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Head Prof. O. M. Avilova

RECONSTRUCTIVE OPERATIONS OF COMBINED LARYNGEAL AND TRACHEAL DISORDERS

O. M. Avilova, M. M. Baghirov

Treatment of combined laryngeal and tracheal tumours and cicatricial strictures is dealt with in number of papers. Endoscopic or external resection of tumours (Grig 1960, McCafferty et al. 1964) resection and plastic reconstruction using auto- or homografts (Chitrov 1954, Gebauer 1950, Cantrell and Folse 1961, Zehm 1977, Biller and Lawson 1981), mechanical dilatation of stenosed segments (Kvashin 1973, Frederichson et al. 1969, Samaan 1970, Courand et al. 1980) are recommended.

The above mentioned operative techniques have a lot of disadvantages: 1) recurrence of endoscopically removed tumours is frequent, 2) mechanical dilatation of strictures is ineffective, 3) reconstructions of the trachea and larynx by means of auto- and homografts require many operative stages, 4) vessels adjacent to grafts are eroded, 5) grafts fall off, 6) in the reconstructed segments new strictures develop.

For these operative technique should satisfy the following requirements: 1) free laryngeal and tracheal airways should be reconstructed in one stage, 2) in case of a cicatricial stricture of the upper segment of the trachea (i.e., above the level of tracheostomy) the function of the vocal cords has to be reconstructed, 3) the draining function of the airways has to be maintained, 4) the operative results should improve.

METHODS

38 patients suffering from cicatricial stenoses (16), tumours (19) and traumatic injuries of the trachea and larynx (3) were treated. 31 of them were adults, 7 children, 16 females and 22 males.

In all of patients cicatricial stenosis of the trachea and larynx was caused by previous tracheostomy performed for the following reasons: traumatic injuries of the laryngeal nerves (5), laryngotracheitis (5) foreign body (5) prolonged assisted ventilation owing to the tetanus (1). The average time of the tracheostomy tube in position was 4.6 years, the upper limit was 14 years.

In 7 of 16 patients repeated attempts to reconstruct the tracheal and laryngeal airways preceded, unsuccessful, however, because of recurrence of the strictures. In 12 patients the course of the illness was complicated by chronic pneumonia (in 4 of them abscesses developed) and in 4 patients by frequent recurrences of bronchitis.

19 patients suffered from tumours. The average time between the ocurrence of the first symptoms and hospitalization for the surgical treatment was 9 months in case of malignant and 3 years in case of benign tumours. Previously (i.e., 1, 5, 8 and 16 years ago) the patients underwent strumectomy.

3 patients were admitted shortly (within hours) after traumatic injuries of the larynx and trachea.

All patients were examined according to a scheme based on the cause and degree of the airway stricture as well as on their general conditions.

5 patients were operated on urgently. Therefore, only the most necessary examinations were performed — i.e., biochemical analysis of the blood, blood cell counts and acid-base balance. X rays of the chest were taken and tracheoscopy done at the operating theatre.

In the other 33 patients the clinical examination were performed according to the scheme. In addition to clinical and laboratory examinations a complex X ray techniques (roentgenoscopy and roentgenography of the chest, tomography at different axes) and other special techniques (laryngoscopy, tracheobronchoscopy, tracheography, functional respiratory tests, etc.) were used.

Tomography and laryngoscopy were considered to be the basic diagnostic methods in patients with tumours, contrast X rays were used to diagnose the degree and extent of cicatricial stenosis.

RESULTS AND DISCUSSION

3 patients with injuries of the trachea were admitted in asphyctic condition. At the region of larynx and trachea they had wounds from which air and blood were leaving. There was a heavy emphysema of the neck, chest and face and gurgling breathing. Simultaneously with anti-shock measures a decompression was performed and a tracheostomy tube was introduced. A lot of blood was suck from the airways through the wound. Reconstruction of the injured organs was started immediately.

In 10 out of 19 patients suffering from tumours, tumours could be palpated in the neck region and seen on lateral X rays in the tracheal lumen.

Special diagnostic methods used for tracheal tumours revealed that in 15 patients the tumours had been localized within the trachea and had spread to the larynx (in 8 patients tumours of the thyroid gland had been concerned), in 4 patients the tumour had originated in the thyroid gland and had grown into the tracheal wall. In 11 cases the tumour grew endoperitracheally, in 4 patients peritracheally. The damage ranged from 2 to 7 tracheal rings and also the cricoid cartilage was affected. Histologically, the following types of tumours were found: adenoma (6), adenocarcinoma (5), small cell carcinoma (5), squamous cell carcinoma (2), polyposis (1). Tracheal stricture

of the 2nd degree was diagnosed in 4, that of the 3rd degree in 10 and that of the 4th degree in 5 patients.

In 8 out of 16 patients suffering from cicatricial damage of the trachea and larynx the tracheal lumen above the tracheostomy level in the cricoid cartilage region was obliterated, and in the other 8 patients the lumen was narrowed. Moreover, also the tracheal lumen bellow the tracheostomy level — up to the middle third of the thoracic portion — was stenosed. 3 patients had also a broad defect of the anterior wall of the larynx and of the cervical portion of the trachea, 2 patients had defect of the oesophagus. In 1 patient oesophageal stenosis and oesophagotracheal fistula were diagnosed.

Reconstructive operations were performed in 35 out of 38 patients. Oesophageal plasty (i.e., closing of the oesophageal wall in 2 patients, removing of the oesophagotracheal fistula in 2 patients) preceded the radical reconstruction of the airways in 4 patients, and in 1 patient the surgical treatment started by resecting a pulmonal lobe with a gangrenous abscess. In 2 patients

Table 1. Characteristics of reconstructive operations

Type of resection and reconstruction	Number of operations	Mortality (no. of patients)
Circular resection of the trachea:		
plasty of the anterior semicircumference of the anastomosis using a cutaneous flap	2	
resection of 1/2 of the arcus and part of the lamina of the cricoid cartilage, tracheocricoid anastomosis	9	—
resection of the arcus and part of the lamina of the cricoid cartilage, tracheocricoid-thyreoideal anastomosis	2	—
resection of the part of the cricoid and thyroid cartilage, tracheo-cricoid-thyreoideal anastomosis	1	—
hemilaryngectomy up to the level of the vocal cords with preservation of the part of the cricoid cartilage lamina, tracheo-cricoid-thareoideal anastomosis	6	—
oval resection of the lateral and anterior walls of the cricoid and parts of the thyroid cartilage, polycyclic tracheo-laryngeal anastomosis	6	1
partial longitudinal laryngotomy, circular flap tracheolaryngeal anastomosis	2	—
resection of the arcus and part of the lamina of the cricoid cartilage, laryngotomy, circular-flap tracheolaryngeal anastomosis	6	—
resection of the anterior semicircumference of the larynx, plasty of the defect using insertion of the tracheal flap	1	—
Laryngotracheotomy		
plasty using flap advancement	1	—
secondary corrective operations	9	1
Suturing of tracheal and laryngeal wounds	3	—
Total	48	2

a pulmonal abscess and empyema pleurae were treated in a conservative way. The results of the operative as well as conservative treatment were satisfactory.

48 plastic reconstructions of the trachea and larynx were performed (see table and Fig. 1).

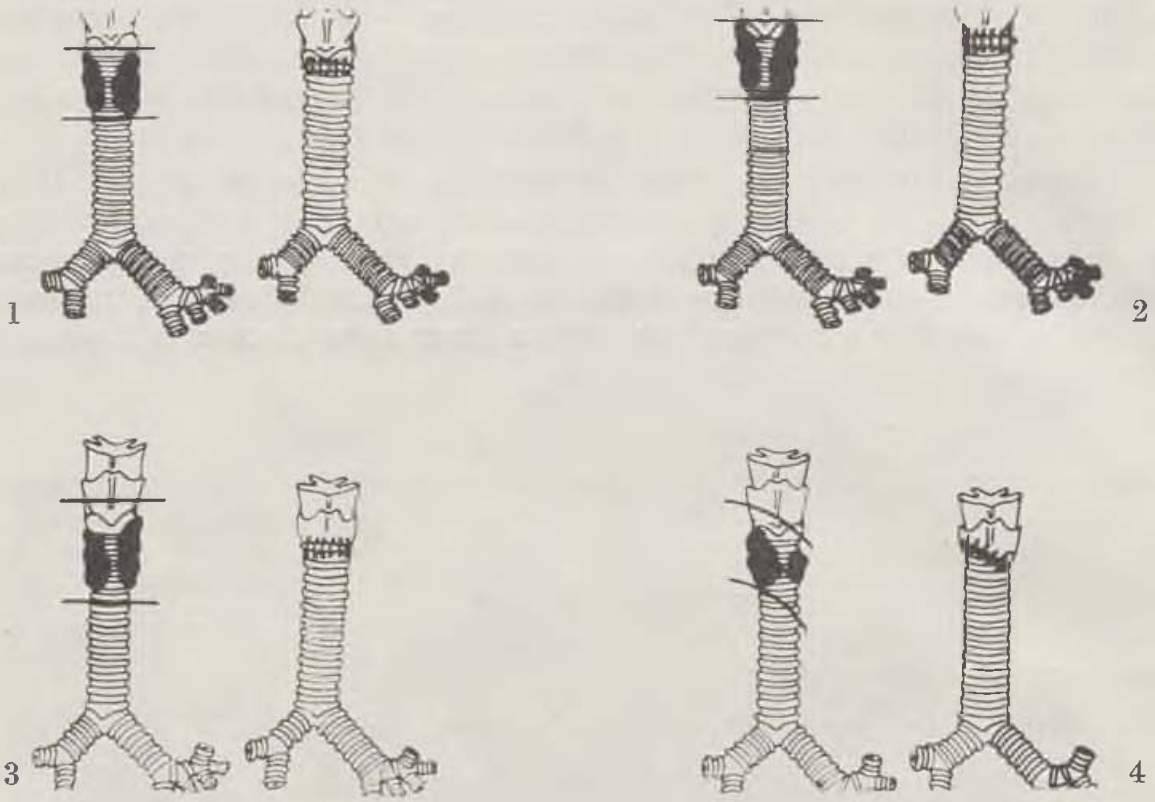

Fig. 1. Different variants of the tracheolaryngeal plasty. 1 — circular resection of the trachea, one half of the cricoid cartilage circumference, tracheocricoidal anastomosis; 2 — circular resection of the trachea and cricoid cartilage, tracheothyroidal anastomosis; 3 — circular resection of the trachea, cricoid cartilage and thyroid cartilage, trcheothyroidal anastomosis; 4 — resection of the trachea and oval or resection of parts of the cricoid and thyroid cartilages, tracheo-cricoid-thyroideal anastomosis

The operative technique was chosen with regard to the extent of the pathological process and to the planned resection of the trachea. In 27 operations cervicotomy and in 21 operations cervicosternotomy was used.

2 patients had already underwent 9 reconstructive operations following a circular resection of the trachea. However, developing laryngeal stricture and recurrent stenosis of the trachea required the combined surgical correction.

We have elaborated a new operative technique (Fig. 2) for tumours affecting the trachea and larynx (Author's certificate No. 651792).

The trachea and larynx are mobilized within the healthy tissue. A tape is placed under the trachea and the affected organs are incised longitudinally

to asses the extent of the tumour. Then, the trachea is incised circularly below the tumour and its distal part is intubated to secure ventilation. The proximal segments of the trachea and larynx are separated from the oesophagus and pharynx and resected together with the affected part of the cricoid and thyroid cartilages.

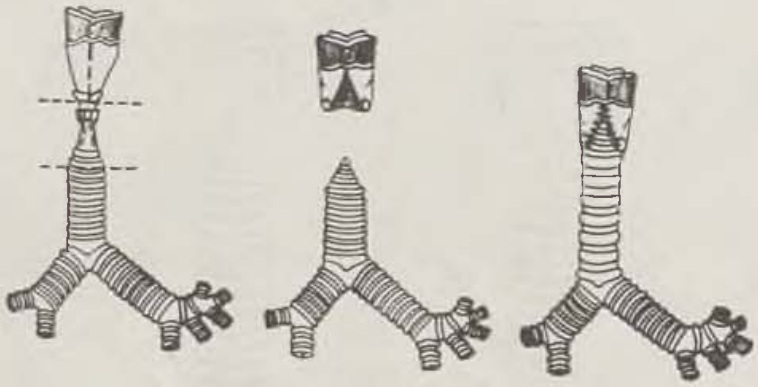

Fig. 2. The circular resection of the trachea, resection of the semicircumferences of the cricoid and thyroid cartilages, anastomosis of the "Russian lock" type

If more than 5 rings of the trachea are to be resected, the trachea is mobilized as far as the bifurcation. From the corresponding semicircumference of the proximal part of the trachea a pedicle flap, big enough to cover the defect of the laryngeal wall, is cut out, and the other semicircumference is resected. Then the circular flap laryngotracheal anastomosis is established.

A different reconstructive technique has been elaborated for complicated cicatricial stenosis of the trachea and larynx (Author's certificate No. 827040).

After cervicotomy and upper partial sternotomy the anterior semicircumference of the larynx and trachea is exposed. It is mobilized in entire length and transected circularly within the extent of the malignant growth. At this stage the orotracheal ventilation is replaced by the mediastinal shunt. The affected segment of the trachea is separated from the oesophagus under visual control, transected above the 1st cartilagineous ring or the cricoid cartilage arcus, and resected.

The larynx is incised longitudinally between the laminae of the thyroid cartilage. A wedge shaped flap big enough to widen the laryngeal lumen to its normal diameter is cut out from the anterior tracheal wall. Posterior and lateral semicircumferences of the trachea and larynx are anastomosed using non-penetrating interrupted sutures, the wedge-shaped flap is inserted between the laminae of the thyroid cartilage and fixed to their margins with knotted sutures.

In our operations, the maximal extent of the resected tracheal segment reached to 9 cartilagineous rings. If tumours affected adjacent organs the operation was more extensive (hemistrumectomy — 8 patients, resection of the oesophagus — 3 patients, resection of the a. carotis communis sinistra

and v. jugularis externa sinistra — 1 patient). One-stage plasty of the oesophagus was performed in 1 patient and a lung lobe with an abscess was resected in another one.

On the average, the nasotracheal intubation was used for 7 days. Only in 2 patients it was used for a longer time (1 month and more). The prolonged

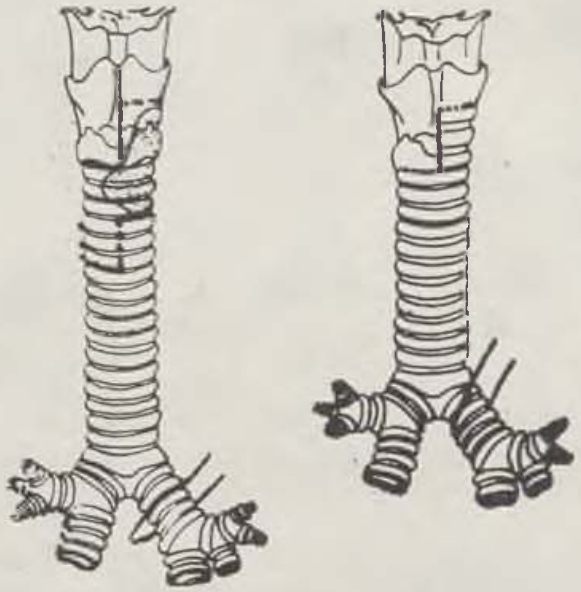

Fig. 3. The circular resection of the trachea, longitudinal laryngotomy, circular flap tracheolaryngeal plasty

intubation enabled us to clean tracheobronchial airways and to secure the adequate ventilation untill the oedema of the anastomosis receded and full adaptation of the laryngeal and tracheal margins took place.

The postoperative course was without complications in 29 patients. In 6 patients complications occurred: insufficiency of the anastomosis (2), stenosis (2), oesophagotracheal fistula (1), pneumonia (1). In 3 patients they were liquidated in a conservative way, in 1 patient by secondary tracheolaryngeal resection. In 2 patients they were lethal. In one of the the insufficiency of the anastomosis required mediastinal tracheostomy; the patient died after 8 days from erosive bleeding from the truncus brachiocephalicus and tromboemboly of a. pulmonalis. The other one died 4 and ½ months after combined resection (a lung lobe, the trachea, larynx, thyroid gland, oesophagus, a. carotis) from an oesophagotracheal fistula and increasing cardiopulmonal insufficiency.

The long-termed postoperative evaluations (up to 7 years) were carried out in all 33 patients. Out of the patients with tumours two died 3 and 5 years after the surgery. The others are alive and without any recurrence. The results of operative treatment of cicatricial strictures and traumatic injuries of the trachea were good, too.

In conclusion, on the basis of our experience the usage of the new effective techniques for tracheolaryngoplasty can be recommended. They secure the radical resection of the affected segments of the trachea and larynx and reconstruction of their structure and function in one stage.

M. D.

SUMMARY

The paper is based on the treatment of 38 patients suffering from combined stenoses (16) and tumours (19) of the trachea and larynx. Radical reconstructive operations were performed in 35 patients (48 operations). The authors have elaborated new methods of the tracheolaryngeal plasty for complicated strictures and tumours affecting simultaneously the trachea and larynx. These techniques were used also in cases of obliteration of the trancheal lumen above the level of tracheostomy. The advantage of the plastic operation is resection and reconstruction of the trachea and larynx in one stage, as well as preservation of the voice. 35 primary and 13 secondary corrective operations were performed. 10 variants of the reconstructive operations were used according to the extent and type of resection of the trachea. The maximum extent of the resection reached 9 cartilagineous rings in patients with tumours, and $^2/_3$ of the tracheal length in cases of cicatricial stenoses. In 29 patients the postoperative period was without complications. In 6 patients they occurred. Two of them died of the erosive bleeding from the truncus brachiocephalicus and cardiopulmona insufficiency. The long-termed postoperative evaluations have shown effectiveness of our new operative techniques.

RESUME

Opérations reconstructives des maladies combinées du larynx et de la trachée

Avilova, O. M., Baghirov, M. M.

Le travail décrit le traitement de 38 malades avec des lésions combinées de la trachée et du larynx. Il s'agissait des sténoses (16 cas) et des tumeurs (19 cas). Chez 35 malades on a exécuté en tout 48 opérations reconstructives radicales. On a élaboré de nouvelles méthodes de la plastie trachéolaryngale pour des sténoses compliquées et pour des tumeurs atteignants simultanément larynx aussi que trachée. Ces techniques ont été appliquées même au cours des opérations des sténoses de larynx et trachée, au dessus du niveau de la trachéotomie. L'efficacité de nouvelles méthodes consiste en une résection simultanément effectuée avec une reconstruction de la trachée et du larynx, à condition que la fonction de l'appareil de la voix reste conservée. En tout on a exécuté 35 opérations primaires et 13 opérations secondaires correctives. En dépendance de l'étendue et du type de la résection de trachée on a utilisé 10 variantes d'opérations reconstructives. La trachée, atteinte par des processus tumoraux, a été réséquée dans l'étendue de 10 cartilages au maximum, au cas de sténose dans l'étendu de 2 tiers de sa longueur. Le temps postopératoire a passé sans complications chez 29 malades. 6 malades ont été atteints par des complications qui ont dans 2 cas évolué vers le décès. Le saignement érosif de *truncus brachio-*

cephalicus et l'insuffisance cardiopulmonaire ont donné lieu à ces deux décès. L'observation postopératoire de longue durée a prouvé une grande efficacité des techniques opératoires alléguées.

ZUSAMMENFASSUNG

Rekonstruktionsoperationen bei kombinierten Erkrankungen des Kehlkopfs und der Luftröhre

Avilova, O. M., Bagirov, M. M.

Die Arbeit beschreibt die Ergebnisse der Behandlung von 38 Patienten mit kombinierten Stenosen (16) und Geschwüren (19) der Luftröhre und des Kehlkopfs. Bei 35 Patienten wurden insgesamt 48 radikale Rekonstruktionsoperationen durchgeführt. Es wurden neue Methoden der Tracheolaryngealplastik bei komplizierten Stenosen und Geschwürprozessen ausgearbeitet, die zu gleicher Zeit sowohl den Larynx als die Trachea befallen. Diese Methoden wurden auch bei Operationen des Kehlkopfs und der Luftröhre über der Ebene einer Tracheotomie angewandt. Die Effektivität der neuen Methoden besteht in der gleichzeitigen Resektion und Rekonstruktion der Trachea und des Larynx unter Aufrechterhaltung der Funktion des Stimmapparats. Insgesamt wurden 35 primäre und 13 sekundäre und korrigierende Operationen ausgeführt. Je nach dem Umfang und dem Typ der Resektion der Trachea wurden 10 Varianten einer Rekonstruktionsoperation angewendet. Bei Geschwürprozessen wurde die Luftröhre höchstens im Bereich von 9 Knorpeln reseziert und bei Stenosen im Umfang von $^2/_3$ ihrer Länge. Bei 29 Patienten verlief die Periode nach der Operation ohne Komplikationen. Bei 6 Patienten erschienen Komplikationen, die in zwei Fällen tödlich endeten; die Ursache war eine erosive Blutung des *truncus brachiocephalicus* und kardiopulmonale Insuffizienz. Eine langfristige Beobachtung der Patienten nach der Operation erwies die hohe Effektivität der beschriebenen Operationsmethoden.

RESUMEN

Operación reconstructiva de las enfermedades combinadas del laringe y la tráquea

Avilova, O. M., Baguirov, M. M.

En el trabajo se describen los resultados del tratamiento de 38 pacientes con afecciones combinadas de estenosis (16) y tumores (19) de la tráquea y el laringe. En 35 pacientes fueron realizadad en total 48 operaciones reconstructivas radicales. Fueron elaborados nuevos métodos de plástica traqueolaringea para estenosis y procesos tumorales complicados que afectan simultáneamente tanto el laringe como la tráquea. Estas técnicas fueron aplicadas también en las operaciones de las estenosis del laringe y la tráquea fuera de la esfera de la traqueotomia. La eficiencia de los nuevos métodos consiste en que se realiza simultáneamente la resección y la reconstrucción de la tráquea y el laringe al conservarse la función del aparato fónico. Se efectuó 35 operaciones correctivas primarias y 13 secundarias. De acuerdo con la extensión y el tipo de la resección de la tráquea se utilizaron 10 variantes de operación reconstructiva. En caso de procesos tumorales la resección de la tráquea fue realizada al máximo en la extensión de 9 cartílagos, en caso de estenosis fue la extensión las $^2/_3$ de la longitud. En 29 pacientes el período posoperacional se desarrolló sin complicaciones. 6 pacientes tuvieron complicaciones que en 2 casos terminaron letalmente-siendo como causa la hemorragia erosiva del *truncus brachiocefalicus* y la insuficiencia cardiopulmonal. Controles posoperacionales de los pacientes realizados a largo plazo demostraron una alta eficiencia de dichas técnicas operacionales.

REFERENCES

1. **Grig, M. G.**: Adenoma of the trachea. Vestn. of Otolaryngology, 6 : 92—93, 1960.

2. **Kvaschin, O. M.**: Obturator-dilatator for treatment of strictures and obliterations of tracheal and laryngeal lumen. J. Ear, Nose Larynx Dis., 1 : 97, 1973.
1973.

3. **Khitrov, F. M.**: The plasty of neck and face defects using the tubed flap. M., Medgiz, 1954.

4. **Billez, H. F., Lawson, W.**: The management of advanced laryngotracheal stenosis. Staged tracheal reconstruction. Laryngoscope, 91 : 217, 1981.

5. **Cantrell, J. R., Folse, J. R.**: The repair of circumferential evolution. J. Thorac. Cardiovasc. Surg., 42 : 589, 1961.

6. **Courand, L., Martigne, C., Panconi, B.**: Desinsertion laryngo-tracheale post-traumatique avec fracture du cartilage cricoide et arrachement des nerfs recurrents. Chirurgie, 106 : 725, 1980.

7. **Frederichson, J. M., Straton, R. W., Goode, R. L.**: Reinforced T-tube tracheal stent. Arch. Otolaryng., 90 : 356, 1969.

8. **Gebauer, P.**: Experiences with surgical reconstruction of the trachea. Amer. Rev. Tuberc., 62 : 176, 1950.

9. **McCafferty, G. J., Parter, L. S., Suggit, J.**: Primary malignant disease of the trachea. J. Laryng., 78 : 441, 1964.

10. **Samaan, H. A.**: Benign tracheal stenosis. Brit. J. Surg., 57 : 909, 1970.

11. **Zehm, A.**: The use of composite grafts for reconstruction of the trachea and subglottic airway. Trans. Amer. Acad. Ophthal., Otolaryng., 84 : 934, 1977.

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RECONSTRUCTION OF THE JAWS WITH PEDICLE BONE GRAFTS

J. Kozák, V. Michal, T. Neméth

The development and introduction into clinical practice of vascular microanastomosis brought an entirely new conception into reconstructive surgery concerned with the transfer of both soft and hard tissues into the site of the defect.

Free bone transfers have been in routine use for decades now using parts of bone from the ilium, ribs and, as an exception, from other parts of the skeleton. Free bone grafts, however, may be attacked by infection which mostly leads to their sequestration and, sometimes, to their complete resorption. Healing in all bone transfers depends on early revascularization from the neighbouring soft tissues. Unfavourable conditions at the implant site such as decreased vascularization in chronic inflammatory and post-injury conditions or changes resulting from actinotherapy are a severe impediment on the healing in of the classical bone graft after it has been temporarily deprived of blood supply in the free transfer technique. The results of healing in free bone grafts transferred into tissues thus damaged were very unfavourable. Thus, for instance, Höltje and Lentrodt report infectious complications in nearly 50 % of all cases of mandibular reconstruction. The main cause of infectious complications is reduced resistance of the transplant deprived of its natural vascular supply. Since cases of adverse biological properties of the soft tissues providing a bed for the free bone graft are fairly frequent microsurgery with its scope for pedicle bone graft transplantation was welcomed as a means permitting the achievement of very good clinical results in bone reconstruction.

Vascular pedicle bone grafts can be taken from the rib (Ariyan, 1978), from the ilium (Taylor, 1979), from the fibula (Taylor, 1975), from the second metatarsus (Ohmori, 1979) and from the radius (Soutar, 1983). All those donor localizations have certain advantages as well as shortcomings.

At our clinical unit we used vascular pedicle bone grafts a total of four times, twice from the rib on a vascular pedicle of a. and v. thoracica interna (Fig. 1) and twice from the hip bone blade on a vascular pedicle of a. and v. circumflexa illium profunda (Fig. 2).

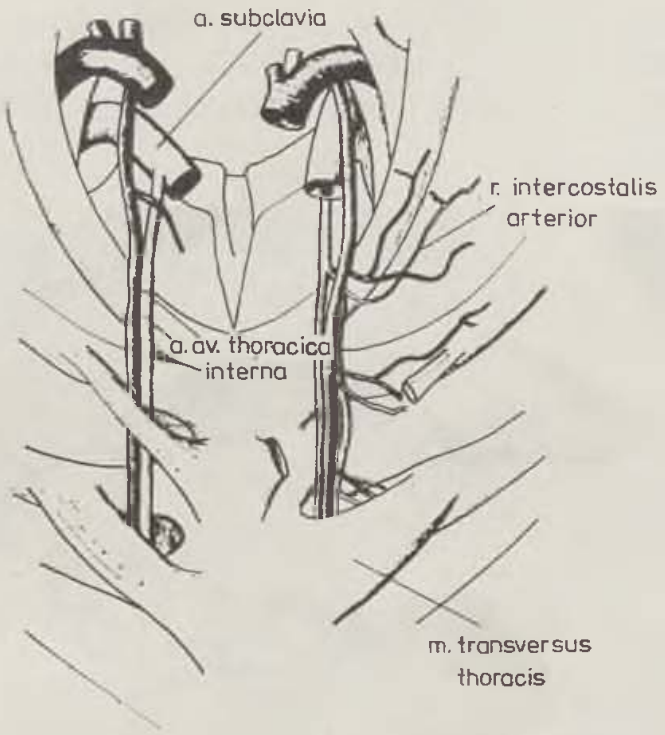

Fig. 1. Diagram of vascular supply to the ribs — internal thoracic artery and vein, and intercostal arteries and veins

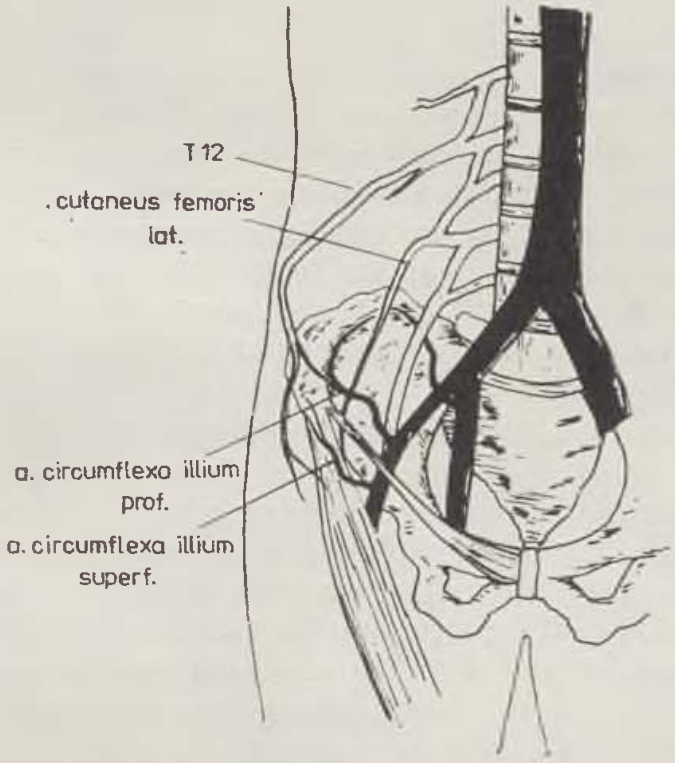

Fig. 2. Diagram of vascular supply to the iliac bone — deep circumflex iliac artery and vein

Patient J. G. (34 years) suffered a gunshot wound defect in the face after being shot at close range from a shotgun. Healing was complicated as a result of osteomyelitis of the remaining bone fragments. The injury itself and the

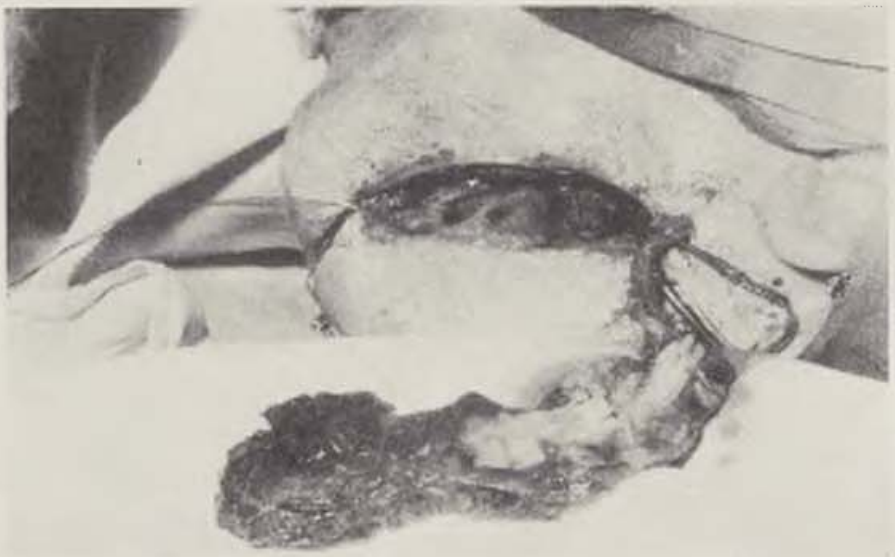

Fig. 5. Part of the fifth rib pedicled to the a. and v. thoracica interna prior to implantation into the defect in the mandible and before anastomosis

inflammation resulted in a large defect of the soft tissues of the face and the mandible on the left with much scarring around. There was little hope of a free bone graft being healed in, which was why a year after the accident we performed bone graft transplantation from the hip bone using a vascular pedicle of a. and v. circumflexa ilium profunda anastomosing the vessels end-to-side to the external carotid artery and the facial vein. The post-operative course was free from complications. Control angiography (Fig. 3) and scintigraphy (Fig. 4) demonstrated satisfactory potency of the vessels supplying the bone graft as well as its viability.

Patient J. F. (female, 40 years) suffered polytraumatic injury during a traffic accident, including a defect of the mandible with subsequent osteomyelitis. We performed two unsuccessful transplantations of free bone grafts from the hip bone. Extensive cicatrical tissue developed around the mandibular bone defect. For that reason we bridged the defect with a bone graft from the rib on a vascular pedicle of a. and v. thoracica interna. The vessels were similarly anastomosed with the a. carotis externa and v. facialis end to side (Fig. 5). There were no post-operative complications.

Patient J. P. (35 years) suffered major injury with loss of soft and hard tissues of the face following a shotgun wound. The classical free bone graft transplantation ended in a failure, which was why we took part of the fifth

rib on a vascular pedicle of a. and v. thoracica interna to anastomose them end-to-end to the a. lingualis and v. facialis. The bone graft withdrawal was followed by the development of pneumothorax which was subsequently treated with drainage. Post-operative scintigraphy proved the viability of the bone graft.

Fig. 6. Bone graft from the iliac bone with part of the iliac muscle and a vascular pedicles of the a. and v. circumflexa ilium profunda

Patient J. T. (39 years) also suffered a major facial defect following a gunshot wound. The large soft tissue defect was treated first with a free musculo-cutaneous flap from the m. latissimus dorsi, and, in the second phase, with the transplantation of a bone graft on a vascular pedicle of a. and v. circumflexa ilium profunda (Fig. 6) anastomosing them end-to-side to the external carodit artery and end-to-end to the facial vein. Scintigraphy demonstrated the bone graft as viable.

DISCUSSION

As our experience so far suggests, transplantation of vascularized bone grafts both from the hip bone and the rib is well suited to reconstruction surgery of the bone in terms of the final outcome. Provided the microsurgical technique of donor tissue withdrawal, the implantation proper and the vascular anastomosis are executed with precision, the bone transplant can be made to heal in even in localizations where previous free bone grafts failed to take in. Another point to be made is that decisive for the outcome is neither the donor site nor the conditions at the recipient site but rather precision of execution during the operation proper. The moot point are indications for such transplant operations. This method is clearly far more complex and time-consuming than the traditional bone transplant operations. One surgical team will take about eight hours to accomplish the operation. Vascularized bone graft implantation

in tissues previously irradiated with reduced biological value is an absolute indication. So are, in our view as well as in other authors' view (Baker, 1983) states after gunshot wounds with resultant defects of hard and soft tissues and with major cicatrical changes in the vicinity of the defect. Such changes may also result from prolonged inflammatory processes. Once again, these result in very unfavourable local conditions.

The choice of the pedicle bone graft donor site is another point for consideration. Comparing the two donor sites used at our place of work (rib, part of the hip bone blade) we believe, concurrently with other authors (Bitter, 1983), vascularized bone grafts taken from the ilium to be the better choice. This is because of the constant course of the a. and v. circumflexa ilium profunda and of the vascular bundle being sufficiently long — 8 to 10 cm — with outside diameter about 2 mm. This diameter permits a safe execution of vascular anastomosis. It is also possible to lift — along with the bone graft — part of the adjacent skin supplied by perforators for the simultaneous reconstruction of the soft and hard tissues. The hip bone tissues also contains a major quantity of spongiosa.

The withdrawal of a rib bone transplant on a vascular pedicle of a. and v. thoracica interna which can, likewise, be lifted complete with the adjacent part of the skin involves the risk of pneumothorax, a condition which may prove to be a very serious complication at wards with no appreciable experience of chest surgery. This type of complication has to be borne in mind prior to taking the graft, the ward must possess the necessary adequate instrumentation, and the complication should be dealt with in co-operation with a specialist. The compound graft containing, in addition to bone, also skin is rather bulky in this particular localization as it must also contain the adjacent part of the musculus pectoralis maior. The rib bone transplant, however, is easier to shape. Other authors have described more donor sites suitable for vascularized bone graft withdrawal, such as, for instance, part of the radius on a vascular pedicle of a. radialis (Soutar, 1983) or the second metatarsus on a pedicle of a. dorsalis pedis (Ohmori, 1979). So far, however, we have had no experience of our own with those grafts.

Post-operative checks on the bone graft viability are very important. Our first two patients had post-operative angiography and scintigraphy performed. However, angiography as an invasive method is very unpleasant for the patients, which is why we now test the bone graft viability with scintigraphy alone in the immediate post-operative period before classical revascularization from the adjacent soft tissues sets in.

Compared with conventional techniques, the new microsurgical reconstructive methods markedly shorten the period of facial reconstruction, a procedure which previously took a number of years to complete. Also the results of reconstructions using microsurgical methods are substantially better. For a number of patients who require reconstruction with the aid of bone tissue transplantation of vascularized bone grafts is the only feasible solution.

J. H.

SUMMARY

The authors present their experience with vascular pedicle bone graft transplantation for mandibular reconstruction. In two cases they used a bone graft from the ilium supplied from the a. and v. circumflexa ilium profunda, in two other cases of similar indication they used part of the fifth rib on a pedicle of a. and v. thoracica interna. They discuss the indications for those microsurgical operations as well as the donor sites. In their opinion, vascularized bone grafts from the ilium are better suited for routine uses since their lifting does not give rise to complications connected with the develop ment of pneumothorax.

RESUME

Reconstruction des mâchoires à l'aide des greffes osseuses aux pédicules vasculaires

Kozák, J., Michal, V., Németh, T.

Les auteurs font connaître ses expériences avec la transposition des greffes aux pédicules vasculaires pour réaliser des reconstructions de la mâchoire inférieure. En deux cas, ils se sont servis d'un greffon osseux pris sur l'os iliaque, sa nutrition étant assurée par «a. a. v. circumflexa ilium profunda». Pour deux cas suivants, les auteurs ont utilisé, de la même indication, une partie réséquée de la 5ème côte, au pédicule vasculaire de «a. a. v. thoracica interna». Les auteurs discutent les indications opératoires et les localités pour la prise des greffons. Ils avancent une oppinion que les greffes osseuses vascularisées, prises sur l'os iliaque, soient plus avantageuse pour l'utilisation courante, car la prise de celles-ci ne produit pas de complications jointes à l'apparition du pneumothorax.

ZUSAMMENFASSUNG

Rekonstruktion des Kiefers mittels Knochenpfropfens an einem Vaskulärstiel

Kozák, J., Michal, V., Németh, T.

Die Autoren führen ihre Erfahrungen mit der Transplantation von Pfropfen an einem Vaskulärstiel bei der Rekonstruktion des Unterkiefers an. In zwei Fällen verwendeten sie Knochenpfropfen aus dem Hüftknochenblatt, das von der a. und v. circumflexa ilium profunda versorgt wurde. In zwei weiteren Fällen verwendeten sie bei ähnlicher Indikation den ausgeschnittenen Teil der fünften Rippe an einem Vaskulärstiel der a. und v. thoracica interna. Die Autoren diskutieren über die Indikationen zu solchen Interventionen sowie über die Entnahmestellen und sind dabei der Ansicht, dass vaskularisierte Knochenpfropfen aus der Hüfte für die normale Anwendung geeigneter seien, weil bei ihrer Entnahme keine Komplikationen in Verbindung mit der Bildung eines Pneumothoraxes entstehen.

RESUMEN

Reconstrucción de la mandíbula con injertos óseos en el pecíolo vascular

Kozák, J., Michal, V., Németh, T.

Los autores presentan sus experiencias con la transposición de los injertos en el pecíolo vascular en casos de reconstrucción de la mandíbula. En dos casos utilizaron injertos del ala del hueso del íleon alimentado por la vena y la arteria circumflexa ilium profunda, en otros dos casos implementaron, con indicación similar, una parte reseccionada de la quinta costilla en un pecíolo vascular de a. y v. thoracica interna.

Los autores discuten sobre las indicaciones respecto de estas intervenciones y sobre la localización de las tomas. Opinan que los injertos vascularizados del íleon resultan más adecuados para un uso corriente ya que al ser tomados no dan margen a las complicaciones producto de la aparición eventual del neumotórax.

REFERENCES

1. **Ariyan,S. et al.:** The anterior chest approach for obtaining free osteocutaneous rib grafts. Plast. reconstr. Surg., 62, 676, 1978.

2. **Baker, S. R.:** Single-stage reconstruction of the mandible following gunshot injury using a free osteomyocutaneous groin flap. Maxillofacial trauma: an international perspective. Praeger, New York, 1983.

3. **Bitter, K. S. et al.:** The iliac bone or osteocutaneous transplant pedicled to the deep circumflex iliac artery I, II. J. max. fac. Surg., 11 : 195, 1983.

4. **Höltje, W., Lentrodt, J.:** Infektionen autologer Knochentransplantate nach Defektrekonstruktion des Unterkiefers. Fortschritte der Kiefer- und Gesichts Chirurgie. Band XX. Georg Thieme Verlag, Stuttgart, 1976.

5. **Ohmori, K. et al.:** Total rhinoplasty with a free osteocutaneous flap. Plast. reconstr. Surg., 63 : 387, 1979.

6. **Soutar, D. S. et al.:** The radia forearm flap: a versatile method for intraoral reconstruction. Brit. J. plast. Surg., 36 : 1, 1983.

7. **Taylor, G. I. et al.:** The free vascularized bone graft. Plast. reconstr. Surg., 55 : 533, 1975.

8. **Taylor, G. I. et al.:** Superiority of the deep circumflex iliac vessels as the supply for free groin flaps. Plast. reconstr. Surg., 64 : 745, 1979.

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THE TENSOR FASCIAE LATAE MUSCULOCUTANEOUS FLAP IN OPERATIONS FOR TROCHANTERIC DECUBITUS ULCERS

V. RIEBELOVÁ

The basic principles of surgery for chronic decubitus ulcers in paraplegic patients were devised more than 30 years ago, and still hold good. These are:

1. radical excision of ulcer down to healthy tissue,
2. removal of bone prominence responsible for the bedsore,
3. filling the ulcer and bone prominence defects by means of muscle transposition,
4. closure of soft tissue defects by local transposition — using large rotation flaps such as could be used again in case of relapse,
5. closing the secondary defect so as to avoid increased skin cover tension in the pressured region (free transplants).

In practice, however, some extremely awkward problems arose even if those principles were duly observed. One of them results from the need to cover large defects in the trochanteric regions. A rotation flap from the anterior and outer surfaces of the thigh with a dorsalward oriented pedicle, indicated here by the classical method, is fairly often likely to develop problems of poor supply — from marginal necrosis down to total flap necrosis. Its mobility is limited and it is difficult to cover the proximal portion of the trochanteric defect with. Lifting it involves a great deal of bleeding. The secondary defect always requires a free graft. In relapses, the scope for repeat flap rotation is limited.

Also limited is the choice of other methods for trochanteric defect coverage. Suture of the defect is but an exceptional option. Z-plasty provides too little material apart from resulting in too many scars in the operated region right over the bone. If a relapse develops, too little material remains for covering the new defect. The only practical choice is one of a dorsal thigh flap, but this ought to be kept in reserve primarily for bedsores in the sciatic region.

In the past few years, a number of authors have published reports recommending the use of the tensor fasciae latae musculocutaneous flap for covering defects in trochanteric decubitus ulcers (TFL MCF).

Pedicled flaps with the fascia lata were first used in 1934 by Wagensteen to cover large defects in hernias though without the superimposed skin. In

1967, Bailey was the first to use and describe the transposition of the m. tensor fasciae latae complete with the respective skin cover as one whole in a case of trochanteric decubitus ulcer aggravated by purulent hip joint arthritis. The

Fig. 1. Cadaver study of TFL MCF. Anatomical situation of structures. Sketch of transfer TFL MCF. — Fig. 2. Lifted TFL MCF and exposed vascular pedicle on a cadaver

TFL MCF as a new surgical technique did not come into really wide use until 1978—1979. This was when Hill, Nahai, Bostwick et al. used it for covering defects not only in the trochanteric regions, but also in the inguinal, hypogastric, sciatic, and perineal regions in the form of transfer, island and free flaps. In their opinion, this is a reliable flap, easy to lift and likely to bring permanently good supply to the damaged area. This made us decide to test this method.

Anatomy of TFL MCF

The m. tensor fasciae latae is a flat cone-shaped muscle taking its origin in the anterior superior iliac crest with insertion to the iliotibial band of fascia lata. Its vascular pedicle is supplied from the lateral circumflex femoral artery entering it from the dorsal side about 7 to 8 cm distal to the anterior superior iliac crest between the m. rectus femoris and the m. vastus lateralis. In addition to the muscle, the artery also supplies the fascia lata and the skin complete with the subcutis all over the external and adjoining anterior side of the thigh down to the knee joint. Motor innervation comes from branches of the superior gluteal nerve while for sensitivity the whole region of the flap belongs to the

territory of the lateral femoral cutaneous nerve. In view of its high-quality and sufficiently long vascular pedicle the TFL MCF can be used as a transfer, rotation, island or free flap.

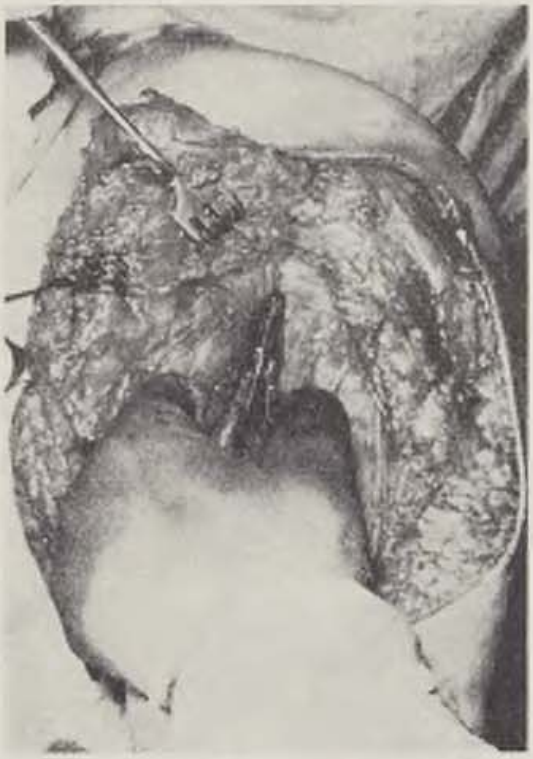

Fig. 3. Simple chronic left-sided trochanteric decubitus ulcer over the posterior greater trochanter edge in a 35-year old spastic paraplegic. Sketch of planned rotation TFL MCF. — Fig. 4. Proximally elevated part of TFL MCF with vascular pedicle exposed. State after decubitus ulcer excision and prior to greater trochanter ablation

Operating procedure

As for the form of transposition of TFL MCF for trochanteric decubitus ulcers we reached the conclusion that the rotation flap was the best to fit in with the principles of surgery for bedsores, and this was also the form we chose for most of our operations.

Description of operation

Following the incision of the skin and subcutis around the ulcer down to the fascia, though prior to its excision, we begin to lift the dorsal portion of the rotation flap. The incision start from the lower pole of the decubitus ulcer to continue arch-wise in the distal and ventral directions to the anterior surface of the thigh. This is where we make a cross incision of the fascia lata suturing its proximal fibres temporarily to the flap edge to prevent it being torn away from the subcutis during the preparation. Only then do we start separating the circumcised part bluntly from the base proceeding proximalward down to the vascular pedicle lateral to the incision around the ulcer. From

there on we have to continue with sharp dissection since owing to previous inflammations the fascia lata is full of scars and firm adhesions to the surrounding tissues. By turning the elevated portion of the flap proximally the

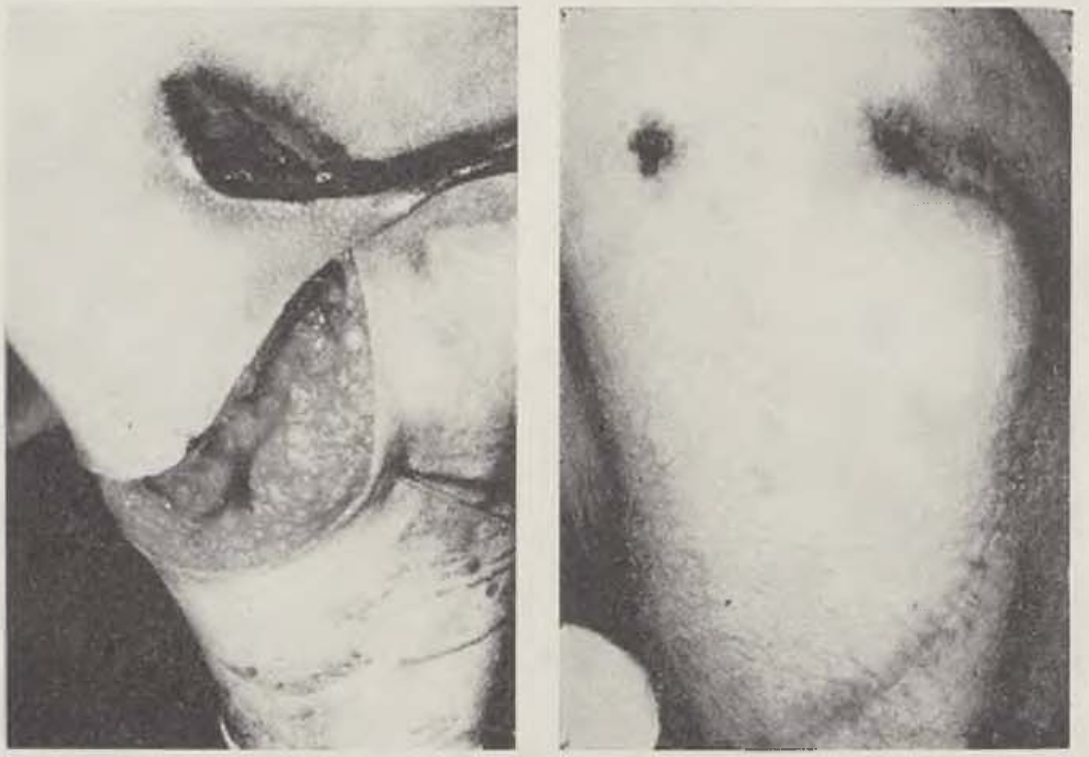

Fig. 5. Rotation of elevated TFL MCF into defect after decubitus ulcer. — Fig. 6. Surgically treated region 3 weeks postoperatively

decubitus ulcer is made widely accessible. The excision of the ulcer, bursae, the greater trochanter or also resection of the hip joint can then safely be commenced in an easy-to-survey operating field. If possible, the resected greater trochanter ought to be covered with the residual insertion of the glutaeus maximus. The flap rotation is completed by continuing the thigh incision medialward and by re-incision along the inner edge of the m. rectus femoris to a distance where the flap can cover tension-free the whole region of the greater trochanter stump complete with a fairly broad band adjoining its dorsal edge. The resulting scars on the flap cusp are thus made to reach the area over the soft base far enough away from the bony base. In large trochanteric defects the required transposition of the flap is so extensive as to make the release incision reach as far as the inguinal ligament unless it is necessary to transsect also the skin bridge distal to the anterior superior iliac crest, thus turning the rotation flap into a transfer or even island flap. The secondary defects can be sutured. Coverage with dermoepithelial grafts is a less frequent necessity. In such cases, secondary defects tend to be localized in areas less exposed to pressure on the anterior or medial surfaces of the thigh.

The above technique was used on 25 decubitus ulcers in flaccid and spastic paraplegics with acute and chronic trochanteric decubitus ulcers of different size and gravity. The size of TFL MCF varied from partial flaps up to total

Fig. 7. Large coalescing ischiotrochanteric decubitus ulcer in a 20-year old female patient with flaccid paraplegia

island flaps. Only two cases required the secondary defect to be covered by a free flap, namely in a coalescent ischiotrochanteric decubitus ulcer with a huge sofa tissue defect, and in a previously repeatedly operated bedsore complicated by coxitis where previous surgical operations performed elsewhere resulted in considerable soft tissue devastation. The flaps were easy to lift with practically no bleeding at all. The flap transfer was always an easy affair. There was not a single case of impaired blood supply.

We had a total of ten classical simple chronic trochanteric decubitus ulcers to operate on. Thereof nine — 90% — have been premanently healed. One severely spastic patient suffers, for reasons unknown to us, from a recurrent abcess beneath the flap evacuated at intervals through a small fistula in the marginal scar allowing the wound to heal for a period of time. The bone tissue is intact.

There was one case of coalescing ischiotrochanteric decubitus ulcer requiring surgical treatment. The patient, in spite of her post-operative problem involving a four-month seroma, has been free from complaints for two years now.

Hip joint resection was invariably used in six chronic trochanteric bedsores complicated by hip joint affection (coxitis, fracture, ankylosis). TLF MCF permitted excellent access to the joint, and the operating field was perfectly easy to survey. Closing the defect with flap was no problem at all. Five of the patients were healed in 4 to 8 weeks' time. The sixth suffered from persisting

ostitic fistula which we removed in a subsequent operation again using a TLF MCF. The patient has now been healed for more than a year.

Encouraged by the ease of operation, safe blood supply to the flap and the opportunities for an extensive flap transfer, we ventured to use the tech-

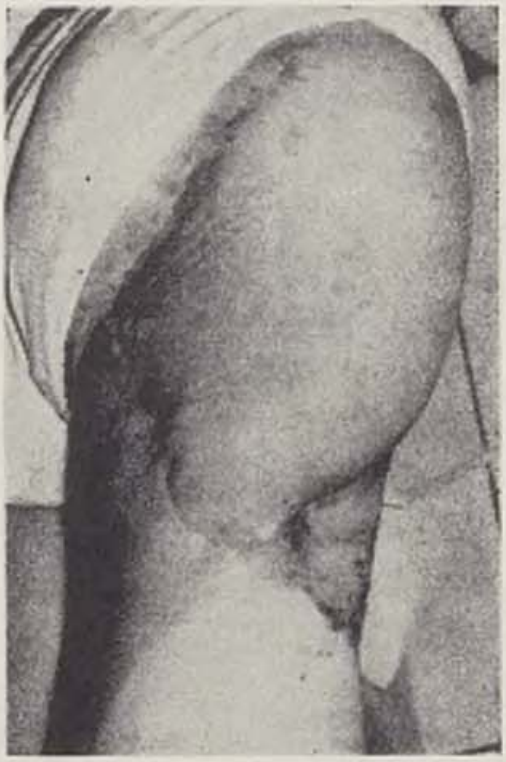

Fig. 8. 6 months after excision of ulcer and all adjacent scars, ischiectomy, ablation of greater trochanter and defect coverage with transfer TFL MCF and with partial dorsal thigh lateral-pedicled flap. Dermoepithelial graft covering secondary defect. Photograph take two months after the management of 4-month persisting seroma underneath the flap. The patient has now been permanently healed for two years

nique in acute trochanteric decubitus ulcers, i.e. in patients in a severe, practically hopeless situation. We started with radical removal of necrotic tissue and ostitis-affected bone processes. The wounds were treated either with primary suture and with the introduction of suction drainage, or they were left wide open and, following débridement, closed with a secondary suture. We used the technique in seven ulcers. In three cases, permanent healing and a rapid improvement in the patients' general condition were achieved in 6 to 8 weeks. One spastic paraplegic suffering from two large trochanteric decubitus ulcers complicated by bilateral acute coxitis was, immediately after operation, transferred to another hospital, and the result of the operation is unknown to us. In the remaining two patients, death occurred after acute ostitis with sepsis proved impossible to control.

Seroma was the most frequent postoperative complication particularly difficult to manage in spastic patients. There was only one case of haematoma.

The only abscess that developed around the bone stumps following hip joint resection for coxitis proved easy to remove. A serious complication of unclear aetiology was seen in one severely affected spastic patient suffering from extensive necrosis of deep lying muscle tissue. In this case, the healing of external soft tissues including the flap took an ostensibly normal course without changes in the patient's general condition. The only option remaining to us was to lift the already sutured TFL MCF again, to remove the muscle necroses and to suture the wound. The ensuing postoperative course was complicated by a refractory seroma taking four months to remove. At present, the patient is cured.

Taking a look back at the nature of the post-operative complications we can now see that, barring some of the seromas, they were really unrelated to the TFL MCF transfer but rather to problems of ostitis and the patients' spasticity.

DISCUSSION

In spite of the low number of surgical cases and the short-term results of 6 months up to two years we feel justified to distill from the amount of experience certain facts which can prove or disprove the usefulness of the method.

The two methods, the classical and the one reported on here, remain unaltered as regards the first two phases of operation — excision of the ulcer and operation on the bone. All that remains is to compare the advantages and disadvantages in the remaining phases of surgery.

Disadvantages of the classical method:

Impaired blood supply to the edges of or to the whole of the flap resulting from the discontinuation of most of the vessels supplying blood from the underlying m. tensor fasciae latae to the skin and subcutis.

Major bleeding in lifting the rotation flap from the fascial vascular perforators.

Limited range of flap transfer and the inevitable difficulties involved in the coverage of the proximal portion of the trochanteric defects.

Secondary defects almost invariably require coverage with a free transplant.

Repeated use of the flap in cases of relapse is, in most cases, unlikely.

The greater trochanter, its vicinity or also the hip joint are not easily accessible.

TFL MCF advantages compared with the classical and other methods:

The TFL MCF is easy to lift.

There is minimal bleeding.

Safe supply is ensured.

A great volume of blood is permanently supplied to the damaged region.

The range of transfer is unusually great without impairing blood supply to the flap.

The skin is transferred with a powerful muscle acting as a "cushion" and providing a large quantity of good-quality material.

The secondary defect rarely requires a free transplant.

If used as a rotation flap, it can — in any possible relapse — be reused protecting the lat. pedicle of the dorsal thigh flap.

TFL MCF disadvantages:

Susceptibility to seroma developing underneath the flap. This may due to the fascia uniting poorly with the bone base and to the fact that in spastic patients m. tensor fasciae latae motoricity is preserved. However, owing to the low number of cases treated we cannot be absolutely sure that the seromas were, indeed, associated with the TFL MCF transfer.

In view of the long-term permanently favourable results some problems might arise at some time in the future from the flap cusp scars situated too near the dorsal edge of the great trochanter stump. To date, however, none of our patients has complained about the scars.

Large transfer TFL MCF cannot be reused in cases of relapse.

Island TFL MCF flaps have two disadvantages:

Their edges are situated right above the bone base, which makes them particularly vulnerable to relapses, and, second, they cannot be used again.

CONCLUSION

The above review of surgical results as well as the relative advantages and disadvantages of the techniques concerned are clearly in favour of the TFL MCF in the transposition, rotation or island forms for the treatment of defects in the trochanteric region. In our view, the technique is well worth recommending.

J. H.

SUMMARY

The uses are described of the m. tensor fasciae latae musculocutaneous flap with a special view to its rotation form in trochanteric decubitus ulcers. The advantages of the technique are compared with the classical method. The conclusion is that the rotation form of the flap is particular offer substantially more advantages than other types of transfer. The results obtained in 25 patients operated on in this way are reviewed.

RÉSUMÉ

Lobe musculocutané et *musculus tensor fasciae latae* en chirurgie des ulcerès décubitaux trochantériens

Riebelová, V.

L'utilisation du lobe musculocutané pris sur *musculus tensor fasciae latae* est décrite, en considérant notamment sa forme rotative, chez de ulcères décubitaux trochantériens. Les avantages de la méthode décrite sont comparés avec la méthode classique.

En conclusion on constate que l'utilisation du lobe musculocutané de *musculus-tensor fasciae latae,* particulièrement sa forme à rotation, est considéramment plus avantageuse que d'autres types de déplacement. On apporte un aperçu des résultats opératoires de 25 malades traités selon la méthode recommendée.

ZUSAMMENFASSUNG

Der Muskulokutanlappen mit dem *musculus tensor fasciae latae* bei Operationen eines trochanterischen Dekubitus

Riebelová, V.

Es wird die Verwendung des Muskulokutanlappens mit dem *m. tensor fasciae latae* unter spezieller Ausrichtung auf seine Rotationsform bei einem trochanterischen Dekubitus beschrieben. Ferner werden die Vorteile der beschriebenen Methode mit der klassischen Methode verglichen.

Zum Abschluss wird festgestellt, dass die Verwendung des Muskulokutanlappens mit dem *m. tensor fasciae latae,* besonders in seiner Rotationsform, wesentlich vorteilhafter ist, als andere Typen von Verpflanzungen. Es wird eine Übersicht der Ergebnisse bei 25 derart operierten Patienten geboten.

RESUMEN

Lóbulo musculocutáneo y el *músculus tensor fasciae latae* en la operación de los decúbitos trocantéricos

Riebelová, V.

Se describe la utilización del lódulo musculocutáneo con el *músculus tensor fasciae latae,* con orientación específica a su forma rotativa, en los decúbitos trocantéricos. Se comparan las ventajas que presenta la metodología descrita frente los métodos clásicos. A modo de conclusión se constata que la utilización del lóbulo musculocutáneo con el *músculus tensor fasciae latae,* específicamente en su forma rotativa, presenta ventajas fundamentalmente mayores que otros tipos de transplantes. Se da una relación de los resultados en 25 pacientes operados de esta forma.

REFERENCES

1. **Bostwick, J., Hill, H. L., Nahai, F. N.:** Repair of the Lower Abdomen, Groin and Perineum with Myocutaneous or Omental Flaps. Plast. reconstr. Surg., 63 : 186, 1979.

2. **Hill, H. I., Nahai, F., Vasconez, L. O.:** The Tensor Fascia Lata Myocutaneous Free Flap. Plast. reconstr. Surg., 61 : 517, 1978.

3. **Hill. H. I., Hester, R., Nahai, F.:** Covering Large Groin Defects with the Tensor Fascia Lata Musculocutaneous Flap. Brit. J. plast. Surg., 32 : 12, 1979.

4. **McGregor. J. C., Buchan, A. C.:** Our Clinical Experience with Tensor Fascia Lata Myocutaneous Flap. Brit J. plast. Surg., 33 : 270, 1980.

5. **Nahai, F., Hill, H. L., Hester, T. R.:** Experience with Tensor Fascia Lata Flap. Plast. reconstr. Surg., 63 : 788, 1979.

6. **Vasconez, L. O., McCraw, J. B., Hall, E. J.:** Complications of Musculocutaneous Flaps. Clin. in plast. Surg., 7 : 1980.

7. **Sanchez, S., Emegdool, S., Conway, H.:** Surgical Treatment of Decubitus Ulcers in Paraplegics. Plast. reconstr. Surg., 43 : 25, 1969.

8. **Schlefan, M.:** The Tensor Fascia Lata: Variations on a Theme. Plast. reconstr. Surg., 68 : 1, 1981.

9. **Souyris, F. et al.:** The Tensor Fascia Lata Musculocutaneous Flap. Anatomical and Technical Recent Data Proposed of Ten Cases Observed in Six Months. Ann. Chir. Plast., 25 : 159, 1980. The rest of references available from the authoress.

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VOLKMANN'S ISCHAEMIC CONTRACTURE

† L. HASMAN

Volkmann's ischaemic contracture was first described by Richard von Volkmann in 1869. The most frequent causes of this condition include severe injury of the forearm or the elbow region caught in rollers, supracondylic fractures of the humerus, or other traumatic mechanisms affecting the forearm and the elbow. Improper use of the tourniquet or plaster-of-Paris dressing is the less frequent case although this mechanisms continues to be often listed as the main cause of clawhand development.

There have been many discussions of the aetiology of Volkmann's contracture, and yet there is still no unity of opinion as regards this point. We believe the condition to be triggered off by vascular emergency affecting both the arterial and the venous systems in connection with the trauma sustained. The logical consequence of this is ischaemia of the whole region of supply resulting in the rapid development of oedema which, in turn, leads to a pressure build-up in the enclosed flexor space of the forearm and, consequently, to more changes typical of the syndrome. The picture and development of the disease are characterized by two stages: the acute and the chronic periods.

The acute phase starts with a precipitate pathological process which relatively soon causes severe damage, particularly to the muscular mass of the forearm. This damage becomes stabilized in the subsequent — already chronic — phase, and, in the absence of an appropriate therapeutical procedure, may result in deformities which preclude the hand from any kind of activity.

Treatment in the acute phase of Volkmann's contracture consists primarily in the undelayed removal of the causes which have brought on the condition, and in relieving the mounting pressure by means of radical longitudinal fasciotomy extending from the ulnar side of the wrist up to the elbow pit, and from there to the external condyle of the humerus. The fingers are postoperatively fixed in extension and the wrist joint in moderate dorsal flexion. Should skin necroses develop, early necrectomy is necessary and later, after the preparation of the granulation areas, closure of the defects with skin grafts.

In the course of the second week, while a picture of gradual fibrosis is already beginning to build up, it is essential to start, at first, mild, and then intensive rehabilitation. Treatment takes a long time and the functional effect of rehabilitation cannot be regarded as definitive until after at least six months.

Deformity of the hand typical of Volkmann's contracture develops in cases where treatment of the acute phase came too late or where the damage was too extensive. Hyperextension of the basic phalanges of the 2nd to 5th digits and flexion of the medial and distal phalanges with simultaneous semiflexion in the wrist joint represent the resting position of the hand. The thumb with its metacarpus in adduction and with the terminal phalanx flexed resists proper function. Paresis of the ulnar or medial nerves does not belong in the basic picture of Volkmann's contracture although the claw-like position of the hand is almost identical with the clinical picture of their involvement.

From the point of view of reconstruction we divide the condition into two groups, depending on the extent of damage.

One group consists of contractures with fibrous degeneration of the flexors but without any major rigidity of the joints or atrophy of the initially uninvolved muscles of the forearm and the hand. The wrist flexion tests, during which the contracted fingers can still be actively extended and flexed, helps to single out cases indicated for surgical operation. In the other group where as a result of wrong treatment and prolonged inactivity there is advanced rigidity of the joints and fibrosis of all muscles — including the small muscles of the hand — to the extent that the hand can only perform the function of a prosthesis, there is practically no hope of repair and the functional results are far from satisfactory.

Consequently, if we take nerve damage, marked rigidity of the joints and atrophy of all tissues as secondary manifestations which have either never developed thanks to early rehabilitation and proper treatment of the acute condition or have developed to an adaptable degree, we obtain the picture of what is now relatively the most frequently seen type of Volkmann's contracture with the forearm flexors affected.

Diverse surgical procedures have been proposed for the correction of Volkmann's contracture. We regard as interesting Page's and Scagliatti's collection of the flexor insertions though we ourselves have had no experience of our own with that technique. The bayonet-like prolongation of the flexor tendons in the forearm usually fails to bring the expected functional benefit because of the degeneration of the bellies of the deep flexor. As for Epstein's surgical proposal — the principle of which is technically the nearest to our own operating procedure — we do not regard this as suitable for the treatment of Volkmann's contracture because it is an operation on the tendons in the palm of the hand and in the fingers posing considerable danger of adhesions in the relatively narrow spaces in that region. Bunnell's operation using the brachioradial muscle as the motor is a great help in cases of complete functional loss of the forearm flexors. Vejvalka's proposed operation for the correction

of contractured fingers by means of extending tendons from the functionally capable flexor bellies on the forearm is justified in isolatedly affected muscles of both flexor groups. Operations on the forearm bones designed to achieve a relative lengthening of the flexors by shortening the radius and the ulna can be seen as just a palliative approach good for cases of stage II of Volkmann's contracture.

Our own procedure — transposition of the flexor tendons — which we have been using for several years now is based on the assumption that the most serious changes affect mainly the group of the deep flexors of the fingers and the long flexor of the thumb. The bellies of those muscles are exposed to destructive pressure, ischaemization and venostasis for the longest time, which is why their fibrosis constitutes the basic pattern of the clinical picture. This fact is referred to by a number of authors describing pathological changes in Volkmann's contracture, and our own operation findings, bioptic tests and anatomical studies stand to confirm this. Routine EMG examination are burdened with static errors, often failing to give a convincing picture of functional impairment. Of more interest and, from the diagnostic point of view, also more valuable are the results of pre-operative arteriography which usually gives a good picture of changes in the vascular bed in the region of the interosseous and ulnar arteries. Changes of this kind are more prominent in patients with a short history of involvement while in longer-lasting deformities improvement can be stated as a result of adaptations of collateral circulation with simultaneous major loss of function.

The surgical operation proper is carried out under potentiated local anaesthesia (even in young patients) which permits us to monitor the function

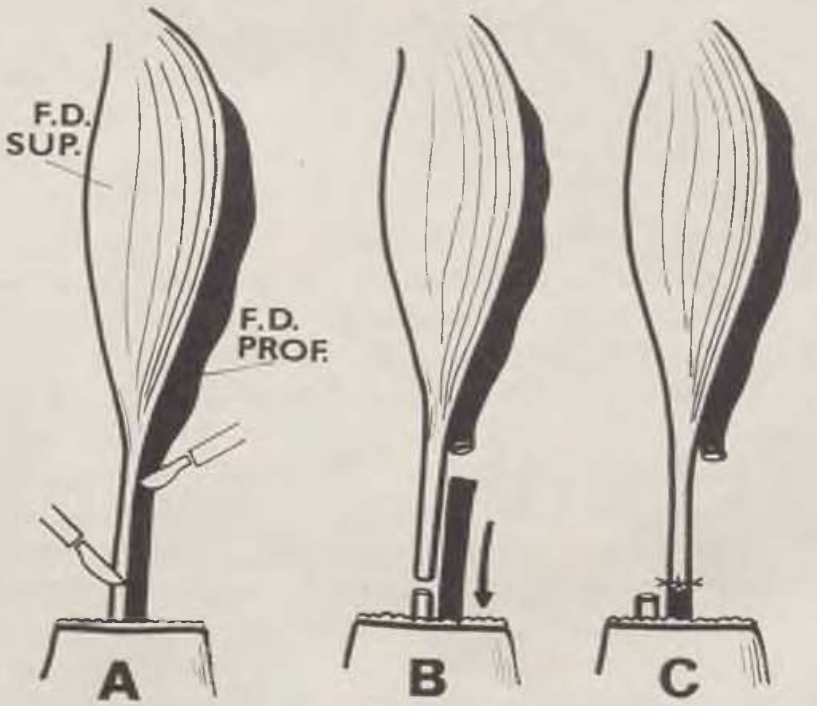

Fig. 1a, 1b, 1c

of each particular muscle as well as to control the range of the necessary contractility. The tendons are transposed by cutting the distal portion of the deep flexor tendon high up proximally nearly as far as the point where the tendon enters the belly of the muscle. The functionally more capable and reparable superficial flexor is used as a motor, and its tendon is cut as distalward as possible (Fig. 1 A). By extending the finger the transected tendon of the deep flexor is shifted as far as the free end of the functional proximal part of the superficial flexor (Fig. 1 B). Then we unite both tendon ends using an end-to-end modification of Bunnell's suture (Fig. 1 C and Fig. 2). At the

Fig. 2.

same time, we also lengthen the tendon of the m. flexor pollicis longus as the flexed position of the terminal phalanx of the thumb usually prevented the restoration of the gripping capacity of the operated hand. In some cases where pre-operative rehabilitation failed to relieve the semiflexion of the wrist we lengthen in a bayonet fashion the flexor carpi ulnaris and radialis.

After the operation, we fix the hand and the forearm with a volar splint in the functional position to begin controlled rehabilitation as early as the 8th day. After each exercise we attach the splint again until on the 18th day we dispense with it altogether. During the rehabilitation period we follow up our patients for 4 to 6 months at regular checks. The functional gain in the operated hand is not regarded as definitive until after 10 to 12 months. After that period, there may be some increase in grasping power in connection with work and continuous rehabilitation efforts but we do not expect any major improvement in the range of motion actually achieved.

The first in our series of surgical case was a 32-year old man — 10 years after severe contusion of the right-hand forearm caught in a transmission while at work. After healing clawhand developed, the configuration of which remained unchanged in spite of rehabilitation started later (Fig. 3). Because

of the deformity the extremity kept receiving less and less exercise until marked atrophy appeared on the forearm and, particularly, the hand. Thanks to consistent exercise, however, the joints of the fingers and the forearm remained relatively free. Although the wrist flexion test result was not exactly

Fig. 3.

Fig. 4.

satisfactory we decided to try surgical treatment. Five months after the operation the patient was able to extend and flex his fingers within the range of functional requirements (Fig. 4 and 5).

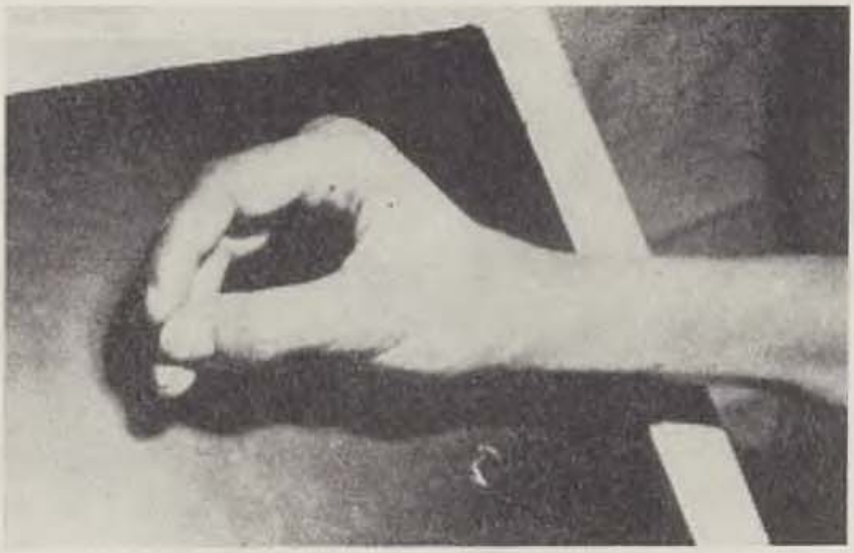

Fig. 5.

Fig. 6.

In another case, a 45-year old joiner had suffered contusion of the right-hand forearm due to the fall of a heavy object 7 months before admission to our unit. He had been treated conservatively with a splint. A fortnight after the accident the fingers of his right hand developed a contraction position.

Fig. 7.

Fig. 8.

a condition which failed to improve despite prolonged rehabilitation. The patient was consequently advised to go on invalidity pension (Fig. 6). Thanks to repeated exercise, stiffening of the joints could be avoided, and in passive flexion of the wrist the patient was able to move his fingers freely, albeit within a limited range (Fig. 7). Four months after surgery and thanks to intensive rehabilitation the patient was able to perform extension and flexion of the right hand (Fig. 8). As a result of more rehabilitation and gradual working exercise the function of the hand improved enough to permit the patient, 6 months after operation, to resume his original job and to do it without any major limitation (Fig. 9).

A similar clinical picture was seen on admission in another of our patients, a 43-year old seamstress who, 20 years before, had suffered an injury of the right-hand forearm with transverse fracture of both forearm bones. Reposition had been performed by surgical operation and, by the patient's own account, there had been healing per secundam. On removal of the plaster-of-Paris dress-

ing, her fingers were found contractured, a position which became stabilized in its present picture after long-term rehabilitation (Fig. 10). Three months after our operation and thanks to controlled exercise, the patient was able to freely extend and flex the fingers of her right hand (Fig. 11 and 12). After another 3 months she was able to resume her previous job.

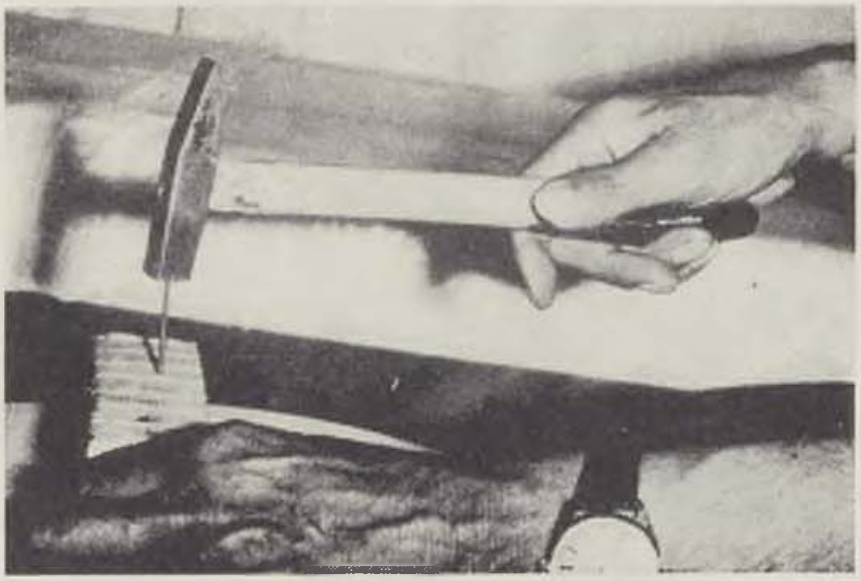

Fig. 9.

Fig. 10.

Fig. 11.

Another interesting and instructive case was a 6-year old boy who developed Volkmann's contracture after a supracondylic fracture of the right-hand humerus and two-day plaster-of-Paris fixation. 6 months after the injury when the patient came to our attention the contracture had already been stabilized.

Fig. 12.

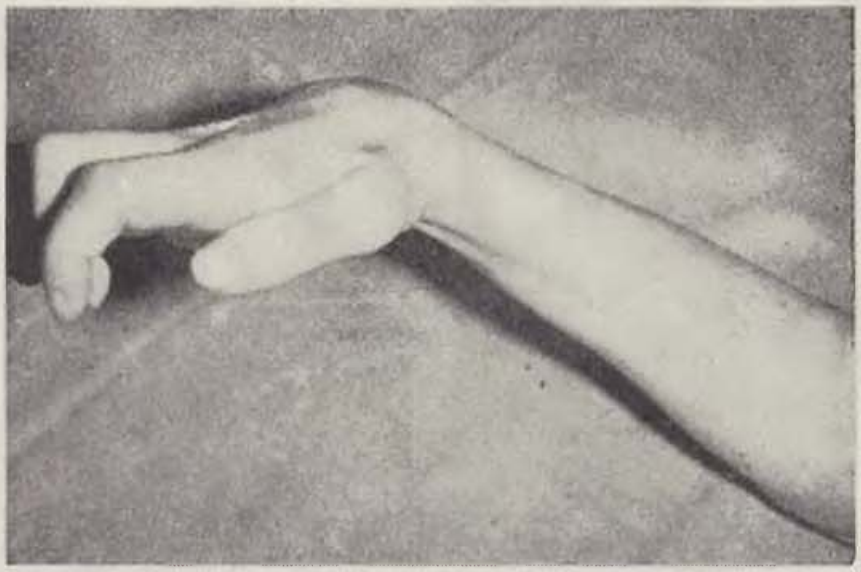

Fig. 13.

The boy was using his right hand very little, mostly just to hold things in position (Fig. 13). The joints of the fingers and the hand were free thanks to the efforts of the mother who kept engaging the boy in exercise all the time. Active motion of the fingers was impossible except with the wrist flexed

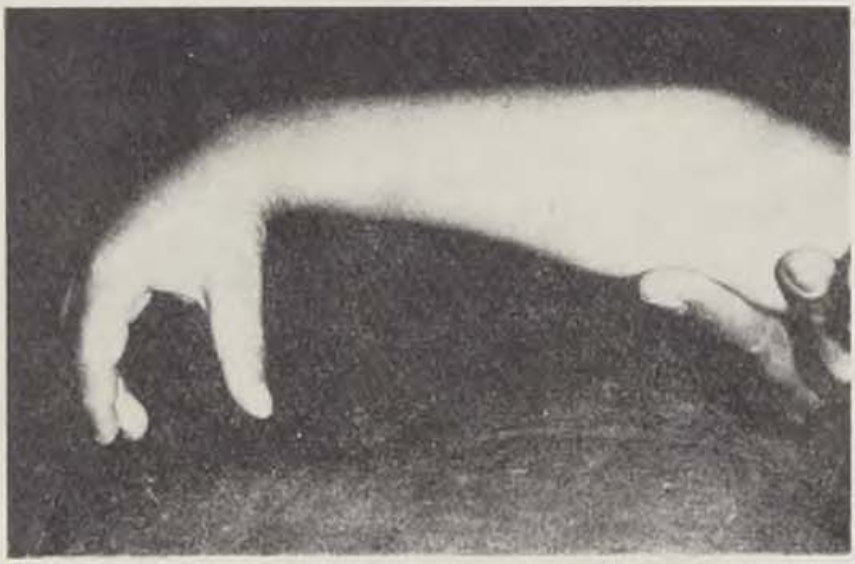

Fig. 14.

Fig. 15.

Fig. 16.

(Fig. 14). In view of the patient's age, we were afraid of surgical intervention as we did not hope for adequate co-operation during post-operative rehabilitation. Following the operation which was performed under local anaesthesia and perfect premedication the course of healing was entirely smooth. Within

Fig. 17.

four months the function of the hand had improved surprisingly but solely after controlled rehabilitation at play, the effectiveness of which we had had some doubt about prior to the operation. The hand in extension is free, flexion of the fingers is functionally satisfactory and so is the boy's grasping capacity (Fig. 15, 16, 17).

Following our good experience with the surgical procedure and results in this 6-year old boy we decided to operate on two more children for Volkmann's contracture, boys aged eight and twelve years. In one of them (Fig. 18) who was admitted at our unit seven weeks after the development of Volkmann's contracture following supracondylic fracture of the humerus on the left we were surprised by persistent oedema of the fingers with trophic changes on the fingers while sensitivity was fairly well preserved. The left hand and the distal third of the forearm were markedly cooler than the contralateral extremity. Arteriography revealed occlusion of the brachial artery on the left 4 cm away from the elbow line with satisfactorily developing collaterals.

For that reason we refrained from the planned corrective operation to perform merely careful removal of the fascia and to relieve the muscle bellies of the superficial flexor in an effort to improve circulation (Fig. 19). Following intensive rehabilitation and an intermission of 4 months marked by pronounced

Fig. 18.

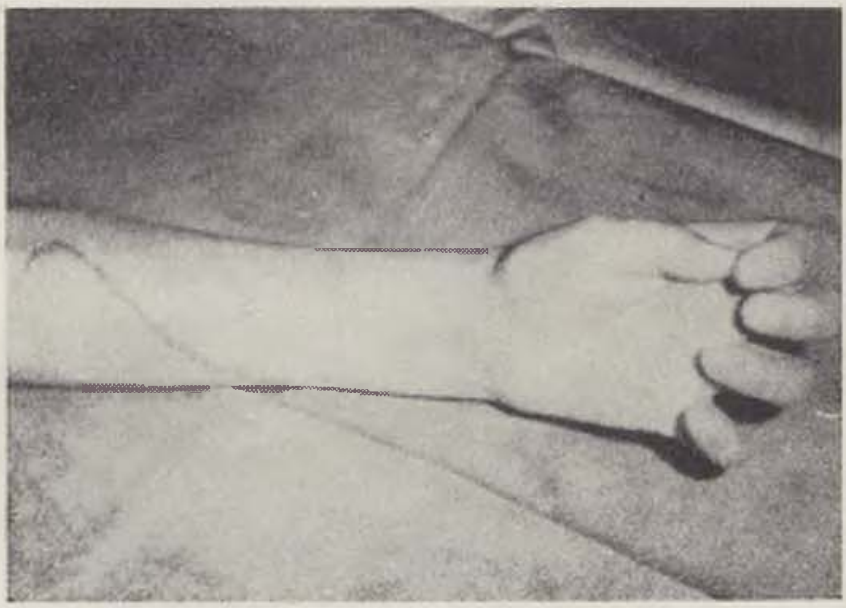

Fig. 19.

improvement in the blood supply to the left-hand extremity we performed a corrective operation in the above described manner with transposition and lengthening of all the flexor tendons. The post-operative course was smooth permitting rehabilitation to be started on the 10th day. At a check-up six

months later, we were able to state satisfactory functional improvement both in grasping larger objects (Fig. 20 and 21) and in more delicate operations (Fig. 22).

Fig. 20.

Fig. 21.

The other patient, a 12-year old boy, operated on in the same way three months before writing this report, there is satisfactory restoration of function while intensive rehabilitation is going on, and the required correction is expected to be achieved within the next 3 to 4 months.

So far we have had good results with the above described surgical operation used, until now, in a total of 11 patients. It is encouraging to note that deformities of the hand of the type of Volkmann's contracture are increasingly rare. This is no doubt evidence of increased care given to patients with

Fig. 22.

fractures of the humerus or other injuries in the regions of the forearm and the elbow. At the same time, it accounts for the relatively low number of patients we have been able to operate on so far, a fact which prevents us from drawing any definitive conclusions. We do hope, however, that in indicated case our procedure will contribute to the surgical treatment of this severe and socially so weighty damage to the hand. J. H.

SUMMARY

Volkmann's ischaemic contracture is a most serious type of hand damage. The author stresses the need for early surgical treatment of the acute form, the importance of rehabilitation, and discusses different corrective strategies in stabilized clinical pictures of the deformed hand. The surgical strategy devised by the author himself is based on the conviction that the gravest degenerative changes affect primarily the group of deep flexors of the fingers and the long flexor of the thumb as these are the longest exposed to ischaemization, venostasis and destructive oedema pressure. Their fibrosis underlies the clinical picture of Volkmann's contracture. During the corrective operation, for which the wrist flexion test is taken as an indication, the peripheral stump of the deep flexor is attached to the central portion of the motori capable superficial flexor. This is not only to relieve the contractured fingers but also to restore their function. Splinting and rehabilitation are essential supplements to the surgical treatment.

RESUME

La contracture ischémique de Volkmann

Hasman, L.

La contracture ischémique de Volkmann présente un des plus grave endommagements de la main. Dans le traité, la nécessité d'une intervention opportune est soulignée, s'il s'agit de la forme acute de maladie. On accentue l'importance de la rééducation et l'on discute de différents procédés correctifs s'il s'agit de l'immage de la déformation de main déjà stabilisée.

Le procédé opératoire est basé sur l'oppinion que les changements dégénératifs les plus graves atteignent surtout le groupe de profonds fléchisseurs des doigts et le fléchisseur long du pouce, dont l'exposition à l'ischémisation, vénostase et à la tension destructive de l'oedème est la plus longue. Leur fibrose pose la base de l'immage clinique de la contracture de Volkmann. L'opération corrective, qui est indiquée par un teste de flexion du poignet, consiste en jonction du moignon périphérique dégagé du fléchisseur profond avec la partie centrale du fléchisseur superficiel dont la motilité reste conservée. De cette manière, on arrive non seulement au dégagement de la contracture des doigts, mais aussi au renouvellement de la fonction. L'application des attelles et la rééducation sont indispensables pour l'effet complet du traitement opératoire.

ZUSAMMENFASSUNG

Die Volkmannsche ischämische Kontraktur

Hasman, L.

Die Volkmannsche ischämische Kontraktur stellt eine der schwerwiegendsten Beschädigungen der Hand dar. Es wird daher die Unerlässlichkeit einer rechtzeitigen chirurgischen Intervention bei der akuten Form betont, ebenso die Bedeutung der Rehabilitation, und es werden die verschiedenen korrektiven Methoden beim bereits stabilisierten Bild der deformierten Hand diskutiert.

Bei dem vom Autor vorgeschlagenen Vorgang der Operation wird von der Voraussetzung ausgegangen, dass die schwersten degenerativen Veränderungen vor allem die Gruppe der tiefen Flexoren der Finger und des langen Beugemuskels des Daumens betreffen, die am längsten der Ischämisierung, der Venostasis und dem zerstorenden Druck des Ödems ausgesetzt sind. Ihre Fibrosis bildet den Grund des klinischen Bildes einer Volkmannschen Kontraktur. Bei der korrektiven Operation, zu der der Flexionstext des Handgelenks die Indikation darstellt, wird an den freigemachten peripheren Stumpf des tiefen Flexors der zentrale Teil des motorisch fähigen oberen Flexors angeschlossen, wodurch man nicht nur die Kontraktionsstellung der Finger löst, sondern auch die Funktion erneuert. Das Schienen und die Rehabilitation sind unerlässliche Ergänzungen der operativen Methode.

RESUMEN

Contractura isquémica de Volkmann

Hasman, L.

La contractura isquémica de Volkmann representa uno de los defectos más graves de la mano. En el estudio se subraya la indispensabilidad de una oportuna intervención quirúrgica en casos de forma aguda del defecto, la importancia de la rehabilitación y se discuten diferentes procedimientos correctivos en la ya estabilizada condición de la mano deformada.

En el procedimiento operativo que recomienda el autor se parte del que las alteraciones más graves degenerativas ante todo afectan un grupo de flexores profundos de los dedos y el flexor largo del pulgar, los que han estado expuestos a la isquemización la venóstasis y la presión devastadora del edema durante el tiempo más largo. Su fibrosis es en la que se fundamenta el diagnóstico clínico de la contractura de Volkmann. Para proceder a la operación de corrección, la indicación es una prueba de flexión de la muñeca. En esta operación, el liberado muñón periférico del flexor profundo se conecta con la parte central del flexor superficial, motóricamente hábil. Con ello no sólo se consigue liberar los dedos de su posición contraída, sino que también se renueva su función. Utilización de tablas y la rehabilitación son complementación indispensable de la intervención operativa.

REFERENCES

1. **Boyes, J. H.:** Bunnell's surgery of the hand. J. B. Lippincott Co., IV Edit., Philadelphia, 1964.

2. **Buck-Gramcko, D.:** Die Ischämische Kontraktur der Hand. Chir. Praxis., 13 : 75, 1969.

3. **Dale, W. A., Lewis, M. E.:** Management of ischemia of the hand and fingers. Surgery, 67, 1 : 62, 1970.

4. **Epstein, G. J.:** In: Bogoraz, N. A.: Reconstructive surgery (in Russian), M., 1948, II. 2.

5. **Goldner, J. L.:** Volkmann's ischemic contracture. In: Hand Surgery (J. E. Flynn), The Williams and Wilkins Co., Baltimore, 1966.

6. **Hasman, L.:** Volkmann's ischaemic contracture (in Czech). Rozhl. Chir., 58, 9 : 551, 1979.

7. **Meyerding, H. W., Krusen, F. H.:** Treatment of Volkmann's ischaemic contracture. Ann. Surg., 110 : 418, 1939.

8. **Scagliatti, O.:** Chirurgische Behandlung der Volkmannschen Paralyse. Verh. dtsch. orthop. Ges., 45 : 219, 1957.

9. **Schink, W.:** Volkmannsche ischämische Muskelkontraktur, pp. 411—424, Allgemeine u. spezielle chirurg. Operationslehre X/3: Die Operationen and der Hand: W. Wachsmuth u. A. Wilhelm. Springer Verlag Berlin-Heidelberg-New York, 1972.

10. **Seyfarth, H.:** Die Desinsertionsoperation bei der Volkmannschen Kontraktur. Chir. Praxis, 4 : 171, 1960.

11. **Spinner, M., Aiche, A., Silver, L., Barsky, A. J.:** Impending ischemic contracture of the hand. Eearly diagnosis and management. Plast. reconstr. Surg., 50 : 341, 1972.

12. **Uebermuth, H.:** Die Ursache des v. Volkmannschen Syndroms. Beitr. Neurochir., 15 : 335, 1968.

13. **Vejvalka, J.:** Volkmann's ischaemic contracture, notes and proposed operation (in Czech). Acta Chir., orthop. Traum. čech., 27, 6 : 481, 1960.

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LOSS INJURIES OF THE FINGERS

M. KRÁLOVÁ

The frequent rate and diversity of loss injuries of the fingers provide an evergreen reason for notes on the strategy of repair in their treatment. In the following brief communication we wish to mention some of reconstructive operations used in the treatment of those injuries at the Department of Plastic Surgery in Brno.

In what are the simplest cases we treat loss of skin cover with free skin transplants. Far more frequent, however, are finger injuries with major and, at the same time, deeper tissue defects when the skin cover lost can only be replaced by a flap, i.e. skin and subcutis. In such cases, we use one of the techniques of flap transfer as shown in the illustrations. Flap transfer permits more demanding reconstructive operations on the injured finger, e.g. replacement of a joint, tendon or bone including nerve suture.

The well known and tested method of cross-finger flap is in certain cases of loss injury of the fingers the most advisable mode of treatment. The re-

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 1., Fig. 2., Fig. 3.: Patient K. K.: shaving machine injury resulting in loss of the tip of the thumb and a small piece of skin on the dorsal side of the distal phalanx of the left-hand index. The thumb tip loss was compensated by a cross-finger flap from the uninjured dorsal surface of the index finger, while the small skin defect on the same finger was covered with a free skin graft

Fig. 4.

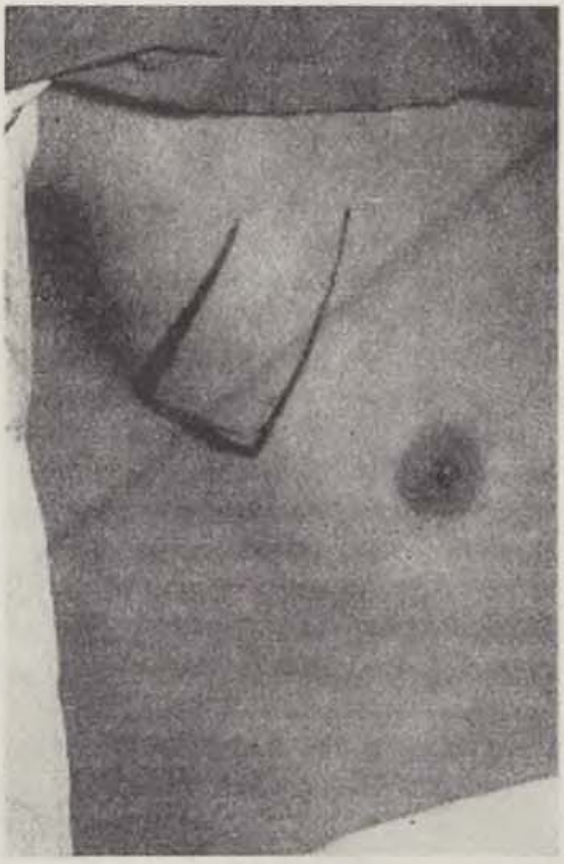

Fig. 5.

Fig. 4., Fig. 5., Fig. 6.: Patient M. F.: a milling machine injury on the dorsal side of the terminal phalanges of the 3rd and 4th digits of the left hand with only the soft bellies of the fingers preserved. Referred to our department days after the accident with granulation surfaces on the injured fingers. A flap taken from the chest was used for covering the defects

Fig. 6.

constructed skin cover is taken from the vicinity of the defect and is, consequently, closest to the original skin in terms of texture, colour and quality.

The criteria for a soundly functional skin cover as well as good aesthetic outcome are met by the tissue of direct single-pedicle flap from the chest.

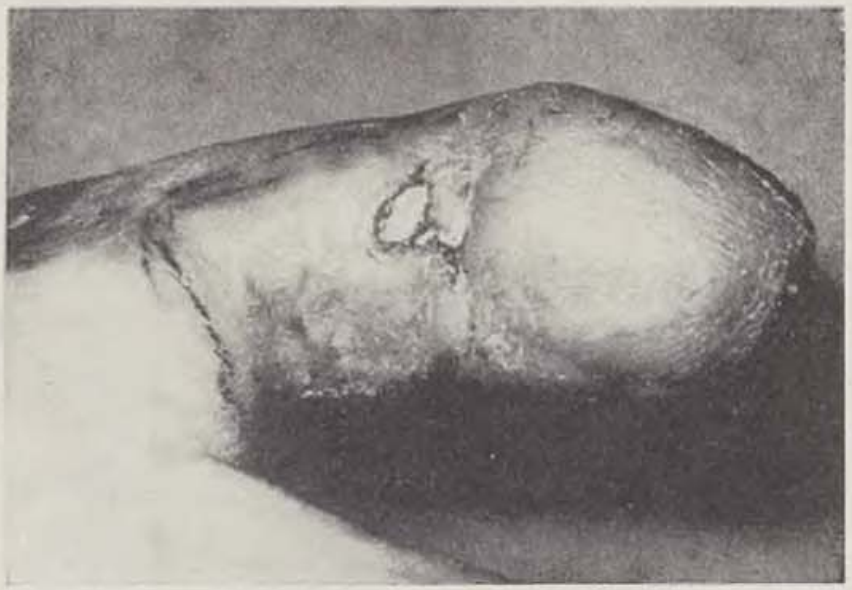

Fig. 7.

The donor site is the ventral surface of the axillary zone of the chest with the flap pedicle beneath the clavicle. The flap always follows the axillary direction. Vascular supply in this particular region is very good, and the flap can be

Fig. 8.

Fig. 9.

Fig. 7., Fig. 8., Fig. 9., Fig. 10.: Patient Z. C.: injured by a radiator fan blade on the right-hand thumb. At primary treatment, the denuded thumb was covered with a lower abdominal flap; referred to our unit for after treatment. To save the thumb it was necessary to transfer a flap large enough to cover the exposed bone over half the basic and the whole of the distal phalanges. A chest flap was implanted into the defect

Fig. 10.

disconnected from the supply pedicle as early as the 16th post-operative day. The secondary defect scar is directed towards the axilla; there is nothing conspicuous about it, which permits its use also in women. The firm and

Fig. 11.

slightly convex surface of the chest simultaneously acts as a suitable "splint" for the hand as it can reliably immobilize the injured hand with the aid of two strips of adhesive tape. Another advantage of the method is in the reduced number of modelling operations on the flap after healing in compared with abdominal flaps which are invariably abundant.

Fig. 12.

Fig. 13.

Fig. 11., Fig. 12., Fig. 13.: Patient Z. K.: injured by a fan blade on the dorsal side of the terminal phalanx of the left-hand index. A flap taken from the arm was transferred to cover the exposed bone of the terminal phalanx

Very good results can also be achieved with direct single-pedicle flaps transferred from the inside or outside surface of the arm in what is known as Colson's operation. This flap, too, is well supplied and the transplanted tissue is adequately thick to match the skin cover of the finger. In addition, the arm provides good immobilization support for the injured hand.

In cases of deep and extensive defects in one or more fingers we prefer single-time direct-transfer single-pedicle flaps taken from the lower abdominal region in the form of tubed or square flaps.

Fig. 14.

Fig. 15.

Fig. 14., Fig. 15., Fig. 16.: Patient J. H.: a milling machines injury involving loss of the volar sides of the 3rd and 4th digits of the right hand down to the bone. The soft tissue defect was covered with a direct transfer single-pedicle flap from the hypogastrium

CONCLUSION

This brief communication was intended to demonstrate the possibilities of plastic surgery in the treatment of loss injuries of the fingers. Correct reconstructive strategy in primary treatment can not only save the functional ability of the injured fingers but also restore good aesthetic appearance of the recipient site.

J. H.

Fig. 16.

SUMMARY

The authoress presents several techniques for the treatment of loss injuries of the fingers, in particular: the crossfinger flap, the thoracic and brachial flaps, and the method of large flap transfer from the lower abdomen. She mentions the need for correct indication, and lists the advantages of the above methods which continue to be useful and relevant even in the present period of advancing microsurgery.

RESUME

Le trauma de perte sur des doigts de la main

Králová, M.

L'auteur allègue plusieurs méthodes du traitement des traumas de perte sur les doigts de la main. Il s'agit d'une méthode qui utilise de petits lobes croisés, thoraciques ou du bras, aussi que des lobes plus grands, provenants de la région du bas-ventre. L'auteur pose l'accent sur une indication précise et sur les avantages des méthodes citées qui ne manquent pas d'importance au temps du développement contemporaine de la microchirurgie.

ZUSAMMENFASSUNG

Verletzungen unter Verlust der Finger

Králová, M.

Die Autorin führt einige Methoden der Behandlung von Verletzungen unter Verlust der Finger an und zwar die Methode des gekreuzten Lappens, des Brustkorbs- und Oberarmlappens und die Methode der Transplantation grösserer Lappen aus der Unterbauchgegend. Sie weist dabei auf die korrekte Indikation und auf die Vorteile der erwähnten Methoden hin, die auch bei der heutigen Entwicklung der Mikrochirurgie nichts an ihrer Bedeutung verlieren.

RESUMEN

Heridas con resultante pérdida de los dedos de la mano

Králová, M.

La autora presenta algunas formas de tratamiento de las heridas con resultantes pérdidas de dedos de la mano, a saber el método del lóbulo cruzado, torácico y del brazo así como el del transplante de grandes lóbulos tomados del hipogastrio. Señala la correcta indicación y las ventajas de los métodos mencionados, que ni siquiera con el actual desarrollo de la microcirujía no pierden nada de su importancia.

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TREATMENT OF KELOID SCARS

S. P. PAKHOMOV, V. F. BOLSHAKOVA, E. C. AKHSAKHALIAN

Not even nowadays either conception of aetiology and pathogenesis of keloid scars or their treatment exists.

Formation of the keloid scars is accompanied by proliferation of the fibroblasts and by hyalinosis. According to Biriukova et al. (1980) the development of keloid scars is preceded by fibromatosis. Atypical reactivity of the organism plays an important role in the formation of the keloid scars pertaining to connective tissue disorders.

According to the literature data the frequency of keloid scars varies considerably. Keloid scars developed as a consequence of burns in 6.4 % according to Kallistov (1970) and in 12—21 % according to Dmitrieva (1955).

Keloid scars originate most frequently from spontaneous healing (ephitelization) of III A burns. They develop also from wounds caused by mechanical injuries, from postoperative wounds, and in consequence to some other pathological conditions (acne, furunculosis, pyodermia and others).

Commonly applied conservative methods using enzymatic and hormonal pharmaceuticals (Conway et al. 1960, Javorski 1973) as well as pyrogenal and diadynamic currents (Selezneva 1976) by far do not secure effective treatment of keloid scars; they are effective only at early stages of keloid scar formation.

Operative treatment of keloid scars is accepted reservedly by many surgeons (Bratus 1963, Selezneva et al. 1979) because — in their opinion — the removal of keloid scars often results in worsening the patient's condition by frequent remissions. According to Maurer (1965) the remissions occur in 40—50 % of cases with the new scar being much larger than that removed. Bratus (1963) found remissions in 8 out of 18 patients. Bolkhovitinova and Pavlova (1977), comparing the results of conservative and operative treatment, found total remissions in 7 and partial remissions in 38 out of 117 patients.

Obukhova (1949) has reached good results using subepidermal removal of the keloid scars. The epidermis was separated in the form of a pedicle

flap and used for covering the wound. This way of dissection of the keloid scar is however difficult and impossible to perform in some circumstances — especially in cases of massive scars. When the graft fails to accomodate the remissions occurs. Conway et al. (1960) dissected keloid scars leaving their narrow marginal strips in situ. This operative treatment was combined with previous irradiation and administration of glucocorticoids, and successful results were obtained in 50—55 % of patients.

METHODS

We have generalized our experience with complex therapeutical approach and long-termed examination of 370 patients (aged from 2 to 65 years) suffering from keloid scars. The treatment was performed at Gorky Research Institute of Traumatology and Orthopaedics and Gorky Research Institute of Dermatology. In 232 patients keloid scars developed in consequence to thermal or chemical burns, in 32 patients after electrocoagulation due to tattooing, in 31 patients owing to acne, in 64 patients after wounds, bites, injections of pharmaceuticals and surgical incisions, in 7 patients after inflammatory skin lesions and in 4 patients they developed spontaneously. In 9 patients the keloid scars were remissions of surgically treated primary keloids at other hospitals.

The keloid scars formed in 118 patients on the face, neck and auricle, in 181 patients on the lower and upper extremities and in 171 patients on the torso. In 276 patients a single well demarcated scar sized from 6 to 100 cm^2 occurred. 94 patients had either more than one (from 3 to 14) or one massive scar (from 200 to 1500 cm^2 or even larger). In 40 patients keloid scars caused eye ectropion and/or face mutilation. In 31 patients they caused contractures of the neck, in 31 patients contractures of the shoulder, elbow and radiocarpal joints and of the hand and fingers, in 10 patients contractures of the joints of the lower extremities. A lot of patients suffered from other deformities and functional disturbances. All the patients suffered from itching and scratching, which prevented them from quiet sleep.

286 patients were treated conservatively, 84 out of them in combination with the operative treatment. 114 surgical interventions removing the keloid scars from 132 localizations were performed. In 45 patients the clinical diagnosis of keloid scars was confirmed by histological examinations of excised scars. In case of the operative treatment healing time was as follows: less than 1 year in 43 patients, between 1 and 2 years in 26 patients, between 3 and 4 years in 6 patients, between 4 and 5 years in 1 patient and more than 5 years in 8 patients.

Conservative treatment consisted of irradiation with Bucky rays generated by RUM apparatus (voltage 10 kV, intensity 5 mA, no filtration, skin-focus distance 10 cm). Each field war irradiated with single doses of 30—36 R in children and from 35 to 80 R in adults. One course consisted of 6—10 doses for each field at intervals of 6—7 days; the total dose being from 350 to 800 R. If necessary, the course was repeated 4—5 times at intervals from 3 to 4 months. The total dose absorbed during 4—5 courses of Bucky rays was

within the limits of 1400—2000 R, which can be considered a safe level of irradiation. Thus, possible complications of irradiation were excluded and irradiation could be combined with massage and overnight application of ointments (under a compressive bandage) containing corticoids, lidaze and heparin. If present, edema and inflammation had been removed by means of inflammatory ointments and lotions before irradiation and massage were started.

Massive and prominent scars resisting the irradiation and causing functional and cosmetic disturbances were treated both conservatively and operatively.

It is generally known that excision of the keloid scars with the healthy surrounding tissue represents a skin trauma which very often results in development of new keloid scars of considerable size. In order to prevent these remissions we have elaborated a new technique (Author's certificate No. 560597) enabling us to dissect the keloid scar without damage to the healthy skin. At first, the epidermal layer of the keloid scar is detached by means of hydraulic effects of 0.5—0.25 % solution of novocaine. Then the epidermis of the scar is incised so that narrow strips of the marginal epidermis can be left in situ and the inside of the scar is completely removed (as if enucleated). The margins of the wound are approximated using catgut subepidermal sutures and the wound is closed by monofil sutures. In case of massive keloid scars, when the approximation of the wound margins without stretching is impossible, the wound is closed using free cutaneous grafts sutured to the marginal epidermal strips formed from the keloid. After healing of the wound or succesful accomodation of the graft (i.e. 10—12 days after the surgery) it is possible to start irradiation (1—2 courses).

RESULTS AND DISCUSSION

Long-termed results (after 2 or more years) of conservative treatment have shown that the clinical healing (disappearance of flat scars) was reached in 209 (73 %) patients. In 41 (14 %) patients the scars improved and in 36 (13 %) patients, which suffered from scars having developed either spontaneously or owing to acne, the treatment was without effect.

Less satisfactory results of the conservative treatment were observed in the patients aged over 40 years. The scars regressed much better in children and young patients, especially if the treatment started soon after the formation of the scar.

The example of successful conservative treatment: Patient B., aged 27. She suffered from II—III A degree thermal burns caused by a flame (30 % of the body surface) and was treated in a regional hospital for 5 months. The keloid scars started to form soon after the healing of the wound and were accompanied by sensations of heat and by itching.

The patient was admitted into Gorkii Research Institute of Dermatology 7 months after the injury and 2 months after healing of the burns. She walked on crutches assisted by accompanying persons.

The keloid scars were circularly arranged and occupied broad areas of the thigh, leg, knee joint, ankle joints and dorsal aspect of the leg. At admittance the scars were edematous, inflamed, fragile with many scratches. The scars at the popliteal region and lateral aspect of the ankle joints were especially coarse and restricted the movements. In the right popliteal region there was an ulcer with undermined margins.

The treatment at the Institute consisted of 4 courses of irradiation (at intervals 3—4 months), antiinflammatory and lytic ointments, and massage. Bucky rays were applied in single doses of 74 R at first to 120 fields, then — according to the progress of improvement — to 100, 80, 40 and 20 fields. The dose administered during 4 courses to one field did not exceed 2000 R. At the end of the first course the inflammation subsided and the pain decreased. The patient was able to walk without crutches and to work. After the second course the ulcer was epithelised and healed. 4 years after the fourth course of irradiation there were only soft scars and free movement in all joints recovered.

In 84 patients we performed 114 surgical interventions and excised 132 keloid scars of various size. In 52 operations the wound was closed by suturing its epidermal margins and in 8 patients epidermal pedicle flap (of the size to 250 cm^2) was used. In 36 operations free skin grafts were used and in 26 operations the free skin grafting was accompanied with the suturing of the epidermis (see the table).

Table 1. Results of individual types of skin plasty in relation to the extent of scarring

Skin plasty	No. of operations removing the scar				Results	
	Single scars	Multiple scars	Broad scars	Total	Healed	Remissions
Local (epidermal suture)	34	10	8	52	51	1
Free	10	6	20	36	33	3
Combined	—	—	26	26	26	—

There were no complications in the postoperative period — all the free skin grafts as well as combined skin grafts accomodated successfully. In 50 patients healing by primary intention took place. In one patient the sutures desintegrated totally and in the second one partially; the wounds healed by secondary intention.

The analysis of long-termed results (from 1 to 10 years) of the surgical treatment supplemented by conservative treatment showed a complete healing in 80 patients.

Our technique of excision of keloid scars decreases the risk of remissions — neither the excision nor suturing of the wound presents trauma to the surrounding healthy skin. Thus, damage to the connective tissue of the dermis and subsequent hypertrophic growth are avoided.

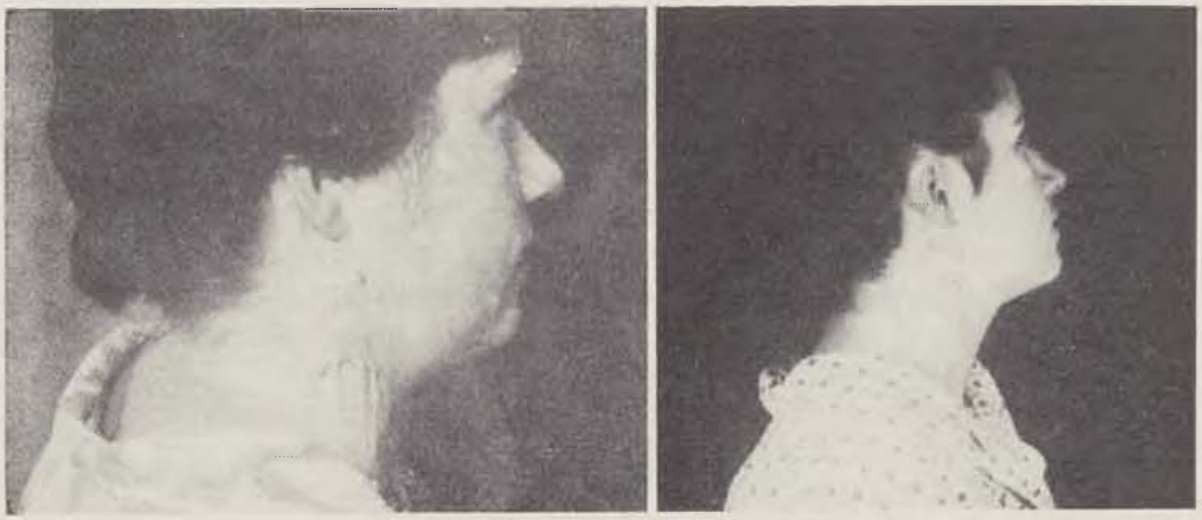

Figure 1. Keloid scar at the neck region after a chemical burn. a) before treatment, b) 9 years after the treatment using epidermal sutures and a free skin plasty

Surgical treatment resulted in the remission of keloid scars in 4 patients (4.8 %) only. In these patients the keloid scars developed spontaneously (3 patients) of after burns (1 patient).

These are the examples of successful treatment: Patient T., aged 24, admitted in the Gorkii Research Institute of Traumatology and Orthopaedics on August 9, 1973. Diagnosis: keloid scars of the right neck region. The scars developed as a consequence of chemical burns caused by sulphuric acid on November 20, 1972. The used treatment of burns was conservative. After healing, prominent star-like dense scars (of the size 14×7 cm in the centre) formed (Fig. 1 a).

In the Institute a combined skin plasty was performed on August 24, 1973. The scar was excised and narrow (0.3 cm) peripheral strips of its epidermis were left in situ. Peripheral parts of the wound (rays of the star) were closed using the approximation of the margins and epidermal sutures. The central part of the wound was covered using free skin graft (0.4 mm thick) from the thigh. It was sutured to the epidermal margins using monofil sutures, and accommodated successfully. In the postoperative period the irradiation course was applied. The treatment was successful, as found on examinations within 9 years (Fig. 1 b).

Patient C., aged 25 years. Admitted into Gorkii Research Institute of Traumatology and Orthopaedics on September 26, 1973. Diagnosis: keloid scars of the left arm and forearm. The prominating massive scar (25×7—9 cm)

Figure 2. Keloid scar of the left arm and forearm after burns caused by boiling water. a) before treatment, b), c) 2.5 years after treatment using a combined skin plasty. The function of the elbow joint completely restored

occupied the anteromedial aspect of the arm, the elbow and the upper part of the forearm. Adjacent to the keloid scar at the elbow was an ulcer (2 cm in diameter) with hyperemic edematous margins. The massive scar limited the movement in the elbow to 75 degrees.

Figure 3. Remission of the keloid scar at the shoulder joint region. a) before treatment b) 10 years after the treatment using a free skin plasty

Two years ago the patient suffered burns by the boiling water. They were treated conservatively. Epithelialization of the wound was followed by the development of the massive scars (Fig. 2 a). On October 4, 1973 we performed a combined skin plasty. The scar was excised except the 0.3 cm wide strips of detached epidermis at its margins. The upper part of the wound at the arm and its distal part at the forearm were sutured after the approximation of the margins. The central part of the wound (18×9—7 cm) was covered using a skin graft (0.5 mm thick) from the thigh. The graft was sutured to the epidermal margins using monofil sutures. The graft implanted successfully and healed by primary intention. In the postoperative period the irradiation with Bucky rays was applied. The results were checked 1 and 2.5 years after the surgery. The wound healed and function restored completely (Fig. 2 b, c).

Remissions of keloid scars are the most difficult to treat. As an example we will demonstrate the following case history. Patient D., aged 16, admitted

into Gorkii Reserch Institute of Traumatology and Orthopaedics on June 19, 1968. Diagnosis: circular keloid scar (8 cm in diameter) at the region of the right shoulder joint and keloid scar (of the size 7×8 cm) at the right nates. The scars projected considerably over the surrounding skin.

Anamnesis: In October 1964 after injection of a drug in the region of the right shoulder a rapidly growing scar occured. It was excised in the year of its formation, and its much larger remission occured in the following year. Another excision — including the healthy surrounding skin — was performed at a regional hospital in 1967; the wound was covered by a free skin graft taken from the lateral aspect of the nates. The graft accomodated only partially, and keloid scars developed both at the host and donor site.

Under subepidermal local anaesthesia (0.5 % solution of novocaine) we excised the scar at the right gluteal region. The wound was covered by two leaves of detached epidermis using monofil sutures. It healed by primary intention. The successful treatment encouraged the patient to ask for the treatment of the keloid scar in the shoulder region (Fig. 3 a). The patient was operated on February 4, 1970. The oval keloid scar (8 cm in diameter) with a central depression, formed at the skin graft, was dissected under the local anaesthesia with 0.5 % novocaine. The narrow strips (3—4 mm) of peripheral epidermis of the scar were left in situ. The defect formed by the excision was covered using a skin graft (0.4 mm thick) obtained from the lateral aspect of the right thigh. The graft was implanted to the epidermal margins using epidermal monofil sutures. The donor site was covered by a perforated polyethylene tape. The graft implanted successfully and the donor site healed without inflammation.

In the postoperative period both the region of excised scar and the donor site were irradiated with Bucky rays. The treatment was successful. Its results were checked 1, 5 and 10 years after the operation (Fig. 3 b).

Thus, this complex approach consisting of irradiation, massage and ointments with corticoids in cases of flat keloid scars, and of surgical excision in combination with irradiation in cases of scars resistent to conservative treatment, enables us to treat successfully most patients suffering from keloid scars.

M. D.

SUMMARY

Experience in the treatment of 370 patients suffering from keloid scars was generalized. A complex treatment consisting of irradiation with Bucky rays, massage and ointments with corticoids, lidaze and heparin is recommended for flat keloid scars. Surgical excision of the enucleation type with suturing the margins of narrow epidermal strips of the scar left in situ is recommended for smaller considerably prominent keloid scars. In case of massive scars the skin plasty should be used in combination with irradiation. This strategy secures successful treatment in 95.2 % of patients.

RESUME

Le traitement des cicatrices kéloïdes

Pakhomov, S. P., Bolchakova, V. P., Akhsakhalian, E. Ch.

Le travail résume des expériences avec le traitement des cicatrices chez 370 malades. Quant il s'agit de basses cicatrices kéloïdes, les auteurs recommendent un traitement complexe consistant en irradiation par le diaphragme de Buck, massages des cicatrices, application des onguents qui comporten corticoïdes, lidase et héparine. De hautes cicatrices kéloïdes sont enlevées par un traitement chirurgical. Sur les bords de petites cicatrices on résèque une bandelette étroite de l'épiderme et ensuite la plaie est recouverte par la suture de ses bords. Des surfaces plus vastes sont recouvertes par une plastie cutanée et consécutivement irradiées par le diaphragme de Buck. L'application des méthodes ci-dessus a mené aux résultats couronnés de succès; les cicatrices ont été enlevées en 95,2 p. 100 des cas.

ZUSAMMENFASSUNG

Die Behandlung von Keloidnarben

Pakhomow, S. P., Bolschakova, V. P., Achsachalian, E. Ch.

Die Arbeit fasst die Erfahrungen mit der Behandlung von Narben bei 370 Patienten zusammen. Im Fall niedriger Keloidnarben empfehlen die Autoren eine komplexe Behandlung, bestehend aus einer Roentgenbestrahlung über eine Bucky'sche Blende, Massieren der Narben und Anwendung einer Salbe, die Kortikoide, Lidase und Heparin enthält. Hohe Keloidnarben beseitigen die Autoren chirurgisch. An den Rändern kleiner Narben werden enge Hautstreifen abgenommen und präpariert und die Wunde wird vernäht. Grössere Flächen werden durch Hautplastik gedeckt, unter darauffolgender Roentgenbestrahlung über eine Bucky'sche Blende. Mit Hilfe dieser Methoden wurden Keloidnarben in 95,2 % aller Fälle erfolgreich beseitigt.

RESUMEN

Tratamiento de las cicatrices queloidales

Pajomov, S. P., Bolshakova, V. P., Ajsajalyan, E. Ch.

El trabajo resume las experiencias del tratamiento de las cicatrices en 370 pacientes. En el caso de bajas cicatrices queloidales, los autores recomiendan un tratamiento complejo consistente de la aplicación de los rayos X a través del diafragma Bucky, el masaje de las cicatrices y la aplicación de pomadas que contienen corticoides, lidaza y heparina. Para eliminar las altas cicatrices queloidales, los autores proceden a intervención quirúrgica. En los bordes de las cicatrices pequeñas se desprenden estrechas tiritas de epidermis y juntándose con costura se cierra la herida. Superficies más grandes se cubren con plástica dérmica y luego se exponen a rayos X al utilizarse el diafragma de Bucky. Con estos métodos se logró una eliminación exitosa de las cicatrices queloidales en el 92.2 % de los casos.

REFERENCES

1. **Birjukov, M. L., Beljakova, T. N., Dmitrijeva, G. I.:** Keloid scars developing due to burns and their connection with fibromatosis. In: Problems of Pathology of Burns. Gorkii, Gorkii's NIITO, 1980, p. 65.

2. **Bolchovitinova, L. A., Pavlova, M. N.:** Keloid scars. M., Medicine, 1977.

3. **Bratus, V. D.:** Surgical treatment of thermal burns. Kijev, Gosmedizdat USSR, 1963.

4. **Dmitrijeva, V. S.:** Surgical treatment of scars of face and neck caused by thermal and chemical burns. M., Medicine, 1955.

5. **Kallistov, B. M.:** Surgical treatment of keloid scars after burns. In: Problems of Pathology of Burns. Gorkii, Gorkii's NIITO, 1970, p. 405.

6. **Michelson, N. M.:** Scars of the skin after burns and injuries and their treatment. M., Central Institute of Postgraduate Medical Studies, 1947.

7. **Obukhova, L. M.:** Treatment of keloid scars. Chirurgija, 11 : 83, 1949.

8. **Selezneva, L. G.:** Keloid scars after burns. Acta Chir. plast., 18, 2 : 100, 1976.

9. **Selezneva, L. G., Judenitc, V. V., Grischkevitc, V. M. et al.:** General principles of conservative treatment of keloid scars after burns. In: The Second Federative Conference on Problems of Deep and Broad Burns. M., Vischnevskij's Institute of Surgery AMS USSR, 1979, p. 165.

10. **Javorski, S.:** Usage of Kenacort in treatment of hypertrophic scars and keloids. Acta Chir. plast., 15, 4 : 189, 1973.

11. **Conway, H., Gillete, R., Smith, J. W., Findley, A.:** Differential diagnosis of keloid and hypertrophic scars by tissue culture technique with notes on therapy of keloids by surgical excision and decadron. Plast. reconstr. Surg., 25, 2 : 117, 1960.

12. **Maurer, G.:** Das Keloid. Arch. klin. Chir., 309 : 14, 1965.

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Announcement

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Jaeger Christian, M.D.
Spedali Civili, 25100 Brescia, Italy

BOOK REVIEW

R. Königová and I. Pondělíček: **Reconstruction and Rehabilitation in Burn Injuries** (Avicenum Medical Press, Prague, 1983).

The last days of the last year saw the appearance on the book market of the long awaited book on problems of somatic and psychological rehabilitation in the burned by Dr. R. Königová, Head Surgeon, and As. Prof. Dr. I. Pondělíček, resident psychologist, both from the Prague burns unit of the Department of Plastic Surgery, Charles University Medical Faculty of Hygiene (head Prof. M. Fára, M. D., DrSc.).

In his word of introduction, Prof. Fára points out that the book offers an interesting view of the needs and potentialities of the comprehensive treatment of burns. I should like to add to those fitting words by stressing the fact that the book is, indeed, quite unique among those of our specialist literature and that it has long been missing by our surgical and medical professions. Unique not only because of the general scarcity of works dealing with problems of burn treatment, but mainly because of the conceptual union of somatics and psychology. It should be noted, though, that already in the past Dr. Königová informed the medical public of her experience in her previous work dealing with the problems of severe burns, albeit a limited selection of problems. In contrast, the present book covers the whole range of the problem in combination with a psychologist's experience. On a total of 277 pages of the text and excellent black-and-white photographs (293), 19 tables and diagrams, the authors present a well-balanced analysis of the problems involved in the treatment of burns — ranging from epidemiology, organization, up to the therapy proper and subsequent rehabilitation. without forgetting to analyze the causes and circumstances of failures.

Both authors proceed from their extensive, decades old experience of burn treatment at the Burns Unit of the Department of Plastic Surgery, Prague, thus giving a reflection of the experience of a whole number of plastic surgeons beginning with Academician František Burian himself, the founder of Czechoslovak plastic surgery in general and burns treatment in particular.

In her chapter on epidemiology and organization, the authoress refers solely to the Prague burns unit, which is, more or less, a detraction from the value of the book as it would certainly have been appropriate to mention also the only one year younger burns department in Ostrava, or also in Třinec and, after all, in Brno, too; not to mention the fact that the history of burns treatment in Slovakia is not referred to at all. In the chapter on organization, a comprehensibly and very instructively conceived one, we miss methodological guidelines issued by the superior body such as those put out by the Slovak Ministry of Health. Without such guidelines, any concentrated therapy is ruled out.

The main asset of the book is in the wealth of information on surgical reconstruction in burns, ranging from prevention, scar correction up to the reconstruction of special regions. The mass of material and text makes up a compact and

well documented whole with special regard to the basic principles of plastic surgery, supplemented by easy-to-survey diagrams and with due emphasis on all the relevant aspects of essential importance for the specialty. It would, in our opinion, have been to the benefit of the book if the authoress had had more pages and options for colour reproductions at her disposal. A brief chapter on the reconstruction of radiation injuries brings out the pitfalls of plastic surgery with references to both the principles and potentialities. There is also a good measure of information on specific instrumentation, apparatuses and devices necessary for the perfect treatment of burns.

In general, it can be said that the amount good advice, special tricks and tips, well-founded directions and a wealth of valuable experience will be greatly appreciated by anyone interested in reconstructive surgery in general and burns in particular.

An entirely new and, in our view, extremely important element of the book is the psychology chapter where on 55 of the total of 277 pages a true expert in the field analyzes the connection between somatic findings and their psychological responses, their feedback, to the process of healing and scar formation, and, eventually, the relationships between somatic and psychological rehabilitation. Dr. Pondělíček's account is easy to understand, precise and instructive, and sure to be welcomed by anyone interested in the rehabilitation of all manner of trauma and post-burn conditions. The deductions are extremely important, and knowledge of them among the medical profession is truly invaluable.

By way of conclusion, I can recommend the book under review to anoyone interested in reconstructive surgery, and still more to all those actually specializing in reconstruction and rehabilitation in order to allow the victims to return to social life and the working process after they have suffered burns. I regard the book as an important contribution to general training textbooks, as well as to plastic surgery reference books and to literature for the general medical public. All this is particularly relevant in view of the multidisciplinary nature of burns treatment. Our congratulations on their wise choice is also due to the Avicenum Medical Press (except for the total absence of colour photographs).

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Fig. 3. a) preoperative angiography of branches of the external carotid artery, b) initial phase of check-up angiography 5 days after operation. Arrow pointing to the deep circumflex iliac artery branching off from the external carotid. c) late-phase arteriography showing the filling of the deep circumflex iliac artery supplying the bone graft (arrow)

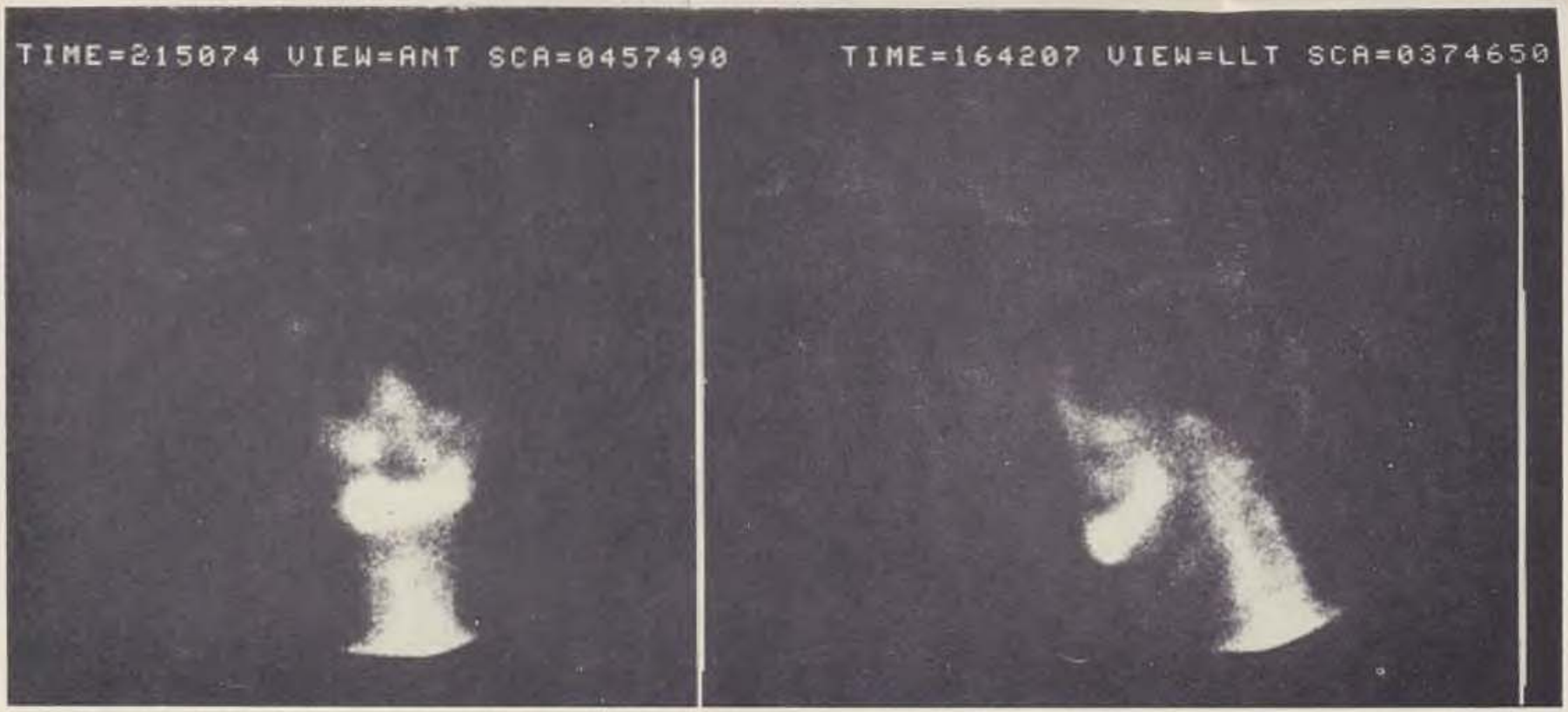

Fig. 4. Scintigraphy in the same patient demonstrating bone graft viability

CONTENTS

STOP FOR A MOMENT AND CONSIDER YOUR HEALTH

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

CZECHOSLOVAK SPAS — OASES OF HEALTH,
QUIET AND INSPIRATION

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