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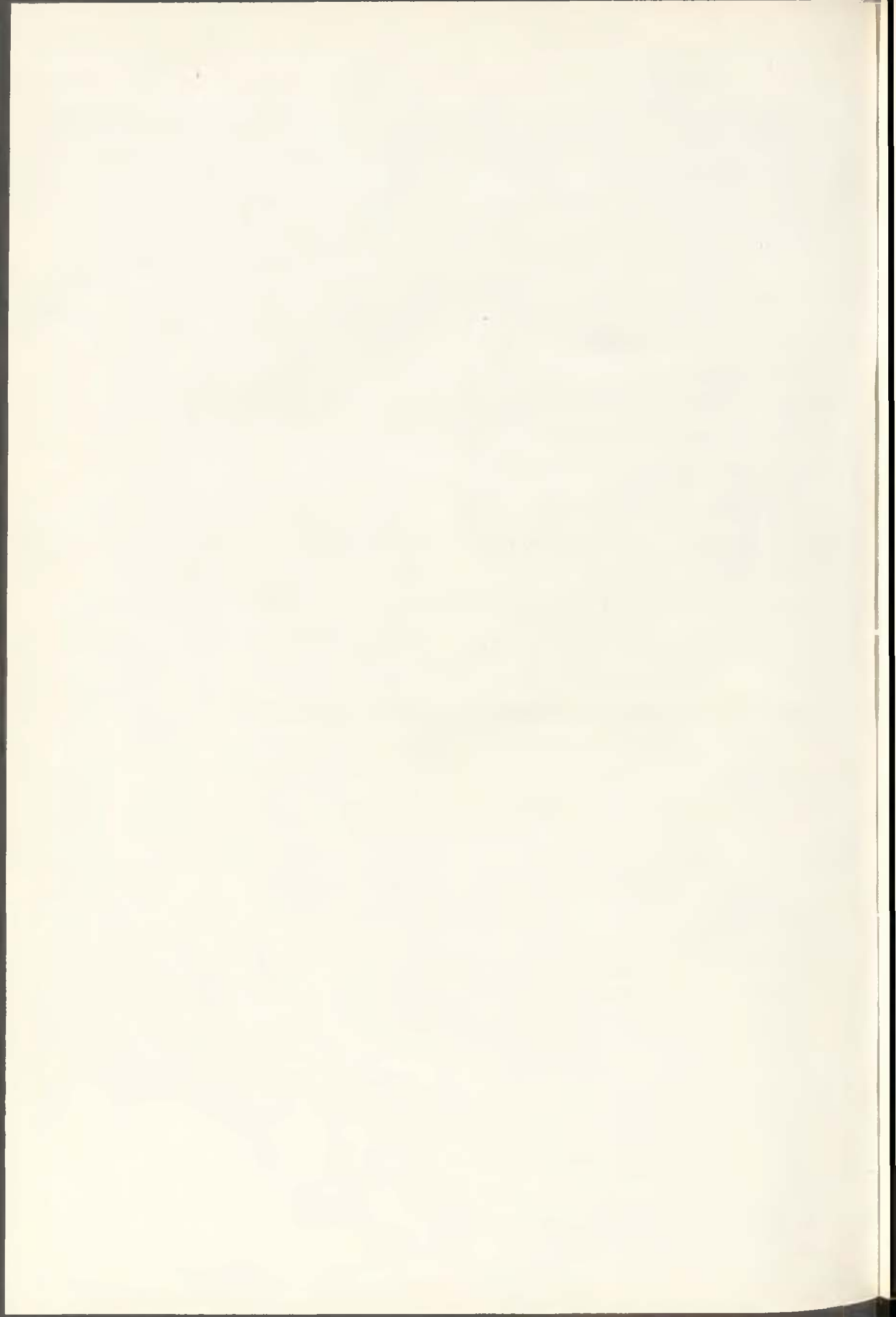
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FRANTIŠEK BURIAN, M. D.

* 17. IX. 1881

† 15. X. 1965

We regret to announce, that Prof. František Burian, M.D., Professor of Plastic Surgery, Charles University, Prague, member of the Czechoslovak Academy of Sciences and many other scientific associations, died after a short illness on October 15th, 1965 at the age of eighty four.

Professor Burian was one of the world outstanding personalities in plastic surgery.

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RECONSTRUCTION OF THE AURICLE IN LARGE DEFECTS AFTER MECHANICAL INJURY

N. I. YARCHUK

Reconstruction of a totally lost auricle is a complicated task for a surgeon specialized in general surgery.

It requires the formation of a thin and elastic auricle occupying the corresponding position on the head and having approximately the same peculiar relief on its lateral aspect as that of the contralateral, healthy side. The auricle consists of thin cartilage covered with skin firmly adherent to it. This is why in a total loss of an auricle a method must be found for reconstructing the skeleton as well its skin cover.

From 1956, we have started to develop a new method, the so-called three-stage reconstruction of totally lost auricles at our Clinic (Yarchuk 1962). It consists of the formation of the auricle from the soft tissues of the retroauricular region on the side of the defect, the injection of minced cartilage into these tissues by means of a revolving syringe, and free skin transplantation. The main feature of this method is the direct injection of minced cartilage into the tissue from which the auricle is going to be reconstructed. The intimate fusion between the cartilage graft and the tissue surrounding it, thus obtained, makes it possible to reconstruct a thin and elastic auricle. This feature brings our method into sharp contrast with the reconstruction of the auricle skeleton as recommended by Peer (1943).

Our new method was based on the clinical employment of minced cartilage as material for support and modelling of the facial relief, injected into the tissues by means of a revolving syringe without first having to separate them into individual layers (Limberg 1957 and 1962).

The first stage of auricle reconstruction consists in the creation of its skeleton from minced cartilage. This is injected with a revolving syringe under the skin of the retroauricular region on the side, where the ear is missing, forming the relief of the future auricle according to the shape of the healthy one on the other side (Fig. 1). We, as a rule, use homogenous cartilage,



Fig. 1.

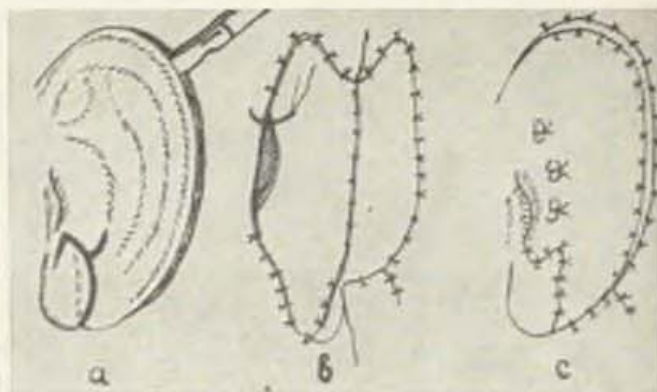


Fig. 2.

Fig. 1. Diagram of the first stage of auricle reconstruction: Area of minced cartilage injected under the skin of retroauricular region through a needle attached to revolving syringe. — Fig. 2. Diagram of the second stage of auricle reconstruction: a) incision along the circumference and mobilizing of flap; b) covering of wound surface on auricle and skull by full-thickness free skin grafts; c) view of newly formed auricle sutured to remnants of original ear.

preserved by quick freezing. If homogenous cartilage is used, this stage becomes so simple, that it can even be carried out in outpatients.

The second stage is the formation of the auricle proper. This is usually performed about four to six months after the first stage. During this period, the connective tissue proliferating around the cartilage graft has bound the small pieces of cartilage together, forming a continuous and firm block which is quite capable of maintaining the reconstructed auricle in the required position. The auricle is reconstructed from the skin and subcutaneous tissue of the retroauricular region plus the minced cartilage graft implanted between

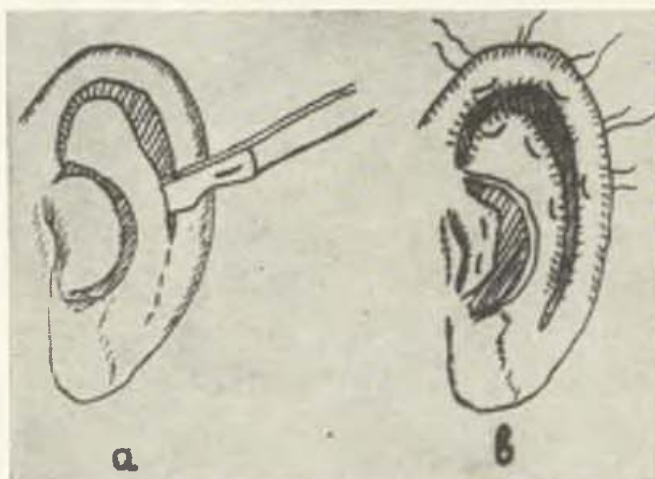


Fig. 3.

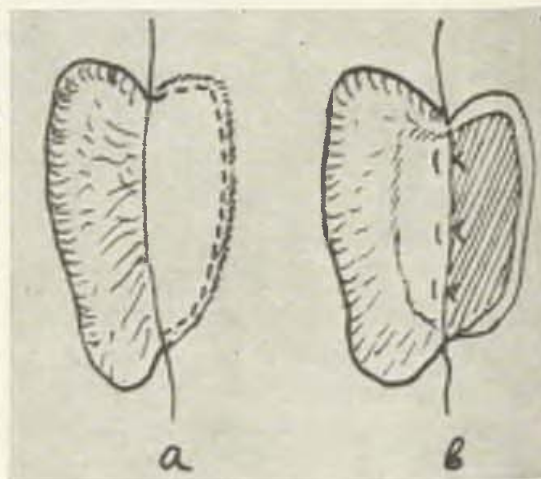


Fig. 4.

Fig. 3. Diagram of the third stage of auricle reconstruction: Creation of the relief on its lateral aspect (a, b). — Fig. 4. Diagram of operation for increasing auriculo-cranial angle of reconstructed auricle, sometimes carried out in the third stage.



Fig. 5.



Fig. 6.

Fig. 5. Complete loss of left auricle after injury. — Fig. 6. The same after completion of second stage of auricle reconstruction.

these layers. The skin incision is made around the outer contour of the cartilage implant and a flap of the required size and shape is mobilized on the fascia without exposing bone (Fig. 2). The dorso-medial aspect of this flap and the donor site are covered each with a full-thickness free skin graft, taken from the inner aspect of the arm. The edges of the two skin grafts, contacting each other in the retroauricular groove, are sutured with catgut stitches. The ends of these stitches are brought out through the retroauricular groove to just behind the external auditory meatus and tied there over small gauze swabs. This permits stretching the skin grafts over the raw surfaces and the obtaining of a retroauricular groove of sufficient depth. The remnants of the original auricle are sutured to the newly formed auricle in the proper position, employing various methods of local plasty. This gives a fully reconstructed auricle, but without the natural relief on its lateral aspect.

The third stage is that of the creation of the relief on the lateral aspect of the reconstructed auricle. This operation is performed about six to eight



Fig. 7.



Fig. 8.

Fig. 7. The same after completion of third stage of auricle reconstruction. — Fig. 8. View of auricles from behind.



Fig. 9.



Fig. 10.

Fig. 9. Loss of lower two thirds of left auricle after injury. — Fig. 10. The same after completion of second stage of auricle reconstruction.

months after the second stage, i.e. when the reconstructed auricle has already acquired its final size and shape. The task of this stage is to deepen the groove between the helix and the anthelix and create a shell-shaped depression around the aperture of the external auditory meatus. Apart from this, if the reconstructed auricle does not stand out from the head at the same angle as the healthy auricle, this can also be repaired at this stage.

Fig. 3 shows a diagram of the way the relief on the lateral aspect of the auricle is formed. An incision is made through the skin along the inner edge of the helix. In the direction of this incision a strip of the implanted cartilage, exposed by it, is excised so as to form a deep furrow. The skin edges are then sutured with deep catgut mattress stitches. In order to form the depression around the external auditory meatus, a curved incision is made running along the border of the future depression, the skin is mobilized as far as the meatus and under it the surplus minced cartilage plus connective tissue is excised. Then the flap of mobilized skin is replaced to the floor of the wound and three fixed with a few catgut stitches (Fig. 3a and b). The skin defects thus created (hatched area in Fig. 3) are covered with thin free skin grafts stuck to Stent inlays.

For making the aurico-cranial angle bigger, the free skin graft in the donor site of the retroauricular region is used once more by mobilizing it up to the retroauricular groove. Now the auricle is raised to a position corresponding with that of the contralateral ear and the mobilized skin graft shifted onto the wound surface on the posterior aspect of the auricle which develops from enlarging the aurico-cranial angle. The mobilized skin graft is then fixed into the new retroauricular groove by a few catgut stitches and the wound surface in the retroauricular region, exposed by the shifting of the original skin graft onto the auricle, is covered by a new free skin graft (Fig. 4a and b).

Both modelling the auricle and forming its relief, exposes the minced cartilage graft, and the full-thickness free skin grafts must often be layed

onto the wound surface densely covered with this tissue. However, we have never met with any complication in the take of the skin grafts under these circumstances.

We have used the described method in the reconstruction of auricular defects of various size and different origin.

We have operated on a total of 70 patients, 28 of whom had an auricular defect after mechanical injury, 12 after burns, and 30 suffered from congenital microtia.

Each of these groups required some special planning of the stages of reconstruction. This is why we consider it expedient to deal, in the following, with our experience in the reconstruction of auricles with large defects after mechanical injury only, such as avulsion, cutting off with a sharp instrument, biting off by man or animal. In our Clinic 28 such patients aged between 25 and 40 have been treated; 26 were men, 2 women.

After mechanical injury to the auricle, the surrounding tissues are usually little damaged by scars. The remnants of the auricle are, as a rule, of regular shape and can well be used for the reconstruction of the ear; the tragus and the external auditory meatus are nearly always preserved. This task of surgery is a little easier if compared with the reconstruction of an auricle damaged by burns or in congenital microtia.

In the following, the results of auricle reconstruction for large defects after mechanical injury are demonstrated in two patients.

Woman, aged 30: The left auricle was cut off with a sharp part of an agricultural machine in Aug., 1961. She was admitted to the Clinic in June, 1962. Fig. 5 shows the left auricle completely missing. Only the tragus and a small part of the ear lobe were preserved. A three-stage reconstruction of the auricle was carried out. In the first stage 9 cm³ of homogenous minced cartilage was injected under the skin of the skull in the region of the missing



Fig. 11.



Fig. 12.

Fig. 11. The same after completion of third stage of auricle reconstruction. — Fig. 12. View of auricles from behind.

ear with a revolving syringe (Fig. 1). The second-stage operation was performed 9 months later (see diagram in Fig. 2). The result of the second stage can be seen in Fig. 6. After another 11 months the plasty was completed by the third stage; for diagram of operation see Fig. 3, the result is shown in Fig. 7 and 8.

Man, aged 33: One year prior to his admission to the Clinic, his left auricle was cut off by a sharp instrument. Fig. 9 shows the lower two thirds of the auricle missing. In a three-stage plasty the missing parts were reconstructed by the above method. The appearance of the auricle after the second stage is shown in Fig. 10. In the third stage, in order to bring the reconstructed auricle into symmetry with the contralateral ear, the auriculo-cranial angle had to be enlarged. For diagram of the latter operation see Fig. 4a and b. The result after completion of the plasty is shown in Fig. 11 and 12.

CONCLUSION

The three-stage reconstruction of an auricle, as described above, is not complicated and requires hospitalization of the patient under ordinary conditions for a period of 6 weeks to 2 months. The method permits formation of a thin and elastic ear at a site and in the position corresponding to those of the missing original auricle.

Modelling of the auricle relief by dissecting the skin on the lateral surface of the ear and excising parts of the cartilage graft followed by covering the new wound surface with free skin grafts, considerably improves the appearance of the ear. This stage of the plasty still requires further improvement and perfection of the technique.

SUMMARY

A method of auricle reconstruction in large defects completed in three stages, is described.

First stage consists in the creation of the skeleton of the auricle to be reconstructed. This is done by employing minced homogenous cartilage injected under the skin of the retroauricular region on the side of the damaged ear with a needle attached to a revolving syringe. The second stage represents the formation of the missing parts of the auricle from skin, subcutaneous tissue and the cartilage graft enclosed between these two tissues. The wound surfaces on the medial side of the newly formed auricle and the donor site on the skull are covered by free skin grafts. The third stage aims at modelling the relief on the lateral aspect of the auricle.

The interval between the individual stages is 6 to 8 months. Seventy patients have been operated on by the described method. The case histories and photographs of two patients with considerable defects in one auricle as a result of mechanical injury, are presented. In these patients reconstruction of the auricle was performed by the described method.

RÉSUMÉ

Le réconstruction du pavillon de l'oreille chez les pertes considérables en suite des accidents mécaniques

N. I. Yarchuk

L'auteur décrit sa manière de pratiquer les reconstructions de pavillon de l'oreille au cas de destruction considérable en trois sessions.

Première opération-mise en forme du futur pavillon de l'oreille par l'auto-cartilage homogéinisé, installé sous la peau de la région rétro-auriculaire à l'aide du seringue à pression. Deuxième opération-mise en forme de la partie perdue du pavillon par la peau, le tissu conjonctif sous-cutané et le cartilage interposé. La partie du derrières bien que la plaie de la tête résultant de cette séparation se couvre par le transplant libre de la peau. Troisième opération-mise en forme des contours externes du pavillon de l'oreille.

Les intervalles entre les opérations sont présentés par six à huit mois. La méthode citée ci-dessus fut employée dans soixantedix cas de la perte du pavillon de l'oreille. On présente les histoires de la maladie si bien que les photos des deux malades ayant subit des pertes considérables du pavillon de l'oreille en suites d'un accident mécanique; ces malades ont été opérés à l'aide de la méthode citée ci-dessus.

ZUSAMMENFASSUNG

Rekonstruktion der Ohrmuschel bei ausgedehnten Defekten nach mechanischen Traumen

N. I. Jartschuk

In der vorliegenden Arbeit wird eine Methode der Ohrmuschelrekonstruktion nach ausgedehnten traumatischen Defekten beschrieben, die in 3 Sitzungen ausgeführt wird.

Die erste Operation besteht in der Formierung des Skeletts der künftigen Ohrmuschel aus zermahlenem homogenem Knorpel, der vermittelt einer Revolverspritze und Injektionsnadel in der retroaurikulären Gegend auf der geschädigten Seite unter die Haut gebracht wird. Die zweite Operation besteht in der Formierung der fehlenden Ohrmuschelteile aus Haut, Unterhautzellgewebe und dem zwischen ihnen enthaltenen Knorpel. Die mediale Oberfläche der neugebildeten Ohrmuschelteile sowie die Hautwunde in der retroaurikulären Gegend werden durch freie Hautlappen gedeckt. Bei der dritten Operation werden die Konturen der Ohrmuschel auf der lateralen Seite gebildet.

Zwischen den einzelnen Operationen liegen je 6 bis 8 Monate. Unter Anwendung der beschriebenen Methode wurden 70 Personen operiert. Der Verfasser bringt die Krankengeschichte und Photographien von 2 Patienten mit beträchtlichen Ohrmuscheldefekten nach mechanischem Trauma, bei denen die Rekonstruktion der Ohrmuschel auf die beschriebene Weise durchgeführt wurde.

RESUMEN

La reconstrucción del pabellón de la oreja en grandes defectos, después de una lesión mecánica

N. I. Yarchuk

La primera etapa consiste en la creación del esqueleto de la aurícula para ser reconstruida. Esto se hace empleando cartílagos homogéneos desmenuzados, inyectados debajo de la piel de la región retroauricular, en la parte de la oreja dañada con una

aguja ligada a una jeringuilla removible. La segunda etapa representa la formación de las partes perdidas de la aurícula, de la piel, el tejido subcutáneo y el injerto cartilaginoso, incluido entre estos dos tejidos. La superficie herida, en la parte media de la nueva aurícula formada y el lugar cedido en el cráneo son cubiertos por los injertos fibres de piel. En la tercera fase, se pretende el modelaje del relieve en el aspecto lateral de la aurícula.

El intervalo entre las etapas individuales es de 6 a 8 meses. Setenta pacientes han sido operados por el método descrito. Se presenta el caso con historia clínica y con las fotografías de dos pacientes con un considerable defecto en la aurícula como resultado de una lesión mecánica. En estos pacientes la reconstrucción de la aurícula fue preformada por el método descrito.

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CHANGES IN BLOOD CLOTTING AND FIBRINOLYSIS IN BURNT DOGS AND THE EFFECT OF DEXTRAN

J. MAZÁK, J. VAŇÁSEK, F. MATĚJA

Increasing interest is being shown in study of the general pathological changes which accompany deep and extensive burns. As part of comprehensive research on haematological changes in burnt dogs, the authors determined blood clotting and fibrinolytic activity at different intervals in dogs burnt by a standard method. In the second part of the experiment, the combined effect of a single burn and the administration of dextran infusions in different phases of the ensuing disease was studied.

MATERIAL AND METHODS

The first experiment was carried out with a group of six burnt and six control dogs of different weights, breeds and sex, anaesthetized with Thio-pental in a single average dose of 25–40 mg./kg. body weight. The standard contact method of producing second and third degree burns of 25% of the body area, after first shaving the area in question, was described in detail in a previous paper.

The animals were examined in pairs (one burnt and one control dog) before burning and 1, 3 and 24 hours and 6 and 21 days after burning. Blood samples for testing blood clotting were collected from the limb veins into tubes of a non-wetting plastic material, without using a hypodermic syringe. The blood was treated immediately.

The following laboratory tests were used: the thrombocyte count, the capillary bleeding time, the prothrombin time, the thrombin time, the toluidine blue titration test, the heparin tolerance test, the protamine tolerance test and determination of fibrinolytic activity by the euglobulin fraction method. All clotting tests were carried out simultaneously in duplicate and the arithmetical mean was evaluated. The red blood picture was also studied during the experiment, including the haematocrit, the leucocyte count and the differential count.

Technical assistance: V. Michalcová, H. Prouzová, M. Klazarová

The thrombocyte count was determined by the direct method, using chelaton III. The normal values in human beings are 120—200 thousand/mm.³ and in dogs 170—600 thousand/mm.³.

Capillary bleeding time: A modification of Duke's test was used, by pricking the animal's washed paw by a standard technique. Normal values: 30—90 seconds.

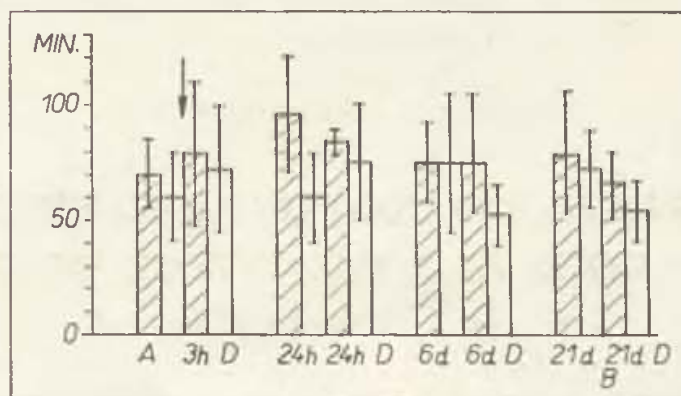


Fig. 1. Euglobulin fibrinolysis significantly lower in burnt dogs 1 and 24 hours and 21 days after burning. A — before burning, B — after burning, D — after dextran, □ — controls, ▨ — burns.

Prothrombin time: Quick's method. Normal values in man about 15 seconds, in dogs 8—12 seconds.

Thrombin time: The plasma clotting time was determined after adding thrombin solution in the same concentration (Topostasin, Hoffmann-La Roche). Normal values in man 15—20 seconds, in dogs 12—18 seconds.

Toluidine blue titration test: The thrombin clotting time was determined in 0.2 ml. plasma containing 0.1 ml. 0.1% toluidine blue solution. Normal values in man 12—20 seconds, in dogs 12—18 seconds.

Heparin tolerance test: Marbet and Winterstein's method, using Danish Heparin (Novo ind. A/S). Normal values in man 150—180 seconds, in dogs 60—165 seconds.

Protamine tolerance test: Beller and Steichel's method [9], using Protamine Roche (Hoffmann-La Roche). Normal values in man 150—180 seconds, in dogs 75—165 seconds.

Fibrinolytic activity: Pudlák's modification of the euglobulin fraction method; plasminogen is precipitated by 1% acetic acid together with the euglobulin fraction. The time needed for the euglobulin fraction to dissolve, after adding 0.1% borax buffer and mol/40 CaCl₂, was determined. Normal values in man 3—4 hours, in dogs 1—1½ hours.

In the second part of the experiment, with six other burnt dogs and six controls anaesthetized with Thiopental, the dogs were again examined in pairs, before burning and 3 and 24 hours and 6 and 21 days after burning. Immediately after burning, the experimental and the control dog each received an intravenous infusion of 6% Czechoslovak-produced dextran in a standard

dose of 20 ml./kg. body weight, administered simultaneously at approximately the same rate. The infusions were repeated in both the burnt and the control dogs after 24 hours and 6 and 21 days. Laboratory clotting tests and control tests of the red and white blood picture were always done just before and after the infusion. In addition to the clotting tests used in the first part of the experiment, the recalcification time, fibrinolysis (by means of fibrin-agar plates) and the thromboelastogram were determined.

The recalcification time was determined by the usual method, which gives clotting times of about 60 seconds in man and of 40—75 seconds in normal dogs.

Fibrinolysis on fibrin-agar plates: Astrup and Müllertz's method [9]. The following preparations were used: fibrinogen (Parenogen, Cutter, U.S.A.), thrombin (Topostasin, Hoffmann-La Roche) and streptokinase (Dornokinase, Burroughs Wellcome & Co.).

Thromboelastogram: Carried out on a Hellige apparatus by Harter's technique, using native blood collected directly from a vein into the cuvettes of the apparatus.

RESULTS

The results of the first part of the experiment were evaluated statistically by the t-test for paired series and the second part by an analysis of variance. Changes in the thrombocyte count, the capillary bleeding time, the prothrombin time, the thrombin time, the toluidine blue titration test and the heparin and protamine tolerance tests in the first part of the experiment were not statistically significant. The only exception was the euglobulin fraction method, which showed a significant decrease in the fibrinolytic activity of the plasma of burnt dogs, with maximum values 1 and 24 hours and 21 days after burning (Fig. 1).

In the second part of the experiment, the effect of repeated dextran infusions in the control dogs was compared with the effect of a single burn combined with repeated dextran infusions in the experimental animals. Changes in the thrombocyte count, the bleeding time, the prothrombin time, the heparin and protamine tolerance tests and the recalcification time were not statistically significant, either in relation to dextran infusions or to burning. The thrombin time was significantly prolonged three hours after burning combined with infusion ($p=0.01$). In the toluidine blue titration test, the clotting time was statistically significantly prolonged in burnt dogs ($P=0.05$) by dextran infusions after 24 hours and 6 and 21 days.

Euglobulin fibrinolysis was significantly inhibited only 24 hours after burning ($p=0.01$). Other variations in values during burn disease and in relation to dextran were not significant (Fig. 2). Plate fibrinolysis did not alter significantly after burns and infusions. Maximum amplitude and the elasticity index in the thromboelastogram showed a decrease in both burnt and control dogs 3 and 24 hours and 6 days after dextran infusions ($p=0.01$) and a less significant decrease after 21 days ($p=0.05$) (Fig. 3).

DISCUSSION

In the comprehensive study of haematological changes after burns, we were interested in the blood clotting findings for the following reasons:

1. In the early shock phase of burns, it can theoretically be assumed that the fluid-coagulation balance of the blood is disturbed, as in other types of shock. Up to now, little attention has been paid to these dynamic changes, largely because of technical difficulties in determining "functional" coagulation disturbances. Endogenic heparin, histamine, changes in fibrinolytic activity

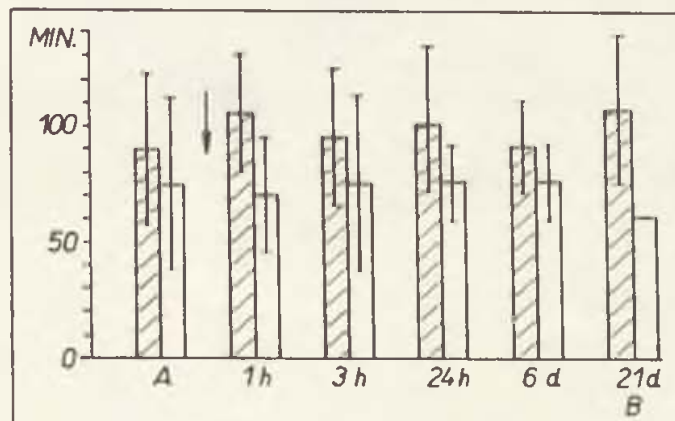


Fig. 2. Euglobulin fibrinolysis significantly lower in burnt dogs only after 24 hours. Changes in relation to dextran were not statistically significant either in the burnt or the control dogs. A — before burning, B — after burning, □ — controls, ▨ — burns, D — after dextran.

and other factors probably participate in the pathogenesis of these disturbances.

2. As shown by Pessereau et al. [12] and Sevitt and Gallagher [13], thromboembolic complications are not infrequent in the course of burns, particularly in the later phase. Small thromboses which develop in the area of the burns are also of practical significance [4]. It is technically very difficult to demonstrate a general hypercoagulative state, however, and even thromboelastography did not fulfil all that was expected of it.

3. Blood clotting in burns can be influenced by dextran infusions. Many authors in other countries have studied the haemocoagulant and haemostatic effect of different types of dextran. The authors' previous experiments with 6% Czechoslovak-produced dextran showed that the relatively most frequent effects were a decrease in the thrombocyte count, and increase in the capillary bleeding time and disturbance of the formation of blood thromboplastin. These changes were directly correlated to the dose of dextran and were especially pronounced in dogs with haemorrhagic diathesis induced by ionizing radiation. According to some authors, dextran also interferes in other aspects of the blood clotting reaction, although these changes are only small and are not of any great clinical significance.

Ad 1. Despite some variation in the laboratory findings, burns of the extent used in these experiments in dogs did not lead to significant blood clotting changes. The only exception was a decrease in euglobulin fibrinolysis. It is

not easy to compare these results with the studies of Pessereau et al. (12), Smidovich and Gerasimova (15), Hejda (10) and Šumbera et al. (17), all of which concern burns in human beings treated by different methods. These studies also lack a statistical evaluation.

Titration tests failed to demonstrate significant changes in endogenous heparin in any phase of burns. Histamine was not determined. Schreus (14),

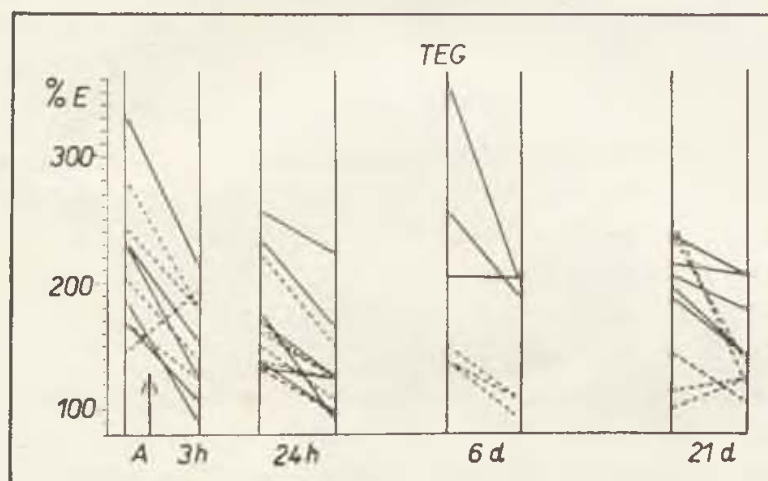


Fig. 3. The blood clot elasticity index (E) fell significantly in the burnt and control dogs after dextran. Dextran was administered repeatedly, at the given intervals. The short lines illustrate the general trend of the decrease in elasticity. A — before burning, — — — controls, ——— burns.

however, reported good therapeutic results with the use of histaminase in patients with burns with a haemorrhage syndrome.

Ad 2. A hypercoagulative state was not demonstrated by any of the given laboratory tests, including the heparin tolerance test, either in the phase of increased blood viscosity or in the later phase of burns. The thromboembolic complications observed by some authors in patients with burns are probably not due only to a hypercoagulative state, but have a more complex origin. The decrease in fibrinolytic activity observed in the present experiments may have some practical significance. The authors already drew attention in an earlier paper to the difficulties of the laboratory demonstration of a hypercoagulative state. No basic objections can be made to the anticoagulant therapy recommended for burns in man by Sevitt and Gallagher (13) and Berberian (4) and practised by German authors (2), because it is backed by experience. In the authors' opinion, however, the indications for this treatment in individual cases and in the concrete phase of burns required further detailed examination. Another question which has not yet been resolved is the choice of the most satisfactory anticoagulant — coumarin, heparin or fibrinolytic drugs.

Ad 3. The haemocoagulant and haemostatic effect of dextran in burnt dogs could not be predicted in detail. Theoretically, it could be manifested in changes in the fibrinogen level and other coagulation factors.

Dextran could help to counteract the danger of thromboembolic complications by lowering the viscosity of the blood. In other countries, dextran with low viscosity is used with increasing frequency in vascular X-ray diagnostics, in haemodialysis and in operations involving extracorporeal circulation, with the aim of preventing thromboembolic complications.

The present results indicate that dextran lowered the elasticity of blood clots in both the control and the experimental dogs. This is in agreement with findings by the Polish authors Uszynski et al. (19) in patients in a plastic surgery department.

SUMMARY

A series of blood clotting tests was carried out in a group of six dogs burnt by a standard technique and six control dogs, before and 1, 3 and 24 hours and 6 and 21 days after burning.

A statistically significant decrease in fibrinolytic activity was determined by the euglobulin fraction method, with maximum values 1 and 24 hours and 21 days after burning.

In another group of six burnt and six control dogs, the effect of a single burn and repeated infusions of Czechoslovak-produced 6% dextran was studied in an extended series of blood clotting tests. The tests were carried out at practically the same intervals as in the first part of the experiment and the dose of dextran was standardized in relation to the body weight of the experimental animals.

A significant decrease in euglobulin fibrinolysis was found only 24 hours after burning.

Dextran did not produce any significant changes, but differences between fibrinolytic activity in the burnt and control dogs were smaller than in the first part of the experiment (without dextran).

The thromboelastogram showed a decrease in the elasticity of blood clots after dextran in both the burnt and the control dogs.

The authors wish to thank Mr. H. Kuksin for assistance with the statistical evaluation.

RÉSUMÉ

Les altérations de la coagulation sanguine et de la fibrinolyse des chiens brûlé et l'influence de Dextran

J. Mazák, J. Vaňásek, F. Matěja

L'auteur présente une série des recherches touchants la coagulation sanguine pratiquées chez six chiens brûlés à moyen d'une technique standardisée. Les examens ont été faits avant la brûlure, et puis dans les intervalles d'une heure, de trois et de vingt-quatre heures et de vingt-et-un jours suivant la brûlure. Une groupe de six animaux (chiens également) tout sains servait de contrôle.

A l'aide de la méthode de la fraction euglobuline on a découvert une diminution significance quand à la statistique dans l'action fibrinolytique au valeurs maximum une heure, vingt quatre heures et vingt-et-un jours suivant la brûlure.

Dans une autre groupe, comportant également six chiens dans l'expérience et six dans le contrôle, on a fait les mêmes recherches touchants la coagulation sanguine

chez les animaux brûlés auxquels ont été administré les perfusions répétées de Dextran provenant de la fabrication tchèque.

Les épreuves ont été faites dans les intervalles équivalents à la première partie des recherches et les doses de Dextran ont été standardisées en relation avec la pesanteur des animaux.

Ce n'est que dans la période de vingt-quatre heures suivant la brûlure qu'on a découvert une diminution significative dans la fibrinolyse euglobuline. Dextran n'a causé aucune change significative, mais pourtant les différences de l'activité fibrinolytique des chiens brûlés en relation respective avec ceux restés indemnes ont été moins exprimées que dans la première partie des recherches (sans emploi de Dextran). Pourtant, le thromboelastogram a montré une diminution de l'élasticité du caillot sanguin en suites des perfusions de Dextran dans les deux groupes des recherches dernières — chiens brûlés et ceux restés indemnes.

ZUSAMMENFASSUNG

Veränderungen der Blutgerinnung und der Fibrinolyse bei Hunden mit Verbrennungen; der Einfluss von Dextran

J. Mazák, J. Vaňásek, F. Matěja

Bei der Versuchsgruppe von 6 Hunden mit standardisierten Verbrennungen und bei 6 Kontrolltieren wurden serienweise Untersuchungen der Blutgerinnungsverhältnisse vor der Verbrennung und 1, 3 und 24 Stunden sowie 6 und 21 Tage nach der Verbrennung durchgeführt.

Statistisch signifikant war das Absinken der fibrinolytischen Aktivität, die mittels der Methode der Euglobulinfraktion ermittelt wurde, wobei das Maximum 1 Stunde, 24 Stunden und 21 Tage nach der Verbrennung auftrat.

In einer weiteren Gruppe von 6 Versuchstieren und 6 Kontrolltieren wurde die Wirkung einer einmaligen Verbrennung und wiederholter Infusionen von Dextran tschechoslowakischer Erzeugung mittels einer erweiterten Serie von Hämoagulations-testen untersucht. Die zeitliche Versuchsanordnung war praktisch die gleiche wie im ersten Versuch und die Dextrandosis war mit Bezug auf das Gewicht der Versuchstiere standardisiert.

Die Euglobulinfibrinolyse war lediglich 24 Stunden nach der Verbrennung signifikant herabgesetzt.

Die Wirkung des Dextrans trat nicht durch signifikante Veränderungen in Erscheinung, aber die Unterschiede zwischen der fibrinolytischen Aktivität bei den Tieren mit Verbrennungen und der bei den Kontrollhunden waren geringer als im ersten Versuch ohne Dextran.

Die thrombelastographische Untersuchung ergab herabgesetzte Elastizität des Koagulums nach Dextranverabreichung bei den Hunden mit Verbrennungen ebenso wie bei den Kontrolltieren.

RESUMEN

Las alteraciones de la hemo-coagulación y de la fibrinolysis en perros tratados por quemaduras, y la influencia del dextran sobre éstas

J. Mazák, J. Vaňásek, F. Matěja

En un grupo standard de 6 perros quemados y 6 para control, fué realizada una serie de exámenes de hemo-coagulación antes de la quemadura, después de 1, 3 y 24 horas y pasados 6 y 21 días, después de la quemadura.

Fue estadísticamente significativo el descenso de la actividad fibrinolítica, comprobado por medio del método de la fracción euglobulínica, con un máximo dentro de 1/una/hora, 24 horas y 21 días, después de la quemadura.

En otro grupo de 6 perros quemados y 6 perros de control, fué investigado el efecto de una quemadura aislada y de repetidas infusiones con dextran de producción checoslovaca, por medio de una serie de tests de hemo-coagulación. El orden en tiempo del experimento fue prácticamente igual que en la primera parte, y la dosis de dextran fue standard en relación con el peso de los animales de experimentación.

La fibrinólisis euglobulínica fue significativamente baja, solamente 24 horas después de la quemadura.

El efecto del dextran no se manifestó con algunos cambios significativos, sin embargo las diferencias de la actividad fibrinolítica entre los perros quemados y los de control, fue menor que en la primera parte del experimento sin dextran.

El examen trombolastográfico mostró una desminución de la elasticidad del coágulo, después del dextran, en los perros quemados y en los de control.

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SURGICAL TREATMENT OF 3rd AND 4th DEGREE BURNS

B. F. SHINDARSKY

There are still different opinions in the literature on the treatment of 3rd and 4th degree burns. Some authors recommend autotransplantation of skin by the islet method of Yanovitch and Chaynsky and the "postage stamp" method, mainly referring to their accessibility and negligible traumatizing effect. The functional and cosmetic results, however, are not so good. Other

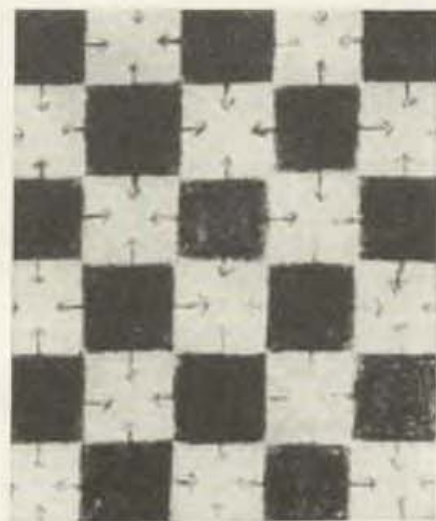


Fig. 1. Diagram of "chess-board" auto- and homotransplantation of skin by the "postage stamp" method.

authors prefer to use large autotransplants of skin in the surgical treatment of 3rd and 4th degree burns. They achieve better functional as well as cosmetic results, but we do not use this method in large burns, because of its considerably traumatizing effect. In very severe burns a combination of auto- and homotransplantation has been recommended either by the method of Mowlem-Jackson or otherwise.

We have been using various methods in the surgical treatment of 3rd and 4th degree burns according to the actual case and guided by considerations for the best functional and cosmetic results. In circumscribed burns of 4th degree with exposure of tendons and bone, we employ skin flap transplant-

ation. This enables us to preserve the exposed tendons and bone and thus the function of the respective part. In 3rd and 4th degree burns up to 20%, we endeavour to cover the wounds with large autotransplants as soon as possible. In burns over 20%, we apply autotransplants of skin by the "postage stamp" method, implanting larger grafts only in the face and around joints in order to achieve better cosmetic and functional results. If there is a shortage of donor sites, we resort to the usual combinations of auto- and homotransplantation in the form of strips of skin according to the method of Mowlem-Jackson. In these cases, we apply autotransplants in the region around the joints, because their take ensures better functional results.

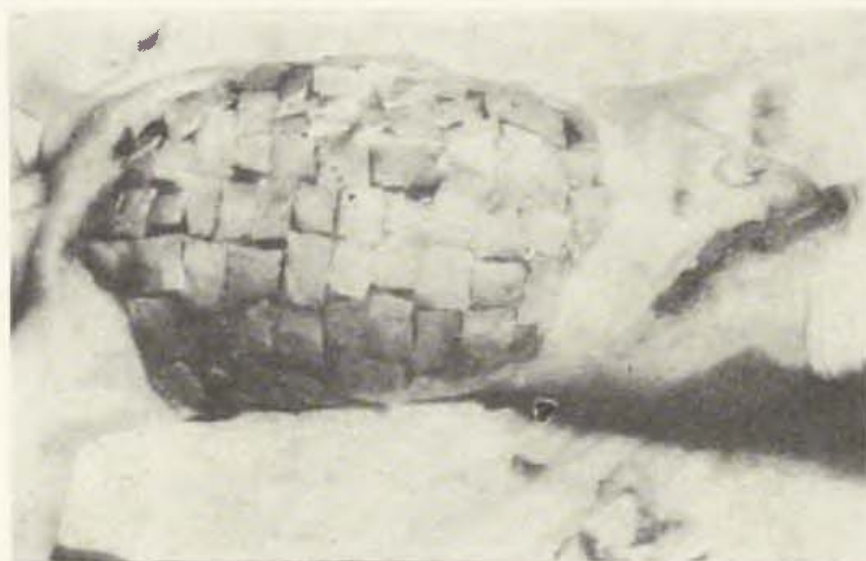


Fig. 2. "Chess-board" auto- and homotransplantation of skin by the "postage stamp" method on completion of operation.



Fig. 3. Autolysis of homotransplants and epithelization from autotransplant "stamps".

In burns of 3rd and 4th degree larger than 30%, we employ the "chess-board" method of combined auto- and homotransplantation of skin by the "postage stamp" manner. Thus, after autolysis of the homografts, epithelization proceeds from the autografts in *four* directions, whereas in the method of Mowlem-Jackson this takes place only in *two* directions (Fig. 1). Here the cosmetic and functional results are not particularly good, but the method

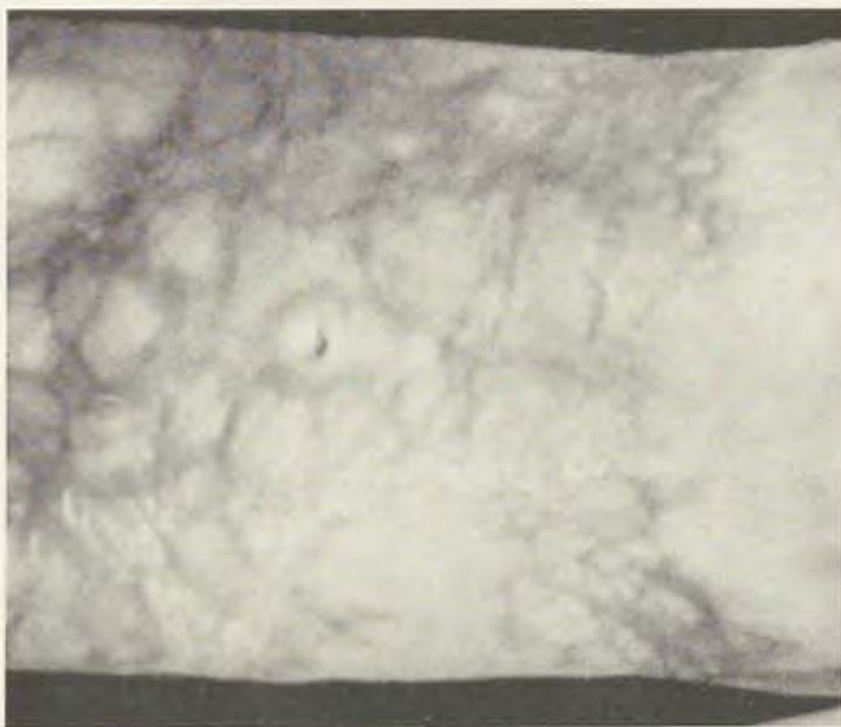


Fig. 4. The cured child.

helps to save patients with large 3rd and 4th degree burns in whom all other forms of treatment are impracticable.

Patient H.A.M., aged two, No. 10488/16. XI. 1962, with burns on right hand, thorax, abdomen and thighs of 3rd and 4th degree. Treatment: We carried out a "chess-board" auto- and homotransplantation by the "postage stamp" method (Fig. 2). After autolysis of the homografts (Fig. 3), the wounds became epithelized from the autografts and the child was discharged cured. No other operation was necessary (Fig. 4).

In large burns of 3rd and 4th degree, first of all blood transfusions must be given, and that in the preoperative period as well as during the operations and the postoperative period. No other substances can substitute for the powerful effect of blood. We do not operate on patients with less than 60% of haemoglobin, 3,000,000 erythrocytes, a haematocrit of 35% and total protein of 5.5%, because the auto- and homotransplants do not take, the donor site wounds do not epithelize and the general condition of the patients deteriorates. Blood transfusion must be continued until the autografts have started to take and the areas epithelized by them have grown stronger.

SUMMARY

The author reports on his experience with the surgical treatment of 3rd and 4th degree burns. In exposure of tendons and bone he recommends skin flap transplantation. In burns up to 20% he endeavours to cover the wounds with autotransplants, thus achieving better cosmetic and functional results. In larger burns, he advises the employing of autotransplants by the "postage stamps" method, but over joints he applies large autotransplants. If resorting to the combination of auto- and homotransplantation, he recommends the method of Mowlem-Jackson and the "chess-board" variation of the "postage stamps" method. He also draws attention to blood transfusion in the pre- and postoperative period as well as during the operation in order to maintain the level of haemoglobin above 60%, the number of erythrocytes above 3,000,000, the haematocrit above 35% and the total protein above 5.5%.

RÉSUMÉ

Le traitement chirurgical des brûlures du IIIème et IVème degrés

B. F. Shindarski

L'auteur présente ses expériences avec le traitement chirurgical des brûlures du IIIème et IVème degrés. S'il trouve les tendons et les os dégagés par l'accident thermique, il pratique la plastie au transplant libre. Dans des brûlures de l'étendue jusqu'à vingt pour cent, il se sert des autotransplants pour la raison qu'ils aboutissent à des résultats plus favorables quand à l'esthétique et la fonction. Si les brûlures surpassent les vingt pour cent respectifs, il est à son avis le mieux d'employer la méthode des dites «timbres postaux», mais, dans les alentours des joints, il emploie des larges autotransplants. S'il est contraint de se servir de la combinaison d'homo et autotransplants, il recourt à la méthode de Mowlem-Jackson ou à la variante des dites «chess-board». Il souligne la nécessité des transfusions sanguines dans la période avant et après l'opération si bien qu'au cours de l'opération afin de soutenir le niveau d'hémoglobine au-dessus de 60%, des globules rouges au-dessus de 3,000.000 et d'hématocrite au-dessus de 35%, toujours en correspondance avec le niveau des protéines sanguines équivalants à plus de 5,5%.

ZUSAMMENFASSUNG

Chirurgische Behandlung von Verbrennungen III. und IV. Grades

B. F. Shindarski

Der Verfasser berichtet über seine Erfahrungen mit der chirurgischen Behandlung von Verbrennungen III. und IV. Grades. Sind Sehnen und Knochen blossgelegt, empfiehlt er die Übertragung von Hautlappen. Bei Verbrennung von mehr als 20% der Oberfläche ist er bestrebt, die Wunden durch Autotransplantate zu decken, wodurch ein besseres kosmetisches und funktionelles Ergebnis erzielt wird. Bei grösseren Verbrennungen empfiehlt er die Anwendung von Autotransplantaten nach der „Briefmarken-Methode“, über den Gelenken jedoch benützt er grössere Autotransplantate. Wendet man die Kombination eines Auto- und Homotransplantats an, empfiehlt der Verfasser die Methode nach Mowlem-Jackson sowie die „Schachbrett“-Modifikation der Briefmarkenmethode. Der Autor hebt auch die Bedeutung von Bluttransfusionen in der prä- und

postoperativen Zeitspanne sowie während der Operation hervor, wobei die Hämoglobinkonzentration über 60%, die Erythrozytenanzahl über 3 Millionen, der Hämatokritwert über 35% und das Plasmaeiweiss über 5,5% gehalten werden sollen.

RESUMEN

El tratamiento quirúrgico de las quemaduras de 3ro. y 4to. grado

B. F. Shindarski

El autor informa sobre su experiencia con el tratamiento quirúrgico de las quemaduras de 3ro. y 4to. grado. En la exposición de los tendones y del hueso, recomienda la transplatación de la piel como pegada. En las quemaduras hacia un 20 % se esfuerza por cubrir las heridas con un auto-transplante, así se logran mejores resultados cosméticos y funcionales.

En las quemaduras mayores, advierte el uso del autotransplante por el método del „sello postal“, pero sobre las articulaciones aplica un autotransplante mayor. Si resulta la combinación de la auto- y de la homotransplatación, recomienda el método de Mowlem-Jackson y del „tablero de ajedrez“ como variación del método del „sello postal“. También llama la atención sobre la transfusión sanguínea en el período pre- y postoperatorio, así como también durante la operación para mantener el nivel de la hemoglobina sobre un 60 %, el número de eritrocitos sobre unos 3,000,000, el valor hematocrítico sobre un 35 % y el total de las proteínas sobre un 5,5 %.

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FISSURA COLLI MEDIALIS

R. KÖNIGOVÁ

Among the interesting problems of children's and plastic surgery are congenital malformations of the face and neck of branchiogenic origin. Most of these formations are situated more lateral to the midline than is the site of the so-called median cleft of the neck, the fissura colli medialis (Karfík 1958), midline cervical cleft-cord (Davis 1950), median fissure of the neck (Ballentyne 1905), fistule superficiele mentosternale (Ombrédanne 1944) and the mentosternale Halsfistel (Kecht 1962). Already in 1905, in his book on antenatal pathology, Ballentyne drew attention to midline clefts of the neck, which he considered to be one of the rarest teratological conditions. This problem was enlarged upon in the Czech literature in 1958 by Prof. Karfík, who reported a more frequent incidence of these malformations if they are correctly classified.

There have been many attempts to explain the origin of fissura colli medialis. Some authors (De Bruin 1928 and MacCollum 1938) considered them to be a form of pterygium colli, analogous to the other skin folds of the neck. The cause has also been attributed to lack of skin on the neck in a vertical direction. Hauptmann and Tannhauser (1941), made a distinction between skin folds and bands of prominent shortened muscles, such as are found in congenital muscular torticollis. Hamilton in his book "Human Embryology" (1951), referred to arrested development as a cause of the condition; Gross (1953) incriminated incomplete fusion of the upper branchial arches in the midline. If the lower arches do not fuse, a cleft or even aplasia of the manubrium sterni or of the entire sternum may develop, or, in the presence of incomplete fusion, a cyst may develop above the suprasternal notch or behind the sternum. Ombrédanne (1932) also wrote of a genetic disturbance in the region of the anterior part of the branchial arches. Récamier (1956) considered that fusion was prevented by the presence of a connective tissue obstacle at the edges of the cleft.

The relation between postnatal anomalies and structures found in the second and third week of embryonic life can be explained by embryology. At this time five grooves have developed below the head of the embryo, running parallel and in a ventromediodorsal direction. These grooves separate the six

branchial arches which later give rise to the neck and the lower part of the face. To each outer groove, covered with ectoderm, there corresponds a similar inner depression of the primary gut with an entodermal lining. These two furrows are separated by a membrane which becomes thicker after the fusion of the anterior poles as a result of the mesoderm growing into it. Under normal developmental conditions, the mesoderm gives rise to the musculature as well

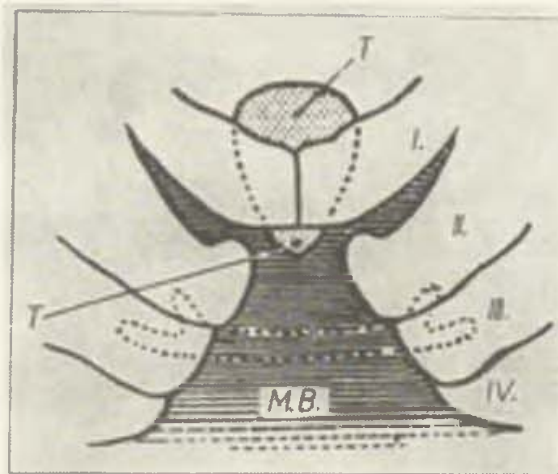


Fig. 1.

as to vascular network. A disturbance in the growth of the mesoderm in the first branchial arch leads to malformation of the mandible, tongue, lower and upper lip and maxilla. Such a disturbance in the neck, however, does not lead to a complete cleft, which would hardly be compatible with life.

At the branchial arch stage the anterior surface of the neck does not yet exist. Fusion of the first branchial arches takes place in the precordial region. The anterior poles of the second to fourth branchial arches recede in the dorsocaudal direction so that a membranous barrier remains between them, the so-called *champ mésobranchial* (Ombredanne, Fig. 1). Later, the head begins to deflect and the mesoderm takes part in the formation of the anterior surface of the neck by the development of an adequate blood supply and musculature. When this is deficient, fibrosis develops in the midline of the neck as a reaction of the defective musculature to too great a pull when the chin separates from the sternum. According to Pohlman (1910), Veau and Politzer (1936) and more recently, according to the theory of Stark (1954), anomalous development is a manifestation of the arrest of mesodermal growth and vascularization, leading to a disturbance in the viability of the central region and to dehiscence in the originally intact epithelium. A similar condition is seen in clefts of the face and anterior wall of the trunk (foetal hernia, extrophy of the bladder, epispadias). The middle part of the sternum may be reduced to a fine avascular membrane formed by a layer of ectoderm and entoderm adherent to each other, which may be absorbed or rupture spontaneously. In 1941, Keith noted circulatory disturbances along the marginal region where the formation of capillaries should have been taking place and



Fig. 2.



Fig. 3.

explained all fissures and fibrous bands in the face and neck by local necrosis from insufficient blood supply. He thought, however, that it related to the effect of the placenta.

After birth, *fissura colli medialis* presents clinically as a shortening, with a raised fold, of skin stretched between the chin and the suprasternal notch. Its base is formed of a hard cord of *connective tissue*, lying subcutaneously, which does not move on swallowing. It is not fixed to the skin or deeper structures [hyoid]. On the top of the fold in the midline, there is usually a groove lined by tissue having the character of *extrophic mucosa* (Fig. 2, 3), running vertically, slightly depressed below the level of the surrounding skin and resembling granulation tissue by its reddish colour, in some cases "weeping", or covered with crusts, in others wrinkled and desquamating. It is usually 5—15 mm. wide and 2—6 cm. long. At its upper or lower end, or both, it runs into a minute *canaliculum* several mm. to cm. long, secretion from which may lead to maceration of the surrounding skin, which suggests a diagnosis of median fistula. The canaliculum either runs towards the hyoid bone without joining it, or superficially to the chin, or else it descends behind the manubrium sterni. *Skin tabs* (or the *molusca* of Ombrédanne) are often found close to the upper and lower canalicum. They are usually a few mm. to 1 cm. long and pigmented, like the surrounding skin of the defect. They do not contain cartilage, therefore the term *fibrochondroma* should be reserved for similar formations situated above the anterior edge of the sternomastoid muscle which usually have a cartilaginous base.

The defect in the skin may sometimes be quite small or completely absent (Fig. 4), but a firm cord is always found, either one for the entire length or forking above the level of the hyoid into two branches attached to two protuberances on the chin, between which there is usually a shallow notch. It is characteristic of the condition that the chin recedes backwards and that there is no angle between the chin and the neck. Sometimes the cleft is continued into the lower lip, where we then observe a depression formed from fibrous tissue. In severe malformations a deep groove in the lower lip may be associated with a cleft of the mandible (Stexard 1935, Chu Hung-Yin). In complete cleft the two halves of the mandible are joined by a syndesmosis, with movement between them, in which case the lower two first incisors are missing (Wassmund 1935). The cleft may also affect the hyoid bone, the thyroid cartilage and the sternum (Morton and Jordan 1935, Davis 1950). However, if it extends to the upper lip and nose (Braithwaite 1949—50), we find two parallel fibrous bands situated paramedially along the edges of the cleft.

On making intraoral examination a diastema is sometimes found between the first incisors and the frenulum is attached between them. When there is hypoplasia of the mandible there is usually a deep bite of the lower incisors in the presence of good articulation of the molars. The tongue may also be cleft at the apex and fibrous cord runs from there to the floor of the mouth so that tongue movements are restricted.



Fig. 4.



Fig. 5.



Fig. 9.



Fig. 10.

Fig. 9, 10. Preoperative photograph of case J. R. (20458).

X-ray examination may show changes in the hyoid bone, sternum and spina bifida of the cervical spine. On the tuberculum mentale, of the mandible there can be seen a projection facing dorso-caudally in the lateral projection, like bone exostoses (Fig. 6). Wynn-Williams (1952) noted rarefaction in the central part of the symphysis menti, which he regarded as incomplete fusion of the mandibular arch. On histological examination of the skin lining of the cleft, squamous epithelium is found with changes of a mucosal character, of the type of dyskerotosis (Fig. 7). There is usually hyperplasia of the epithelium, with irregular thickening of the stratum corneum in some places so that it becomes uneven and shows papilliform wrinkling. The stratum Malphigii and the stratum germinatum do not have their normal stratified structure. In the corium, beneath these changes, the sebaceous and sweat glands are not normally developed. In addition, there is lengthening of the interpapillary projections of sparse connective tissue close up to striped muscle. Inclusions of sero-mucous glands are sometimes found in these layers like manifestations of hamartoma.

Histological examination of the skin tabs (Fig. 8) shows normal squamous epithelium and intact skin appendages, with small bundles of striped muscle in the deep parts. Cartilage has never been found, so that we are not dealing with choristoma.

In the fibrous cord, atrophic muscle bundles can be seen microscopically, with regressive changes, including loss of stipes up to marked sclerohyper-

plasia with massive perivascular lymphoplasmocytic infiltrations penetrating into the musculature which shows dissociation and atrophy. There is thus localized fibrosis of the hypercollagenous type and an atrophic dedifferentiated type of damage (platysma), which Van Duyn (1963) compared with the histological findings in congenital muscular torticollis.

If all the characteristic signs of *fissura colli medialis* are kept in mind while examining the patient, other forms of congenital anomalies of the median part of the neck, such as ectopic thyroid, dermoid cysts and teratoma, can be excluded. Confusion occurs most often with a cyst and fistula or other remnants of the thyroglossal duct. These, however, are anomalies which are genetically quite different. The thyroid gland develops in the ventral field of the pharyngeal part of the primitive gut. In later development, it descends to the lower part of the neck, forming the so-called thyroglossal duct which is later obliterated in the thyroglossal tract. This gradually atrophies and by the end of the eighth week of embryonic life has completely disappeared. Islets of unilayer cylindrical epithelial cells, typical for the thyroid, may, however, persist anywhere along the course of the duct. Maceration of the skin near the fistulae of cysts may lead to confusion with the skin defect in *fissura colli medialis*.

Formations arising from the thyroglossal duct move on swallowing and, at operation all the epithelium must be excised as well as the hyoid bone, and the thyroglossal duct followed right up to the root of the tongue. On the



Fig. 11.



Fig. 12.



Fig. 13.



Fig. 14.

Fig. 13, 14. Photograph of case J. R. (20458) following operation.

other hand, the success of the operation for fissura colli medialis depends on the total removal of the fibrous tissue which is like the fibrous cords in hypospadias that must also be dissected out and removed completely without leaving any remnants, at the straightening operation. The association of fissura colli medialis with a raised fold of skin over a firm cord with persistent thyroglossal duct, in the form of a cyst situated in the suprasternal notch and appearing in the third year of life, was described by Maneksha [1961].

Twenty-two patients with a diagnosis of median fistula of the neck were found in the records of the University Department of Plastic Surgery in Prague, from 1927. We classified 12 of these in retrospect as fissura colli medialis. Twenty-three patients were operated on at the University Ear Nose and Throat Department with a diagnosis of central fistula of the neck, but only two of these could be recognized as fissura colli medialis. Nineteen cases of median anomalies of the neck were treated at the Brno University Department of Plastic Surgery. Six of these were diagnosed as fissura colli medialis (Karfík — personal communication).

A follow-up of these patients was carried out in November 1964. This gave an opportunity of inspecting the local condition [scars] but also and mainly, drew attention to various factors having an influence on the end results. The most important were:

A) The extent of the cleft: 3 patients had complete clefts, one infra-mandibular, 5 infrahyoid and 3 infracricoid (Fig. 11, 12) clefts. In complete types (Fig. 9, 10, 13, 14) the greatest danger to the development of the face is hypoplasia of the mandible.

B) Age of the patient: Two children were operated on at the age of one year, one woman at 30, the remaining patients between 7 and 10. The best results were obtained after operation carried out at the age of a year because the mandible and the face as a whole could then develop normally.

C) The type of operation performed is most important. Even in a small cleft and after early operation, the results will not be satisfactory unless the correct surgical technique has been used. The earlier patients in our department were admitted merely with the diagnosis of median fistula of the neck and only the various manifestations were operated on, such as the skin tabs and canaliculi, since the condition was not regarded as being one genetic entity in the way that *fissura colli medialis* is now. They were therefore excised by small horizontal incisions, but this did not relieve the pull on the mandible. In 1963, Van Duyn still used horizontal incisions for severing fibrous cords. This led to recurrences, but Z-plasty, which could have provided a permanent solution, was not carried out.

In two of our patients operated on in 1927 and 1938, a spindle-shaped vertical excision of the hard band was made with linear suture of the deeper layers and horizontal incision at the level of the hyoid in the first case, and at the level of the thyroid in the second, to attain elongation of the shortened tissue. The condition was not improved upon, on account of the development of scar contracture in the midline.

Since 1949, total excision of the skin defect has been carried out with extirpation of the canaliculi and the entire fibrous band with its attachment to the skeleton, including the exostoses on the symphysis menti. The muscle shortening in the vicinity has been abolished by wedge-shaped incisions and the fold of skin flattened out by Z-plasty. We have found this method to be the only correct one for *fissura colli medialis*. Chandler (1937) first reported the use of Z-plasty on operations for congenital skin folds in the neck. It is interesting, however, that even large textbooks of surgical methods and techniques (Bier-Baum/Kümmel 1955) do not refer at all to Z-plasty in connection with median anomalies of the neck. Even the most recent German works (Kecht 1962, Pulkkinen 1962) do not refer to this application of Z-plasty. On the other hand, in the English literature (Wynn-Williams 1952) it is stressed, in the same way as in our department, that wedge flaps for Z-plasty should be formed not only from skin but also from the platysma and deeper, in order to model the angle between the chin and the neck and thus to remove any further danger of tension. It must be remembered that the anterior part of the platysma is degenerated and if left in situ it will have a tendency to shorten and to form another fibrous cord. The aim, therefore, is to remove the pull on the mandible, to prevent the re-formation of scar contractures by placing the scars in the transverse or oblique direction and to ensure treatment

by systematic massage and rehabilitation for at least a year after operation. It is important to arrange orthodontic cooperation to prevent retrusion of the chin and overlap of the teeth.

S U M M A R Y

In the study of congenital malformations affecting the central part of the neck it is necessary to distinguish *fissura colli medialis* (Karfík) in the differential diagnosis from other median anomalies of the neck. The origin of this condition is different. The history and embryology of this malformation is given briefly, pointing to a certain similarity with facial clefts and clefts of the anterior wall of the trunk (*hernia foetalis*, *epispadias*, *extrophia* of the bladder). According to Starky's theory, it is caused by the arrest of mesodermal ingrowth and thereby the failure in the skin cover of the neck over the site where the mesenchyme is missing.

Clinically, *fissura colli medialis* has the form of a skin fold, based on a cord of fibrous tissue, arising in the symphysis menti to the suprasternal notch. Orthodontic, X-ray and histological examination of the defective skin, including that of the skin tabs and canaliculi in the upper and lower poles, are necessary for confirming the diagnosis.

An analysis of the patients (20) operated on at the University Department of Plastic Surgery in Prague and Brno and the Ear, Nose and Throat Department of the Faculty Hospital, in Prague 10, demonstrated the importance of the method of operation. It is always essential to remove the fibrous cord completely and to use wedge-shaped flaps for Z-plasty in suturing the incision, to prevent a contracting scar from developing. The correct diagnosis of this malformation is important for ensuring the normal development of the mandible and the teeth.

R É S U M É

Fissura colli medialis

R. K o n i g o v á

En étudiant les anomalies congénitales de la face antérieure du cou, il faut absolument différencier l'anomalie appelée *fissura colli medialis* (Karfík) — le sillon ou la corde médiane du cou, grâce à son évolution tout à-fait différente des autres déviations congénitales dans la région d'arc branchial.

Une courte description de l'histoire et de l'embryologie de cette anomalie est présentée par l'auteur. Elle est analogue aux fentes médianes de la face ou du tronc tels que l'hernie foetale, *epispadie*, l'*extrophie* de la vessie. Tout d'accord avec la théorie de Stark, elle dérive d'un arrêt de développement des implants mésodermaux faute de l'insuffisance mésodermale.

Il n'est que rarement considéré, ce diagnostic, à l'égard des symptômes classiques: la corde fibreuse partante de l'éminence mentonnière vers la fourchette du sternum. L'anomalie est située sous le tissu dermal, atteint de différents défauts, accompagné des lacunes et des cryptes intra-dermales à l'extrémité supérieure et inférieure du sillon en question. Pour compléter le diagnostic, il faut ajouter des examens en X rays, en histologie des défauts dermaux et de la corde fibreuse si bien que des examens intra-orals.

En faisant l'analyse des vingt cas opérés à la clinique de la chirurgie esthétique de Prague et de Brno si bien qu'à la clinique otorhinolaryngologique de Prague, on affirme l'importance du type d'opération décrit: la nécessité absolue d'enlever complètement la corde fibreuse et d'employer tous les principes fondamentaux de la chirurgie esthétique — quand à l'emplacement des cicatrices — c'est-à-dire des lambeaux glissants pour éviter une nouvelle contracture postopératoire, causant la possibilité d'hypoplasie du mandibule ainsi que la déformation de la dentition au cours du développement de la face.

ZUSAMMENFASSUNG

Fissura colli medialis

R. Königová

Beim Studium der angeborenen Missbildungen, die die mittlere Halspartie betreffen, ist es notwendig, die sogenannte mittlere Halsspalte (Fissura colli medialis — Karfik) differentialdiagnostisch abzugrenzen, da ihr Zustandekommen sich von dem der anderen angeborenen medialen Aberrationen im Bereich der Kiemenbögen unterscheidet. Die Geschichte und die Embryologie dieser Missbildung werden kurz erörtert: diese Entwicklungsstörung kann als Analogie der Gesichtsspalten sowie der Spalten der Rumpfvorderwand (Hernia foetalis, Epispadia, Exstrophia vesicae urinariae) angesehen werden. Nach der Theorie Starks kommt es hier zum Stillstand der sogenannten Mesodermisierung und damit zur Störung der Hautdecke über der Stelle des Mesenchymmangels. Klinisch tritt die Fissura colli medialis in Form einer Hautfalte in Erscheinung, deren Grundlage ein derber bindegewebiger Strang bildet, der an der Symphysis menti ansetzt und bis in die Jugulargrube geht. Zur Präzisierung der Diagnose ist es erforderlich, eine orthodontische und röntgenologische Untersuchung durchzuführen sowie den Hautdefekt einschliesslich der Hautwucherungen und der Kanälchen an seinem oberen oder unteren Pol histologisch zu untersuchen.

Die Analyse der 20 Fälle, die an der Klinik für plastische Chirurgie in Prag, an der in Brünn und an der Hals-Nasen-Ohrenklinik des Fakultätskrankenhauses in Prag 10 operiert wurden, wies auf die Bedeutung der Operationsmethode hin. Es ist unbedingt notwendig, den fibrösen Strang vollständig zu entfernen und zum Verschluss der Operationswunde keilförmige Lappen in Z-Plastik als Prophylaxe kontrahierender Narben anzuwenden. Die richtige Diagnose dieser Missbildung ist für die normale Entwicklung des Unterkiefers und des Gebisses von grosser Wichtigkeit.

RESUMEN

La fissura colli medialis

R. Königová

En el estudio de los defectos congénitos que afectan la parte media del cuello, es necesario diferencialmente, en el diagnóstico, distinguir la tal llamada fisura media del cuello, fissura colli medialis (Karfík), su origen es distinto al de otras aberraciones congénitas del cuello en la región de los arcos branquiales. Se presenta una discusión concisa sobre la historia y la embriología de este defecto, en el cual se puede ver una determinada analogía con las fisuras de la cara y con las fisuras de la pared ventral del tórax (hernia foetalis, epispadia, extrophia vesical urinariae). Según la teoría de Starek, aquí se produce un paro en la tal llamada mesodermización, y con esto un trastorno de la cubierta de la piel sobre el lugar con escasez de mesénquima.

Clinicamente la fissura colli medialis se manifiesta en forma de pliegues en la piel, cuya fase es una faja de tejido conjuntivo denso que se inserta en la sinfisis del mentón y va hasta la fosa yugular. Como suplemento para el diagnóstico es necesario el reconocimiento ortodóntico, radiográfico y histológico del defecto de la piel, inclusive de las excrecencias y canales de la piel, en el polo superior e inferior.

El análisis de los operados en la Clínica de Cirugía Plástica, en Praga, Brno y en la ORL Clínica del Hospital Facultativo en Praga 10, demostró la importancia de los métodos de operación. Es incondicionalmente necesario extraer la faja fibrosa completamente, y para el cierre de la herida operatoria, utilizar los lóbulos cuneiformes de Z-plástica, como prevención para la contracción de las cicatrices. La diferenciación correcta de este defecto es importante para el desarrollo de la mandíbula inferior y de la dentadura.

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M. Fára, J. Hrivnáková

THE PROBLEM OF PROTRUDING PREMAXILLA IN BILATERAL TOTAL CLEFTS



Fig. 7.



Fig. 8.

Fig. 7, 8. Patient B., aged 6. No. 9630. Condition after excision of premaxilla in infancy.

Š. Demjén, V. Marcinková

KLIPPEL-FEIL SYNDROME AND CLEFT PALATE



Fig. 2.

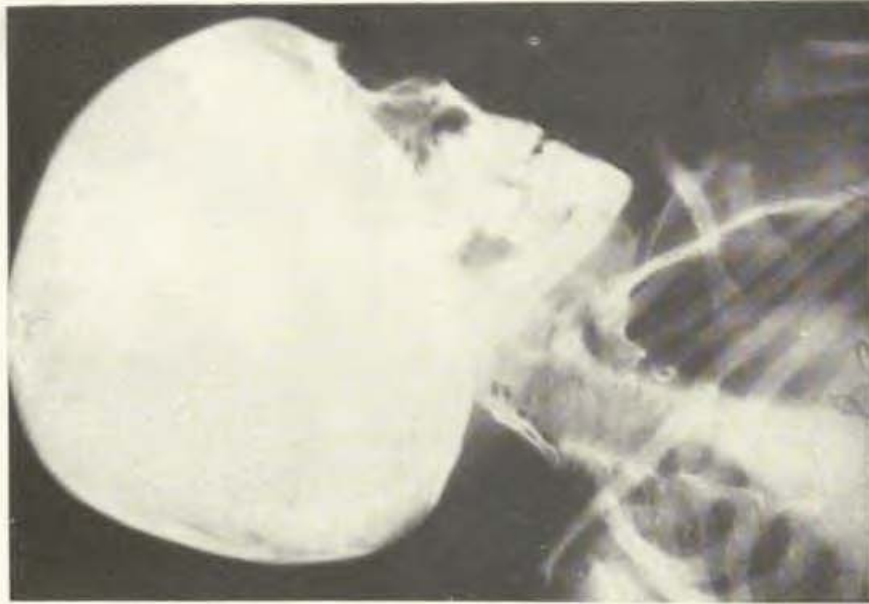


Fig. 3.

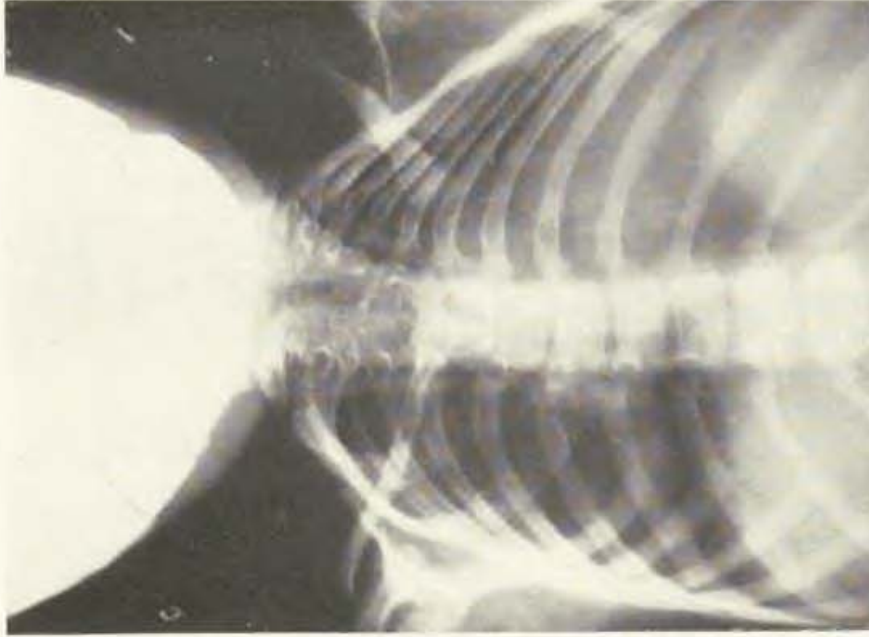


Fig. 4.

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THE PROBLEM OF PROTRUDING PREMAXILLA IN BILATERAL TOTAL CLEFTS

M. FÁRA, J. HRIVNÁKOVÁ

Retropositioning of the premaxilla into the line of the alveolar arch is the most urgent problem in the treatment of bilateral total clefts. Surgeons are divided into two camps according to their different opinions relating to this question. Those belonging to the first group carry out surgical retropositioning of the premaxilla in all cases of marked protrusion, either fully conscious of the damage done to the premaxilla itself and to the entire formation of the upper jaw by this operation, or denying the risk. Surgeons of the second group adhere to conservative treatment as far as this is possible.

The Prague University Department of Plastic Surgery has always been a protagonist of the second trend and the results ascertained in the follow-up of 506 patients with bilateral total clefts (i.e. with clefts of the lip, maxilla and palate, with or without bridges) uphold this standpoint.

We have never found even the most extreme protruding premaxilla to be an obstacle to proper suture of the lip. We cannot, therefore, agree with surgeons who indicate resection in the vomer as a preparatory step or at the same stage as the operation on the lip. We carried out two-stage operations in all our cases of bilateral total clefts, and thorough although sparing mobilization always permitted reconstruction by joining all affected tissues, suturing the musculature to the prolabial tissue and the skin without much tension. The pressure of the reconstructed lip was usually sufficient to ensure enough retroposition of the protruding premaxilla to make operation on the vomer unnecessary. An important part is played here by postoperative stomatological and orthodontic treatment to prevent the two halves of the maxilla coming closer together behind the premaxilla and making its falling into place between them possible.

Certain enormously protruding premaxillae, however, show no tendency whatsoever to recede and success cannot be expected from further conservative treatment. In such cases, secondary surgical retroposition is the only possible solution.

Every open operation on the vomer or the neck of the premaxilla endangers subsequent development of these bones. This danger is the greater the younger the patient. The studies of some authors have shown that vomerectomy may



Fig. 1.



Fig. 2.



Fig. 3.



Fig. 4.



Fig. 5.



Fig. 6.

Fig. 1—6. Patient Ž., No. 45531. Example of spontaneous recession of greatly protruding premaxilla after suture of the lip. The congenital right-sided deviation of the premaxilla (Fig. 1, 2), straightened out after the suture of the left side of the lip (Fig. 3); the prolabium, small at first (Fig. 4), has increased in size up to the age of two (Fig. 5) and, at the same time, the premaxilla has fallen into line with the alveolar arch (Fig. 6). In the mouth the healed velum after Schweckendiek's operation can be seen.

even have a deleterious effect on the growth of the entire maxillae or the whole central part of the face (e.g. Glover and Newcomb, 4). Monroe [12], in autopsy studies of the premaxilla and septum, found a much lower growth activity of these bones in stillborn infants with clefts than in stillborn infants without clefts. He considered the cartilaginous junction between the premaxilla and the septum to be the most vulnerable region in bilateral total cleft and also to be responsible for the growth of the surrounding bones.

On more than one occasion we have also observed a poorer development of the maxillae after removal of the premaxilla (carried out elsewhere) or after its surgical retroposition. However, since growth in the facial bones of the middle level proceeds at first from the corresponding suture and later by subperiosteal apposition, we are of the opinion that the main disorder is the congenitally inferior developmental capacity, the results of which may become conspicuous in the collapse of the lateral segments after the disappearance of the premaxilla.

A number of methods have been suggested and used for the surgical retroposition of the premaxilla, from simply fracturing the neck of the premaxilla

(5), via a quadrangular (7) or triangular (17) excision of the vomer to subperiosteal horizontal (13) and oblique lateral (17) vomerotomy.

Fixation is achieved either by nailing or suture of the premaxillary mucoperiosteum to the lateral alveolar segments or by simply wedging the premaxilla between these segments.



Fig. 9.



Fig. 10.



Fig. 11.



Fig. 12.



Fig. 13.



Fig. 14.



Fig. 15.

Fig. 7, 8. Patient B., aged 6, No. 9630. Condition after excision of premaxilla in infancy. Fig. 9—12. Patient H., No. 11527. Condition after excision of the premaxilla at another hospital with the prolabium drawn forwards onto the columella. — Fig. 13—15. Patient T., No. 22398. The greatly protruding premaxilla was retroposed surgically by wedge-shaped resection of the vomer at the age of one year. The premaxilla has decreased in size but has still not atrophied at the age of 6. However, a conspicuous diminution in the size of the entire maxilla has taken place, as though the operation on the vomer had interfered with the growth potential of the upper jaw.

All these operations, however, only give imperfect results if compared with what is considered a prerequisite of success after such an operation. The retropositioned premaxilla should occupy a correct position with regard to the *anteroposterior relationship with and the horizontal plane* of the alveolar process. The *angle of the teeth* should be correct with regard to their occlusion with the lower incisors. Furthermore, *firm union* should take place at the site

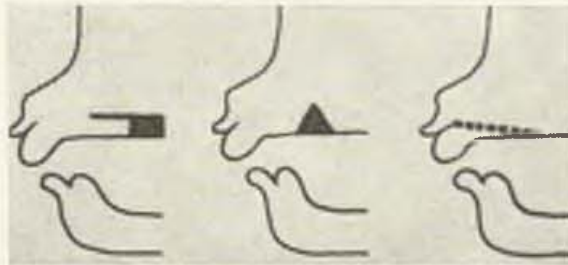


Fig. 16. Types of operations on the vomer: quadrangular and triangular resection and horizontal osteotomy.

of the osteotomy and *rotation* of the premaxilla or its *deviation* caused by the projection of one and recession of the other cleft margin should be prevented.

Most surgeons are now aware of the great risk of operation on the vomer and they only indicate it in cases where it is absolutely essential. Although most surgeons agree that the surgical retroposition of the premaxilla should only be done as a supplementary operation, there are still some who perform it as a primary operation in infants to prevent tension in the suture of the lip. Whether tension develops, however, depends on the method of operation used. The above procedure is followed, in particular, by surgeons who use lateral flaps according to the Hagedorn-Le Mesurier-Barsky principle, which makes the suturing of the lip more difficult. They carry out retroposition simultaneously with the primary suture of the lip or as an independent preparatory operation.

At the Prague University Department of Plastic Surgery, the premaxilla was retropositioned surgically in 31 cases of extreme protrusion, i.e. in 9.7% of 317 cases of markedly protruding premaxilla in bilateral total cleft, mostly as a secondary operation after the suture of the lip. Selection of cases for this operation was always very strict, because we were aware that the subsequent growth of the premaxilla could be retarded or even atrophy might set in. In actual fact, damage nearly always occurred although it sometimes did not become clearly evident until many years later. We never observed pseudoarthrosis at the site of osteotomy.

For clarity we give a survey of the patients operated on in this way. Tab. 1.

More or less normal growth of the premaxilla was only observed in three children after a lapse of 6—8 years from the time of the operation on the vomer. In two of these, horizontal vomerotomy had been carried out (these

two patients were uniovular concordant twins), and in one a wedge-shaped resection.

The results after operation on the womer must be evaluated very cautiously in each case, since in some the initial slight diminution of the premaxilla registered a few years after operation, led to marked atrophy after a lapse of 10 to 13 years.

Tab. 1.

No.	Patient	Vert. resect. age	Wedge resect. age	Hori- zont. vomer. age	Decrea- sed after	Atro- phied after	Almost normal after	Remarks
304	N. O. 1923	7 yr.				2 yr.		
3048	M. D. 1930		6 mos. with lip		12 yr.			
1955	T. A. 1930		4 mos. with lip			10 yr.		
11818	K. J. 1942		12 yr.				6 yr.	
16965	K. J. 1944	6 yr.			7 yr.	13 yr.		
11571	Š. J. 1945		5 yr.		2 yr.			
15715	H. J. 1946			9 yr.	3 yr.			
					4 mos.			
11918	L. J. 1946	4 yr.			8 yr.			
14734	M. M. 1947	4 yr.			7 yr.			
16345	N. J. 1947		11 yr.			4 yr.		
17377	S. A. 1947	2 yr. with lip						without check-up
16492	B. E. 1948	5 yr.			3 yr.	5 yr.		died
16594	J. V. 1948		9 mos. with lip					
15739	M. I. 1948	3 yr.				6 yr. 13 yr.		almost disappeared
16732	M. E. 1948			7 yr.	3 yr.			
15738	Š. M. 1948		3 yr.		6 yr.			very mobile
18758	E. E. 1949	2 yr.			6 yr.			
19037	C. A. 1949	1 yr.			8 yr.			
19112	K. O. 1949			6 yr.	6 yr.	13 yr.		
22398	T. A. 1950		1 yr.		4 yr.	2 yr.		very mobile
24027	P. J. 1951			5 yr.		6 yr.		
24028	P. L. 1951			5 yr.			8 yr.	
27042	K. Z. 1952			5 yr.	2 yr.			
27404	M. Z. 1952			2 yr.	2 yr.			
25687	M. F. 1952			4 yr.	5 yr.			
					2 yr.			
26586	P. V. 1952			2 yr.	7 yr.			
24284	P. S. 1952			4 yr.	4 yr.			died
29921	L. M. 1954			2 yr.				
33966	P. M. 1955			3 yr.	2 yr.			very mobile
39546	B. M. 1956			2 yr. with lip	6 yr.			
36925	H. R. 1957			2 yr.	5 yr. 1 yr.	2 yr.		almost disappeared

Marked atrophy of the premaxilla developed in 10 children, irrespective of the type of operation employed, i.e. in a third of all cases after surgical retropositioning of the premaxilla. Individual variations in the blood supply



Fig. 17.



Fig. 18.



Fig. 19.

Fig. 17—19. Patient L., No. 11918. The large anteriorly displaced premaxilla, holding four teeth and showing no tendency to recede (Fig. 17), was retroposed by vertical vomerotomy. Two years after the operation the premaxilla is in line, and shows no signs of growth disturbance (Fig. 18). Seven years after vomerotomy, atrophy has set in (Fig. 19). The premaxilla has decreased in size and only holds two teeth.



Fig. 20.



Fig. 21.



Fig. 22.

Fig. 20—22. Patient H., No. 36925. Two years after suture of the lip the enormously protruding premaxilla (Fig. 20) was retroposed by horizontal vomerotomy (Fig. 21, condition before this operation). Four years after retroposition all that has remained of the premaxilla is a small stump (Fig. 22).

and growth potential of the premaxilla may be blamed for this. The age of the patient at operation is also important. Operations carried out at a later age cause less damage to the growth of the premaxilla than when carried out in young children or in infants. We must therefore regard surgical retropositioning of the premaxilla as a very risky operation even if the most sparing technique is employed. However, it cannot always be avoided, but should only be carried out after the failure of all conservative methods of reinforcing the physiological pressure of the reconstructed lip by various stomato-orthodontic appliances.

However, atrophy of the premaxilla is not necessarily caused by osteotomy of the vomer. We have observed it several times in children not treated in this way and where interference with the premaxilla or its neck on the reconstruc-

tion of the floor of the nose in primary suture of the lip, had been minimal. The technique had not been rougher and the tension of the sutured lip any greater than in other patients, so that the cause in these cases certainly lay in the poor adaptability of the premaxilla to the slightest alteration in its conditions of nutrition and pressure. Sometimes, of course, the reaction of the premaxilla to worsening of its blood supply is evident already at operation. For example, in a number of cases we observed evidence of a circulatory disturbance in the premaxilla, lasting for many hours, following the mere raising of a small lateral mucoperiosteal flap from the vomer which happened to contain a significant, although not very large artery.

In infants with a greatly protruding premaxilla, we try to restrict further protrusion before the operation on the lip. For this purpose we have constructed



Fig. 23.



Fig. 24.

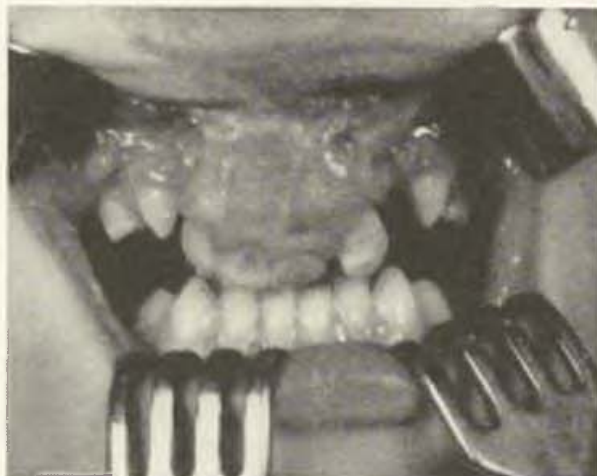


Fig. 25.

Fig. 23—25. Patient T., No. 38051. Spontaneous atrophy of premaxilla without operation on the vomer. Fig. 23. Condition before primary suture. Fig. 24. 2½ years after primary suture of the lip the premaxilla has diminished to half its original size. Fig. 25. After 5 years all that has remained of the premaxilla is a small stump.



Fig. 26.



Fig. 27.



Fig. 28.



Fig. 29.

Fig. 26—29. Examples of repressive appliances. Fig. 26. Band with soft rubber pad. Fig. 27. Band with cotton wool pad. Fig. 28. Repressing ring whose rim acts directly on the premaxilla. Fig. 29. Acrylic saucer which fits the anterior and caudal surface of the premaxilla.

repression bands and various types of appliances fixed to a firmly applied skull cap. They lie on the prolabium or directly on the premaxilla. When signs of pressure develop, the manner of application is altered for a certain time. We have found a soft cotton wool or sponge rubber pad on the repression band to be the most suitable. This acts directly on the prolabium and exerts elastic pressure by being attached to the cap by elastic bands. Equally good



Fig. 30. Patient Č., No. 43423. Example of lowered premaxilla frequently occurring in bilateral complete cleft.

are saucer-shaped appliances made from plastic enveloping the premaxilla anteriorly and caudally, which make it easier to guide it in the right direction, i.e. backwards and upwards.

In accord with the present universal opinion on the preoperative treatment of the relations between the maxilla and their neighbouring structures, we have also introduced the orthodontic preparation of infants, starting soon after birth. At the age of 4—6 weeks we have a palatine plate made by the method of McNeil, to maintain the lateral segments of the maxillae in a favourable position for the retroposition of the premaxilla, and as soon as the infant gets used to it, we start with applying the repressive devices. On using the combined approach there is no need to fear the pressure from without having an undesirable effect in bringing the lateral segments of the maxillae closer together while pushing the premaxilla backwards. Although one cannot expect rapid or effective retroposition of the premaxilla after the wearing of repressive appliances, the results are, nevertheless encouraging.

We must be careful not to allow the premaxilla to tilt downwards and backwards during this preoperative treatment. This unpleasant consequence of excessive pressure, which is accompanied by an S-shaped bending of the vomer, can also be produced by the pressure of the reconstructed lip within several months of the primary suture.

The above appliances are sometimes used after the operation on the lip as after-treatment and we have found that both infants and older children wear them willingly and gladly.



Fig. 31.



Fig. 32.



Fig. 33.

Fig. 31—33. Patient F., No. 45666. Large greatly protruding premaxilla holding four teeth, recession attained by aid of a repressive band applied before and even after suture of the lip. Check-up photograph at the age of four shows the premaxilla already in line with the alveolar arch and, at the same time, also considerable narrowing of the cleft in the palate after the Schweckendiek operation.

The main factor in the reposition of the protruding premaxilla is played, of course, by the reconstruction of the orbicularis oris. This justifies and even forces us to undertake primary suture of the lip in bilateral total clefts sooner than in unilateral clefts. We are of the opinion that, with the two-stage method,

it is reasonable to operate at time intervals permitting the entire lip to be closed at the age of six months. At this age we need not fear too great a danger for the development of the upper jaw, if we operate very carefully; on the other hand, we can assume that the functioning lip will have a favourable effect not only on maxillary relations, but also as a stimulus to skeletal growth.

DISCUSSION

The question of the protruding premaxilla in bilateral total cleft cannot be simply answered either by saying that surgical retroposition should be undertaken or by regarding this operation as contraindicated. The problem is far more complicated.

There can be no doubt that severing or resection of the vomer or neck of the premaxilla often endangers development of the premaxilla itself and that as a consequence of its atrophy, collapse of the lateral parts of the maxillae occurs, leading to a major disturbance in the formation of the middle level of the face. There are cases, however, of enormously protruding premaxilla in which neither the pressure of the reconstructed lip nor conservative stomato-orthodontic treatment is able to bring the parts of the upper jaw into correct mutual relation. In these cases surgery is unavoidable, but we must assess its indication, select the suitable method with the greatest care and place the operation as late as possible, fully aware of the risks involved. It must be remembered that the damage to the premaxilla may not become fully apparent until many years later so that optimistic conclusions from short-term follow-up do not provide an objective assessment of the gravity of this operation.

We consider that the manner suturing the lip is very important for decreasing the number of cases in which surgical retroposition is necessary. A two-stage operation using perpendicular or almost perpendicular sutures always permit us to close the lip even if the premaxilla was very large and, at the same time, we reconstruct a lip which is more mobile in a horizontal direction than that after operations which employ lateral flaps for supplementing the prolabium.

In view of the danger incident in all known methods of surgical retroposition of the premaxilla, we have recently been carrying out research on the blood supply of the central segment of the maxilla at the instigation of Professor Karfík, and we are attempting to restrict development of protrusion of the premaxilla by palliative operations of the arterial network and, if necessary, by slight disturbance of the growth zone in its neck. The future will show whether surgical retroposition can be avoided in this way.

SUMMARY

A total of 506 patients have been treated for bilateral total cleft at the Prague University Department of Plastic Surgery. In 31 out of 317 cases with marked protrusion of the premaxilla, surgical retroposition was undertaken,

mostly as a secondary operation. In most patients this led to damage to the growth of the premaxilla either alone or together with developmental retardation of the entire maxillae. Marked signs of atrophy often developed many years after the operation, in some cases up to 10—13. We must, therefore, regard surgical retroposition of the premaxilla as a risky procedure which should, as far as possible, be made unnecessary by conservative treatment. We consider osteotomy of the vomer as a primary operation in infants to be harmful without exception.

R É S U M É

Le problème de protrusion de l'os intermaxillaire dans les cas des fentes complètes bilatérales

M. Fára, J. Hrivnáková

Cinq cents six malades avec la fente complète bilatérale ont été soignés à la clinique de chirurgie plastique de Prague. De trois cents dix-sept cas représentants des grandes protrusions de l'os intermaxillaire trente-un ont été soumis à la rétroposition chirurgicale, dans la plupart des cas en intervention secondaire. Sans prendre compte de la méthode dont on s'est servi pour ce but, la plupart des malades a subi des dégâts considérables quand au développement complet de l'os intermaxillaire. Bien souvent les premiers signes respectifs de l'atrophie ont pris place quand s'écoulèrent plusieurs années de l'intervention en question, quelque fois il a fallu de dix à treize ans pour les distinguer. En suite de ces constatations il est absolument nécessaire de considérer la rétroposition chirurgicale de l'os intermaxillaire comme méthode de grand risque que l'on doit éviter en face des possibilités et des résultats respectifs des méthodes conservatives. Quand à l'ostéotomie telle que, pratiquée comme intervention primaire chez le nouveau-né, elle est considérée par les auteurs comme absolument contraindiquée, aboutissant sans exception à des résultats défavorables.

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

Das Problem der Prominenz des Zwischenkiefers bei totalen beiderseitigen Spaltbildungen

M. Fára, J. Hrivnáková

An der Klinik für plastische Chirurgie in Prag wurden insgesamt 506 Patienten mit totaler beiderseitiger Spaltbildung behandelt. Bei 31 von 317 Fällen mit grosser Protrusion des Zwischenkiefers wurde die chirurgische Retroposition durchgeführt, und zwar überwiegend als sekundärer Eingriff. Ungeachtet der Art der angewandten Methode traten bei den meisten Patienten Wachstumsschäden am Zwischenkiefer selbst oder Retardation der Entwicklung des ganzen Oberkiefers auf. Häufig traten ausgeprägte Atrophiezeichen erst mehrere, manchmal sogar erst 10 bis 13 Jahre nach der Operation auf. Die chirurgische Retroposition des Zwischenkiefers muss also als riskanter Eingriff betrachtet werden, der im Rahmen der konservativen Behandlung nach Tunlichkeit zu vermeiden ist. Die Osteotomie des Vomers als primäre Operation bei Säuglingen halten wir für ausnahmslos schädlich.

RESUMEN

El problema de la prominencia intermaxilar en las fisuras bilaterales completas

M. Fára, J. Hrivnáková

En la Clínica de Cirugía Plástica en Praga fueron tratados en total 506 pacientes con fisura bilateral total. En 31 de los 317 casos de grandes protrusis de la porción intermaxilar, fué realizada una retroposición quirúrgica, en su mayoría como una actuación secundaria. Sin tener en cuenta el tipo de método usado, se produjo, en la mayoría de los pacientes, un daño en el crecimiento del mismo intermaxilar ó en el desarrollo retardado de todo el maxilar. A menudo se manifestaron síntomas significativos de atrofia, hasta después de un largo lapso de tiempo siguiente a la operación, algunas veces hasta dentro de 10—13 años. Por eso tenemos que considerar la retroposición quirúrgica del intermaxilar como una actuación arriesgada, la cual debemos rehuir dentro de las posibilidades de un tratamiento conservativo. La osteotomía del vómer como operación primaria en el recién nacido, la consideramos entonces sin excepción, como dañina.

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FISSURA COLLI MEDIALIS



Fig. 8.

FISSURA COLLI MEDIALIS

R. Königová



Fig. 7.

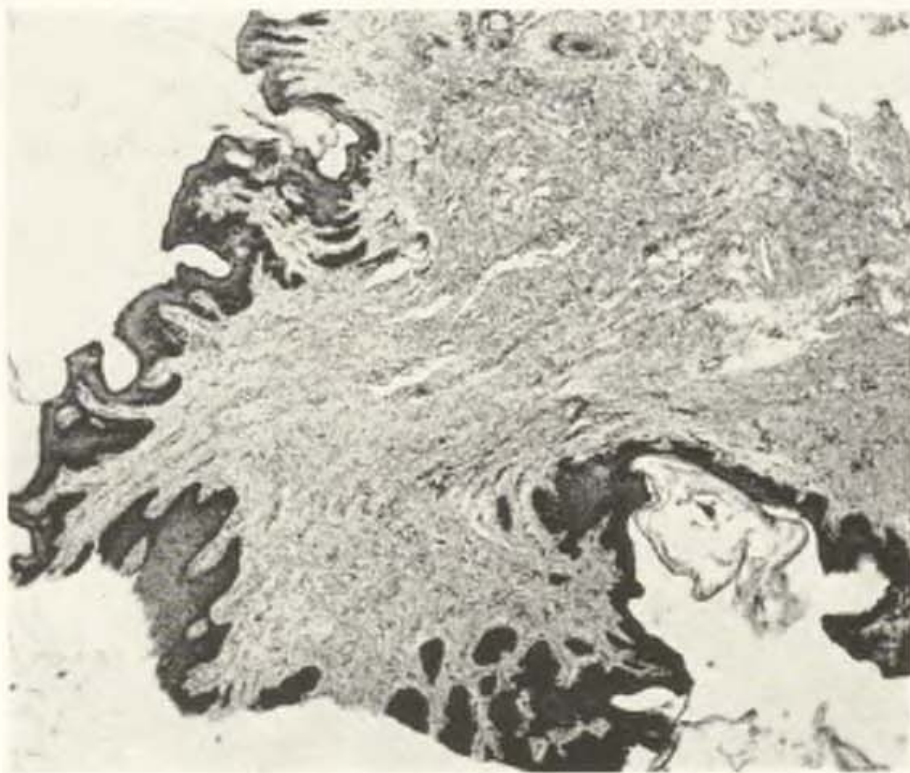


Fig. 8.

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KLIPPEL-FEIL SYNDROME AND CLEFT PALATE

Š. DEMJÉN, V. MARCINKOVÁ

This syndrome was first described by Klippel and Feil in 1912 (7) and was dealt with again in the thesis of Feil in 1919. It is seen but rarely in routine practice. It is not mentioned even in large statistics on cleft palate, such as those of Fogh-Andersen. It is probable that some cases are not diagnosed, mainly because not all the signs are clearly developed.

In early childhood this anomaly may escape observation. Attention is primarily drawn to the obvious anomaly, quite often associated with this syndrome, so that the patient is registered as suffering from a cleft palate, for example, and the Klippel-Feil syndrome only becomes apparent in later development. This is what happened with a patient of ours, a girl who was admitted at the age of two years with the diagnosis of cleft palate. The anaesthetist was not able to carry out intubation so that the operation had to be postponed. When she returned to the Department at the age of four, the signs of the Klippel-Feil syndrome were already quite definite. She was sent to us with the diagnosis of cleft palate and torticollis.

The diagnosis is not difficult if the surgeon keeps the possibility in mind. The syndrome is characterized by the following signs:

- a) The absence of, or the presence of only a short, thick neck,
- b) Restricted movement of the head and neck, mainly on bending the head to one side,
- c) Conspicuously low hair-line on the neck.

This clinical picture is accompanied by typical X-ray changes in the cervical vertebrae. These comprise various malformations of the vertebrae, sometimes also affecting the upper thoracic vertebrae. There may be fusion of some vertebrae or the entire cervical spine may be fused into one solid mass, fusion of the spinal apophyses and irregular deformation of the lateral apophyses. The number of vertebrae may be decreased. The arches are not always joined up and occult spina bifida and hemivertebrae may be present.

In the differential diagnosis, we must consider deformation of the cervical spine after injury, suboccipital Pott's disease and pterygia collis, as for example, in Turner's syndrome. The diagnosis of Klippel-Feil syndrome is made from the X-ray picture of the cervical spine.

ETIOLOGY

Feil himself assumed that the primary lesion was a high spina bifida and that as a result of pressure and injury, fusion occurred and malformation of the cervical spine developed. In this connection he drew attention to intra-uterine trauma, endometritis, irregular segmentation of the spine in the first weeks of intrauterine life, etc. The theories of all authors on the origin of



Fig. 1.

the Klippel-Feil syndrome are in agreement that it arises very early in fetal life. In general, the deformity is the result of dysplastic factors which affect the chondrogenic body of the vertebra.

ASSOCIATED DEFORMITIES

Klippel and Feil reported on patients with the typical syndrome only. Subsequently many associated deformities were reported. Our patient had a cleft palate and defective hearing. Other authors reported congenital deafness, platybasia of the skull, cervical rib, fusion of the ribs, fusion of the scapula with one vertebra, of the Atlas with the occipital bone, fusion of all cervical vertebrae, persistent contractures of the cervical muscles, raised scapulae attached to the cervical spine (Sprengel's syndrome), defects in the shoulder and upper limbs, micrognathism, hydrocephalus, strabismus, pulmonary stenosis, torticollis, asymmetry of the face, scoliosis of the dorsal spine, idiocy and various mental disorders, Recklinghausen's disease, massive spinal apophyses, syringomyelia, oxycephaly, aplasia of bone apophyses, kyphosis, hemivertebrae, etc.

Jarcho and Lewin (6) did not find any changes in the spinal cord at autopsy. Avery and Rentfro(2) found a deep anterior fissure in the upper part of the spinal cord and in the lower part they found two fissures which almost duplicated the spinal canal.

We have only found two detailed reports of the Klippel-Feil syndrome in combination with cleft palate in the accessible literature. Noble and Frawley,



Fig. 5.



Fig. 6.



Fig. 7.

1925 [9] and Fraser and Calnan, 1961 [4] referred to this syndrome only in passing. Gonzales Ulloa and Gonda, 1949 [5], reported one case without any other deformities. Martin and Traube, 1952 [8] reported three cases combined with cleft palate and Cohney, 1963 [3] reported six cases combined with cleft palate.

The observations of Cohney were instructive for us and we shall, therefore, refer to them in more detail, mainly because he followed up and evaluated the longterm effect of the operation on the palate on speech. Of the 6 patients

with cleft palate, only two had normal speech and in the deformation in the cervical vertebrae was minimal. In the other four speech was good at the beginning but deteriorated with time and no improvement could be achieved even by further operations. Examination revealed that the velopharyngeal valve which was tight at the beginning, later showed insufficiency. Cohnsey explained the changes in the quality of speech by changes in the relative



Fig. 8.

position of the functional components of the palatopharyngeal mechanism. He referred to the experimental work of Pruzansky (11, 10) and Ardan, Kemp and Lind (1) who pointed out that palatopharyngeal closure is different in children and adults, depending on the relative position of the hard palate and the posterior pharyngeal wall, together with the corresponding soft tissues and the soft palate

In the normal child the hard and soft palate descend together as a result of vertical growth in the floor of the nose. According to Ardan and Kemp, during normal development, the hard palate descends from the relatively high position in the child, to about the level of the arch of the Atlas in the adult. This is thought to be the result of enlargement of the maxillary antrum. During the same period, the cervical vertebrae grow higher, which changes the position of the posterior pharyngeal wall in relation to the palate.

In cases of the Klippel-Feil syndrome, in which development of the cervical spine is abnormal, it can be assumed that this abnormal development of the posterior pharyngeal wall is the cause of the altered interrelationships between the anatomical components taking part in the speech mechanism. In this

manner, the originally tight velopharyngeal valve becomes insufficient and the good initial speech gradually deteriorates.

C a s e r e p o r t : The patient was admitted on October 27, 1962 with the diagnosis of isolated cleft palate. The baby girl was born on October 1, 1960, the birth weight was 2,300 g., and the pregnancy and delivery were normal. Our records have the following note: isolated cleft palate, short and thick neck, indication of right-sided torticollis. The child is beginning to talk.

The paternal grandmother had a congenital deformity of both wrist joints.

On attempting intubation, the anaesthetist was unable to open the mouth sufficiently to introduce the laryngoscope. The operation was postponed.

The patient was readmitted on September 16, 1964. She was sent with the diagnosis of cleft palate and torticollis. On examination it was found that the child was not yet talking and did not hear well. It was thought that she might be deaf. Otherwise she was alert and intelligent. She had a short, thick neck, with restricted movements and a low hair-line in the neck. The X-ray finding was: Congenital anomaly of the cervical and thoracic spine from C3 to TH4 (clefts, wedge-shaped vertebral bodies, hemivertebrae, synostosis). The accumulation of anomalies and the blocking of an entire section of the spine causes overlapping of the vertebral bodies so that the entire region appears funnel-shaped and shortened and is difficult to assess. As a result of the above changes the left half of the thorax is deformed, the ribs run obliquely downwards and the intercostal spaces are narrowed. The changes described are in keeping with a diagnosis of Klippel-Feil syndrome (Dr. Prunyi).

On September 16, 1964 a Kilner (four-flap) operation was performed on the palate. The patient was discharged home healed on October 21, 1964. She will be followed up in the phoniatic and orthodontic departments and will be given a detailed genetic examination. We shall give a further report of the progress of this case later.

S U M M A R Y

The author reports on a patient now aged four years with the Klippel-Feil syndrome combined with cleft-palate, muteness and deafness. He discusses the clinical signs of the syndrome and the differential diagnosis. He will give a further report on the functional result in this case five years after the operation on the cleft palate.

R É S U M É

Le syndrome de Klippel-Feil et le bec-de-lièvre

Š. Demjén, V. Marcinková

L'auteur décrit un malade âgé de quatre ans souffrant de syndrome de Klippel-Feil associé de la fente du palais; pour compléter, le malade était sourd-muet. Une large discussion de syndrome si bien que du diagnostic différentiel est présentée. L'auteur promet de démontrer le malade cinq ans après l'opération du palais pour prouver les effets fonctionnaires de l'opération préférée.

ZUSAMMENFASSUNG

Klippel-Feil Syndrom und Gaumenspalte

Š. Demjén, V. Marcinková

Die Verfasser berichten über ihre nunmehr 4jährige Patientin, bei der Klippel-Feil-Syndrom in Kombination mit Gaumenspalte und Taubstummheit besteht. Die klinischen Symptome des Klippel-Feil-Syndroms und die Differentialdiagnose werden erörtert. Über das funktionelle Ergebnis der Operation werden die Verfasser nach fünfjähriger postoperativer Beobachtungsdauer referieren.

RESUMEN

El síndrome de Klippel-Feil y la hendidura del paladar

Š. Demjén, V. Marcinková

El autor dá a conocer su experiencia con su paciente, ahora de 4 años de edad, la cual tiene el síndrome de Klippel-Feil, en combinación con la hendidura del paladar y la sordomudez. Analiza los síntomas clínicos de este síndrome, el diagnóstico diferencial, y pasados 5 años después de la operación de la hendidura del paladar, dará a conocer los resultados funcionales de esta operación.

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OXYGEN SATURATION OF SKIN GRAFT AND RECIPIENT ZONE FOR IMPROVING THE TAKE

O. V. DOLNITSKY, N. M. PETRUN, A. R. SHURINOK

Free skin autotransplants often undergo dystrophic and necrobiotic changes complicating their take. This happens on account of nutritional disorders in the tissues of the transplant. The most unfavourable conditions for its survival exist during the first days after transplantation, i.e. when it actually has no vascular nor nervous connection with the organism.

As was shown by our previous investigations (Dolnitsky et Petrun 1962), the metabolism of the transplant is grossly altered after transplantation, particularly its aerobic processes, in connection with oxygen consumption in the skin. Apart from this, the skin graft is also exposed to the unfavourable influence of the external conditions, such as oscillations of temperature, exciccation, and to pathogenic microorganisms and endogenous toxins. Because of the circumstances, under which integration of a skin graft takes place, there is rarely any case in which clinically no signs of dystrophy can be observed.

We distinguish four degrees of dystrophy in a transplant:

The first (or slight) degree is characterized by the change in colour from pallid to slightly cyanotic, and the graft becomes slightly oedematous. The epidermis, however, remains intact over the entire area of the graft. The graft takes well without any complications.

The second (or moderate) degree of dystrophy shows marked cyanosis and oedema, and blisters develop on the graft surface filled with a yellow translucent fluid. In the end this graft, too, takes well.

The third (or severe) degree of dystrophy is characterized by deep cyanosis, severe oedema and desquamation of the epidermis over large areas. The blisters are filled with fluid containing blood. At the sites of the most marked dystrophic changes, foci of deep necrosis develop in the graft.

The fourth (or very severe) degree of dystrophy shows the same changes as the third degree, but more marked, and leads to subtotal or total necrosis of the graft.

Until we shall be able to explain what causes dystrophy of a transplant, we shall not find ways and means of preventing or mitigating it. In surgical

practice the free skin graft is left, after transplantation, without any measures aimed at influencing the process of integration. It is left to the surgeon just to ascertain the final result of transplantation.

These considerations have induced us to set a task of elaborating a method which would counteract the development of trophic disorders in a transplant and thus improve its take. With this in mind (and following the suggestion



Fig. 1. Gas chamber (polyethylene wrapping) into which oxygen is blown for saturating the skin graft and its recipient zone. Patient D., aged 13, with traumatic skin defect in leg.

of Shurinok), we used oxygen saturation of the transplant itself and its recipient zone. The theoretical basis of the employment of oxygen for this purpose was provided by the studies of Zülzer (1904), Shaw et Messer (1931), Zhironkin et Zykina (1948) and Petrun (1952, 1957, 1960) which showed that oxygen was capable of penetrating the normal skin cover of the human organism. Petrun (1962) also proved that the penetration of oxygen through skin can be intensified (from 1—2% in the pulmonary gas volume under normal conditions to 25—30% (provided the partial pressure of oxygen is increased in the atmosphere.

Oxygen penetrates skin directly and also through the efferent ducts of sebaceous and particularly sweat glands. Every sweat gland is surrounded by a dense network of capillaries whose endothelium lies close to its wall. Thus very favourable conditions are created for the exchange of gasses between the blood and the atmosphere.

We were interested in what happened to skin when turned into a transplant; whether oxygen could penetrate it and whether this skin could make use of it for metabolic processes. As was shown by our investigations (Dolnit-

sky et Petrun 1962], tissue respiration proceeds in an isolated skin specimen placed under normal atmospheric conditions and at a temperature of +2 to +4° C for the first 24 hours after operation, but afterwards drops sharply to zero at the end of 48 hours. If, however, the graft received a continuous supply of oxygen, tissue respiration was prolonged to 4×24 hours and afterwards reached zero only at the 5th or 6th day. On the basis of these observations

Tab. 1. Comparable Data on Dystrophy of Skin Grafts in Different Methods of Transplantation

Degree of dystrophy of graft	Method of transplantation	
	With oxygen	Without oxygen
I	2	24
II	14	16
III	8	6
IV	2	—
Total	26	46

we came to the conclusion that a skin graft consumes oxygen from without with a positive effect on its oxidizing processes. Moreover, the graft possesses the capacity of making better use of its own nutrient resources. Thus storage in oxygen preserves viability of a skin graft for a longer period.

One of us (Dolnitsky) elaborated a special method for saturating a skin graft its recipient zone with oxygen. For this the limb must be immobilized after operation in a circular plaster cast into which a window is cut over the site of transplantation. The wound is covered with 2 to 3 layers of gauze soaked in an antibiotic solution and on them a three-forked glass tube is placed, the ends of which hold rubber tubes with openings for the dispersion of oxygen. The whole is then wrapped in a polyethylene chamber: after transplantation on a terminal part of the limb in the shape of a bag, at a more proximal site in the shape of a cuff (Fig. 1). The polyethylene chamber is fixed to the limb by gauze bandages thus creating a semihermetic space under it. After this the patient is taken to the ward where the glass tube is connected to an oxygen supply system. Oxygen flows from a rubber bag under reduced pressure and at a flow speed of 5 l/min. which is regulated by the flowmeter of an anaesthetic apparatus connected too the rubber bag. In order to moisten the gas, oxygen is led through a Bobrov apparatus a third of whose volume has been filled with saline or boiled water.

Oxygen is supplied under the polyethylene wrapping continuously for 7 to 8 days after operation with the exception of the short periods, when the dressings have to be changed. At that time the oxygen supply system is disconnected at the forked glass tube and the patient is taken to the dressing room. After dressing the patient is brought back to the ward and the glass

tube is again connected to the oxygen supply system. The staff is instructed as to the observation of safety measures required during this treatment. After 7 to 8 days the supply of oxygen is slowed down and after that cut off completely.

Oxygen, which fills the space under the polyethylene wrapping, saturates the entire recipient zone and thus also the skin graft. It escapes from under



Fig. 2. Same patient with granulating wound in leg prior to operation.

the plaster cast and the polyethylene wrapping where it has been fastened to the plaster. In the oxygen chamber there is a constant microclimate with a temperature oscillating between 27 and 30° C, humidity between 80 and 90%, oxygen concentration between 60 and 70% and that of carbon dioxide up to 0.1%.

We have used oxygen after free skin grafting in 60 children with various conditions; 46 had suffered from scar deformations after burns, 14 had had granulating or fresh wounds.

Change of dressings and, on this occasion, check-up of take of the transplant was carried out on the first, third, seventh and tenth day after operation. We observed that moisture accumulated in the polyethylene chamber and condensed in the form of drops on its walls soaking the gauze pads over the transplant. The gauze pads, therefore, did not stick to the graft as with other methods of treatment, and could easily be removed at each dressing. The constantly moist dressings also improved drainage of the wound and that is why we did not observe formation of a haematoma under the graft in a single case. In wounds treated by the usual methods, the perforation holes in the skin grafts soon lose their function of draining the bed, because the dry gauze gets stuck to them and they also get blocked by plugs of dried wound discharge.

Tab. 1 gives the evaluation of results of the above 46 cases as compared to a group of 26 children with scar deformations after burns who were treated by free skin grafting without the employment of oxygen. It can be seen that where oxygen was not used, the majority of grafts underwent dystrophic changes of the second, third, and fourth degree while most oxygen saturated transplants took, showing dystrophic changes of the first degree only.



Fig. 3. Same leg 24 days after application of full-thickness skin grafts using method of oxygen saturation. The transplants have taken completely showing but very slight dystrophic changes.

We believe that the creation of a suitable microclimate has a favourable effect not only on the transplant, but also on the entire recipient zone. Tissue hypoxia and, connected with it, traumatic oedema were much less in the cases treated with oxygen saturation than in those without. The adequate saturation with oxygen of the recipient zone was borne out by the bright red colour of blood on the gauze pads during dressings. The patients themselves noticed the analgetic effect of oxygen.

The clinical results obtained from the employment of oxygen for saturating the recipient zone of a skin graft prove that this method is capable of improving the take of a skin transplant. Oxygen saturation of a skin graft brings about better results from skin transplantation (Fig. 2 and 3).

SUMMARY

In the process of taking a skin graft usually undergoes dystrophic changes owing to nutritional disorders in its tissues. Until it has been adequately revascularized, it lives under conditions of hypoxia which affects its aerobic metabolism. Investigations of tissue respiration in skin placed in a normal

atmosphere or in an atmosphere constantly saturated with oxygen showed a more intensive and longer lasting metabolism in the specimens saturated with oxygen.

In order to improve the take of a skin graft, a method of saturating the graft as well as the recipient zone with oxygen has been elaborated and used. Moistened oxygen was run from a rubber bag with a flow of 5 l./min. under polyethylene wrapped around the graft and its recipient zone. Thus a semi-hermetic gas chamber was created with the temperature of the gas kept between 27 and 30° C, the relative humidity between 80 and 90% and the oxygen concentration between 60 and 70%. Clinical observations bear witness to an improved take of the graft. The number and degree of dystrophic changes and the signs of hypoxia in the recipient zone decreased.

RÉSUMÉ

La méthode de l'oxydation du transplant de la peau si bien que de son lit, ayant pour but l'accélération de sa prise

O. V. Dolnickij, N. M. Petrun, A. P. Chourinok

Le transplant libre de la peau est soumis, au cours de sa prise, aux changements dystrophiques faute de son alimentation manquée. Aussi longtemps que la révascularisation suffisante n'aie pris place, le transplant se trouve en état de l'hypoxémie, cause de l'endommagement des procès métaboliques respectifs du transplant en question. Les examens touchant la respiration du transplant libre de la peau dans un milieu gazeux normal en comparaison avec celui enrichi de l'oxygène ont montré des changements métaboliques beaucoup plus exprimés si bien qu'à la durée prolongée chez le transplant du milieu enrichi quand à l'oxygène.

Ayant pour l'accélération de la prise du transplant une méthode fut inventée, qui enrichissait par l'oxygène le lambeau de la peau par glissement si bien que son lit. La méthode consiste en transmission de l'oxygène humide dans un sac en polyéthylène sous la vitesse de 5 l/hr, le sac comportant et le transplant et son lit. Le sac forme une sorte de chambre hermétique à température de 27—30°, à l'humidité de 80—90%, le pourcentage de l'oxygène représentant de 60—70 %. Quand à la clinique, la prise du transplant était évidemment accélérée. Le degré si bien que la qualité des changements dystrophiques de même que les signes de l'hypoxémie de la zone opérée ont été considérablement influencés.

ZUSAMMENFASSUNG

Die Methodik der Sauerstoffsättigung des Hauttransplantats sowie der Transplantationszone zwecks besseren Anheilens

O. V. Dolnickij, N. M. Pjetrun, A. R. Schurinok

Das freie Hauttransplantat unterliegt während des Anheilens gewöhnlich dystrophischen Veränderungen, die durch eine Ernährungsstörung seiner Gewebe bedingt sind. Bevor eine hinreichende Revaskularisation erfolgt, befindet sich das Hauttransplantat in ständiger Hypoxie, wodurch die aeroben Stoffwechselprozesse gestört sind. Die Untersuchung der Gewebeatmung von Haut, die sich im üblichen Gasmilieu befindet, sowie von Haut, die konstant mit Sauerstoff gesättigt wird, zeigte einen intensiveren und länger anhaltenden Stoffwechsel im sauerstoffgesättigten Transplantat.

Zur Förderung des Anheilens des Transplantats wurde eine Methodik der Sauerstoffsättigung des Hautlappens sowie seines Implantationsgebietes ausgearbeitet und angewendet. Angefeuchteter Sauerstoff wurde aus einem Ballon (Strömungsgeschwindigkeit 5 Liter/Minute) in eine Polyäthylenkammer eingeführt, die das Transplantat und seine Implantierungszone umgab. In der Kammer bestand ein semihermetisches Milieu mit einer Lufttemperatur von 27 bis 30° C, einer relativen Feuchtigkeit von 80 bis 90% und einem Sauerstoffgehalt von 60 bis 70%. Die klinischen Beobachtungen sprachen für ein besseres Anheilen des Transplantats. Umfang und Grad der dystrophischen Veränderungen sowie Zeichen der Hypoxie im Operationsgebiet nahmen deutlich ab.

RESUMEN

La saturación con oxígeno del injerto de piel y la zona de recepción para su realización

O. V. Dolnickij, N. M. Petrun, A. P. Shurinok

En el proceso de su realización, un injerto de piel tiene que soportar los cambios distróficos causados por los desórdenes nutricionales en sus tejidos. Mientras no ha sido adecuadamente vascularizado, vive bajo condiciones de hipoxia, la cual afecta su metabolismo aeróbico. Las investigaciones de la respiración tisular en la piel situada en una atmósfera normal ó en una atmósfera saturada constantemente con oxígeno, mostraron un metabolismo intensivo y de mayor duración en los espécimes saturados con oxígeno.

Para la realización de un injerto de piel se ha usado como método, uno elaborado por los autores que consiste en la saturación del injerto así como de la zona de recepción, los dos con oxígeno. El oxígeno humedecido fué aplicado por medio de un saco de goma con un fluído de 5 l./min., bajo polietileno entizado alrededor del injerto y de su zona receptora. Así fué creada una cámara de gas semihermética, con el gas mantenido a una temperatura entre 27 y 30 grados centígrados, la humedad relativa entre 80 y 90%, y la concentración de oxígeno entre 60 y 70%. Las observaciones clínicas sirven de testigo para la realización del injerto. El número y el grado de los cambios distróficos y las señales de hipoxia en la zona de recepción disminuyeron.

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THE DISORDER IN IRON METABOLISM DEVELOPING IN BURNS DISEASE

J. NOVÁK, I. BERNÁT, G. DÓZSÁN, E. SÁNDOR

Anaemia nearly always develops in the course of burns disease. It is resistant to drug therapy (folic acid, vitamine B₁₂, etc.) and can only be influenced temporarily and slightly by blood transfusion. This „burns anaemia“ only improves after healing has taken place; but even after anatomical healing, the patient may remain anaemic for a number of months.

There can be no doubt that the destruction of red cells taking place in association with the trauma (1,2) or the shorter life-span of the red cells which have been impaired by the effect of heat (3, 4), play some part in the origin of the anaemia. A toxic factor has been demonstrated in the plasma in animal experiments (7). Some authors are of the opinion that the „toxic“ (or septicotoxic) impairment of the bone marrow may also play a part in the pathogenesis of secondary anaemia (8). Others mention hypoproteinaemia as well (6).

The red cell count plays such an important role when indicating operation in patients with burns that some authors include a low cell count among the contraindications of autoplasty (Frank 10). However, in patients suffering from extensive burns, autoplasty is essential before healing can occur. Moreover, the various homoio- and heteroplastic procedures do not always lead to the final or sometimes even temporary improvement of the anaemia.

In other cases the strictly anatomical healing is not immediately followed by the normalization of the blood picture, showing that the anaemia is primarily a haemopoietic disorder.

No exact data are available at present on the detailed pathogenesis of burns anaemia. It seems certain, however, that a disorder in haemoglobin synthesis plays some part in the cause of the anaemia (James et al. 6).

We have, therefore, started a series of investigations to throw light on the pathomechanism of haemoglobin production arising in burns disease. The present paper reports the first step in the clinical study.

It is well-known that the haemoglobin molecule consists of protoporphyrin III, iron and globin. There is sufficient globin available for haemoglobin formation even in hypoproteinaemic conditions. However, disturbances in haemoglobin formation can occur if there is insufficient iron, if there is failure

to synthesise a sufficient amount of protoporphyrin or if some disturbance in the combination of these two components is present.

In the present work an investigation was made of the changes in iron metabolism using biochemical methods. The iron concentration of the serum was determined by the method of Bothwell and Mallett. The normal mean values in males were 117, in females 104 micrograms/100 ml. Extreme values

Fig. 1. Distribution of the cases included in the paper

Severity	Number of patient	
	number	%
Mild*)	82	77
Medium	14	13
Severe	11	10
Total	107	100

*) 2 patient with electric shock are included here

were 92—140 and 87—132 micrograms/100 ml. respectively. Ringelmann's method was employed for the determination of the iron binding capacity. The normal mean value was 196 micrograms/100 ml. The extreme values amounted to 258 and 322 micrograms/100 ml. respectively. The saturation coefficient was calculated from the following formula:

$$SC = \frac{\text{Se iron level}}{\text{Full iron binding capacity}} \times 100$$

where SC = saturation coefficient and Se = serum.

Values below 28 and above 42 are pathological.

Iron metabolism investigations were carried out on a total of 107 patients after burns injury. The values found in 25 healthy subjects served as controls. The iron level in the serum was determined in 196 cases and the total capacity (and thus also the saturation coefficient) in 169 cases. The distribution of the patients is shown in Tab. 1 and Fig. 1.

The investigations showed that the changes in iron metabolism developing as a consequence of burns injury are not dependent on sex; such data, therefore are not given.

In summarizing the results it can be said that disturbances in iron metabolism developed in all three classic categories of burns injuries (slight, medium, severe) and in a significant proportion of the cases (Fig. 2). The value of the saturation coefficient was lower than normal in most cases, in some it was decreased to 10—11. It was normal in a few cases and in some pathologically high. *There was no definite connection between the degree of metabolic disturbance and the severity of the trauma.*

Some of the 120 examinations made in patients with slight injury, were made after healing. This increased the number of normal values, but the proportion of pathological results (80 out of 120 examinations) was significant even so.

In some cases the result deviated from the normal even after a banal injury. A few cases are given as examples:

Extent and degree of injury	Se Fe	Saturation coefficient
14% I., 1% II. degree	45	14
3% II. „	80	24
6% II. „	65	20
1% II. „	80	22
1% II. „	55	16

The low value of the saturation coefficient arises from a fall in the iron level of the serum, the total iron binding capacity generally decreases later than the former and to a smaller extent and attains the normal value earlier. That is why the low value of the saturation coefficient is most marked in the later stage, after 25 days. This is well illustrated in Fig. 3. where the difference between the number of all investigations and that of the investigation showing a low saturation coefficient, is greater before the twenty-fifth day than at

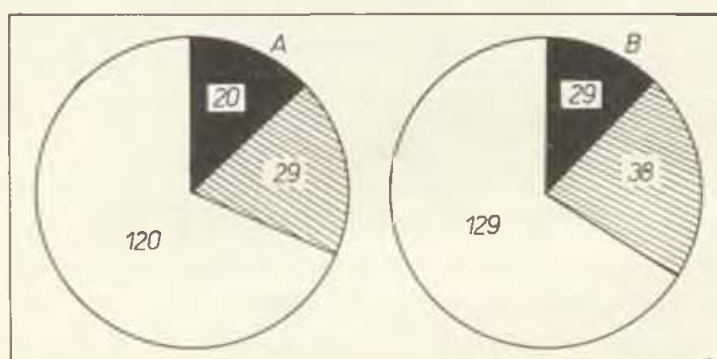


Fig. 1. A — Distribution of investigations of saturation coefficient according to severity of damage; B — distribution of serum iron examinations according to severity of damage; ■ severe burn, ▨ medium severity, burn, □ mild burn.

a later stage. At the same time, the saturation coefficient and the curves showing the values of the serum iron level, are practically parallel from the third day onwards. The simultaneous decrease in the serum iron level and the iron binding capacity can be considered to be *one of the characteristics of burns disease*. The simultaneous reduction of both values has only been observed in a few diseases in human pathology, e.g. malignant neoplasms, leukoses, Hodgkin's disease and infectious diseases.

It is a question whether the disturbance in iron metabolism developing during burns disease, or more exactly in consequence of burns injury, is the result of „toxaemia“ or infection. *That the laboratory values show differences at such an early stage, some time before the septic stage,* is evidence against the septic component. In patients with burns of medium severity and in severe burns, half (5 out of 9) of the examinations carried out within 48 hours of the

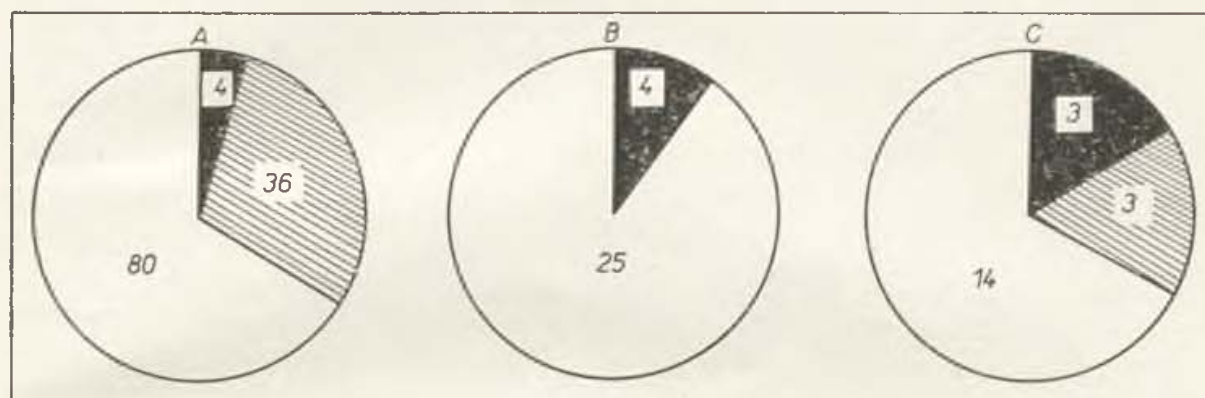


Fig. 2. Distribution of saturation coefficient values in injuries of different severity (irrespective of time elapsed from injury); A — mild burns, B — medium severe burns, C — severe burns, — normal values, — low values, — high values.

injury already showed low serum iron levels. The examinations made after 3 days, however, also in 9 cases, all yielded pathological results (Fig. 4). The disturbance in iron metabolism observed in mild second degree burns is also evidence against the pathogenetic significance of infection (examples illustrating this were given above). In view of these findings, it is improbable that infection is the main pathogenetic factor. However, the possibility that it plays some part in the *maintenance* of the disturbance in iron metabolism cannot be ruled out.

The role of toxic impairment could not be excluded on the basis of the above investigations. The pathological values obtained within 48 hours of the injury were against it to some extent; the preponderance of pathological values observed between the third and eighth days, i.e. in the toxaemic stage, however, support it. Investigations carried out between the third and eighth days in 9 cases of medium severe and severe burns, all showed pathological serum iron levels. Such levels were found in 21 out of 27 cases with mild injuries. The ratio is similar in the investigations carried out at a later stage, being 32 out of 35 in severe and medium severe burns and 10 out of 13 in mild burns. The second figure can be accounted for by a deterioration in iron metabolism. At this stage one can no longer speak about eliciting factors, but only at most of sustaining factors and in this sense infection may and must also be taken into consideration.

There can be no doubt, however, that stress seems to be the most probable factor in pathogenesis. The pathological results obtained in cases with mild

injuries and the pathological values appearing on an average two hours after injury (6 out of 14) are in favour of this (among the 14 who were examined most had mild injuries). In mild cases of the first and second degree of severity, the wound surface averaged 7% of the body surface and measured about 1100 cm.² The afferent fibres going from this area to the brain carry sufficient stimuli to evoke stress even if relatively mild. Finally, the fact that

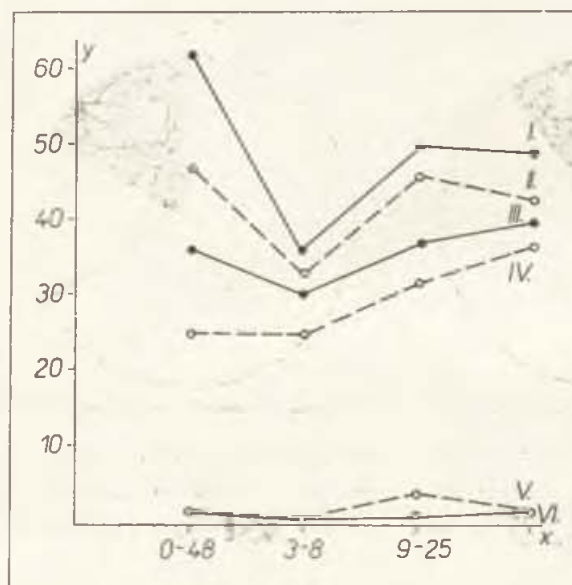


Fig. 3.

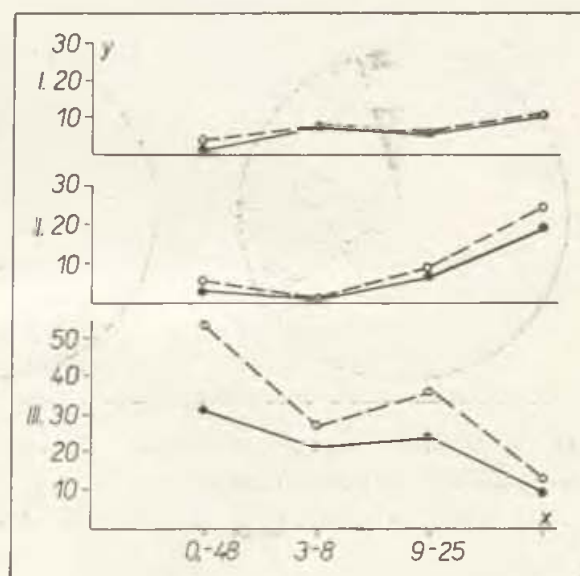


Fig. 4.

Fig. 3. Comparison of development of Se iron and saturation coefficient in miscellaneous cases, depending on time; I — Se iron examinations, II — SC examinations, III — low Se iron values, IV — low SC iron values, V — high SC and Se iron, VI — values respectively; *y*: number of examinations, *x*: time of examination counted from day of injury. — Fig. 4. Change in Se iron values in course of disease in dependence on severity of burn damage; I — severe, II medium severe, III mild; *y*: number of examinations, *x*: time of examination counted from day of injury; — — — — low Se iron values, ————— all examinations.

similar biochemical changes ensue in experimental stress (ACTH, adrenaline, several mechanical and other stress effects), supports our opinion.

In our opinion, the disorder in iron metabolism is caused primarily by the role of stress supported probably by toxic factors. In the maintenance of already developed disturbances in haemoglobin synthesis, infection must also be taken into consideration.

The investigations reported in the present paper were intended to clarify the fact as well as the dynamics of the pathogenesis of the disturbance in iron metabolism. The results point to the disturbance in iron metabolism as the main pathological mechanism in the development of burns anaemia. We shall report our investigations on changes in the absorption of iron, its distribution within the body and its incorporation, in later papers.

SUMMARY

Authors investigated the pathological mechanism of burns anaemia. They determined the serum iron level and total serum binding capacity in 107 patients with burns of different degrees of severity. The results demonstrated a severe disturbance in iron metabolism. It is conjectured that the main role in causation is played by stress with the participation of toxic impairment.

RÉSUMÉ

Les changements dans le métabolisme du fer dans la maladie des grands brûlés

J. Novák, I. Bernát, G. Dózsán, E. Sándor

Les auteurs ont suivi le mécanisme du développement de la soit-dite "anémie des brûlés". Ils se sont rendu compte de la quantité du fer dans le sérum des brûlés si bien que de ses relations chez 10 des malades atteints de différent degrés de brûlure. Les résultats de ses examens ont montré des considérables dégâts considérables touchant le métabolisme du fer des grands brûlés. Les auteurs défendent leur théorie de rôle important de la toxaémie en suite du choc dans la pathogénèse des endommagements respectifs du métabolisme du fer.

ZUSAMMENFASSUNG

Störung des Eisenumsatzes bei der Verbrennungskrankheit

J. Novák, I. Bernát, G. Dózsán, E. Sándor

Die Verfasser studierten den Pathomechanismus der Anämie bei Verbrennungen. Es wurde der Plasmaeisenspiegel und die totale eisenbindende Kapazität des Serums bei 107 Personen mit Verbrennungen verschiedenen Grades untersucht. Die Ergebnisse wiesen auf eine schwere Störung des Eisenumsatzes hin. Die Verfasser nehmen an, dass an der Pathogenese der Anämie ausser Stress auch toxische Einflüsse beteiligt sind.

RESUMEN

Los desórdenes del metabolismo del hierro desarrollados en la enfermedad de la quemadura

J. Novák, I. Bernát, G. Dózsán, E. Sándor

Los autores investigaron el mecanismo patológico de la anemia en la quemadura. Determinaron el nivel del hierro en el suero y la capacidad total de unión del suero en 107 personas con accidentes de quemaduras de diferentes intensidades. Los resultados demostraron el desorden agudo del metabolismo del hierro. Suponen que en la patogénesis, además del "stress", el empeoramiento tóxico juega también algún papel.

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ANNOUNCEMENTS

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of the

Tenth Congress of the Pan-Pacific Surgical Association:

Part I — September 20—28, 1966

in

Honolulu, Hawaii

Second Mobile Educational Seminar:

Part II — September 28—October 10, 1966

in

Japan and Hong Kong

Part III — September 28—November 1, 1966

in

Japan, Hong Kong, The Philippines, Thailand, India,
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The Board of Trustees of the Pan-Pacific Surgical Association is pleased to announce the dates of the Tenth Congress of the Association and the Second Mobile Educational Seminar to countries bordering on the Pacific basin.

Part I, the Honolulu portion of the Congress, will convene at the Princess Kaiulani Hotel in Honolulu, Hawaii, on September 20, 1966 and continue through September 28. Part II and Part III will depart from Hawaii on September 28 and travel to Japan and Hong Kong, with Part II returning to San Francisco, California, on October 10 in time for the opening of the American College of Surgeons, and Part III continuing on to the Philippines, Thailand, India, Singapore, Australia and New Zealand, returning to Hawaii on November 1, 1966.

The Tenth Congress offers an extensive scientific program presented by more than 300 leading surgeons from all parts of the world in nine different surgical specialties and related specialties: General Surgery, Ophthalmology, Otolaryngology, Thoracic Cardiovascular Surgery, Neurosurgery, Obstetrics and Gynecology, Orthopedic, Plastic Surgery, Urology, Anesthesiology and Radiology. We extend this invitation to all physicians to attend and participate in these meetings.

For further information, please, write: Pan-Pacific Surgical Association, Room 236, Alexander Young Building, Honolulu, Hawaii 96813.

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Original papers on all aspects of plastic surgery can be accepted for publication in *Acta chirurgiae plasticae* in Russian, English, German, French and Spanish. Two clearly legible copies of the manuscript are required. Each article must be preceded with an adequate resumé in at least three copies. The heading should include the name of the institution at which the work dealt with has been carried out, i.e. name of institution, name of the head of the institution with full academic title, in the case of a university clinic the name and place of the university. References should be listed in the internationally accepted manner. Illustrations: photographic documentation — black and white, not retouched, glossy. Drawings and graphs must be clear and suitable for reproduction. In the case of all illustrations a vertical arrangement is welcome. Illustrations must be clearly marked, with the lower edge indicated on the reverse side. Similarly the annotation of photographs and graphs on the reverse side must include their number and the author's name together with the title of the article. The proper position of each illustration should be clearly indicated in the manuscript so that it may be correctly placed in the text. The editorial board relies on authors to limit their articles to a reasonable length.

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Zwecks Publikation in der Zeitschrift *Acta chirurgiae plasticae* werden Originalarbeiten, die sämtliche Probleme der plastischen Chirurgie betreffen, in russischer, englischer, deutscher, französischer und spanischer Sprache angenommen und in den angeführten Sprachen publiziert. Die Arbeiten müssen in 2, gut leserlichen Exemplaren, angefertigt sein. Jeder Artikel muss ein genügend langes Resumé, wenigstens in 3 Exemplaren enthalten. In dem Titel ist der Arbeitsplatz, dem die Arbeit entstammt, d. i. der Leiter des Arbeitsplatzes mit vollem akademischen Titel, und soweit es sich um eine Universitätsklinik handelt, ebenfalls deren Sitz und Bezeichnung anzuführen. Literaturangaben sind nach den internationalen Gebräuchen anzuführen. Bildbeilagen: photographische Dokumentation schwarz-weiß, unretouchiert, auf Glanzpapier. Zeichnungen und Graphen sollen klar und reproduktionsfähig sein. Bei allen Bildbeilagen ist eine vertikale Anordnung erwünscht. Die Bezeichnung der Bilder muss deutlich, der Unterrand auf der Rückseite bezeichnet sein. Die Bezeichnung der Photographien und der Graphen muss auf der Rückseite ebenfalls eine Ordnungsnummer, Namen des Autors und Titel der Arbeit enthalten. In der Handschrift muss annähernd die Stelle bezeichnet sein, wohin die Abbildung logisch gehört, um sie im Text richtig einordnen zu können. Die Redaktion erwartet, dass sich die Autoren mit Ihren Beiträgen auf einen entsprechenden Umfang beschränken werden.

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Pour la publication dans la revue *Acta chirurgiae plasticae* seront acceptées les oeuvres originales concernant tous les problèmes de la chirurgie plastique en langues russe, anglaise, allemande, française et espagnole et seront publiées dans ces langues. Les oeuvres doivent être rédigées en 2 exemplaires très lisibles. Chaque article doit contenir un résumé suffisamment long, au moins en trois exemplaires. Dans l'en-texte doit être indiqué le lieu de travail duquel l'ouvrage provient, c'est-à dire le titre du lieu du travail, le nom du travail dirigeant avec les titres académiques en entier. Dans le cas où il s'agit d'une clinique universitaire, le nom et le siège de l'université doivent être également indiqués. La littérature doit être intitulée d'après les usages internationaux. Annexes illustrées: documentation à photographies noir sur blanc, non retouchées, brillantes. Les dessins et graphiques doivent être clairs et aptes à la reproduction. Pour toutes annexes illustrées le rendement vertical est recommandé. La description des illustrations doit être bien distincte, la limite inférieure doit être marquée au verso. De même la descriptions des photographies et graphiques au verso doit contenir le numéro d'ordre et le nom de l'auteur avec le titre de l'article. Dans le manuscrit doit être indiqué d'une façon très visible l'endroit où la reproduction doit figurer, afin qu'il soit possible de la placer exactement dans le texte. La rédaction serait reconnaissante aux auteurs de limiter leurs contributions à une longueur normale.

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