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SOCIAL AND HEALTH ASPECTS OF AUGMENTATION MAMMAPLASTY

M. Fára, H. Topinka, A. Nejedlý, Z. Pros, J. Hrivnáková, M. Čakrtová, J. Měšťák, A. Sehr(*)

Well developed and shapely breasts always been viewed as the most impressive characteristic of femininity, which is why already in the earliest cultures and, in particular, in antiquity they were so copiously represented (in art) and celebrated (in poetry and fiction).

In our time, healthy and well developed breasts are not only a guarantee of the woman's ample role in maternity but, from the psychological point of view, also an important condition of every woman's assertion in society.

The plastic surgeon is thus expected to help women along the following lines: to reconstruct a breast mutilated for health reasons on the one hand and, on the other hand, to remodel or augment a breast affected by congenital anomaly, or an atrophic or again a hypertrophic breast as a secondary condition arising mostly from repeated breast feeding or from climacteric.

While an ablated breast has to be reconstructed in a complex, multi-stage fashion, in cases of subcutaneous mastectomy the removed gland can be replaced by a suitable implant in a single-step operation. In the overwhelming majority of our patients augmentation or modellation mammaplasty was indicated for psychic reasons in different forms of congenital underdevelopment (agenesis, aplasia, hypoplasia) or in cases of later-life deformation.

However, it is mainly congenital developmental mammary defects that give the victims a distressing feeling of inferiority and of having to cover up the defect. Added to this awareness of cosmetic inadequacy, the women thus affected suffer from a complex of functional inferiority with regard to the other, the main mission of the would-be mother, i. e., to breastfeed the children they will give birth to. It is surprising to realize how often women affected by congenital or acquired breast defect are exposed to other people's thoughless, inconsiderate joking and consequently traumatized sometimes to the point of developing psychosis with all the consequences of exclusion from normal life.

Considering that inborn hypoplasia or acquired atrophy of the breasts bring the victims many serious emotional problems, augmentation mammaplasty has, in recent decades, become a routine therapeutical method used for health, psychological and even psychiatric reasons.

Treatment

The nature of the defect, whether congenital hypoplasia or acquired atrophy, precludes any cause rectification, which is why attempts at hormonal treatment have also been abandoned.

Since the very beginnings, augmentation mammaplasty has been marked by efforts to replace the defective tissue with autogenous tissue alternating with efforts to use man-made materials.

At the Prague Department of Plastic Surgery, breast augmentation using autogenous tissue was started soon after the end of the 2nd World War. Academician Burian introduced the transfer of corioadipose segments from the gluteal region, rarely from the hypogastrium, using, at first, the delayed-transfer technique to make sure that the resulting cicatrization should limit the post-operative absorption of the adipose tissue transferred. He also used tissue transplantation, i. e., fat with part of the gland from one breast to the other. In our 1962 publication (Pešková-Fára) we mentioned the fact that this type of graft had never been rejected in any of the women operated on at our Prague unit. The sake of completeness, though, we should add that Burian performed the first hypoplastic breast augmentation, using adipose tissue transfer from the submammary region, already in 1934 (Pešková-Fára, 1963).

This other technique appears to be justified by the relatively considerable need for replacement tissue which can hardly be taken, without visible marks, anywhere else on the victim's body. Hence the constant search for new, if possible, organically inert substances. Over the past three decades, countless report have been published in praise of the ease and simplicity of surgical procedure and excellent cosmetic results using prosthetical artificial materials such as polyvinyl alcohol, polyester, polystane, polyurethane sponge, Silastic filled with inert gel, and so on. In this country, only two types of domestic products have been tested and used so far: hydron-porous prosthesis, and prosthesis consisting of double polyethylene sheet filled with polyester staple.

Over the past period, there has been a simultaneous stream of reports admitting all sorts of complications, the most important being the rejection of the xenograft after several years despite the fact that experiments revealed that material as entirely inert. Oncologists then warn of the potential cancerogenicity of artificial materials, especially in the presence in the breast of residual mammary gland known for its susceptibility to malignant growth. Patients with breast prosthesis also often complain of hardness of the breast caused by the progressive rigidity of the capsule.

OUR OWN MATERIAL (Tab. 1, 2)

In order to make an objective assessment of the results of augmentation mammaplasty using different types of material in a sufficiently large group we checked the process of healing and long-term therapeutical results in a total of 162 patients operated on at the Prague Department of Plastic Surgery over a period of 25 years —1960—1984. The indications for mammaplasty are listed in Tab. 1.

Table 1

Surgical indication		Number
Congenital hypoplasia	bilateral	79
	unilateral	25
Atrophy from breast feeding		28
Subcutaneous mastectomy		11
State after mammary ablation		8
Aplasia for exposure to X-rays in childhood		4
Aplasia for inflammatory involvement of the gland in childhood		2
Aplasia for extirpation of benign tumour from the chest region in childhood		3
Aplasia for pulmonary tb in childhood		1
Atrophy after hormonal treatment for metrorrhagia		1

Table 2

Period 1960—1984	Number of	
	implanted prostheses	patients
Corio-adipose implants	95	61
Contralateral corio-adipose transplants	4	4
Hydron	156	95
Silastic	20	12
Polyster staple	8	5
Acryl	7	4

A total of 95 corioadipose implants from the gluteal region were used in 61 women, 34 times bilaterally, 27 times unilaterally. Permanent union was achieved in 89 implants, though a measure of fat resorption was noted in all cases. Very good results, i. e., but minor resorption with the original size and shape of the breast nearly preserved and with elasticity on palpation, were found in roughly three quarters of the group, while in the rest of the patients resorption was more noticeable. 6 patients had to have the implant extirpated because of abnormal fat resorption (1 case), cystic fibrous degene-

ration (1), phlegmona (1), persistent purulent secretion (1) or cyst formation (2). Reoperations were performed using corioadipose implants in two cases and hydron in four cases. Another patient developed isolated cysts which were subsequently removed without in any major way affecting the appearance or shape of the breasts (Fig. 1—6).

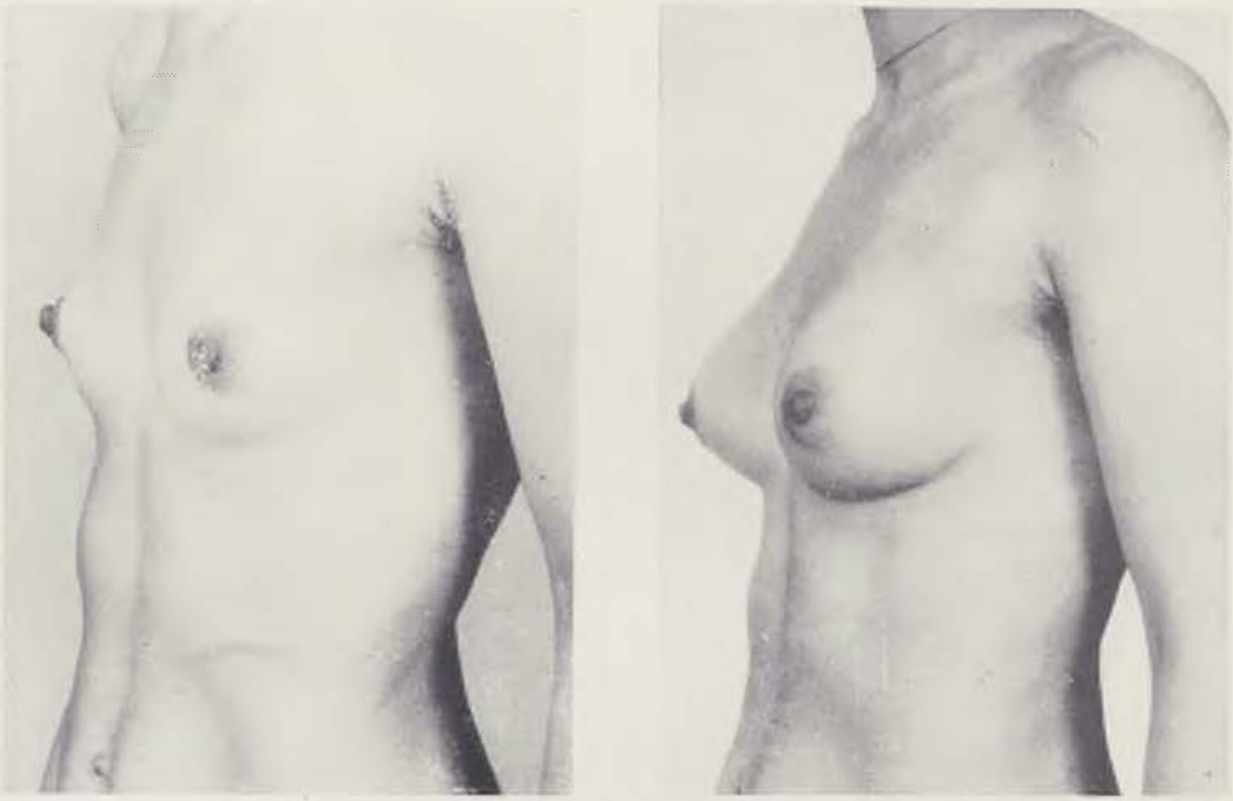


Fig. 1, 2 Patient B. V. Congenital hypoplasia of the breasts; state before — and 5 years after corio-adipose implantation

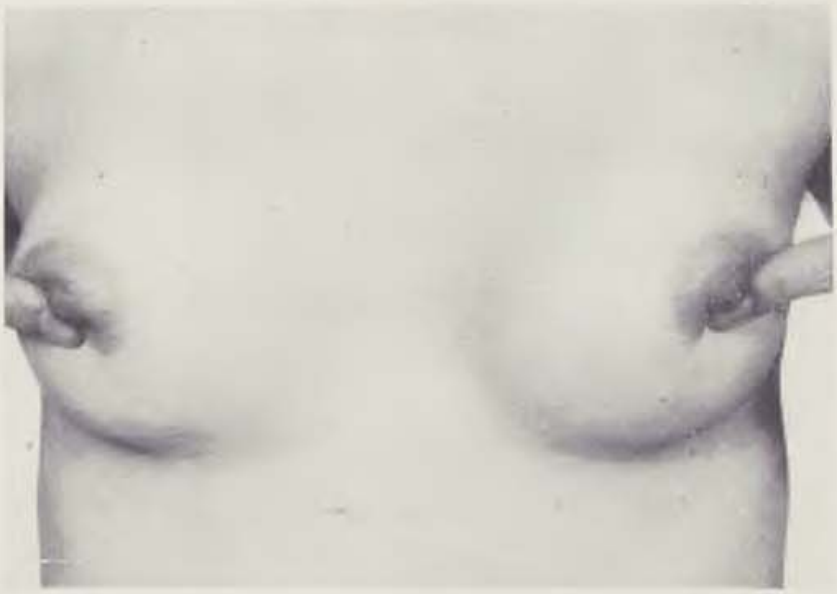
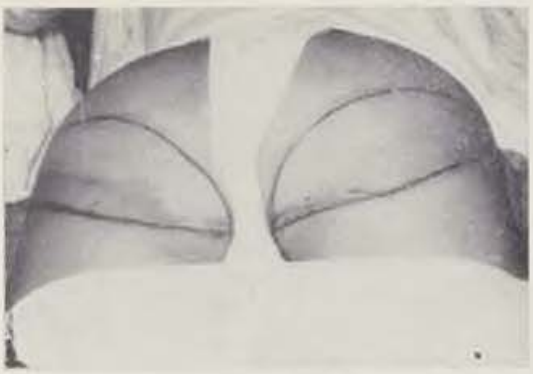


Fig. 3 Patient B. V. Corio-adipose implant elasticity demonstrated by finger pressing against the areola



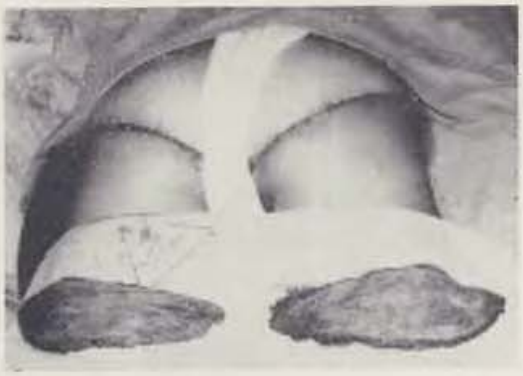


Fig. 4, 5, 6 Technique of corio-adipose implants withdrawal from the gluteal region and shaping them into cones

In 95 women a total of 156 h y d r o n pads were used, thereof 61 times bilaterally, 34 times unilaterally. Permanent union was seen in 121 implants. As regards breast appearance very good results were obtained in the overwhelming majority of our patients, though in nearly all of them the implants soon became hard due to ossification from the base, often giving rise to complaints of their considerable weight. In 35 cases, the hydron implants had to be extirpated for purulent complications, pressure necrosis of the skin cover, the implant becoming loose to the point of turning round, abscess, breast tenderness, and other inflammatory complications. Reaugmentation was performed using either implants of the Cronin type, corioadipose implants, or hydron again, and, in exceptional cases, local transfer according to Longacre. In 5 cases, no reaugmentation was performed either for the patient's loss of interest or for poor field conditions. In other words, the one great disadvantage of the hydron prosthesis is their ossification from the base resulting — in a matter of months or years — in almost complete hardening and weight increase.

8 pieces of p o l y e s t e r staple prosthesis were used in five patients, thereof in three bilaterally, in two of them unilaterally. Permanent union was achieved in 7 out of the 8 prostheses. In the remaining one case the pad had to be removed for pressure necrosis of the skin cover and replaced by a Silastic implant after the breast had healed and the cavity dilated with an acrylic pad. Apart from this case, we performed extirpation in several more cases at the request of patients operated on elsewhere. The main reasons given were sub-

Fig. 7 Patient M. P. State after mammary glands extirpation
Fig. 8 Patient M. P. State at 18 years after hydron implantation

Table 3

Complications requiring implant removal	Corio--adipose implants	Hydron	Silastic	Polyester staple	Acryl	Contralateral corio-adipose transplants
Abnormal implant resorption	1	—	—	—	—	—
Cystic fibrous degeneration	1	—	—	—	—	—
Cysts	2	—	—	—	—	—
Phlegmona	1	—	—	—	—	—
Purulent secretion	1	17	—	—	—	—
Pressure necrosis of skin	—	4	—	1	—	—
Inflammation	—	8	—	—	—	—
Abscess	—	2	—	—	—	—
Implant loosening	—	3	—	—	—	—
Breast tenderness	—	1	—	—	—	—
% of total of prostheses implanted	6.3	22.4	0	12.5	0	0

jective complaints arising from the implants considerable hardness, from their tendency to come loose from the base, rustling sounds caused by movement,

etc., and also from apparent, not only palpable, but clearly visible implant shrinkage (Tab. 3, Fig. 9—11).

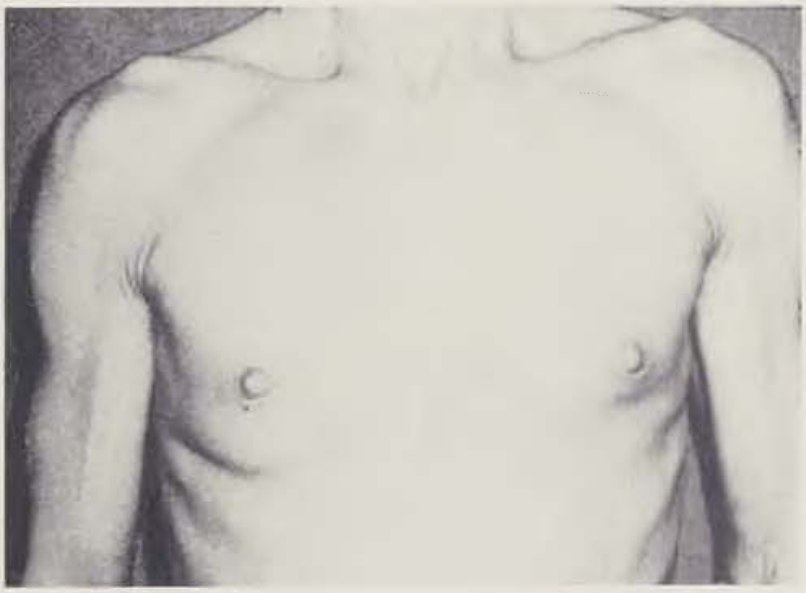


Fig. 9 Patient J. B. Congenital hypoplasia before surgery

Fig. 10, 11 Patient J. B. State 3 years after implantation of polyester staple prostheses. The check-up pictures show the whole implants shifting against the base under pressure of the fingers

Silastic prostheses filled with inert gel of the Cronin type were used for mammaplasty performed on 12 women, in 8 of them bilaterally, in 4 unilaterally, a total of 20 implants. Permanent union was achieved in all of them; there was only one case of early complication, a post-operative haematoma which was subsequently evacuated without any consequences. Very good lasting results were noted in all the patients (Fig. 12—14).

Acrylic implants were used for temporary breast augmentation and for purposes of dilatation in 7 cases involving 4 patients. In each case, these were removed after a period of several months and replaced with hydron in 4 breasts, with corioadipose implants in 2 breasts, and with a Silastic implant

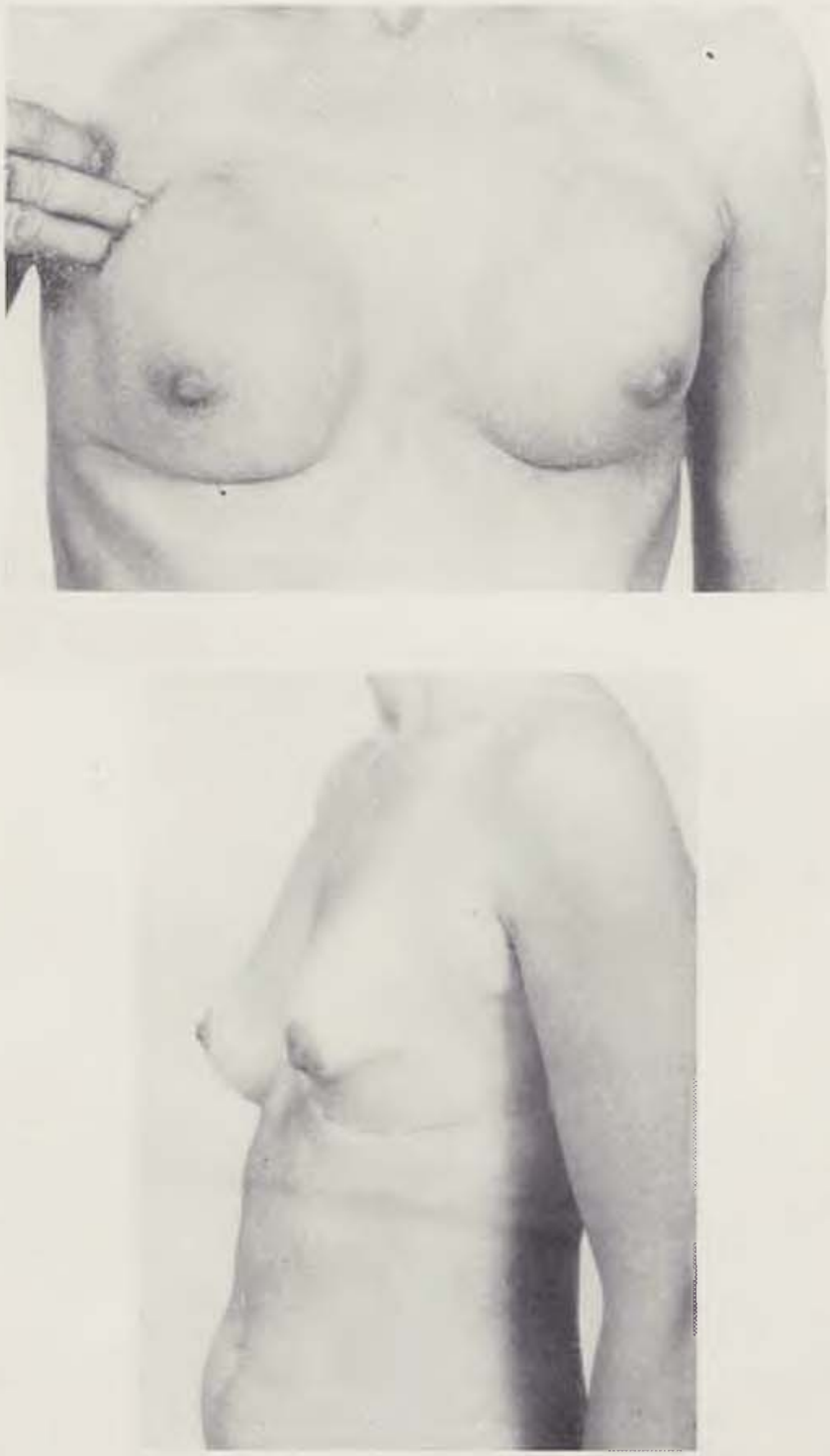


Fig. 12 Patient N. F. Contraction of poly-ester staple implant discernible on the patient's left breast 11 months after implantation. The implantation had been performed at a different centre

in 1 breast. All the implants were accepted with no complications whatsover (Fig. 15, 16).

In four patients with considerable breast asymmetry the corio-adipose resected excess from the contralateral side was used for the implant. All those tissue transfer operations resulted in permanent union (Tab. 4, 5).

Fig. 13 Patient N. F. Removed deformed polyester staple prosthesis, beside it a Cronin-type Silastic prosthesis ready for implantation

Fig. 14 Patient N. F. State after the implantation of Cronin-type Silastic prosthesis
hesis

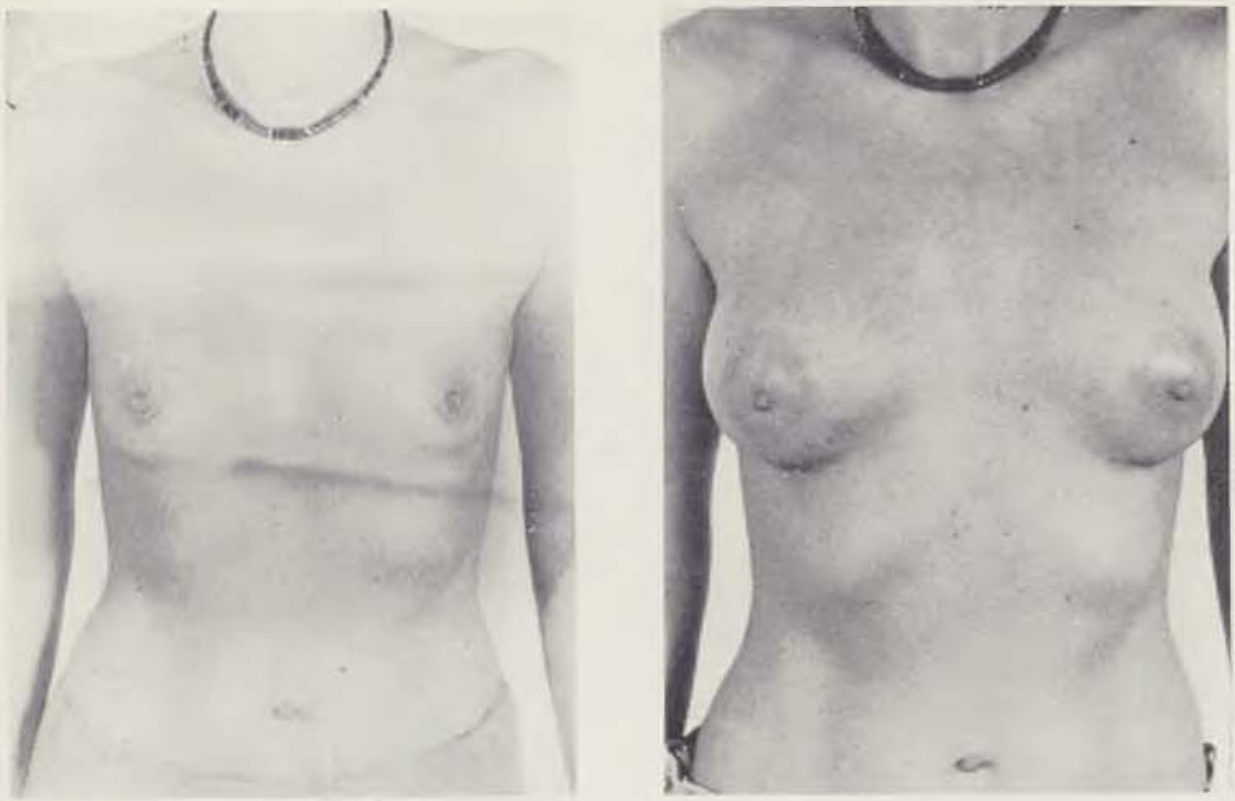


Fig. 15 Patient M. C. Congenital hypoplasia of the breasts prior to surgery

Fig. 16 Patient M. C. State after implantation of Silastic prostheses of the Cronin type
Fig. 17 Patient E. P. State 27 years after both breasts had been injected with paraffin at a different centre

In our group there is only one case of augmentation mammaplasty using paraffin performed elsewhere; all our department was asked to do was re-

move the resulting paraffinomas. As an interesting sideline we should add that we came across a fresh case of paraffin injection in the breast as recently as 1984. The patient admitted to have performed the operation herself on her medical friend's advice (Fig. 18—20).

Table 4. Complications not requiring implant removal

Corio-adipose implants	Number
Post-trauma infiltrate	7
Resorption	4
Colliquated fat secretion	2
Purulent secretion	1
Seroma	1
Cysts	1
Moderate secretion	2
Total	18 = 18.9 %

Hydron	Number
Implant loosening	3
Pressure necrosis of skin	1
Tenderness	4
Inflammation	2
Hematoma	2
Seroma	2
Psychic depression	1
Purulent secretion	1
Breast oedema	1
Sub-implant consolidation	1
Suture dehiscence	1
Total	19 = 12.1 %

DISCUSSION

Two aspects in particular deserve reference, a) the purely medical one, b) the risk of the complications of healing in together with the cosmetic results.

As for the health aspects, i. e., ruling out the risk of malignant degeneration resulting from foreign material implantation, there is no question that autogenous tissue, in our case gluteal corium with fat, is the only suitable material.

As for the hazard of health complications, Hydron is on top of the list, and as for cosmetic and subjective problems, polyester staple is the worst

offender. Silastic implants of the Cronin type came out as by far the best option. The Cronin prosthesis also produced the best cosmetic results as regards the shape, the preservation of the initial post-operative volume and implant elasticity.

Table 5. Complications not requiring implant removal

Polyester staple	Number
Pressure felt	1
Rustling felt	4
Total	5 = 62.5 %

Silastic	Number
Post-operative hematoma	1
Total	1 = 5 %

Contralateral corio-adipose transplants	Number
Total	0

Acryl	Number
Total	0

Hydron exhibited great rigidity due to ossification from the base in a matter of a few years, sometimes even months. Prostheses filled with polyester staple were unacceptably rigid from the very beginning.

In our opinion, corio-adipose implants from the buttocks, despite the difficulties of operation, and despite the usual partial shrinkage and, after the elapse of years, partial ossification, are the safest material for breast augmentation. 90 % of the women treated in this way were immediately and for good relieved of their distressing psychic problems as indications for surgery. Silastic prostheses filled with inert gel are, in our view, the optimum choice in the case of women who, at the time of surgery, have but a minimal mammary gland and where there is no risk of its mechanical oppression by foreign ma-

terial, or in the case of women whose condition precludes a major operation lasting 2 to 3 hours or staying in bed for a whole week, a period necessary for a smooth healing of the secondary defects on the buttocks. Unlike hydron or polyester staple prostheses, Silastic implants keep the required consistency

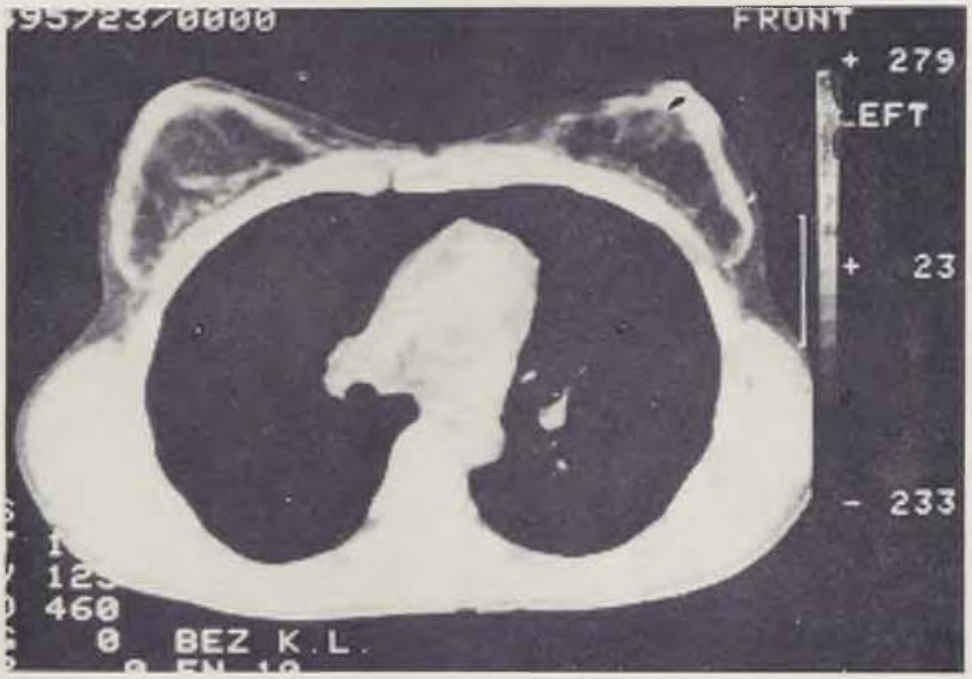


Fig. 18 Patient B. V. CT check-up 5 years after corio-adipose implant surgery. A minimum of contraction or calcification

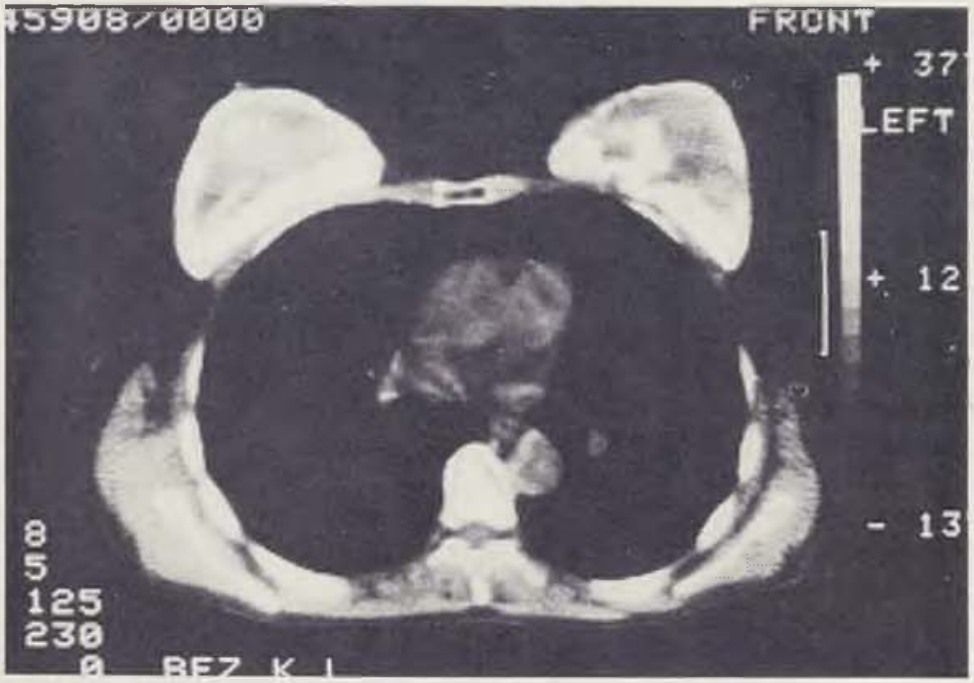


Fig. 19 Patient M. P. CT check-up 18 years after hydron implantation. A coherent thick calcified layer is discernible around the whole of the implants

and elasticity. This experience of ours was passed on to the Ministry of Health of the Czech Socialist Republic already on January 12, 1981, and now, as a result of comprehensive research, the Prague Department of Plastic Surgery had adviced the Ministry to start arranging their production or purchase.

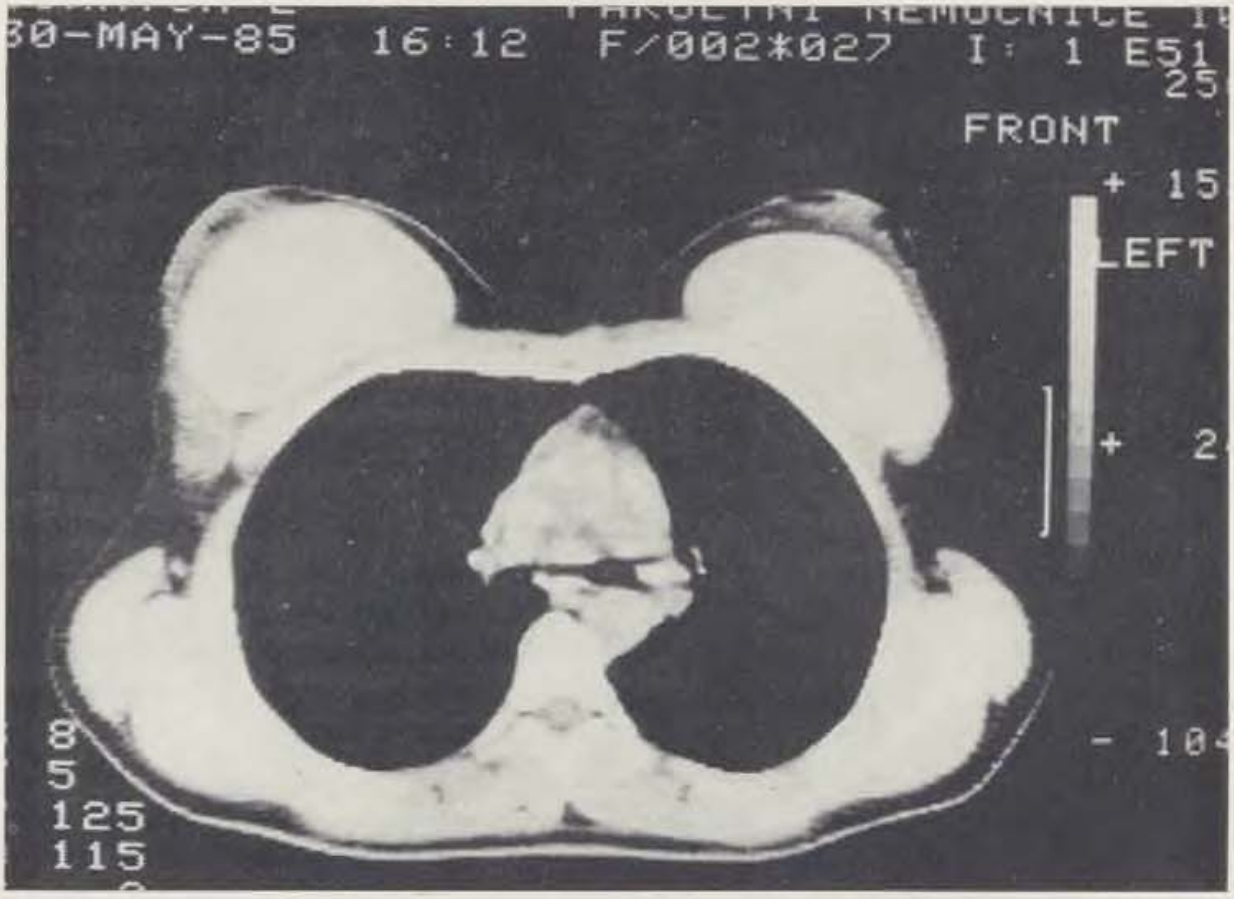


Fig. 20 Patient M. C. CT check-up of Cronin type prostheses 5 years after implantation. There are practically no calcifications

SUMMARY

The authors present the results of a comprehensive clinical and X-ray assessment of augmentation mammaplasty performed on 162 patients at the Prague Department of Plastic Surgery over 25 years, from 1960—1984. The prostheses used included both autogenous material (corium with fat) and foreign material: two types of domestic prostheses (porous hydron and double polyethylene sheet filled with polyester staple), and one imported product (Silastic prosthesis of the Cronin type filled with inert gel).

From the purely medical point of view, i. e., ruling out the risk of malignant degeneration resulting from foreign material implantation, autogenous tissue is undoubtedly the only suitable implant. From the cosmetic point of view, Silastic implants of the Cronin type came out as by far the best option.

RESUME

Les aspects sociaux et de sauté sur les opérations d'augmentation des seins

Fára, M., Topinka, H., Nejedlý, A., Pros, Z., Hrivnáková, J., Čakrtová, M., Měšťák, J., Sehr, A.

Les auteurs rapporent leurs résultats obtenus par l'apprétiation clinique et radiologique d'augmentations des seins. Les opérations d'augmentation ont été effectuées à la Clinique de la chirurgie plastique à Prague sur 162 malades au cours de 25 ans, dans les années 1960—1984. Comme matériel d'augmentation, on a choisi soit un matériel autogène (corium avec graisse), soit allogène. Ce matériel-ci était représenté par deux types de prothèses de provenance intérieure (hydron poreux et double-folie en polyéthylène, comblée du tissu de polyester) et par un produit étranger (prothèse en silastic, comblée du gel inerte, type Cronin).

En matière de santé, le tissu autogène est incontestablement le matériel de préférence, vu le risque de dégénérescence maligne qui pourrait être provoquée par un matériel allogène. En matière cosmétique, les meilleurs résultats ont été obtenus par l'application de l'implant en silastic, type Cronin.

ZUSAMMENFASSUNG

Die gesellschaftlichen und gesundheitlichen Gesichtspunkte von Augmentationsoperationen der Brüste

Fára, M., Topinka, H., Nejedlý, A., Pros, Z., Hrivnáková, J., Čakrtová, M., Měšťák, J., Sehr, A.

Die Autoren legen die Ergebnisse einer komplexen klinischen und röntgenologischen Einschätzung der Augmentation der Brüste bei 162 Patientinnen vor, die an der Klinik für plastische Chirurgie in Prag innerhalb von 25 Jahren, 1960—1984, operiert wurden. Zur Augmentation wurde sowohl autogenes Material (Korium mit Fett) als auch fremdes Material in der Form zweier Typen von inländischen Prothesen (poröses Hydron und doppelte Polyäthylenfolie ausgefüllt mit Polyesterwolle) und einem ausländischen Erzeugnis (Silastikprothese ausgefüllt mit inertem Gel des Cronin-Typs) verwendet.

Vom gesundheitlichen Standpunkt aus, d. h. um das Risiko einer malignen Ausartung durch die Einwirkung des eingesetzten fremden Materials auszuschliessen, ist zweifellos das autogene Gewebe das einzige geeignete Material. Vom Gesichtspunkt der kosmetischen Ergebnisse erwiesen sich eindeutig als die besten die Silastik-Einlagen vom Cronin-Typ.

RESUMEN

Aspectos sociales y los de medicina de operaciones aumentativos de glándulas mamarias

Fára, M., Topinka, H., Nejedlý, A., Pros, Z., Hrivnáková, J., Čakrtová, M., Měšťák, J., Sehr, A.

Los autores presentan aquí los resultados de la calificación compleja clínica y radioscópica de la aumentación de glándulas mamarias en 162 enfermas, operadas en la clínica de la cirugía plástica en Praga a lo largo de 25 años, es decir en el período 1960—1984. Para la aumentación emplearon tanto el materiál autógeno (corium con grasa), como y el material ajeno en el aspecto de dos tipos de prótesis de procedencia nacional (hidrono poroso y una lámina doble, llenada por fibre de poliéster), como y un producto de procedencia extranjera (el prótesis de silicona de Siláctic, llenado por gel inerte de tipo de Cronin).

Del aspecto de medicina, es decir en el sentido de la eliminación de peligro de degeneración maligna bajo la influenza de implantado de material ajeno, indiscutiblemente por único material se presenta el tejido autógeno. Del aspecto de resultados cosméticos univocamente como mejores se mostraron piezas de silicona de tipo de Cronin.

REFERENCES

1. **Pešková, H., Fára, M.**: Congenital dysplasia of the female breast (in Czech). Acta Chir. orthop. Traumat. čech., XXIX, 6 : 536, 1962.

2. **Pešková, H., Fára, M.**: Subtotal and total mastectomy with mammaplasty (in Czech). Acta Chir. orthop. Traumat. čech., XXX, 6 : 490, 1963.

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A SURVEY OF TESTING METHODS AND TECHNIQUES FOR FREE SKIN GRAFT REVASCULARIZATION

V. Sekan, M. Brozman

General observation is the basic and simplest method for the evaluation of scientific and medical phenomena. Long before the development of microscopy and chemical analysis, transplant progress could be followed by simply judging its appearance. To this day, inspection remains a useful method of gathering immediate information on whether or not the graft is taking.

In terms of clinical practice, plastic surgeons use visual assessment and palpation as diagnostic criteria to determine the actual condition of skin grafts and flaps. With regard to autogenous skin in reconstructive surgery, particularly in burns treatment or loss injury handling, only very few clinicians would really fall back on histological tests as these require excision from the transplant. Gibson and Medawar (1943) and Henry et al. (1962) belong among those few who added periodic histological sections to their clinical observation of human auto- and heterografts. Thus they were able to supply important information on the sequence of reactions occurring in human skin grafts.

Some researchers, e. g., Converse and Rappaport (1956), Ceppellini et al. (1966) and Mc Donald (1968) added direct stereomicroscopy of the skin as an adjuvant and reliable diagnostic aid. Skin stereomicroscopy is a useful technique for determining the transplant vascular system behaviour in situ. Unlike histochemistry and histology, it leaves the transplant intact.

In contrast to this, researchers using laboratory animals in experiments can make use of diverse combinations of different diagnostic testing procedures in conjunction with general criteria for diagnosing the skin graft condition.

Microscopic criteria include histology, stereomicroscopy, etc. Dammin and Murray (1959) regard the characteristic growth of hair for the donor tissue as absolute proof of graft survival. In contrast, skin colour and pigmentation are not, comparably, reliable indicators of survival since successful autografts are known for their tendency to change the original coloration to a darker or paler shade.

The visible onset of autogenous skin rejection in poorly pigmented animals or humans takes the form of initial oedema, gradual hardening of the transplant, change of coloration from the initially pale pink to dark red which is soon turned into bluish or even black. The rejected tissue will shortly change into a hard, dry, discolored detritus.

In contrast, successfully autotransplanted tissue is soft and elastic after 6 to 8 days, pale pink indicative of neovascularization, and, in general, shows the appearance of normal skin.

There are a number of experimental methods to help deal with the problem of free skin transplant revascularization.

1. Histological examination of sections

Sections from the bed and transplant are examined for the processes going on in those structures. We can also study processes taking place in the bed-transplant interface. The first histological studies of skin transplant acceptance and rejection come from Garré (1889) and Goldman (1890).

2. Intravascular injection of contrast media

Intracardial, intravenous or intraarterial injections of contrast medium will visualize the vascular system of the bed, the transplant, and the development of anastomoses. The technique was first used by Thiersch (1874), Henke and Wagner (1889).

3. Experimental vital microscopy of the skin (direct microscopy and stereomicroscopy)

Taylor and Lehrfeld (1953) analyzed (more precisely in 1955) some of the basic inadequacies of general observation and histological analysis of transplants. They introduced direct stereomicroscopic examination of transplants in situ in consecutive days under incident light, by means of which changes in the blood vessels and the conditions of blood flow were easily detectable.

4. Combination of testing methods

Role, Taylor and Charipper (1959) used a combination of four techniques to study auto- and allograft behaviour in mice and rats:

a) daily general and stereomicroscopic examination,
b) routine histological specimens,
c) cardial injection of Indian ink solution,
d) intravenous injection of the soluble dye bromophenol blue.

5. Microangiographic study of microvasculature

This method was developed by Bellman (1953) and Bellmand and Velander (1957), and used for the study of full-thickness grafts from rabbit ears. Vascular filling was observed on the injection of X-ray contrast medium.

6. Transparent chamber technique

In 1924, Sandison was the first to design a transparent tissue chamber for the direct in situ observation of living tissue cells over long periods of time. As the first chambers were taxed with difficulties, the technique failed to come in general use. In 1943, Algire successfully adapted the technique to the mouse. In 1951, Conway, Joslin and Stark were the first to apply the transparent chamber principle to skin transplants.

7. Histochemical studies

Scothorne and Tough (1972) and Scothorne and Scothorne (1953) explored the potential uses of histochemical tests to find out more about the fate of transplants. Their experiments were designed to define quantitative changes in the levels of glycogen and ribunucleic acid as indicators of carbohydrate and protein metabolism in human transplants.

8. Isotope techniques

In 1957, Lydkin used radioactive phosphorus to study autograft blood supply in rabbits. Another experimental method to account for the role of vascular and circulatory changes in the transplant is that Ohmori and Kurata (1960) using radioactive phosphorus and transplant radioactivity measuring with a Geiger-Müller counter.

9. Electron microscopic observation

Researchers in other branches of medicine and biology applied electron microscopy on a large scale but it was not until 1964 that Wiener, Spiro and Russel supplied new information on the ultrastructural characteristics of skin transplants in the rabbit.

10. Biochemical studies

More and Schayer (1969) were the first to inform on changes in the structure of intracellular histamine build-up in full-thickness grafts in connection with observations of the healing process in autografts. In 1971, Jasani and Lewis described a sequence of changes in the activities of six intracellular rabbit enzymes during auto- and allograft healing.

CONCLUSION

Our aim was to show the evolution of experimental methods and techniques for the determination of the state of revascularization in free skin transplants. While the problem of autograft revascularization is generally known, the above methods may supply new information mainly as regards the revascularization and rejection of allo- and heterografts. In clinical practice, we continue to use the simplest methods of investigation, i. e. inspection and palpation.

SUMMARY

In clinical practice, the authors use the techniques of inspection and palpation as diagnostic criteria of the actual condition of skin transplants. However, in experimental work it seems better to use different combinations of diverse diagnostic procedures in conjunction with the general criteria of assessing the state of the transplant.

RESUME

Le précis de méthodes d'exploration et de techniques de revascularisation de la greffe cutanée libre

Sekan, V., Brozman, M.

Le critère diagnostique que nous avons adopté dans la clinique pour évaluer l'état d'une greffe cutanée, c'était l'exploration par inspection et par palpation. Quand on

procède à l'expérimentation, il est plus convenable d'utiliser plusieurs combinaisons de divers procédés diagnostiques, joints aux critères généraux d'évaluation de l'état de la greffe.

ZUSAMMENFASSUNG

Übersicht über die Untersuchungsmethoden und die Revaskularisierungstechnik eines freien Hauttransplantats

Sekan, V., Brozman, M.

In der klinischen Praxis verwenden wir als diagnostisches Kriterium der Feststellung des Stands eines Hauttransplantats die Untersuchung durch Inspektion und Abtasten. Zum Unterschied davon ist es bei einem Experiment geeigneter, verschiedene Kombinationen unterschiedlicher diagnostischer Methoden anzuwenden und sie mit den allgemeinen Kriterien zur Feststellung des Stands eines Transplantats zu kombinieren.

RESUMEN

La sinopsis de métodos y de técnicas de examen de la revascularización de transplantante cutáneo libre

Sekan, V., Brozman, M.

En la práctica clínica en función del criterio diagnóstico de estipulación del estado del transplantante cutáneo empleamos el examen por la inspección y por la palpación. En desacuerdo con ésto, en los experimentos más conviene usar a diferentes combinaciones de variados métodos diagnósticos, unidos a criterios generales para la estipulación del estado del transplantante.

REFERENCES

1. **Coppellini, R. et al.**: Survival of test skin grafts in man: Effect of genetic relationship and of blood groups incompatibility. Ann. N. Y. Acad. Sci., 129 : 421, 1966.
2. **Dammin, G., Murray, J.**: Criteria for acceptance of skin grafts. Transplant. Bull., 6 : 429, 1959.
3. **Henry, L. et al.**: A histologic study of the human skin autograft. Amer. J. Path., 39 : 317, 1961.
4. **Henry, L. et al.**: The rejection of skin homografts in the normal human subject. Part II. J. clin. Invest., 41 : 420, 1962.
5. **Jasani, M., Lewis, G.**: Lymph flow and changes in intracellular enzymes during healing, and rejection of rabbit skin grafts. J. Physiol. Lond., 219 : 525, 1971.
6. **McDonald, J.**: Rejection of skin allografts by healthy humans. Relationship of type rejection to degree of immunity. Arch. Surg., 97 : 306, 1968.
7. **Moore, T., Scheyer, R.**: Histidine decarboxylase activity of autografted and allografted rat skin. Transplantation, 7 : 99, 1969.
8. **Ohmori, S., Kurata, K.**: Experimental studies on the blood supply to various types of skin grafts in rabbits using isotope P^{32}. Plast. reconstr. Surg., 25 : 547, 1960.
9. **Rolle, G. et al.**: Vascular changes in skin grafts in mice study and their relationship to homograft breakdown. J. cell. comp. Physiol., 53 : 215, 1959.
10. **Wiener, J. et al.**: An electron microscopic study of the homograft reaction. Amer. J. Path., 44 : 319, 1964.

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GROWTH CHARACTERISTICS AND DERMATOGLYPHIC PATTERNS IN A BOY WITH ELLIS — VAN CREVELD SYNDROME

Z. Šmahel, I. Horák, Z. Klein

Our earlier study reported in detail (Horák and Šmahel, 1983) the clinical findings recorded in a boy with autosomal recessive hereditary chondroectodermal dysplasia (Ellis and van Creveld syndrome). The boy had all five basic features of this syndrome, i. e. chondrodystrophy, ectodermal dysplasia, postaxial polydactylia, incomplete median cleft upper lip, and a narrow deformed chest, while the inconstantly present inborn heart defect was not demonstrated. Chondrodystrophy was manifested by the small stature which was due to the shortening of his extremities of mesomelic and acromelic type and by a narrow deformed chest with a prominent sternum. Ectodermal dysplasia was characterized by dystrophic nails, hypodontia and hypoplastic enamel. The upper and lower extremities had six fingers or toes, with the exception of the left hand with eight fingers growen together. The family history was inconclusive, laboratory tests and the chromosomal pattern were normal.

The present study was aimed at an analysis of data obtained in our patient during the long-term follow-up of his growth. The dermatoglyphic patterns presented in this report included the findings recorded in the affected boy, in his parents and in his normal brother.

METHOD

The somatic development of the patient (Fig. 1a, b) aged eighteen was followed-up regularly from the age of six years by one of the authors. The check-up examinations were carried out annually on his birth date. Anthropometric data were compared with relevant Czech norms: body height and weight according to Prokopec et al. (1973), the sitting height and the dimensions of the upper extremities according to Škvařilová (1975), those of the lower extremities according to Krejčovský (thesis) and the characteristics of the trunk according to Bláha et al. (1982). The patient did not attend the check-up examinations at the age of nine and fourteen years. Values of body height and

weight in various time intervals were available from the age of nine months. He was treated on an in-patient basis at the age of nine and 21 months because of severe bronchopneumonia. Subsequently he did not suffer from any severe infection.

Fig. 1a, b The patient at the age of 9 months and 17 years

RESULTS

Body development: Up to the age of 2.5 years his body weight (Fig. 2) was markedly reduced (by more than 3 standard deviations) because of insufficient adaptation to his environment and ill-health (birth weight 3.350 g, i. e. —0.2 SD). During the subsequent period of life up to 4.5 years his condition improved to —2 SD and after the age of ten years followed a further improvement (to —1 SD). At this age the patient showed a favourable

general somatic and physical development with a marked improvement of his chest deformity. Changes of body height were less spectacular. Some improve-

Fig. 1b

ment occured between ten and fifteen years of age (from —2.0 SD to —1.5 SD), however the change during the whole period of follow-up was negligible (from —2.0 SD at six to —1.9 SD at eighteen; birth length 49 cm). The sitting height was consistent with the norm and thus confirmed that the smaller body height was due exclusively to the shortening of his lower extremities.

The values of body height and weight recorded during the period of investigation are presented on figure 3. The curve of weight increments confirms the increase occuring at the age of eleven and twelve years and then again during puberty. The curve of body height is consistent with that in controls but for a slight delay of pubertal acceleration which is less conspicuous (because of the lack of check-up at the age of nine and fourteen years the increments ascertained after two years are divided by two and the values obtained are entered between the pertinent years).

The shortening of his upper extremities and of their individual segments remained unchanged during the investigated period of life (Fig. 4a; some variations were due to the differing value of SD in controls). A similar development-

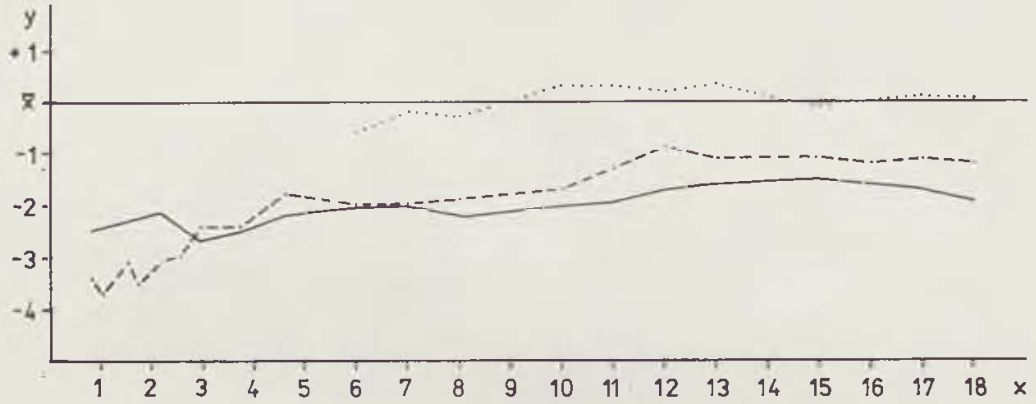

Fig. 2. Development of body height, body weight and sitting height in the patient (deviations from the norm are expressed in terms of SD)
..... sitting height, _____ height, — — — — weight, x — years, y — S. D.

al pattern showed the length of lower extremities as illustrated by the somatogram (Fig. 5). Yet, because of the arrest of growth of the hands the difference from normal increased after the age of sixteen. An identical trend showed the curves of thoratic dimensions (Fig. 4b), inclusive of its depth. Thus the anteroposterior growth of the chest proceeded predominantly in its lateral parts which were initially sunken (Fig. 1) and this resulted in a substantial improvement of pectus carinatum. However, the chest remained narrow. The narrowing of the shoulders grew less conspicuous between the age of ten and twelve years and than after puberty. The pelvic width was consistent with the norm. The curves of the circumferences of extremities, which are generally in good correlation with the somatic developmental pattern, showed differing developmental characteristics (Fig. 4c). At the age of eleven and twelve years occurred a definite improvement with values reaching almost the norm.

The basic deviations recorded at the age of six, ten, fifteen and eighteen years are summed-up on the somatogram (Fig. 5) which confirms the particularly marked shortening of the distal parts of extremities and smaller circumference of the narrowed chest. These typical characteristics of the syndrome were constant. A reduction of the described deviations with advancing age was recorded only in the circumferences of extremities, in body weight and in biacromial width.

D e r m a t o g l y p h i c s t u d i e s (Tab. 1): Only composite (two triradii) patterns with a very high TRC value (244) were disclosed on the fingers of our patient. Composite patterns were present also in his father and their numbers were increased in his brother as well. TRC was increased in all family

members, similarly as the regularly higher a-b ridge count. There was a high frequency of double loops. The proband had on the right hand an increase of b-c ridge count, at the expense of the c-d ridge count (on the left hand their assessment was not possible because of surgery). The hypothenar on the left

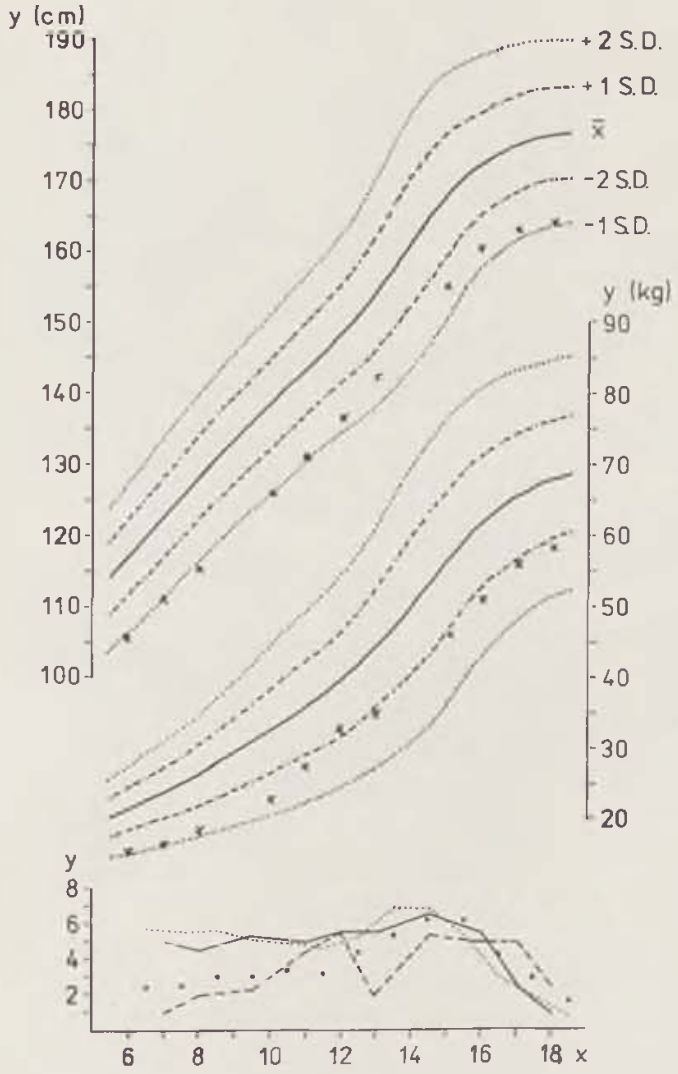

Fig. 3 Values of height and weight in individual years and curves of increments
y — height in cm, weight in kg, increments, x — years
_____ height, — — — — weight, ... weight control, ... height control

hand showed an ulnar loop and a triradius in t″ position. His father had on his left hypothenar a concentric whorl with triradii t′ and t″, while his brother had on the right a proximal loop with t″. No deviations of the thenar and of

the interdigital patterns, or of the course of main lines were present in any of the individuals examined. The proband had bilateral typical simian lines and one flexion crease on his right little finger. Our patient and both his

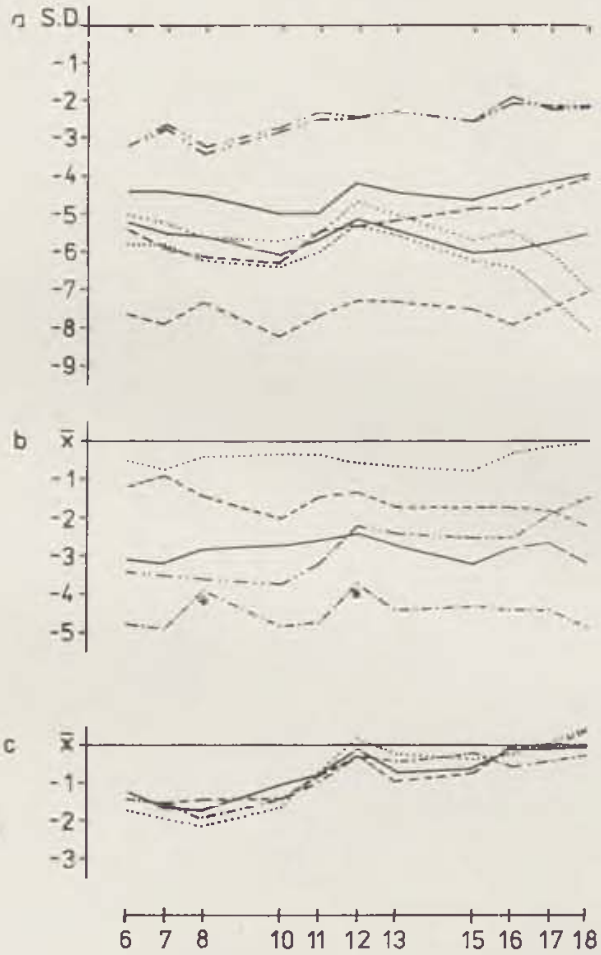

Fig. 4 Deviations of the length of extremities (a), of trunk dimensions (b), and of circumferences of extremities (c) in relation to age expressed in terms of standard deviations (variation caused by high values of SD in controls)
a — length: _____ upper extremity, — . . — upper arm, — — — — — forearm, ... hand, dx = thick line, sin = thin line
b — chest: _____ circumference, — — — — depth, — . — . — width: — . . — biacromial, ... bicristal
c — circumferences: _____ arm dx, — — — — forearm dx, — . — . — thigh dx, ... calf dx

parents had on their feet bilateral distal loops on the hallucal area, while no patterns were disclosed on the calcar. His mother had on her right foot accesory triradii p and p′ while triradius c was missing and on the left sole was an accesory triradius p. The patient had on his right foot a triradius p and a whorl below the left little toe.

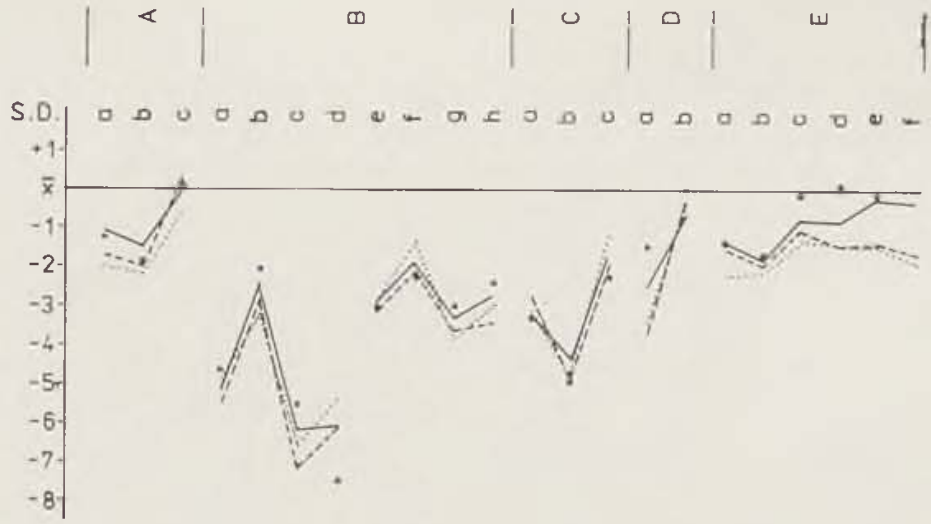

Fig. 5 Somatograms at the age of 6, 10, 15 and 18 years (the mean value for both sides was used in dimensions of extremities) A — body: a — weight, b — height, c — sitting height

B — length: a — upper extremity, b — upper arm, c — forearm, d — hand, e — lower extremity, f — thigh, g — shin, h — foot

C — chest: a — circumference, b — width, c — depth

D — width: a — biacromial, b — bicristal

E — circumferences: a — head, b — abdomen, c — arm, d — forearm, e — thigh, f — calf

..... 6 years, — — — — 10 years, _____ 15 years, ... 18 years

Tab. 1. Dermatoglyphic findings

		Finger patterns					Hypoth	t in %		a—b	b—c	c—d	TRC
Propositus	dx	D	D	W	W	W	O	15.9		45×	49××	19+	
	sin	D	W	W	D	W	L_u	16.2	38.8	—	—	—	244
Father	dx	D	W	W	W	W	A_d	21.6		43×	30	42	
	sin	L_u	W	W	W	W	W_c	28.8	48.6	39	25	43	174
Mother	dx	D	L_u	L_u	L_u	L_u	A_r	13.7		48×	32	38	
	sin	D	L_u	L_u	W	L_u	A_r	13.7		46×	33	43	163
Brother	dx	D	L_u	L_u	W	D	L_p	49.3		56×	35×	36	
	sin	D	L_u	L_u	D	D	O	14.3		49×	32	40	203

×larger by more than 1 S.D. (××2 S.D.)
+smaller by more than 1 S.D.
norms according to Kuklík males: a—b 37 ± 5.7 b—c 26 ± 8 c—d 34 ± 10
(both sides, mean ± 1 S.D.) females: a—b 38 ± 5.4 b—c 26 ± 9 c—d 35 ± 12

DISCUSSION

Patients with chondroectodermal dysplasia have a favourable prognosis quad vitam, provided that they have neither an inborn heart defect, nor a severe deformity of the chest associated with respiratory insufficiency. The substantial somatic improvement which occurred in our patient predominantly within two periods of time were in agreement with this experience. The first improvement occurred after the age of 2.5 years, at a time when he was free of recurrent severe bronchopneumonia and then again after the age of ten years when he went for his holidays to Yugoslavia and the following year to Cuba. In contrast to this improvement the deviations in the proportions of extremities and of the trunk persisted. The difference from normal neither increased nor decreased. They were due to chondrodystrophy. The reported findings showed further a slight retardation of the pubertal growth acceleration which was less intense (Fig. 3). This was in agreement with the retarded development of secondary sex characteristics. At the present time the patient is in a good physical condition (Fig. 1) and his growth is almost terminated (Fig. 3).

We failed to disclose in the literature a longitudinal study of the growth in individuals with Ellis-van Creveld syndrome which would confirm our observations. However, the deviations described in patients varying in age were identical and thus provided circumstantial evidence that proportional differences showed no substantial changes during development of the affected individual.

Patients with chondroectodermal dysplasia have mostly composite dermatoglyphic patterns. Da Silva et al. (1980) report a high frequency of composite finger patterns (87 whorls on 117 fingers), high TRC values (on the average 333 in males and 313 in females) and a-b ridge counts (76 in males and 71 in females). Frias & Cascos (quoted by da Silva et al., 1980) found also 20 whorls on 32 fingers. Seemanová et al. (1979) described a boy with a TRC 173 (exclusively whorls) and with a simian line showing an atypical oblique course on the palms. The latter authors recorded a normal dermatoglyphic pattern in the parents and in two normal sisters of the patient. A bilateral simian line was ascertained in identical twins by Goor et al. (1965). Our observations confirmed the high frequency of composite finger patterns and the increased TRC in affected individuals, but they were not necessarily associated with the inborn anomaly since composite patterns were present also in the father of our patient. These patterns were not related to the heterozygous genotype since they did not occur more frequently in his mother. It was not possible to exclude an association of heterozygosity with an increase of TRC or of the a-b ridge count. The patterns of the hypothenar resulted in a higher position of the palmar triradii (in the father and both sons) and represented most probably a familiar characteristic, similarly as the frequent occurrence of double loops on fingers.

SUMMARY

Longitudinal anthropometric studies in a boy with chondroectodermal dysplasia (Ellis and van Creveld syndrome) showed a favourable somatic develop-

ment, however the degree of body disproportions remained constant. The shortening of extremities and the narrow chest persisted. The dermatoglyphics consisted exclusively of composite finger patterns with high total ridge count. However, composite patterns were more frequent also in his father and normal brother. TRC was increased in all family members with a similar increase of the a-b ridge count.

RESUME

La croissance physique et les caractéristiques dermatoglyphiques chez un garçon avec le syndrôme Ellis-van Creveld

Šmahel, Z., Horák, I., Klein, Z.

L'observation anthropométrique à longue échéance d'un cas de la dysplasie chondroectodermique (syndrôme Ellis-van Creveld) chez un garçon a mis en évidence un développement somatique favorable. Egalement, on a constaté une disproportion persévérante du corps avec des membres. Les membres étaient abrégés, surtout dans leurs parties distales, le thorax restait étroit. Le tableau dermatoglyphique ne montrait que de dessins compliqués avec un haut nombre général de lignes. Mais les dessins compliqués, et d'une fréquence élevée, se manifestaient aussi chez le père et le frère de l'atteint. TRC était augmenté chez tous les membres de la familie, aussi que la quantité des lignes a-b.

ZUSAMMENFASSUNG

Das körperliche Wachstum und die dermatoglyphische Charakteristik bei einem Knaben mit dem Ellis-van Creveld'schen Syndrom

Šmahel, Z., Horák, I., Klein, Z.

Die longitudinale antropometrische Beobachtung eines Knaben mit chondroektodermaler Dysplasie (Ellis-van Creveld'sches Syndrom) zeigte eine günstige somatische Entwicklung, jedoch eine gestörte Proportionalität der Ausmasse der Gliedmassen und des Körpers unter andauerndem Zustand. Die Gliedmassen sind verkürzt, besonders in den distalen Partien, und der Brustkorb verbleibt eng. Das dermatoglyphische Bild zeigt ausschliesslich komplizierte Muster mit einer hohen Gesamtzahl von Linien. Solche komplizierten Muster sind jedoch in höherer Frequenz auch beim Vater und beim Bruder des Betroffenen zu finden. TRC ist bei allen Familienmitgliedern gesteigert und ähnlich die a-b-Anzahl der Linien.

RESUMEN

El crecimiento de la estatura y las características dermatoglíficas de un chico con el síndroma de Ellis-van Creveld

Šmahel, Z., Horák, I., Klein, Z.

La vigilancia antropométrica prolongada por un chico con la displasia condroectodermal (el síndroma de Ellis-van Creveld) demuestro a un favorable desarrollo somático, pero la proporcionalidad descompuesta de tamaños de las extremidades y del cuerpo poseen por un estado permanente. Las extremidades están disminuidas, sobre

todo en partes distales, el cuerpo va a quedarse estrecho. En el cuadro dermatoglífico exclusivamente hay diseños complejos con alto número total de líneas. Sin embargo, los diseños complejos en el número aumentado presentan también en el padre y en el hermano del afectado. El crecimiento total de la estatura está aumentado en todos miembros da la familia, lo mismo que a - b número de las líneas.

REFERENCES

1. **Bláha, P. and coworkers:** Anthropometric studies of the Czechoslovak population from 6 to 35 years (in Czech). OZZ VS, Prague, 1982.

2. **Goor, D., Rotem, Y., Friedman, A., Neufeld, H. N.:** Ellis-van Creveld syndrome in identical twins. Brit. Heart J., 27 : 797, 1965.

3. **Horák, I., Šmahel, Z.:** Chondroectodermal dysplasia (Ellis-van Creveld syndrome). Report of a case. Acta Chir. plast., 25 : 161, 1983.

4. **Krejčovský, L.:** Thesis under preparation.

5. **Kuklík, M.:** Unpublished dermatoglyphic norms.

6. **Prokopec, M., Suchý, J., Titlbachová, S.:** The results of the third whole-state investigation of the youth in 1971 (in Czech). Čs. Pediat., 28 : 341, 1973.

7. **Seemanová, E., Kopecký, A., Salichová, J., Handzel, J.:** Ellis-van Creveld syndrome in a boy (in Czech). Čas. Lék. čes., 118 : 368, 1979.

8. **Silva da, E. O., Janovitz, D., de Albuquerque, S. C.:** Ellis-van Creveld syndrome: report of 15 cases in an inbred kindred. J. Med. Genet., 17 : 349, 1980.

9. **Škvařilová, B.:** The growth patterns in the upper extremities of Prague school age children. Anthropologie, 13 : 101, 1975.

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ONE STAGE TOTAL CHEEK RECONSTRUCTION WITH DOUBLE FOLDED EXTENDED LATISSIMUS DORSI MUSCULOCUTANEOUS FLAP

Y. Maruyama, Y. Iwahira, C. Hashimura, H. Ono

INTRODUCTION

Secondary reconstruction of a total cheek defect in one stage after cancer surgery or trauma is one of the most difficult procedures in the head and neck region. Many different flaps for the reconstruction of complicated defects have been reported. This article presents a successful case in which an extended latissimus dorsi musculocutaneous flap was transferred to cheek and intra-oral soft-tissue defects by a double-folded technique in one stage.

Fig. 1 Preoperative view

Case descriptions

A 70-year-old male presented with a tumor on the left cheek (Fig. 1). Several excisions had not afforded a permanent cure and the tumor recurred. Upon

admission to our institute, a biopsy was done, revealing a squamous cell carcinoma of the cheek. A radical resection of the tumor along with a radical dissection of the left side of the neck, and a one stage reconstruction with an extended latissimus dorsi musculocutaneous flap were planned. Under general anesthesia, the tumor, surrounding tissue, and oral mucosa were removed (Fig. 2).

Fig. 2 Defect after en bloc wide excision of tumor

At the same time, a latissimus dorsi musculocutaneous flap was designed. The overlying skin was measured so that there was enough to cover the outer surface of the cheek defect, oral lining and oral floor. Parts of the oral lining and floor were placed on the extended portion of the latissimus muscle (Fig. 3). The flap was elevated from the thoracic wall and the thoracodorsal vessels were confirmed to be behind the latissimus muscle.

The underlying fascia was included on the extended portion of the flap. Upon proximal dissection of the flap, the vascular branches to the serrents anterior was ligated and severed, and the proximal attachment of the latissimus dorsi muscle was cut off (Fig. 4). Next, a tunnel through which the flap could be introduced to the defect was created under the pectoral muscle and clavicle. The flap was then set into the defect.

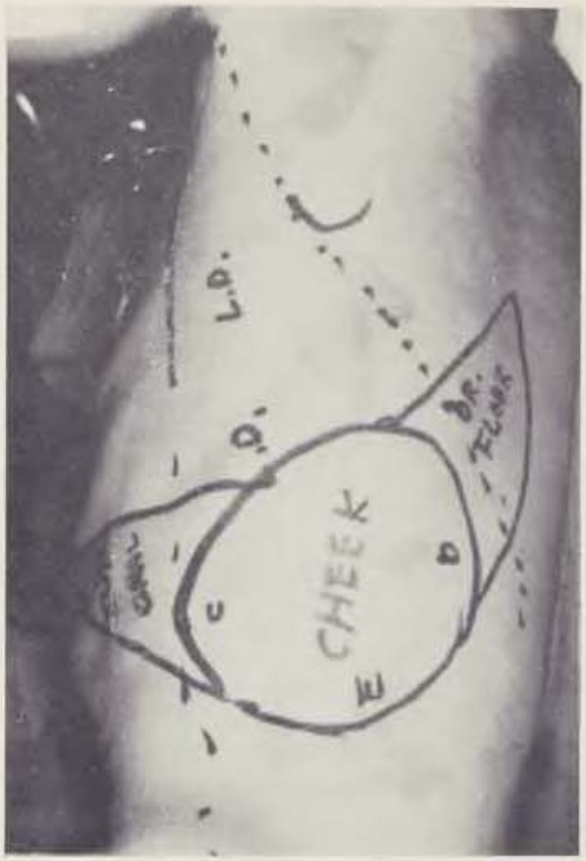

Fig. 3 The bilateral triangular extensions indicate the intra-oral lining

Fig. 4 Elevation of the flap

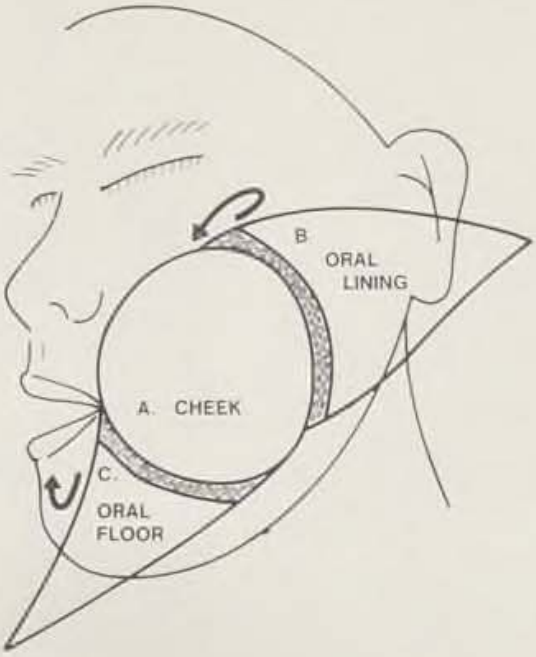

Fig. 5a The flap was introduced to the defect and was made double
5b Schema of the procedure: Doubled triangles are folded for inner coverage
A — cheek, B — oral lining, C — oral floor

Fig. 6 Double-folded flap placed in intra-oral area

The overlying flap skin was incised to the level of the fascia layer in order to permit doubling (Fig. 5a, b). Each portion of the flap was sutured intra-orally in two layers with vicryl 4-0 (Fig. 6a, b). The outer surface of the flap was sutured in two layers with nylon 5-0 (Fig. 7).

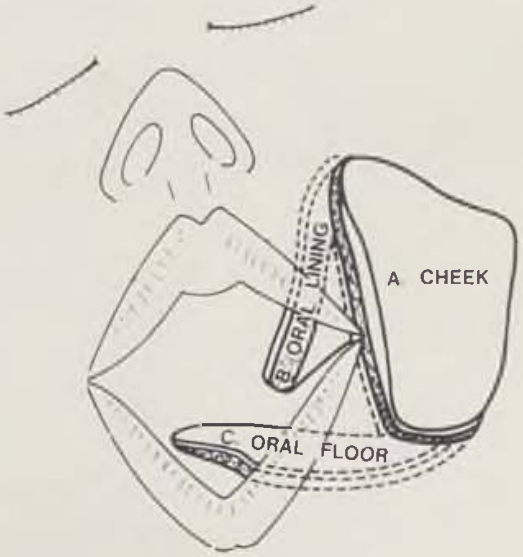

Fig. 7a Immediate result
7b Schema of the reconstruction
A — cheek, B — oral lining, C — oral floor

Two weeks postoperatively, the flap had taken well, and the patient was discharged from the hospital. Three months after the initial surgery we added some minor touch up marginal z-plasty surgery (Fig. 8a, b).

DISCUSSION

Secondary reconstruction of a total cheek defect in one stage is one of the most difficult procedures for the head and neck region operation. The total cheek defect, simultaneously utilizing temporal and deltopectoral flaps for cover and lining, has been popular (McGregor and Reid, 1970). The use of the latissimus dorsi musculocutaneous flap (Maruyama, 1979; Watson, 1982), pectoralis major (Maruyama, 1980) and trapezius musculocutaneous flap (Bertotti, 1980) have also been reported as useful.

However, they sometimes require a two stage operation, or are too small. A free flap transfer takes a long time and requires a microscope and high technique. In our case, the patient had lung disorders and was too old to endure a long-term operation.

Fig. 8a Postoperative view 9 months

Fig. 8b Intra-oral view

In order to make a cover, oral lining and floor in one step, the flap skin has to be folded. In examining the vascular anatomy of latissimus dorsi musculocutaneous flap, it was confirmed that the skin portion of the flap can be extended anteriorly and posteriorly with the fascia included. This constitutes a new way to reconstruct the cover, lining and floor of a total cheek defect in one stage.

SUMMARY

The use of a double-folded extended latissimus dorsi musculocutaneous flap in a one stage reconstruction of a total cheek defect is described.

A successful case and the advantages of this flap in both cheek and intraoral reconstruction are emphasized.

RESUME

La reconstruction totale de la face, effectuée dans un temps, par lobe musculo-cutané latissimus dorsi, étendu et plié en deux

Maruyama, Y., Iwahira, Y., Hashimura, C., Ono, H.

La description d'une application réussie du lobe musculo-cutané latissimus dorsi, étendu et plié en deux, qui a été effectuée dans le cadre d'une reconstruction d'un grand défaut de la face en un seul temps.

Les avantages de la greffe décrite pour la reconstruction de la face aussi que pour celle de la cavité buccale sont accentuées.

ZUSAMMENFASSUNG

Die einmalige totale Rekonstruktion des Gesichts mittels eines herausgezogenen und doppelt umgelegten Hautmuskellappens des m. latissimus dorsi

Maruyama, Y., Iwahira, Y., Hashimura, Ch., Ono, H.

Beschrieben wird die erfolgreiche Verwendung eines doppelt umgelegten herausgezogenen Hautmuskellappens des m. latissimus dorsi bei der einmaligen Rekonstruktion eines grossen Defekts des Gesichts. Besont werden die Vorteile eines solchen Transplantation bei der Rekonstruktion sowohl des Gesichts als auch des Innern der Mundhöhle.

RESUMEN

La reconstrucción total de una vez de la mejilla con ayuda del lóbulo cutáneo-muscular alargado y doblado de m. latissimus dorsi

Maruyama, Y., Iwahira, Y., Hashimura, Ch., Ono, H.

Está escrito el uso éxito del lóbulo cutáneo-muscular — alargado y doblado — de m. latissimus dorsi para la reconstrucción de una vez de un gran defecto de la mejilla. Están subrayadas ventajas de éste transplantante tanto para la reconstrucción de la mejilla, como y del interior de la cavidad bucal.

REFERENCES

1. **Bertotti, J. A.:** Trapezius musculocutaneous island flap in the repair of major head and neck cancer. Plast. reconstr. Surg., 65 : 16, 1980.

2. **Fujino, T., Maruyama, Y.:** Double-folded free myocutaneous flap cover to a total cheek defect. J. Maxillofac. Surg., 9 : 96, 1981.

3. **Maruyama, Y.:** Free latissimus dorsi myocutaneous flap in the dynamic reconstruction of cheek defects: A preliminary report. J. Microsurg., 1 : 231, 1979.

4. **Maruyama, Y. et al.:** A dynamic reconstruction of a facial defect with a pectoralis major myocutaneous flap. Brit. J. plast. Surg., 33 : 145, 1980.

5. **McGregor, I. A., Reid, W. H.:** Simultaneous temporal and deltopectoral flaps for full thickness of the cheek. Plast. reconstr. Surg., 45 : 326, 1970.

6. **Watson, J. S.:** The use of the latissimus dorsi island flap for intra-oral reconstruction. Brit. J. plast. Surg., 35 : 408, 1982.

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TENDON AND NERVE INJURIES OF HAND IN CHILDREN

E. Paneva-Kholevitc

Over past decades considerable number of papers dealt with the specific problems of child's age — i. e., traumatic injuries to peripheral nerves and flexor tendons of the hand. Individual papers were concerned with the problems of surgical approach and results of the treatment of the hand in children.

The present paper is based on our experiences in the treatment of combined traumas of tendons and nerves in 51 children aged under 15 years (the mean age being 7 years and 3 months), followed from 1 to 10 years after the operation. Only 1 patient was operated on urgently, 46 patients were treated after more than 3 months and 4 patients even after a longer period from the injury.

The injuries of flexor tendons were classified according to the zones, generally accepted in the tendon surgery (Fig. 1a); the same scheme was used

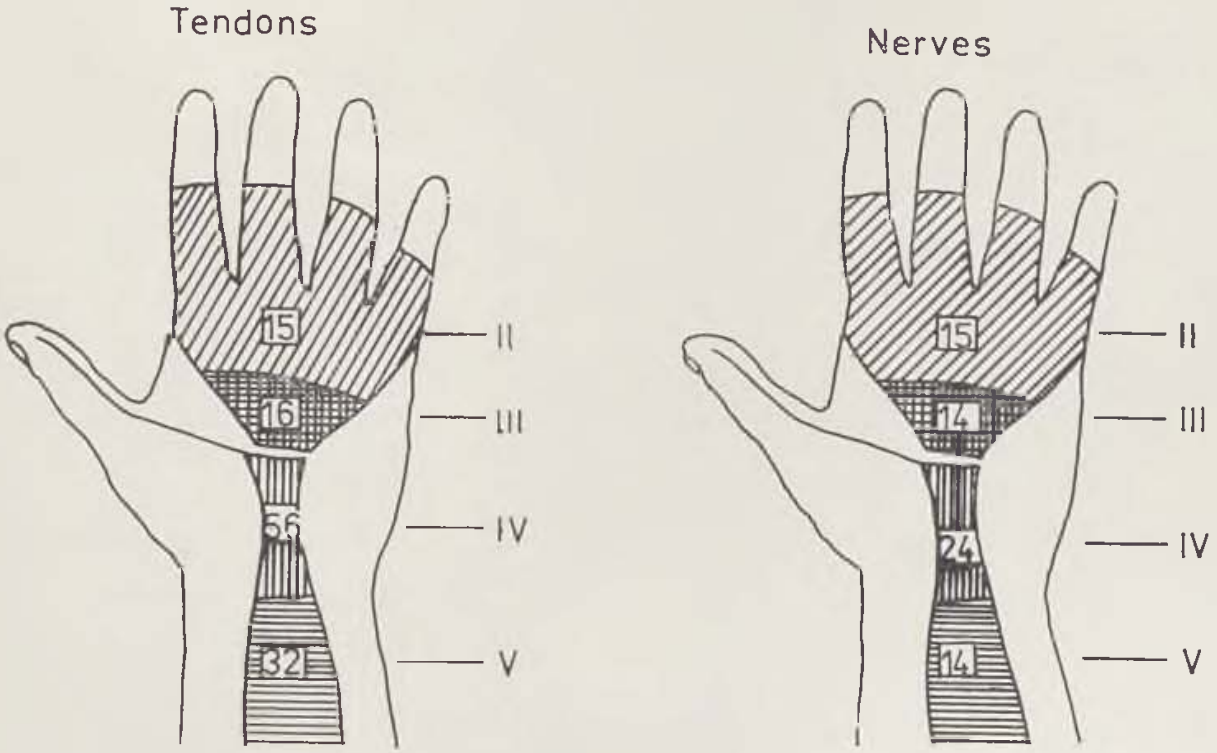

Fig. 1a, b Distribution in the zones. a — injured tendons, b — injured nerves

to classify nerve traumas. The kind of injury is significantly determined by the zone — severing of the proper digital nerves in the second zone, severing of the common digital nerves in the third zone, cutting of the median or ulnar nerves (or both of them) in the fourth and fifth zone (Fig. 1b).

Our classification of our results of the repair of flexor tendons is based on the 4 degree scale of Boyes (with some additions), and those of the nerve repair on the system of Seddon.

The second zone

The group consists of 15 patients suffering from the injuries to tendons of both flexors of one digit, accompanied by injuries to one proper digital nerve (14 children) or both proper digital nerves (1 child). Our operative strategy was as follows:

a) a two-stage plasty using a tendon pedicle graft according to our own method (Fig. 2a, b, c — 14 cases),

b) early pull-out secondary suture of the deep flexor tendon (1 child).

Simultaneously, at the first stage of the plasty, the injured nerves were repaired. In 12 cases an epineural suture was performed. In one case, with injury to both digital nerves at different levels, only corresponding axial proper digital nerve was reconstructed using a crisscross suture (Fig. 3). In 2

Fig. 2a

Fig. 2b

Fig. 2a, b, c A scheme of tendon plasty in two stages. a — the first stage, b and c — the second stage

Table 1

Injury	Results				Total
	Very good	Good	Fair	Bad	
Tendons	8	5	2	0	15
Nerves	10	3	1	1	15

cases with incompletely severed nerves the neurolysis was used. For the results see Tab. 1.

In one patient with different results the secondary suture of injured flexor tendons resulted in adhesions, with limited movement. The tendolysis, performed several months later failed to improve the conditions.

As far as nerve injuries are concerned, the indifferent results and bad results were observed with the neurolysis.

For case history see Fig. 4a—d.

Fig. 3 A scheme of the crisscross suture of a digital nerve

Fig. 4a

Fig. 4b

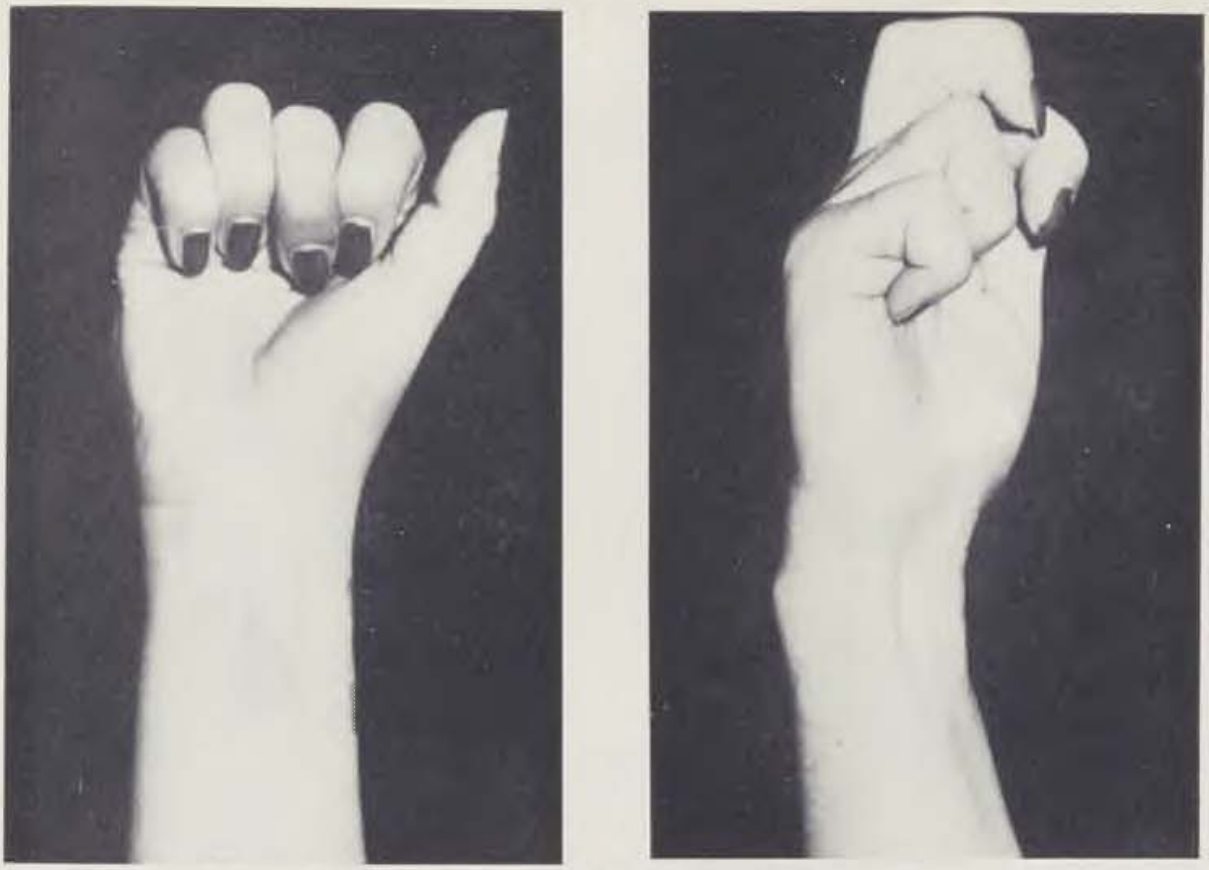

Fig. 4a, b, c, d Patient V. S., 6 years after injury to the flexor tendons and the radial nerve of the digit. a — before the operation, b, c, and d — 15 years after the surgery: a complete recovery of sensitivity and mobility, though the digit is a little thinner

The third zone

This group consists of 8 patients with injuries to flexor tendons of 16 digits, 11 severed common digital nerves, severed sensoric portion of the median nerve above its ramification (2 cases) and severed motoric branch of the median nerve (1 case).

The operative technique for tendon repair was as follows:

a) a pull-out suture of the deep flexor tendon (3 patients),

b) a non-removable suture (6 patients) of either only deep flexor tendon (3 patients) or of both the deep and superficial flexor tendons (3 cases),

c) tendolysis, in patients with limited movements due to surgical interventions performed in other hospitals immediately after the injury (6 patients),

d) a retrograde transposition of the distal end of the deep flexor tendon to the deep flexor tendon of the adjacent finger (1 patient).

The nerves were repaired using the following techniques:

a) the epineural suture (9 cases),

b) the funicular suture (2 patients), use to repair the sensoric portion of the median nerve severed immediately above its ramification,

Fig. 5a

Fig. 5b

Fig. 5a, b, c Patient G. M., 7 years with injured tendons of the flexors of the second and third digits at the III zone and with injury to the two common digital nerves

c) neurolysis (3 patients) performed in patients with incompletely recovered sensitivity after the primary suture. Table 2 shows the results.

For case report see Fig. 5a—c.

Fig. 5c

a — at admission there is a small wound due to lost sensitivity, the pull-out suture of the tendon and epineural suture of the nerve are applied,
b and c — a complete recovery one year after the surgery

Table 2

Injury	Results				Total
	Very good	Good	Fair	Bad	
Tendons	6	5	4	1	16
Nerves	7	6	1	0	14

The fourth zone

This group consists of 17 patients with the severed tendons of both flexors of 56 digits, 15 injuries to the median nerve and 9 injuries to the ulnar nerve

(7 patients had traumatic injuries to both the median and ulnar nerves). In 14 patients with traumatic injury to the tendons of 3, 4 or 5 digits a pull-out wire suture "en bloc" according to our own method was used. It is based on the simultaneous fixation of all the tendons severed by an "O" shaped pull-out wire suture. The suture is led upon the surface, where it is drawn by means of a bow-shaped plate (Fig. 6). Additional support is provided by very fine

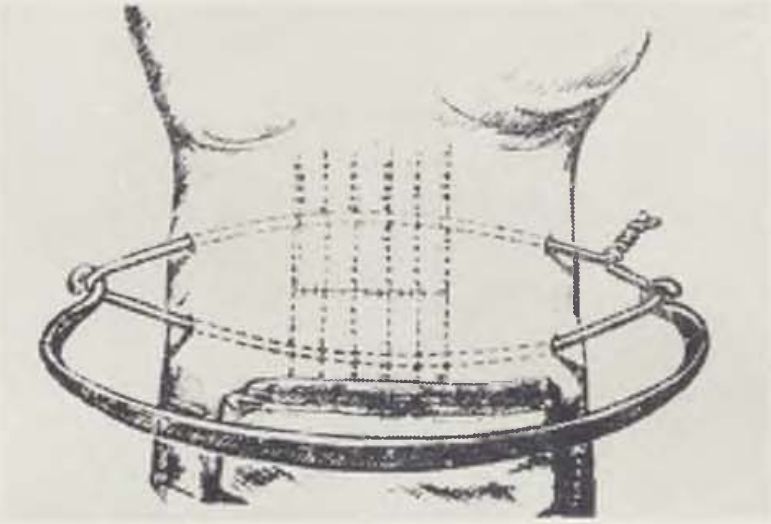

Fig. 6 A scheme of the pull-out wire suture "en-bloc"

adaptive sutures, taking only the superficial layers of the tendon. The proximal and distal ends of the tendon are approximated by stretching the "O" shaped wire suture. After a month the suture is to be removed. This method was used with 3 patients to suture separately deep and superficial flexor tendons. In other patients only deep flexor tendons were sutured. In 2 patients with injured tendons of 2 digits only, a permanent inner suture of the deep flexor tendon was used. In other 2 patients with injured flexor tendons of 2 digits that were treated by the primary suture performed immediately and resulting, due to adhesions, in incomplete mobility, the tendolysis was used.

The nerves were repaired by means of 21 epineural and 3 funicular sutures.

For the results see table 3.

Table 3

Injury	Results				Total
	Very good	Good	Fair	Bad	
Tendons	32	20	4	0	56
Nerves	16	6	2	0	24

Fig. 7a

Fig. 7b

Fig. 7c

Fig. 7d

Fig. 7a

Fig. 7b

Fig. 7a, b, c, d, e, f Patient A. G., 9 years with severed tendons of the II-V digits and nn. medianus and ulnaris at the level of the carpus a — immediately after the injury, urgent "en bloc" suture of the tendons of the deep and superficial flexors, the epineural suture of the two nerves b — after two months — visible atrophic changes and deformations, typical for the paralysis of nn. medianus et ulnaris
c — the rehabilitation: applying of an elastic apparatus to correct the deformation "en griffe" d, e, f — a complete recovery two years after the surgery

Our results are, with regard to the bad prognosis of injuries of this zone, quite optimistic. Indifferent results of the treatment occurred only with 5 injuries to digits and 2 injuries to nerves.

For case report see Fig. 7a—f.

The fifth zone

This group consists of 11 patients with injuries of the tendons of both flexors of 32 digits, as well as injuries to 14 nerves. Out of the latter, 8 were injuries to the median nerve and 6 to the ulnar nerve (in 3 patients both median and ulnar nerves were affected). The operative approach used to repair tendons did not differ from that used with injuries to the carpus. Injured tendons of one or two digits were replaced using an inner non-removable suture (in most cases, tendons of the deep and superficial flexor were sutured separately). Multiple injuries were repaired using the already described pull-

out "en-bloc" suture. For the injured nerves the epineural suture was used. The results are shown in table 4.

Table 4

Injury	Results				Total
	Very good	Good	Fair	Bad	Total
Tendons	22	8	2	0	32
Nerves	6	6	1	1	14

In this group, a complete restoration of the sensoric and motoric function of the nerves was achieved in less than 50 per cent of patients. Thus, the results are worse than in case of traumatic injuries to the carpus. It is caused by the more serious character of injuries (deep cut wounds, torn and crush injuries) as well as by a more proximal localization of injuries. On the other hand, operative results of tendon injuries in this localization are better than

Fig. 8a

Fig. 8b

Fig. 8a, b, c Patient D. M., 5 years with injured tendons of the III and IV digits and of n. ulnaris, a — before the operation, 2 months after the injury; the "en griffe" deformity of the V digit b, c — the result of the treatment

those of injuries at the level of the canalis carpi, which can be explained by anatomical features of the fourth zone (Fig. 8a—c).

DISCUSSION

According to Entin, in combined injuries to the digital flexor tendons and nerves of the hand in children, the injuries to tendons influence negatively the prognosis of injuries to nerves, and vice versa. The most important difficulties are those related to the small size of structures injured, to the risk of secondary contractures due to keloid scars and to an insufficient cooperation of the patient. On the other hand, the youth of the patient is advantageous because healing is more rapid, joints more mobile and regenerative capacity of nerves is rather high.

Our experience with early secondary repair of combined injuries to tendons and nerves of the hand in the young age justifies us to draw promising conclusions. We have treated — using microsurgical methods — 67 patients with injuries to nerves. The results were very good in 58 per cent and rather good in 31 per cent of cases. Prevalently, epineural sutures were used — the funicular suture was used in a few cases only. Thus, the effectiveness of the

two methods cannot be compared. Our results are identical with the data of Allien and Alnot, who obtained very good results with the secondary repair of peripheral nerves in 54 per cent and good results in 33 per cent of the cases. They also reported that out of 54 cases of secondary sutures of the hand nerves in adults they had reached very good results in 18 per cent and in 22 per cent of patients good results.

The results of secondary reconstructive suture of flexor tendons in patients with combined injuries to nerves and tendons are also better in the child's age than in the adult age. We have repaired 119 flexor tendons of both flexors (severed at a different level) in children younger than 15 years. The results were very good in 57 per cent and good in 32 per cent of cases. The results of the treatment of similar injuries in the adult age (140 patients) are the following: in 30 per cent very good and in 28 per cent good.

In the literature also the possibility of using free grafts for the secondary repair of injuries to deep flexor tendons in the critical zone in the child's age is often discussed. First of all, there is question whether it is necessary to maintain the proportion of the length of a graft to that of the digit during the period of growth.

Hag and Dupuis believe that free grafting is the method of choice in traumas with unfavourable prognoses and without the primary tendon sutures.

From our experiences it follows, that the secondary repair of the deep flexor tendons using a tendon pedicle grafts has certain advantages in comparison to the free graft. Namely earlier mobility and no risk of rupture of the proximal suture. We sometimes observed, in children suffering from combined injuries to tendons and nerves at the critical zone, after 10 or more years, a certain growth deficit of the digit. However, a slightly decreased length and width of the digit represented neither cosmetic nor functional defect. The growth of the transplant was never retarded. Isolated reconstruction of the deep flexor tendon in the child's age resulted frequently in a moderate hyperextension of the proximal interphalangeal joint. For this reason, even in the absence of cicatricious changes in the III, IV and V zone, we reconstruct the tendons of deep and superficial flexors separately, and perform, in the II zone, tenodesis of the proximal interphalangeal joint at 5 degree flexion. The latter is achieved using lateral strips of the superficial flexor tendon.

The above described pull-out wire suture "en bloc" is the factor contributing decisively to better repair of injuries to flexor tendons at the IV and V zone. Its advantages are seen in the following: the shortening of the prolongation of the surgery, the absence of additional operative trauma, no risk of suture rupturing.

In the present paper we do not discuss a primary repair of combined injuries to tendons and nerves in the child's age. As we have no statistical data of our own to compare the two approaches, we use the primary repair in children for the treatment of cut wounds. This is in accordance with a general principle of surgical treatment of tendons and nerves. In our opinion, the violation of this principle is the main reason of unsuccessful results of primary

sutures and worse prognosis of the secondary repair. An early surgical intervention, performed in only 1 patient in our material, had showed exceptionally good results.

SUMMARY

The authoress reports on her experience in the treatment of combined injuries to flexor tendons and nerves of the hand in 51 children aged under 15. The treatment was performed urgently in 1 case, within 3 months after the injury in 45 patients and in 5 patients even later.

For convenience, the kind of injury, operative strategy and results obtained are described in relation to the level of injury.

Injury to tendons. They consisted of the severance of both flexors of 119 digits at the following zones: 15 at the second zone, 16 in the third zone, 56 in the fourth zone and 32 in the fifth zone. Various methods were used in relation to the level of the injury: a non-removable suture, a pull-out suture "en bloc" according to the author's own method, a two-stage plasty using a tendon pedicle graft, etc.

The operative results were evaluated according to the four-degree scale of Boyes: they were very good in 68 patients (57 %), good in 38 patients (32 %), fair in 12 and poor in 1 patient.

There were 67 injuries to nerves, of which 15 were injuries to proper digital nerves, 11 injuries to common digital nerves, 2 injuries to sensoric portion of the median nerve, 1 injury to motoric portion of the median nerve, 23 and 15 injuries to the median and ulnar nerve respectively.

The results of the treatment were evaluated according to four-degree system of Seddon: in 39 patients (58 %) they were very good, in 21 patients (31 %) they were good, in 5 patients fair and in 2 patients poor. Treatment of both tendons and nerves in the child's age was more successful than in the adult age.

RESUME

Traumatisme de nerfs et de tendons chez les enfants

Paneva-Kholevich, E.

L'auteur fait part de ses expériences avec le traitement des traumatismes combinés de nerfs et de tendons des fléchisseurs de la main, chez les enfants agés de moins de 15 ans. Dans 1 cas, le traitement a été entrepris immédiatement après le traumatisme, dans 15 cas après 3 mois et chez 5 enfants encore plus tard. Pour simplifier la question, on aborde les traumatismes, la technique opératoire et les résultats du point de vue de localisation du traumatisme. Traumatismes de tendons. Il s'agissait de l'interruption de tendons des deux fléchisseurs sur 119 doigts dans les localisations suivantes: 15 cas dans la 2ème zone, 16 cas dans la 3ème zone, 56 cas dans la 4ème zone, 32 cas dans la 5ème zone. Selon localisation on a utilisé plusieurs techniques opératoires: suture au fil absorbable, suture en bloc (par la propre méthode de l'auteur) au fil à enlever, plastie en deux temps utilisant un greffon tendineux pédiculé et d'autres. Les résultats ont été soumis à une classification de 4 degrés selon Boyes:
— très bons chez 68 patients (57 %),

— bons chez 38 patients (32 %),
— médiocres chez 12 patients,
— mauvais chez 1 patient.

Ensuite on a traité 67 traumatisme de nerfs: dans 15 cas c'étaient les traumatismes de nervi digitales proprii, dans 11 cas nervi digitales communes, dans 2 cas les traumatismes de nervus mediani dans sa partie sensorielle, dans 1 cas nervus mediani dans sa partie motrice. Dans 23 cas il s'agissait de nervus medianus traumatisé et dans 15 cas c'était nervus ulnaris.

Les résultats ont été évalués selon le système de 4 degrés d'après Seddon: chez 39 malades (58 %) très bons, chez 21 malades (31 %) bons, chez 5 malades médiocres et chez 2 malades mauvais.

Le traitement opératoire des traumatismes de nerfs et de tendons à l'âge enfatin apporte des résultats meilleurs qu'à l'âge adulte.

ZUSAMMENFASSUNG

Verletzungen der Nerven und Sehnen der Hände bei Kindern

Paneva-Cholevits, E.

Die Autorin informiert über ihre Erfahrungen mit der Behandlung kombiniert Verletzungen der Nerven und Sehnen der Flexoren der Hände bei Kindern unter 15 Jahren. Bei einem Kind wurde mit der Behandlung sofort nach dem Unfall begonnen, bei 15 Kindern binnen 3 Monaten nach dem Unfall und bei 5 Kindern noch später. Der Einfachheit halber werden die Unfälle, die Taktik der Operationen und ihre Ergebnisse vom Stadtpunkt der Lokalisierung der Verletzung beschrieben.

Sehnenverletzungen. Es handelte sich um ein Zerreissen der Sehnen beider Flexoren von 119 Fingern bei folgender Lokalisierung: in 15 Fällen in der 2. Zone, in 16 Fällen in der 3. Zone, in 56 Fällen in der 4. Zone und in 32 Fällen in der 5. Zone. Je nach der Lokalisierung wurden mehrere Operationsmethoden angewandt: das Vernähen mit nichtbeseitigter Naht, das Vernähen „en-bloc" (eigene Methode) mit beseitigter Naht, die Zweietappen-Plastik unter Verwendung des Sehnenpfropfens am Stiel, sowie weitere. Die Ergebnisse der Operationen wurden nach der vierstufigen Skala von Boyes eingeschätzt: sie waren sehr gut bei 68 Patienten (57 %), gut bei 38 Patienten (32 %), zufriedenstellend bei 12 Patienten und schlecht bei 1 Patienten.

Es wurden ferner 67 Nervenverletzungen behandelt, davon in 15 Fällen Verletzungen der n. digitales proprii, in 11 Fällen der n. digitales communes, in 2 Fällen der sensorischen Teile der n. mediani, in 1 Fall des motorischen Teils der n. mediani, in 23 Fällen war der n. medianus verletzt und in 15 Fällen der n. ulnaris. Die Ergebnisse der Behandlung wurden nach dem vierstufigen System von Seddon eingeschätzt: sie waren bei 39 Patienten sehr gut (58 %), bei 21 Patienten gut (31 %), bei 5 Patienten zufriedenstellend und bei 2 Patienten schecht.

Bei der operativen Behandlung von Verletzungen der Nerven und Sehnen im Kindesalter werden bessere Ergebnisse erzielt als bei Erwachsenen.

RESUMEN

Las heridas de nervios y tendones del brazo en los niños

Paneva-Jolevich, E.

La autorin presenta las informaciones sobre propias experiencias en la terapia de heridas combinadas de nervios y tendones de flexores del brazo en los niños de la edad menos que 15 años. La terapia se la empezaron a realizar instantáneamente

del accídente en 1 niño, en el transcurso de 3 meses después del accidente en 15 niños y en 5 niños más tarde. Con fin de simplificación de los accidentes la táctica de operación y los resultados están escritos del aspecto de la localización de las heridas.

Las heridas de tendones. Se trataba sobre la interrupción de tendones de ambos flexores de 119 dedos con la localización siguiente: en 15 casos en II. zona, en 16 casos en III. zona, en 56 casos en IV. zona y en 32 casos en V. zona. Según la localización emplearon unos métodos de operación: por suturar por la sutura inseparable, por suturar "en-bloc" (por propio método) por medio de la sutura separable, por medio de plástica de dos etapas empleando al injerto de tendón con raíz, etc. A los resultados de operaciones se les calificaron según la escala de Boyes (e) de 4 grados: muy buenos serían en 68 enfermos (57 %), buenos en 38 enfermos (32 %), bastante buenos en 12 enfermos, y de calidad mala en 1 enfermo.

Además curaron a 67 heridas de nervios, inclusivamente en 15 casos a las heridas de n. digitales proprii, en 11 casos de n. digitales communes, en 2 casos a la herida de la sensoria de n. mediani, en 1 caso la de la parte motor de n. mediani, en 23 casos fué herido n. medianus y en 15 casos n. ulnaris. Los resultados de la terapia se las calificaron según el sistema de Seddon de 4 grados: en 39 enfermos (58 %) serían muy buenos, en 21 enfermos (31 %) buenos, en 5 enfermos bastante buenos y en 2 enfermos de grado malo.

Al efectuar la terapia de operación de heridas de nervios y tendones en la edad de infancia están logrados mejores resultados, que en la edad adulta.

REFERENCES

1. **Paneva-Kholevitc, E.:** Two-stage plasty of digital flexors injured at the level of an osseofibrous canal. Acta Chir. plast., 7, 2 : 109, 1965.

2. **Paneva-Kholevitz, E.:** Our experience with combined injuries of nerves and digital flexor tendons in children. Orthopedia and Traumatologia, 10, 3—4, 220, 1973.

3. **Pugatcev, A. G.:** Injuries of tendons of hand and digits and their treatment in children. Medgiz, 1960.

4. **Pekov, P. I.:** Microsurgery of peripheral nerves. Thesis, Sophia, 1981.

5. **Allien, J., Alnot, A.:** Résultats des sutures nerveuses sous microscope. Rev. Chir. orthop., 64 : 276, 1978.

6. **Entin, M.:** Flexor tendon repair and grafting in children. Amer. J. Surg., 109, 3 : 287, 1965.

7. **Hag, J., Dupuis, C.:** The intrinsic fate of the tendon grafts in small children's hands and their results. Brit. J. plast. Surg., 18, 4 : 341, 1965.

8. **Linsay, W. V., Walker, F. G., Farmer, A. W.:** Traumatic peripheral nerve injuries in children. Plast. reconstr. Surg., 30, 4 : : 462, 1962.

9. **Seddon, H.:** Surgical disorders of the peripheral nerves. Second ed., London, Churchill-Livingstone, 975, p. 303.

10. **Sunderland, S.:** Nerves and nerve injuries. Edinburgh, Livingstone, 1968.

The rest of the literature at the author.

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USE OF THE MESENTERY AND MUCOUS MEMBRANE — FREE INTESTINE WALL IN INTESTINE SURGERY

I. A. Komarov, E. M. Mochov, N. A. Sergeiev

Within the first 5 to 10 days after operation on the intestines, incompetent sutures are the most frequent cause of difficult complications, i. e., diffuse peritonitis, eventration and intestinal fistulae. This concerns especially injuries of the large intestine, after which the incompetency of the sutures develops in the range from 4 to 69 per cent. Quite naturally, there is a continuous quest for new methods to increase the effectiveness and to prevent leak of the intestine sutures. These methods make use of improved technique of intestine suturing, of suture materials with bactericidal effects, of special glues, etc. (Kerscher et al., 1979). Currently, methods using autologous grafts to support the intenstine sutures are increasingly favoured; they are used in circumstances of an inflammation as well as without any infection (Romanenko, 1980). However, many aspects of this problem are still controversial or remain to be studied: the choice of suitable tissues, formation of the graft, its fixation, etc. The use of mucous membrane-free flaps is also poorly understood, and there are rather few papers dealing with this method.

Our experimental and clinical studies aimed at establishing the possibilities of operative techniques using mucous membrane-free parts of the small intestine and full-thickness flaps (on the vascular pedicle) formed from the large intestine mesentery.

The suitability of a mucous membrane-free pedicle flap from the small intestine was studied experimentally with 43 dogs. In the 1st series of experiments (28 dogs) a mucous membrane-free flap from the small intestine was used to reconstruct a duodenal wall defect. In the 2nd series of experiments (15 dogs) the flap was used to support the transversal anastomosis of the ileum. The mucous membrane was removed using a scalpel or scissors (after previous hydraulic preparation), or by means of a special apparatus of our own — the demucosator[1]. In the 1st experimental series, a segment of the muscularis and serosa of the lower portion of the duodenum (size 2 × 4 to

1 — Author's certificate No. 906552

3 × 6 cm) was excised. A wound (1—2 cm long) was done in the mucous membrane in the centre of the defect. The wound was closed with catgut sutures. The mucous membrane-free flap was formed from the small intestine and sutured to the margins of the defect of the serous and muscular layer of the duodenal wall (Fig. 1). The continuity of the small intestine was re-established using end-to-end anastomosis.

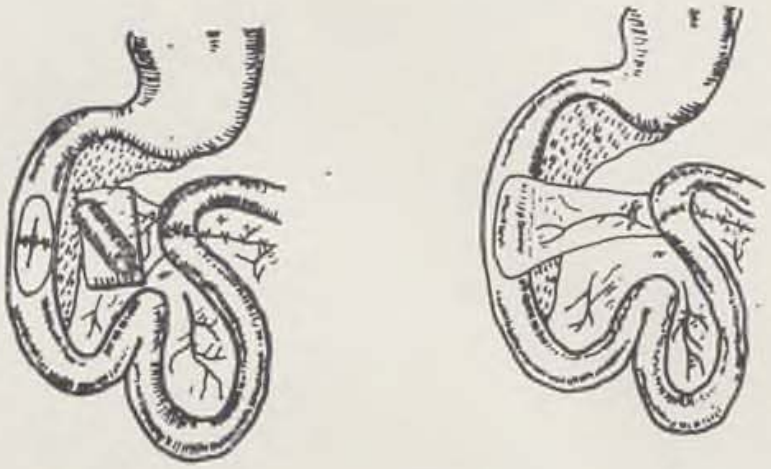

Fig. 1 Plasty of the defect of the duodenal wall by means of the mucous membrane-free pedicle flap of the small intestine

In the 2nd experimental series, anastomoses of the small and large intestine were supported. A 4—6 cm long segment of the illeum was cut out with its mesentery forming the pedicle, and devoid of the mucous membrane. Illeocoloanastomoses "end-to-end" and "site-to-site" were sutured in two layers. The anastomoses were wrapped by the mucous membrane-free flap of the small intestine, margins of which were fixed to the intestinal wall (Fig. 2). Postoperatively, the animals were followed clinically. After finishing the experiments, macro- and microscopic evaluations were performed.

Also, in some experiments, the intestine vasculature was examined using the vasography. 3 dogs died shortly after the operation. The first dog from an overdosage of anaesthetic drugs, the second and third one from the eventration and pneumonia respectively. All other animals survived up to 2 years after the operation. No leak of the sutures was found.

Results of our experiments demonstrate that the mucous membrane-free flap adheres to the intestinal wall quickly and reliably. Within the first days after the surgery there occur a moderate oedema of the vascular pedicle, as well as inflammatory infiltration and local blood permeation of the flap. The flap is gradually growing into the intestinal wall, and later (3—6 months after the surgery) it is difficult to differentiate it. Histologically, the muscularis is well developed, and there are, between its bundles, layers of connective tissue of different size. The vasography has shown that the contrast material, in most cases, penetrates the vascular plexus of the graft as well as the minute vessels of the intestine wall next to the graft.

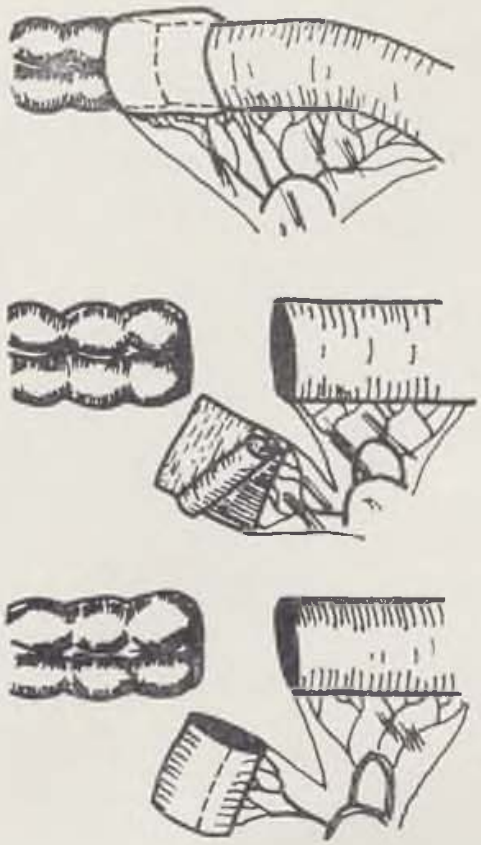

Fig. 2 The mucous membrane-free flap of the small intestine used to support sutures of the enterocoloanastomosis

Thus, plasty using the mucous membrane-free flap of the small intestine proved to be a reliable and valuable method of supporting the intestinal sutures.

Promising results were obtained also in experiments, in which the sutures and anastomoses of the large intestine were supported using a full-thickness pedicle flap formed from the mesentery of the large intestine. The flap consists of two layers of the visceral peritoneum containing in between a well developed vascular plexus.

The experiments were performed with 50 randombred dogs. In 5 of them we used the resection of the large intestine with subsequent anastomosis "end-to-end". 45 animals served to model injuries of the large intestine (penetrating as well as through-and-through wounds) complicated by purulent peritonitis. In order to standardize the wounds, we have developed an original perforator, equipped with interchangeable tips, enabling us to produce wounds of required shape and size. The laparotomy was performed with regard to developing peritonitis (from minutes to two days) and the intestinal wounds were closed in two layers with sutures of Albert-Lamber. After rinsing the abdominal cavity, the intestinal sutures were supported by mesenterial pedicle flaps. The sutures of control animals were left without any support. We have developed 4 different ways how to form and fix the full-thickness pedicle flaps

of the mesentery. The sutures of single penetrating wounds of the large intestine were covered by U-shaped flaps. The flap has its base at the intestinal wall and is cut out between two major radial vessels of the mesentery adjacent the wound. The graft is spread out over the sutured wound and fixed to the intestine with silk sutures. The "window" in the mesentery is sutured as well (Fig. 3). For supporting the sutures of through-and-through wounds of the intestine, the mesenterial flap was parted in the midline. Both halves of the

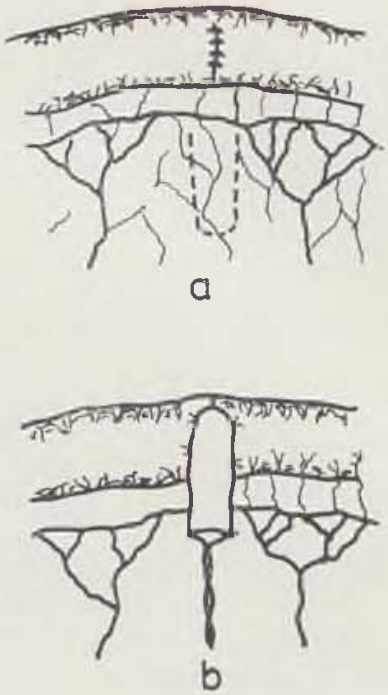

Fig. 3 A scheme of formation of the mesenterial pedicle flap for simple penetrating wounds of the small intestine
a — cutting out of the U-shaped mesenterial flap in the projection of the sutured penetrating wound of the large intestine
b — fixation of the mesenterial flap to the intestinal wall over the suture; suturing of the mesenterial "window"

flap were turned into the opposite direction and fixed to the intestine to envelope the intestine sutures (Fig. 4). Anastomoses of the large intestine were supported in the following way. During mobilization of the intestine segment to be resected, a longitudinally oriented flap, containing the arcuate vessels, was cut out of the surrounding mesentery (Fig. 5). The flap was positioned and fixed along the "end-to-end" anastomosis. In some experiments we have covered the anastomosis using two approaching pedicle flaps (Fig. 6).

The results were evaluated at various stages after the surgery (from 8 hours to 4.5 months) using clinical, operative and pathological anatomy data.

12 dogs served as controls, in which the sutures of the large intestine were left without any support. In these dogs, healing of wounds of the large intestine was — even in the reactive stage of the peritonitis — accompanied

by formation of adhesive conglomerates of adjacent organs, which testifies to leak of the sutures. When the dogs were operated on during the toxic period of the peritonitis, the incompetency of the sutures, resulting in spread purulent peritonitis, was the cause of death of 2 animals.

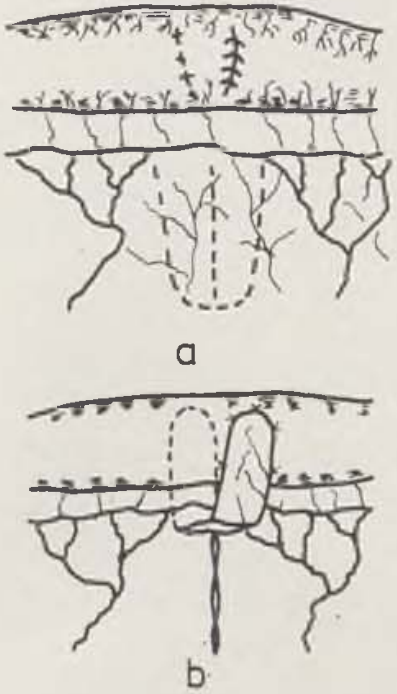

Fig. 4 A scheme of support to the sutures of a through-and-through wound of the large intestine

a — cutting out of the two mesenterial flaps in the projection of the sutured wounds at the opposite sites of the completely perforated intestine

b — the mesenterial flaps turned in the opposite direction and fixed to the intestinal wall over the sutures; the sutured "window" in the mesentery

In experimental animals, operated on in circumstances of the reactive peritonitis, the cohesion of the mesenterial flap to the intestine took part after 24 hours. On the 3rd day, the graft united sufficiently firmly with the visceral peritoneum of the intestine. The tight union of the flap with the intestine was present 6 days after the surgery. The flaps were grown into the intestinal wall within 11 days. The growing together of the mesenterial autograft and the intestine is completed at the end of the second week.

When the large intestine was sutured within the toxic period of the peritonitis, joining of the flap serosa with the intestine started 2 days after the surgery and it was quite sufficient already on the 4th day. In the subsequent period, a firm growing together of the graft and the large intestine peritoneum took place, the implantation of the graft being completed at the end of the 2nd week. 4.5 months after the surgery the zone of the plastic support of the

sutures had the appearance of a whitish star-like spot. No leak of the sutures was observed.

Thus, the experimental results have shown good plastic properties of the full-thickness pedicle flaps of the large intestine mesentery. These flaps can contribute, in circumstances of the reactive as well as the toxic peritonitis, to prevention of leak of the sutures and to diminishing of the inflammation of the operative zone.

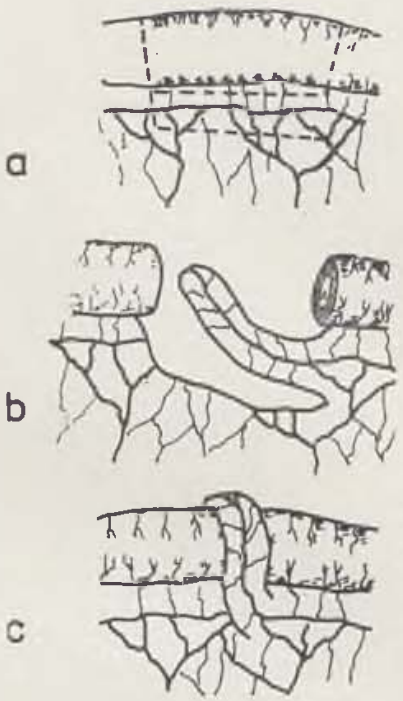

Fig. 5 A scheme of support to sutures of the "end-to-end" anastomosis of the large intestine by means of the mesenterial graft
a — resection of the large intestine and formation of the mesenterial pedicle flap including the major arcuate vessels
b — completed resection of the large intestine, formed mesenterial pedicle flap (in projection of the resected part of the intestine)
c — "end-to-end" anastomosis of the large intestine supported by the mesenterial pedicle graft

At our clinic, within past 20 years, 220 patients suffering from various diseases of the small and large intestine were treated surgically using intestinal sutures and anastomoses. 106 patients were males, 114 patients were females. They were aged from 15 to 90 years. 116 patients suffered from tumours, 85 from other diseases and 19 from injuries. 21 patients were operated on in circumstances of adhesion in the abdominal cavity, in 128 patients there was the peritonitis, in 7 and 4 the ascites and general exhaustion respectively. With 134 patients the sutures of the large intestine were not supported by autografts — their insufficiency developed in 29.1 per cent. With 66 patients the sutures were supported by a pedicle flap from the omentum, adipous lo-

bules and visceral or parietal peritoneum. The insufficiency of the sutures was observed in 18.2 per cent. In 20 patients suffering from tumours and fistulae of the large intestine, the full-thickness mesenterial pedicle flaps were used. This method succeeded in preventing leak of the sutures in the early postoperative period in all patients, even if the operation was complicated by the exsudative peritonitis.

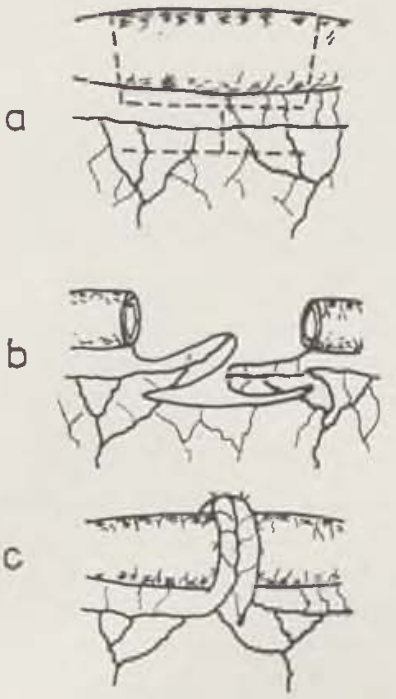

Fig. 6 A scheme of supporting the sutures of the anastomosis of the large intestine using two approaching mesenterial flaps

a — resection of the large intestine and cutting out of the two approaching mesenterial pedicle flaps

b — completed resection of the large intestine, formed two approaching pedicle flaps which include the major arcuate vessels

c — formed "end-to-end" anastomosis of the large intestine, the mesenterial flaps turned into the opposite directions and fixed over the sutures of the anastomosis

CONCLUSIONS

1. Experimental use of the mucous membrane-free pedicle flap formed of the small intestine to support the intestine sutures has proved promising possibilities of this method, which can be recommended for the clinical use.

2. The full-thickness mesenterial pedicle flap should be used to support sutures of the large intestine performed in patients with infected abdominal cavity or with tumours.

SUMMARY

The paper deals with clinical as well as experimental experience with mucous membrane-free segments of the small intestine and full-thickness pedicle mesenterial flaps used to prevent leak of the intestinal sutures.

In the experiments, 93 dogs were used. The plastic properties of the mucous membrane-free flaps of the small intestine were examined with 43 animals. In 28 animals defects of the serosa and muscularis of the small intestine were covered, and in 15 animals illeotransversal anastomoses were supported. The full-thickness mesenterial pedicle flaps were used for additional peritozation of the sutures and anastomoses of the large intestine in 50 dogs. Out of them, 45 dogs were operated on in circumstances of the peritonitis. In the experiments, 4 techniques of formation and fixation of the full-thickness mesenterial grafts were elaborated and used.

The experiments have shown that the mucous membrane-free segments of the small intestine as well as the full-thickness mesenterial flaps applied both in the "clean" and infected abdominal cavity increase the hermetic properties and effectiveness of the intestinal sutures.

RESUME

L'utilisation du mésentère et de la paroi intestinale dépourvue de muqueuse dans les interventions sur les intestins

Komarov, I. A., Mokhov, E. M., Sergeyev, N. A.

Le travail traite les expériences cliniques et expérimentales avec l'utilisation des segments d'intestin grêle dépourvus de muqueuse et des lobes mésentèriques (en pleine épaisseur) au pédicule vasculaire afin d'augmenter l'hermétisme des sutures intestinales. Pour effectuer les expérimentations, on a utilisé 93 chiens. 43 chiens étaient l'objet de l'étude de plasticité des greffons intestinaux, dépourvus de muqueuse. Ces greffons étaient implantés sur les sites de défauts de sérose et de musculature de l'intestin grêle chez 28 chiens. Chez 15 chiens, on a recouvert les anastomoses iléotransversales. Chez 50 chiens, de lobes mésentèriques pédiculés (en pleine épaisseur) ont été utilisés pour soutenir les sutures et les anastomoses du gros intestin. 45 animaux ont été opérés en état de péritonite survenue. Au cours des expérimentations, on a élaboré et appliqué 4 méthodes de création et de fixation des greffons mésentèriques. Les expérimentations ont confirmé que les segments libres d'intestin grêle, dépourvus de muqueuse, aussi que les lobes mésentèriques au pédicule vasculaire multipliaient l'hermétisme et l'efficacité des sutures intestinales et cela sans faire différence entre la chirurgie «propre» et celle du ventre infectieux.

ZUSAMMENFASSUNG

Die Verwendung des Mesenteriums und der von der Darmwand gelösten Schleimhaut bei Darmoperationen

Komarow, I. A., Mochow, E. M., Sergejew, N. A.

Die Arbeit befasst sich mit den klinischen und experimentellen Erfahrungen mit der Verwendung der von den Segmenten des Dünndarms und den mesenterialen Lappen (in vollem Umfang) am Gefässtiel zur Steigerung der hermetischen Abgeschlossenheit der Nähte beim Nähen des Darms befreiten Schleimhäute. Bei diesen Experimenten wurden 93 Hunde verwendet. Bei 43 Hunden wurden die plastischen Eigenschaften der von freien Darmpfropfen befreiten Schleimhäute untersucht. Bei 28 Hunden wurde mit diesen Pfropfen ein Defekt der serösen Häute und der Muskulatur des Dünndarms gedeckt. Bei 15 Hunden wurden ileotransversale Anastomosen gedeckt. Die Pfropflap-

pen des Mesenteriums (in voller Stärke) wurden zur Stützung der Nähte und der Anastomosen des Dickdarms bei 50 Hunden verwendet. Bei 45 dieser Tiere wurde die Operation bei entstehender Peritonitidis ausgeführt. Mittels der Experimente wurden vier Arten der Bildung und Fixierung mesenterialer Pfropfen angewendet. Die Experimente bewiesen, dass die von freien Segmenten des Dünndarms ebenso wie von mesenterialen Lappen am Gefässpfropfen befreiten Schleimhäute, die sowohl in der „reinen" als auch in der infizierten Bauchhöhle verwendet wurden, die hermetische Abgeschlossenheit und die Effektivität der Darmnähte steigern.

RESUMEN

El empleo de mesenterio y de pared intestinal, previada de mucosa, en operaciones de los intestinos

Komarov, I. A., Mojov, E. M., Sergeiev, N. A.

El artículo está dedicado a las experiencias clínicas y experimentales en el empleo de segmentos de intestino delgado, previados de mucosa, y de lóbulos mesenteriales (en pleno espesor) sobre raíces vasculares con fin de aumentar a la hermeticidad de las suturas al suturar los intestinos. En experimentos usaron 93 perros. En 43 perros investigaron propiedades plásticas de libres injertos intestinales, previados de mucosa. En 28 perros por medio de estos injertos cubrieron el defecto de la serosa y de la musculatura de intestino delgado, en 15 perros cubrieron anastomosis ileotransversales. A los lóbulos mesenteriales con raíces vasculares (en pleno espesor) se les emplearon para sostener a las suturas y a las anastomosis de intestino grueso en 50 perros. En 45 animales la operación se la realizaron al producirse la peritonitis. En experimentos elaboraron y emplearon 4 técnicas de formación y de fijación de injertos mesenteriales. Los experimentos mostraron, que libres segmentos de intestino delgado, previados de mucosa, lo mismo que lóbulos mesenteriales con raíces vasculares, empleados tanto en "limpia" cavidad abdominal, como y en la infecta, aumenta la hermeticidad y la efectividad de suturas intestinales.

REFERENCES

1. **Romanenko, N. I.:** Use of the omentum and parietal peritoneum in operations in the abdominal cavity. Chirurgia, 7 : 33, 1980.
2. **Kerscher, P., Wünsch, P. H., Steidi, H.:** Naht der Submukosa bei der Dickdarmanastomose. Chirurg., 50, 12 : 770, 1979.

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CONTENTS

STOP FOR A MOMENT AND CONSIDER YOUR HEALTH

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.

CZECHOSLOVAK SPAS — OASES OF HEALTH,
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