ACTA CHIRURGIAE PLASTICAE

INTERNATIONAL JOURNAL
OF PLASTIC SURGERY

13 · 2
1971

Acta chir. plast. 13 : 2 : 1971

AVICENUM - CZECHOSLOVAK MEDICAL PRESS
PRAGUE

Published four times (in 1959: two times) a year by Avicenum — Czechoslovak Medical Press, Malostranské nám. 28, Praha 1. Editor in Chief Prof. Dr. H. Pešková; Deputy of Editor in Chief Prof. Dr. V. Karfík. — Adress of the editorial office: Acta chirurgiae plasticae (R. Vrabec, M. D. — Secretary) Legerova 63, Praha 2, Czechoslovakia. — Orders through ARTIA, Smečky 30, Praha 1. — Press: Středočeské tiskárny, n. p., provoz 01, Hálkova 2, Praha 2

ACTA CHIRURGIAE PLASTICAE — 13, 2, 1971

Medical Faculty of Hygiene, Charles University, Prague (Czechoslovakia)
Clinic of Plastic Surgery,
Head Prof. H. Pešková, M. D., DrSc.

INCREASE OF THE BIOLOGICAL VALUE OF THE PHARYNGEAL FLAP BY TUBULATION OF ITS PEDICLE

M. FÁRA

At the Clinic of Plastic Surgery in Prague the primary pharyngofixation by means of the upper-based flap, has become routine practice in almost every cleft palate repair (1).

In electromyographic studies of the functional activity and thus also of the biologic value of pharyngeal flaps we ascertained a relation between the functional manifestations of the flap muscle component and the degree of postoperative scarring (2). This scarring is due to the open base of the flap

Fig. 1. Drawing of tubulated upper-based pharyngeal flap sutured into the palate.

which is left to heal per secundam intentionem. Partial covering of the rear surface of the flap by nasal mucosa of the sutured halves of the soft palate did not remove this disadvantage and for this reason we have turned to closing the pedicle by its tubulation.

The proximal half of the flap is tubulated usually by means of three catgut stitches and only the mucosa is sutured. Were the muscle layer included in the suture, a tension in the flap would have been caused and

circulation-disturbance would have followed. Unless the edges of the mucosa had been damaged, the suture should hold firm and the closed part of the flap should heal. Special attention is paid to the circular suture by which the space between the flap base and the upper edge of the sutured secondary defect on the pharyngeal back-wall, is closed.

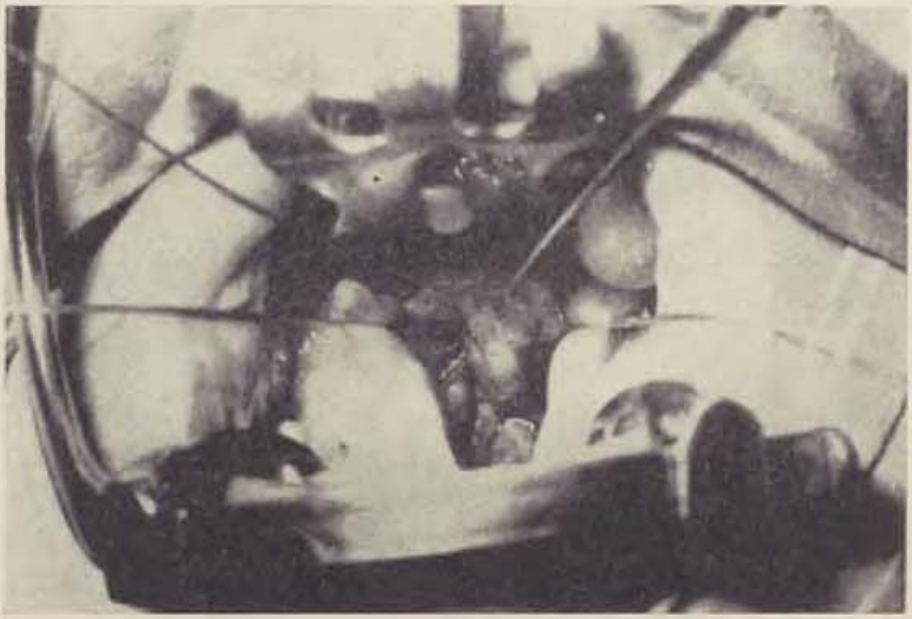

Fig. 2. Peroperative photograph of the upper-based pharyngeal flap tubulated at the base. View from above.

Tubulation of the base of the flap affords a further advantage. The flap does not disappear if it loosens from the velum, it remains in form of a protuberance on the posterior pharyngeal wall. This bulging may participate according to our clinical and skiagraphical findings in better formation of the palatopharyngeal closure imitating the Passavant's ridge.

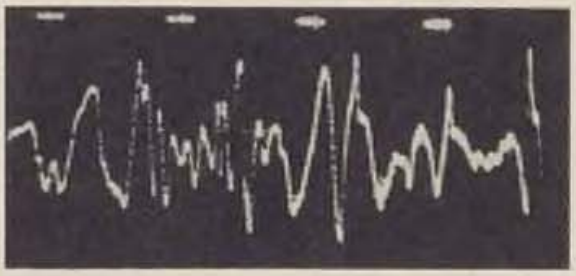

Fig. 3. Electromyographic record collected from the center of a tubulated upper-based pharyngeal flap, 2 years after operation.

Originally only wide and thin flaps were tubulated, however in the past 2 years it has become the usual procedure. The flap loosens from the velum about as often as in untubulated flaps i. e. in less than 10 % of cases.

The predominant majority of tubulated pharyngeal flaps maintains 2—3 years after the operation, very good electrical activity.

In one case we ascertained the excellent condition of the muscle fibers also histologically when we were obliged for phoniatric reasons (rhinophonia clausa at extreme hypertrophy of the lower nasal turbinates) to excise such a flap two years after the operation. The flap cover maintained the original character of the pharyngeal mucosa on the entire circumference. The muscle fibers associated in bundles, were evident on the entire flap section. At the circumference there was more muscle tissue than in the center. A relatively greater amount of fibrose tissue was amongst the individual muscle fibers there. The muscle fibers, in single cases cut obliquely or longitudinally on the slice, maintained the original striation as proof of their full vitality.

Fig. 4. Cross section of a tubulated upper-based pharyngeal flap, 2 years after operation.

On basis of experience gained so far, we believe the partial tubulation of the flap will afford us conditions for permanent maintenance of the functional activity of the flap. Under conditions of the Czech language (demanding a very high standard of palato — pharyngeal closure), this flap contributes considerably to the good results of our cleft palate therapy.

SUMMARY

Tubulation of the proximal half of the upper-based pharyngeal flap:

a) safeguards uncomplicated healing,

b) prevents scarring of the muscle component and thus,

c) improves conditions for permanent maintenance of the functional activity in the flap.

RÉSUMÉ

L'ammélioration de la valeur biologique du lambeau pharyngéal à l'aide de la tubulisation de son pédicule

M. Fára

La tubulisation de la partie proximale du lambeau pharyngéal au pédicule proximal nous assure une guérison sans complications, tout en supprimant la cicatrisation du componant musculeux ce qui amméliore les conditions pour la restauration de l'activité de fonction du lambeau respectif.

ZUSAMMENFASSUNG

Verbesserung des biologischen Wertes des Pharyngeallappens durch Tubulisation seines Stieles

M. Fára

Durch Tubulisation der proximalen Halfte des Pharyngeallappens mit seinem oberen Stiel wird unkomplizierte Heilung gewährt, Vernarbung der Muskelkomponente vermieden und hiermit die Bedingungen für die dauerhafte Erhaltung der Funktionsaktivität im Lappen verbessert.

RESUMEN

Perfeccionamiento del valor biológico del lóbulo faringeal por la tubulación de su pecíolo

M. Fára

Por la tubulación de la mitad proximal del lóbulo faringeal con el pecíolo superior aseguramos la curación no complicada, impedimos la cicatrización del componente muscular y de esta manera mejoramos las condiciones para la conservación permanente de la actividad de función en el lóbulo.

REFERENCES

1. **Fára M., Sedláčková E., Klásková O., Hrivnáková J., Chmelová A., Šupáček I.:** Primary pharyngofixation in cleft palate repair. Plast. reconstr. Surg., Baltimore, 45 : 449, 1970.
2. **Fára M., Véle F.:** The histology and electromyography of primary pharyngeal flaps. Cleft Palate J., in print.

Doc. Dr. M. Fára, DrSc., Šrobárova 50, Prague 10, Czechoslovakia

Department of Operative Surgery and Clinical Anatomy
Kirov's GIDUV (Government Post-graduate Medical School), bearer of the Lenin Order,
Leningrad (USSR)
Rector Prof. E. V. Maystrakh

CHEMICAL-BIOLOGICAL PROPERTIES OF LOW-MOLECULAR SILICON POLYMERS AND METHOD OF EMPLOYMENT IN CONSERVATION OF HOMOLOGOUS TISSUES OF MESENCHYMAL ORIGIN

V. V. NIKITIN

Multiple studies on bone plasties have convinced Soviet and foreign surgeons that tissues of mesenchymal origin, bone, cartilage, etc., both fresh and conserved, when implanted in the bone bed, undergo slow necrobiosis with subsequent lysis, and are then replaced by newly formed bone tissue (Leriche et Policard, 1926; Kornev, 1927; Nadein, 1958, 1962, 1969; Rev, 1959; Kovalenko, 1961; Nadein et Bogoyavlensky, 1962; Klen, 1962; Tkachenko, 1962, and others).

In an effort to simplify conservation of tissues, in 1954 Nadein recommended hard paraffin, which subsequently was widely used in many surgical departments as an agent for the conservation of homologous tissue. Other rather complicated methods of tissue conservation, such as freezing, cooling, lyophilization, etc., led ultimately to the same results: conserved cells remain viable for no longer than five to seven days. This was confirmed by the author's own observations (Nikitin, 1968).

In order to simplify tissue conservation still further, Nadein recommended in 1964 the use of indifferent substances which would not be toxic to tissues or organs, were hydrophobous, and would not hamper the respiration of tissues embedded in them. Experimental and clinical studies have demonstrated that low-molecular silicon polymers, which have been synthesized in the All-union Scientific Research Institute of Synthetic Rubber, possess these properties. These polymers are used because they are neutral with respect to the tissues of the organism; they are transparent fluids with a viscosity between one and several hundreds of poise and in appearance are somewhere between glycerin and thick honey. When the catalyst ADE-3 (diaethylamino-methyltrietoxysilan) is added to the polymer, the fluid turns into a transparent and elastic, rubber-like substance. Due to the maximum

links within the molecule and the high energy of the SiO link, silicon polymers preserve their structure within a considerable range of temperatures: from 0^0 to $+250\ ^0$C, and from 0^0 to $-60\ ^0$C. This distinguishes these substances from other carbohydrate elastomers which disintegrate at such temperatures. Long exposure to light, oxygen and ozone have similarly not been found to have influence on the structure of these substances. Silicon polymers are soluble in alcohol, petrol, acetone and other organic substances; they are insoluble in water. Their specific gravity ranges between 0.96 and 0.98 g/ccm, and the coefficient of refraction is between 1.4030 and 1.4050. Exposure to strong acids, alkali or oxides of heavy metals leads to increase in viscosity, but the linear structure and other properties are preserved. Exposure to ionizing irradiation (10^6 r) causes a change in structure due to the formation of transverse links between the molecules, as a result of which the substance becomes less fluid. SKTN polymers are widely used in industry, and also in dermatology for the preparation of ointments and creams because they do not irritate or desicate skin. On the contrary, they pretect it from diluted acids, alkali and many other chemicals but do not hamper the exchange of gases (Bažant et al., 1954). A multitude of tests carried out in industry, both in the Soviet Union and abroad, have shown that protracted inhalation of vapours of organic silicon monomers do not cause changes in the kidneys. In a series of studies (Bažant, Chvalovský et Rathouský, 1954; and others) dealing with the toxicity of the polymers, it was established that silicons do not poison the organism and have only a mechanical influence on it. To verify the fact that the polymers under study do not have a toxic effect, the author of this paper carried out experiments on mice (a total of five experiments) to determine the condition of infiltrates which had developed at sites where polymers had been injected (intra-abdominally, intramuscularly and subcutaneously). The results showed that SKTN polymers had no toxic effect on the organism of the animals, and were absent in the regional lymph nodes. Evidence of the fact that polymers are permeable by gases was furnished by the author's experiments on fish, which were kept for a month or longer in an aquarium covered by a 1 cm thick layer of polymers of a viscosity of up to 300 poise. The properites of these polymers, as referred to above, induced Nadein to use SKTN for conservation of homologous tissues of mesenchymal origin.

Employing low-molecular silicon polymers for conservation of homologous tissue transplants, both in experiments and under clinical conditions, the author studied the physical-chemical electron-microscopic, cytological, mycological, bacteriological, biochemical and other properties of the polymers in many (over 1500) experiments. The results of the observations showed that SKTN polymers are sterile and possess bactericidal properties against some microorganisms (bacterium coli, and others). On the whole, in both primary and secondary series, a total of 203 bacteriological studies were carried out which furnished evidence that polymers placed in a receptacle rinsed in the ordinary manner, i. e., not sterilized, do not show any bacterial growth.

To verify these observations, water with a bacterium coli titre of 0.4 to 4.0 and a solid growth of proteus was chosen for rinsing the receptacles, and after SKTN polymers were placed in them no bacterial growth developed. The bactericidal properties af the polymers were studied in 74 experiments. The polymers were specially contaminated with microorganisms which are most frequently met with in medical practice: staphylococcus aureus, bacterium coli, and the anaerobe clostridium sporogenes. They were tested with antibiotics (penicillin, streptomycin) and without them. Two ml of contaminated polymer were placed in each test-tube and the test-tubes were then placed in a thermostat at 37 °C for 21 days. The following tests were then carried out: from the test-tubes (without antibiotics) with inocula of staphylococcus aureus and bacterium coli, smears were made on meat-peptone agar in a Petri dish, and from the tubes with anaerobe inocula on Zeissler agar. From seven-day inocula in polymers without the addition of antibiotic, the smears showed growth of staphylococcus aureus in only 30 %, while anaerobes grew in 100 % of cases; bacterium coli smears showed no growth at all.

Polymers with antibiotics added and contaminated with the same bacteria produced no microbial growth (except anaerobes); they remained sterile.

In the second series, 128 bacteriological experiments were carried out on homologous tissue transplants (bone, cartilage and others) conserved in polymers with and without the addition of antibiotics. The conserved tissues were kept at room temperature (18—20 °C) for seven days, and the tissue particles were examined by the method described above: bacterial growth was observed in no case. For control, homologous tissue was placed in test-tubes with sugared meat-peptone broth or Kitt-Tarozzi medium as well as conserved in hard paraffin. These samples were incubated in a thermostat at 37 °C for 14 days and 2, 7, 14 and 21 days later, smears were made from them on hard culture media. Bacterial growth was observed in no case.

The absence of microbial growth in polymers with antibiotics induced the author to investigate the interaction between low-molecular polymer and particles of penicillin or streptomycin under the electron microscope. The specimens were examined in an IEM-6A electron microscope. At a magnification of 12,000 x the polymer film showed a globular structure presenting the picture of rubber molecule associates rolled up in clews. After the addition of indifferent substances (e. g. coal), the polymer film preserved its globular structure. Thus it may be assumed that if micro-organismus grow in the polymer with no antibiotics added, the rolled-up polymer molecules do not envelop them sufficiently to prevent them from growing. If, however, antibiotics (or other substances posssessing an OH-radical) are introduced to the polymer, its molecules, activited by these substances, start to envelop the micro-organismus more intensively, thus not permitting them to grow.

To study the influence of length of conservation on homologous tissue specimens of bone and cartilage stored in SKTN polymer, cytological investigations of these tissues were carried out by means of vital staining according

to the methods of Nasonov et Alexandrov (1940) and Alexandrov (1949). Neutral red was used as vital dye. This is an organic compound of an aromatic line capable of becoming apparent as granules in the cytoplasm of intact cells, and of spreading diffusely when the cells are damaged. The basic investigation (40 experiments) was carried out on cartilage taken from the ear of rabbit and conserved in polymer for 3—5 months at room temperature (20 ^{0}C). A total of 40 cartilage specimens taken from 20 rabbits were thus subjected to histological examination; 28 of them had been taken from live animals and 12 five hours after death. The histological sections 30 to 40 μ in thickness were processed in the following manner: they were soaked in a Petri dish with Ringer solution for one hour and then transferred to a Petri dish containg 0.02 % neutral red and double Ringer solution in equal parts for another 30 minutes. After staining, the sections were rinsed in ordinary Ringer solution for 30 minutes, then placed on the slide in a drop of ordinary Ringer solution and examined under the microscope with the light coming from below. After 4 to 5 days of conservation in polymers, no granules of neutral red were found in the cytoplasm or nuclei of chondrocytes; the cells had begun to become diffusely stained, the nuclear membrane appeared sharply drawn, and pyknosis and cytolysis were present.

However, as was shown by biochemical investigation (60 tests) aimed at determining glutamino-oxalato-acetic transaminase of cartilaginous tissue conserved in the same polymer, fermentative activity is more stable than other cellular functions and persists over a longer period of storage (up to 15—25 days). The results of this investigation permit the conclusion that tissues conserved in SKTN polymers (and in other conservation media) and stored for more than 4—5 days, preserve their fermentative activity for a long time, even after paranecrotic changes have started to develop in their cells.

The satisfactory results of experiments with bone and cartilage homotransplants conserved in polymer and transplanted into bone defects produced in animals (rabbits, cats), made it possible to apply this method in clinical conditions. In the Makarov Regional Clinical Hospital in Leningrad (1968), with Nadein and Rubinstein acting as consultants, twelve operations were carried out in which bone defects were bridged with bone grafts taken from cadavers and conserved in polymer for 3 months. The results were favourable. A total of 75 experiments with transplantation of bone or cartilage homografts conserved in polymer for six months showed that when bone defects in animals (rabbits and cats) were bridged with these transplants regenerative processes developed in all cases.

However, in the bone and cartilage grafts conserved in polymer and stored for more than three months, small clots of white flakes could be observed near the surface of the tissue samples in the depth of the polymer. These samples were subjected to careful bacteriological and mycological examination: the flakes were separated from the tissue with a sterile Pasteurizing pipette and with it the polymer and the suspended flakes were inoculated on culture media. For the first inoculations of each sample, three

test-tubes with sloped must-agar without antibiotics (pH 6.8) and two Petri dishes with the same culture medium, and also two test-tubes with sloped meta-peptone agar (ph 7.2), were used. The smear in the dishes was made with a glass spatula. One Petri dish and one test-tube of each series was incubated at 37 ^{0}C in a thermostat, the remaining dishes and tubes were left at room temperature (20—24 ^{0}C). After two days of incubation at room temperature, small white round colonies with an only surface could be seen in the media which proved, under the microscope, to be filaments of a mycelium; after 4—5 days there were even organs of fruiting. In the tubes and dishes incubated in the thermostat no fungal or bacterial flora could be detected even three weeks after inoculation.

For further study and specific identification of the isolated cultures of fungi, the primary colonies were transferred to the following culture media: must-agar, Saburo agar with glucose, meat-peptone agar and Chapek-Doks agar. To study the morphology of the fungi in more detail, microcultures of all strains investigated were cultivated in parallel on agar blocks. The growth of fungi on these agar blocks was checked every day. As soon as fruiting organs appeared, they were measured using the ocular micrometer MOV-1 and photographed with the Microphot-D. As a result of these investigations, Penicillium expansum, Aspergillus terreus and Pullularia pullulans were identified.

These fungi correspond to the widely spread species of saprophytes and parasites of the higher plants; their spores are constantly found in the open air as well as indoors. As was ascertained by Chayka et Nikitin (1970), during preparation of tissue specimens for conservation, mould fungi fell from the air into their surface and subsequently grew into colonies within the polymer, drawing on the embedded tissue as the source of nutriment. In the absence of tissue, that is, in the pure polymer, fungal growth was observed in no case. The aerial origin of the fungi which contaminate conserved homologous tissue grafts can be considered confirmed by the fact that similar features were observed in specimens prepared by using sterilized polymer.

To find a way of preventing the development of moulds on tissue specimens conserved in silicon polymer, experiments with different fungistatic substances which could be added to the polymer were carried out. A total of 1016 observations were thus registered.

Citric, boric, carbolic and benzoic acids, sodium salicylate, sodium thiosulfate and potassium iodide were used as fungistatic substances.

Concentrations of these substances ranging from 0.03 to 2.0 % were tested on 22 strains of different species of mould-and yeast-like fungi isolated from the air. It should be pointed out that in this series of experiments particles of fungal colonies with sloped agar containing a large amount of viable fungal elements were used as inocula. In order to create conditions for the experiment as near as possible to those of the process of conservations of tissue specimens, two series of experiments with Petri dishes containing media plus the

same substance at concentrations between 0.004 and 2.0 % were carried out. The dishes with solid culture media and containing the substance under investigation were exposed for ten minutes out of doors and in a room (four dishes for each substance) in order to permit them to be contaminated by fungal spores from the air, and then stored at room temperature. Growth of colonies was checked after 8—10 days. At the same time, Petri dishes containing pure nutrient media (without the addition of fungistatic substances) were exposed in the same way. It was thus shown that potassium iodide, sodium thiosulfate and citric acid had a very weak fungistatic effect. Sodium salicylate arrested the growth of fungi at a concentration of 0.5 %, boric acid at 0.25 %, and carbolic acid at 0.06 %. Benzoic acid arrested fungal growth at a concentration of 0.03 %.

These substances can therefore be added to the polymer in order to prevent the conserved tissue from being damaged by fungi. This was verified by the last series of experiments on animals.

Under experimental conditions and by the method described above, conservation of bone (femur and tibia) and cartilage (rib) tissue specimens taken from 50 animals (rabbits and cats) was carried out.

Homologous bone grafts for clinical purposes were taken from fresh cadavers according to "Instructions For the Preparation of Cadaver Blood and Tissues" together with bacteriological test samples and observing the requirements for asepsis and antisepsis.

The method of preparation and conservation of homologous bone and cartilage grafts in SKTN silicon polymers was as follows: under strict aseptic and antiseptic conditions, bone and cartilage tissue was taken from cadavers, stripped of all remnants of soft tissue and immersed in a 200—250 ml glass or plastic container filled with fluid silicon polymer and mixed with one of the fungistatic substances. The author used 0,06 % carbolic acid for the purpose. If necessary, the fluid polymer could be turned into a transparent rubber-like substance by the introduction of the catalyst ADE-3 (diaethylaminomethyltrietoxysilan) at a concentration of 0.25/100.0 polymer.

It should be pointed out that SKTN polymer can be stored in an unsterile receptacle, though the receptacle which was used for the conservation of tissues embedded in the polymer was always sterilized. On bacteriological examination of such conserved tissue samples no microbial growth was ever observed.

After immersion of the tissue specimens in polymer, the glass vessel was closed up with a plug which was then sealed with paraffin. The plastic bags were fused at the edges. Under these conditions, conserved homografts of bone and cartilage can be stored at room temperature for up to 2.5 years and even longer.

To make the homografts ready for use it was sufficient to paint the plastic bag containing the tissue embedded in polymer with a disinfectant or alcohol and then the bag as well as the elastic rubber-like mass was cut open

with a scalpel in order to extract the tissue graft. Extraction of the graft from the glass vessel was carried out using tweezers.

In the Makarov Regional Clinical Hospital in Leningrad (1968), homografts conserved by the above method were used in plastic operations on seven patients (for fracture of the surgical neck of humerus in five patients, for pseudoarthrosis resulting from a carpal scaphoid fracture in one patient and for a bone cyst in the terminal phalanx of the thumb in another). Very favourable early results were achieved in all these patients. The postoperative period was uneventful, without complications or reaction. The process of assimilation and regeneration of bone tissue proceeded with the same activity as when homologous tissue grafts conserved by freezing or embedding in paraffin were used.

The special features of low-molecular SKTN silicon polymer and the advantage of its use as compared with methods of conservation used until now are its transparency, facilitating the visual check-up of the tissue samples, the fact that it does not require sterilization, that it is available and easy to manipulate, and that it makes it possible to store the conserved tissue at room temperature. Another very important quality of hard SKTN polymers is that they can easily be cut with a knife. This makes it possible to extract the homograft in pieces of the required dimensions and cover the tissue left in the polymer with the same conserving substance.

CONCLUSIONS

1. Microbes are absent in low-molecular silicon polymers.

2. Low-molecular silicon polymers are non-toxic, do not poison the tissues of the organism, are hydrophobous and permeable for gases (thus not impeding the exchange of gases).

3. Addition of fungistatic substances (0.06 % carbolic acid or 0.03 % benzoic acid) to silicon polymers protects conserved tissue from mould and ensures long storage at room temperature, up to 2.5 years and even longer.

SUMMARY

Low-molecular silicon polymers, used for conservation of homologous tissue of mesenchymal origin, such as bone, cartilage or other, are characterized by the fact that they are indifferent to living tissue, non-toxic, do not require sterilization, and can be used for repeated conservation of the tissues referred to above. Vital staining of these tissues showed that after 4—5 days of conservation in the polymer, karyopyknosis and cytolysis start to take place. In this condition, however, conserved tissue does not lose its vital activity, as is shown by the presence of ferments even after 25 days of storage.

Bacteriological investigation of polymers and tissues conserved in them furnished evidence that no bacteriological growth developed when they were

placed in a receptacle rinsed in the ordinary manner, and after contamination with staphylococcus aureus, bacterium coli and anaerobes, silicon polymers with antibiotics added remained sterile (except for the growth of anaerobes).

It has been established by experiments and clinical observation that homologous tissues conserved in SKTN polymers behave in the same way as those conserved by freezing or embedding in hard paraffin.

Addition of fungistatic substances (0.06 % carbolic acid or 0.03 % benzoic acid) to SKTN polymers permits long storage of homologous tissue (up to 2.5 years and longer) at ordinary room conditions.

All this permitted the author to use SKTN polymers for tissue conservation.

RÉSUMÉ

Les propriétés chimiquo-biologiques des polymeres de silicon aux petites molécules (SKTN) et la mode de leur emploie durant la conservation des tissus homologues d'origine mézenchymal

V. V. Nikitin

Les polymères de silicon aux petites molécules (SKTN) dont on se sert au cours de la conservation des tissus homologues d'origine mézenchymal (les os, les cartillages etc.) se caractérisent par leur indifférence en face des tissus vivant; ils ne présentent pas de toxicité, ils n'exigent pas la stérilisation et ils offrent la possibilité d'emploie durant la conservation répétée de ces tissus. En employant des couleurs vitales chez les tissus homologues on a prouvé que, après leur conservation dans le polymère dans la période de 4—5 jours les cellules présentent une picnose des noyeaux de même que la cytolyse du protoplasme. Pourtant dans cet état les tissus ne perdent pas leur activité vitale, fait prouvé par la présence des ferments dans la période de 25 jours.

Au cours des examens bactériologiques des polymères et des tissus conservés à leur aide on a trouvé qu'ils n'ont pas montré aucune croissance des microbes dans les bassins nettoyés ordinairement mais, quand les polymères ont été contaminés paralellement avec les antibiotiques par des microbes tels que staphylococque doré, bactérium coli ou par la flore anaerobe, on n'a pas trouvé — sauf les anérobes — aucune croissance bactérielle; les cultures restèrent stériles. A l'aide des observation cliniques et celles expérimentales on a trouvé que les tissus homologues conservés dans les polymères (SKTN) présentent la même conduite que ceux conservés à l'aide du froid ou bien encore à l'aide de la parafine.

L'emploie des matières fungostatiques telles que l'acide carbolique au pourcentage de 0,06 % ou de l'acide benzoique au pourcentage de 0,03 % avec les polymères offre la possibilité de la conservation très longue des transplants homologues (durée de 2,5 années et plus) dans des conditions des chambres normales.

Tutes ces données ont permit à l'auteur d'employer les polymères (SKTN) en tant que matière de conservation de tissus.

ZUSAMMENFASSUNG

Chemisch-biologische Eigenschaften der niedermolekularen Silikonpolymere (SKTN) und ihre Anwendungsweise bei der Konservierung homologer Gewebe mesenchymalen Ursprungs

V. V. Nikitin

Die niedermolekularen Silikonpolymere (SKTN), die bei der Konservierung der homologen Gewebe mesenchymalen Ursprungs (Knochen, Knorpel u. dgl.) benutzt werden, kennzeichnen sich dadurch, dass sie gegenüber dem lebendigen Gewebe indifferent sind, keine Toxizität aufweisen, nicht sterilisiert werden müssen und die Möglichkeit bieten, bei wiederholter Konservierung dieser Gewebe wieder benutzt zu werden. Durch Vitalfärbung der homologen Gewebe wurde nachgewiesen, dass nach 4—5 Tage dauernden Konservierung im Polymer in den Zellen Kernpyknose und Zytolyse des Protoplasmas auftritt. In diesem Zustand verlieren jedoch die Gewebe nicht ihre vitale Aktivität, wie auf Grund der Anwesenheit von Fermenten in ihnen nach 25 Tagen nachgewiesen werden konnte.

Bei bakteriologischen Untersuchungen der Polymere und der mit ihnen konservierten Gewebe wurde nachgewiesen, dass sie in gewöhnlich ausgewaschenem Gefäss kein Mikrobenwachstum aufwiesen, wenn jedoch die Polymere (SKTN) mit Antibiotica mit Mikroben kontaminiert waren, wie Staphylococcus aureus, Bacterium coli oder mit anaerober Flora, ist — mit Ausnahme der Anaerobier — kein Bakterienwachstum beobachtet worden; sie blieben steril.

Durch experimentelle und klinische Beobachtungen ist ermittelt worden, dass sich die in Polymeren (SKTN) konservierten Gewebe ähnlich verhalten, wie homologe Gewebe, die durch Fiefkühlung oder Einbettung in Paraffin konserviert wurden.

Der Zusatz von fungostatischen Mitteln (0,06 % Karbolsäure oder 0,03 % Benzoesaure) zu den Polymeren (SKTN) macht es möglich die homologen Transplantate eine lange Zeit lang (bis 2,5 Jahre und darüber) bei gewöhnlichen Zimmerbedingungen zu konservieren.

Dies alles ermöglichte dem Autor die angeführten Polymere (SKTN) als Mittel zur Gewebekonservierung anzuwenden.

RESUMEN

Propiedades químico-biológicas de los polimeros de silicón de bajo peso molecular (SKTN) y el modo de su aplicación en la conservación de los tejidos homólogos del origen mesenquimatoso

V. V. Nikitin

Los polimeros de silicón de bajo peso molecular (SKTN) los que se emplean en la conservación de los tejidos homólogos del origen mesenquimatoso (los huesos, los cartílagos etcétera) se caracterizan por eso, que son indiferentes al tejido vivo, no son tóxicos, no tienen que ser esterilizados y dan la posibilidad del empleo en la conservación repetida de estos tejidos. Por el teñido vital de los tejidos homólogos se demostró, que después de su conservación en los polimeros durante el tiempo

de 4 hasta g días aparece en las células la picnosis de los núcleos y la citolisis de la protoplasma. Pero en tal estado no pierden los tejidos su actividad de la vida lo que evidencia la presencia de los fermentos en ellos durante el tiempo do 25 días.

En los examenes bacteriológicos de los polimeros y de los tejidos por ellos conservados se demostró que en un vaso lavado del modo corriente no arrojaban ningún crecimiento de bacterias, pero si los polimeros (SKTN) con los antibióticos fuesen contaminados de los microbios como staphilococcus aureus, bacterium coli y de la flora anaerobica no era comprobado — con excepción en los anaerobios — ningún crecimiento de bacterias; restaron estériles.

Por los estudios experimentales y clínicos se comprobó, que los tejidos homólogos conservados en los polimeros (SKTN) se portan de igual manera como los tejidos homólogos conservados por la congelación o por el riego en la parafina.

El aditamento de las substancias fungostaticas (0,06 por ciento del ácido carbólico o 0,03 por ciento del ácido benzoico) a los polimeros (SKTN) da la posibilidad de la conservación prolongada de los injertos homólogos (hasta dos años y medio y más) en las condiciones ordinarias de habitación.

Todo esto hizo posible al autor empear los polimeros mencionados (SKTN) como un medio para la conservación de los tejidos.

REFERENCES

1. **Makarov, A. P., Nadein, A. P., Nikitin, V. V., Pavlova, A. F., Karlin, A. V., Rakov, A. A.**: The Use of Silicon Polymers for Conservation of Homologous Bone Grafts Employed in Experiments and Surgical Practices. Vestn. Chir., 1968.
2. **Nadein, A. P.**: The Biological Basis of Transplantation of Homologous Bone and the Methods of its Conservation, Leningrad, 1969.
3. **Nikitin, V. V.**: Investigation of Tissue Conserved in Lowmolecular Silicon Polymer. Citol., 10 : 441, 1968.
4. **Chayka, N. A., Nikitin, V. V.**: Damage by Fungi to Tissues Conserved in Polymer and its Prevention. Mikol. Fitopat, 4 : 61, 1970.

V. V. Nikitin, Pr. Kosmonautov 18, flat 66, Leningrad M-211, USSR

Medical Faculty of Hygiene, Faculty Hospital, Prague (Czechoslovakia)
Department of Anaesthesiology
Head Dr. J. Počta, CSc.

TREATMENT OF BURNED PATIENTS BY THE ANAESTHESIOLOGIST

J. POČTA, M. ŠIMKOVÁ-NOVOTNÁ, V. CHVÁTLINOVÁ

The specific features of the work of the anaesthesiologist at the Unit for Burned Patients, may be divided into three phases:

1. aid in primary treatment of the burned wound
2. aid in resuscitation and intensive care for the wounded patient
3. cooperation in reconstructive and reparative surgery, removal of the sequellae of burned areas on the body surface.

Each of these phases has its specific requirements limited by the given sector of work. It is the aim of the anesthesiologist to still pain, to forgo development of burn schock, to prevent negative interference into the vegetative balance of the wounded person.

His activity in dealing with the above facts may be divided as follows:

a) cooperation at the bed of the patient (mainly at the Department of Intensive Care) with the specialist for treatment of burns

b) work at the operating theater.

Let us first pay attention to the primary treatment of the burned body area in the wounded person from the point of the anaesthesiologic approach. If we disregard small and superficial wounds, there remain those burned areas which the surgeon is obliged to treat by means of anaesthesia. Indication of local anaesthesia is quite limited. Only the block of brachial plexus in burns in the upper extremities would come into question. The remaining larger and large operations must be carried out in complete anaesthesia. The frightened and scared patient reacts quite inadequately to even the slightest treatment. Along with the already mentioned factors, anaesthesia has also an ethical mission here, it aids to a considerable extent the mental balance of the patient.

We may sum up the characteristic features of anaesthesia in the following points:

1. repeated anesthesia in short time sectors of 2—3 days
2. the necessity of more frequent general anaesthesia in small and short treatment, especially in children

3. the maintaining of adequate nutrition of the patient makes it necessary to refrain from the demand for long period pre-operative fasting and to secure quick — practically immediate — postoperative awakening.

4. avoidance of deep sedation which might induce inhibition of breathing, might disturb the program of nutrition and rehabilitation as well as post-operative treatment, which makes active cooperation of the patient necessary

5. simplicity in the technique of anaesthesia so as to afford active motions and cooperation by the patient also in acts such as bath, open treatment of transplants and grafts etc.

6. the smallest possible toxicity of anaesthetics, analgetics and pharmacons

7. it is of advantage if the patient is awake during the surgical operation and for this reason analgetic methods take precedence before methods which bring the patient into the condition of unconsciousness.

The Department of Anaesthesiology at the Faculty Hospital of the Medical Faculty of Hygiene has not a complete number of qualified medical staff at disposal at present which would afford statisfactory compliance with the demands set by the Department for Burns at the Clinic of Plastic Surgery. For this reason we focused attention mainly to administration of anaesthesia in primary treatment. According to the program such treatment is being carried out on three days per working week.

The following procedures for all performances carried out in primary treatment — dressing, necrectomy, grafting etc. — comply as much as possible with the requirements for the above points:

A) The requirement of waking up in time and small toxicity is complied with, by inhalation anaesthesia by a mixture of nitrous oxide, oxygen and halothane. We do not consider intravenous administration of anaesthetics — chiefly thiopental — to be correct for both reasons mentioned (postanaesthetic slumber and toxicity). The patient is quickly brought into a condition of general anaesthesia, the laryngeal reflexes are maintained, so that there is no threat of aspiration of the stomach contents in case of womitting. For the same reason we decided recently, to give the patients tea early in the morning even on the day of the operation, so as to forgo too great losses of liquids due to fasting. We take this procedure with adults and with children.

B) For the bath, analgesia with methoxyflurane administered by tube — the analgiser of the firm ABBOTT — proved satisfactory. The vapour concentration amounts to 0,25—0,35 %, the depth of analgesia is decided by the patient himself as he is holding the tube in his mouth with his own hand.

C) In some patients with burns on one upper extremity, we applied the brachial block according to Wiemers and Macintosh.

D) Strongly effective analgetics afford a high degree of analgesia at maintenance of full consciousness by the patient. The substances are: phentanyl, pethidin, pentazocine etc. According to our experience, phentanyl though being a stronger analgeticum than pethidin possesses a number of negative

properties — vomiting, desorientation. This is not the case with pentazocine which we administer intravenously directly at the operating theater immediately prior to the operation. The patients cooperate in the dressing. It is only suitable for dressing, for necrectomy or grafting it is insufficient.

E) In short but painful operations which the surgeon is able to perform within 2—3 minutes, we apply propanidid-Epontol intravenously immediately prior to the operation. The substance is slightly toxic and degradates directly in the blood circulation without loading the parenchymous organs.

F) We consider ketamin-hydrochloride-"Ketalar" to be a great progress and advantage in repeated anesthesia in children. It is a psychomimeticum witch considerable analgetic effect overlasting for several hours after application. Administration may be intravenous (1—2 mg/kg body weight) or intramuscular (5—12 mg/kg body weight). Onset of effect is after 1—5 minutes and the period of lasting is from 15 to 30 minutes, according to the method of application. Analgesia is excellent during this period. The patient is dissociated from what is just happening. This state is usually connected with dreams which in children are mostly of pleasant and merry character. We do not find a similar condition in adults however. Their dreams may take a stormy even depressive trend. For this reason Ketalar should rather be applied in children. We often applied this type of anaesthesia the results have been practically always positive. Indication must be carefully decided however. Anaesthesia by means of Ketalar is suitable in dressing, necrectomy, grafting possibly even in the bath. The patient may be contacted during the operation, he may be asked for active cooperation such as lifting the extremity, breathing deeply etc. Should the operation be prolonged, half the anaesthetic dose may be repeated or one may change over to inhalation anaesthesia by means of nitrous oxide, halothane and oxygen. Ketalar is also suitable in fresh facial burns if the narcotizing face mask can not be applied to the face.

G) Last but not least, our palette of anaesthesiologic procedures comprises trichlorethylene, a halogane analgeticum mainly popular in England. It is administered by special evaporizers solely designed for this purpose. The concentration may be only analgetical and n o t anaesthetical. The price is low. We have not introduced it into practice so far.

The pharmacologic preparation of patients before anaesthesia consists in principle of a vagolyticum — atropin and of a small dose of sedative which would not induce deeper central inhibition.

In the second phase, the anaesthesiologist cooperates at the Unit for Burns at the Department of Intensive Care and in the treatment of burn shock. Follow-up of blood circulation and the prevention of peripheral failure is of utmost importance. Correct dosage of substitue solutions, substitution of ions and establishment of acidobasic balance are the primary tasks. Peripheral and central analeptics are out of place here.

In case of inhalation burns, attention must be focused on correct pulmonary ventilation and acidification of the tissues. No hesitation is in place

— endotracheal intubation or tracheotomy must be carried out with the utmost speed.

Unfortunately this work-sector is not being taken care of sufficiently because there is a lack of trained medical staff and we anaesthesiologists owe much mainly to patients and science. We tried to solve the situation at least partly — in order to secure the best care possible for the burned patients — by carrying out detailed individual training of paramedical personnel in resuscitation and reanimation. The same attention was paid by us to the physicians — surgeons working at the Unit for Intensive Care. Our service is consultant care service only.

In the third phase of activity the anaesthesiologist at the Unit for Burns works in the sector of reparative surgery, treating sequellae of burn. Many operations, especially the smaller ones can be carried out by the surgeon under local anaesthesia. Large operations require however anaesthesia and in this case we proceed as a rule in the same way as in operations in general surgery. Anaesthesia is usually administered by a small dose of thiopental followed by inhalation anaesthesia with dinitrous oxide mixed with oxygen and halothane.

We carry out endotracheal intubation mainly in facial operations in order to ascertain passage in the respiratory pathways and to clear the way for the surgeon in the field of operation. With firm contractures on the face and throat, intubation is often rendered rather difficult. In such instances it is apt to select Ketalar as the anaesthetic.

In order to secure all udertakings fully, the permanent presence of two anaesthesiologists at our Unit for Burns during the whole week, is most desirable. This woud afford the surgeons the possibility to operate in peace and the patient would feel safe and suffer no pain.

It would be unfair, if the work done by the instrument nurse would not be mentioned here. Smooth running requires a qualified anaesthesiologic nurse working at the operational theater by the side of the respective anaesthesiologist. At the Department of Intensive Care, two qualified resuscitation nurses should be for each bed. The work carried out by the anaesthesiologic and the resuscitation nurses, is closely connected with the activity of the physician. The quality of their work reflects directly on the level of treatment.

It was our intention to inform you in our report about the work of the anaesthesiologist at the Unit for Burned Patients and to describe the manifold work which must be decided — in respect of anaesthetic procedures — according to the degree of erudition. We believe it to be quite wrong to adhere to one — though simple — method, we believe, on the contrary, rather in the careful selection of modern methods of anaesthesia, combining them aptly and expediently just as the condition of the burned patient and the tactics of the surgeon require.

SUMMARY

The activity of the anaesthesiologist at the Unit for Burned Patients consists of:

1. aid in primary treatment of burned persons,
2. aid in resuscitation and intensive care,
3. cooperation in the removal of sequellae of burned areas on the body surface.

In primary treatment, the following types of anaesthesia occur:

1. General inhalation anaesthesia with nitrous oxide, halothane and oxygen
2. analgesia by methoxyflurane
3. analgesia by trichlorethylene
4. intravenous application of Epontol in short operations
5. block of bracchial plexus
6. pentazocine as intravenous analgeticum in dressing
7. Ketalar — psychomimeticum with highly analgetic effect — is of advantage in children
8. thiopental is unsuitable
9. phentanyl an analgeticum with limited indication

The patient in burn shock is a great hazard. Substitution of liquids, treatment of minerals and acidobasic balance stand in the foreground of treatment. Central and peripheral analeptics are unsuitable. In inhalation burns, endotracheal intubation or tracheotomy should be carried out without delay. Anaesthesia in reparative surgery does not differ from general anaesthesia in general surgery.

RÉSUMÉ

L'activité d'anéstésiologue au cours du traitement des brûlés

J. Počta, M. Šimková-Novotná, V. Chvátlinová

L'activité d'anésthésiologue dans le service des brûlés se compose de:

1. l'aide au cours du premier traitement des brûlés
2. l'aide au cours de la réanimation et au cours du soin intensif
3. de la collaboration durant l'abolition des suites des brûlures

Au cours du premier traitement on peut se servir des suivants modes d'anésthésie:

1. l'anésthésie complète d'inhalation de N_2O, halothane accompagné d'oxygène
2. l'analgésie par methoxyfluran
3. l'analgésie par trichlorethylène
4. l'application intraveineuse d'Epontol pour les interventions courtes
5. le bloc du plexe brachial
6. pentazocine comme analgésie intraveineuse pour les pansements
7. Ketalar chez les enfants psychomimeticum à l'analgésie très élévée
8. Thiopental est directement inconvenable
9. Fentanyl comme analgésie d'indication réservée.

Le malade au cours de la période du choc des brûlés présente un grand danger. Le remplacement des fluides, la restitution des minérales et de l'équilibre acido-basique sont des problèmes du premier ordre. Les analeptiques centrals et ceux de périphérie ne doivent pas être employés. Les brûlés d'inhalation doivent être soumis à la trachéotomie ou l'intubation endotrachéale.

L'anésthésie au cours de la chirurgie réparatrice ne diffère pas de celle de la chirurgie générale.

ZUSAMMENFASSUNG

Die Tätigkeit des Anästhesiologen bei der Behandlung der Verbrannten

J. Počta, M. Šimková-Novotná, V. Chvátlinová

Die Tätigkeit des Anästhesiologen auf einer Station für Verbrannte besteht aus:

1. Hilfe bei primärer Betreuung der verbrannten Personen
2. Hilfe bei der Resuscitation und intensiven Betreuung
3. Mitarbeit bei der Behebung der Folgen der verbrannten Flächen an der Körperoberfläche.

Bei der primären Betreuung kommen folgende Anästhesietypen in Betracht:

1. allgemeine Inhalationsanästhesie mit Stickoxydul, Halothan mit Sauerstoff
2. Analgesie mit Methoxyfluran
3. Analgesie mit Trichloräthylen
4. intravenöse Verabreichung von Epontol bei kurzdauernden Eingriffen
5. Blockierung des plexus brachialis
6. Pentazocin als intravenöses Analgeticum bei Verbandwechsel
7. bei Kindern eignet sich Ketalar, ein Psychomimeticum mit hoch analgetischer Wirkung
8. Thiopental ist ungeeignet
9. Fentanyl als Analgeticum ist nur beschränkt angezeigt.

Ein Patient im Verbrennungsschock bildet ein grosses Risiko. Der Ersatz der Flüssigkeiten, und die Wiederherstellung der Mineralien und des Säuren-Basengleichgewichtes stehen im Vordergrund der Behandlung. Zentrale und periphere Analeptica sind nicht angezeigt. Bei Inhalationsverbrennungen soll mit Endotrachealintubation oder Tracheotomie nicht gezögert werden.

Die Anästhesie in der Wiederherstellungschirurgie unterscheidet sich nicht von der Allgemeinanästhesie in der Allgemeinchirurgie.

RESUMEN

Actividad del anestesiólogo en la asistencia de los quemados

J. Počta, M. Šimková-Novotná, V. Chvátlinová

La actividad del anestesiólogo en la estación para los quemados consta:

1. de la ayuda en la asistencia primaria de las personas quemadas
2. de la ayuda en la resucitación y en la asistencia intensiva
3. de la colaboración en la eliminación de las consecuencias de las áreas quemadas de la superficie del cuerpo.

En la asistencia primaria se toman en consideración estos tipos de anestesia:

1. anestesia inhaladora total con el óxido nítrico, con halothano con el oxígeno
2. analgesia con metoxiflurano
3. analgesia con tricloretileno
4. para las operaciones cortas la aplicación intravenosa del Epontol
5. el bloque del plexus brachialis
6. pentatocino como el analgésico intravenoso en los vendajes
7. en los niños es ventajoso Ketalar, el psicomimetico con el efecto altamente analgésico
8. thiopental es incoveniente
9. fentanil como analgésico tiene la limitación de la indicación.

El paciente en el choque de quemadura ofrece un riesgo alto. El reemplazo de los humores, el reajuste de los minerales y del equilibrio acidobásico está al frente de la cura. Los analépticos centrales i periféricos no son convenientes. En las quemaduras inhaladoras no hay que vacilar con la intubación endotraqueal o con la traqueotomia.

La anestesia er la cirugía de reparación no se diferencia de la insensibilización total en la cirugía general.

Dr. J. Počta, Šrobárova 50, Praha 10, Czechoslovakia

The International Association for Maxillo-Facial-Surgery will hold its 1st World-Congress in Dresden from the 8th—12th May 1972. The association purposes to unite all collegues who are working in the field of jaw and face-surgery (for example jaw-surgeons, plastic-surgeons, nose-ear-throat-surgeons, neuro-surgeons and so on).

Members of the presidium are: President: Prim. Dr. H. G. Bruck, Wienna; secretary-general: OMR Prof. Dr. Dr. W. Bethmann, Thallwitz; vice-presidents: Prof. Dr. L. Bornstein, Iowa-City; Prof. Dr. H. Brückner, Rostock; Prof. Dr. H. Z. Konuralp, Istanbul; Prof. Dr. L. Lebourg, Paris; Prof. Dr. V. Popescu, Bukarest; Prof. Dr. Fr. Urban, Praha; treasurer: MR Dr. Dr. H.-J. Hochstein, Thallwitz.

Main subjects of the 1st world-congress are:

1) newer methods in the treatment of facetumors,
2) unspecific inflammations, proceeding from the skull,
3) orthopaedic operations on the skull of the face.

Notification for participation as well as for lectures, reports and films are requested to be sent to: OMR Prof. Dr. Dr. W. Bethmann, 7251 Thallwitz/DDR, Schloßklinik. Notifications for membership of the association may be directed to Prof. Bethmann, Thallwitz too.

Medical Faculty of Hygiene, Charles University, Praha [Czechoslovakia]
Institute of Forensic Medicine
Head Doc. S. Hájek, M.D.,DrSc.
Institute of Medical Microbiology
Head Prof. J. Sedlák, M.D.,DrSc.

DEATH CAUSES AFTER BURNS

S. HÁJEK, Z. GREGORA, J. ŠTEFAN, M. KOTASOVÁ

Continuous perfection, caused the therapy of burns to undergo recently considerable changes. This may be observed in the clinic and in the morphologic picture. One of the indicators of changes is the mutual comparison of death causes previously and at present, possibly mutual comparison of findings from different work places if their procedure in the therapy differed.

In the endeavour to afford a more clear picture of the mentioned changes we analysed a group of 102 afflicted persons aged 15 to 90 years, hospitalized since 1966 at the Unit for Burns, Clinic of Plastic Surgery, Medical Faculty of Hygiene in Prague, who had died there and their post mortem was at our Institute.

Table 1

Age (in years)	—20	—30	—40	—50	—60	—70	—80	—90	Total
Men	7	8	5	6	12	7	4	8	57
Women	—	2	—	4	5	7	16	11	45

The age distribution of our group is demonstrated on table 1. This table demonstrates that the male group is equally distributed on the whole — excepting a slight rise between the age of 50—60 years. In women on the other hand, significant increase is to be noted in the higher and high age groups. This rise is obviously connected with the fact that even women of these age groups carry out house-work which often their health is unable to stand. For this reason they meet with lethal thermic accidents more often than women of the lower age groups.

The death causes are surveyed on table 2. irrespective of sex and age.

Table 2. demostrates that the highest percentage of deaths was due to insufficient circulation. The afflicted persons were predominantly of high and

higher age — the burned area being small as a rule — who had been ill already before the accident. In a number of cases in this group thermic damage would have not led to death by itself; death was caused in these patients by decompensation of their condition. Besides the burns, we ascertained in the post mortem usually extensive sclerosis of the coronary arteries and fibrosis or dystrophic changes of the heart muscle. In 5 cases we diagnosed infarction of the myocard. In 17 patients who died of insufficient circulation after burns, we ascertained more or less developed hypostatic bronchopneumonia.

Table 2

Cause of death	Number of cases
Insufficient circulation	36
Sepsis	34
Shock	21
Bleeding from the duodenal ulcer	2
Other	9
Total	102

The second largest group of deaths after burns was in our branch caused by sepsis. We met with it as the cause of death in 34 patients rather of younger or medium age, more rarely in elderly and old people. Formation of sepsis was most frequently caused by Staphylococcus pyogenes aureus, Proteus and Pseudomonas aeruginosa. In about half the cases of sepsis it was a combination of two or possibly more microbes, most often the golden staphylococcus and proteus. There was an interesting relation between the incidence of Staphylococcus pyogenes aureus and Pseudomas aeruginosa, at decreasing sepsis of staphylococci, sepsis due to Pseudomonas increased — and vice versa. This finding points to a certain trend in the genesis of sepsis after burns: about 15—20 years ago, Streptococcus haemolyticus played a leading part with us. In our group we did not ascertain it even once. On the other hand, Pseudomonas aeruginosa which at that time we did not ascertain, begins to predominate now. This phenomenon is obviously connected with the nature of therapy, especially with the character of antibiotics which are being administered. Literary data from the United States of America inform us at present about sepsis after burns conditioned predominantly by Gram-negative strains and some reports speak already of fungoid infection of burned areas penetrating even into blood circulation. For the time being we have not observed such pictures afters burns. We consider the burned areas to be the place from where the exogenic infection spreads. We did not observe in our group spreading of infection from purulent phlebitis quite frequently described by foreign authors. This may be explained by the fact that the physicians at the Unit for Burns in Prague did not introduce cannulas into the femoral veins and thus did not form conditions for purulent phlebitis. In 16

patients sepsis was accompanied by more or less developed bronchopneumonia. The patients afflicted with sepsis died usually within a few weeks after the accident. The shortest period of survival was 5 days — cause of the sepsis was Pseudomonas aeruginosa — the longest survival was 440 days when we raised from the spleen of the patient a golden staphylococcus along with Proteus. This was also a case of very heavy septic cachexia. We met with distinctly developed septic cachexia in 14 patients. Most of them were admitted to the Unit for Burns quite some time after the accident. They were originally trated at country hospitals. They died several months and weeks after the accident and we found in bacteriological examination most often Proteus, possibly in combination with Staphylococcus aureus.

The third large groups were cases of death by shock. We diagnosed shock in 21 cases, the patients belonged rather to the higher age groups with more extensive burns. The period of survival ranged from a few tens of minutes to a few tens of hours. If we compare these results with prior analysis, it is obvious that due to the effect of anti-shock therapy, death by shock decreased considerably in the past 20 years.

Burn complications of the gastrointestinal tract ought to be mentioned. We are referring to stomach erosions and duodenal ulcers. Foreign clinical reports state an incidence of these complications of up to 34 %. They may lead to death by bleeding or bursting of the ulcer followed by inflammation of the peritoneum. Larger or smaller bleeding from erosions and ulcers, were observed by us in 11 cases and bleeding from the duodenal ulcer which led to death was only observed in 2 cases. We did not observe a single perforation with peritonitis. We believe that this difference between our results and those of other work places may be explained by different therapy — be it another relation of crystalloids to colloids in the rehydration of the patient, administration of hormones etc.

The different therapy might perhaps also explain the decrease of deaths in the picture of shock kidney. We used to observe in the past damage of the lower nephron, recently however — probably due to satisfactory anti-shock therapy — it practically disappeared. Precise verification of the effect of therapy upon the individual morphologic changes in burns can not be carried out however, because pathologists abroad do not report about therapy in this respect.

The last group of nine patients in table 2 in the column „other" (death causes after burns), consists of four cases of lung inflammation (without sepsis or insufficient circulation), two cases of embolia of the pulmonary artery and one case was observed each in: failure of kidney, laryngeal oedema and brain malacia.

Summing up our findings in conclusion, it is clear that the previously feared burn shock has stepped into the background. This was caused by the intensive care for the patient immediately on admittance to hospital. Sepsis still remains however the most critical complication of a thermic accident. The previously observed sepsis by conditionally Gram-positive microbes has

been recently substituted by sepsis induced by Gram-negative microbes. This is probably due to the continuously developing therapy by antibiotics. Burns in old people form — and apparently will continue to form — a large percentage of deaths at Units for Burns in regions where thermic working accidents do not predominate. A decrease of this percentage will not be achieved by medical care but rather by effective prevention — just as in other age groups too.

SUMMARY

In 102 patients aged 15—90 years, who died after thermic accidents, the cause of death was in more than 1/3 of cases insufficient circulation, in 1/3 sepsis and in 1/5 of cases burn shock. Insufficient circulation predominated in persons of the higher and high age groups, whereas sepsis war rather the cause of death in persons of younger or medium age. In recent years a decrease in death by shock was observed. In the genesis of septic complications of burns, Gram-negative microbes begin to predominate over Gram-positive microbes. Burns in old people are and apparently will remain a critical problem.

Résumé

Les causes de la mort au cours de la maladie des brûlés

S. Hájek, Z. Gregora, J. Štefan, M. Kotasová

Chez 102 des malades agés de 15—90 ans, morts en suite de l'accident thermique, plus d'un tiers des cas avait comme cause de mort une insuffisance cardiaque, dans un tiers des cas la septicémie et dans une cinquième des cas le choc des brûlés. L'insuffisance cardiaque était plus remarquée chez les malades de l'âge avancé et chez les agés, la septicémie en tant que cause de mort était plutôt plus remarquée dans les catégories des gens jeunes et chez ceux du moyen age. Au cours des années dernières la mort dans la période du choc était plus rare qu'auparavant. Dans la génése des complications septiques de la maladie des brûlés les microbes gramnégatifs viennent de supprimer ceux grampositifs. Un problème très grave présentent et il parait qu'encore longtemps présenteront les brûlures des gens vieuses.

Zusammenfassung

Todesursachen bei der Verbrennungskrankheit

S. Hájek, Z. Gregora, J. Štefan, M. Kotasová

Unter 102 Verbrannten im Alter von 15—90 Jahren, die infolge eines thermischen Unfalls gestorben sind, bildete in mehr als einem Drittel der Fälle die Todesursache die Kreislaufinsuffizienz, in 1/3 der Fälle Sepsis und in 1/5 der Fälle Verbrennungsschock. Kreislaufinsuffizienz überwog bei Menschen in höheren und hohen Altersgruppen, demgegnüber bildete Sepsis die Todesursache eher bei Menschen in jüngeren und mittleren Altersgruppen. In den letzten Jahren ist ein Absinken der Zahl der Todesfälle durch Schock verzeichnet worden. In der Genese der septischen Komplikationen der Verbrennungskrankheit beginnen gramnegative Mikroben über den grampositiven Mikroben Vorherrschaft zu gewinnen. Ein schwerwiegendes Problem sind und werden auch offensichtlich bleiben die Verbrennungen bei alten Leuten.

Resumen

Causas de la muerte en la enfermedad de quemadura

S. Hájek, Z. Gregora, J. Štefan, M. Kotasová

En 102 afectados de la edad 15 hasta 90 años los que murieron a consecuencia del accidente térmico, fue en más que un tercio de los casos la causa de la muerte insuficiencia de la circulación, en un tercio de los casos la sepsis y en un quinto de los casos el choque de quemadura. La insuficiencia de la circulación predominó en la gente de los grupos de edad más altos y altos, mientras que la sepsis fue la causa de la muerte más en la gente de la edad más joven y mediana. En los ultimos años se observaba el descenso de la muerte por el choque. En la génesis de las complicaciones sépticas de la enfermedad de quemadura principian a prevalecer los microbios gramnegativos sobre los microbios grampositivos. Un problema grave son y evidentemente restarán en lo sucesivo las quemaduras de la gente vieja.

Doc. S. Hájek, M.D.DrSc., Šrobárova 50, Praha 10, Czechoslovakia

---

University of Milan (Italy)
Institute of Surgical Pathology
Dir. Prof. L. Gallone

STATISTICAL RESEARCH ON CURLING'S ULCER

GRISOTTI A., SAVOIA A., TAIDELLI G.

Among the complications that can take place in the postburn period, gastroduodenal ulceration is indeed one of the most serious.

Curling's original description in 1842 is refererred to duodenal ulceration subsequent to thermal trauma, and later others confirmed this location as elective. Nevertheless in more recent studies (1, 2) gastric location has been proved to be much more frequent than duodenal. It has been however maintained in the literature the term "Curling's ulcer" to mean all the gastroduodenal erosions and ulcerations occurring in the postburn period.

From a morphological point of view these lesions can consist in superficial erosions of gastrointestinal mucosa or show the characteristic features of a real ulcer of various deepness, up to transmural penetration.

In case of the typical Curling's duodenal ulcer the more frequent location is uncommonly the posterior wall, in contrast to the higher incidence of anterior location of peptic ulcer.

Distinctive features of these lesions in respect of peptic ulcer are the frequent multiplicity (9) and the lack, like in stress ulcer, of inflammatory response and connective tissue proliferation.

The pathogenesis of Curling's ulcer at the present point of research is still under discussion.

Dissimilarity in location, number, size, inflammatory response and colonizing bacteria suggests a pathogenesis different from peptic ulcer. It has been hypothesized a relationship between sepsis and gastric lesions, but it has not been possible to show any established link.

It has been demonstrated (4) an increase in gastroduodenal contractility and a tendency to increased gastric acidity and uropepsin excretion (8, 9): antiacid and anticholinergic drugs however have been experienced to have no prophylactic value (8).

The considerable morphologic similarity between stress and corticosteroid induced ulcers permits to hypothesize a pathogenetic mechanism, which found large agreement, enrolling this disease in the general adaptation syndrome.

It could be namely the abnormal stimulation of pituitary and adrenal glands, with subsequent hyperproduction of ACTH and glicocorticoids, to cause the appearance of gastrointestinal mucosa lesions.

In 1936 Selye (7) experimentally demonstrated the possibility of provoking gastric ulceration by adrenaline administration; in 1930 Simonart found in the first stage of shock erosions and bleeding points on gastric mucosa; in experiments with rabbits (8) the constant appearance of these lesions after a severe thermal trauma is anticipated, and the gravity increased, if the rabbits are pretreated with noradrenaline.

Table 1

		gr.	Calories
Proteins	Minced meat (beef, chicken) Boiled meat (beef, chicken) Roasted brains Croquettes Milk Fresh cheese Eggs	70	280
Carbohydrate	Bread, bread sticks Biscuits Fruit squashes Whisked fruits Juices Fresh and cooked fruits Fresh and cooked greens Mashed potatoes Spaghetti with ragout or tomato sauce Lump sugar Jam	200	800
Fat	Cheese (fresh, Parmesan) Milk Cream Butter Olive oil	30	270
Total		300	1350

Average feeding table for severely burned patients in 2nd—3nd day postburn

This table is merely indicative both for the quantity (which is gradually increased in the following days according to the extent of the burn) and for the quality, which will be respectful for national and individual tastes. The most seriously burned patients sometime present swallowing impairment and need fluid meals; only exceptionally a nasogastric tube is required.

Though Curling's ulcers manifest at least after the first week postburn, it cannot be excluded that they should be considered as the evolution of the described alterations established during the first hours postburn, in the early stage of circulatory shock.

STATISTICAL DATA

During the last five years 2.300 patients have been admitted to the Milan Mayor Hospital Burn Unit; 883 patients had a burn index of more than 30 %. During this period it has been possible to found reliable symptoms of gastrointestinal ulceration, such as melena and hematemesis, in eighteen surviving patients. In other cases, but with a very low incidence, it has been possible to recognize a varied abdominal symptomatology (epigastric pain, abdominal distention, diarrhoea, etc.) not clearly related to a gastroduodenal lesion.

In this same period 66 autopsies have been performed, with a report of 3 cases of gastric multiple erosions and one case of an old dated duodenal ulcer.

Clinical and anatomical reports of gastroduodenal lesions amount therefore to a total of 21, all of which referred to patients with a burn index of more than 30 %.

Curling's ulcer incidence therefore appears to be in these series 2,23 % of severely burned patients, and 0,91 % of the entire admissions.

DISCUSSION

From these data is seems that the incidence of gastrointestinal hemorrhagic complications is in our Burn Unit lower than previously reported (more than 10 % of admissions) (1). The reasons of this difference can be manifold.

It may be important the fact that in our Unit even severely burned patients begin to be abundantly fed starting from the second day postburn (Tab. 1), and that alkaline solutions, lactoferments and non absorbable intestinal antibiotics (neomycine) are routinely orally administered.

Of prime importance from our point of view is the removal of those pathogenetic factors more frequently hypothesized, that is corticosteroids and cathecolamine hyperproduction, by means of an early and effective antishock therapy, regulated on the fundamental indices of diuresis and microhematocrit values.

We must not forget the possibility that the very low incidence in our series could be attributed not only to therapy peculiarities, but possibly to technical mistakes in pointing out these lesions; the fact that the autopsies were performed after more than 24 hours from death, could interfere with the checking of minor ulcerations, owing to mucosal autolysis in stomach and duodenum.

REFERENCES

1. **Moncrief, J. A., Switzer, W. E., Teplitz, C.:** Curling's ulcer. J. Trauma 4, 481, 1964.
2. **Artz, C. P., Moncrief, J. A.:** The treatment of burns. Saunders Co. 1969.
3. **Bothe, E. A., Magee, R. B.:** Multiple Curling's ulcers involving the esophagus, stomach and duodenum. Penn. Med. J. 56, 642, 1953.
4. **Necheles, H., Olson, W. H.:** Experimental investigation of gastrointestinal secretions and motility following burns and their relation to ulcer. Surgery 11, 751, 1942.
5. **Friesen, S. R.:** The genesis of gastroduodenal ulcer following burns: an experimental study. Surgery, 28, 123, 1950.
6. **Hummel, R. P., Lanchantin, G. F., Artz, C. P.:** Clinical experiences and studies in Curling's ulcer. J.A.M.A. 164, 141, 1957.
7. **Selye, H., Stehle, R. L., Collip, J. B.:** Recent advances in the experimental production of gastric ulcers. Canad. J. Med. Ass. 34, 339, 1936.
8. **Harvengt, C.:** Le systéme adrénergique et le choc circulatoire précoce des brulés. Arscia ed. Bruxelles 1968.

Dr. Grisotti A., University, Institute of Surg. Pathology, Milan, Italy

---

The Hellenic Society of Plastic and Reconstructive Surgery announces that, at a General Assembly on the 25th of February, the following officers were elected for the period 1971—1972. — J. D. Kyrtatas, President, P. Kakaras, Vice President, G. M. Kotsianos, General Secretary, N. D. Sgouras, Treasurer, G. S. Polycratis, Member of the council, M. G. Stavrakis, Member of the council, P. K. Kolliopoulos, Member of the council.

University of Milan (Italy)
Institute of Surgical Pathology
Dir. Prof. L. Gallone

OUR EXPERIENCE WITH SILVER NITRATE HALF PER CENT IN THE TREATMENT OF BURNS

A. SAVANI, A. SAVOIA, G. TAIDELLI

The topical therapy of burns has always been a controversial point; the different techniques from time to time proposed (1) did generally bring nothing definite to the problem.

It does not therefore exist at the present moment a technique universally accepted as the most effective.

Fig. 1. A. G. 22 years: deep second degree burns and third degree at the face, thorax and upper limbs. — Fig. 2. Detail of the same patient.

Tab. 1. Deaths associated with burns treated by open method (1/4/1968 — 30/4/1969) and by silver nitrate (1/5/1969 — 31/5/1970) on basis of percentages of body burned surfaces

	Open method			Silver nitrate		
Per cent burned	patients	deaths	%	patients	deaths	%
15	258	0	0	533	1	0,18
16—30	48	2	4,16	159	5	3,14
31—40	43	1	2,32	57	4	7,01
41—50	13	0	0	20	3	15
51—60	2	1	50	2	2	100
60	14	14	100	9	7	77,77
Total	378	18 = 4,76%		780	22 = 2,82%	

These are in brief the actual courses:

1) Exposure
2) Wet dressings (with $AgNO_3$ 0,5 % or antibiotics solutions)
3) Creams (Sulfamylon, Sulfadiazione).

From more than one year the topical treatment with half per cent aqueous silver nitrate solution, after Moyer (2, 3) except for a few variants, has been adopted in this Burn Center.

The burn surface is covered with about 24 layers of gauze, abundantly soaked by silver nitrate and covered by two cotton sheets; in addition a sheet

Fig. 3. The slow but constant reepithelisation without any infection has given spontaneous thorax face healing. — Fig. 4. The same patient of the above picture at the moment of discharge: only few areas at the forearms have been grafted.

and two or three dry blankets are suspended over the patient's bed by means of metallic frames, creating a warm and wet air chamber. The gauze is kept constantly soaked by adding silver nitrate solution every four hours.

The gauze is changed every other day; from the end of the second week periodical baths in tubes containing about 500 litres of tap warm water, additioned with two litres of Cetavlon 0,5 % solution are started, in order to

Fig. 5. An example of dressing: the face has been left in air exposure because second degree burned.

make easier the softening and separation of eschars. Escharectomy is performed on every dressing change, without general anaesthesia; the parenteral administration of an analgesic drug half an hour before generally has proved sufficient.

Tab. 2. Deaths associated with burns by open method (1/4/1968—30/4/1969) and by silver nitrate (1/5/1969—31/5/1970) on basis of age

	Open method			Silver nitrate		
Age	patients	deaths	%	patients	deaths	%
0—10	85	3	3,52	277	3	1,08
11—20	38	1	2,63	106	0	0
21—30	101	5	4,95	130	0	0
31—40	73	3	4,1	102	4	3,92
41—50	36	3	8,33	81	1	1,23
51—60	31	1	3,22	55	5	9,09
>60	14	2	14,28	29	9	31,03
Total	378	18 = 4,76%		780	22 = 2,82%	

Average of mortality = 32,5 years Average of mortality = 49,7 years

Debridment of burn wounds is in this way completed in third-fourth week, and a surgical grafting procedure can then be undertaken.

On grafted areas and on donor sites dressings are performed with $AgNO_3$ 0.5 % after Moyer, or with ointment penicillin gauze. With this latter technique the dressing is removed for the first time in the fourth day and replaced with silver nitrate 0.5 % soaks till complete restitution.

In our experience ointment gauze offers the advantage of preventing the eventual shifting of grafts from their beds, but no substantial difference has been noted between the two methods.

Tab. 3. Deaths from 1. 4. 1968 to 30. 4. 1969

Name	Age	Sex	Diagnosis	% Burned Surface
M. G.	30	M	Acute renal failure Sepsis	80
R. E.	40	M	Acute renal failure Endofthalmitis from sepsis	80
P. G.	45	M	Shock in chronic alcoholism	70
C. E.	30	M	Septicaemia	65
S. E.	6	M	Shock	80
M. S.	31	M	Sepsis, anuria (B. Pseudomonas)	75
R. D.	26	M	Cardiac arrest	40
S. M.	26	M	Cardiac arrest, anuria	70
D. F.	38	M	Shock	90
G. R.	68	F	Heart failure	20
B. R.	5	F	Sepsis (B. Pseudomonas)	75
Z. G.	62	M	Diabetic coma	20
C. G.	23	M	Sepsis (B. Pseudomonas)	60
M. G.	55	M	Anuria, sepsis (B. Coli)	65
S. R.	45	M	Renal and liver failure Sepsis (Streptococcus)	95
C. R.	12	M	Acute renal failure sepsis	85
S. O.	42	M	Sepsis (B. Pseudomonas)	65
A. C.	2	M	Shock	90

Average age: 32,5 years.

The silver nitrate half per cent has a remarkable bactericide action [4] without being at the same time caustic for the tissues. This results in an histo-prophylactic action, owing to the possibility for cells to regenerate from the epithelial residuum in the inner layers of dermis, which may be spared by thermal trauma, and afterwards no more destroyed by pathogenous bacteria [5].

Besides, silver nitrate applied on open wounds is not toxic [6], because it precipitates as an insoluble salt, binding plasma proteins and Cl- and HCO_3-ions. The danger of improverishing the tissues of necessary electrolytes, as pointed out by Moyer, proved to be very easily avoidable by means of an abundant administration, especially during the period of shock, of isotonic solutions of these electrolytes.

STATISTICAL DATA

The results of a statistical evaluation of two groups of patients, treated with different techniques, are shown in four tables.

The first group is composed of 378 patients, admitted from 1. 4. 68 to 30. 4. 69, treated by exposure and for the most part adult, being in this period the Burn Center almost exclusively destined to labour accidents victims.

Tab. 4. Deaths from 1. 5. 1969 to 31. 5. 1970

Name	Age	Sex	Diagnosis	% Burned Surface
B. M.	74	F	Acute renal failure	55
P. P.	82	M	Myocardium infarct	25
F. G.	66	F	Cardiac failure and anuria	40
P. R.	32	F	Sepsis and anuria (B. Proteus)	90
A. C.	30	F	Sepsis and anuria (B. Proteus)	95
G. T.	67	F	Heart failure in intestinal cancer	20
A. M.	66	M	Anuria, renal failure	70
C. I.	4	M	Acute renal failure	60
D. R.	2	M	Sepsis	80
T. P.	38	M	Renal failure, sepsis (B. Pseudomonas)	20
C. M.	3	F	Sepsis, anuria (B. Coli)	70
P. P.	55	F	Acute renal failure	35
P. A.	53	F	Acute renal failure	35
M. G.	52	F	Sepsis, anuria (B. Pseudomonas)	50
P. N.	68	F	Anuria in diabetic renal disease	70
E. A.	65	F	Heart failure	25
S. A.	54	M	Acute renal failure and liver in alcoholism cirrhosis of the liver	35
C. C.	33	M	Liver and renal failure in chronic alcoholism	45
T. M.	56	M	Shock, anuria	90
S. T.	71	F	Cerebral trombosis	10
S. M.	81	M	Acute respiratory failure, pulmonary oedema	20
G. B.	43	M	Acute renal failure	48

Average age: 49,7 years

The second group is composed of 780 patients of any age, admitted from 1. 5. 69 to 31. 5. 70 and treated with silver nitrate soaks.

Mortality rates in relation to the various burn indices are considered in Tab. 1; differences between the two groups within the limits of every class were not statistically significant on account of the low number of cases. It is only to be noted that in the exposure group there were 18 deaths and 378 patients, with a mortality per cent of 4,76 and that 22 patients died on a total of 780 patients (mortality 2,82 %) in the silver nitrate group.

In Tab. 2 mortality rates in relation to age are considered: remarkable is the increase of patients younger than 10 and older than 51 years in the more recent nitrate group; the percent ratio of deaths still remains almost unaltered, so that the average age of dead patients shifts from 35,5 years in the exposure group to 49,7 in the silver nitrate group.

Tab. 3 and 4 at last show the causes of death in the two considered groups. Sepsis prevails in the first group, (Tab. 3) while the diseases typical of aged people (myocardium, infarction, diabetes, liver failure from alcoholism) appear significantly as joint causes of death in the second period (Tab. 4) when besides the silver nitrate, other preventive measures were taken, first of all antipseudomonas routine vaccination.

FINAL CONSIDERATIONS

The exposed data and our experience allow to say that the results obtained with silver nitrate 0,5 % are at least equal to those stated by authors making use of other recent methods of topical treatment of bunrns (7, 8, 9, 10).

The low cost of the solution, the simplictiy of use, the better comfort of the patients owing to the reduction of pain, the uselessness of sterilized rooms and gowns, make us pursue this way, awaiting further developments and techniques capable of making less serious the injuries of fire on our patients' body.

RÉSUMÉ

Nos expériences avec le traitement des brûlures a l'aide de $AgNO_3$ au pourcentage de 0,5%

A. Savani, A. Savoia, G. Taidelli

Les données décrit jusqu'alors de même que nos propres expériences nous permettent de dire que nos expériences avec le traitement à l'aide de $AgNO_3$ au pourcentage de 0,5 sont au moins aussi bonnes que celles des autres auteurs se servant des autres méthodes du traitement local chez les brûlures (7, 8, 9, 10).

Les rasions de poursuivre cette méthodes sont suivantes: le prix bien bas de la solution, la simplicité de l'emploie, le comportement plus favorables des malades en suite de l'ammélioration des douleurs et enfin le fait le plus remarquable — celui de l'abolition de l'emploie des chambres stériles et de la vaisselle stérile.

Les autres attandent encore une ammélioration dans le traitement des brûlures graves.

ZUSAMMENFASSUNG

Unsere Erfahrungen mit der Behandlung der Verbrennungen mit halbprozentiger Silbernitratlösung

A. Savani, A. Savoia, G. Taidelli

Auf Grund der gewonnenen Daten und nach unseren Erfahrungen erlauben wir uns zu behaupten, dass die mit der halbprozentigen Silbernitratlösung gewonnenen Ergebnisse zumindest so gut sind wie die Ergebnisse anderer Autoren, von denen andere Methoden zu der Lokalbehandlung der Verbrennungen benutzt werden (7, 8, 9, 10).

Die Gründe für das Ausharren auf unserem Wege sind die folgenden: niedrige Kosten der Lösung, Einfachheit der Anwendung, besseres Wohlbefinden der Kranken bei verminderter Schmerzhaftigkeit und Zwecklosigkeit der sterilen Räume und Mäntel. Wir erwarten weitere Verbesserung in der Behandlung von Kranken mit schweren Verbrennungen.

RESUMEN

Nuestras experiencias con el tratamiento de las quemaduras con el nitrato de plata

A. Savani, A. Savoia, G. Taidelli

De acuerdo con los hechos ganados y según nuestras experiencias nos tomamos la libertad de decir que los resultados conseguidos con el nitrato de plata al medio por ciento son lo mentos tan buenos como los resultados de otros autores que emplean un método diferente del tratamiento local de las quemaduras (7, 8, 9, 10).

Los motivos para permanecer en nuestro camino son: bajo precio de la solución, la simplicidad del empleo, más buen tiempo de los pacientes con menor dolencia y la inutilidad de las habitaciones y batas estériles.

REFERENCES

1. **Moncrief, J.**: The status of topical antibacterial therapy in the treatment of burns. Surgery, 63 : 892, 1968.
2. **Monafo, W., Moyer, C.**: Effectiveness of dilute aqueous silver nitrate in the treatment of major burns. Arch. Surgery, 91 : 200, 1965.
3. **Polk, K.**: Treatment of severe burns with aqueous silver nitrate (0,5 %). Ann. Surgery, 164 : 753, 1966.
4. **Cason, J., Jackson, D., Lowbury, E.**: Antiseptic and aseptic prophylaxis for burns: use of silver nitrate and isotors. Brit. Med. J., 2 : 1288, 1966.
5. **Scarpicchio, A., Constable, J., Opitz, B.**: Comparative effects of silver nitrate and sulfamylon on epidermal regeneration. Plast. reconstr. Surgery, 41 : 319, 1968.
6. **Ternberg, J., Luce, E.**: Methemoglobinemia: a complication of the silver nitrate treatment of burns. Surgery, 63 : 328, 1968.
7. **Dominguez, O.**: Treatment of burns with silver nitrate versus exposure method, analysis of 200 patients. Plast. reconst. Surg., 40 : 489, 1967.
8. **Howell, J.**: Silver nitrate versus sulfamylon in the treatment of burns. North Carolina Med. J., 29 : 280, 1968.
9. **MacMillan, B., Hill, O., Altemeyer, W.**: Use of topical silver nitrate, mafenide and gentamicin in the burn patient. Arch. Surgery, 95 : 472, 1967.
10. **Wilde, N.**: A comparison of $AgNO_3$ treatment with other techniques in the treatment of burns. Plast. reconstr. Surg., 40 : 271, 1967.

Dr. A. Savani, University, Institute of Surgical Pathology, Milan, Italy

University of Milan (Italy)
Institute of Surgical Pathology
Dir. Prof. L. Gallone

VACCINATION AGAINST PSEUDOMONAS INFECTION IN BURNED PATIENTS: ASPECTS AND PROBLEMS

G. TAIDELLI, A. SAVANI, A. GRISOTTI

Septicaemia is without any doubt nowadays the major cause of death in severely burned patients. A proper perfusional therapy allows to dominate rather easily the early shock phase, by preventing renal complications, which were previously very dangerous in the first hours for the patient's life.

In addition, according to our experience, an early food administration, together with intestinal antibiotics and lactoferments in large doses, permits

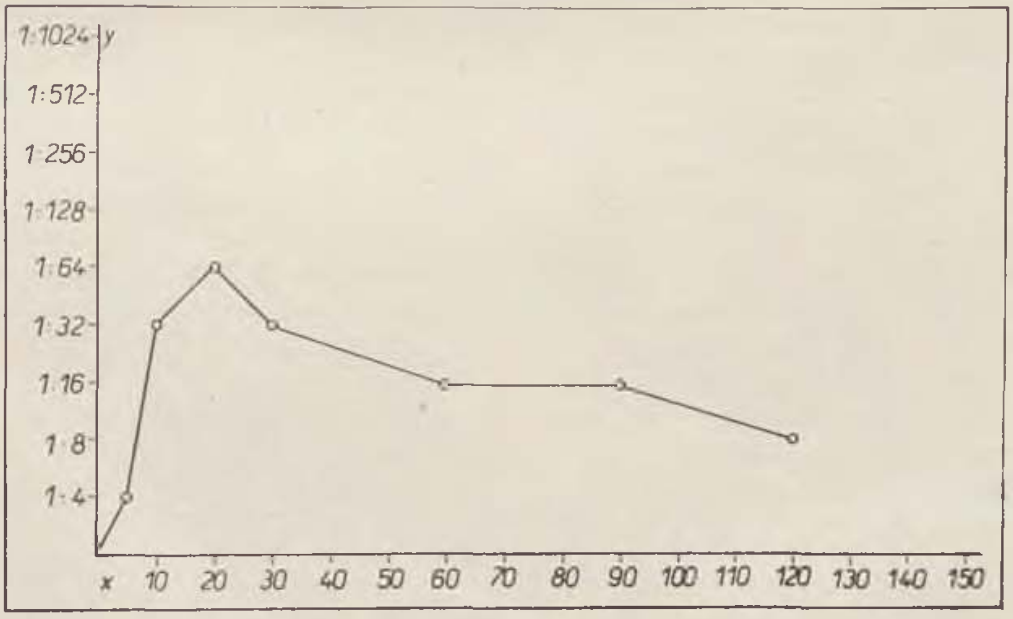

Fig. 1. Agglutination titre in the vaccinated volunteers group.

to reduce to an insignificant incidence the serious intestinal diseases, very frequent in other series.

Patients with a burn index of even more than 50—60 % have a possibility of spontaneous delimination of the eschars, surgical repair and complete restitution, but begin in the 10th—14th day postburn to show increasing

temperature with septic characteristic, and often they die by sepsis in the third or in the fourth week.

Responsible bacteria, isolated from positive blood cultures, have been recognized in most cases as Pseudomonas (1). This organism, gramnegative and anaerobic, has the peculiarity of being highly resistent even to specific antibiotics like carbenicillin* (2); such a therapy therefore has resulted useless and sometime harmful, owing to the very large doses used.

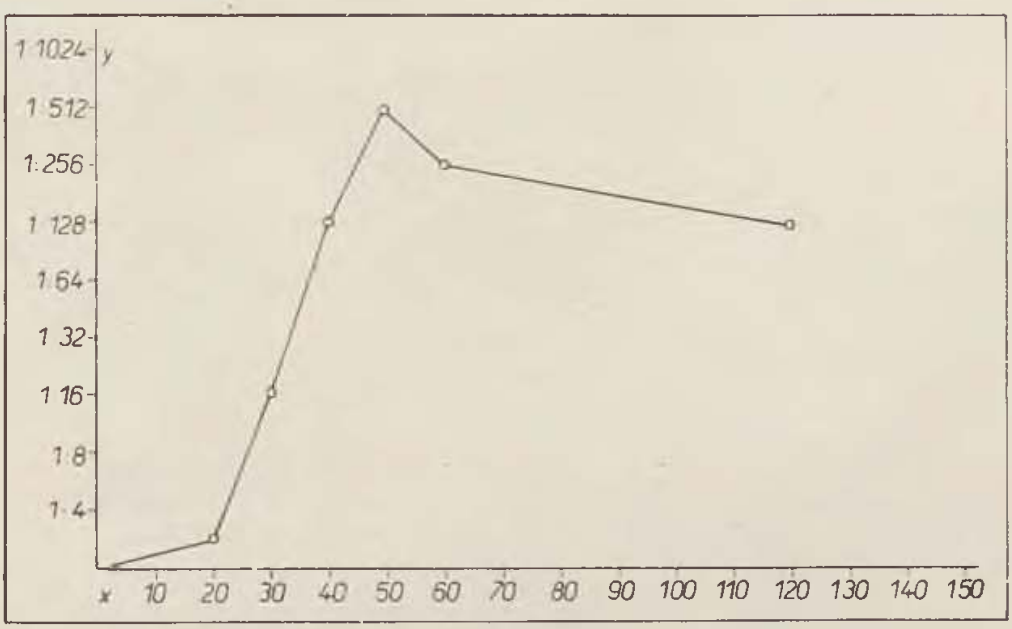

Fig. 2. Agglutination titre in burned and not vaccinated patients.

French authors demonstrated by means of antibiograms routinely taken from all their patients, that in most burns, no matter the severity of trauma, pseudomonas infection on burn wounds is the last step of an infective escalation. This takes place with virulentation of common pyogenes, streptococci and staphylococci, usual guests of body surface, sensible to normal antibiotics and therefore easily eliminated, to end up with the much more dangerous pseudomonas sepsis.

If we consider that such pseudomonas infection requires two-three weeks to take place, and that all gramnegative bacteria have a strong antigenic power owing to the high protein content of their cellular wall; it seems evident that the solution of such a weighty problem is to be sought for in a prophylactic therapy, that is preventive vaccination (3), for which all the previous statements for positive results existed (4, 5).

American authors (6) in fact have lately adopted a vaccination against seven Pseudomonas strains, together with hyperimmune human serum, with highly positive results.

---

* Pyopen, produced in Italy by Farmitalia.

Also in our Center for Burns routine vaccination against Pseudomonas infection has been adopted. The present communication shows practic results obtained after one year's treatment and points out a few problems not yet well defined, first of all the serologic estimation of the patient's respondency to this treatment.

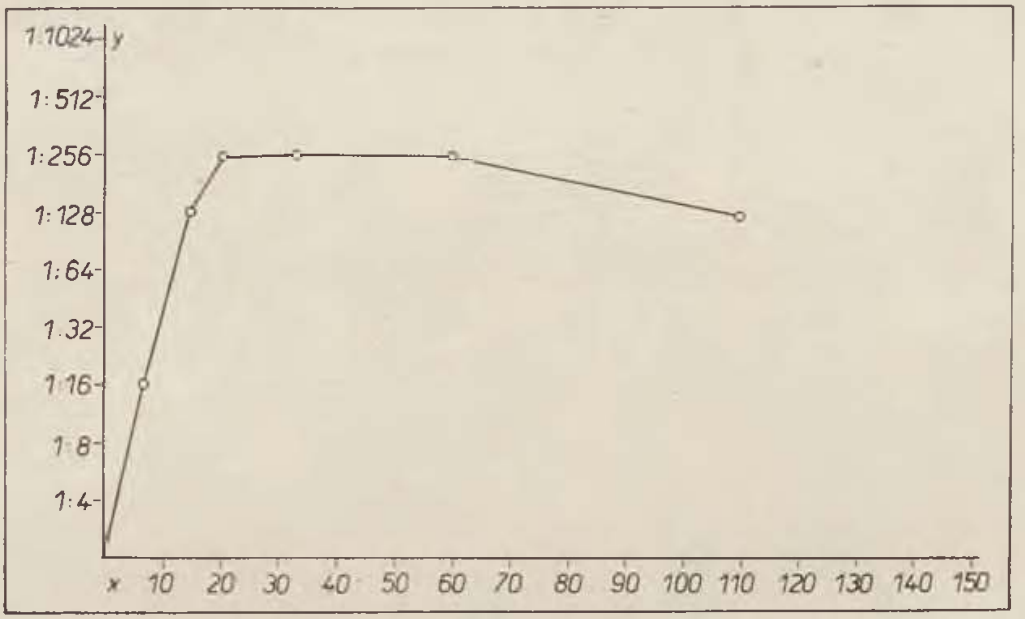

Fig. 3. Agglutination titre in burned vaccinated patients.

MATERIALS AND METHODS

Pseudomonas organisms were isolated from purulent material taken from burn wounds of patients in our Burn Center, preserved in Liquoid and then grown in agar-tryptose.

The vaccine is composed of three strains of Pseudomonas. Vaccination is performed with the dose of 1 ml. of formalin treated bacteria suspension (titre: one milliard organisms/ml) injected in the first and in the fifth day postburn.

Three groups have been considered:

1. 21 patients who suffered local Pseudomonas infection and were not vaccinated.

2. 59 volunteers, not burned, vaccinated.

Table 1

Pre-vaccination Period from 1. 4. 68 to 31. 3. 69				Vaccination Period from 1. 5. 69 to 31. 5. 70			
Total deaths (patients 378)	18	Pseudomonas septicaemia	8	Total deaths (patients 780)	22	Pseudomonas septicaemia	3
		Other causes	10			Other causes	19

3. 20 patients (5 males, 15 females) with an average burn index of 22 %, age 23, weight 53 Kg., vaccinated.

All the three group have been evaluated from an immunologic point of view for three months with periodical agglutination tests.

The volunteers (2nd group) and the burned vaccinated patients (3rd group) have been repeatedly checked for VDS values for about one month after vaccine injection.

RESULTS AND DISCUSSION

An objective estimation of data is not very easy, because these were collected in a rather short period of time (one year), and because other efficacious measures against gramnegative infection, like topical dressings with AgNO 0,5 % soaks, were taken in the same period (7, 8, 9, 10). We however tried first to evaluate mortality indices, considering an equal period during which preventive vaccination was not yet performed.

As described in the table, during the vaccination period deaths from Pseudomonas septicaemia were percentually much lower than in the preceding year.

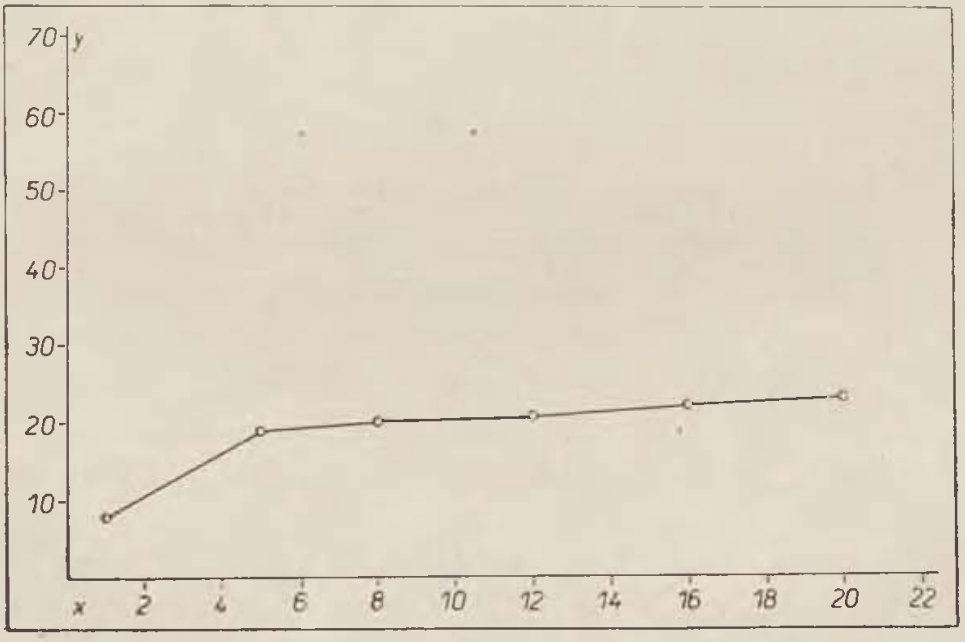

Fig. 4. V D S values in the vaccinated volunteers group.

A second control was performed on an immunological basis: Fig. 1, 2, 3 — show the antibody response, as reflected by the agglutination test, respectively of vaccinated volunteers, of burned not vaccinated patients, and of burned vaccinated patients.

The first group does not reach high agglutination titres (max. 1/64); the prompt and quick rise of values till 20th day signifies however a certain antibody response.

The slow increase in the second group, with a maximum in 50th day (titre 1/512) testifies a Pseudomonas infection, which slowly produced an immunization not sufficient yet to last long, as it is proved by the following quick decrease.

At last, it is evident the sharp increase, even with lower agglutination titre (perhaps on account of a mitigated infection) in the group of burned and vaccinated patients, where antibody response, together with a high agglutination titre, is prolonged to the third month postburn.

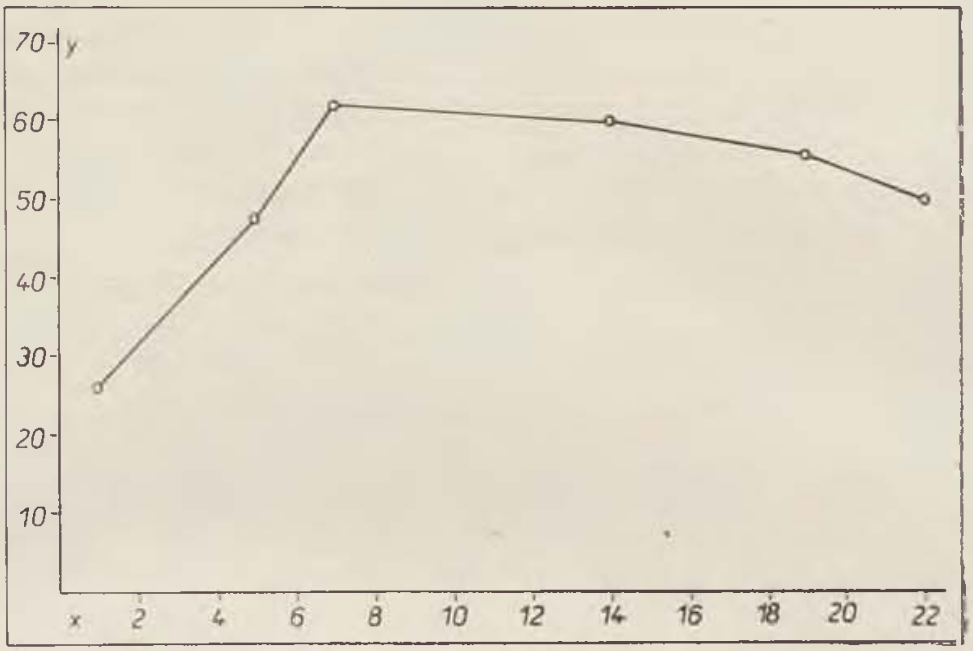

Fig. 5. V D S values in burned vaccinated patients.

Evident, expecially in the first two weeks, is the analogy between agglutination titre values of vaccinated volunteers and burned vaccinated patients, with comparable speed of increase and duration of high values for a long period.

The VDS values have been evaluated as a sign of serum globulins increase. As shown in Fig. 4—5, the Katz index increases considerably both in volunteers and in burned patients. It always increases in the postburn period, owing to the altered proteins reabsorption; important is the fact that it increases in the volunteers group.

At last it can be said that from a practical point of view antipseudomonas vaccination is rather effective; on the other hand we still lack reliable data to clarify all the aspects of antibody production following pseudomonas vaccine administration.

To this purpose further laboratory data, referring to proteins and lipids of serum are being achieved and the results will be exposed in a following paper.

REFERENCES

1. **Polk, H., Ward, C., Clarkson, J., Taplin, D.:** Early detection of Pseudomonas burn infection. Arch. Surg. 98 : 292, 1969.
2. **Newson, S. W.:** Carbenicillin resistent pseudomonas. Lancet 2 : 1141, 1969.
3. **Alexander, J. W., Fisher, M. W., Mac Millan, B. G., Altemeier, W. A.:** Prevention of invasive pseudomonas infection in burns with a new vaccine. Arch. Surg. 99 : 249, 1969.
4. **Markley, K., Smallman, E.:** Protection by vaccination against Pseudomonas infection after thermal injury. J. Bact. 96 : 6774, 1968.
5. **Jones, R. Y.:** Protection against Pseudomonas aeruginosa infection by immunization with fractions of culture filtrates of Ps. aeruginosa. Brit. J. exp. Path. 49 : 411, 1968.
6. **Feller, J., Pierson, C., Arbor, A.:** Pseudomonas vaccine and hyperimmune plasma for the burned patients. Arch. Surg. 97 : 225, 1968.
7. **Muir, I. F., Owen, D., Murphy, J.:** Sulphamylon acetate in the treatment of pseudomonas pyocyanea infection of burns. Brit. J. plast. Surg. 22 : 201, 1969.
8. **Thompson, R. E. M., Colley, E. W., Chimmock-Jones, G. J. G.:** Sensitivity of hospital strains of Pseudomonas aeruginosa to sulphamylon acetate. Brit. J. plast. Surg. 22 : 207, 1969.
9. **Barclay, T. L., Barisoni, D.:** Local gentamicin in the care of extensive burns. Brit. J. plast. Surg. 21 : 277, 1968.
10. **Fox, C. L., Rappole, B., Stanford, W.:** Controle of Pseudomonas infections in burns by silver sulfadiazine. Surg. Gynec. Obst. 128 : 1021, 1969.

Dr. G. Taidelli, Institute of Surg. Pathology, Milan, Italy

In The General Assembly held by the Spanish Society of Plastic and Reconstructive Surgery on December 19th, 1970, the following office bearers for 1971—1973 were elected: President: Dr. Fernando Enríquez de Salamanca. Vice-President: Dr. Alfonso Núñez Cabezas de Herrera. Secretary: Dr. Alejandro Bermúdez Ruiz. Treasurer: Dr. Ulrich Hinderer Meise. Officers: Dra. Purificación Arvez García, Dr. José A. Bañuelos Roda, Dr. Manuel Tafalla Peña. Dr. Eugenio Vázquez Gundín.

Medical Faculty of Hygiene, Charles University, Prague (Czechoslovakia)
Clinic of Plastic Surgery
Head Prof. H. Pešková, M. D., DrSc.

REGIONAL ECTODERMAL DYSPLASIA WITH TOTAL BILATERAL CLEFT

M. FÁRA

It is comparatively frequent that clefts of the lip and palate are associated with other congenital anomalies. When however these combined findings appear repeatedly in form of a certain syndrome or singularly with some sort of connection among the individual symptoms, they are of considerable importance from the aetiopathogenetic point of view. For this reason each such case deserves a detailed analysis.

OBSERVATION

A girl M. K. case history No. 69.464, aged 4 years was entrusted to our care as a cleft patient when two months old.

She was the first-born child of young parents, the mother was 22 and the father 24 years old. The pregnancy had been preceded by an abortion in the third month. This fact and vomiting, were the reason for hormonal support during pregnancy in form of injection therapy carried out twice a week since the middle of the first, till the end of the fourth month of pregnancy. The mother took no other medicine during all her pregnancy, she was healthy all the time, had not been x-rayed, nor did she undergo any physical or mental trauma.

The child was born with its head in the correct position, it weighed 3.300 g and cried out immediately after birth. The chromosomal finding was normal. The subsequent psychomotoric development was not delayed.

Local finding: The skin on the face and on all the head is thin, shiny, desquamating. Hair is scarce and only present on the skull circumference, the rest of the head is quite hair-less. Eye-brows and eye-lashes are practically non-existent. In the region of the great fontanella of the skull and on its left, 5 dermoidal cysts of pea to hazel-nut size are placed subcutaneously, well movable to the base. Skin — namely of the upper lids — is strikingly thin, shortened and taught. The tarsal plates are hypoplastic on palpation. The right upper lid is permanently quite everted, the left upper

lid also shows signs of ectropion and everts during sleep or when crying. Also both lower lids show signs of ectropion more in their external halves. Signs of epidermalisation are evident on the conjunctiva of the everted right upper lid. There is a not too distinct bilateral injection of the bulbar conjunctiva. The child is able to close both eyes even if the lids are everted, only during sleep a 3 mm wide lagophthalmos occurs bilaterally.

Fig. 1. M. K. before operation of the lip at the age of 4 months.

The chief congenital anomaly is a wide total bilateral cleft of the lip, jaw and palate, complicated by aplasia of the premaxilla. At the front end of the vomer only a tiny distally directed protuberance was formed instead of the premaxilla, width 3 mm length 4 mm. To this finding corresponds the distinctly underdeveloped prolabium — not larger than a pea. The alveolar processi are almost indistinct with no dental buds on the x-ray.

Surgical therapy. At the age of 4 months bilateral suture of the lip, shifting the muscle stumps down in horizontal direction and mutual suture of the muscle bundles of both sides under the prolabium, was carried out. A bone transplant from the eighth right rib was placed between both jaw segments.

At the age of 11 months both upper lids were augmented by free skin grafts (in full thickness) from the left hypogastrium. Simultaneously tarsorrhaphy of 5 mm length was performed in the external pole of both palpebral apertures thus almost completely removing the ectropion of the lower lids.

At the age of 3 years and 3 months the palate was closed with retroposition and fixation means of the tubulated upper-based pharyngeal flap. Removed was also the right throat tonsil and dermoidal cysts on the head.

Development of the child and results of the therapy.

Till the present the child is developing in a normal manner physically and mentally. Merely the signs of ectodermal insufficiency in the head region observed since the start, prevail. The skin is still of paper thickness, it desquamantes and does not sweat. The border of hair is placed far back, the vertex is bare. Eye-brows and lashes developed very poorely and consist only of short, thin and quite light coloured single hairs. No teeth have cut through in the upper and lower jaw, x-ray of the jaws does not disclose even signs of

Fig. 2. M. K. before operation of the lids at the age of 11 months. — Fig. 3. M. K. aged 3½ years.

their buds. Development of the maxilla is somewhat delayed in comparison to the mandibula.

The child has never been seriously ill, it only had a slight cold several times.

After each surgical therapy healing was always without any complications. Opening of both palpebral apertures is normal, the ectropion was removed. The skin grafts take well with the vicinity. Because the orbicularis oris muscle had been well reconstructed and introduced in its function, the prolabium dilated considerably and it aids formation of a quite loose upper lip. The columella is still short, will be prolonged at the age of 6 years. The bone implanted in the maxilla took without any complications and together

with the intraoral dilatation apparature it aids to maintain acceptable width of the jaw. The operation of the palate was also performed with good result. The palate is long, well movable, the pharyngeal flap took well, without scars. The child learned to speak within 6 months after the operation without any sings of rhinophonia.

DISCUSSION

The imperfect qualitative condition of the skin (thin, shiny, desquamating) and its insufficient quantity mainly manifesting on the lids, as well as the pathologic development of skin adnexae (scarce hair, eye-brows

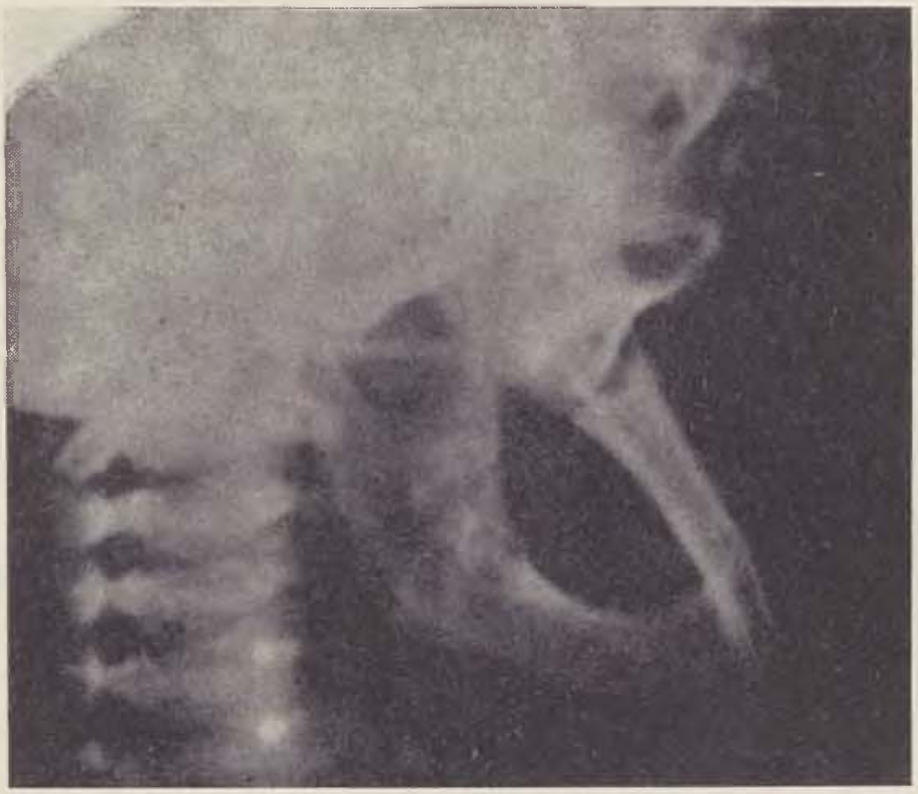

Fig. 4. M. K. x-ray of the teeth-less jaw at the age of 3½ years.

and lashes, defective sweat glands, dermoid cysts) tend to prove a certain form of regional ectodermal dysplasia.

The simultaneously present ectropion is the natural consequence of developmental skin disturbance in all four lids. This statement on the obvious cause of congenital ectropion is of importance for studying the forming of this defect. Really congenital ectropion is a very rare anomaly and it is rather difficult to ascertain its causes. No more than 20 cases (1—6) have been reported so far. It is important of course to distinguish between congenital primary ectropion and the secondarily formed ectropion — also ascertained immediately at birth. It can be the sequel to birth trauma and then the lids are lifted due to oedematose conjunctiva. When the swelling is absorbed the

condition becomes quickly normal (usually within 14 days). It may be also the case of lifting of the lid edges by pressure of the inborn cyst situated under the lid conjunctiva.

Half of the congenital primary ectropions were isolated cases, the other half were of hereditary character. Some of the carriers of this defect had associated anomalies on the lids for ex. ptosis, epicanthus, undeveloped lashes or — on the contrary — a double row of lashes (distichiasis) or bad development of the lacrimal apparatus. Familiar incidence was described in ectropion associated with distichiasis, pterygium colli and Milroy's disease (1).

The associated heavy total bilateral cleft in our patient is a most interesting observation from the point of investigation of the causes of cleft formation in lip and palate. If we are able to consider all skin, hair and lid findings as well as the undeveloped teeth to be the doubtless sequellae to regional ectodermal dysplasia affecting the head region, why should we not seek the cause of cleft formation in this case in insufficient development of the ectoderm? We must take it for granted that forming of a healthy upper lip necessitates correct development of the mesenchyme and the ectoderm. Otherwise a cleft may form either as the sequel to bad proliferation of the mesenchyme so that the else normally developing epithelial wall does not become sufficiently firm or the cleft may be caused primarily by the defective ectodermal component at good growth potency of the mesenchyme. This second possibility affords the explanation of the cleft formation in connection with regional ectodermal dysplasia. Premaxillary aplasia could have formed due to the fact that the dental buds did not develop at all and for this reason there was no impuls for growth of this medial part of maxilla Practically no development of lateral alveolar processi was the analogue finding.

SUMMARY

Isolated aplasia of the maxilla at bilateral cleft or isolated primary ectropion of the lids, are very rare congenital anomalies. In the studied child, both findings were associated with numerous manifestations of developmental disturbances in skin and skin adnex with undeveloped teeth. The general pathologic picture seems to be the sequel to regional ectodermal dysplasia affecting the head. The possible connections were discussed.

RÉSUMÉ

La dysplasie régionale d'ectoderme accompagnée du bec-de-lièvre billatéral

M. Fára

L'aplasie de l'os intermédiaire chez le bec-de-lièvre billatéral de même que l'ectropium des palpèbres présentent une anomalie innée très rare. Chez l'enfant respectif ces deux malformations ont été encore accompagnées par des multiples troubles du développement de la peau, de ses adnexes et par l'absence des dents. Il parait que tout l'immage pathologique n'était que suite d'une dysplasie régionale d'extoderme ayant lieu dans la tête. L'auteur discute les possibilités des relations respectives.

ZUSAMMENFASSUNG

Regionäre Ektodermdysplasie, verbunden mit beiderseitiger Totalspalte

M. Fára

Die Aplasie des Zwischenkiefers bei beiderseitiger Spalte und das primäre Ektropium der Augenlider sind sehr seltene angeborene Anomalien. Bei dem beobachteten Kind erschienen diese beiden Befunde in Verbindung mit zahlreichen Erscheinungen einer Entwicklungsstörung der Haut und der Hautadnex mit nichtenwickeltem Gebiss. Es scheint, als ob das gesamte pathologische Bild die Folge einer regionären, den Kopf befallenden Ektodermdysplasie wäre. Die möglichen Zusammenhänge werden diskutiert.

RESUMEN

Displasia ectodermal regionar unida con la grieta total bilateral

M. Fára

La aplasia del os incisivum en la grieta bilateral así como ectropium primario de los párpados son las anomalías congénitas muy raras. En el niño observado fueron los dos diagnósticos unidos con numerosas manifestaciones del defecto del desenvolvimiento de la piel y de adnexa cutis y con ningún desarrollo de los dientes. Parece como si todo el cuadro patológico fuera la consecuencia de la displasia ectodermal regionar que afecta la sabeza. Se discuten las relaciones posibles.

REFERENCES

1. **Falls, H. F., Kertesz, E. D.:** A new syndrome combining pterygium colli with developmental anomalies of the eyelids and lymphatics of the lower extremities. Trans. Amer. Ophthal. Soc., 62 : 248, 1964.
2. **Hopen, J. M.:** Congenital eversion of upper eyelids. Arch. Ophthal. (Chicago), 53 : 118, 1955.
3. **Johnson, C. C., McGowan, B. L.:** Persistent congenital ectropion of all four eyelids with megaloblepharon. Amer. J. Ophthal., 67 : 252, 1969.
4. **Musgrave, R. H., Garrett, W. S.:** Congenital primary ectropion. Plast. reconstr. Surg., 45 : 507, 1970.
5. **Picó, G.:** Congenital ectropion and distichiasis. Etiologic and hereditary factors. A report of a case and review of the literature. Amer. J. Ophthal., 47 : 363, 1959.
6. **Stillerman, M. L., Emanuel, B., Padorr, M. P.:** Eversion of the eyelids in the newborn without an apparent cause. J. Pediat., 69 : 656, 1966.

Doc. Dr. M. Fára, DrSc., Srobárova 50, Prague 10, Czechoslovakia

ISUL - Department Orthopaedics and Traumatology, Sofia (Bulgaria)

BIPEDICLED ISLAND FLAP

J. HOLEVICH, E. PANEVA-HOLEVICH

Several years ago one of the authors discussed four possibilities for the transfer of sensitivity on the thumb from the dorsal surface of the index finger. Subject of the present report is the latest variant of this procedure, which was successfully applied on a more numerous series only recently. The experience had enabled further precisation of some of the details of the surgical technique and the comparison of the results with those achieved with the island flap suggested by Littler and some of its modifications (Hueston, Holevich), as well as with the sensitized flaps from the dorsal surface of the hand, described to date (Holevich, Wilson, Adamson and assoc., Khun, Gaul, Bralliar and Horner).

PRINCIPLE OF THE METHOD

The dorso-radial surface of the index finger, extending from the proximal and middle third borderline of the base phalanx to the distal IP joint, represents the donor area. The area thus outlined is transposed to the thumb as an island flap with two nutritive pedicles — a volar one and a dorsal one (Fig. 1.).

The volar nutritive pedicle includes the following structures:

a) the volar radial artery of the index finger. This artery, as well known, supplies with blood besides the volar skin, also the dorsal surface of the finger, distally to the first IP joint, by means of several branches passing obliquely through the subcutaneous tissue. It is connected to the small dorsal vessels of the digit through anastomotic branches. The inclusion of the volar artery in the nutritive pedicle of the island flap by no means interferes with the donor finger blood supply.

Insofar operative technique is concerned, the topographo-anatomical relationships and existing variations in the radial artery of the index should be beared in mind. Most frequently, it arises from the deep palmar arch, directly from the radial artery or from the principal artery of the thumb. and crosses the distal part of the palm between the first interosseus and the adductor pollicis. Only at the base of the digit, it penetrates into the subcutaneous tissue underneath the volar aspect of the first lumbrical muscle

(Kovanov and Travin). Rather seldom, the radial digital artery of the index originates from the superficial arterial arch (Kaplan). In the latter instance, it is situated in the distal part of the palm, beneath the fascia, volarwards from the adductor of the thumb and lumbrical, in a common bed with the corresponding nerve.

b) one or two dorsal branches of the radial digital nerve of the index finger, arising from the common trunk at the level of the proximal part of the base phalanx. The finding ot two branches, originating from points distant

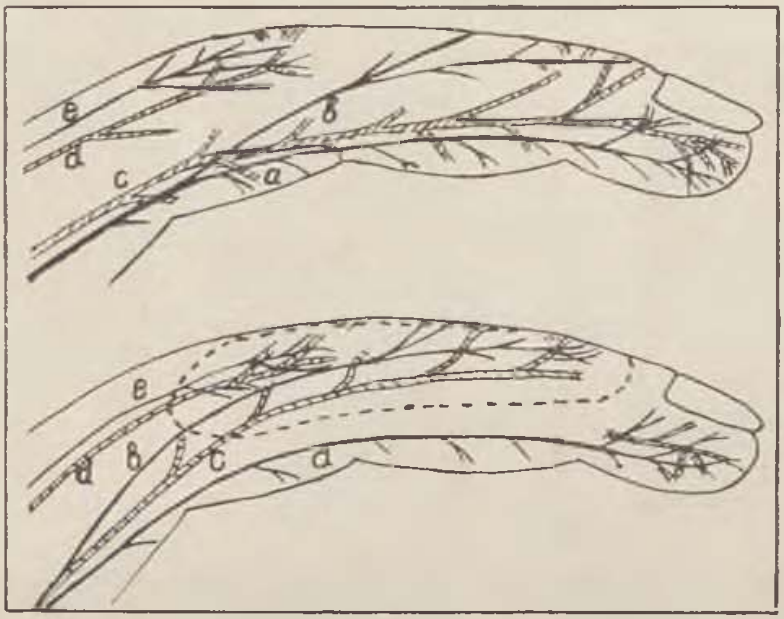

Fig. 1. Bipedicled island flap — diagram: a) the proper volar radial nerve of the index finger, b) dorsal branch of the proper volar-radial digital nerve of the index, c) the proper volar-radial artery of the digit, e) dorsal digital branch of the radial nerve and d) dorsal radial artery of the index.

from each other, or of a single, slightly thicker branch, which subsequently ramifies, is an issue of anatomical variation. These branches innervate the skin along the dorsoradial aspect of the finger at the level of the proximal IP joint and the middle phalanx. More distally, at the level of the distal IP joint, the third dorsal branch separates and innervates the corresponding region of the skin, in the proximity to the nail bed. It is not included in the nutritive pedicle.

The dorsal neurovascular nutritive pedicle comprises the branch of the radial nerve, extending to the dorso-external surface of the index, the corresponding artery and one or two of the superficial veins. As already pointed out by the authors elsewhere, it is not necessary to dissect these structures separately. They are mobilized in a common bundle, wide about 1 cm, together with the surrounding loose connective tissues and even part of the dermal layer of the skin.

OPERATIVE PROCEDURE

A skin island is tailored on the dorso-radial aspect of the index finger, measuring in length 6—7 cm and width — up to 1 centimeter. One longitudinal incision runs along the neutral lateral line of the digit, and the other — along the dorsal surface, close to the midline. In its distal end, the flap is rounded, whilst in the proximal — tapered. Distal- and ulnarwards, the skin and subcutaneous tissues are incised up to the paratenon of the dorsal aponeurosis, whereas along the lateral surface of the finger and in the most proximal part of the flap — merely the epidermal layer of the skin is cut.

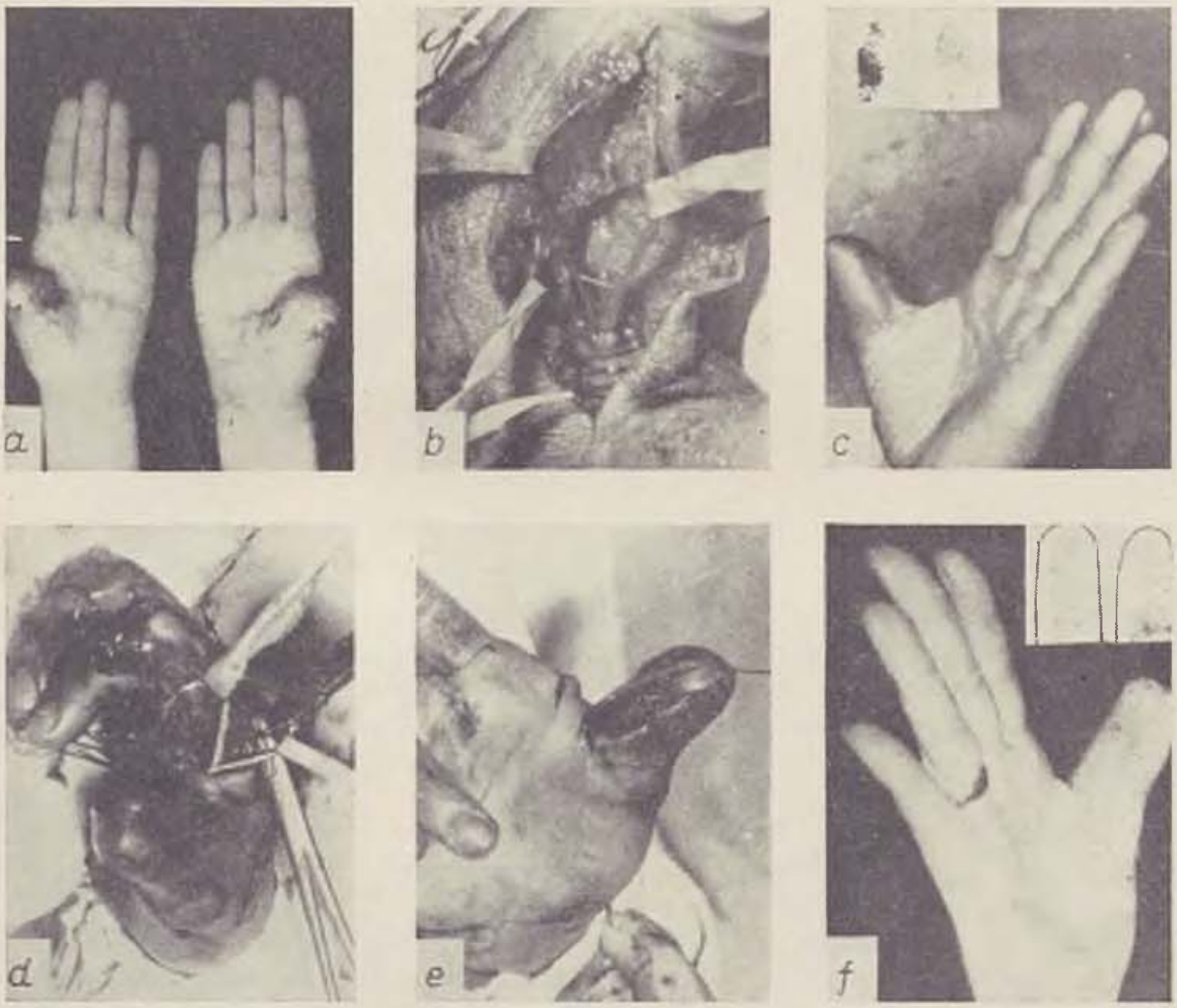

Fig. 2. Case E.B.H., aged 19 years — a) condition after bilateral amputation of the thumb, b) technical details of the operation on the left thumb, illustrating the proper volar digital nerve and two dorsal branches dividing from the proper volar digital nerve, c) result — normal ninhydrin printing test of the island flap and of the volar surface of the donor digit, d) and e) stage of the operation on the right thumb, showing the proper volar digital nerve, the dorsal branch of the proper volar digital nerve, the proper digital artery and the transferred island flap, f) outcome of the right thumb reconstruction. Normal printing test of the island flap and of the volar surface of the donor digit.

Thereafter, the incision proceed in proximal direction, approximately, up to the point where the radial artery penetrates in between the two bellies of the first interosseus. At this point, too, only the dermo-epidermal layer of the skin is divided. In order to secure access to the volar neurovascular bundle additionally, a transverse incision along the course of the distal palmar crease is performed.

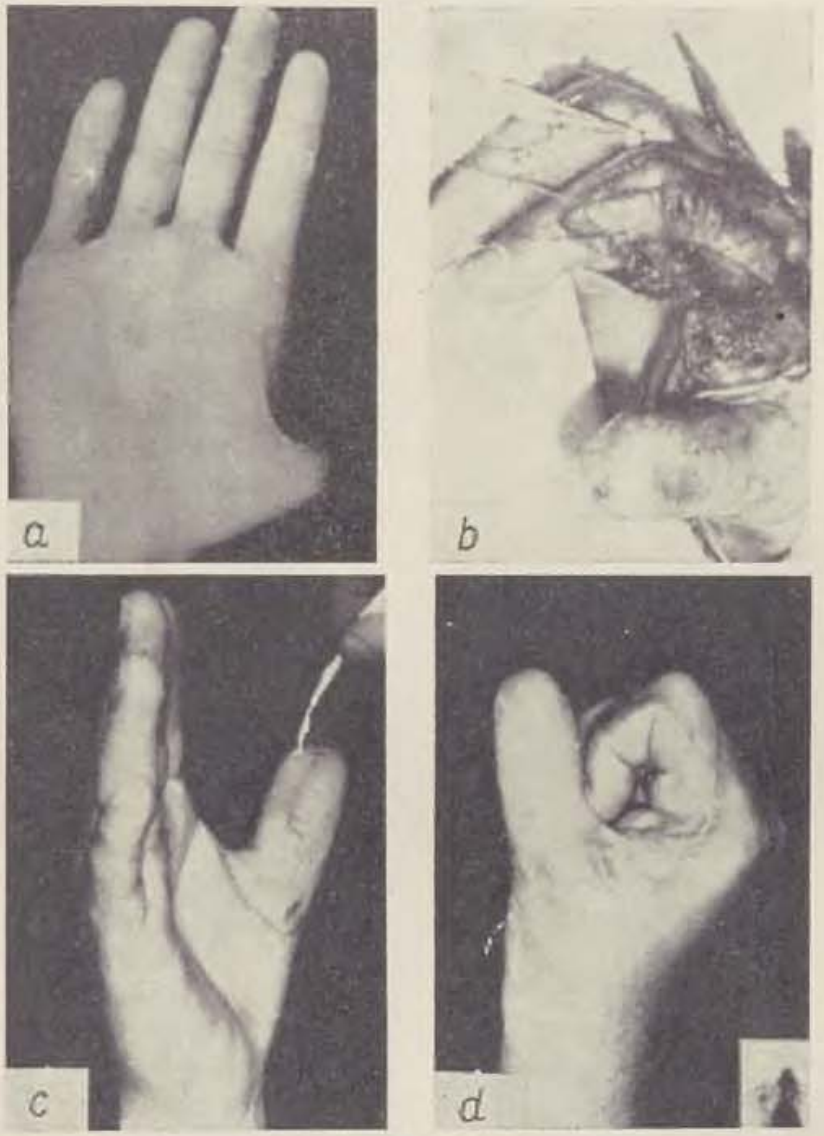

Fig. 3. Case B.D.T., aged 20 — condition after amputation of the right-hand thumb: a) photograph before the operation, b) stage of the island flap dissection and c), d) result. Ninhydrin printing test of the island flap within normal limits. Fully preserved stereognostic sensibility on the flap and volar surface of the donor digit.

First, the volar neurovascular nutritive pedicle is dissected. The digital skin is undermined just underneath the dermo-epidermal layer, until reaching the proper volar digital nerve. It is traced with great caution up to the point of emanating one or two dorsal branches. At this point, the most critical stage of the operation begins — the longitudinal division of the dorsal

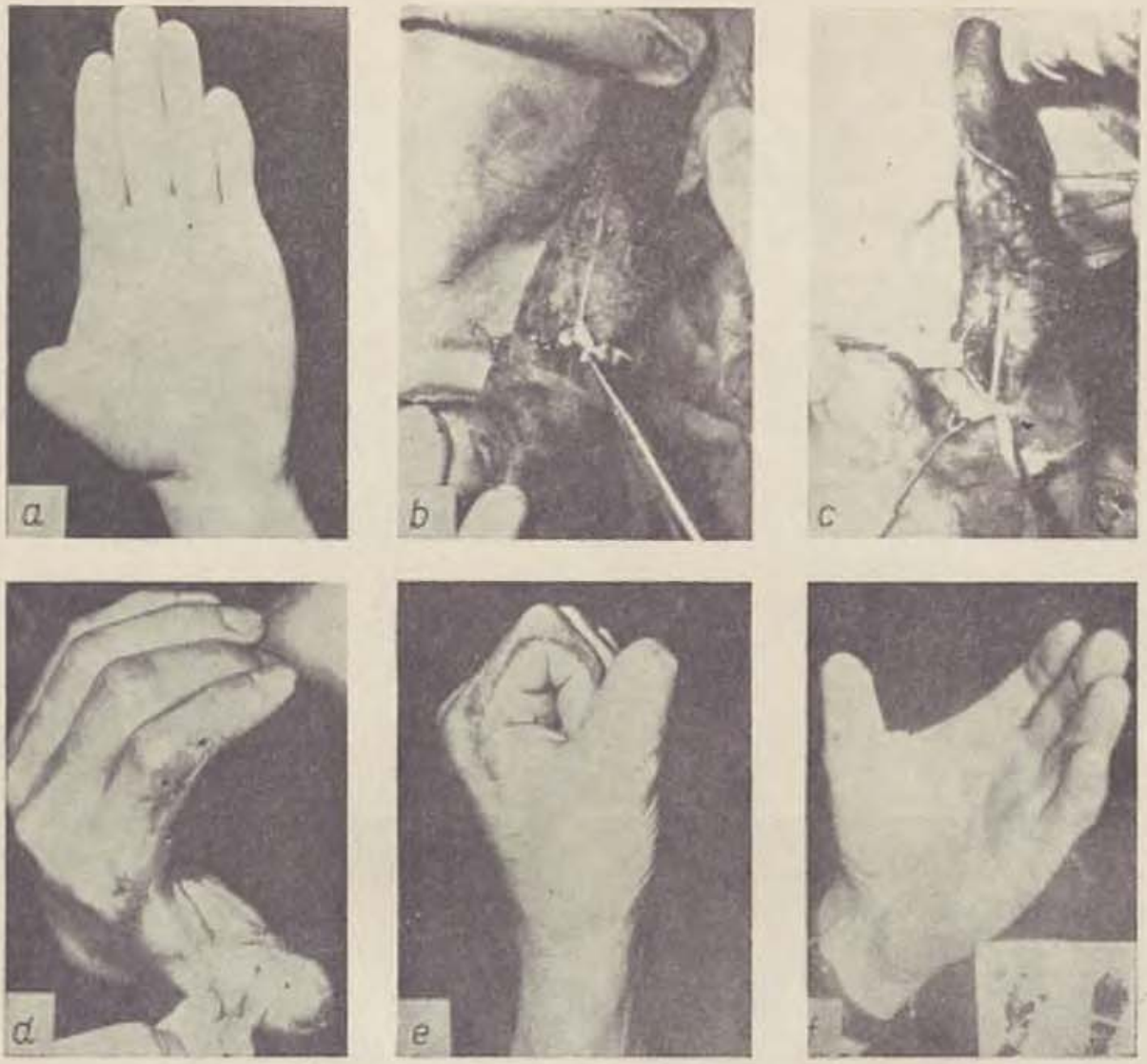

Fig. 4. Case F.I.F., aged 25 — a) condition prior to operation, b) and c) technical details of the operation. Division of the dorsal branch of the volar digital nerve from the common trunk, d), e), f) result — two point discrimination, although the sensation is referred to the donor surface. The ninhydrin printing test reveals conserved sudomotor function of the island flap skin and along the volar surface of the donor finger.

branches from the common trunk up to the level of the distal digital crease. The assistent handels the basic trunk and corresponding branch very gently, employing glove bands, and pulls them slightly on both sides. The operator performs gradual longitudinal sectioning of the perineurium with a fine scalpel. After completing the dissection, the volar nerve is retracted ulnarwise. Then, the proper volar digital artery, lying behind the nerve is identified. It is ligated at the level of the distal IP joint. Thereby, the flap is gradually elevated together with the volar artery. Ligature of some of the volar skin branches of the digital artery is very seldom required. The dorsal branches, directed to the island flap are preserved.

Fig. 5. Case T.M.S., aged 43 — a) degloving injury of the thumb with avulsion of tendons and distal phalanx, b), c) the proper volar digital nerve is illustrated, as well as its dorsal branch, before and after their longitudinal division, d), e) result. The ninhydrin printing test of the flap and along the volar surface of the donor finger is normal.

To the end of mobilizing the volar radial artery of the index finger proximally up to the distal palmar crease, a backward retraction of the first lumbrical is necessary. Better mobilization of the artery is provided for by provisional sectioning of the tendinous portion of the same muscle. Whenever the digital artery arises from the superficial arterial arch (two of our cases), its separation proves to be easier. By including the volar radial artery of the index in the nutritive pedicle, the entire amount of blood flowing through it is shifted in the direction of the island flap.

Dissection of the dorsal nutritive pedicle is carried out by, first, undermining the skin on both sides of the incision, as in free graft prelevation. Next, we raise a band of subcutaneous tissue, together with the perimysium of the first dorsal interosseus. The vessels and nerves already mentioned are

included in this band. Some of the anastomotic branches to the volar artery, connecting the two nutritive pedicles are usually conserved.

A bed is formed, the size of the island flap, along the volar-ulnar surface and on the tip of the reconstructed after Nicoladoni thumb. In the first interdigital web, just underneath the dermal layer of the skin, a wide tunnel

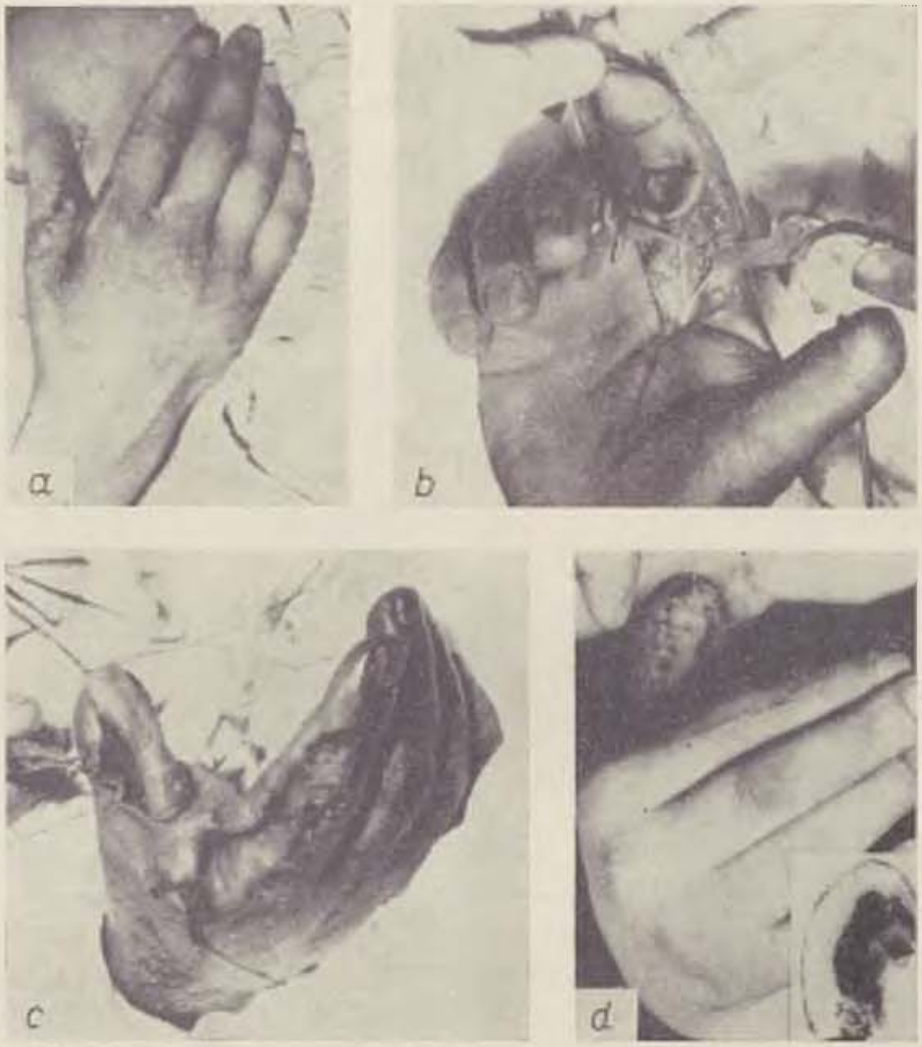

Fig. 6. Case V.S.V., aged 43. Degloving of the skin of the thumb with avulsion of part of the distal phalanx — a) emergency resurfacing of the defect by means of a tubed flap, b), c) operative session details — proper volar digital nerve, dorsal branch of the proper volar digital nerve and the transferred island flap, d) result — preserved stereognostic sensibility. Normal ninhydrin printing test of the island flap and of the volar surface of the donor digit.

is made. The flap is turned volarwards, passed through the tunnel and sutured over the recipient surface. The two neurovascular bundles remain lying within the subcutaneous tissue of the first interdigital web. The donor surface is covered with a free graft (three fourths thickness). The index is immobilized in a splint and the thumb is dressed with a soft bandage. After the 12th day, the stitches are removed and functional treatment is initiated aiming prompt mobilization of the index finger.

After severalfold practice on cadaver, we transferred, for the first time in 1966, an island flap from the dorsoradial surface of the index on a double (volar and dorsal) nutritive pedicle. Our up-to-date experience comprises seven cases, distributed in the following manner:

a) reconstruction of the thumb after the method of Nicoladoni — 4 operations (3 patients). One of the patients in this group was with bilateral amputation. In three instances, the transfer of sensation was the final, independent stage of repair (Figs. 2 and 3). In one case, the island flap preceded the bone plasty (Fig. 4). The latter policy did not prove very feasible, since, due to the lack of bony-frame support, the island flap was partially rectracted and the thumb resulting somewhat shorter.

b) after degloving injury of the thumb with subsequent emergency resurfacing with a tubed flap — 2 cases (Figs. 5 and 6). In one of them (Case 5), simultaneously with the transfer of the island flap, we performed bone plasty aiming the elongation of the thumb.

c) in anesthetic thumb resulting from avulsion of both digital nerves and skin loss along the volar surface — 1 case (Fig. 7).

Intraoperative accidents such as injury of some of the nerves or vessels included, did not occur in our series. The postoperative course was uneventful. As early as in the first postoperative hours, the transposed skin regained normal coloration with no signs for ischemia or venous stasis whatsoever. The patient felt the touch along the surface of the flap and distinguished two points, distant several millimeters from each other, although he referred the sensation to the donor site. The sensitivity along the prehensile surface

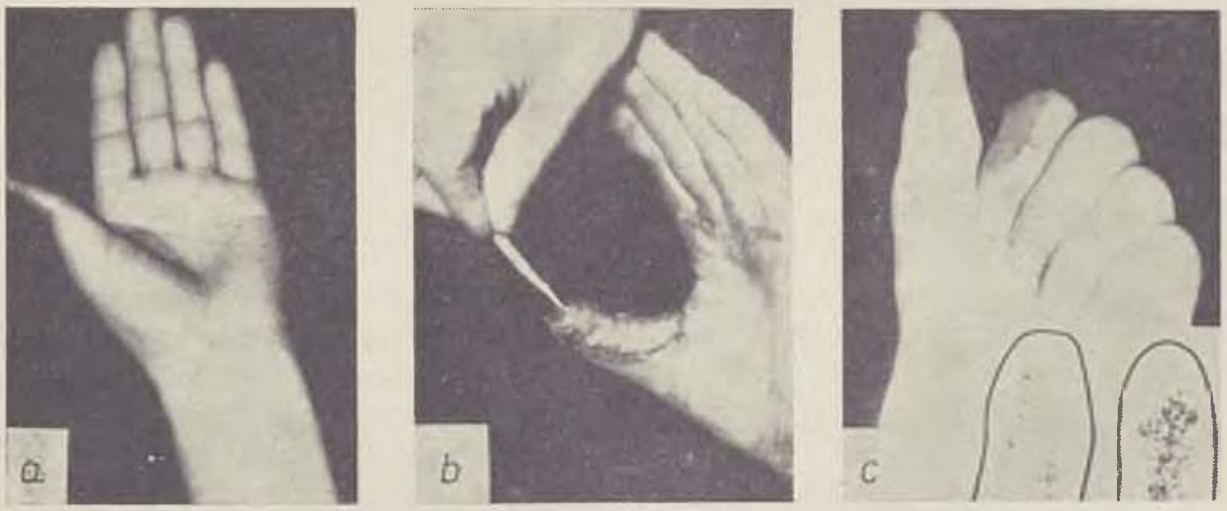

Fig. 7. Case I.P.S., aged 45. Heavy traumatic injury of the thumb of the left hand with large skin loss. Avulsion of both proper digital nerves. Fracture of the IP joint: a) condition before the operation, b), c) result — fully preserved sensibility of the island flap skin. Normal ninhydrin printing test of the island flap and donor finger skin.

of the donor finger was fully preserved. The ninhydrin test performed between the 12th and 30th day after the operation proved the conservation of perspiration, equally over the surface of the flap and along the prehensile surface of the donor finger. The free grafts on the donor surface were successful with no exception. Within 45 days from the operation, the movements in the IP joint of the index finger were fully regained.

DISCUSSION

Our experience accumulated to date, although limited, warrants the assumption that the island flap from the dorso-radial surface of the index finger on double (volar and dorsal) nutritive pedicle has certain advantages. It enables the resurfacing of the entire prehensile surface of the thumb from the tip to base, without hazards for disturbing the palmar skin innervation of the donor digit.

A further advantage of the bipedicled island flap is its excellent blood supply. It has two sources of arterial blood supply — a volar and dorsal one — with some anastomotic branches between each other. If one of these sources were blocked at the base of the finger, due to bending, trauma or other cause, the blood flow would not be interrupted thanks to the anastomotic network existent. Normally, the blood flows from the arteries with greater caliber towards those with smaller caliber, i. e. from volar to dorsalwards. Anyway, whenever the pressure in the larger arteries falls, the blood stream reverses its flow. The latter fact was proved in investigations carried out by Peacock, Paneva and others.

A much more adequate venous return from the island flap is secured by way of the dorsal veins included in the nutritive pedicle, as shown by our experience had heretofore.

In our series we did not come across sensory disorders in the island flap, as reported by Murray and associates .This might be explained with the rather substantial size of the skin island, with the preservation of both innervation sources of the donor area (the dorsal branches of the volar digital nerve and the respective branch of n. radialis), with the anastomoses between them as well as with the very good circulation of the flap.

In the initial stages of application of the method we were rather worried by the uncertainty whether or not such an extensive operative intervention (skin dissection, exposure of the neurovascular bundle, removal of one volar artery) on the second important finger was justified. Isn't there a hazard for rigidity of the proximal IP joint or other complications? Although the results hitherto obtained are encouraging, further observations are definitely required.

SUMMARY

A new procedure is described for the transfer of sensibility to the thumb by means of an island flap. The dorso-radial surface of the index finger is the donor site. The flap is supplied by two neurovascular pedicles — a volar

one (including the corresponding artery of the index together with its dorsal branches and the dorsal ones of the volar digital nerve, which are divided from the common trunk in a longitudinal fashion) and a dorsal one (including the dorsoradial artery and nerve of the index and one or two superficial veins).

Up to date, this procedure was applied to seven cases. The results obtained proved to be very good. The advantages of the method according to the authors are the following:

a) provides for coverage of the prehensile surface of the thumb with skin having normal sensibility;

b) good arterial flow to the flap and venous return;

c) the innervation and volar skin coverage of the donor finger is preserved intact.

RÉSUMÉ

Le lambeau en îlot à deux pédincules

J. Holevitch, E. Paneva-Holevitch

Les auteurs ont décrit une nouvelle méthode opératoire du transfer de la sensibilité a l'aide du lambeau en îlot. La place donatrice est celle de paroi dorsoradiale d'indice. Le lambeau est nourrit par deux pédincules neuro-vaiseuses, dont une de la face volaire comportant a. radialis volaris digiti II propria avec ces branches dorsales et la branche volaire du nervus radialis volaris digiti II, qu'on partage longitudinalement du fascicle commun et d'une dorsale comportant a. radialis dorsalis, n. radialis dorsalis digiti II et une ou deux veines superficiales.

Jusqu'alors les auteurs ont ainsi opéré sept malades. Les résultats ont été très favorables. La méthode présente de suivants avantages:

a) elle donne la possibilité de couvrir la paroi de prise du poucet par la peau à la sensibilité normale

b) elle facilite le courant du sang artériel dê meme que le retour du sang veineux

c) les nerfs et la peau de la face volaire d'indice restent entièrement intacte.

ZUSAMMENFASSUNG

Inselartiger Lappen mit zwei Stielen

J. Cholevitsch, E. Paneva-Cholevitsch

Die Autoren berichteten über ein neues Operationsverfahren bei der Übertragung der Empfindlichkeit auf den Daumen unter Anwendung eines inselartigen Lappens. Als Spender dient die dorsoradiale Fläche des Zeigefingers. Versorgt wird der Lappen von zwei Nervengefässstielen, einem volaren (umfassend a. radialis volaris digiti II. propria mit dorsalen Zweigen und die volaren Zweige des n. radialis volaris digiti II., die aus dem gemeinsamen Bündel longitudinal abgetrennt werden) und einem dorsalen (enthaltend a. radialis dorsalis, n. radialis dorsalis für den Zeigefinger und eine oder zwei oberflächliche Adern).

Bis zu der gegenwärtigen Zeit operierten wir auf diese Weise sieben Kranke. Die Ergebnisse waren sehr gut. Die Methode hat folgende Vorteile:

a) ermöglicht die Deckung der Greifseite des Daumens mit Haut mit normaler Empfindlichkeit,

b) gute arterielle Zufuhr und guter venoser Blutabfluss,

c) die Innervation und das Hautgewebe auf der Volarseite des Zeigefingers sind vollständing unversehrt.

RESUMEN

Lóbulo de islote con dos pecíolos

J. Holevich, E. Paneva-Holevich

Descrivimos un nuevo procedimiento de operacion del traslado de la sensibilidad al pulgar con la aplicación del lóbulo de islote. El donante es la superficie dorsoradial del índice. El lóbulo es abastecido con dos pecíolos nervioso-vasculares, uno palmar (el que contiene a. radialis volaris digiti II. propia con los ramos dorsales y los ramos palmares n. radialis volaris digiti II., los que apartamos longitudinalmente del atado común) y uno dorsal (el que contiene a. radialis dorsalis, n. radialis dorsalis para el índice y una o dos venas de superficie).

Hasta nuestro tiempo operamos de este modo siete pacientes. Los resultados fueron muy buenos. El método tiene estas ventajas:

a) hace posible cubrir la parte para tomar del pulgar por la piel con la sensibilidad normal,

b) bueno conducto de arteria y la salida de vena de la sangre,

c) el abastecimiento con los nervios y el tejido de la piel en la parte palmar del índice son completamente intactos.

REFERENCES

1. **Adamson, I. E., Ch. Horton and H. Crawford:** Sensory rehabilitation of the injured thumb. Plast. reconstr. Surg., 40 : 53, 1967.
2. **Bralliar, F. and R. Horner:** Sensory cross-finger pedicle graft. J. Bone Jt Surg., 51-A: 1264, 1969.
3. **Gaul, J. S.:** Radial-innervated cross-finger flap from index to provide sensory pulp to injured thumb. J. Bone Jt Surg., 51-A: 1257, 1969.
4. **Hueston, J.:** The extended neurovascular island flap. Brit. J. plast. Surg., 18 : 305, 1965.
5. **Holevich, J.:** Island flaps with neurovascular pedicle including the dorsal branch of the volar digital nerve. Ortop. Traum., 3 : 119, 1966 (Sofia).
6. **Holevich, J.:** Use of skin flap from the dorsal aspect of index finger for restoration of the sensitivity of the thumb. Acta Chir. plast., 6 : 1—8, 1964.
7. **Kovanov, V. and A. Travin:** Surgical anatomy of the upper limb. „Medicina" Publ., Moscow, 1965.
8. **Murray, J. F., J. Ord and G. Gavelin:** The neurovascular island pedicle flap. J. Bone Jt Surg., 49-A: 1285, 1967.
9. **Peacock, E.:** Reconstruction of the hand by the local transfer of composite tissue island flaps. Plast. reconstr. Surg., 25 : 298, 1960.
10. **Paneva-Holevich, E.:** Possibilities for conservation of fingers in injuries severely impairing the blood supply of the hand. Ind. J. Surg., 30 : 438, 1968.
11. **Wilson, J. W.:** Restoration of sensation to the thumb by neurovascular island pedicle skin graft. J. Bone Jt Surg., 46-A: 216, 1964.

Prof. J. Holevich, 8 Belo-more Street, Sofia, Bulgaria

Otto Korvin's Hospital and Policlinic, Budapest (Hungary)

LACERATED WOUNDS OF FINGERS CAUSED BY RINGS

A. MAJOR

When jumping off a lorry, a passenger may catch a prominent egde of the car with the ring on one of his fingers which thus gets torn out of his hand. This is a typical mode of injury.

In less serious cases, the ring causes a partial or circular tear in the skin of the proximal phalanx. Unfortunately, the typical injury occurs more often. Here the skin is pulled off the finger like a glove and the terminal phalanx is torn off at the level of the distal interphalangeal joint; the tendons and bones of the proximal and middle phalanges remain intact.

It is striking that this type of injury has been reported on in the Hungarian literature relatively more often than elsewhere (which is perhaps due to the construction of lorries used in Hungary).

In 1953, Racz described 18 such patients who were admitted to hospital within a period of six months, and Sarkany, already in 1951, reported on three cases in which the finger had to be amputated.

Racz treated these injuries by plastic methods. According to his opinion, the Italian, i. e., the muff plasty with the injured finger being inserted under the skin of the abdomen, proved most satisfactory. However, in some of these cases, amputation had to be carried out subsequently. The function of the hand, too, was impaired. As a prevention of such accidents, he recommended to forbid soldiers wearing rings.

In the period between 1953 and 1958, there was also a relative increase in the number of such cases admitted to the Korvin's Hospital, Budapest; within six years 12 patients, and among these one woman.

The first cases were also treated by the Italian method, but the results were poor, and in fivé cases, the finger had ultimately to be amputated. Somewhat better results were achieved by muff plasties with which, in two out of four cases, it was possible to save the finger, though from a functional and cosmetic point of view, the results were far from ideal.

The results, both functional and cosmetic, were much better in the last three patients.

The method employed consisted in the following: From the skin on the contralateral side of the abdomen, a pedicle flap was formed, corresponding

in length and circumference to the carefully measured dimensions of the skeleton-plus-tendon stump of the finger.

The author believes that the procedure was so efficacious because the skin of the flap was almost completely stripped off its fat; only small pieces of subcutaneous fat were left in place. In the first case, this excision was carried out, because the failures in the preceding cases were ascribed to the flap having been too thick and too rigid, and because the skin covering the finger stump had remained insensitive. The risk of impeding the blood supply of the flap by excising its subcutaneous fat was taken because otherwise failure proved inevitable.

Fig. 1.

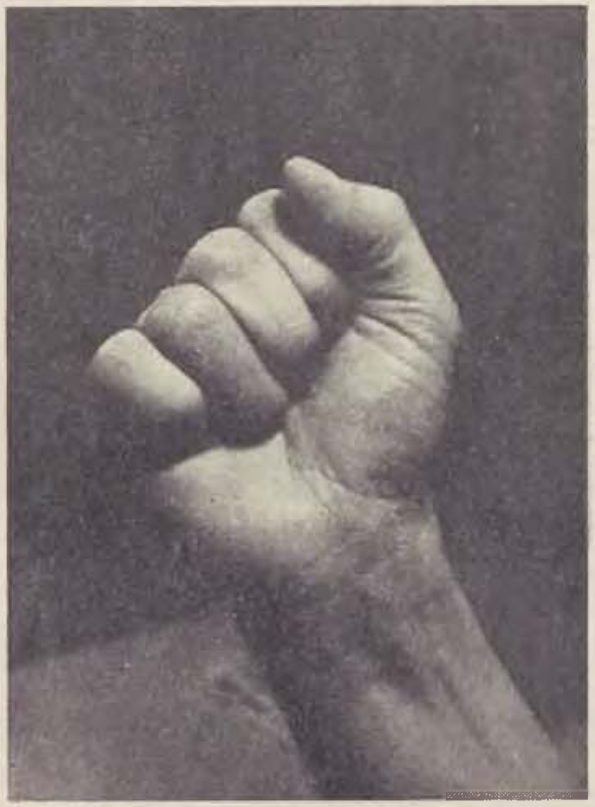

Fig. 2.

The results were striking. The viability of the flap was not affected by the removal of subcutaneous fat, and three weeks after the operation, when the flap was separated from its donor site, it properly covered the tip of the finger stump.

The skeleton-plus-tendon stump was placed in the flap so that the longitudinal suture did not lie on its volar but on its ulnar side. Coverage of the donor site was effected without difficulty with the help of four auxilliary incisions. In the following period, the tip of the finger stump had not to be adjusted by a corrective operation.

The good results in the last cases are ascribed to the employment of a fat-free flap. This method, as is shown in the above instances, does not

impair viability of the flap and gives the stump an elastic skin cover. Degeneration of the subcutaneous fat, that is, being replaced by rigid scar tissue, lowers the quality of the covering skin and inhibits sensitivity, movements and the formation of skin folds, thus poorly serving its function. This certainly applies to a condition when the recipient site was already covered by a rather thin layer of fat prior to injury.

Here is the short history of A. K., a man aged 26. He jumped from a lorry, a ring on his ring finger was caught in a prominent part of the car, and the finger was torn off. On admission, the skin of the finger was almost completely missing from the middle of the proximal phalanx distally, and the terminal phalanx had been torn out of the distal interphalangeal joint.

An approximately 1 mm. broad band was excised from the remaining skin at the wound edge (for the purpose of wound toilet), and the finger stump covered in the way described above. After wound healing, the patient received physiotherapy for several weeks.

The present condition can be seen from the enclosed photographs.

Sensitivity and mobility of the finger are perfect. The patient himself considers the finger to be "the same as all others, only its nail has never grown again".

SUMMARY

A method of covering a skinned finger using a pedicle flap has been described and explained. The efficacy of this method is ascribed to the excision of subcutaneous fat from the flap. In cases in which the flap had been employed without this preparation, the results were poor. Based on the favourable results — and contrary to the unbending opinion maintained hitherto — it has been recommended to remove most of the frequently interfering subcutaneous fat, which does impair the viability of a pedicle flap even if used at other sites.

RÉSUMÉ

Les plaies lacérées des doigts causées par les anneaux

A. Major

Dans l'article l'auteur décrit et explique la méthode de la couverture des doigts don la peau a été arrachée au cours de l'accident, à l'aide du lambeau pédiculé dont le tissu sous-cutané de graisse fut enlevé. Les bons résultats obtenus à l'aide de cette méthode sont, parait-il, favorisé par l'enlevement de cette couche de graisse. Les résultats obtenus avec le lambeau pédiculé sans enlèvement du tissu de graisse étaient bien mauvais. Visant sur ces beaux résultats obtenus par cette méthode l'auteur contrairement à l'avis jusqu'alors défendu par tous récommende d'enlever la plupart de la couche de graisse laquelle tant que tant est d'obstacle. Ce procédé ne fait pas abbaisser le vitalité du lambeau pédiculé même quand il est employé pour couvrir un autre lieu qu'en est le doigt.

ZUSAMMENFASSUNG

Risswunden der Finger, verursacht durch Fingerringe

A. Major

Im Artikel beschreibt und erläutert der Autor eine Methode zur Deckung von Fingern, von denen beim Unfall die Haut abgerissen worden ist, mittels eines Stiellappens mit entferntem Unterhautfettgewebe. Die guten Ergebnisse dieser Methode werden allein der Exzision dieses Gewebes zugeschrieben. Die Ergebnisse mit der Anwendug eines Lappens in voller Schichtdicke bei derartigen Verletzungen waren nämlich schlecht Unter Hinweis auf die guten Ergebnisse, die mit der beschriebenen Methode erzielt wurden, empfiehlt der Autor — im Gegensatz zu der bisher unerschütterlich vertretenen Meinung — den vorwiegenden Teil des Unterhautfettgewebes, das ohnehin meistens behindernd wirkt, zu entfernen, womit die Vitalität des Stiellappens keineswegs beeintrachtigt wird, auch wenn er zur Deckung einer anderen Stelle als des Fingers benutzt wird.

RESUMEN

Heridas de rasgón de los dedos ocasionadas por un anillo

A. Major

En el artículo se describió y explicó el métodó de la cobertura de los dedos de los que fue la piel quitada en el accidente, por el lóbulo de pecíolo, de lo que fue apartado el tejido adiposo subcutáneo. Los buenos resultados con este método se imputan al recorte mismo de este tejido. Es decir que los resultados con el empleo del lóbulo del espesor llene en las heridas análogas fueron malos. Al indicar a los buenos resultados ganados con el método descrito el autor recomienda — en el contraste al punto de vista hasta hoy intransigentemente tomado — que la mayor parte del gordo subcutáneo, la que de todos modos las más veces imposibilita, se elimine, lo que no origina la disminución de la vitalidad del lóbulo de pecíolo aun cuando se emplea para la cobertura otro lugar que el dedo.

A. Major, Gorky Fasor 9—11, Budapest VII. Kir., Hungary

TYPOGRAPHICAL CORRECTION

By mistake the master plates of figures 1 c) and 1 d) on page 103 (12, 2, 1970) were exchanged.

CONTENTS