Conen et al [1971], and many others.

At our own department we have for years now been studying the problems of morphological inborn defects with a special view to their aetiology. The present study is mainly concerned with the hereditary [genetic] causes of inborn errors of the upper extremities.

MATERIAL AND METHODS

350 boys and girls suffering from malformations of the upper extremities, particularly the hand, were hospitalized and surgically treated at the Košice department of plastic surgery in the course of 25 years, i.e. from 1953 to 1978. To cope with all these cases, a seven-page genealogical-epidemiological questionnaire was devised -- in addition to the existing clinical records. The questionnaire consists of three parts. Part one (A) concerns the proband affected by some sort of inborn developmental extremity defect. Part two (B) concerns the proband's mother, her brothers and sisters and relations. Part three (C) concerns the proband's father, his brothers and sisters and relations.

The questionnaire, which the probands' parents were asked to fill in in the privacy of their homes, was kept supplemented and improved as a result of personal interviews with the patient's parents and with the patients themselves so long as they were already grown up. In this way we were able to collect 320 filled in or supplemented questionnaires out of a total number of 350 patients under observation, which represented 91.4 %.

RESULTS

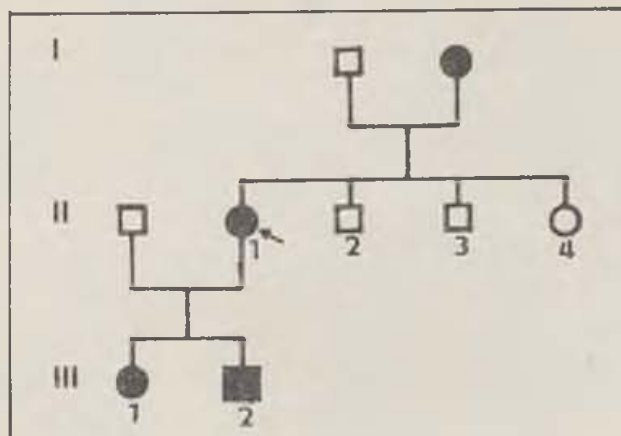
Following an evaluation of 320 questionnaires and on the basis of personal interviews with the affected patients, their parents and relations, 104 cases could be assumed to have been due to endogenous (genetic) causes, which represented 32.5 % of the total number of the subjects under observation. 86 cases were evaluated as being due to exogenous (external) causes, which amounted to 26.5 %. No causal connection could be given in a total of 130 cases (i.e. 41 %).

Tab. 1. Genetic causes of inborn developmental upper limb defects

Affection	Number	Rate	
Proband's relations	10	9.6	
Mother	26	25.0	44.2
Mother's relations	20	19.2	
Father	16	15.4	46.2
Father's relations	32	30.8	
Total	104	100	

A subsequent, more detailed analysis of the cases of those affected by inborn defects of the upper extremities, particularly the hand, due to endogenous causes revealed the same sort of affection in the probands' siblings

Tab. 2. Camptodactyly (pedigree of proband P. M. cl. n. 7705)



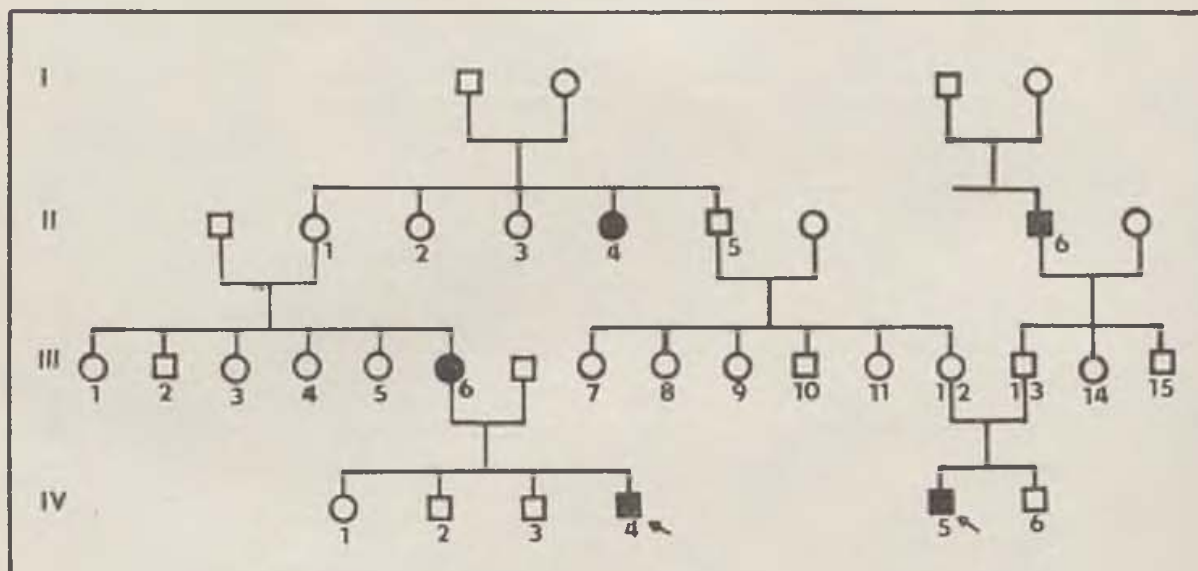
in 10 families, a proportion of 9.6 %, in the probands' mothers in 26 cases, a proportion of 25 %, in the mothers' parents and other relations in 20 (19.2 %) cases. Inborn defects of the upper extremities similar to those in the probands themselves were recorded in 44.2 % on the side of the mothers and their relations.

The probands' fathers were affected by similar inborn defects in 16 cases (15.4 %), the fathers' parents and other relations in 32 cases (30.8 %). The

incidence rate of inborn defects similar to those in the probands on the side of the fathers and their relations was found to be 46.7 %. Tab. 1.

The following facts were established in constructing the family trees of probands affected by the particular types of inborn developmental upper limb defects:

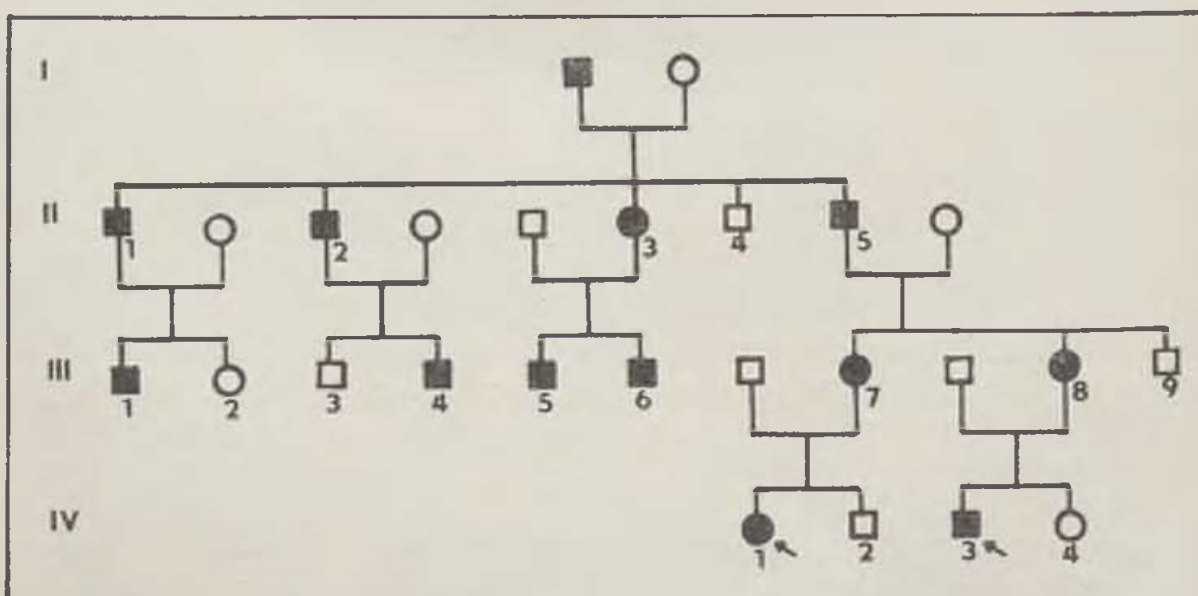
Tab. 3. Syndactyly dig. 3.—4. man. u. (pedigree of probands F. M. cl. n. 5537, F. I. cl. n. 9074)



The incidence of camptodactyly in three generations: the patient herself (P. M. cl. notes No. 7705), her daughter and son as well as the patient's mother. Tab. 2.

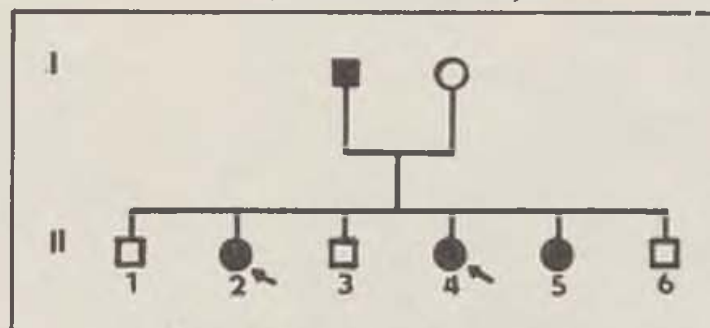
The incidence of syndactyly (skin form) in three generations: proband (F. M. cl. notes No. 5537), his mother, and his grandmother's sister.

Tab. 4. Syn-polydactyly (pedigree of probands V. D. cl. n. 8296, B. V. cl. n. 9010)



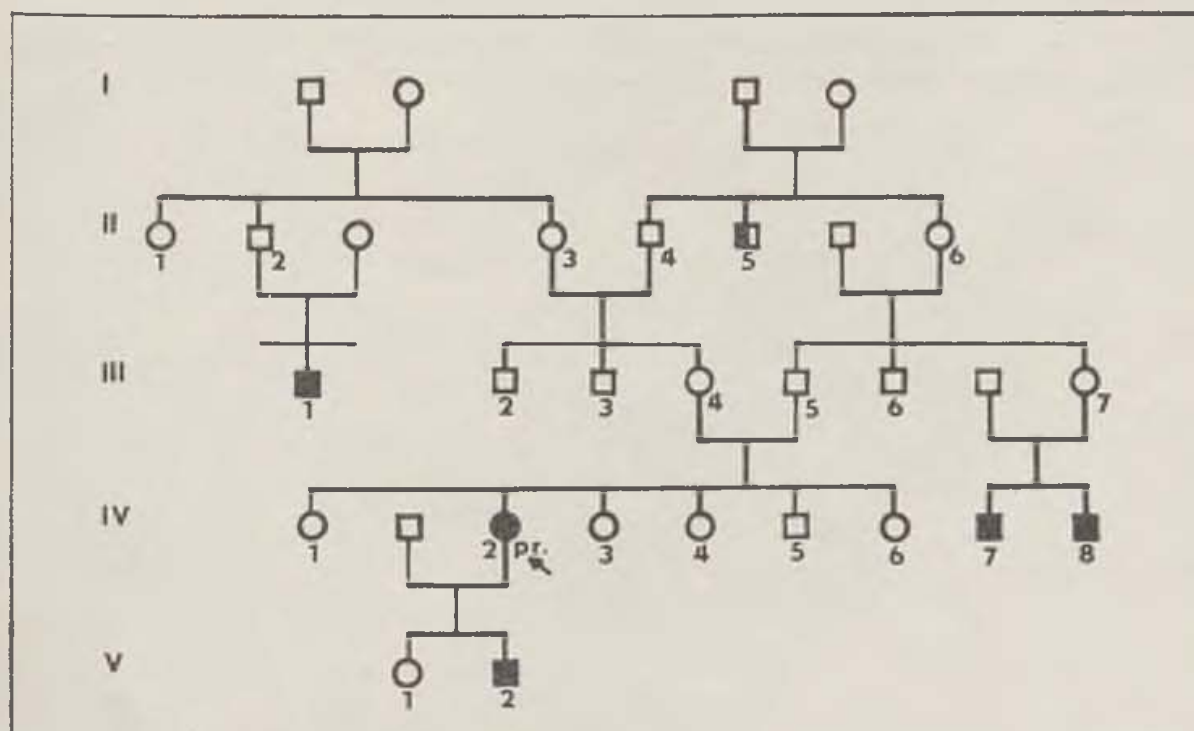
Proband (F. I. cl. notes No. 9074), his mother unaffected — unlike his grandfather on the father's side and his other grandfather's sister on the mother's side. The mothers of the two probands are related (cousins). Tab. 3.

Tab. 5. *Adactylia longitudinalis terminalis medialis* (pedigree of probands V. A. cl. n. 1052, V. M. cl. n. 3936)



The incidence of syn-polydactyly was recorded in four generations. The proband under observation (V. D. cl. notes No. 8296) and his female cousin (B. V. cl. notes No. 9010). Similar defects were found in the mother, grandfather and greatgrandfather. Also: four male cousins of the

Tab. 6. *Hemimelia longitudinalis terminalis ulnaris* (pedigree of proband A. E. cl. n. 2873)



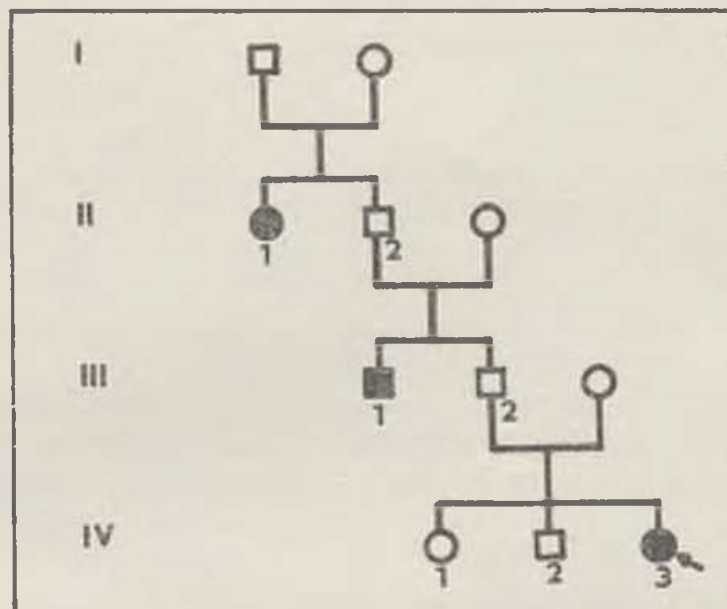
proband's mother, two brothers and one sister of his grandfather on the mother's side. Tab. 4.

The incidence of medial adactyly (*adactylia longitudinalis terminalis medialis* — cleft hand) in two generations. Three girls affected (V. A.

cl. notes No. 1052, V. M. cl. notes No. 3936, the third not hospitalized yet). Three boys unaffected. The father similarly affected. Tab. 5.

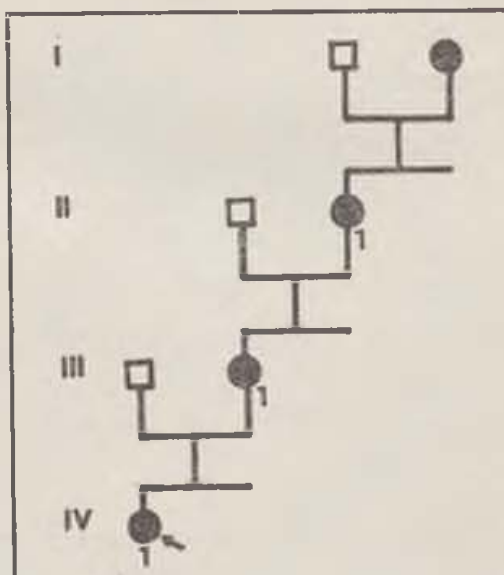
The incidence of ulnar hemimelia (hemimelia longitudinalis terminalis ulnaris) in three generations. The proband (A. E. cl. notes No. 2873)

Tab. 7. Polydactylia radialis (pedigree of proband S. S.)



gave birth to a boy similarly affected. The proband's two male cousins affected and so is a male cousin of the proband's mother. The II-5 affection involves inborn hearing defect. Tab. 6.

Tab. 8. Polydactylia medialis (pedigree of proband S. S. cl. n. 10368)

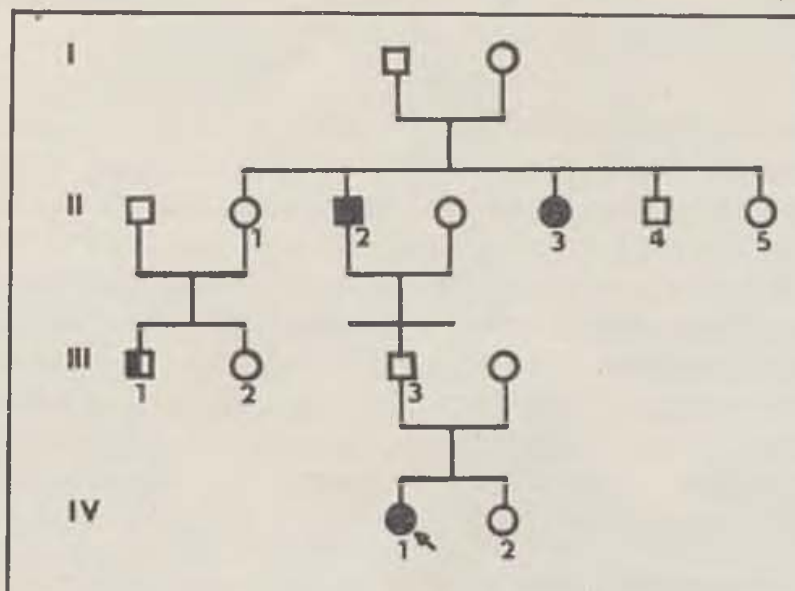


The incidence of radial polydactyly (polydactylia radialis) was observed in three generations: proband (S. S. — treated as outpatient), his grandfather and his sister. The proband's father and mother unaffected.

A male cousin of the proband's father affected (III-1) by hare-lip and cleft palate. Tab. 7.

The incidence of medial polydactyly (polydactylia medialis) was seen in four generations. The proband herself (S. S. cl. notes No. 10368), her mother, grandmother and great-grandmother all affected by similar defects. Tab. 8.

Tab. 9. Polydactylia ulnaris (pedigree of proband Č. K.)



The incidence of ulnar polydactyly (polydactylia ulnaris) in three generations: the proband (Č. K. treated as outpatient), his father's brother and grandfather's sister. Tab. 9.

The above listed examples of family pedigrees appear to give a clear enough idea of the importance of endogenous (genetic) factors for the development of different kinds, types and forms of inborn defects of the upper extremities.

DISCUSSION

With reference to the present state of literary knowledge and our own clinical experience we can conclude that inborn developmental defects in upper extremities are due either to endogenous (genetic) or to exogenous causes. Inborn errors resulting from defective genetic material are called hereditary while those resulting from external causes (factors) with their harmful effects in the course of intrauterine development are referred to as congenital.

Nevertheless, any precise distinction between the factors involved proves to be an extremely difficult task for each trait, disease or error (anomaly, malformation) always result from the co-action of endogenous and exogenous factors with heredity playing a more significant role at one time and the effects of external environment at other times. The endogenous and exogenous causes can be said to constitute a dialectic unity. There have been cases of

genetic factor being altered under the impact of external environmental effects such as in the case of monozygotic twins, one of whom was affected by limb malformation while the other was developed normally in spite of fact that they both shared the same genetic background.

Problems of human teratology were discussed at the 1960 international congress of teratologists in London. Proceeding from 25 years of experience in experimental work and clinical observations, some of the participants estimated that inborn errors in man were due to alterations in genes in 20 %, to alterations in chromosomes in 10 % (the two combined — 30 %), to the presence of viruses in 10 % while the causes of the remaining 60 % of the cases involved remained obscure.

As our own analysis of the cases followed suggests, endogenous (genetic) factors are believed to be responsible for 32.5 % cases of inborn limb defects in children. In following up the particular forms of inborn effects affecting the upper extremities, especially the hand, hereditary connection was found in 50 % cases of camptodactyly, in 50 % cases of the skin form of syndactyly, in 30 % cases of syn-brachydactyly, in 70 % cases of syn-polydactyly, in 50 % cases of medial aplasia of the hand, in 50 % of ulnar aplasia of the hand, and in 50 to 60 % cases of polydactyly. A more detailed analysis of each of the forms of polydactyly revealed 20 % hereditary connection in radial polydactyly, 100 % in medial polydactyly, and 50 % in ulnar polydactyly.

Owing to exogenous (external) causes identified in 26.5 % and in 41 % of the cases involved we were unable to put into the connection any particular cause to help us explain the development of congenital defects of the extremities. This particular group of inborn developmental limb defects probably included causative factors so far unidentified. It should also be noted that this group includes cases, in which it proved impossible to collect all the data required. Thus, for instance, the probands' parents often failed to give data on their own parents' brothers and sisters, on their grandparents and their brothers and sisters or on other near or distant relations. Presumably, the proportion of endogenously based inborn defects would have been higher than that reported here had the data been more complete.

As regards the probands' mothers, the rate of incidence of similar inborn defects (25 %) was higher than the fathers' (15.4 %), however, as regards the pedigree, the rate of incidence of similar inborn defects on the side of the mother and her relations (44.2 %) was not all that different from that of the paternal side (46.2 %).

CONCLUSION

Studies of literature and of our own clinical material made us reach the conclusion that it is inevitable not only to treat cases of inborn developmental limb defects but also to try and prevent them. However, effective prevention is out of the question unless the actual causes of such defects are recognized. Purposeful and effective prophylaxis depends on our knowledge of the harmful factor responsible for inborn errors.

Medical consultative services depend, to a large extent, on the knowledge of the genetic background of those engaged to be married, newly married couples and their parents. A medical specialist should be able to provide a full answer to those already affected by some sort of inborn limb defect, or to healthy individuals — parents of limb-affected children — as to the chances of bringing to life healthy offspring.

Our conclusions only corroborate geneticists' knowledge, though to make practical use of the knowledge it is desirable to build up (or to complete the construction) genetic centres (departments, clinics, and other units) all over Czechoslovakia in keeping with the relevant programme adopted several years ago. Such units (their staff) are expected to ensure: 1. outpatient follow-up of those affected by inborn defects, and that on the basis of a uniform nation-wide system, 2. consultative medical services for prospective spouses, newly married couples and parents, 3. specialist co-operation with those branches of health care responsible for the treatment (including surgical treatment) of inborn defects, including department of plastic surgery. 4. scientific research, without which genetics as a science would be unable to make progress.

J. H.

SUMMARY

Out of 350 boys and girls hospitalized and surgically treated at the Košice Department of Plastic Surgery 320 of those followed up for inborn defects of upper extremities, particularly the hand, were processed genealogically. Endogenic (genetic) causes were found responsible for inborn limb defects in 104 (32.5 %) cases. Similar defects were found to have affected the probands' siblings in 10 (9.6 %) families, the probands' mothers in 26 (25 %) cases, the mothers' parents and other relatives in 20 (19.2 %) cases. There were 16 (15.4 %) cases of the fathers being affected by similar inborn errors, 32 (30.8 %) cases of the fathers' parents and other relations being affected. Family trees were reconstructed to show the incidence of inborn defects of the hand (camptodactyly, syndactyly, syn-polydactyly, adactylia medialis, hemimelia ulnaris, polydactylia radialis, medialis et ulnaris) in two three and four generations.

RÉSUMÉ

Généalogie clinique des défauts d'évolution innés des extrémités supérieures

Guzanin Š.

Des 350 garçons et filles hospitalisés et traités opérativement à la clinique de la chirurgie plastique à Košice, nous avons élaboré généalogiquement 320 cas des malades affectés par des défauts innés des extrémités supérieures, surtout de la main. Nous avons constaté une cause endogène (génétique) de l'affection innée des extrémités chez des enfants dans 104 cas (32,5 %). Des frères et soeurs es patients examinés étaient affectés par un défaut pareil dans 10 (9,6 %) familles, les mères des patients examinés dans 26 (25 %) cas, les parents de la mère et d'autres parents dans 20 (19,2 %) cas. Les pères des enfants examinés étaient affectés par un défaut inné pareil dans 16 (15,4 %) cas, les parents du père et d'autres parents dan 32

(30,8 %) cas. On a établi des généalogies dans lesquelles la présence des défauts innés de la main (camptodactylia, syndactylia, synpolydactylia, adactylia medialis, hemimelia ulnaris, polydactylia radialis, medialis et ulnaris) a été enregistrée dans 2, 3 et 4 générations.

ZUSAMMENFASSUNG

Klinische Genealogie der angeborenen Entwicklungsfehler der oberen Extremitäten

Guzanin Š.

Von 350 hospitalisierten und operativ gelösten Jungen und Mädchen in der Klinik der plastischen Chirurgie in Košice verarbeiteten wir genealogisch 320 Fälle, die von angeborenen Fehlern der oberen Extremitäten, namentlich der Hand betroffen waren. In 104 (32,5 %) Fällen fanden wir eine endogene (genetische) Ursache des angeborenen Fehlers der Extremität. Mit ähnlichem Fehler wurden die Geschwister des Probanden in 10 (9,6 %) Familien, die Mütter des Probanden in 26 Fällen (25 %), die Eltern der Mutter und andere Verwandte in 20 Fällen (19,2 %) heimgesucht. Die Väter wurden mit ähnlichem angeborenen Defekt in 16 Fällen (15,4 %), die Eltern der Väter und andere Verwandte in 32 Fällen (30,8 %) heimgesucht. Es wurden Stammbäume zusammengestellt, in denen das Vorkommen der angeborenen Handdefekte (camptodactylia, syndactylia, synpolydactylia, adactylia medialis, hemimelia ulnaris, polydactylia radialis, medialis et ulnaris) in zwei, drei und vier Generationen erfasst wurde.

RESUMEN

Genealogía clínica de los defectos congénitos en las extremidades superiores

Guzanin Š.

De 350 jóvenes de ambos sexos hospitalizados y tratados en la Clínica de Cirugía Plástica de Košice, hemos elaborados los datos de 320 casos afectados con defectos congénitos en las extremidades superiores, particularmente en las manos. Comprobamos en 104 (32,5 %) de los casos endógenos una causa genética de la afección. Fue comprobado que en 10 casos (9,6 %) los hermanos del afectado sufren de defectos congénitos similares, en 26 casos (25 %) las madres y en 20 casos (19,2 %) los abuelos u otros familiares. Los padres sufren de similares defectos congénitos en 16 casos (15,4 %) y los abuelos u otros arientes en 32 casos (30,8 %). Fueron elaborados árboles genealógicos en los que se registraron las frecuencias de aparición de defectos en brazos (camptodactilia, sindactilia, sinpolidactilia, adactilia medialis, hemimelia cubital, polidactilia radialis, medialis y cubital) en dos, tres y hasta 4 generaciones.

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VENOUS CANNULATION IN CHILDREN WITH EXTENSIVE BURNS



Fig. 1. Patient S. T., age 9 years, b.w. 35 kg, 3rd degree burns extending over 63 % of body surface, on day 2 after admission and after relief incisions.



Fig. 2. Patient S. T., silastic cathether introduced percutaneously through burned areas into left subclavian vein. Areas already covered with allo (homo-) grafts

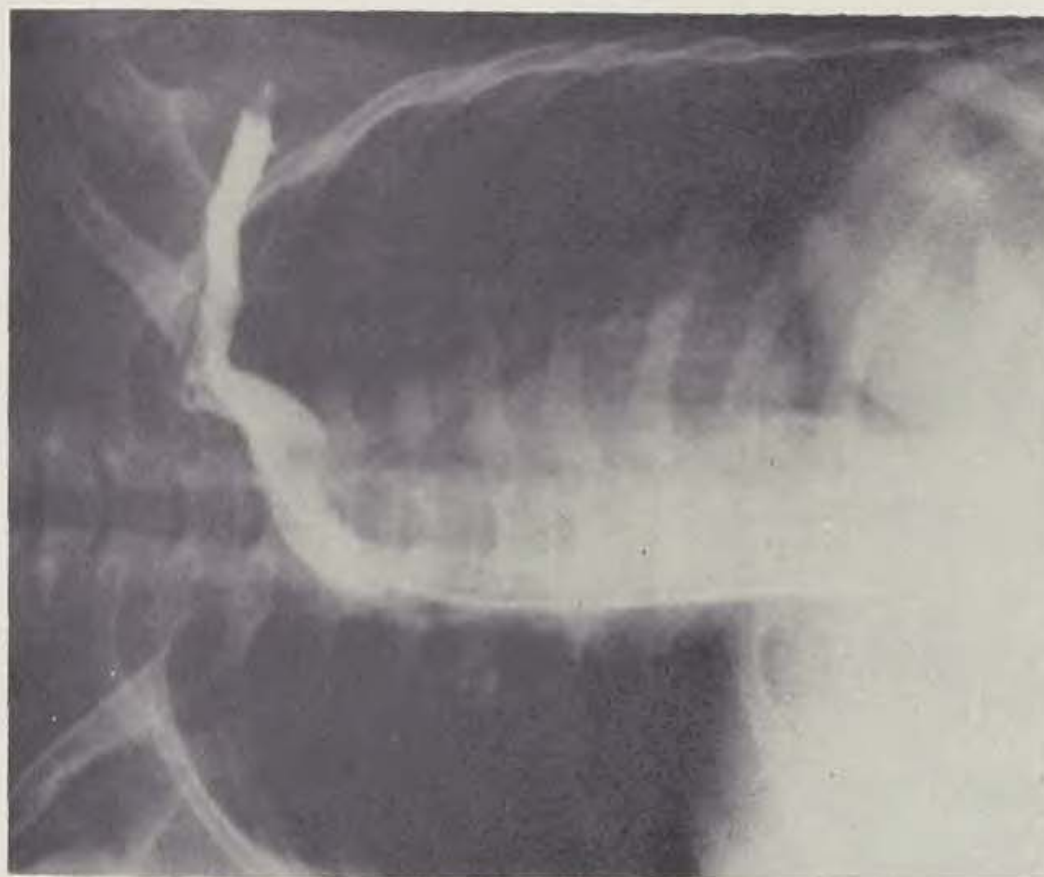
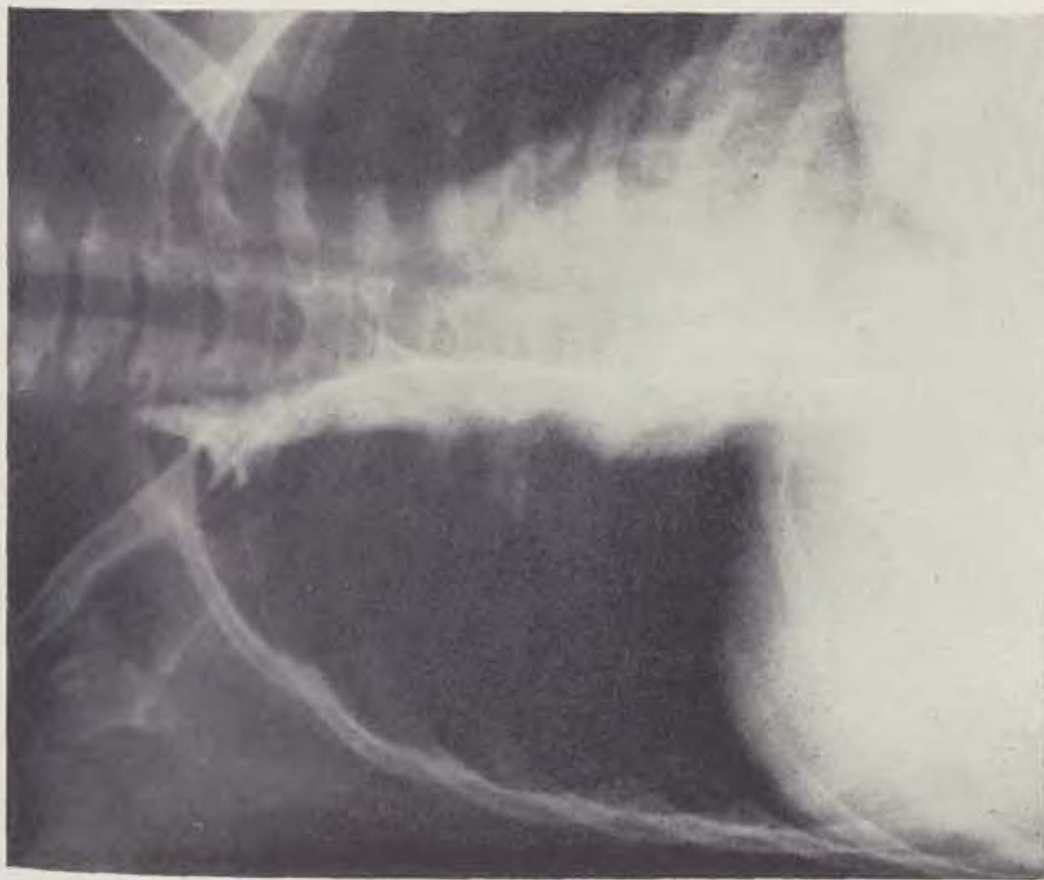


Fig. 3. Patient S. T., superior cavography. Homogenous superior vena cava contrast filling without signs of stenosis or obstruction after contrast medium injection into point of communication between v. jugularis interna dx. and v. subclavia l. sin. v. brachiocephalica l. sin. and superior vena cava after contrast medium injection at point of confluence of v. jugularis interna sin. and v. subclavia l. sin. and contrast medium drainage into right atrium

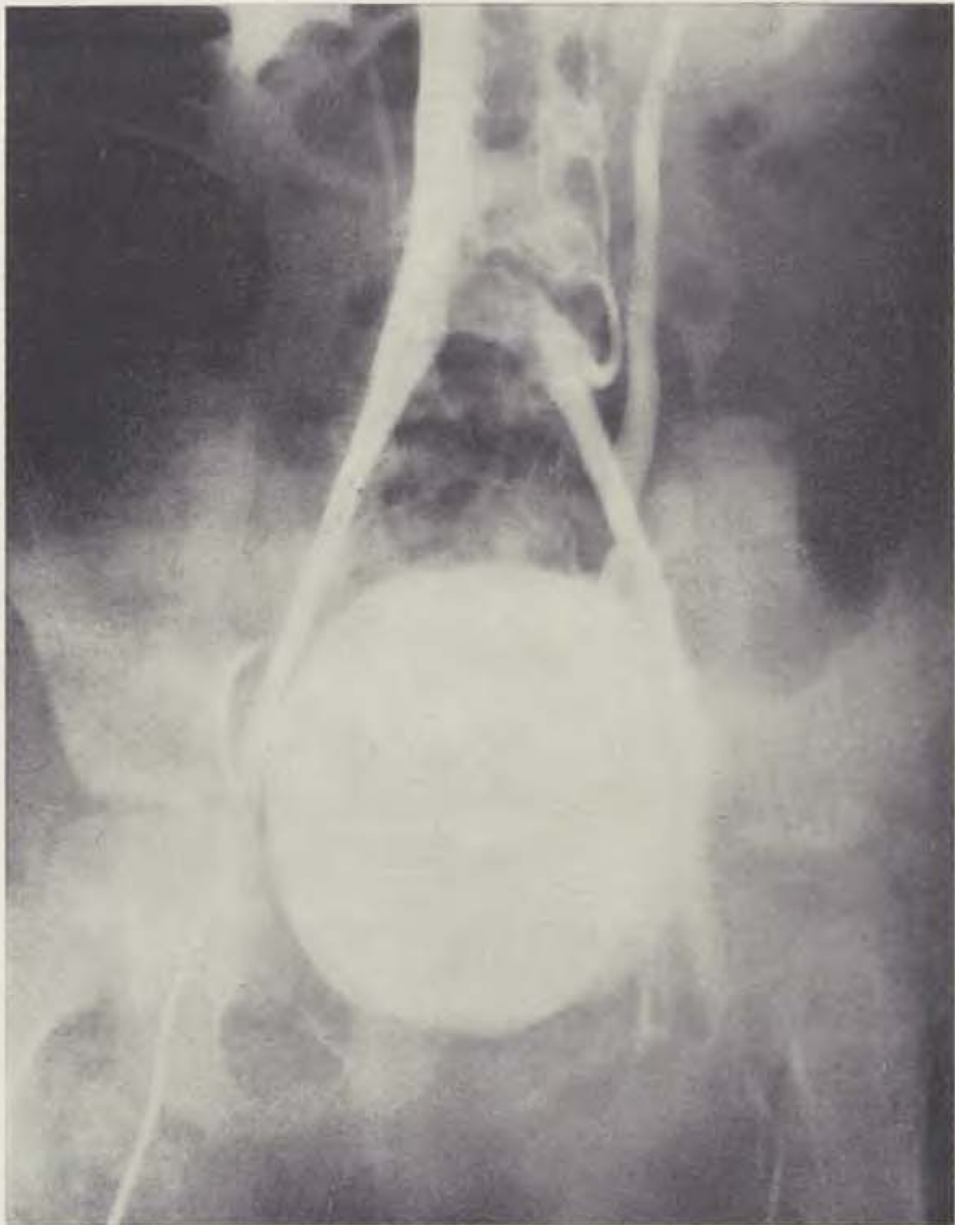


Fig. 5. Patient S. T., inferior cavography. Free drainage of contrast medium through femoral, iliac and inferior vena cava after simultaneous injection into femoral veins. Catheter introduced in the right femoral, puncture needle in the left femoral veins

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The rest of the literature available at the author's.

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14th Scientific Conference of the Section of Plastic and Reconstructive Surgery of the Society of Polish Surgeons, in October 22, 1978, the Executive Committee of the Section was elected, for the tenure of 1978—1980, with officers:

President: Doc. dr hab. med. Michał Krauss; Vice-president: Prof. dr hab. Jan Goldstein; Members: Doc. dr hab. med. Kazimierz Kobus, Doc. dr hab. med. Wanda Kondrat, Prof. dr hab. med. Tadeusz Orłowski, Dr med. Antoni Trybus.

Secretary: Dr med. Jerzy Potocki.

According to the resolution of the meeting, XV Scientific Conference of the Section will be organized in 1980 by the Clinic of Plastic Surgery of Medical Academy in Łódź.

The address of Secretariat is: Department of Plastic Surgery, 02-097 Warszawa, Banacha 1a, Poland.

A. V. Lunatcharskii's Medical Institute, Astrakhansk (USSR)
Director Professor V. B. Sutchkov
Department of Traumatology, Orthopaedics and Military Medicine
Director Professor N. P. Demichew

RECONSTRUCTIVE OPERATIONS ON TENDONS AND A TENDO-LIGAMENTOUS APPARATUS

N. P. DEMICHEW

A significant progress in development of effective methods designed for reconstruction of integrity of injured tendons and a tendo-ligamentous apparatus has been achieved during the last years.

As is generally known, the injuries of this kind have attracted attention of surgeons, traumatologists and orthopaedists for many decades. However, the techniques of treatment have become obsolete during the time and the desired results were not always obtained, especially by old and neglected cases.

An allo- and xenoplasty of tendons has become widely spread during the sixties and seventies of this century. It was enabled by improvements of the techniques utilized for preservation of biological tissues.

Advances in this field were achieved due to intensive efforts of numerous investigators all over the world. Thus, the most important principles of the tendon's reconstructive surgery have been formulated.

Based on these principles, the intensive studies and clinical research performed during the last decade have resulted in development of four fundamental methods used for plasties of the tendons: an autoplasty, an alloplasty, a xenoplasty and an explantation.

A successful application of each method by itself and of their combinations was dependent on accuracy of the available data and on their evaluation in respect to a character, localization and size of the injury.

The results obtained by treatment of acute and chronic injuries affecting tendons and a tendo-ligamentous apparatus by 428 patients, representing 543 operations during the time period ranging from 1962 to 1977, were analyzed by me (Demichew 1967) and by my disciples (Khlopunova 1973, Matskeplishvili 1974, Nebiev 1974 and Putilin 1975).

The data gathered during examination of 318 patients, by whom the total of 425 reconstructive operations was performed, will be described in this paper. The patients with primary suture of tendons were not included. The tendons of hand and finger flexors were damaged by 98 patients (a number of 159 tendons was reconstructed), the tendons of hand and finger extensors

were damaged by 38 patients (79 tendons were reconstructed), the Achilles tendon was damaged by 75 patients, the tendon of biceps muscle by 18 patients, the tendo-ligamentous apparatus was injured by 89 patients and 94 operations were performed.



Figure 1. Patient G., 22 years old. The tendon of the IIIrd finger flexor on the right hand was injured. a — before the operation, the active flexion is impossible by the IIIrd finger;

Plasty of tendons of the hand and finger flexors

The methods of the tendon plasty used in treatment of old tendon injuries localized on hands and fingers have deeply changed during the last years (Dubrov 1940, Paneva-Kholevitch 1965, Degtyareva 1970). Until the last 10—15 years, majority of the reconstructive techniques applied to tendons consisted in application of anastomoses between ends of the tendons and autografts.

Usually, fresh tendon autografts were applied together with epitenonium and paratenonium. However, the range of applications of such techniques was often limited by a lack of the plastic material, especially, if several tendons were reconstructed simultaneously, by discrepancies in diameter or length of the tendons and by a necessity to perform an additional operation.

According to our opinion, an ideal way, how the old injuries of hand and finger tendons should be treated, has to provide an anatomical and functional recovery of the tendon's integrity, if a good adaptation of a graft and the tendon's ends has been secured. The factors influencing a choice of the most adequate material are related to a localization and level of the tendon's injury, to a technique of the operation, to a method of the treatment during the post-operational period and to occurrence of concomitant injuries of nerves, joints, bones and blood vessels.

The main problem connected with free grafting of the tendons consists definitely in the way, how a normal healing of the tendon wounds could be secured in conditions when a proliferative reaction of the surrounding tissues



b and c — full-range flexion and extension of the hand 1½ years after the operation

has been minimized. On the one hand, the graft's fusions with the surrounding tissues are necessarily required as a source of its nutrition and it represents their positive role. On the other hand, the established cohesions make move-

ments of the reconstituted tendon more difficult and thus the function of the hand is disturbed.

In order to ensure a successful surgical treatment, these factors have to be controlled. The way of the control depends on anatomical localization



Figure 2. Patient K., 19 years old. The tendons of the IIIrd, IVth and Vth finger flexors on the right hand were injured. a — before the operation, active flexions of the IIIrd—Vth fingers are absent;

of the injured tendons of the hand's flexors and on proximity to the "critical zone". Thus, the difficulties inherent to plastic reconstruction of the old tendon injuries affecting the hand and finger flexors are determined by all these factors.

We will not dwell on the technique of the operation in this paper, as it was described by us in a sufficient detail elsewhere (Demichew 1974).

The free tendon plasty was performed by 90 patients from the total of 98 patients, thus showing a possible application of the tendon allografting in the case of late surgeries (Figs. 1 and 2).

It is interesting that the transplantation of preserved tendons did not increase a risk of the operations. The highest number of complications (almost $\frac{2}{3}$) associated with the tendon plasties consisted in development of the post-operational adhesions. According to our data, it was basically not so much dependent on the type of the plastic material, as on the specific anatomical and physiological features of the injured region. It is evidenced by the fact that there were obtained very good results of operations performed on the Achilles tendon and on the hand's extensors, after reconstruction of the tendon's defect of the biceps muscle and of ligamentum patellae proprium, after the alloplastic reconstruction of the cruciate and lateral ligaments of the knee joint etc.

In respect to reconstruction of the flexor tendons in the limits of the "critical zone", i.e. in the region of the sliding apparatus, it is our opinion that the form and biological nature of the grafted tendon are apparently not so practically significant, as particularly the specific features of the anatomical and topographical relationships in the given area. Therefore, the assertions



b and c — full-range flexion and extension of the fingers three years after allotransplantation of the tendons. A slightly expressed contracture of the fingers during extension can be noticed

claiming inevitability of postoperational adhesions and other complications of the tendon alloplasty do not seem to be substantiated at all.

Of course, all that what has been said up to now, did not mean in any sense an "overshadowing" of the autoplasty. It should be realized that the autografting represents recently the most perfect way of the plasty. It is important, however, that an oversimplified or too straightforward approach in estimation of the results should be avoided.

The long-term results of the reconstructive operations were followed by 98 patients suffering from injuries of 159 tendons of hand flexors. The good results were obtained by 58 patients, the satisfactory results were obtained by 32 patients and the bad results were observed by 8 patients.

Plasty of tendons of the hand and finger extensors

The clinical and pathological signs associated with injuries of the tendons of the hand and finger extensors are somewhat different from the features characterizing injuries of the tendons of the finger flexor. In the first place, it is explained by particularities of the anatomical and topographical structure.

If the extensor tendons are damaged on dorsal side of the hand, the ends of tendons are not pulled apart in majority of the cases. The suture of the tendons or the tendon plasty is not difficult to be performed. This specificity is one of the main differences between the tendon plasty of extensors and the plastic reconstruction of flexors of the fingers. The synovial sheaths of the hand and finger extensors are practically less significant than the synovial sheaths of the finger flexors. The surgical treatment of injuries affecting the common extensor in the region of the proximal and distal interphalangeal joints is especially promising.

Another equally important specific feature consists in the fact that the function of fingers may be preserved, if the tendons of extensor become united with surrounding subcutaneous tissues by adhesions.

The recent advances achieved in reconstructive surgery of the tendons offer possibilities, how better results could be achieved in treatment of injuries of this kind.

Well-known difficulties arise in the case of extensor injuries localized on the forearm and in the region of the radiocarpal articulation. The interrupted ends of the tendons are widely separated, the anatomical relationships are confused, large adhesions develop, the tendons atrophy and their external appearance is altered. However, such a pathological situation brings about only technical difficulties, by no means influencing negatively the functional results of the plasty.

The surgical treatment of patients with old injuries was focused to reconstruction of the anatomical and functional integrity of the injured organ. With this aim, three types of the surgical techniques were applied, i.e. an immediate union of ends of the tendons accomplished basically by a scar duplication according to Rozov, a transposition of tendons from one finger to

another one and a reconstruction of the tendon's defect by a preserved graft.

Earlier in our practice, the graft and the tendon were united by an end-to-end anastomosis utilizing mainly the Cuneo's suture.

Recently, the buried Cuneo's suture is used only in the cases, when the distance between the tendon's ends is not longer than 3 cm. According to our experience, the tendon plasty utilizing the tendon grafts united side-to-side represents the most favourable approach. This technique was applied in majority of the patients.

It is indicated by our data that the most suitable material for reconstruction of the defects occurring on extensors of the hand and fingers are tendons of the hand extensors or tendons of the long and short peroneal muscles preserved by freezing or lyophilization preceded by sterilization in the performic acid.

It is necessary to use thin and elastic grafts that can become more quickly and more effectively vascularized.

On the dorsal side of the hand, the best results were obtained in the forearm and the wrist-joint regions. As a rule, the graft's length markedly influences reparative regeneration of the reconstructed tendon: the shorter is the graft, the more perfect healing of the tendon's wounds is attained, and vice versa. In such cases, the results of the tendon's reconstruction were especially favourable in respect to an age of the patient, a nature of the injury and special features of the clinical course.

The total of 38 patients having suffered from injuries of hand and finger extensors that resulted in damage of their tendons, were followed by us. The number of 79 damaged tendons was reconstructed.

By 33 patients, good results, i.e. a full or almost full recovery of the tendon's function, were achieved. The satisfactory results (significant improvement of the hand's function) were observed by 4 patients. By 1 patient, the final result was bad.

Plasty of the Achilles tendon

The injuries of the Achilles tendon were recorded by 47 patients (0.57 %) from the total number 8,219 patients hospitalized in the clinic of our institute with diagnoses of the locomotor system injuries during the time period 1963—1970 (Demichew et al. 1974). Nowadays, the total of patients that had suffered from the Achilles tendon injuries and were operated on has reached the number of 75.

In treatment of these injuries, the best results were achieved by suturing or, if necessary, by a plasty performed as soon as possible after the accident. Unfortunately, some patients were not treated in a proper time (due to various reasons, like a careless and non-qualified examination of the physician or a patient's relation to his own health lacking seriousness), especially in the case of subcutaneous ruptures. The plastic operation is the only way, how the Achilles tendon's integrity can be reconstructed after prolonged periods of time since the moment of the injury.

A bridge-like method and a free graft autoplasty have been still used by many surgeons for reconstruction of the Achilles tendon's defects.

The advances of transplantology that have been reached during the last years enabled utilization of the preserved tendon allografts also in the case of the Achilles tendon plasties.

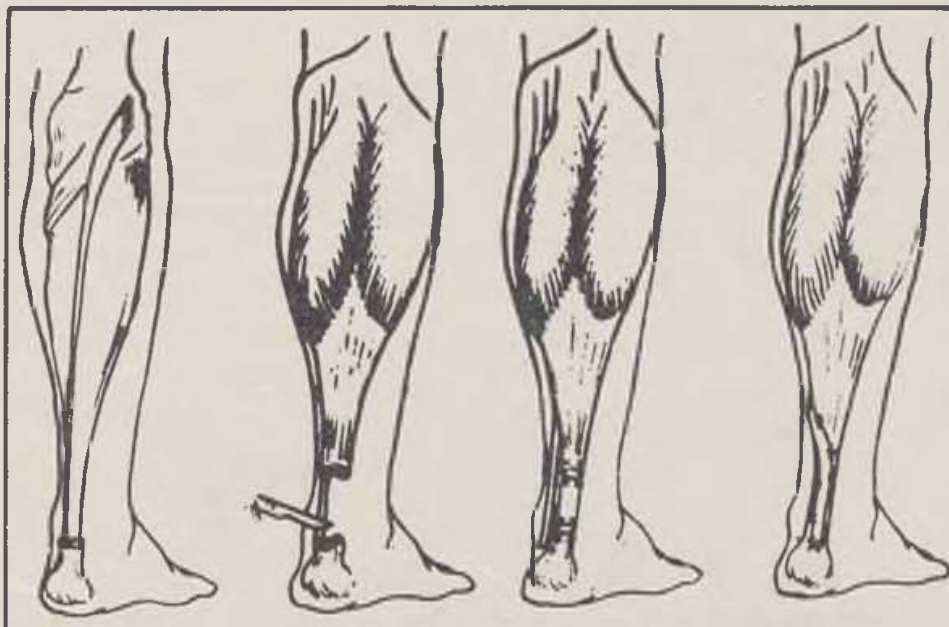


Figure 3. A combined auto- and alloplasty in the case of a subcutaneous rupture of the Achilles tendon (a diagram). a — the posterior crural muscles were removed (m. gastrocnemius), the thin and long strip of the tendon is well seen; b — a refreshing of the lacerated ends of the Achilles tendon and interruption of the m. plantaris near its insertion area; c — reconstruction of the Achilles tendon's defect using an allograft; d — transposition of the m. plantaris and its fixation to posterior and lateral sides of the reconstructed tendon

The patients coming to our clinic with old neglected ruptures of the Achilles tendon are treated according to the method, which was developed by us in 1967. It consists of the following points: a) the lacerated ends of the Achilles tendon are refreshed and the plantaris muscle if cut off near its insertion area; b) the Achilles tendon's defect is substituted by means of a preserved allograft; c) the plantaris muscle is transposed and fixed to posterior and lateral sides of the reconstructed tendon (Fig. 3).

The plastic reconstruction of the Achilles tendon's defect is followed by immobilization of the extremity using a dorsal plaster cast. It extends from tips of the toes to the middle third of femur and is maintained for 6 weeks. The shin is fixed in a flexion position, the foot in a slight plantar flexion. The sutures are removed on the 10th—12th day. A physiotherapy and functional exercise are indicated, when the plaster cast has been taken down.

Based on the good anatomical and functional results obtained by 98 % of the patients, it is concluded that our method of the Achilles tendon alloplasty should be more widely used. It is corroborated by the fact that the auto-

plasty cannot be applied in treatment of relatively large defects or in the case of widespread degenerative — dystrophic affections of the tendon tissue [diffuse fat depositions, flabbiness, disaggregation of fibrils].

The Achilles tendon alloplasties performed by us led to results that are not inferior to results obtained by the tendon autoplasties.

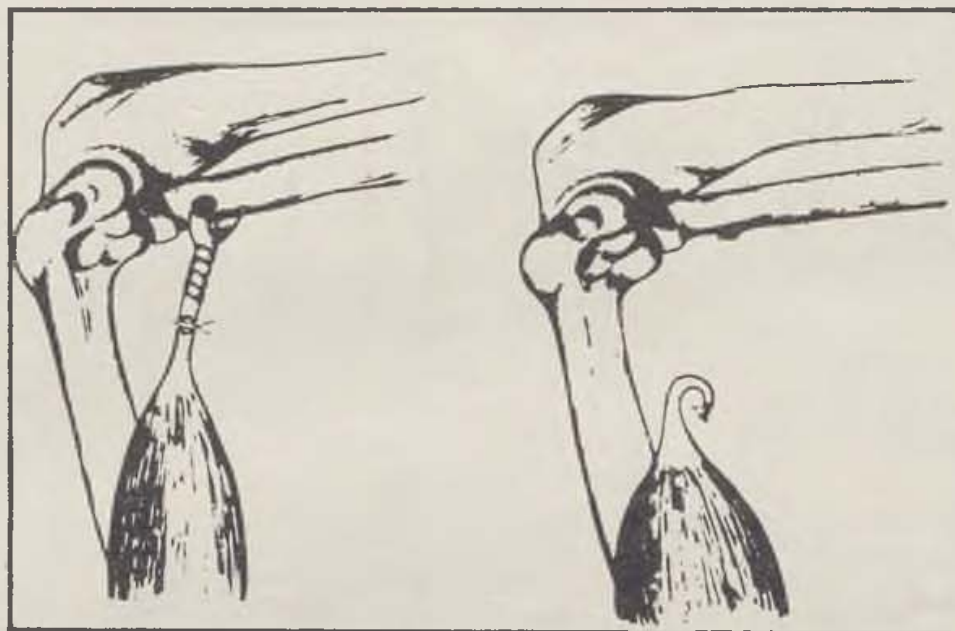


Figure 4. An alloplastic reconstruction of the distal tendon on the m. biceps humeri [a diagramm]

Plasty of the tendon of the m. biceps humeri

Although the covered muscle injuries are relatively frequent, especially in the case of the m. biceps humeri, this problem has attracted just minimal attention in our and foreign literature. In addition to it, the covered muscle injuries often remain unrecognized and are dealt with under different diagnoses, thus leading to erroneous ways of treatment. The function of the injured extremity is disturbed and the patient's capability to work is diminished.

In the soviet literature, the injuries of the m. biceps humeri are reported in papers written by Trubnikova (1956), Matskeplishvili (1974) and others, in which, however, only a small number of observations was described.

The operative treatment of the covered rupture of the m. biceps humeri has not been given an appropriate consideration. It could be explained by a late diagnosis and by the fact that the function of the injured extremity is apparently maintained. Besides the m. biceps humeri as the main flexor of the forearm, m. brachialis, m. brachioradialis and also m. pronator teres, which turns the palm inwards, participate in flexion of the elbow joint as well. The partial maintenance of the forearm flexion is due to function of these muscles.

The injuries of the m. biceps humeri may be treated by various well-known methods.

A number of 18 patients suffering from injuries of the m. biceps humeri were hospitalized in our clinic in the years 1970—1977. All the patients were surgically treated. Since 1970, the allogenic tendons (Fig. 4) sterilized in performic acid and then lyophilized or frozen were utilized for the reconstructive plasty of the ruptured m. biceps humeri.

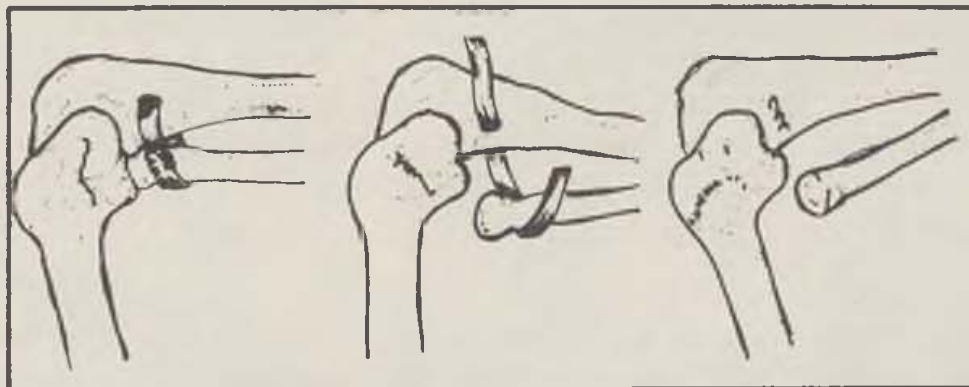


Figure 5. A technique used for reconstruction of the circular ligament of radius by means of a tendon allograft: a — dislocated head of radius; b — the graft was led through a channel drilled in ulna; c — the luxation was repaired, free ends of the tendon were stretched and sutured side-to-side by a caprone thread

During 6 weeks after the operation, the extremity was immobilized in the elbow joint by a plaster splint or on the wedge-shaped pillow. When the plaster cast was taken off, cautious passive movements, a physiotherapy and a massage were indicated.

The long-term results of the surgical treatment were followed by 17 patients for 15 months — 3½ years. Good results were found by 15 patients, satisfactory results by 2 patients.

Plasty performed by injuries of the tendo-ligamentous apparatus

Here should be listed: a surgical treatment of an extension contracture in the knee joint, a reconstruction of cruciate and lateral ligaments of the knee joint, treatment of fibrous-ligamentous structures formed following the accidental dislocation of tendons of the peroneal muscles, surgical treatment of a habitual luxation of arm and of acromial end of clavicle, treatment of paralytic deformities, of neglected and habitual luxations of a head of the radius (Fig. 5) and others. Totally, 94 operations of 89 patients were performed.

CONCLUSIONS

1. The tendon allografts were used for reconstructive operations on tendons and a tendo-ligamentous apparatus in the cases, when the autoplasty was impossible for various reasons, or it was connected with an additional large trauma.

2. The favourable results of the tendon plasty depend on many factors, including an origin of the plastic material, anatomical and physiological special features of the injured organ, a recognition of laws controlling the regenerative process in the tendon tissue, concomitant damages of bones, joints, nerves and blood vessels, a technique of the operation and a method of treatment during the postoperational period.

3. Advanced methods used for sterilisation and preservation of tendons and application of advanced techniques in plastic reconstruction of the damaged tendons, especially of deep hand and finger flexors in the limits of the synovial-aponeurotic structures, will improve rehabilitation of a significant portion of the patients, as the secondary operations like tenolysis, arthrodesis and amputations will be unnecessary. M. T.

SUMMARY

The problem of plastic reconstruction of tendons and a tendo-ligamentous apparatus during late periods after the injury, was analysed in respect to its current state. Special attention was paid to the surgical treatment of tendons of the hand and finger flexors and extensors, of the Achilles tendon and of the m. biceps humeri tendon.

The difficulties, positive and negative aspects of the described methods and the discussion points were dealt with.

Totally, the author observed 318 patients with the given diagnosis, by whom 425 reconstructive operations were performed during a period of 15 years (since 1962 to 1977).

RÉSUMÉ

Opérations de reconstruction des tendons et de l'appareil cartilagineux et ligamenteux

Demichev N. P.

Nous avons analysé l'état actuel des reconstructions plastiques des tendons et de l'appareil cartilagineux et ligamenteux qui ont lieu longtemps après le moment du trauma. Nous nous sommes concentrés surtout sur le traitement des tendons des muscles fléchisseurs et extenseurs de la main et des doigts, du tendon d'Achille et des tendons de m. biceps humeri.

Nous avons mentionné les difficultés, le pour et le contre de différentes méthodes de traitement et les problèmes qui se prêtent à la discussion.

Au cours de 15 années (1962—1977) l'auteur a suivi 318 malades au total avec les diagnostics mentionnés, chez lesquels on a effectué 425 opérations de reconstruction.

ZUSAMMENFASSUNG

Wiederherstellungsoperationen der Sehnen und des Sehnenbänderapparates

Demischew N. P.

Es wurde der gegenwärtige Stand der Frage der plastischen Wiederherstellung der Sehnen und des Sehnenbänderapparates in von dem Zeitpunkt des Traumas entfernten Zeitabständen analysiert. Aufmerksamkeit wurde vor allem auf die Behandlung

der Sehnen der Flexoren und Extensoren der Hand und der Finger, der Achillessehne und der Sehnen des m. biceps humeri konzentriert.

Wir erwähnten die Schwierigkeiten, die positiven und negativen Seiten verschiedener Behandlungsverfahren und etliche Diskussionsprobleme.

Binnen 15 Jahren (1962—1977) verfolgte der Autor insgesamt 318 Patienten mit den angeführten Diagnosen, bei denen 425 Wiederherstellungsoperationen durchgeführt wurden.

RESUMEN

Operación de reconstrucción de tendones y del aparato de tendones y ligamentos

Demichev N. P.

Fue analizado el estado actual de la reconstrucción plástica de tendones y del aparato tendoligamentoso, en períodos distantes de la época del trauma. Fue dedicada especial atención al tratamiento de los tendones de flexión y extensión de manos y dedos, del tendón de Aquiles y tendones de biceps-húmero.

Nos referimos a las dificultades, a los aspectos positivos y a los negativos referidos a diversos procedimientos de cura y a cuestiones discursivas.

Durante 15 años (1962—1977), el autor investigó un total de 318 pacientes con los diagnósticos indicados a los cuales fueron realizadas 425 operaciones reconstructivas.

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SUBSIDIARY TREATMENT OF LIVER COMPLICATIONS IN THE BURN DISEASE

J. CHLUMSKÝ, † P. MAREČEK, R. VRABEC

In 1840, James Long, a doctor from Liverpool, found out that the extensive and deep burn injury is not merely a skin injury, but a serious overall disease giving rise to complications of great incidence. This should be born in mind, he says, when therapy is to be determined. That his demand is justified is evidenced by the fact that these days merely 6 % of injured die of immediate consequences of the thermal injury whereas in the resting fatal cases serious subsequent complications set on. They even account for the clinical picture of the burn disease in those individuals who survive the injury.

The first reports on accompanying liver damage date back to the end of the last century (Schjerning 1884, Bardeen 1899), initially based on separate examinations. After that time, experimental and clinical studies have been made more and more frequently attempting to describe and explain the origin of accidental liver complications which almost regularly occur in the course of every deeper burn disease (2, 3, 4, 6, 8, 12, 14, 15, 16).

Aetiopathogenesis of liver complications, no matter whether directly or indirectly linked with the loss of epithelium, is without doubt complex, and there has been achieved no detailed knowledge of it so far. Harm effects of shock, including all possible stress complications, are mostly successfully reduced to a minimum, by means of modern treatment. In spite of that, the liver cell is exposed to an extreme load under shock as well as during the further course of the burn injury, especially then in the period of sepsis or toxemia, if you like. The influence of hypoxia when shock caused by oligoemia and liver microcirculation disturbances, although relatively short-termed, leads to metabolic acidosis on one hand, and on the other hand it changes the properties of cell organelles, mitochondria in particular, as well as the properties of cell membrane. Energetic metabolism slows down due to diminished formation of ATP. The ion balance is disturbed drastically because of the change in permeability of the cell membrane. Out of the factors producing a negative effect upon the liver cell we can state e.g. sepsis, gram-negative

one in particular, and toxemia even though some other factors such as possible caloric deficiency, repeated surgical performances, some efficient up-to-date drugs etc. can not be denied a possible participation (6, 8, 12, 14, 15). Moreover, we also have to take into account a previous liver damage e.g. after an overcome virus hepatitis, or some other overall infection, after a toxic (alcohol) or nutritious load, or a damage arisen during the existing overall metabolic disorder, if any, (for instance diabetes mellitus) etc.

Taking into account the complexity of the burn injury as well as regular participation of all important systems we cannot be surprised that the clinical picture of an arising liver complication is not distinct, but rather obscured by serious local and overall symptoms of the thermal injury. Also physical examinations of the organs of abdominal cavity do not bring always exact results which makes it necessary to start investigation in a purposeful manner immediately after the first symptoms of a liver disturbance appeared. In this respect serum transaminase has been found the most efficient as it usually shows a slight increase in activity only and as a rule it does not exceed the rate of 200—250 U/l as well as that of bilirubinaemia which can reach the value of about 3 mg% in the first days after accident, or, if you like, immediately after the onset of sepsis. The early icterus is brought about by a disproportionate load of the liver cell (5), rather than by suggested haemolytic mechanisms (14). Nor can it be caused by virus hepatitis B which may, as a rule, appear in late convalescence (1, 14) and manifest itself as a so called late icterus (6).

Burn diseases of the early stage as well as microscopic and electronoptic findings of liver puncture samples are usually little characteristic, similarly as clinical and laboratory picture. It is in the further course when changes in composition are intensified in dependence on seriousness and length of the septic stage, and they are characterized by loss of glycogen and a various degree of steatosis of the liver cells, by a finding of unicellular necrosis of the liver cells with a corresponding resorptive mesenchymal reaction and sometimes also with microcellular infiltration of portal tracts (4).

This is why the performed load of liver parenchyma, characterized by slight functional deviations on one hand, on the other hand then by a finding of non-characteristic morphological changes, makes it possible to understand why virus hepatitis, as a rule manifesting itself in the late phase of the burn disease, can often take a heavy and persistent course, marked even by a switch to chronic liver disorder (7).

Some latest reports admit the possibility of infection superimposed by cytomegalovirus which has also hepatotropic properties (10).

On the basis of our experience gained lately while observing patients hospitalized in the ward of intensive care of the Burns Unit of the Department of Plastic Surgery (Charles University, Prague) where a general examination and therapeutic course is secured, we were endeavoured to find the most suitable way of hepatoprotective therapy. It should, according to our opinion, become an indispensable part of a complex treatment, aimed at shock, sepsis,

metabolic and electrolytic disbalance, to sustain the functions of organism of vital importance.

However, the first experiments with the substitute treatment (vitamins, liver extracts), supplemented by administration of berolasis, thioctic acid did not bring the effect we expected. For this reason, we were searching for another ways of treatment out of which the mixture of arginine and malic acid has been found useful. It is assumed that this preparation, besides its possitive effect on synthesis of urea, is able to support formation of ATP for which malic acid represents an energy source of importance. A combined effect mutually supporting both components should maintain and presumably also enhance detoxication processes which make harmless mainly the wastes of nitrogen metabolism.

Arginine-malate (Rocmaline®-HEK, Lübeck) prepared either as an infusion solution, or as a concentrate added into a solution of glucose, was given by infusion i.v. in daily doses of 1000 ml. in all heavier forms of burn disease either immediately after shock treatment, or during the first signs of secondary liver disorder.

PATIENTS AND METHODS. RESULTS

Out of a larger number of people being under this kind of treatment we picked out a group of 25 patients who were generally examined. At our disposal there were the results of liver biopsy performed at a 20—60 day interval after the burn injury. The average age of our patients was 32 years, whereby the youngest one was 20 and the oldest 56 years old. The burn extension equaled 41,5 % of body surface and was evaluated as III, or II-III if you like. Only during one examination we dealt with a carbonized upper limb which had to be amputated. One patient was a diabetic, another two had excessive weight. A regular consumption of beer, wine or concentrated alcohol has never been proved.

If the abdominal wall was not burned we ascertained in majority of the patients a slight enlargement of the liver only which did not excede one to two finger's breadth below the costal margin, yet enlargement of the spleen has never been found. The level of bilirubin in the serum was increased during our 14 examinations up to 1,5—3,2 mg% which was corresponding with the finding of subicterus of sclerae and the skin. In all patients there has been found an increase in activity of serum transaminases out of which GPT was always in a slight excess of GOT. Their activity peak reached the value of about 250 U/l.

The changes in electroforetic spectrum of blood protein were reflecting the existing state of the inner environment, or, if any, they showed the reaction towards pathological processes going on in organism rather than we could derive from them a specific pronouncement as to the existing state of the liver. Only one observation of liver puncture samples brought a slight periportal fibrosis, all other cases showed merely non-characteristic changes, as defined above. There has been no normal finding of the liver tissue.

The arginine-malate treatment, started in time, resulted almost always in rapid stabilization of deviations, including normalisation of bilirubinaemia. Similarly, we have ascertained a positive effect on laboratory data, provided the pathological changes started in the phase of fever and temperature fluctuations of the septic period. All patients of the group, being referred to, survived the burn disease. Only one female patient died of virus hepatitis and liver failure which took a fulminant course and manifested itself after more than three months after the injury which was healed up completely at that time.

DISCUSSION AND CONCLUSIONS

While the death rate in burns of the early phase decreases markedly, owing to an up-to-date antishock treatment, numerous clinical experiences show that the death rate of the late phase of the burn disease, brought about by infection, toxemia and other associate complications, can be presently hardly swayed, in spite of local and overall treatment (17). In the period of 1939—1947 and 1948—1957 Phillips and Cope (General Hospital, Massachusetts) made observations for a comparison of two groups of young and middle-aged patients whose burns caused death, and it was found out that the average time of survival was prolonged from the original 4,6 to 15,7 days in the latter. The same authors reported that the shock rate as a cause of death went down from 20 % to 2 % and that the deadly effect of respiratory system disorder has not been diminished substantially (43 and 42 % in both groups). At the same time there has been marked an unfavourable increase in trouble-causing incidents, such as sepsis, associate cardiac affections, kidney failure, cerebrovascular disturbances, complications from the part of gastrointestinal tract etc. (13). Also we must not forget to mention the importance of age which makes the prognosis (14) unquestionably worse both in children (9) and in individuals of advanced age.

We can see clearly that one of the crucial questions of today is the need to look for new and improve the existing ways of treatment aimed at prevention, or, if needed, at inhibition of all known complications affecting the course of the burn disease till the stage of convalescence.

Serious liver complications such as metastatic abscesses can nowadays be faced by application of efficient antibiotics the medication of which is required by sepsis itself. That is why, a continuous decrease in their frequency can be expected.

The reason why we in detail concern ourselves with the clinical and laboratory picture of the liver disorder of a lighter type which was at the beginning defined as an integral part of the initial phase of the thermal injury and burn disease which follows, is that we realize the necessity to intensively support, during the whole course of the burn disease, the many-sided metabolic and detoxication liver activity, greatly exposed to a load under the mentioned exceptional conditions. It is true that the range of adaptability as well as the regeneration capabilities of the liver are great. That is why the parenchymous

disorder is of low degree only and it is usually to a great extent reversible. Only exceptionally it leaves traces of a slight fibrosis of the liver tissue, or, at times, a limit or a moderate increase in activity of serum transaminases is persisting. However, the simultaneous load of drugs, also conditioned by anaesthesia in repeated surgical performances, as well as other associate complications naturally increase demands on liver functions to excess and thus condition clinical manifestation of the liver disorder which remains not once in the background of the clinical picture of the deep burn. Less frequently, a slight icterus can appear right in the beginning of the burn disease particularly as a sign of hepatocellular disorder. On the other hand, a terrain prepared in this way is more liable to get hurt when in contact with another noxis, especially with virus hepatitis B which has been the case until recently before we introduced screening examinations of blood donors by means of HBsAg. Even then, late aftereffects of virus hepatitis were no rare phenomenon [7].

Considering liver dysfunction or changes in liver composition, which have been dealt with above, we must not forget to mention increased demands on metabolism of NH_3 the level of which goes up both during shock and due to an ever increasing catabolism of protein and fat, acidosis and intensified absorption of NH_3 from intestine [11]. The resulting hyperamoniacaemia is explained by liver's incapability to keep the metabolism of NH_3 and NH_4 on an appropriate level. Laborit and his co-fellows tried to explain on the basis of the mentioned mechanisms some central symptoms in burned patients. The symptoms are as follows: uneasiness, disorientation, somnolence etc.

It was the very piece of knowledge that brought into our minds the idea to give arginine-malate (Rocmaline) by infusion in serious burns and thus to make a good use of its pharmacological effect on urea formation, support of detoxication liver functions as well as on formation of ATP. The results obtained from our observations were remarkable. Not only have we ascertained a rapid regress of laboratory signs of liver dysfunction, but we could also find the burn disease taking a favourable and undisturbed course.

It is certainly rather difficult to evaluate the real effect of a preparation applied along with others, especially when compared with hepatoprotective treatment by entirely causal medicaments, and when there are other therapeutic interventions going on simultaneously, such as rationally controlled nutrition, debridement of necrosis tissues, covering early areas with skin grafts, medication of efficient antibiotics etc. In spite of that, we feel justified to consider our applied arginine-malate treatment to be fruitful. Finally, we can assume that the arginine-malate treatment along with other therapeutic interventions contributes a new way of how to overcome serious stage of sepsis and toxemia as well as it can, in general, positively influence the prognosis of the burn disease.

R. B.

SUMMARY

Described has been today's knowledge of aetiopathogenesis of the accompanying liver disorder in extensive burns and its clinical, laboratory and

morphological manifestation. At the same time the author emphasized the necessity to support the liver functions which are in extensive burns exposed to a maximum load. Moreover, the author reports his own experience with argininemalate application which, yet as a part of a complex therapy, has so far been found the most suitable when compared with all previously tried hepatoprotective procedures. This ensues from observations carried out in a group of 25 patients. Arginine-malate application has always resulted in a rapid clinical stabilisation of the liver dysfunction. Also the further course of the burn disease has been favourable.

RÉSUMÉ

Thérapie de soutien des complications hépatiques de la maladie de brûlure

Chlumský J., Mareček B., Vrabec R.

On décrit des connaissances contemporaines concernant l'étiopathogénésie de l'altération hépatique d'accompagnement des brûlures extensives, ses aspects cliniques, laboratoires et morphologiques et on souligne le besoin de soutenir des fonctions hépatiques qui sont dans le cas de la maladie de brûlure chargées au maximum. On rapporte de propres expériences favorables de l'application de l'arginine — malate qui s'est montré — comme une partie composante de la thérapie complexe bien entendu — comme jusqu'au présent le plus convenable de tous les procédés hépatoprotecteurs testés avant dans le groupe de 25 malades. Il aboutissait toujours à l'arrangement rapide du dysfonctionnement hépatique. L'évolution ultérieure de la maladie de brûlure était aussi favorable.

ZUSAMMENFASSUNG

Unterstützende Therapie der Leberkomplikationen bei der Verbrennungskrankheit

Chlumský J., Mareček B., Vrabec R.

Es wurden die gegenwärtigen Erkenntnisse der Ätiopathogenese der begleitenden Leberstörung bei umfangreichen Verbrennungen sowie ihre labor-klinische und morphologische Manifestation beschrieben und es wurde die Forderung der Unterstützung der Leberfunktionen hervorgehoben, die bei der Verbrennungskrankheit maximal belastet sind. Die Autoren berichten über ihre eigenen günstigen Erfahrungen mit der Applikation von Arginin-Malat, das — allerdings als Bestandteil einer komplexen Therapie — sich unter allen früher versuchten hepatoprotektiven Verfahren bei einer Gruppe von 25 überwachten Kranken als bisher das beste erwiesen hat. Es führte in allen Fällen zu einer raschen klinischen Besserung der Leberdysfunktion. Der weitere Verlauf der Verbrennungskrankheit war ebenfalls günstig.

RESUMEN

Tratamiento auxiliar de complicaciones en las quemaduras

Chlumský J., Mareček B., Vrabec R.

Son descritos simultáneamente los conocimientos de la etiopatogeneza acompañante de los trastornos que se registran en amplias quemaduras, se manifestación clínica y de laboratorio, así como morfológica y subradas las exigencias de auxiliar la función hepática, las cuales en las afacciones por quemaduras están afectadas al

máximo. Las referidas experiencias positivas en la aplicación de arginin-malát, la cual — como parte de la terapia global — de todos los procedimientos hepatoprotectores experimentados con anterioridad se ha demostrado en 25 casos de enfermos analizados, como el más conveniente. Conduce siempre a una rápida corrección de la disfunción hepática. También el transcurso de la afección causada por quemaduras es positivo.

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VENOUS CANNULATION IN CHILDREN WITH EXTENSIVE BURNS

J. ŠPATENKA, R. KÖNIGOVÁ, S. TŮMA

It is a well-established fact that the extent of a burn is directly proportional to its prognostic relevance. Affections involving more than 20 % of the body surface in adults and 10 % in children are classified as extensive burns — Königová et al. (9). Extensive burns require comprehensive treatment — i.e. intensive therapy in terms of homeostasis protection, adequate nutrition, and infection control. An important part of this involves the intravenous supply of drugs, saline and colloid solutions for burn shock management, but also the earliest possible reversion of catabolism, and adequate supplies of energy and nitrogen for anabolic processes. In extensively burned patients oral intake of food is either ruled out altogether or merely partially possible; hence the need for total or supplementary parenteral nutrition of sometimes considerably long duration (even a number of weeks). In septic complications a firm place in comprehensive treatment is occupied by the intravenous supply of antibiotics (depending on microbial sensitivity), steroids, cardiotonics, alpha-blockers, and other drugs. In cases of infection it is essential to maintain intensive parenteral supply of energy and nitrogen (solutions of glucose, sorbitol, amino acids) and also minerals, vitamins, plasma and blood (14). The solutions thus supplied are highly hypertonic and these together with others and routinely used chemotherapeutics cause local irritation of the venous endothelium. Another important point to be borne in mind is the frequent withdrawal of blood samples for biochemical, hematological and bacteriological examinations. Sooner or later the clinician finds himself in a situation when the supply of peripheral veins has been exhausted. Unless by that time the patient is able to tolerate fluids and nutrients adequately supplied orally, central venous system catheterization is the only alternative. In children the problem is aggravated by the fact that a child's entire venous system is

much more subtle and technically less well accessible than an adult's and that the lower the patient's weight and age the higher the requirements for the necessary volume of fluids and calories supplied (correlated to kg of body weight or m^2 of body surface).

In introducing central venous catheters (CVC) in the burned the authors gained from experience they have had with this technique at the Department of Pediatric Surgery, Medical Faculty of Pediatrics, Charles University, Prague (12, 13). At present, their group consists of 185 children who have received treatment using about 225 CVC. In the employment of the method certain specific features of the burn trauma have to be borne in mind. Any of the complications involved in the use of CVC (technical, infection, or thromboembolic) may prove to be unmanageable in the critically burned. As the risk of infectious complications is greater here, puncture should be preferred to venotomy in the introduction of CVC and the superior vena cava to the inferior vena cava for cannulation. Wherever possible, cannulation via the burned area should be avoided as the risk of the infection becoming generalized is enormous here (11). In other words, the surgeon is not at liberty to introduce CVC using only one technique in which he has become particularly skilled; instead he must choose access to the central venous system according to the patient's clinical condition and be skilled in using all approaches. The authors have developed their own system of introducing and maintenance of CVC for the treatment of extensively burned patients with the involvement of those areas, through which CVC is introduced (neck, clavicular areas, groins).

METHOD

Following a meticulous surgical preparation of the burned area, the surgeon should exchange his gloves, cover the choosen area with towels again and, using instruments from a separate set, introduce CVC by puncturing some of the large veins: the internal jugular vein (7), the subclavian vein using the supraclavicular (15) or subclavicular approaches (1, 10), the common femoral vein below the inguinal ligament (5). Seldinger's needle (KIFA PE 160) without mandrin is used for the puncture with a syringe firmly attached to the cone throughout the operation aspirating lightly all the time. Following the introduction into the vein the puncture needle is pulled out leaving just the external cannula in the lumen of the vein. This is then used for the insertion of an elastic, at least 35 cm long guide wire with a flexible end of 0.6 mm outside diameter (DITA Tábor). The metal cannula is then removed from the vein and, guided by the wire, a 20 cm long teflon vascular dilator with a tapered tip gliding along the introducer is inserted percutaneously into the vessel. The proximal end of the dilator is funneled to prevent it from slipping freely into the lumen. The dilator is then used for introducing into the vessel a tightly fitting sleeve in the shape of a 12.5 cm long X-ray-contrast tube with a closure designed for the attachment of the catheter (Desilets-Hoffman Percutaneous Venous Introducer, USCI, USA). The inside diameter of the tubing permits the repeated introduction of catheters of the

corresponding size once the vascular dilator with the flexible wire has been pulled out [4]. In patients who are particularly at risk soft silastic catheters (Dow Corning, USA) are used. Eventually, after the catheter has been introduced, the tubing is removed and the catheter fixed to the skin with a few stitches. The neighbouring area is protected by 3 % iodine tincture and covered up with sterile dressing. After catheterization, X-ray check-ups of the cannula position are performed using injections of 1—5 ml iodine contrast medium (Verografin 60 %, Léciva). Prior to starting the therapy, the surgeon should plan his "cannulation rotation system", i.e. determine the order in which the veins will gradually be used for the introduction of CVC. The use of each catheter is to be discontinued each time after two or a maximum of three days, and another vein used according to the CVC schedule. In this way, the clinician has at his disposal the two internal jugular veins, both subclavian veins and both femoral veins, which means that one particular vein need not be recannulated until after 12 to 18 days. Should some of the veins become unusable, the next one scheduled is used thus shortening the whole cycle. Each time the catheter is removed, swabs from the point of entry and the tip of the cannula are dispatched for bacteriological tests. In cases of febrile conditions hemoculture tests are added.

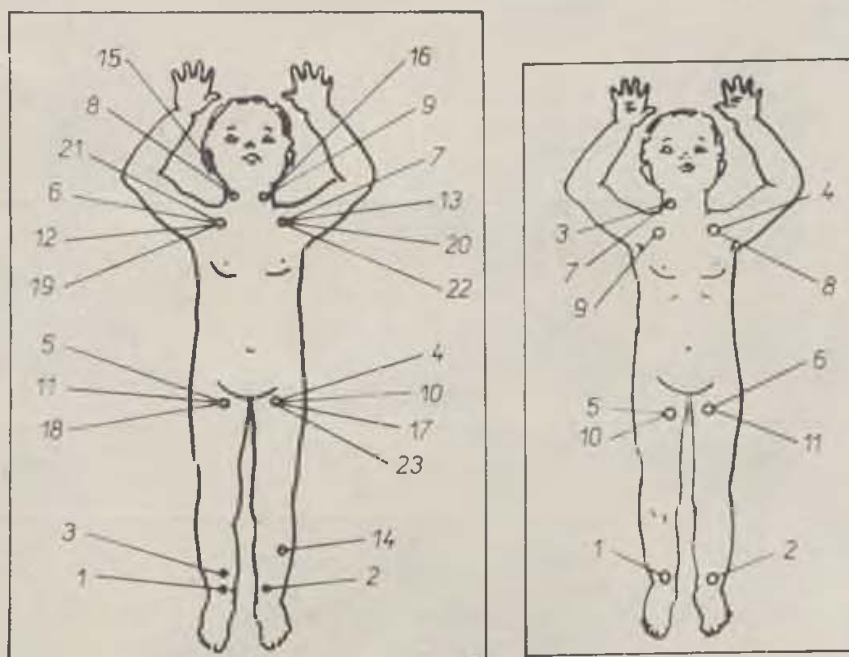


Diagram 1. Patient S. T. — pattern of gradual cannulation
 Diagram 2. Patient M. K. — pattern of gradual cannulation

RESULTS

This system was used in two extensively burned children aged 9 and 5 years, body weights 35 and 23 kg, both suffering from 3rd degree burns affecting body areas of 63 % and 80 % respectively. During the treatment, the two children had 23 and 11 venous catheters introduced — see diagrams

Table 1. Bacteriological tests — patient S. T.

Cannula No.	Localization	Tip	Skin	Haemoculture
1	VSM dx.	—	—	—
2	VSM sin.	sterile	sterile	sterile
3	VSM dx.	sterile	sterile	—
4	VSM sin.	pseudomonas	pseudomonas	sterile
5	VF dx.	pseudomonas	pseudomonas staphylococcus	pseudomonas
6	VS dx.	pseudomonas	pseudomonas	—
7	VS sin.	pseudomonas klebsiella	pseudomonas klebsiella	sterile
8	VJI dx.	staphylococcus pseudomonas	staphylococcus pseudomonas	sterile
9	VJI sin.	sterile	sterile	—
10	VF sin.	sterile	pseudomonas	pseudomonas
11	VF dx.	pseudomonas	pseudomonas	—
12	VS dx.	pseudomonas	pseudomonas	sterile
13	VS sin.	enterobacter.	pseudomonas	—
14	VSP sin.	sterile	pseudomonas	pseudomonas
15	VJI dx.	pseudomonas	pseudomonas	pseudomonas
16	VJI sin.	staphylococcus	staphylococcus pseudomonas	—
17	VF sin.	sterile	sterile	sterile
18	VF dx.	sterile	sterile	—
19	VS dx.	yeast	sterile	sterile
20	VS sin.	sterile	sterile	sterile
21	VS dx.	sterile	sterile	sterile
22	VS sin.	enterococcus	sterile	—
23	VF sin.	sterile	sterile	—

VSM = v. saphena magna; VSP = v. saphena parva; VF = v. femoralis, VS = v. subclavia, VJI = v. jugularis interna.

Table 2. Bacteriological tests — patient M. K.

Cannula No.	Localization	Tip	Skin	Hemoculture
1	VSM dx.	sterile	sterile	—
2	VSM sin.	sterile	enterobacter.	—
3	VJI dx.	staphylococcus	enterobacter.	sterile
4	VS sin.	enterobacter.	staphylococcus	—
5	VF dx.	sterile	staphylococcus streptococcus	—
6	VF sin.	e. coli enterobacter. staphylococcus	enterobacter. staphylococcus	sterile
8	VS sin.	enterobacter. staphylococcus	enterobacter.	—
10	VF dx.	pseudomonas	e. coli	—
11	VF sin.	pseudomonas proteus	enterobacter	—

VSM = v. saphena magna; VF = v. femoralis; VS = v. subclavia, VJI = v. jugularis interna

1 and 2. There were no major technical complications except that in two cases the internal jugular and in one case the subclavian veins failed to be punctured, and in three other cases X-ray check-ups necessitated readjustment of catheter tip position by pulling it out a little. Bacteriological test results are listed in Tables 1 and 2.



Fig. 6. Patient S. T., condition 3 moths after injury, after acute reconstruction of face and neck for prominent disfiguring scars

No clinical signs of venous thrombosis in the cannulated vessels or of pulmonary embolism were observed. No such signs were found in the post-mortem examination of the patient who eventually died either (as established macroscopically and by histological tests).

The other patient, a girl of 9 with 3rd degree burns covering 63 % of her body surface, had central veins angiography performed after receiving a course of treatment for a period of 51 days — Figs 3—5. The pictures show the central venous system as remaining perfectly patent without signs of parietal thrombosis.

CASE REPORTS

1. Patient S. T., a girl of 9, b. w. 35 kg, 3rd degree burns involving 63 % of body surface. Mechanism of injury: flaming up of a silon slip caused by heat radiator. The patient, in a state of severe shock, was flown to the burns centre in Prague over a distance of 180 km. On the following day, relief incisions were made — see Fig. 1. and the affected area was protected with Sulfamylon (Winthrop, England). On the 6th post-injury day, the central venous system had to be cannulated starting the "rotation system of cannulation". The technique of introducing a silastic catheter into the left subclavian vein percutaneously through areas already after partial allo-(-homo-)transplantation is shown in Fig. 2. In the following 51 days there were a total of 19 CVC using both internal jugular veins, both subclavian veins, and both femoral veins. See diagram No. 1. The patient was healed within 2 months and, after a fortnight's walking rehabilitation course, released from hospital. Control angiography of the central venous system was carried out at 3 months after the trauma — Fig 3—5 — and acute reconstructive operations on the face and neck were started — Fig. 6.

2. Patient M. K., a girl of 5, b. w. 23 kg, 3rd degree burns involving 80 % of the body surface. Mechanism of thermal injury: children's cot caught fire during play with matches at home. The patient, in a serious condition, was taken to Prague in an ambulance car over a distance of 100 km. Immediately on admission relief incisions had to be made on the neck and chest because of respiratory insufficiency. 48 hours after admission, the "rotation system of cannulation" was started. A total of 9 CVC were introduced in the course of 19 days. Despite all-inclusive intensive and extensive care the girl died 22 days after the injury. Cause of death: necrotizing bronchopneumonia and total failure of antiinfective humoral and cellular immunity (drop in immunoglobulins — mainly IgG, leucopenia 1800, thrombocytopenia 95 000). Postmortem showed no signs of cannulated veins thrombosis of pulmonary embolization.

DISCUSSION

As a matter of principle we use CVC in the burned only if such a treatment is absolutely indicated. The method is extremely demanding from the point of view of asepsis not only during the catheter introduction proper but also in subsequent treatment (local and general). At our centre we have so far no possibility of using centrally prepared mixtures for total parenteral nutrition or micropore filters to be fitted into infusion sets. The point is often considered as to whether or not blood samples should be taken from CVC. According to our own established practice, this is permissible if performed by a surgeon in the operating theatre in the full observance of all the relevant principles of asepsis (not by the ward nursing staff!). We are fully aware of the considerable technical and material demands involved in the above method of CVC introduction. However, our reasons for using it were as follows:

Silastic rubber (3) appears to be the most suitable material for CVC. Catheters made of this material are rather soft, flexible, capable of "floating" in the blood stream of the major veins, and cause little or no irritation to the vein walls. On the other hand, just because of these mechanical properties, they are very difficult to introduce. It is often important for the patients' survival that each of the veins has to be cannulated repeatedly during the

treatment, and also that any thromboembolic complications should be reduced to a minimum. For those reasons, the more rigid catheters made of other materials (e.g. PVC, teflon, etc.) cannot be used at all. We had no opportunity to use heparin-impregnated silastic (6).

X-ray control of the position of the catheter after its introduction is clearly necessary for the timely detection and correction of any wrong tip position.

The catheter may often have to be introduced in a septic state. The assumption in bacteremia is that bacteria are taken up in fibrin "sleeves" formed on the surface of the catheter in the blood stream (6). At the same time, infection penetrates along the catheter from the burned area to the vein. These are the reasons for the frequent exchanges of the cannula in cases where it is introduced through an infected, burned area. No doubt it would be much more advantageous in such patient if we could use silastic catheters impregnated with antibiotics according to microbial sensitivity (2).

We avoid preventive anticoagulation therapy in children. In clinical terms, there were no signs of venous thrombosis in the cannulated vessels. In any case, in thromboembolic complications any farmakological treatment as anti-coagulants or fibrinolytics just as well as surgical thromboectomy would obviously be contraindicated in such critically affected patients. Instead, symptomatic treatment would have to suffice. However, prior to introducing any further CVC, accurately performed phlebography would be essential so as not to possibly loosen a free thrombus head in the process of this further cannulation. We would then use the technique of multiple phlebography-scopy which, in surgical terms, occupies the first place in the diagnosis of venous thrombosis (8).

CONCLUSION

In the authors opinion, the use of CVC is indicated as part of comprehensive treatment in critically burned children. In view of the need to introduce catheters percutaneously through the burned areas, the risk of possible infection or thromboembolic complications should be reduced as much as possible and the cannules exchanged in 2—3 days at the latest. A description is presented of the technique of introducing elastic silastic catheters in a "rotation system" involving the removal of CVC after 2 to 3 days and introduction of the next scheduled CVC using another large vein. J. H.

SUMMARY

The authors describe a technique of central venous system cannulation in extensively burned children in which there is no other alternative except central venous catheter (CVC) introduction through the burned areas. A "rotation system of central venous system cannulation" is proposed. Using the Seldinger technique with the employment of Desilets-Hoffman introducers, soft silastic CVC are introduced and changed every 2—3 days. The two internal jugular, subclavian and femoral veins are used for cannulation according to a preconceived schedule. The uses of the method are demonstrated in two

children aged 9 and 5 years with 3rd degree burns affecting areas of 63 % and 80 % involving the use of 19 and 9 CVC during periods of 51 and 19 days respectively. The first patient, a girl, survived and was healed, the other, also a girl, succumbed to the injury.

RÉSUMÉ

Problématique du cathétérisme veineux des enfants brûlés extensivement

Špatenka J., Königová R., Tůma S.

Les auteurs décrivent une méthode du cathétérisme du système veineux central des enfants brûlés extensivement où on ne peut pas éviter l'introduction des cathéters veineux centraux (CVC) par des surfaces brûlées. Les auteurs ont proposé le soi-disant «système rotatoire du cathétérisme du système veineux central». Par la méthode de Seldinger et à l'aide des introducteurs Desilets — Hoffman ils introduisent des CVC moux en silastique qui sont échangés tous les 2—3 jours. Pour effectuer le cathétérisme ils se servent des deux veines jugulaires internes, des veines sous-clavières et des veines fémorales d'après l'ordre fixé en avance. L'utilisation de la méthode est démontrée par l'exemple de deux enfants de 9 et 5 ans avec des brûlures du 3^e degré à la surface de 63 % et 80 % où on a appliqué 19 et 9 CVC pendant 51 et 19 jours. La première malade a survécu et guéri, la deuxième a succombé à la maladie initiale.

ZUSAMMENFASSUNG

Die Problematik der Venenkanulation bei umfangreich verbrannten Kindern

Špatenka J., Königová R., Tůma S.

Die Autoren beschreiben ein Verfahren der Kanulation des zentralen Venensystems bei umfangreich verbrannten Kindern, wo die Einführung von zentralen Venenkathetern durch die verbrannten Flächen nicht vermieden werden kann. Sie entwarfen das sogenannte „Rotationssystem der Kanulation des zentralen Venensystems“. Mittels der Technik nach Seldinger führen sie mit Hilfe der Einführgeräte von Desilets-Hoffman weiche zentrale Venenkatheter aus Silastik ein, die alle 2—3 Tage gewechselt werden. Zur Kanulation benutzen sie die beiden inneren Drosselvenen und die Schlüsselbein- und Oberschenkelvenen nach vorher geplanter Folgereihe. Die Anwendung der Methode demonstrieren sie bei zwei Kindern im Alter von 9 und 5 Jahren mit Verbrennungen des III. Grades an einer Fläche von 63 % und 80 %, wo 19 und 9 zentrale Venenkatheter 51 und 19 Tage lang benutzt wurden. Die erste Kranke überlebte und genes, die zweite erlag der grundlegenden Erkrankung.

RESUMEN

Problemática de la canilación (cateterización) de venas en el caso de amplias quemaduras en los niños

Špatenka J., Königová R., Tůma S.

Los autores describen la manera de realizar la canilación del sistema venoso central en los niños que han sufrido extensas quemaduras, cuando no es posible evitar la introducción de catéteres venosos en las superficies donde se encuentran las quemaduras. Proponen el llamado „sistema de cateterización de rotación del sistema central de venas“. Mediante el método Seldinger se introducen con la ayuda de sondas Desilets-Hoffman de catéteres venosos de silastik, los cuales se cambian siempre cada

dos o tres días. Para la cateterización se utilizan las venas yugulares, subclavia y femoral, según un plan fijado con anticipación. El uso de este método lo demuestran en dos niños de 9 y 5 años respectivamente, con quemaduras de tercer grado en una superficie del 63 % y el 80 %, en los cuales fueron usados 19 y 9 catéteres venosos centrales durante 51 y 19 días. El primero sobrevivió y cicatrizó, mientras que el segundo falleció.

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CHANGES OF BASIC BIOCHEMICAL INDICES IN RAT LIVER TISSUE AFTER INTRAPERITONEAL APPLICATION OF ENDOTOXIN

B. HEJCMANOVÁ, Z. KONÍČKOVÁ, J. MUSIL, J. MOSEROVÁ

The present spread of gram-negative infection coupled with increased incidence of accompanying shock reactions has recently provoked lively discussion on the role endotoxin has to play in the development of such conditions. Endotoxin is often referred to as the main pathological factor responsible for the development of shock as such. In order to see to what extent a similar mechanism could be presumed in the development of burn and endotoxin shock we decided to compare the changes in basic biochemical indices in the liver tissue of rats after burns (2) with those after the application of endotoxin.

METHODS

Following the application of endotoxin to rats we monitored the liver tissue for the contents of glycogen, soluble proteins, water, triglycerides, and for the activity of the enzyme ornitincarbamyltransferase (OCT).

White female Wistar rats, weighing about 200 g each, were used for the experiment. Endotoxin was applied intraperitoneally in doses of 5 mg per animal. The animals were destroyed by decapitation in the following time intervals after the application of endotoxin: 1 hour, 6 hours, 1 day, 2 days, 3 days. There were 10 animals in each time interval group. The livers were removed for the determination of the five basic biochemical values which were then compared with those found in unexposed animals, i.e. in the control group.

Glycogen was determined using the anthrone method (7). Homogenization of the liver tissue and incubation of the homogenate for the determination

Table 1

Time after endotoxin application	Glycogen mg/g wet weight	Water %	Proteins mg/g wet weight	OCT micromols NH ₃ /g w. w.	Triglycerides	
					% w. w.	% d. w.
Controls	77.41 ± 33.45 n = 38	64.46 ± 2.03 n = 29	236.6 ± 50.9 n = 42	1135 ± 274 n = 24	2.78 ± 0.99 n = 26	7.80 ± 2.87 n = 26
1 hour	71.40 ± 27.28 n = 20	64.21 ± 1.96 n = 10	191.6 ± 11.9 n = 10	867 ± 155 n = 9	2.04 ± 0.52 n = 10	5.71 ± 1.34 n = 10
6 hours	6.36 ± 3.10 n = 17	67.99 ± 2.28 n = 10	269.7 ± 31.3 n = 10	1087 ± 203 n = 9	3.32 ± 1.03 n = 10	10.39 ± 3.02 n = 10
1 day	15.70 ± 8.40 n = 8	64.51 ± 2.16 n = 8	231.4 ± 31.3 n = 10	1380 ± 191 n = 8	4.28 ± 1.05 n = 8	12.19 ± 2.82 n = 8
2 days	22.75 ± 16.64 n = 6	66.60 ± 3.84 n = 7	200.2 ± 19.8 n = 7	808 ± 151 n = 7	8.67 ± 3.83 n = 7	17.43 ± 12.29 n = 7
3 days	29.00 ± 14.22 n = 6	67.82 ± 1.59 n = 6	186.1 ± 16.3 n = 6	746 ± 118 n = 6	8.66 ± 3.05 n = 6	31.42 ± 9.52 n = 6

Table 2

Time	Glycogen mg/g w. w.		Water %		Protein mg/g w. w.		OCT microm NH ₃ /g		Triglycerides % w. w.	
	burn	end.	burn	end.	burn	end.	burn	end.	burn	end.
1 h	28.72	71.40	66.18	64.21	262.7	191.6	1381	867	3.14	2.04
6 h	4.28	6.36	64.24	67.99	296.9	269.7	997	1087	4.29	3.32
1 d	23.30	15.70	70.00	64.51	287.2	231.4	1378	1380	2.85	4.28
2 d	42.20	22.75	66.90	66.60	225.5	200.2	781	808	6.34	8.66
3 d	61.21	29.00	64.27	67.82	173.5	186.1	825	746	4.81	8.65

of OCT were performed according to Reichard (6), the ammonia thus released was determined using the Berthelot reaction (4), and OCT activity expressed in micromols of ammonia per one gram of tissue. Soluble proteins were

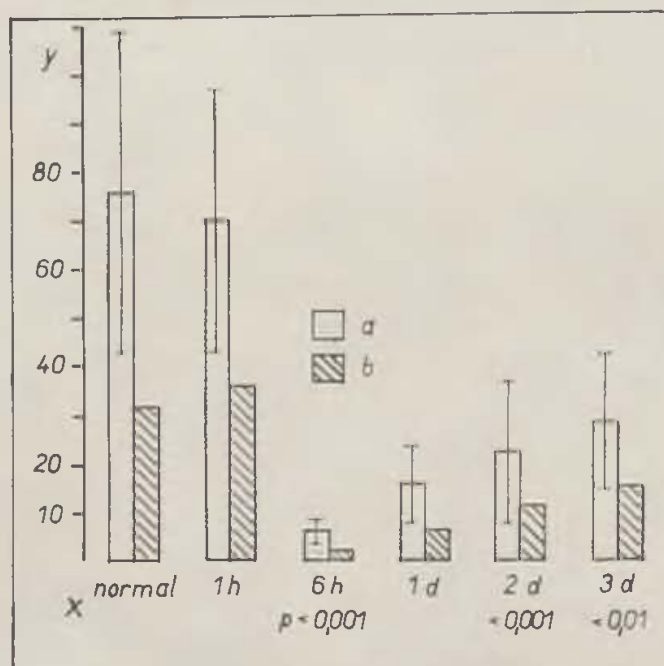


Fig. 1. Glycogen (rat liver after endotoxin) — a = mg/g wet weight, b = mg/mg protein $\times 100$, y = mg/g w. w., x = time after exposure normal

measured by means of the Lowry method (5). To estimate triglycerides and water contents a method of tissue drying and hydrolysis according to Irsigler (3) was used, and the enzyme in the hydrolysate determined according to Eggstein (1) by means of Boehringer sets.

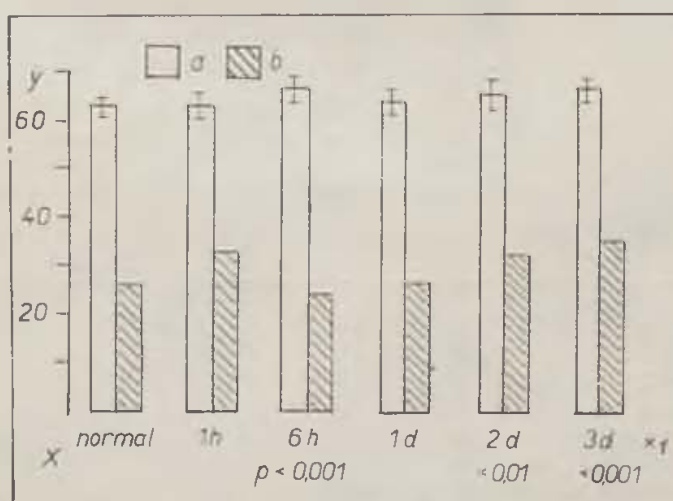


Fig. 2. Water (rat liver after endotoxin) — a = % wet weight, b = mg/mg protein $\times 100$, y = % w. w., x = time after exposure normal, x_1 = time after application

RESULTS

The results are plotted in graphs complete with their statistical significance, and summed up in tables.

Tab. 1 gives the average values of the biochemical indices followed up at

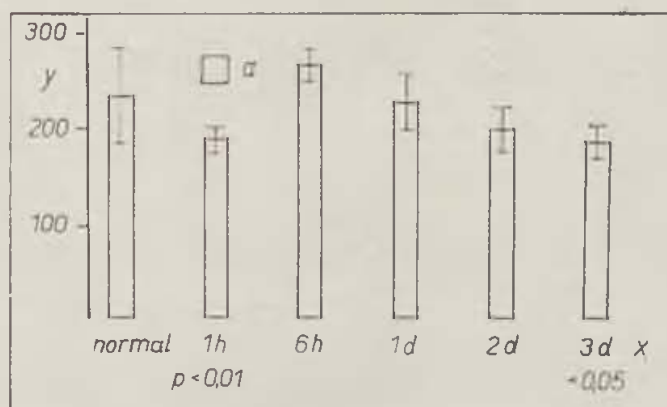


Fig. 3. Proteins (rat liver after endotoxin) — a = mg/g wet weight, y = mg/g w. w., x = normal, x_1 = time after application

different time intervals together with the standard deviation and the number of animals in each group.

Tab. 2 gives, side by side, the average values of biochemical indices in the liver tissue of burned rats and in the liver of rats which received endotoxin.

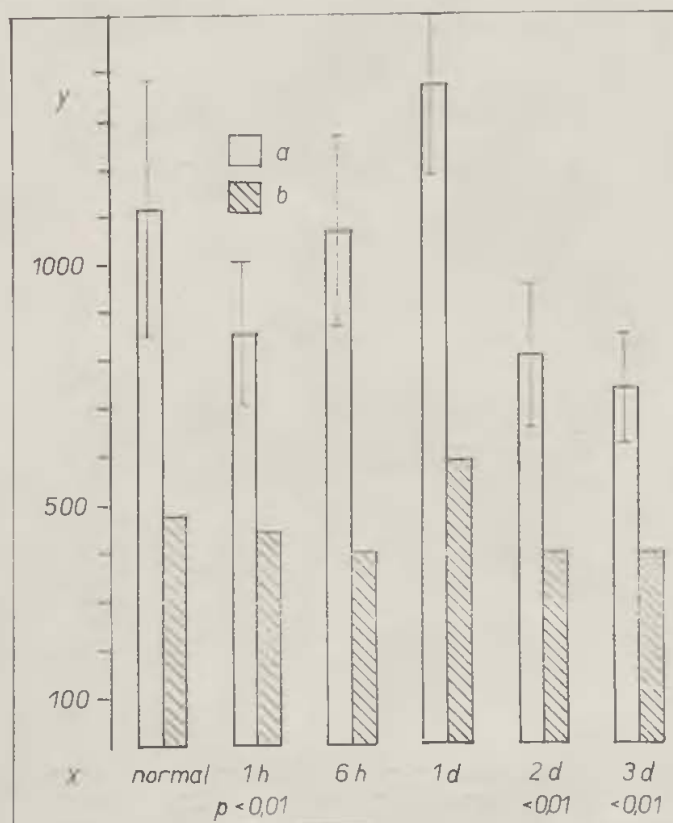


Fig. 4. Ornithinecarbamyltransferase — a = micromol NH₃/g wet weight, b = micromol NH₃/mg protein × 100, y = μ .mol/g w. w., x = time after exposure normal

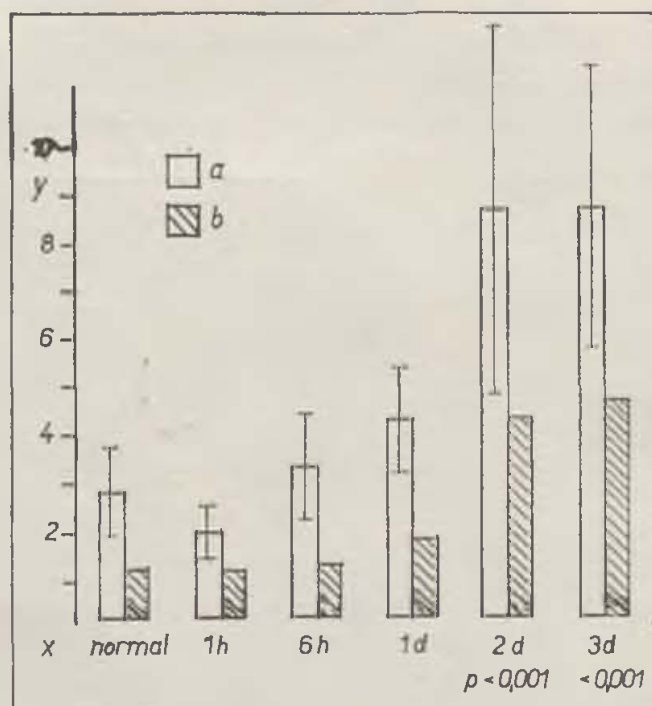


Fig. 5. Triglycerides [rat liver after endotoxin] — a = % wet weight, b = mg/mg protein $\times 100$, y = % w. w., x = time after exposure normal

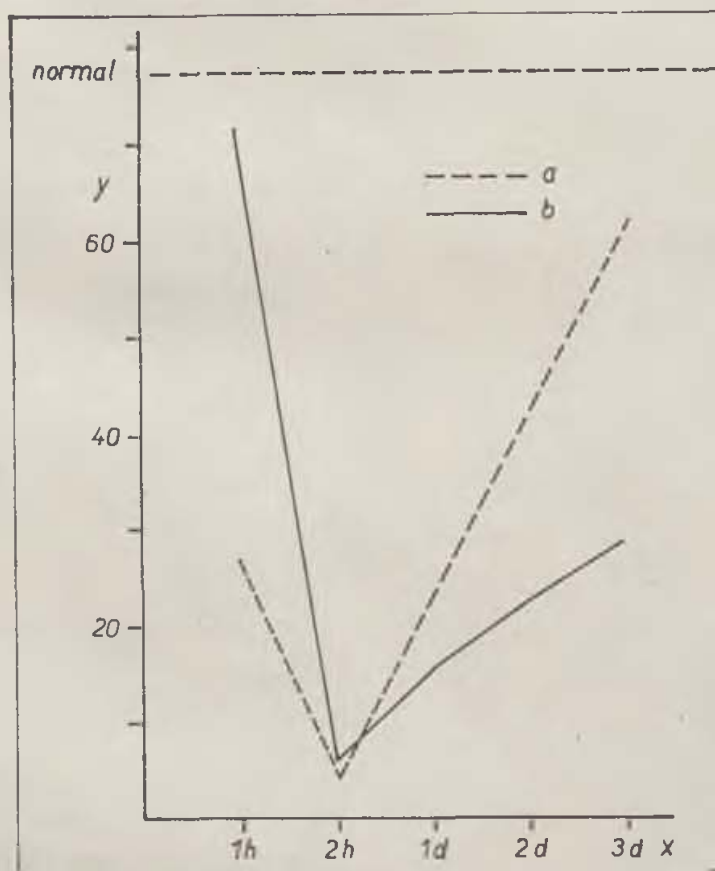


Fig. 6. Glycogen — a = burned, b = endotoxin, y = mg/g w. w. normal, x = time after exposure

Glycogen: 1 hour after the application of endotoxin the content of glycogen in the experimental animal's livers was almost that of the control values, in 6 hours there is a sharp drop to 8.2 %. Later on, glycogen is seen slowly increasing until on day 3 it reaches 37.4 % of the control value.

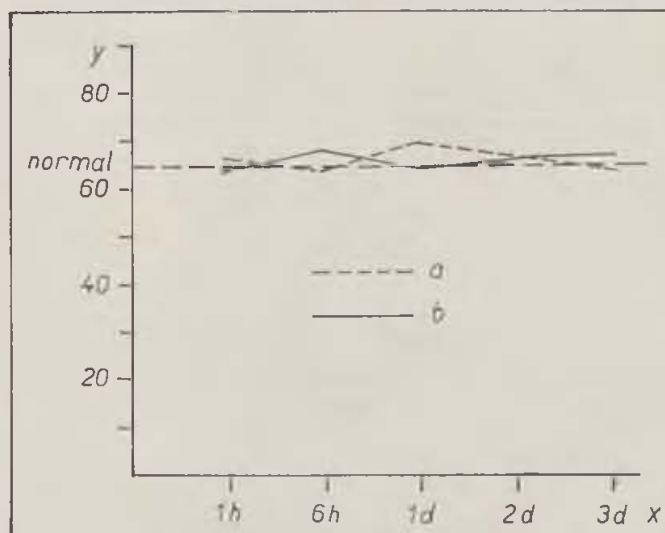


Fig. 7. Water — a = burned normal, b = endotoxin normal, x = time after exposure

Water: The amount of water in the liver varies slightly always near the control value.

Proteins: In general, there is a mild drop in the contents of soluble proteins in the liver tissue, on day 3 by a total of 22 % of the control value.

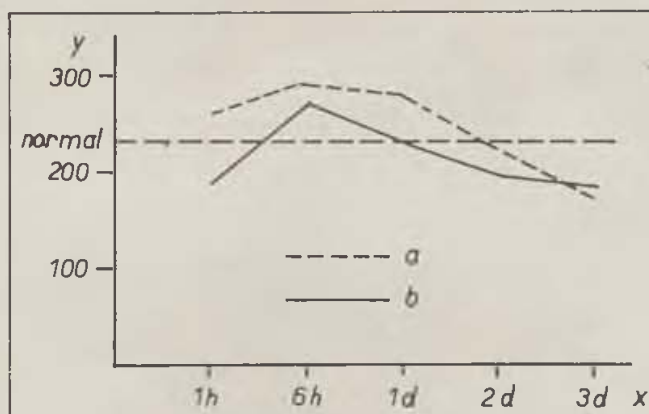


Fig. 8. Protein — a = burned, b = endotoxin, y = mg/g w. w. normal, x = time after exposure

OCT: OCT activity is increased on day 1 of the application of endotoxin; as from day 2 there is a noticeable decrease; on day 3 OCT activity amounts to about 65 % of the control value.

Triglycerides: As from hour 6 after endotoxin administration the content of liver triglycerides is seen rising — reaching maximum on days 2 and 3 — 312 % of the control values.

DISCUSSION

Comparisons between the five basic biochemical values in the livers of rats after burns and those after endotoxin can be summed up by stating that

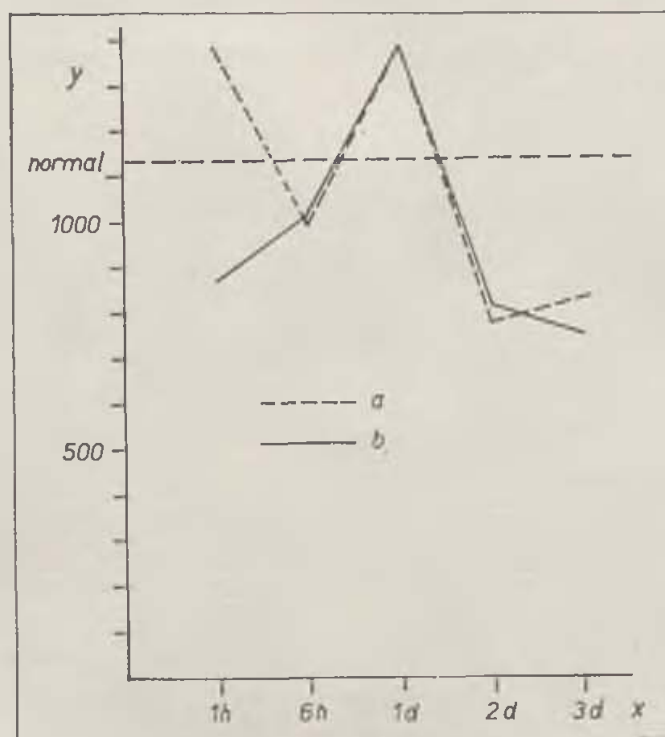


Fig. 9. Ornithinecarbamyltransferase — a = burned, b = endotoxin, $y = \mu\text{mol/g w. w.}$, $x = \text{time after application}$

water, protein and OCT show an agreement in the course of the values for the three follow-up day. There are, however, differences as regards

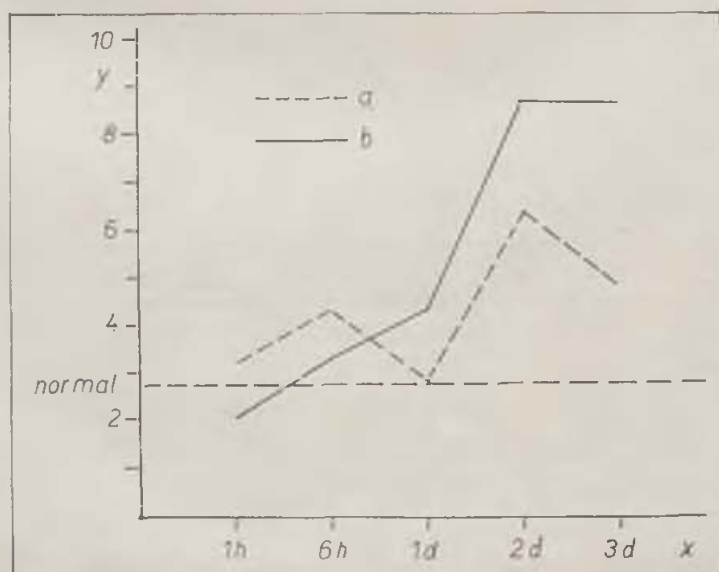


Fig. 10. Triglycerides — a = burned, b = endotoxin, $y = \text{w. w. normal}$, $x = \text{time after exposure}$

glycogen and triglycerides. During the first hour after the application of heat there is a marked decrease in the contents of glycogen in the liver to about one third of the control value; in rats after the application of endotoxin the values are, on the whole, normal. It is only after six hours that the drop in both types of exposure becomes the same. The subsequent increase in the contents of glycogen is then more prominent after burning than after the application of endotoxin until on day 3 after the exposure the contents of glycogen after endotoxin is about one half compared with that after the application of endotoxin. Triglycerides in the liver is higher on days 2 and 3 after the use of endotoxin in comparison with those in burned rats, reaching nearly double the value on day 3. J. H.

SUMMARY

Comparisons between values obtained from animals exposed to burns and those in animals after the application of endotoxin suggest that there is no substantial difference in the basic biochemical indices and that general shock changes are involved in both cases. Two points should be stressed: a) the above study is concerned with basic indices only, and b) the problem raised cannot be elucidated until the complex metabolic process involved have been studied in detail.

RÉSUMÉ

Les changements des index biochimiques fondamentaux dans le tissu hépatique des rats après l'administration intrapéritoneale de l'endotoxine

Hejčmanová B., Koníčková Z., Musil J., Moserová J.

La comparaison des valeurs acquies des animaux brûlés et des animaux auxquels on a administré l'endotoxine prouvent que dans les cas mentionnés il n'y a pas de différence essentielle en ce qui concerne les index biochimiques fondamentaux et que dans les deux cas il s'agit des changements généraux de la caractère de choc. Il faut cependant souligner que le travail présenté traite seulement des index fondamentaux et que la réponse à cette question ne peut être donnée qu'après des études détaillées des processus métaboliques complexes.

ZUSAMMENFASSUNG

Veränderungen der grundlegenden biochemischen Indikatoren im Lebergewebe der Ratten nach intraperitonealer Verabreichung von Endotoxin

Hejčmanová B., Koníčková Z., Musil J., Moserová J.

Der Vergleich der Werte, die bei verbrannten Tieren und bei mit Endotoxin behandelten Tieren gewonnen wurden, zeugt dafür, dass in den grundlegenden biochemischen Indikatoren kein wesentlicher Unterschied besteht und dass es sich in beiden Fällen um allgemeine Schockveränderungen handelt. Es ist jedoch hervorzuheben, dass es sich in der vorliegenden Arbeit tatsächlich lediglich um grundlegende Indikatoren handelt und dass eine Antwort auf die gegebene Frage erst ein eingehendes Studium der komplizierten Stoffwechselprozesse geben kann.

RESUMEN

Cambios de los índices bioquímicos básicos en los tejidos hepáticos de ratas, luego de suministrárseles endotoxina por la vía interperitoneal

Hejcmanová B., Koníčková Z., Musil J., Moserová J.

La comparación de los valores logrados en los animales quemados y en los que se les aplicó endotoxina, indica que en los índices bioquímicos básicos de los casos citados no existen una diferencia fundamental y que en ambos casos se trata de transformaciones corrientes producidas por shock. Es preciso, no obstante, subrayar que el trabajo presentado se trata realmente sólo de índices básicos y que sólo un estudio detallado de procesos metabólicos más complicados pueden dar respuesta exhaustiva a esta cuestión.

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POST-BURN CHANGES IN BASIC BIOCHEMICAL INDICES IN RAT LIVER TISSUE

B. HEJCMANOVÁ, Z. KONÍČKOVÁ, J. MUSIL, J. MOSEROVÁ

Any extensive burn is bound to cause grave overall changes in the organism despite adequate and correctly chosen therapy. The profound disruption of metabolism noticeable right in the initial phase of the burn disease and persisting until the late stages of the involvement represents an unusual strain on the liver which is an organ of crucial importance for the burned patient's metabolism. Huge demands are placed on the liver both as regards the breakdown of excessive quantities of catabolites, neutralization of microbial and tissue toxins, etc., and as regards increased anabolic requirements. One important thing to remember here is that such increased demands are placed on an organ which has been damaged by hypoxia right from the burn injury and subsequent shock.

Morphological changes in the liver tissue of the burned are known particularly from pathological-anatomical findings and have been described by a number of authors [10]. Morphology alone, however, can hardly give an idea of the degree of liver damage. For that reason, some authors have in recent years been trying to gauge liver function changes by means of biochemical methods, in particular, by monitoring enzyme activity in the liver tissue and in the blood (levels of LDH, AF, transaminases of GOT, GPT, etc.) [8].

The present study proceeds from monitoring the changes of basic biochemical indices in the liver tissue of burn experimental animals (water, glycogen, proteins, triglycerides contents) supplemented by observations of changes in the activity of OCT which is now regarded as one of the sensitive indicators of liver damage.

Experimental part

White female Wistar rats weighing cca 200 g each were used in the experiments in mild ether intoxication. The rats were shaved on their dorsal parts and burned using a device described in more detail in a report by

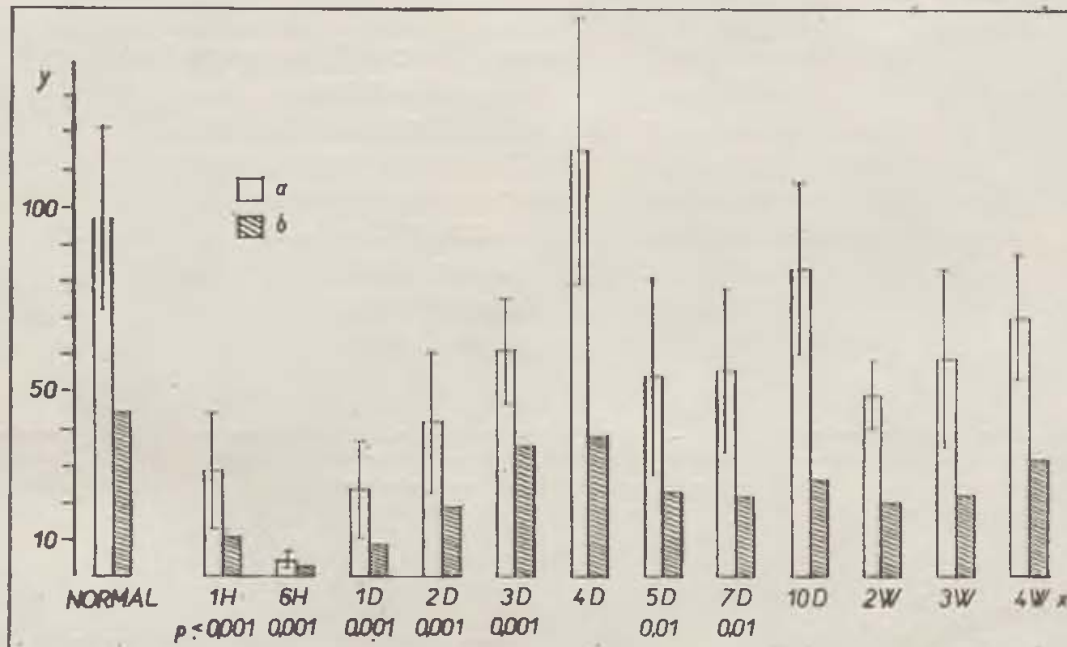


Fig. 1. Glycogen [liver of the burned rats]; a = MG/G wet weight; b = MG/MG proteins X100; y = MG/G WW; x = Time after burning

Prouza and Janeček (6). Exposure times of 5 seconds and heat flow intensity of about 10 kal/cm² gave rise to 3rd degree burns covering an area of about 50 cm². The burned animals were placed separately in cages, kept on routine pellet diet with unlimited water supply and without medication. Then they

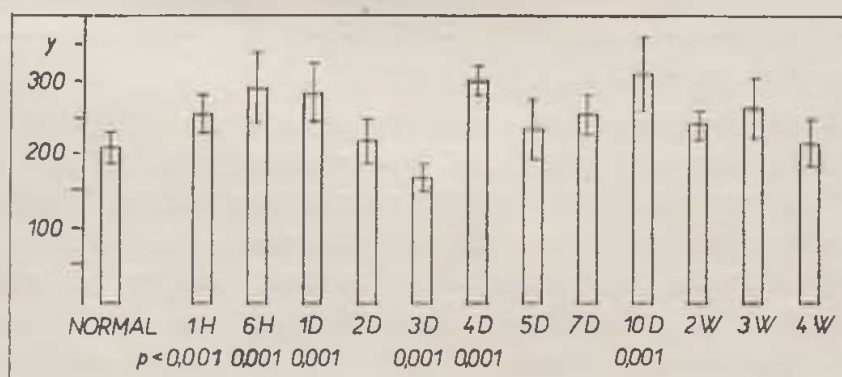


Fig. 2. Proteins [liver of the burned rats]; y = MG/G WW; x = Time after burning

were destroyed by decapitation at different time intervals and their livers removed for biochemical tests. Each time group consisted of about 10 burned rats, each time simultaneously killing two to four control, healthy, unburned animals. Thus the burned rats were joined by another control group of 10

animals exposed to the same conditions as the rats prior to exposure, t.j. mild ether narcosis, stretching in frames, shaving on the back, transport.

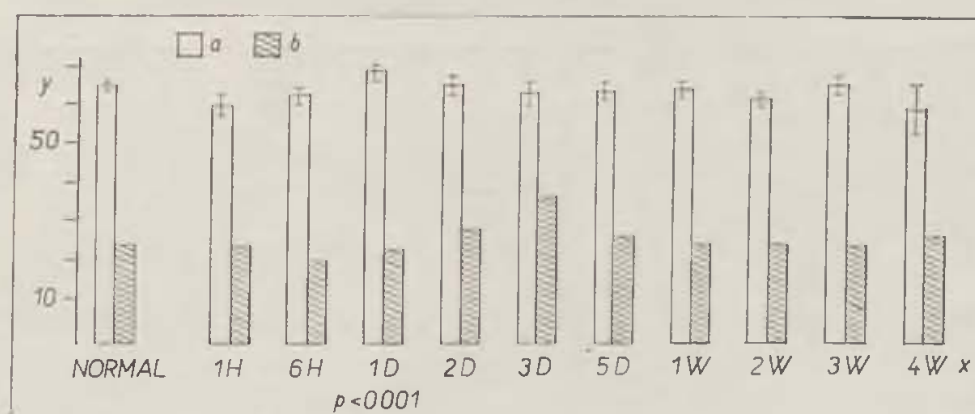


Fig. 3. Water (liver of the burned rats) a = % wet weight; b = MG/MG proteins $\times 10$
y = % WW, x = time after burning

The times after exposure, at which the animals were destroyed and their livers removed for investigation: Hours: 1, 6. Days: 1, 2, 3, 4, 5, 10. Weeks: 1, 2, 3, 4.

Biochemical methods:

Glycogen determination: immediately after the destruction of the animal and removal of liver, part of the tissue weighing about 10 mg was put in a pre-weighed test-tube with 1 ml 30 % KOH. Glycogen was determined using the anthrone method, [9].

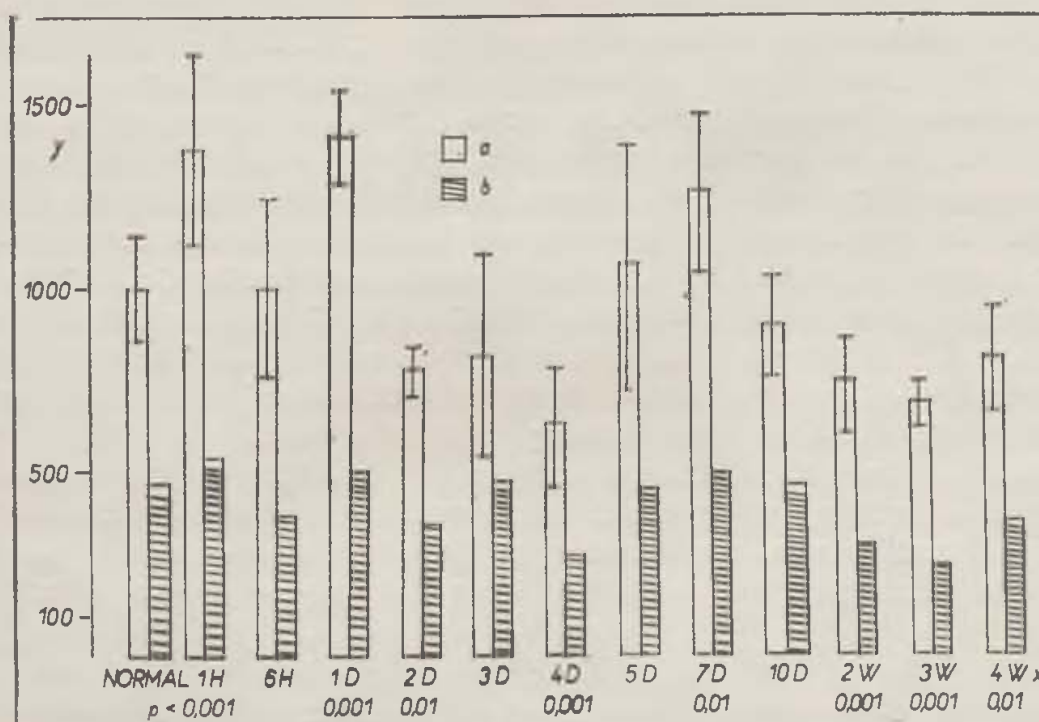


Fig. 4. Ornithinecarbamyltransferase (liver of burned rats) a = $\mu\text{Mol NH}_3/\text{GWW}$; b = $\mu\text{Mol NH}_3/\text{MG proteins} \times 100$; y = $\mu\text{Mol NH}_3/\text{GWW}$; x = Time after burning

The rest of the tissue was wrapped in aluminium foil, covered in dry ice and put in a freezer to be stored at -20°C for an assay of ornithincarbamyl-transferase, and contents of proteins, triglycerides and water.

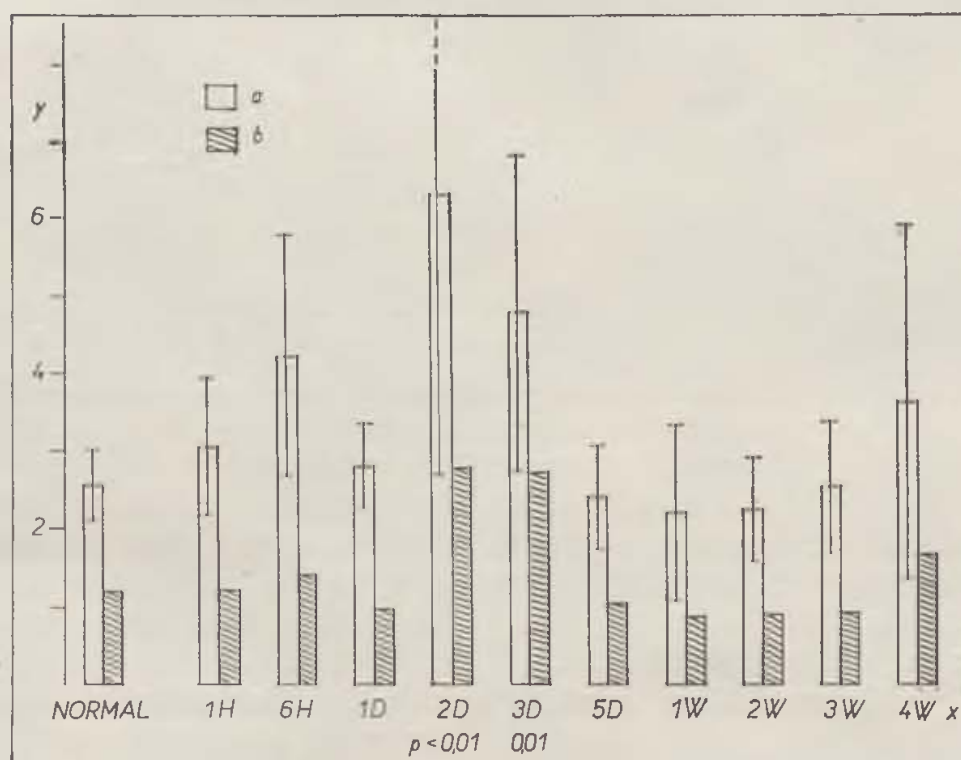


Fig. 5. Triglycerides [liver of the burned rats; a = % wet weight; b = MG/MG proteins $\times 10$; y = % WW; x = Time after burning]

Ornithincarbamyltransferase determination [E. C. 2.1.3.3] (OCT): to determine OCT activity and protein contents, the tissue was promptly weighed and put in ice. Homogenization and incubation was performed according to Reichard (7). The tissue was homogenized by means of a teflon piston in distilled water (about 10 mg/2 ml) for a period of 2 to 3 minutes using ice as a coolant. Within 15 minutes of homogenization, the homogenate was used for incubation with citrulline in arsenic buffer of pH at 37°C for 24 hours. The ammonia thus released was determined using Berthelot's test according to Kontinen (4), and OCT activity was expressed in micromols of NH_3/g tissue or per mg protein. Soluble protein determination: soluble proteins in the homogenate were determined using Lowry's method.

Determination of triglycerides and water: to determine the content of triglycerides and water the tissue was dried and hydrolyzed according to Irsigler (3) and enzyme determination of triglycerides performed in buffered hydrolysate according to Eggstein (2) using Boehringer company sets.

RESULTS

The results obtained were processed in the form of graphs and average values plotted in a table.

[Insert: graphs with statistical significance marked and graph captions]

Table

Time after burn	Glycogen mg/g w. w.	Water %	Proteins mg/g	OCT micromols NH ₃ /g	Triglycerides	
					% ww	% dw
Controls	98.34 ± 24.43 n = 9	67.01 ± 1.00 n = 10	216.50 ± 24.23 n = 10	996.70 ± 141.12 n = 10	2.64 ± 0.44 n = 9	7.96 ± 1.25 n = 9
1 h.	28.72 ± 15.54 n = 14	66.18 ± 2.37 n = 13	262.72 ± 26.45 n = 18	1381.25 ± 259.60 n = 8	314 ± 0.93 n = 11	9.42 ± 2.93 n = 11
6 h.	4.28 ± 2.11 n = 14	64.24 ± 2.12 n = 5	296.94 ± 61.91 n = 12	997.50 ± 245.82 n = 4	4.29 ± 1.57 n = 5	11.85 ± 3.77 n = 5
1 d.	23.30 ± 13.59 n = 13	70.00 ± 1.79 n = 8	287.23 ± 43.44 n = 13	1378.43 ± 58.86 n = 6	2.85 ± 0.54 n = 7	9.57 ± 2.19 n = 7
2 d.	42.20 ± 19.61 n = 14	66.90 ± 2.32 n = 7	225.57 ± 30.49 n = 7	781.29 ± 65.03 n = 7	6.34 ± 3.64 n = 7	18.73 ± 10.85 n = 6
3 d.	61.21 ± 15.09 n = 10	64.27 ± 3.00 n = 10	173.50 ± 19.32 n = 10	825.80 ± 270.78 n = 10	4.81 ± 2.03 n = 10	13.52 ± 5.40 n = 10
4 d.	116.93 ± 36.61 n = 7		305.87 ± 21.32 n = 9	625.00 ± 158.74 n = 10		
5 d.	54.34 ± 27.58 n = 9	65.23 ± 2.14 n = 12	238.92 ± 43.60 n = 11	1065.88 ± 337.99 n = 8	2.41 ± 0.66 n = 12	6.94 ± 1.91 n = 12
7 d.	55.79 ± 22.36 n = 9	66.91 ± 1.68 n = 8	261.11 ± 27.42 n = 9	1266.25 ± 212.72 n = 8	2.22 ± 1.13 n = 8	6.69 ± 3.37 n = 8
10 d.	83.62 ± 23.18 n = 10		318.56 ± 50.31 n = 9	895.43 ± 134.58 n = 7		
2 w.	49.89 ± 9.53 n = 8	63.17 ± 1.37 n = 7	247.44 ± 21.00 n = 9	718.57 ± 129.15 n = 7	2.25 ± 0.67 n = 7	5.92 ± 1.80 n = 7
3 w.	59.25 ± 24.23 n = 10	67.15 ± 1.38 n = 10	269.30 ± 42.92 n = 10	637.80 ± 59.87 n = 5	2.56 ± 0.89 n = 11	7.93 ± 2.61 n = 11
4 w.	70.79 ± 17.28 n = 9	60.09 ± 6.32 n = 9	219.00 ± 30.93 n = 9	802.78 ± 141.95 n = 9	3.67 ± 2.33 n = 9	10.10 ± 5.33 n = 9

The table gives average values of the biochemical indices followed at different time intervals with standard deviation and number of individuals in each group.

Glycogen: Glycogen content drops rapidly to about one third of the initial value within one hour of the exposure, reaching its lowest value (about 5.5 % of the normal value) within 6 hours, then rising again. On day 4, glycogen values are higher than in the controls; this is followed by another drop followed by variable levelling up to control values.

Soluble proteins: during the period between 1 hour after exposure and 1 day, the content of proteins is elevated as opposed to decreased glycogen content. On day 3, with the content of glycogen increasing, there is, however, a maximum drop in protein contents. The subsequent course of protein and glycogen contents is similar in nature.

Water: water contents vary very slightly around the control value.

Triglycerides: The first day after exposure the values vary around the normal, reaching maximum on day 2 (228 %), remaining elevated still on day 3, then dropping moderately below the normal. As from week 3, the values rise again.

Ornithincarbamyltransferase: OCT activity is increased till the end of day 1 after exposure, dropping on day 2 and sinking to minimum values around day 4 (63 %). Then, the activity is seen rising until day 7, dropping afterwards but rising again in week 4.

Summed up, maximum drop in glycogen contents was the first phenomenon we observed after exposure to burn injury (as early as 1 hour after burning). Days 2 and 3 after exposure were characterized by findings of maximum values of triglyceride contents in the liver; day 3 was marked by a minor drop in protein content; as from day 2 on there was also a drop in OCT activity. Glycogen as well as OCT were characterized by a double decrease and increase of values, except in glycogen where maximum changes appeared earlier. As from day 5 on, the contents of triglycerides mostly dropped slightly below normal values.

DISCUSSION

The sharp drop in liver tissue glycogen content is undoubtedly caused by the washing out of catecholamines occurring soon after the organism has suffered a burn injury. Adrenaline and noradrenaline enhance glycogenolysis in the liver and muscle by increasing cyclic AMP which in turn activates phosphorylase (1). The drop in glycogen content in the liver may then, to a certain extent, be enhanced also by the burned animals taking in less food. The further course of the glycogen curve is determined by the equilibrium between glycogenolysis and gluconeogenesis, i.a. also from protein catabolism (8).

In spite of the overall increased breakdown of proteins in the burned organism we found no substantial changes in the contents of the burned animals' livers.

Also practically unchanged remains the post-burn water content in the liver tissue in spite of the considerable loss of fluid. All that can be seen in the liver tissue is obviously just a transfer of water from the extracellular space into the cells themselves which, as histology suggests, become swollen

Triglycerides rise rapidly in the liver cells during the first post-exposure days. A share in this is probably again taken by the washing out of catecholamines which stimulate adipose tissue lipolysis into glycerol and non-esterified fatty acids, the increase of which in the plasma of burned patients was described by Doleček [1]. However, oxidation of fatty acids in the liver does not seem to be impaired. In general, increased triglycerides in the cell can be attributed to inadequate synthesis of proteins indispensable for the formation of lipoprotein molecules.

There is an extensive literature devoted to liver enzymes behaviour in different diseases. No such liver tissue studies have so far been performed in the burned or, if they have, there has been little system in tissue enzyme investigations. More attention has been devoted to cytoplasmic enzymes in the blood. Swedish authors were concerned mainly with changes in OCT serum activity [8] as these are regarded as specific manifestations of liver mitochondria damage. However, some of the latest studies refer to the possibility of serum enzyme activity showing qualitative signs of membrane system damage, but also to the fact that such enzyme activity changes may well be due to the participation of a whole series of factors so that the time or the degree of their elevation need not always be in connection with the onset or intensity of cell damage. Therefore, determination of enzyme activity changes directly in the liver tissue appears to be a much more telling sign of the damage done.

Post-burn liver OCT activity may be a reflection of the combination of two processes, one of which increases the activity while the other brings it down. Increases in the OCT enzyme activity may be seen as corresponding to increased requirements for the removal of NH_4^+ resulting from protein and amino acids breakdown. Decreased activity may again be connected with increased membrane permeability for enzymes as well as with membrane system damage. J. H.

SUMMARY

Body surface flame burns are conducive to changes in the composition and metabolism of liver tissue. In experimental burns in rats liver tissue contents of glycogen, water, soluble proteins, triglycerides, and ornithincarbamyltransferase activity were followed at different time intervals after exposure (1 hour up to 4 weeks). The time course of the changes is recorded in graphs and a table. In the biochemical indices under observation all changes were statistically evaluated against a control group. The following important conclusions were drawn:

Glycogen changes are marked by a double drop and an increase similarly as in ornithincarbamyltransferase, except that in the enzyme the changes were less prominent and delayed in time. Glycogen is marked by maximum decrease in the shortest time after exposure. On day 2, there is a conspicuous increase in fat deposition in the liver tissue. The greatest changes in glycogen, proteins, triglycerides and ornithincarbamyltransferase are recorded as early as three days after exposure.

RÉSUMÉ

Changements des index biochimiques fondamentaux dans le tissu hépatique des rats après le brûlement

Hejčmanová B., Koníčková Z., Musil J., Moserová J.

Après le brûlement de la surface du corps par une flamme se produisent aussi des changements de la constitution et du métabolisme du tissu hépatique. Pour les brûlures expérimentales nous avons observé le contenu du glycogène, de l'eau, de l'albumine soluble, des triglycerides et l'activité de l'enzyme d'ornithine-carbamyl transférase dans le tissu hépatique aux différents intervalles après le brûlement (depuis 1 heure jusqu'à 4 semaines). L'évolution temporelle des changements a été enregistrée dans des graphiques et dans une table. Pour des index biochimiques observés on a évalué des changements par rapport à un groupe de contrôle. De ces résultats ressortent les conclusions principales suivantes:

Il se produit un double abaissement et un double accroissement du glycogène, de même que d'ornithine-carbamyl transférase, mais les changements de cette enzyme sont moins remarquables et reculés. Le plus grand abaissement du glycogène se produit dans le plus court délai après le brûlement. Le deuxième jour se produit un accroissement frappant de la déposition des graisses dans le tissu hépatique. Les plus grands changements du glycogène, des albumines, des triglycerides et d'ornithine-carbamyl transférase on lieu trois jours après le brûlement déjà.

ZUSAMMENFASSUNG

Veränderungen der grundlegenden biochemischen Indikatoren im Lebergewebe der Ratte nach Verbrennung

Hejčmanová B., Koníčková Z., Musil J., Moserová J.

Nach der Verbrennung der Körperoberfläche durch Flamme kommt es zu Veränderungen in der Zusammensetzung und im Stoffwechsel des Lebergewebes. Bei experimentellen Verbrennungen an Ratten untersuchten wir im Lebergewebe den Glykogen- und Wassergehalt, den Spiegel des löslichen Eiweisses und der Triglyzeriden und die Aktivität des Enzyms Ornithinkarbamyltransferase in verschiedenen Zeitabständen nach der Verbrennung (ab 1 Stunde bis 4 Wochen). Der Zeitverlauf der Veränderungen ist in graphischen Darstellungen und in einer Tabelle erfasst. Bei den untersuchten biochemischen Indikatoren wurden die Veränderungen im Vergleich zu einer Kontrollgruppe statistisch ausgewertet. Aus den Ergebnissen ergeben sich folgende wesentlichste Schlüsse:

Bei dem Glykogen kommt es zu zweifachem Anstieg und Absinken, ähnlich wie bei der Ornithinkarbamyltransferase, bei diesem Enzym sind die Veränderungen jedoch weniger ausgeprägt und zeitlich verschoben. Beim Glykogen erscheint das grösste Absinken in kürzester Zeit nach der Verbrennung. Am nächsten Tag findet eine auffallend gesteigerte Fettablagerung im Lebergewebe statt. Die grössten Veränderungen des Glykogens, der Eiweisse, der Triglyzeride und der Ornithinkarbamyltransferase erscheinen bereits drei Tage nach der Verbrennung.

RESUMEN

Cambios de los índices bioquímicos básicos en los tejidos hepáticos de ratas luego de sufrir quemaduras

Hejčmanová B., Koníčková Z., Musil J., Moserová J.

Después de quemaduras superficiales del cuerpo con fuego se producen también cambios en la constitución y metabolismo de los tejidos hepáticos. En casos de quemaduras experimentales realizadas a ratas, observamos en los tejidos hepáticos un contenido de glicógeno, agua, proteínas solubles y triglicéricos, así como actividad de la enzima ornithincarbamiltransferasa en diversos intervalos, después de acontecida la quemadura, [de una hora a 4 semanas]. El proceso de cambios es registrado en gráficos y en una tabla. En los índices bioquímicos analizados fueron evaluados estadísticamente los cambios con respecto al grupo de control. De los resultados se desprenden las siguientes conclusiones:

En el glicógeno tiene lugar una disminución y crecimiento dobles, al igual que en la ornithincarbamiltransferasa, solo que en esta enzima los cambios son menos marcados y temporalmente postergados. En el glicógeno acontece la mayor disminución inmediatamente después de la quemadura. El segundo día tiene lugar un llamativo depósito de lípidos en los tejidos hepáticos. El mayor cambio de glicógeno, proteínas, triglicéridos i ornithincarbamiltransferasa tiene lugar ya 3 días después de acontecida la quemadura.

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NEW BOOKS

E. V. Usoltseva, K. I. Mashkara: **Surgery of Diseases and Injuries of the Hand.** The 2nd revised and completed edition, Meditsina, Leningrad 1978, 336 pp.

In this book, the authors generalized their long-time experience in treatment of hand diseases and injuries that represent an important problem of the contemporary surgery. The book consists of 15 chapters and is divided into a general and a special part. These parts are subdivided in respect to diseases and injuries of the hand.

The topics dealt with in the general part are: significance of the hand as an organ, concise review of hand pathology, general principles of prevention, program of treatment, examination of patients with diseases and injuries of the hand. In addition to it, data on statistics, classification and nomenclature are added.

In the special part, in the chapter on hand diseases, the suppurative and non-suppurative inflammatory diseases of the hand are described in detail. Special attention is paid to diagnostic and therapeutic errors occurring in practice and to their consequences. Thereafter, the clinical features of specific hand infections are described, i.e. tuberculosis, syphilis, gonorrhoea, actinomycosis and brucellosis.

The alterations of the hand occurring by common diseases in connection with diseases of the osteoarticular system, or caused by professional influences, are described under the heading "Degenerative — dystrophic diseases of the hand". The diseases attacking the auxiliary tendon organs built from connective tissue in the hand region are taken up separately. In each chapter, the clinical features of the disease and the results of conservative and surgical treatment are delineated.

The malignant and benign tumours of the hand and structures resembling their appearance are dealt with in another chapter. The diagnostics, treatment and results are shown on illustrative examples from the authors' own experience.

Hand injuries are the topic of the following chapter of the special part. The problems of diagnostics, clinical features and results of conservative and surgical treatment of closed hand injuries are reviewed in the case of contusions, strains, luxations and fractures.

The exposed injuries are classified as simple and complicated ones; the latter may be combined with injuries of tendons and nerves, or with luxations and fractures. The significance of the first aid, skin cleanness, surgical handling of wounds, immobilization and reconstruction of destroyed relationships is stressed. Various conservative and surgical methods that could be applied in treatment of hand injuries are recommended. The burns, frostbites and combined hand injuries are considered under separate headings.

The complications, consequences and final results of hand diseases and injuries are analyzed in a special chapter.

The problems of medical rehabilitation of out-patients are explained in the last chapter. The conservative measures are suggested and the surgical techniques are described that can be utilized in treatment of such patients.

The handbook consists of 336 pages, 171 figures, 18 tables and a bibliography comprising 150 quotations.

The book "Surgery of diseases and injuries of the hand" written by E. V. Usoltseva and K. I. Mashkara obtained a diploma as an award given by the Ministry of Health of USSR in 1976. It was translated to English and published in U.S.A.

The authors. — Yelena Vasilyeva Usoltseva, M.D., is professor of surgery in Surgical department of the hospital. She is a honorary member of the Pirogov's Surgical Society in the district of the town Kirov. She has specialized in traumatology and has written more than 100 scientific papers. Majority of them deals with problems of hand pathology. She generalized experience gained by all the soviet medicine during the Great Patriotic war (in the years 1941—1945) in the field of "Hand injuries". She is consulting physician in the municipal center of hand surgery in Leningrad.

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DAY AFTER DAY AND YEAR AFTER YEAR YOU ARE CONSTANTLY CHASING SOME AIM OR ANOTHER, YOU STRETCH THE MAINSPRING OF YOUR HEALTH TO THE VERY MAXIMUM. AND HOW LONG DO YOU THINK YOU CAN CONTINUE TO DO SO? REMEMBER THAT YOU HAVE ONLY ONE HEALTH AND FINALLY MAKE UP YOUR MIND TO GRANT IT, AT A VERY REASONABLE PRICE, WHAT IT DESERVES: COMPLEX TREATMENT AT ONE OF THE OLDEST AND THE MOST WIDELY RECOGNIZED SPAS IN EUROPE.

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