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COMPUTERIZED ANGIOGRAPHIC STUDY OF THE VASCULAR SUPPLY OF THE PECTORALIS MAJOR MUSCLE

P. CANDIANI, G. L. CAMPIGLIO, P. QUATTRONE*, A. LOVARIA*

INTRODUCTION

The need to repair at one time wide defects following surgical removal of carcinomas or traumas of the cervicofacial and thoracic regions has stimulated research into reconstructive solutions using local flaps. As in other areas of the body, the use of muscular or musculocutaneous flaps allows immediate reconstruction with functional and aesthetic results that are far more satisfactory and allow much shorter hospitalization period than in the past. The pectoralis major muscle or musculocutaneous flap, having good vascularization and a wide range of movement, is well suited to this purpose. Initially proposed for repair of the presternal area, these flaps have replaced the deltopectoral flap of Bakamjian as an ideal means of reconstruction of the cervicofacial region.

Thanks to the considerable progress in microsurgery, the possibilities for reconstruction by plastic surgery have increased greatly. However, exciting and successful as the new techniques may be, it is still important to reassess and perfect the flaps already known. Essentially such improvements would aim to reduce scarring and functional impairment thus achieving a better cost-benefit ratio.

Any discussion concerning a muscular or a musculocutaneous flap has to be focused on the analysis of the intramuscular vascular anatomy as also in the latter the principal characteristic is that the blood supply to the skin comes from its muscular component. The vascularization of the pectoralis major muscle has already been described by other authors. In this study we examine the vascular anatomy of this muscle using an image analyzer and a computerized measuring system to quantify the essential features objectively.

MATERIALS AND METHODS

We examined 22 pectoralis major muscles removed from fresh cadavers of both sexes and aged from 45 to 65 years.

We excluded subjects over 65 and those in cachectic conditions, that is with atrophic and fibrous muscles, therefore inappropriate for a study such as this. Another indispensable requirement for proper investigation was good preservation of the axillary vessels and the absence of significant atherosclerotic and thromboembolic lesions.

Through a Y-shaped cut in the thoracic wall, we severed the muscle at the thoracic and humeral insertions and separated it from the underlying pectoralis minor muscle. After lifting the clavicle and the sternum we isolated the segment of the axillary artery which includes the origin of the thoracoacromial artery. We opened the axillary artery along its upper margin, taking care not to damage the vessels which lead from the opposite margin, and located the ostium of the thoracacromial artery. A small angiographic catheter was introduced into this vessel and the muscle was perfused for 20–30 minutes with warm water (approx 50 °C) in order to dissolve the small clots of blood that had formed since death. (Fig. 1.). This was done using 20 cc syringes in preference to smaller syringes, which tend to develop very high injection pressures. It was observed that pulsatile perfusion not only simulates the arterial impulse but is also less likely to cause intramuscular vascular ruptures than continuous perfusion.



Fig. 1. A left pectoralis major muscle is perfused with warm water in order to dissolve the small clots of blood formed since death.

Through the same catheter we then introduced about 50 ml of a solution of barium sulphate and water (200 gr BARYTGEN diluted in 155 ml water). More concentrated solutions were found to be too dense to reach the peripheral areas uniformly, while thinner solutions did not provide a satisfactory light-dark contrast. As the barium sulphate diffused through the muscle we took X-ray photographs using an exposure of 200 mA for 0.032 sec. (6.4 MAS), with 48 kV and T16 (3M) reinforcement screens. The distance between film and ranogenous source was 105 cm, the film size was 35 X 35 cm type XD (AOT) 3M.

The X-ray photographs, thus obtained, were examined with a Zeiss Kontron IBAS 2000 image analyzer using a semi-automatic computerized measuring program (Fig. 2). In particular we considered the longitudinal and transverse diameters of each muscle and the length and course of the principal branches of the thoracoacromial artery in its intramuscular portion.

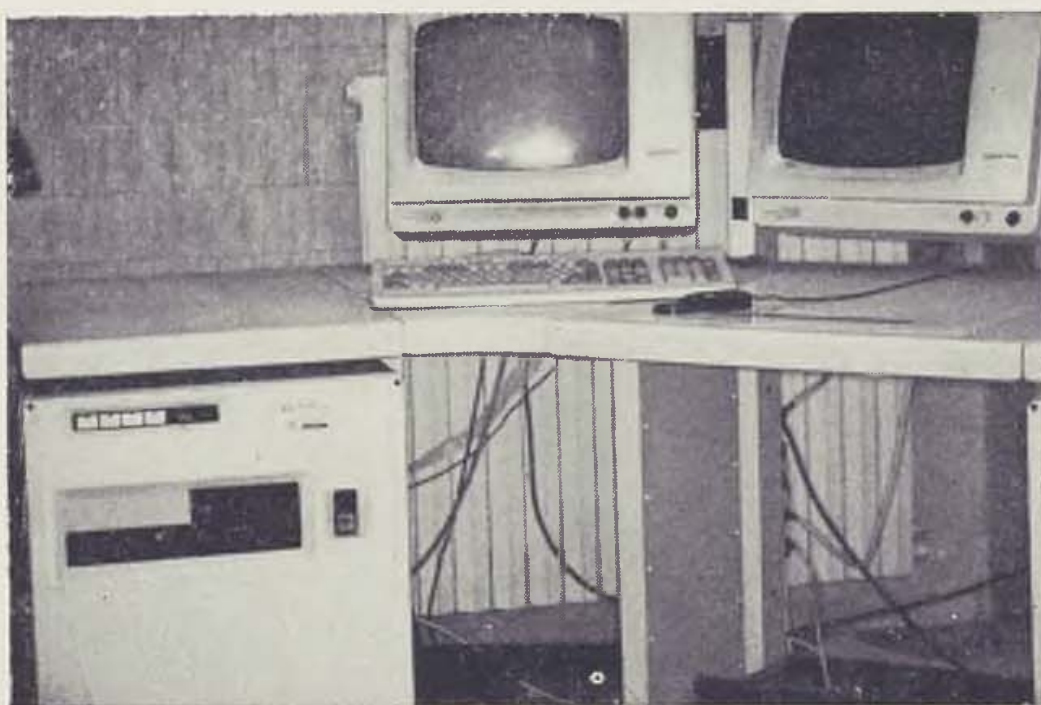


Fig. 2. A comprehensive view of the Zeiss Kontron IBAS 2000 image analyzer utilizing a semi-automatic computerized measuring program.

RESULTS

The average length and width of the muscles were 23.5 cm (± 0.78 cm) and 13 cm (± 0.5 cm) respectively.

The thoracoacromial artery forms the dominant vascular pedicle of the pectoralis major muscle (80 % of the muscular parenchyma, the remaining 20 % being supplied by perforators of the internal mammary artery). This artery has its origin in the second portion of the axillary artery, at the border between the medial third and the two lateral thirds of the clavicle and beneath the clavicular insertions of the pectoralis major muscle. After crossing the medial margin of the pectoralis minor muscle tendon and having perfo-

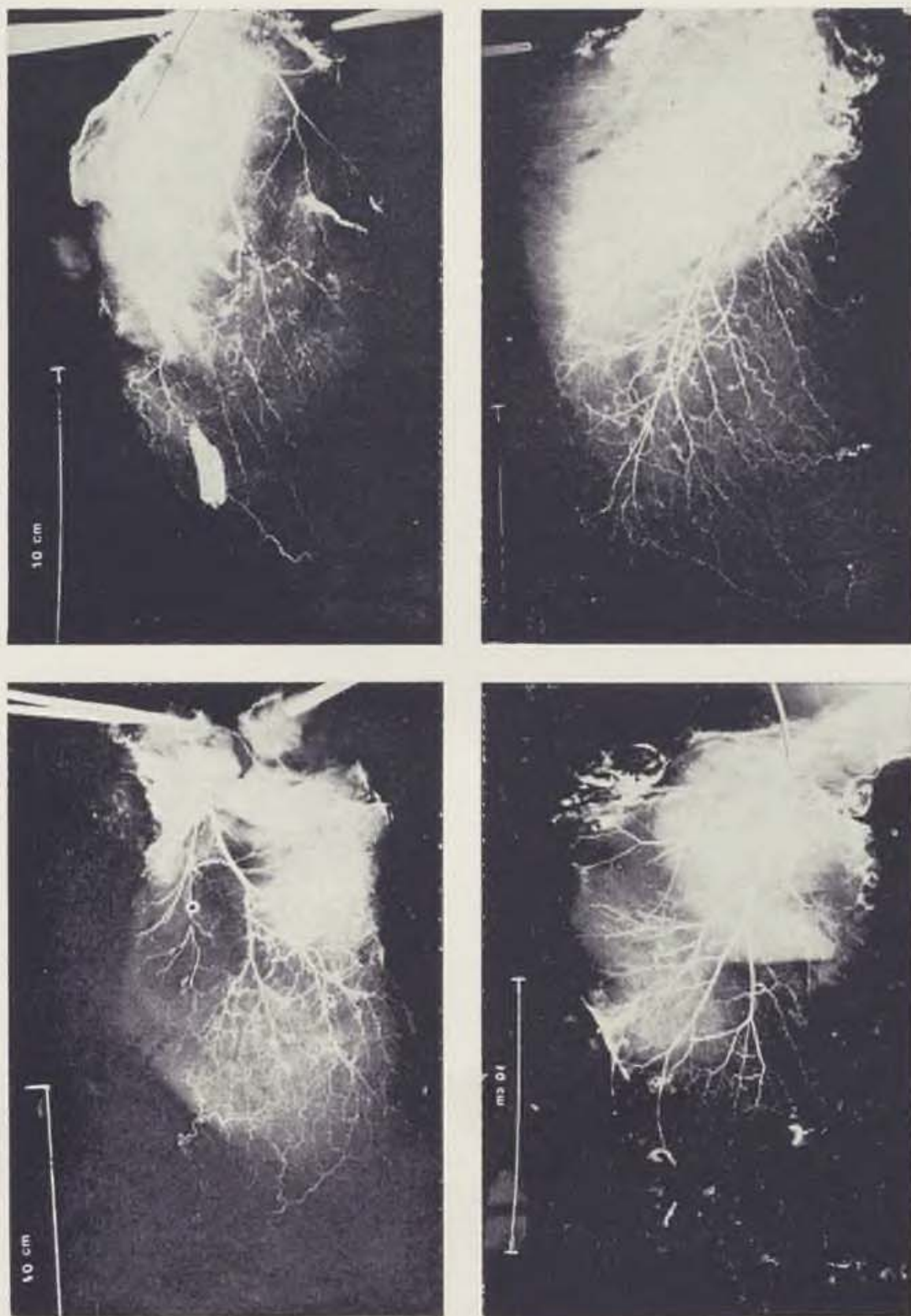


Fig. 3. X-ray photographs of pectoralis major muscles. It is possible to recognize the four main branches of the thoracoacromial artery.

a) and b) right muscles

c) and d) left muscles

rated the clavicoracopectoral fascia, at 3.57 cm (± 0.25 cm) from origin, the thoracoacromial artery divides into four main branches: acromial, deltoid, pectoral and clavicular. (Fig. 3a, b, c, d.)

The most frequent subdivision is that of a main bifurcation of the common trunk into the pectoral and deltoid branches with the acromial artery originating further down from the latter. The deltoid branch runs in a lateral direction to supply the anterior fibres of the deltoid muscle. During its course it also provides various vessels for the lateral part of the clavicular origin of the pectoralis major muscle, the medial area being perfused by the clavicular branch. The length of the deltoid branch is 3.49 cm (± 0.24 cm) on the right and 3.74 cm (± 0.17 cm) on the left; the calibre is 0.15 cm (± 0.01 cm) on the right and 0.18 cm (± 0.02 cm) on the left. Its principal axis, measured by drawing a straight line from the origin of the vessel to its first significant bifurcation forms an angle of 131° ($\pm 2.52^\circ$) on the right and 128° ($\pm 1.4^\circ$) on the left with a plane perpendicular to the muscle.

The pectoral branch, perfusing more than 60 % of the muscular parenchyma, is the principal vascular pedicle of the pectoralis major muscle. It subdivides into a number of small branches which spread into the sternocostal portion. The terminal vessels run first towards the lateral margin of the muscle and, then, following a medially open concave course, continue towards the sternal insertions to form anastomoses with the internal mammary artery perforators. Its length and calibre are respectively 6.78 cm (± 0.2 cm) and 0.23 cm (± 0.01 cm) on the right and 6.25 (± 0.15 cm) and 0.25 (± 0.01 cm) on the left. The angle of its principal axis with a perpendicular plane to the muscle is 95° ($\pm 2.01^\circ$) on the right and 100° ($\pm 1.84^\circ$) on the left. The angle between its principal axis and that of the clavicular branch is 30.9° ($\pm 1.58^\circ$) on the right and 38.6° ($\pm 1.46^\circ$) on the left. In 78 % of the cases it was possible to identify a larger collateral branch along the course of the pectoral branch. This has a length of 2.35 cm (± 0.14 cm) on the right and 3.4 cm (± 0.15 cm) on the left. Its calibre is 0.07 cm (± 0.01 cm) on the right and 0.05 cm (± 0.01 cm) on the left. The angle of its main axis with that of the pectoral artery is 60° ($\pm 1.31^\circ$) on the right and 46° ($\pm 1.41^\circ$) on the left.

The clavicular branch has a somewhat variable origin. With a characteristic trifurcation of the principal trunk it can originate from the thoracoacromial artery along with the pectoral and deltoid branches (60 % of the cases on the right and 90 % of the cases on the left); alternatively it may start directly from the pectoral branch. The clavicular artery vascularizes the clavicular portion of the pectoralis major muscle. It has a length of 4.3 cm (± 0.1 cm) on the right and 4.7 (± 0.2 cm) on the left. Its calibre is 0.22 (± 0.09 cm) on the right and 0.21 cm (± 0.07 cm) on the left. Its principal axis forms an angle of 66° ($\pm 1.9^\circ$) on the right and 75° ($\pm 1.8^\circ$) on the left with a plane perpendicular to the muscle. Also for this branch it is possible to discern a larger collateral branch (95 % of the cases) which has a length of 2.19 cm (± 0.11 cm) on the right and 2.15 cm (± 0.13 cm) on the left. The calibre is 0.05 cm (± 0.01 cm) on the right and 0.04 cm (± 0.02 cm) on the left. Its principal axis forms an angle of 56° ($\pm 1.8^\circ$) on the right and 64° ($\pm 1.7^\circ$) on the left with the axis of the clavicular artery.

All the branches of the thoracoacromial artery intercommunicate freely by means of numerous anastomoses which allow a uniform perfusion in the various muscular zones and alternative circulatory channels. The presence of these anastomoses does not necessarily mean that in normal circumstances the blood would be distributed through all these channels but they are important for the development of functional collateral shunts. As the calibre of the arteries gradually decreases, the number of these connections increases as in the case of the mesenteric vessels in the intestine.

CONCLUSIONS

The data obtained show the segmentation of the pectoralis major muscle into two subunits, each provided with its own vascular supply, namely, the clavicular segment and the sternocostal segment. The former originates from the clavicle and is separated from the latter by an intramuscular septum of loose connective tissue. In all the muscles studied the clavicular segment was vascularized by the clavicular branch of the thoracoacromial artery. The sternocostal segment consists of the central mass of the muscle and it originates from the sternochondral region. Its vascular supply comes from the pectoral branch of the thoracoacromial artery.

This segmentary nature of the pectoralis major muscle and of its vascular pedicle is an interesting example of the philogenetic metamerism that is present in all vertebrates and is particularly evident in the truncal musculature of certain mammals (Fig. 4). It is also possible that it is a vestige in the adult organism of the embryonic distribution of the ventral mesoderm (Fig. 5).

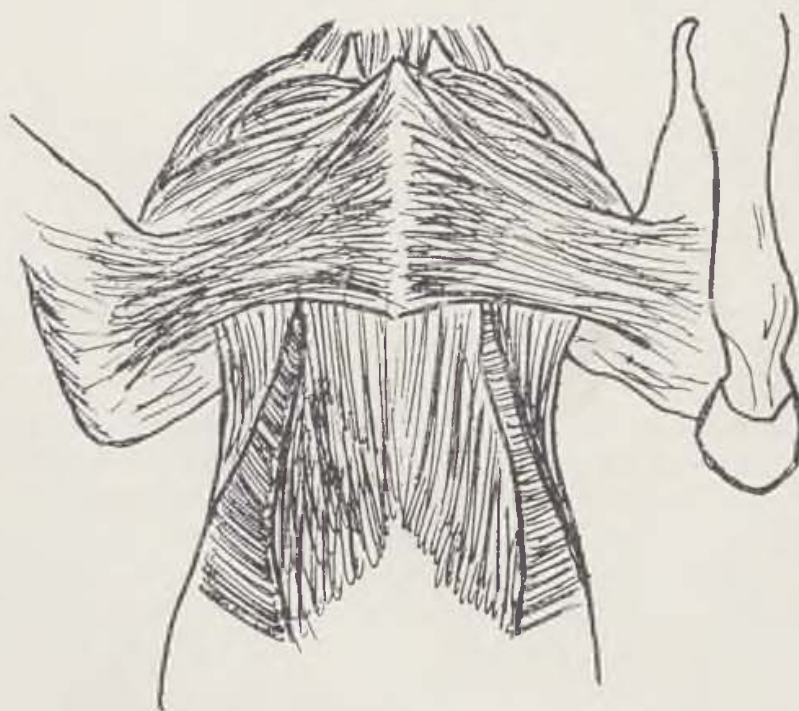


Fig. 4. Superficial muscles of the ventral part of trunk in the horse.

Our anatomical findings confirm and verify the presence of a constant and well defined vascular supply as reported in literature. The pectoral artery follows a similar course on both sides having a slightly greater calibre on the right; the clavicular artery has a shorter course and a smaller calibre with little difference between the right and left hemisomas.

Minor anatomical variables and the presence of a well-developed intramuscular vascular supply makes the pectoralis major muscular and musculocutaneous flap, either as transposition or expanded flap, a useful and safe procedure in many pathological situations.

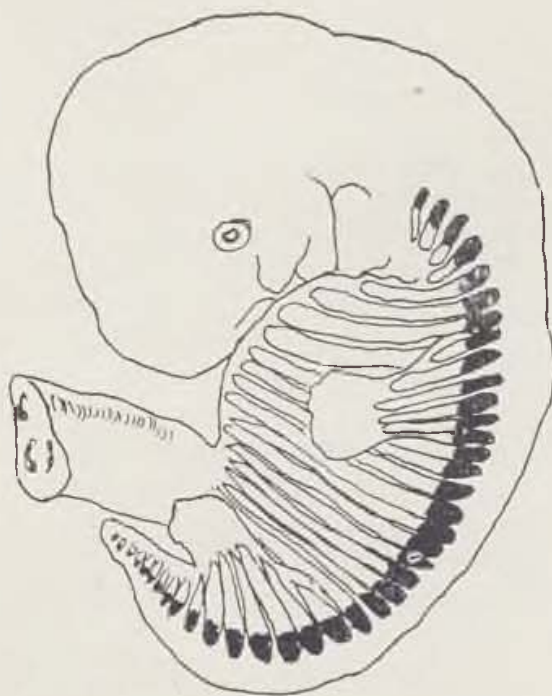


Fig. 5. Embryonic distribution of the myotomes in the humans demonstrates an early segmentation of ventral mesoderm.

SUMMARY

The pectoralis major muscle or musculocutaneous flap is well suited to repair immediately wide defects following surgical removal of carcinomas or traumas of the cervicofacial and thoracic regions. Microsurgery has recently suggested exciting and successful solutions for the same purposes, but we think it is still important to reassess and perfect the flaps already known in order to achieve a better cost-benefit ratio.

We examined the intramuscular vascular anatomy of 22 pectoralis major muscles using an image analyzer and a computerized measuring system to quantify the essential features objectively.

The data show the segmentation of the pectoralis major muscle into two subunits, each provided with its own vascular supply. Slight anatomical



differences and the presence of a well-developed intramuscular vascular supply makes the pectoralis major muscular and musculocutaneous flap a useful and safe procedure.

R É S U M É

L'étude angiographique d'ordinateur de l'alimentation sanguine du muscle pectoralis major

Candiani, P., Campiglio, G. L., Quattrone, P., Lovaria, A.

Le lambeau musculair ou musculo-cutané de pectoralis major muscle est bien approprié aux réparations immédiates de vastes défauts, séquelles du traitement chirurgical du cancer ou des traumatismes de la région cervicofaciale ou pectorale. Aux cas pareils, la microchirurgie a proposé, le dernier temps, d'excitants procédés réussis mais nous trouvons ausssi important de réexaminer et de perfectionner les lambeaux déjà connus, dans le but d'obtenir un meilleur rapport entre les frais et les avantages. Nous avons examiné l'anatomie intramusculaire des vaisseaux chez 22 muscles pectoralis major, à l'aide de l'analyseur d'image et d'un système de mesurement par ordinateur pour une quantification objective des caractéristiques essentielles. Les données témoignent une division du muscle pectoralis major en deux sous-unités, dont chacune possède son propre alimentation sanguine. Les différences anatomiques subtiles et l'existence d'une alimentation sanguine intramusculaire bien développée font de la lambeau musculair ou musculo-cutané de pectoralis major une procédure très bénéfique et sûre.

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

Angiographische Computer-Studie der Blutversorgung des musculus pectoralis major

Candiani, P., Campiglio, G. L., Quattrone, P., Lovaria, A.

Der musculus pectoralis major oder sein Haut-Muskel-Lappen ist äusserst geeignet zu einer unmittelbaren Reparatur ausgedehnter Defekte nach einer chirurgischen Beseitigung von Krebs oder Unfällen in der cervicofazialen oder Brust-Region. Die Mikrochirurgie hat in letzter Zeit eine aufregende und erfolgreiche Lösung für die gleichen Zwecke vorgeschlagen, jedoch wir nehmen an, dass es auch weiterhin von Wichtigkeit ist, die schon bekannten Lappen erneut zu bewerten und zu vervollkommen, mit dem Ziel, ein noch besseres Verhältnis zwischen den Aufwendungen und dem Nutzen zu erzielen. Wir haben mittels intramuskulärer Gefäss-Anatomie 22 Fälle von musculus pectoralis major untersucht, unter Anwendung eines Abbildungs-Analysators und eines Computer-Messsystems zur objektiven Quantifizierung der wesentlichen Eigenschaften. Die Angaben zeigen eine Aufteilung des musculus pectoralis major in zwei Untereinheiten, von denen jede ihre eigene Blutversorgung besitzt. Die feinen anatomischen Unterschiede sowie die Gegenwart einer gut entwickelten intramuskulären Blutversorgung machen die Transplantierung des musculus pectoralis major und seines Haut-Muskel-Lappens zu einer sehr nützlichen und sicheren Prozedur.

REFERENCES

1. **Ariyan, S.:** The pectoralis major myocutaneous flap: a versatile flap for reconstruction in head and neck. *Plast reconstr. Surg.*, 63:73, 1979.
2. **Ariyan, S.:** The pectoralis major, sternomastoid and other musculocutaneous flaps for head and neck reconstruction. *Clin. Plast. Surg.*, 7:89, 1980.
3. **Arnold, P., Pairolero, P.:** Use of pectoralis major muscle flaps to repair defects of anterior chest wall. *Plast. reconstr. Surg.*, 63:205, 1979.
4. **Bakamjian, V.:** A technique for primary reconstruction of the palate after radical maxillectomy for cancer. *Plast. reconstr. Surg.*, 31:103, 1963.
5. **Brusati, R., Collini, M., Bozzetti, A., Chiapasco, M., Galioto, S.:** The pectoralis major myocutaneous flap. Experience in 100 consecutive cases. *J. Cranio Max. Fac. Surg.*, 16:35, 1988.
6. **Coleman, J. J.:** Complex Thoracic wounds: muscle and musculocutaneous anatomy in closure. *South Med. J.*, 78:125, 1985.
7. **Despieux, J. L.:** The pectoralis major musculocutaneous flap. Anatomical study. *Ann. Chir. Plast. Esthet*, 29:23, 1984.
8. **Freeman, J. L., Walker, W., Shaw, H.:** The vascular anatomy of the pectoralis major myocutaneous flap. *Br. J. Plast. Surg.*, 34:3, 1981.
9. **Mathes, S., Nahai, F.:** Classification of the vascular anatomy of muscles: experimental and clinical correlation. *Plast. reconstr. Surg.*, 67:177, 1982.
10. **Moloy, P. J., Gonzales, F.:** Vascular anatomy of the pectoralis major myocutaneous flap. *Arch. Otolaryngol. Head Neck Surg.*, 112:66, 1986.
11. **Reid, C. D.:** The vascular territory of the acromiothoracic axis. *Br. J. Plast. Surg.*, 37:194, 1984.
12. **Tobin, G. R., Bland, K., Adcock, R.:** Surgical anatomy of the pectoralis major muscle and neurovascular supply. *Surg. Forum*, 32:573, 1981.
13. **Tobin, G., Mavroudis, M., Howe, W., Laman, G.:** Reconstruction of complex thoracic defects with myocutaneous and muscle flaps. *J. Thorac. Cardiovasc. Surg.*, 85:219, 1983.

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SUCCESSFUL HEALING OF A BURN INJURY COVERING 100 % OF TBSA AND 96 % IIIRD DEGREE WITH INHALATION INJURY

LIU BINGSEN, LI LIANGUI, ZHOU JIARU

INTRODUCTION

Many cases of successful healing of IIIRD degree burns above 90 % TBSA have been reported. Nevertheless only one case with 100 % TBSA and 96 % of full-thickness skin loss was reported in Guangzhou, China in 1989. From September 1987 to August 1989 a patient with 100 % TBSA and 96 % of full thickness skin loss burn was treated in our hospital. No complication of his heart, lung, liver, kidney or digestive tract function developed and neither septicemia nor mycosis occurred in the course of treatment.

CASE REPORT

The patient was male, twenty six years old. He suffered burn in the morning of September 4th 1987 and was admitted to our hospital thirty minutes after the accident in shock and coma. His whole skin appeared as dark eschar, his vibrissae were burned, the mucous membrane of mouth was pale, body temperature was 35 degrees C, pu's rate 160/min., tachypnoea 50/min, blood pressure zero. Rutine hematological investigation showed haemoglobin 180 g/L, white cell count 21.4×10^9 , hematocrit 60 %, PaO₂ 8.73 kpa (after pulmotor supply), PcO₂ 4.60 kpa, BE -17 mmol/L. Diagnosis: burn injury covering 100 % of TBSA with 96 % of full-thickness skin loss and inhalation injury (Fig. 1).

The patient smoothly overcame the shock stage with help of fluid replacement which included i.v. infusions of buffer solution plus 5 % glucose solution, plasma, human albumin, 5 % sodium bicarbonate. The total quantity was 10 300 ml in the first 24 hours (Table 1). The tracheotomy with artificial ventilation and escharectomy of breast and both upper extremities were performed as soon as the patient was admitted to our hospital. Two hours post-burn diphenhydramine, cimetidin, indomethacin and pethidin were combined for intravenous application. The urine was dark brown but after immediate

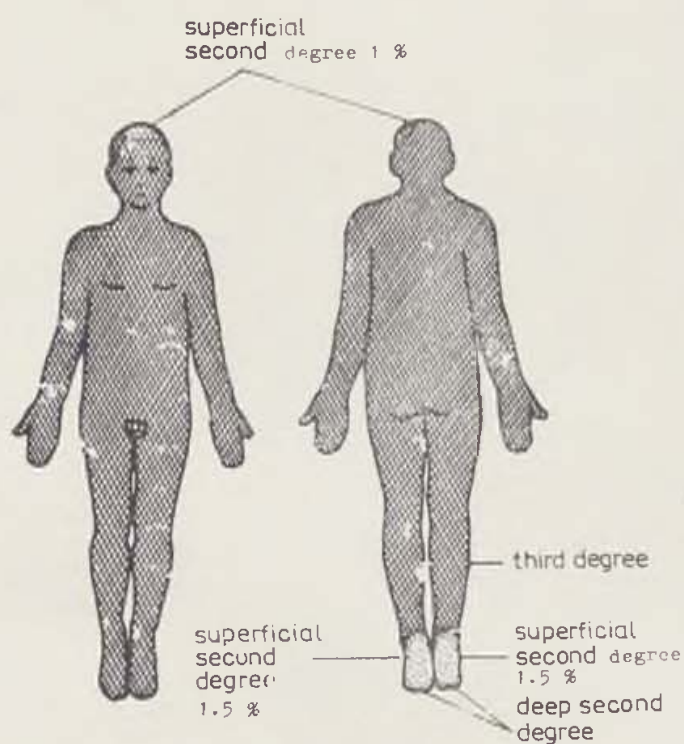


Fig. 1. A. superficial second degree deep second degree third degree, B. 48 hours postburn — the supine position and both upper extremities released by escharectomy.



Fig. 1. C. 48 hours postburn, lateral position.

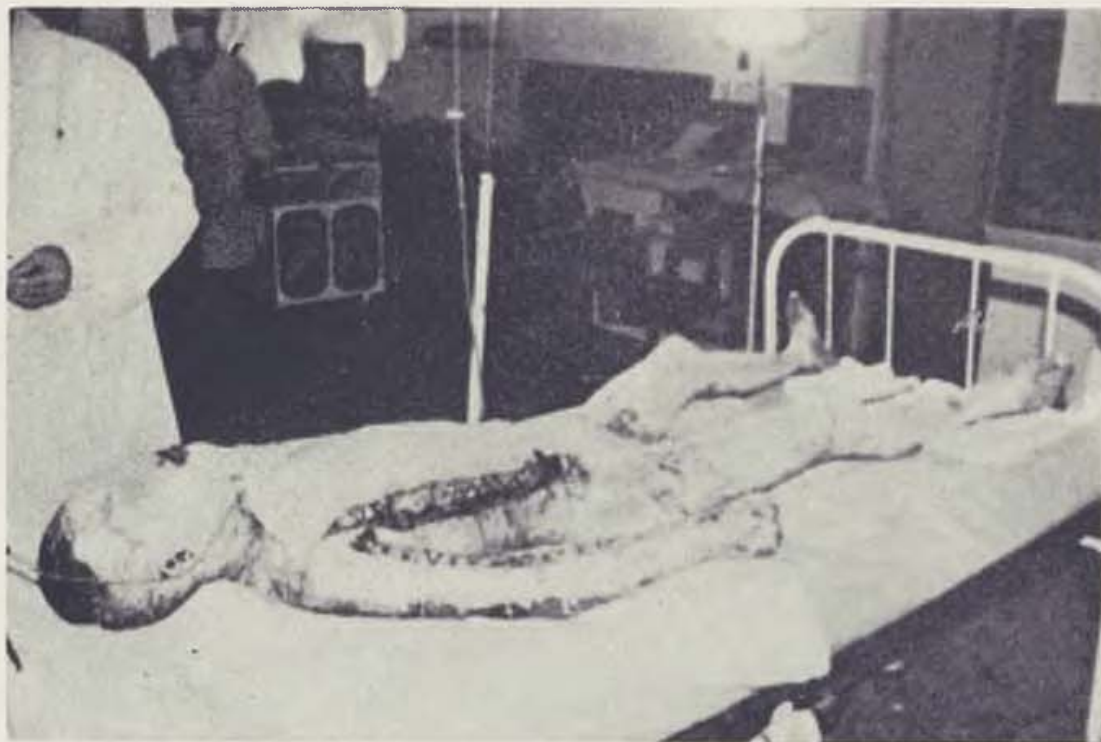


Fig. 1. D. 48 hours postburn.



Fig. 1. E. 9 months postburn, supine position.

infusion of 5% sodium bicarbonate 1400 ml haemoglobinuria disappeared in 36 hours postburn. The urinary output was 2404 ml in the first 24 hours.

The burned areas were cleaned with 0.05% hibitan solution and covered with 5—10 % silver sulphadiazine once or twice every day. Then all the body was irradiated with an arc lamp for 24 hours. Escharectomy and micro-grafting were completed 8 days postburn (Table 2), the expansion ratio was up to 1:11—50 maximum. The total area excised was 65% of TBSA, the escharectomy was carried out four times, the také of autogenous epidermis from scalp 26 times, total number of operations was 36. Thirty days postburn the skin grafts took well and the patient's condition was improved and stable. The escharectomy wounds were healed except that on the right upper extremity. The residual granulation wounds were repeatedly covered with auto- and homoskin stamps until 260 days postburn (Fig. 2).

During the shock stage antibiotic treatment with gentamycin and penicilin was applied. 48 hours postburn gentamycin and penicilin were substituted by cefoperazone sodium and piperacillin sodium. Garlic and 5-fluorocytosine were combined to be applied on the twentieth day postburn (Table 3).



Fig. 1. F. One year postburn.

Table 1. Fluid and drug applied during the first 24 hours

Group	Fluid (ml) and Drug (mg)	Postburn (hour)			
		1	2	8	24
Grystal		1000	1000	1800	4300
Colloid (1)			1100	2300	4000
5% Glucose				700	1200
Grystal and colloid			1 : 1.2	1 : 1.3	1 : 1
5% Natrii bicarbonas	300		500	800	1400
Urine (ml) / hour	0		80	140	101
Diuretic				500	800
20% Mannitol				250	550
Furosemide				40	80
Meperidine (total dose)	100		180	230	430
Phenergan				25	150
Diazepam				10	30
10% Chloralhydras (ml)				10	20
Indomethacin				50	200
Cimetidine				400	800
Cedilanid					0.4
Total fluid (2)	1300		2600	6500	12 250

(1) Include blood 600 ml and 20% albumin 100 ml

(2) Include-alkaline and diuretic drug

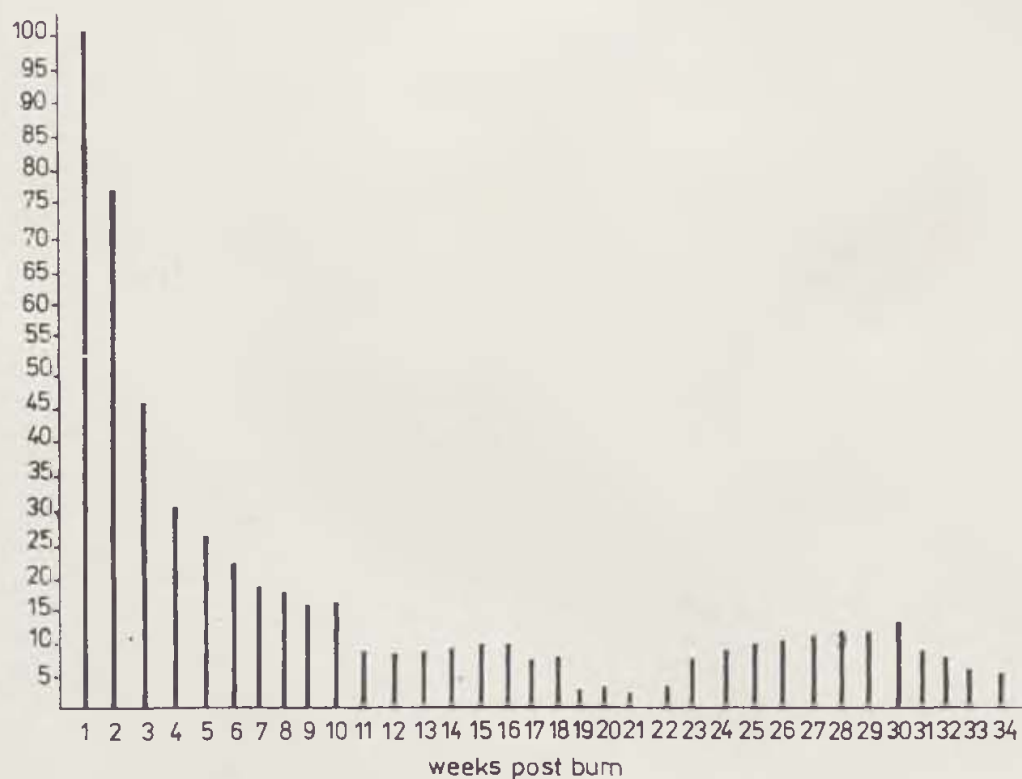


Fig. 2. Wound area per cent

Table 2. Operationing state on days 260 postburn

Time	Postburn (days)	Excision area and portion	Donor skin	Ratio	Wound state	Operational method
1	8	left lower extremity 16%	scalp 0,3%	1 : 50	escharectomy	auto-microskin grafting and allogeneous skin covering
		right upper extremity 6.5%	foot 0,6% plate	1 : 11	escharectomy	by autoskin grafting wedged into covered allogeneous skin was fenestated
2	20	right lower extremity 16%	scalp 0.5%	1 : 34	escharectomy	auto-microskin grafting and allogeneous skin covering
		left upper extremity 1%	scalp	1 : 34	escharectomy	left upper arm was amputated and stump microskin grafting
3	22	chest 8%	foot 0.5% plate	1 : 16	escharectomy	auto-microskin grafting and allogeneous skin covering
		abdomen 3%	foot 0,2% plate	1 : 1	escharectomy	by autoskin grafting wedged into covered allogeneous skin was fenestated
4	23	face and head 4%	foot 0.3% plate	1 : 13	auto-homoskin	mixing skin stamp-shaped grafting
		neck 2%	foot 0.2% plate	1 : 12	granulation	auto-homoskin mixing skin stamp-shaped grafting
5	27	lower 2% abdomen	scalp 0.5%	1 : 14	by autoskin	grafting wedged into covered allogeneous skin was fenestated
		waist 5%	scalp	1 : 14	escharectomy	by autoskin grafting wedged into covered allogeneous skin was fenestated
6-36	30-260	chest, abdomen lumbodorsal, both malleoli, both thighs.	scalp, foot plate, allgeneous skin	1 : 5 to 10	residual granulation	auto-homoskin mixing skin stamp-shaped grafting

Table 3. Antibiotic treatment on two months postburn

antibiotic group		days since burn dose/day	2	3	6	9	13	11	14	17	20	23	26	29	31	34	37	40	43	46	49	51	54	57	60	63
penicillin	3 600000u																									
gentamycin	240000u																									
cefoperazone	8 gram																									
piperacillin	8gram																									
ceftazidime	6gram																									
amikacin	800mg																									
garlic injection	60 mg																									
5-fluoro-cytosine (PO)	500mg																									
Flagyl (PO)	400mg																									
Rifampin(PO)	600mg																									

Two days postburn the patient's temperature increased above 39 degrees C, white blood cell count increased to $20-25 \times 10^9/L$. After the first escharectomy the patient's temperature increased above 40 degrees, the white blood cell count increased to $30 \times 10^9/L$, the tachypnoea 60/min, PaO_2 9.85 kpa. The X-ray of the chest was normal, three blood cultures on days 3, 9, 12 postburn were negative. The test on occult blood in the stool was positive. After the fourth escharectomy the patient's condition improved and temperature decreased to 38-39 degrees C. Forty five days postburn the patient's condition got suddenly worse, breathing became shallow, tachypnoea 60/min, temperature increased above 40 degrees C, white blood cell count increased to $30-35 \times 10^9/L$ and drowsiness was followed by coma. Blood pressure dropped and nausea and vomiting appeared. Staphylococcus aureus was isolated from the wounds but the blood culture was negative. Diagnosis of toxic shock was made. After intravenous application of ceftazidime (for four days) he patient regained consciousness and his condition improved.

Three days postburn naso-gastric tube feeding with cow's milk, broth, rice water etc. was started. Throughout the treatment the patient received intravenously liquid 10% chyle fat 30 000 ml, plasma 50 000 ml, albumin 400 gram, blood 50 000 ml. Venesection and cannulation were performed in a special way, naturally under strictest sterile conditions. The cannula went at least ten centimeters through the subcutaneous tissue before entering the vein. Between the cannula and the end of the infusion set a special container with 75 % alcohol was installed to prevent the invasion of bacteriae when changing the infusion. Using this procedure each cannula could be kept in place for above thirty days.

DISCUSSION

Smoothly getting through the shock stage is the key to the successful healing of extensive burns. Rapid fluid replacement and early alkalified urine are very important for overcoming the heavy metabolic acidosis, clearing away hemoglobinuria and preventing early kidney failure.

Pulmonary disfunction is the major cause of mortality of extremely burned patients (Deming et al., 1980). Early lung disfunction has been most commonly attributed to the increase of microvascular permeability to proteins, decrease of oxygenation as well as release of a great number of vasoactive mediators from burned tissue. The agents which have an effect on the constriction of smooth muscles in lungs include histamine, serotonin and thromboxane A₂ (the potent pulmonary vaso- and broncho-constructor agent as well as the promotor of platelet aggregation). During the early stage of depressurising escharectomy, tracheotomy, artificial ventilation and application of diphenhydramine, cimetidin and indomethacin were combined to prevent respiratory failure. Indomethacin is a cyclooxygenase inhibitor (Yuan Shilin, 1984) which implies inhibition of both thromboxane and prostacyclin. The agent also impairs platelet aggregation and stabilises neutrophils and scavenge oxygen radicals. It is well known that histamine produces lung oedema and increases lung microvascular permeability to proteins. Cimetidinum and theohydraminum are inhibitors of receptors H₁ and H₂ which imply the inhibition of lung oedema and decrease lung microvascular permeability to proteins.

Incomplete capillary perfusion in hypovolemic shock in burn patients induces oxygen deficit in tissues. If the patient develops mania, oxygen consumption will increase, resulting in more oxygen deficit. To help the patient smoothly overcome the shock stage we used a large quantity of pethidine applied intravenously in small doses (15—20 mg each time).

The micrografting is a good method in the treatment of extensive burns. We can take autogenous epidermis repeatedly from the scalp, from the small areas with slight burns, and in this way a key problem of wound coverage can be solved. The success of microskin grafting depends on: 1. thorough debridement of all necrosis tissues in the burn wound, 2. covering the wound with fresh allogeneous skin graft and 3. complete hemostasis of the wound and fixation of the graft. Good nourishment and application of antibiotics play an important role in the treatment. Our special way of cannulation helped to avoid the difficulties in performing the infusion therapy.

SUMMARY

The authors describe successful healing of a burn injury covering 100% of TBSA with 96% full-thickness skin loss and inhalation injury. The patient was admitted to the burn department of our hospital on September the 4th 1987. He smoothly overcame the shock stage with help of fluid replace-



ment and application of alkaline drugs in large quantities. Early escharectomy and repeated micrografting were performed. The treatment is discussed.

ACKNOWLEDGEMENT

The authors would like to thank professor Zhang Mingliang of Beijing Jishuitan Hospital and professor Xu Gong xun of Second Military Medical College Shang Hai for their help in the process of treatment.

RÉSUMÉ

Guérison réussie d'un malade brûlé à 100 % de la surface corporelle, dont 96 % brûlures de troisième degré, et avec les brûlures des voies respiratoires

Bingsen, L., Liannngui, L., Jiaru, Z.

Les auteurs décrivent un cas de brûlures de 100 % de la surface corporelle, dont 96 % étaient de troisième degré. Le malade a été admis au Département des brûlures de l'hôpital des aciéries à Handan, en République populaire de Chine, le matin du 4. 9. 1987. On a réussi à le sortir sans problèmes du choc par l'administration immédiate de solutions de substitution et de substances alcaliques en grandes quantités. Après l'exécution précoce de l'escharotomie et d'une microgreffe, le pronostic du malade était bon. Le traitement est discuté.

ZUSAMMENFASSUNG

Erfolgreiche Behandlung eines Patienten mit Verbrennungen von 100 % der gesamten Körperoberfläche, davon 96 % Verbrennungen dritten Grades und mit Verbrennungen der Atemwege

Liu Bingsen, Li Liannngui, Zhou Jiaru

Die Autoren beschreiben den Fall von Verbrennungen im Umfang von 100 % der gesamten Körperoberfläche, davon 96 % Verbrennungen dritten Grades. Der Patient wurde auf die Abteilung von Verbrennungen des Krankenhauses der Stahlwerke in Handan in der Volksrepublik China am 4. 9. 1987 morgens aufgenommen. Es gelang, ihn glatt aus dem Schock herauszubringen und zwar durch sofortige Verabreichung von Ersatzlösungen und alkalischer Stoffe in grosser Menge. Nach dem Ausführen der rechtzeitigen Escharotomie und Mikrotransplantation war seine Prognose eine gute. Die Behandlung wird diskutiert.

RESUMEN

Tratamiento exitoso de un paciente con quemaduras del 100 % de la superficie del cuerpo, de las cuales el 96 % fueron de tercer grado, además de presentar quemaduras del aparato respiratorio

Liu Bingsen, Li Lianngui, Zhou Jiaru

Los autores describen un caso de quemaduras del 100 % de la superficie del cuerpo, de las cuales el 96 % fueron de tercer grado. El paciente fue internado en el departamento de quemaduras del hospital de las acerías de Handan, en la Republica Popular China, el 4 de setiembre de 1987 por la mañana. Facilmente se logró que el paciente superara el shock mediante el inmediato suministro de soluciones sustitutivas alcalinas en grandes cantidades, Luego de la realización de una escarotomía inmediata y de proceder a la realización de microtransplantes, la prognosis de recuperación fue buena. El tratamiento discutible.

REFERENCES

1. Li Tianzeng et al.: Experiences of successful management of 100 % TBSA (3rd degree 96 %) burned patient with severe inhalation injury. *Plast. and Burns J.*, China, 5, 169, 1989.

2. Demling, R. R. et al.: Early lung disfunction after major burns: role of oedema and vasoactive mediators. *J. Trauma* 25: 959, 1985.

3. Yuan Shilin: Burn (Patophysiology books). People's Medical Publishing House, Beijing, China, 1984.

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MULTIPLE SYMMETRIC LIPOMATOSIS

P. BASSE, M. LOHMAN, C. HOVGAARD, B. ALSBJØRN

Multiple symmetric lipomatosis (MSL) is a rare condition in which non-encapsulated accumulations of fat occur in a symmetrical manner around the neck and shoulders. These accumulations may progress to involve the parotid region, and even the upper trunk. The limbs and lower body are rarely involved giving a characteristic appearance, described by Madelung (8) in 1888 as "Fetthals" or "Horsecollar". It may be pointed out that MSL, while exhibiting a distinct predilection for the neck, does not invariably or necessarily invade this region (7, 12). Besides being cosmetically disfiguring, the lesions are generally asymptomatic. There are, however, reported cases of tracheal compression necessitating intubation (1, 9). The disorder was first described by Brodie in 1846. Lanois and Bensaude (6) published in 1898 a collective review of the entire literature and listed three main characteristics: its symmetry, its location and its diffuse nature, establishing MSL as a unique clinical entity.

The disorder is predominant in males, but a number of cases have been reported in females. Although multiple cases have been reported in some families (5), most cases have been singular, with no evidence of hereditary predisposition.

Grossly the adipose deposits are firm, nontender, nonencapsulated, and they blend well into the surrounding subcutaneous tissue. Microscopically the fatty tissue is indistinguishable from other lipomatous tissue, except for some increase in the fibrous and vascular elements. Electron microscopy has not shown any significant characteristics (13).

The etiology of MSL is unknown. Several authors have suggested relationships between MSL and endocrine or metabolic disorders. Associations have been reported with abnormal glucose tolerance (3), renal tubular acidosis (13), gout (2) and hyperlipoproteinemia (4), but no known consistent pattern has been demonstrated. Alcoholism has been an extremely and almost constantly associated factor in the cases mentioned in the literature. The lipogenic and antilipolytic effects of alcohol may play a role in the growth of the fatty deposits in a susceptible individual (11).

The first appearance of the tumors is usually after the age of 20, although exceptions occur [5]. The clinical course of the disease, though variable, is typically progressive over a period of years. The lipomas are not known to disappear spontaneously and the only effective treatment is surgical resection or liposuction, although complete removal is not feasible.

We wish to report one case of MSL in which alcohol was an associated factor, and discuss the clinical course and the results obtained by surgical resection and liposuction.

CASE REPORT

A 47-year-old male in good health developed symmetrical lipomatous enlargements of his shoulders, neck, arms and chest. Several smaller lipomatous areas on the trunk and femora were present too. He complained of his appearance and difficulty with clothing (Fig. 1.). There was a history of earlier alcohol abuse. There was no history of surgical and medical illness. Familial history was unremarkable. Laboratory values were normal.

OPERATIVE DETAILS

At two major operations within 3 months range, were removed 1500 g and 1800 g of lipomatous tissue over respectively the right and left shoulder.

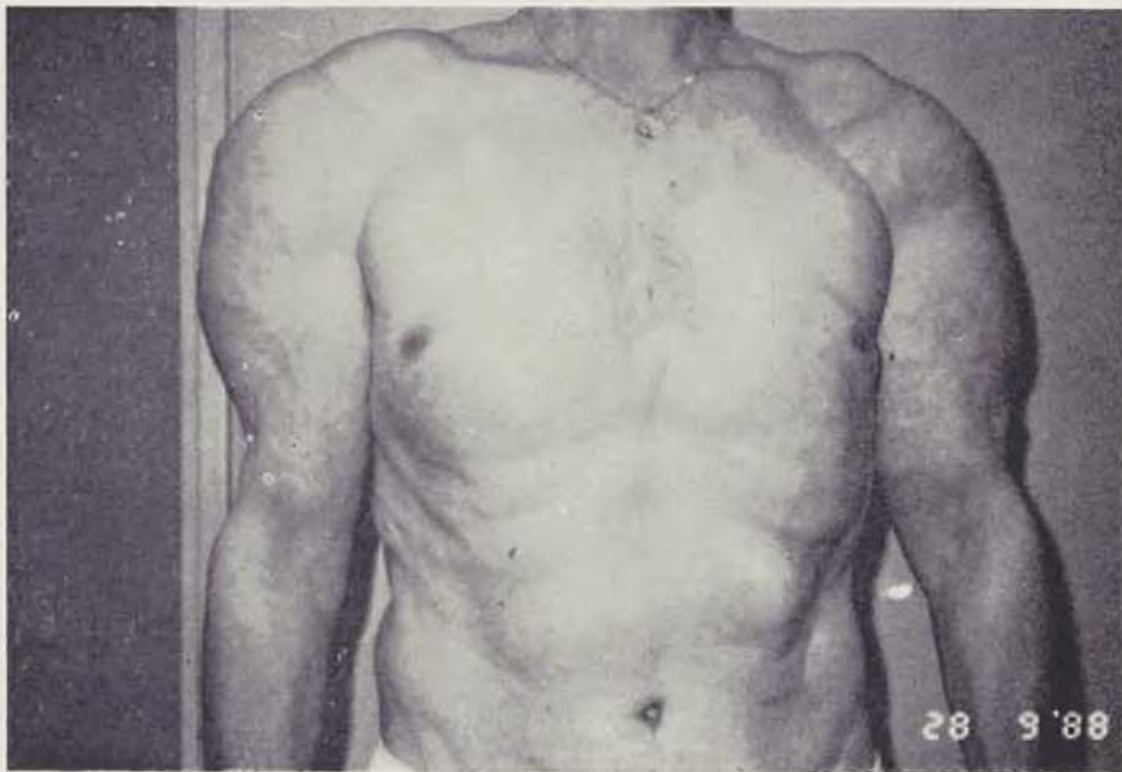


Fig. 1.



Fig. 2.



Fig. 3.

Large W-incisions was made, and the flaps were thinned out and trimmed. During the second operation an isolated lipomatous accumulation over the left trapezius region was removed with a surprising ease, using suction-assisted lipectomy. The postoperative course was uneventful. The stays in hospital were respectively 5 and 6 days. Three months later the patient underwent suction-assisted lipectomy at his chest, with spatula-tipped cannulas ranging in size from 4 to 8 mm. A total of 600 ml adipose tissue was removed with ease. The stay in hospital was 1 day. When the procedures were finished an elastic dressing was applied over the chest for 3 weeks. Microscopic examination of the specimens revealed characteristic mature fat cells, with none or only very thin capsules.

At a clinical control 5 month later recurrence was seen (Fig. 3.), and it was decided to treat our patient with sequential patterns of suction-assisted lipectomy, evaluated on individual basis.

DISCUSSION

The clinical course of MSL is usually one of progressive slow growth of the fat deposits and symptoms referable to the tumor size. The symptoms are primarily those of disfigurement, although the patient, as in our case, in addition may complain of interference with the neck motion and difficulty with clothing. The patient's demand for cosmetic correction is high, and the only choice of treatment is surgical excision or as in our case, sequential patterns of excisions followed by suction-associated lipectomy.

Liposuction is a closed, subcutaneous technique primarily used in aesthetic surgery for removal of fatty deposits. Liposuction can be performed safely under local anesthesia with 1% adrenalin for hemostasis.

A blunt cannula attached to a suction apparatus is used for subcutaneous radial tunnel suction through a small incision through the skin. The tunnels are introduced in the fat tissue 1 cm under the skin tissue, and the suction is causing fibrotic bands that probably will reduce the lipomatous recurrences. The complication rate is reported in the literature to be less than 1%, primarily reported as hematoma, infection and temporary, paresthesia.

In our opinion liposuction is an ideal approach to reduce the cosmetic scarring by MSL. The advantages of this treatment instead of classical surgical excision of the fat are, a reduction of the significant scarring, a reduction of the recovery period and a lower cost and reduced hospitalization time.

The functional and cosmetic benefits of surgery are usually temporary and recurrences may be evaluated on individual basis. Our experience with suction-assisted lipectomy as treatment in MSL is so far promising. Repeated liposuction procedures may show to be the ideal approach to reduce the recurrent lipomatous deposits in the patients, in order to create an acceptable cosmetic effect and social life for the patients.

SUMMARY

Multiple symmetric lipomatosis (MSL) is a rare disorder only mentioned in about 200 cases in the medical literature. It manifests as massive lipomatous deposits in specific areas of the body. The cause is unknown, although there frequently is a history of alcoholism. Surgical lipectomy has so far been the choice of treatment. We present a review of the disease and report one case successfully treated with liposuction.

Key words: Multiple symmetric lipomatosis, Madelungs disease, liposuction.

RÉSUMÉ

Lipomatoses multiples symétriques

Basse, P., Lohman, M., Hovgaard, C., Alsbjörn, B.

La lipomatose multiple symétrique (MSL) est une maladie rare, mentionnée dans la littérature médicale dans 200 cas seulement. La lipomatose se manifeste par les dépôts lipoides massifs dans certaines parties du corps. La cause en est inconnue quoique à l'anamnèse de la maladie l'alcoolisme est fréquemment découvert. Comme méthode de traitement, on choisit souvent une lipectomie chirurgicale. L'article donne un précis de la maladie et les détails sur un cas traité avec succès par la méthode de liposuction.

ZUSAMMENFASSUNG

Mehrfache symmetrische Lipomatose

Basse, P., Lohman, M., Hovgaard, C., Alsbjörn, B.

Mehrfache symmetrische Lipomatosen (MSL) sind seltene Erkrankungen, die lediglich in 200 Fällen der medizinischen Literatur erwähnt werden. Sie erscheinen als massive Fettablagerungen an gewissen Körperteilen. Die Ursache ihrer Entstehung ist nicht bekannt, obwohl in der Anamnese häufig Alkoholismus erscheint. Als Heilmethode wird häufig chirurgische Lipectomie gewählt. Hier wird eine Übersicht über die Erkrankungen geboten sowie ein Bericht über einen erfolgreichen Fall der Behandlung mittels der Methode der Liposuktion (Absaugen des Fetts).

RESUMEN

Lipomatosis simétricas múltiples

Basse, P., Lohman, M., Hovgaard, C., Alsbjörn, B.

La lipomatosis simétrica múltiple (LSM) es una afección rara, sobre la cual existen sólo 200 menciones en la literatura médica. Se manifiesta como un depósito masivo lipoidal (sebáceo) en ciertas partes del cuerpo. Las causas no son conocidas a pesar de que en la anamnesis de esta enfermedad es frecuente en pacientes

alcohólicos. Frecuentemente se recurre al método quirúrgico de cura de la liectomía. El estudio presenta un cuadro de la enfermedad y un informe sobre un caso de tratamiento exitoso por el método de la liposucción.

REFERENCES

1. **Birnholz, J. C.:** Advanced laryngeal compression due to diffuse symmetric lipomatosis. *Br. J. Radiol.*, 46:245, 1973.
2. **Enzi, G.:** Multiple symmetric lipomatosis: An updated clinical report. *Medicine*, 63:56, 1984.
3. **Golwell, J. A.:** Effects of resection of adipose tissue on the diabetes and hyperinsulinism of benign symmetric lipomatosis. *Diabetes*, 21:13, 1972.
4. **Green, M. L.:** Benign symmetric lipomatosis with gout and hyperlipoproteinemias. *Am. J. Med.*, 48:239, 1970.
5. **Groch, J.:** Studien ueber das Lipom. *Dtsch. Z. Chir.*, 26:307, 1987.
6. **Kurzweg, F. T.:** Familial multiple lipomatosis. *Am. J. Surg.*, 82:762, 1951.
7. **Lyon, I. F.:** Adiposis and lipomatosis. *Arch. Int. Med.*, 6:28, 1910.
8. **Madelung, O. W.:** Ueber den Feit-hais. *Arch. Klin. Chir.*, 37:106, 1888.
9. **Moretti, J. A.:** Laryngeal involvement in a benign symmetric lipomatosis. *Arch. Otolaryngol. Head Neck Surg.*, 97:495, 1973.
10. **Newman, J.:** Evaluation of 5458 cases of liposuction surgery. *Am. J. Cosmet. Surg.*, 1:25, 1984.
11. **Ortega, S.:** Lipomatosis simetrica multiple, asociada a etilismo, cirrosis y miopatia en una mujer; proposito de un caso. *Rev. Clin. Esp.*, 182:72, 1938.
12. **Osment, L. S.:** Cutaneous lipomas and lipomatosis. *Surg. Gynecol., Obstet.*, 127:129, 1968.

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EXTENSIVE CORIUM GRAFTS

M. FARA, J. HRIVÁKOVÁ, M. TVRDEK

In our era of impressive advances in the technology and operative techniques of plastic surgery; in an era of free transplantation of whole section of tissue (not only with reliable blood supply but, also, sensitive); in an era of the laser, liposuction, expanders, airbeds, etc., it is appropriate to look back and re-introduce with satisfaction some old proven procedures. It is just on these occasions that one is tempted to ask whether it indeed is necessary to replace invariably auto-genous tissue with plastic materials.

In this paper, we would like to examine briefly the timeless virtues of the corium in extensive plastic surgery procedures involving the abdominal wall.

The corium is a material with multiple potential applications and a site suitable for its removal can be found on each patient. It occurs in varying thickness to fit every purpose, from the thinnest graft removed from the upper eyelid to the thickest one on the buttock.

The corium can be transplanted either alone to be employed primarily in a variety of suspensions, to reinforce risk sutures, to cover a tissue defect that might possibly evolve into a hernia (not only abdominal but, also, muscular in the thigh, etc.), or it can be used in combination with, e.g., fat layer for augmentation mammoplasty or to round out a hypoplastic face.

The Czechoslovak school of plastic surgery has used, from the very beginning of the era started by Prof. Burian, autogenous corium most extensively, and its contributions to the literature include new modifications of its use, be that in the form of free graft (e.g., Kubáček's use of the corium in unhealing skin defects) or taking the form of pedicle flaps (e.g., Burian's modification of Rees's operations of upper eyelid suspensions in ptosis).

Communications presented at our symposia have repeatedly pointed to the appropriateness of use of corium grafts to cover hernial gates and muscular diastasis in plastic surgery of the abdominal wall, and reported excellent outcome following these procedures.

Still, when faced with the need to reinforce flaccid musculature due to prolonged dehiscence in some of their groups, e.g., between m. rectus abdomini or in cases of denervation of oblique abdominal muscles following lateral incision in renal surgery, the surgeon will, almost as a rule, resort to reinforcement with plastic nets. At the same time, in procedures performed

to manage such extensive defects, the skin will usually be stretched so much that the necessary segment of the corium can be taken from it without major problems.

It is the aim of this article to share with the reader our encouraging experience both with reinforcement of the weakened parts of the abdominal wall by extensive corium grafts and with abdominal wall reinforcement where, while direct suture of individual layers was possible, the corium graft is placed over this suture in an effort to avoid any recurrent prolapse, or hernia.

In recent years, this approach has been employed in a total of 15 patients (9 man and 6 women) operated on at the Department of Plastic Surgery in Prague. The corium graft was obtained from excessive skin of the abdominal wall. After removing the epithelium from the outer, and fat from the inner side, the graft was sutured in place with the outer side down using fine monofilament stitches under tension. Corium graft rejection was never observed, only in several cases did minor excretion of the dissolved fat or haematoma occur.

The following photos illustrate our operative technique in a case involving corium grafting to reinforce the hypogastrium along its full width on following sides.

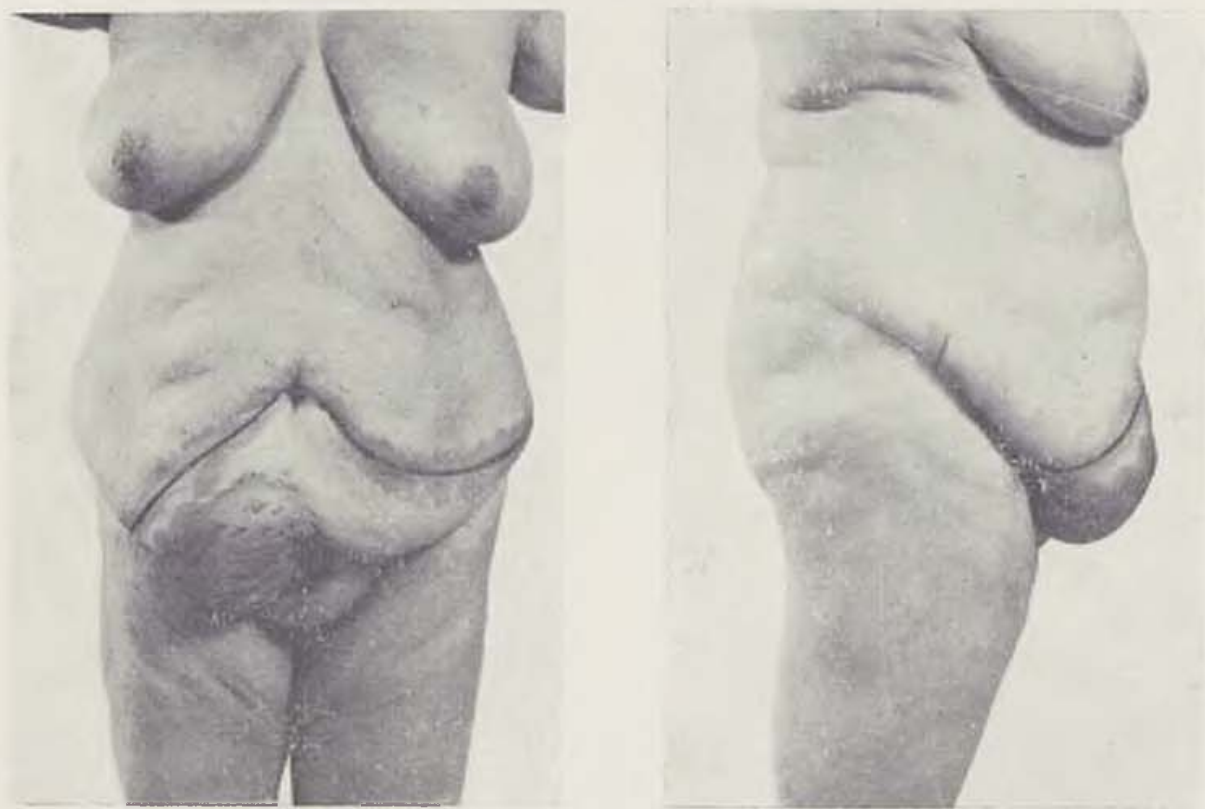


Fig. 1. Patient R. M., case report 170434. Massive skin overhang of the whole abdomen with delineated extent of scheduled reduction; the hatched area marks hernia in the scar after an inferior perpendicular laparotomy. — Fig. 2. ditto [a lateral view].



Fig. 3. Eliberation of jejunal loops from the hernial sac.

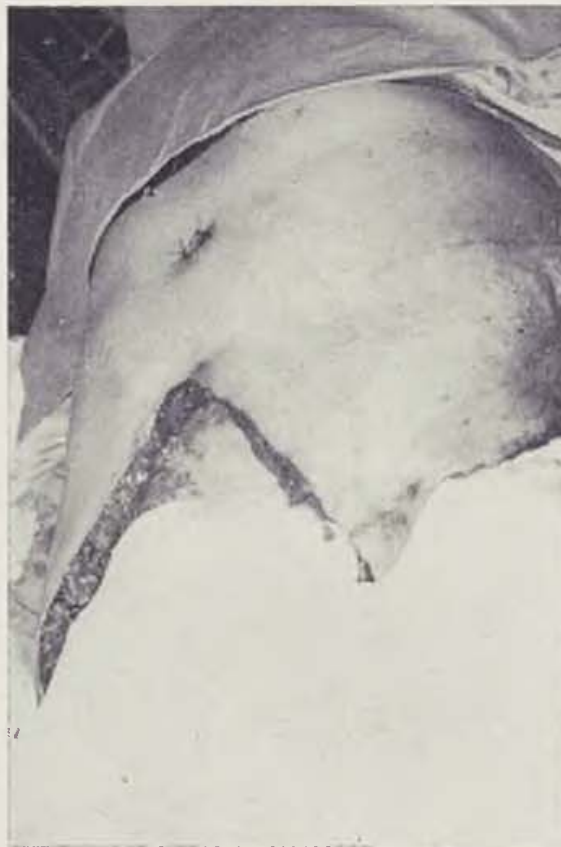


Fig. 4. Status after abdominal skin has been pulled from the level of circumscribed umbilicus to the symphysis and with umbilicus transplanted to a new position

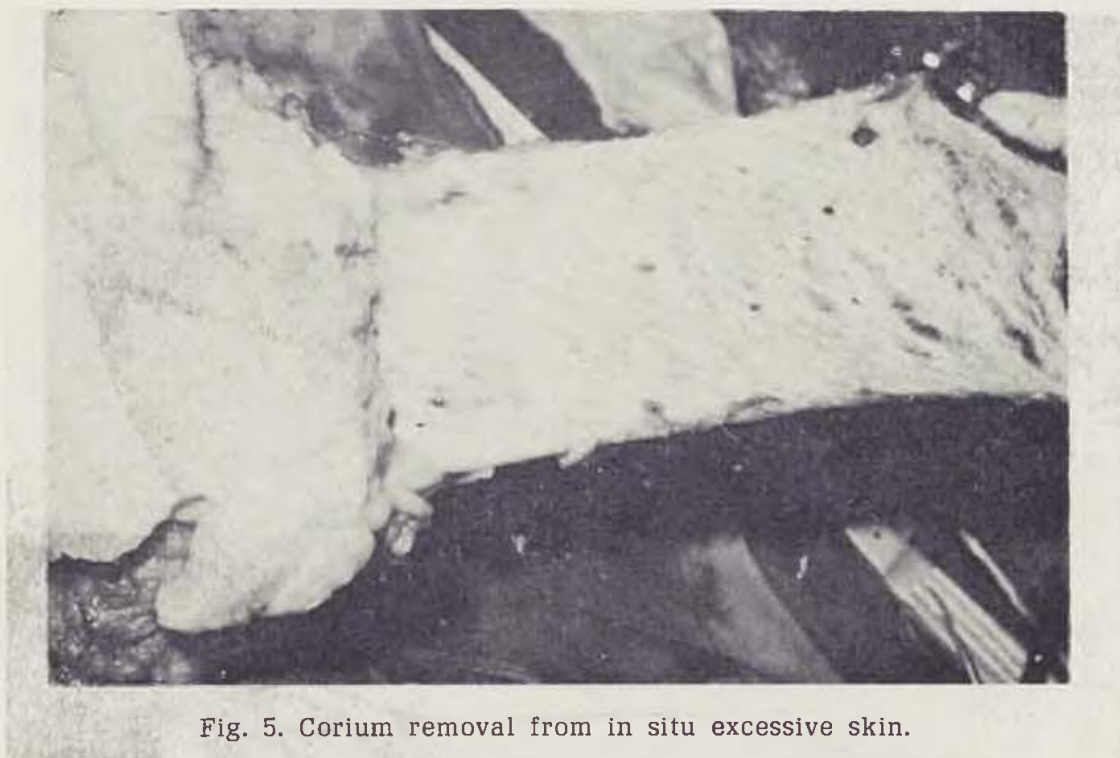


Fig. 5. Corium removal from in situ excessive skin.



Fig. 6. Whole flaccid hypogastrium covered with an extensive corium graft following suture of m. rectus abdomini diastasis and closure of the hernial gate.



Fig. 7. Appearance of the abdomen on completion of surgery.



Fig. 8. Lateral view at the firm abdominal wall one year after surgery.

SUMMARY

Even in our times of revolutionary advances in the technology and operative techniques in plastic surgery, the corium is a material with multiple applications and can be found in the patient at varying thickness. The aim of the article is to show that its indication to reinforce flaccid musculature or to cover muscular defects of the abdominal wall is fully justified even in a time of routine use of plastic nets.

RÉSUMÉ

Greffons étendus du corium

Fára, M., Hrivnáková, J., Tvrdek, M.

Même à l'époque actuelle du progrès vertigineux de la technique chirurgicale et des interventions en chirurgie plastique, le corium est un matériau à l'usage multiple et qu'on peut retrouver sur le corps du patient en diverses épaisseurs. Le travail a pour but de montrer que les indications pour le raffermissement de muscles affaiblis ou pour le recouvrement des défauts des muscles de la paroi abdominale sont pleinement justifiées, même à l'époque d'utilisation fréquente des filets plastiques.

ZUSAMMENFASSUNG

Ausgedehnte Koriumspäne

Fára, M., Hrivnáková, J., Tvrdek, M.

Auch in der gegenwärtigen Zeit des ungeheuren Fortschritts in der Technik und der operativ-plastischen Chirurgie ist das Korium ein Material, das vielseitig gebraucht wird und das man am Körper eines Patienten in verschieden dicker Schicht finden kann. Die vorliegende Arbeit will zeigen, dass seine Indikation zur Festigung geschwächter Muskulatur oder zum Überdecken von Defekten der Muskulatur der Bauchwand auch zur Zeit der Routineanwendung von Netzen aus Kunststoffen völlig berechtigt ist.

RESUMEN

Injertos de corium amplios

Fára, M., Hrivnáková, J., Tvrdek, M.

A pesar del vertiginoso progreso que se ha operado en la época actual en materia de la cirugía plástica, sigue siendo el corium un material de múltiples usos

y que puede ser encontrado en el cuerpo del paciente con diversos espesores. El trabajo pretende demostrar que su indicación para el fortalecimiento de los músculos debilitados o para el recubrimiento de defectos de los músculos de las paredes abdominales, incluso en la actualidad, en que es corriente el uso de fibras plásticas.

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COURSES IN THE DISSECTION OF MUSCULOCUTANEOUS FLAPS ON CADAVERS, BRNO

J. Veselý, J. Samohýl,

In co-operation with the Department for Plastic Surgery of the Instituto Nazionale per la Riserca sul Cancro in Genova the Department for Plastic Surgery at Brno organized, under the auspices of Prof. MUDr. I. Bařinka, DrSc., since 1987 already traditional international courses in the surgical dissection of musculocutaneous flaps. This activity was initiated on the basis of studies at the dissecting-room which were carried out for two years by Drs. Berrino, Veselý and Drařan.

The courses last for two days and are organized twice per annum. They consist of a theoretical and of a practical part. Theoretical lectures deal with the anatomy, adequacy and methods of flap dissection and of their clinical application. At the dissecting-room the participants are instructed in the techniques of flap dissection and they exercise their use in practice. The course includes instructions on the dissection of 13 statistically most commonly applied musculocutaneous and fasciocutaneous flaps. The agenda of the course is supplemented by a rich program of entertainment. The lectures are delivered by plastic surgeons from Genova, Milan and Brno, as well as by prominent visiting lecturers from Italy and other countries.

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BILATERAL BREAST RECONSTRUCTION AFTER MASTECTOMY

L. DRAŽAN, T. MRÁZEK, E. DUNGELOVÁ

In Czechoslovakia, breast reconstruction following mastectomy is still a rare procedure rather than part of standard care for the patient with breast cancer. This is mainly due to the fact that, for most physicians, survival is the priority while the quality of life of the patient after mastectomy is outside the scope of his attention. Moreover, breast reconstruction is often seen as a procedure deteriorating the patient's prognosis *quo ad vitam*. Another obstacle hindering development of reconstruction is the paucity and unavailability of silicone-made prostheses, until recently indispensable for attaining the volume and symmetry of the reconstructed breast [1, 2].

Since November 1980, when Carl R. Hartrampf performed the first breast reconstruction using the transverse abdominal island flap (TAIF, TRAM 3, 4, 5), the procedure has gained acceptance in Czechoslovakia. A TRAM flap is usually of a sufficient volume to form, in unilateral reconstruction, the breast of a required size.

This article reports on our first application of a TRAM flap in bilateral reconstruction.

A 44-year-old patient, O. Z., presented to our clinic seeking left breast reconstruction. She was 4 years after radical modified mastectomy for ductal carcinoma T1, No, Mo (Fig. 1). The patient suffered from persistent depression, traced back to the time of mastectomy, and had progressive polyarthritis in remission. She was lean with a flat abdomen. The patient complained of tenderness in the right breast in which ultrasound and mammography revealed macrocystic mastopathy.

The patient's alarming psychic status was made still worse by fear of cancer in her right breast. A positive family history — her mother died of breast cancer aged 45 years — supported the diagnosis of high-risk parenchyma in the right breast.

The coexistence of three main risk factors

- contralateral cancer,
- cystic mastopathy,
- strong positive family history



Fig. 1.

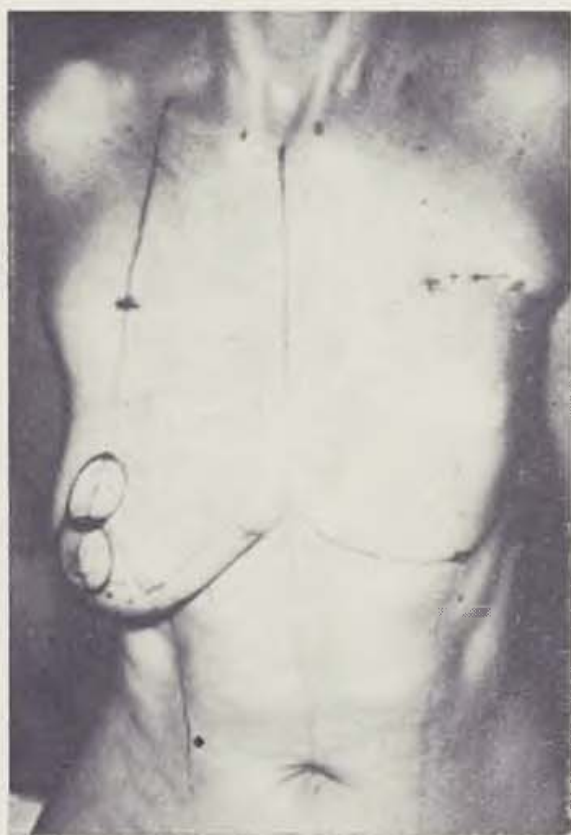


Fig. 2.



Fig. 3.

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33, 1, 1991

Ezrokhin, V. M.: Removal of wrinkles and redundant skin in the region of the forehead	1
Tepicharova, P., Anastasov, K. J.: The double folded pectoralis major musculocutaneous flap for pharyngostome closure — case report	8
Stockarová, D., Pilnáček, J., Rubín, J., Kolařík, M.: Musculocutaneous flaps for the treatment of chronic osteomyelitis of the heel	12
Guzanin, Š.: Use of the distraction method in hand surgery	22
Govila, A.: Proboscis lateralis type IV — a report from the Indian subcontinent	34
Stadin, G. I.: Primary reconstructive surgical treatment of patients with cancer of the mucous membrane of the floor of the oral cavity	40
Šmahel, Z., Müllerová, Ž., Škvařilová, B., Havlová, M.: Differences between facial configuration and development in complete and incomplete unilateral cleft lip and palate during the prepubertal period	47
Jiroutová, O.: Hypodontia in patients with isolated cleft palate, its relationship to etiopathogenesis	57

33, 2, 1991

Torres, V., Garcia, Herruzo, R., Herredero, F. X., Santos, Lenguas, F., Ratero, S., Martinez, Fresno, S. del: Penetration power of antiseptic creams ("in vitro" model with pig skin)	65
Černý, M., Fára, M., Hrivnáková, J.: Aetiological modifying and lethal factors in cleft lip and palate	72
Kruchinski, G. V.: External ear reconstruction	87
Poláček, V., Brož, L., Kripner, J., Bouška, I., Liška, E.: Unexpected gastrointestinal complications in severely burned children	98
Alsbjörn, B. F., Basse, P.: Surgical relocation of retracted eponychion	100
Divakov, M. G.: Revascularization of avascular spongy bone and head of the femur in transplantation of vascular bundle [An experimental and clinical study]	114
Bieńkowski, W., Gromadzińska, J., Pawłowicz, Z., Strużyna, J., Wąsowicz, W., Szaffer-Marcinowska, B., Zamorski, R.: Concentrations of selenium and lipid peroxides and glutathione peroxidase activities in plasma of thermally in- jured pigs	126
Grigoruk, A. A., Sokol, A. A.: The surgical repair of a defect of tendinous distortion of the patella and of the joint capsule during an arthrolysis of the knee joint	133

33, 3, 1991

Měšťák, J., Zadorožná, M., Čákrťová, M.: Breast reconstruction in women with Poland's syndrome	137
Kossmann, T., Wittling, I., Bühren, V., Sutter, G., Trentz, O.: Transferred triage to a level I trauma center in a mass catastrophe of patients: many of them with burns	145
Česaný, P.: Local anaesthesia in cosmetic surgery	151
Svoboda, S., Pafko, P.: Use of the free jejunal loop to replace cervical oesopha- gus in an experiment	155
Basse, P., Alsbjörn, B.: Paraffinoma of the male breast	163
Dytrych, Z., Tyl, J., Schüller, V., Helclová, H., Beránková, A.: Mental and social problems of families with handicapped child	166
Atanasov, N., Petrova, M., Tsołova, N.: Combined dermatoplasty in deep burns in the region of flexion of the joints in children	178

33, 4, 1991

- Candiani, P., Campiglio, G. L., Quattrone, P., Lovaria, A.: Computerized angiographic study of the vascular supply of the pectoralis major muscle . . . 185
- Bingsen, Liu, Liangui, Li, Jiaru, Zhou.: Successful healing of a burn injury covering 100 % of TBSA and 96 % IIIrd degree with inhalation injury . . 194
- Basse, P., Lohman, M., Hovgaard, C., Alsbjørn, B.: Multiple symmetric lipomatosis 204
- Fára, M., Hrivnáková, J., Tvrdek, M.: Extensive corium grafts 210
- Dražan, L., Mrázek, T., Dungelová, E.: Bilateral breast reconstruction after mastectomy 217
- Šmahel, Z., Brejcha, M., Müllerová, Ž.: Craniofacial morphology in unilateral cleft lip and palate in adults 224
- Česaný, P., Ševčíková, M., Raška, L.: The influence of external factors on the development of primary palatal cleft 242
- Veselý, J., Samohýl, J.: Courses in the dissection of musculocutaneous flaps on cadavers, Brno 216
-



Fig. 4.



Fig. 5.

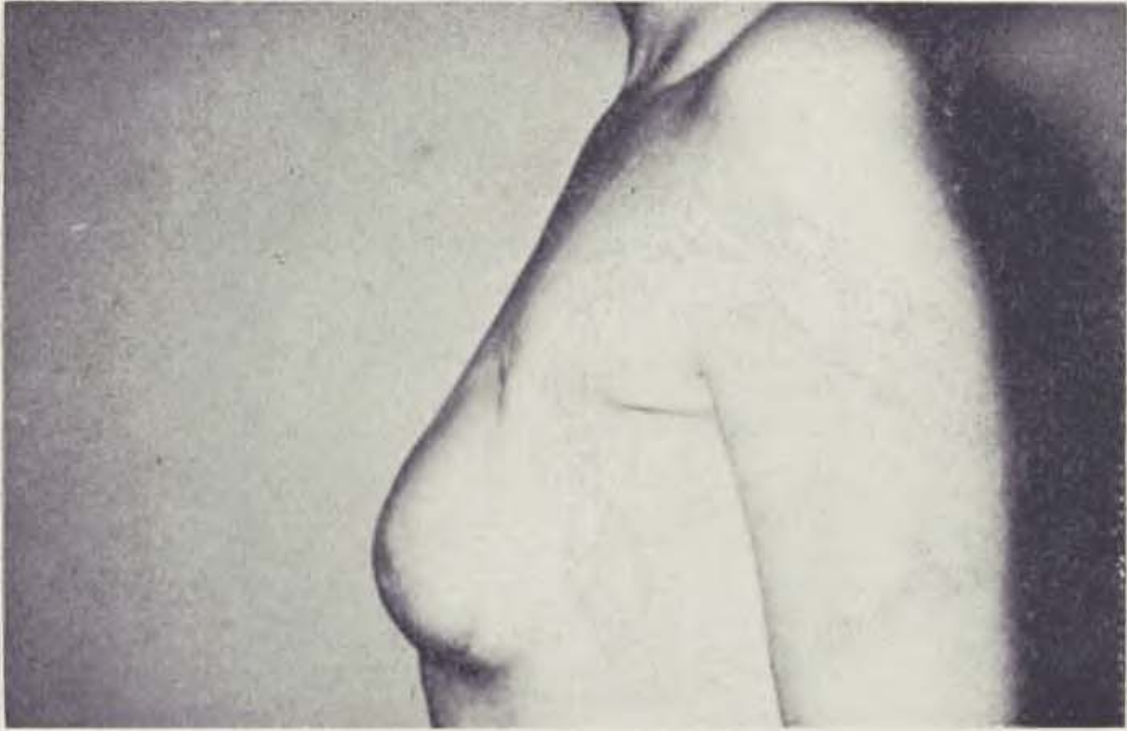


Fig. 6.

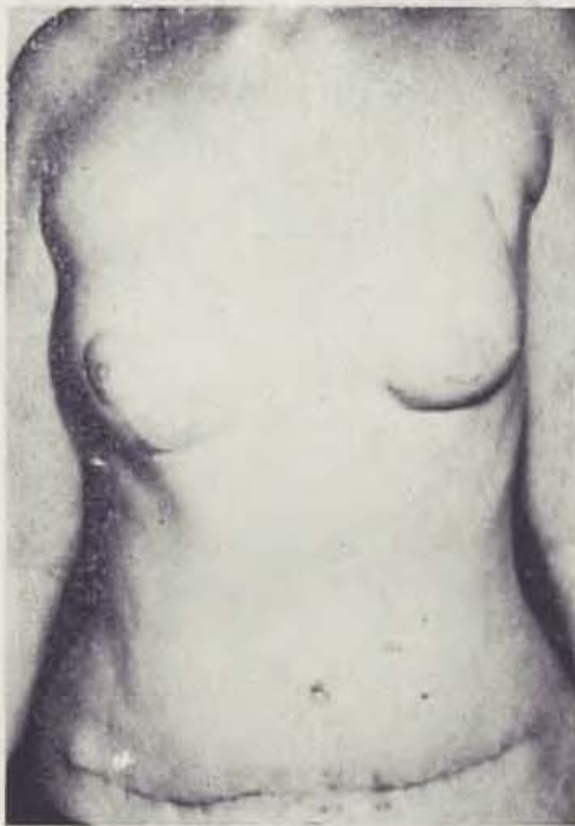


Fig. 7.

is an indication of subcutaneous mastectomy (6, 7, 8). This procedure was undertaken simultaneously with mastopexy using the technique developed by Woods (7, 8, Figs. 2, 3). After five days, bilateral reconstruction using TRAM flaps de-epithelised on the right side (Figs 4, 5) was performed. Six weeks later, we reconstructed the nipple with a dermal-fat flap and a skin graft removed from the gluteal region (9) (Figs 6, 7, 8). At the same time, correction of the relatively excessive soft tissues of the anterior axillary fold was done using a transposition flap.



Fig. 8.

Note: TAIF (Transverse Abdominal Island Flap) is the original term used to refer to the technique of transplatation of the transverse abdominal island flap supplied by epigastric vessels running through m. rectus abdomini. This term was approved by the authors of the original study, Drs. Hartrampf, Schlefman and Black, in 1981. TRAM (Transverse Rectus Abdominal Myocutaneous) is the term for the same operative procedure coined by Dr. J. Bostwick and generally used today.

DISCUSSION

Status after unilateral ablation for cancer and the finding of a mastopathy in the contralateral breast is a frequent finding in candidates seeking breast reconstruction. In these situations, the physician is faced with a twin problem: to gauge the degree of risk to the parenchyma in the remaining breast,



and to select a modality which, while minimizing the risk of malignant reversal, would allow satisfactory reconstruction.

Leaving aside the perennial problem of implantation materials not yet available in this country, the optimal policy — from the point of view of reconstruction — apparently is to talk the patient into almost symmetrical reconstruction using a bilateral TRAM flap. Occasionally, however, it may be difficult to persuade the patient about the appropriateness of breast ablation unless it is affected by cancer, and the patient may find the idea of undergoing subcutaneous mastectomy with subsequent bilateral reconstruction psychically more acceptable. The problem is that, in this procedure, it is not easy to attain breast symmetry in terms of their contour. Skin reduction and nipple mastopexy is a necessity but even then a hollow space of a shape different from that of the reconstructed contralateral breast results. The different direction of scars following mastopexy is just another factor making symmetry impossible. It seems it is time to consider use of a type of subcutaneous mastectomy other than the technique developed by Woods.

CONCLUSION

The technique of the TRAM flap is suitable for bilateral reconstruction after both radical modified and subcutaneous mastectomy. In the patient reported in this article, a twin goal was attained:

1. elimination of asymmetry of the thorax following left mastectomy and
2. removal of high-risk parenchyma of the right breast.

The patient's flat abdomen with a thin fat layer allowed us only a small volume of the breast yet satisfactory symmetry and appearance were obtained.

SUMMARY

The authors discuss the development of breast reconstruction following mastectomy in Czechoslovakia and present their first case of bilateral reconstruction employing the technique of the TRAM flap. In addition, they explore the possibility of eliminating high-risk parenchyma during with contralateral reconstruction.

RÉSUMÉ

Reconstruction bilatérale des seins après mastectomie

Dražan, L., Mrázek, T., Dungelová, E.

Les auteurs réfléchissent sur l'évolution de la chirurgie reconstructive des seins, dans les conditions tchécoslovaques, et présentent leur premier cas d'une reconstruction bilatérale, effectuée par la technique de lambeau — TRAM.

Ils évaluent les possibilités du parenchyme de risque en combinaison avec une reconstruction bilatérale.

ZUSAMMENFASSUNG

Beiderseitige Rekonstruktion des Brüste nach einer Mastektomie

Dražan, L., Mrázek, T., Dungelová, E.

Die Autoren denken über die Entwicklung der Rekonstruktion der Brüste nach einer Mastektomie unter tschechoslowakischen Bedingungen nach und demonstrieren ihren ersten Fall einer beiderseitigen Rekonstruktion mittels der Technik eines TRAM-Lappens. Sie erwägen die Möglichkeit einer Lösung des Risiko-Parenchyms in Kombination mit einer andersseitigen Rekonstruktion.

RESUMEN

Reconstrucción bilateral de senos luego de una mastectomía

Dražan, L., Mrázek, T., Dungelová, E.

Los autores reflexionan sobre el desarrollo de la cirugía de la reconstrucción de senos luego de una mastectomía en las condiciones de Checoslovaquia y presentan el primer caso de reconstrucción bilateral de senos efectuada mediante la técnica TRAM-lap.

Los autores consideran las posibilidades de parencima resgosa en combinación con la reconstrucción bilateral.

REFERENCES

1. Bařinka, L.: Latissimus dorsi musculocutaneous flap and its potential uses. *Acta Chir. Plast.*, 26:41, 1984.
2. Bostwick, J., Vasconez, L. O., Jurkiewicz, M. J.: Breast Reconstruction after a Radical Mastectomy. *Plast. reconstr. Surg.*, 61:682, 1978.
3. Hartrampf, C. R., Schefflan, M., Black, P. W.: Breast Reconstruction with a transverse abdominal island flap. *Plast. reconstr. Surg.*, 69:2:216, 1982.
4. Hartrampf, C. R.: Transverse Abdominal Island Flap Technique For Breast Reconstruction After Mastectomy, University Park Press, Baltimore, 1984.
5. Hartrampf, C. R., Bennett, G. K.: Autogenous Tissue Reconstruction in the Mastectomy Patient — A Critical Review of 300 Patients. *Ann. Surg.*, 205,5:508, 1987.
6. Bařinka, L., Šerá, D.: Plastické metody v chirurgickém řešení dysplazie ženského prsu. *Rozhl. Chir.*, 61:12, 1982.
7. Woods, J. E.: Subcutaneous mastectomy: Current State of the Art. *Ann. Surg.*, 11, 6:413, 1983.
8. Woods, J. E.: Detailed Technique of Subcutaneous Mastectomy With and Without Mastopexy. *Ann. Plast. Surg.*, 18, 1:51, 1987.
9. Hartrampf, C. R., Culbertson, J. H.: A Dermal-Fat Flap for Nipple Reconstruction, *Plast. reconstr. Surg.*, 73, 6:982, 1984.

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CRANIOFACIAL MORPHOLOGY IN UNILATERAL CLEFT LIP AND PALATE IN ADULTS

Z. ŠMAHEL, M. BREJCHA, Ž. MÜLLEROVÁ

The present communication provides a detailed description of craniofacial changes of the X-ray pattern in patients with unilateral cleft lip and palate. The reported series is homogeneous according to age (adults), sex (males), cleft type (lip and palate), affected side (rightsided anomalies) and surgical procedures (lip repair according to Veau and palate repair by pushback usually with pharyngeal fixation). The study supplements previous reports dealing with the same problems in the other types of orofacial clefts (Šmahel 1984 a, b, c). The findings could provide the clinical practice with more precise information on the deviations which are to be expected, as well as on the prospects and results of treatment. The inclusion of clefts involving the right side alone made it possible to assess facial asymmetries on the basis of mean values.

MATERIAL AND METHODS

Into our studies were allotted males aged 20—42 years, and thus the data obtained represent the final ontogenetic stage of the malformation attained under the influence of therapy. Of the 58 examined patients 32 originally had a complete cleft and 26 an incomplete cleft (10 with soft tissue bridge and 16 with both soft and bony bridge). All patients were Czechs and were operated upon at the Clinic for Plastic Surgery in Prague. Individuals with associated anomalies and those who were subjected previously to facial osteotomy were excluded. The mean age of these patients was 27.14 years. Primary palatoplasty consisted of a pushback associated predominantly (in 45 individuals) with pharyngeal flap surgery. Cheiloplasty

was performed according to Veau. The mean age at the time of primary lip suture was 8.19 months and of palate suture 4.91 years.

The series of controls consisted of volunteers matched for age who were treated on because of injuries mostly of extremities, as well as of university students. They were selected at random without an examination of the interrelation between the two jaws, but with clinically acceptable occlusion and no apparent facial dysharmony. Their mean age was 27.18 years and thus was identical with that of our patients (inclusive of age distribution, $F\text{-test} = 1.34$). The body weight and height were representative for our general population (176.9 cm and 77.2 kg).

X-ray films were obtained under standard conditions (focus-object distance 3.70 m, focus-film distance 4.00 m). The head of the patients was fixed by a cephalostat and was inclined caudally about 15° from the Frankfort plane (horizontal line passing through the outer canthus and the centre of the ear rod in the meatus acusticus). The enlargement was 8.1 %.

Craniometric points used for the interpretation of teleroentgenographic film are presented on fig. 1—2 and specified in another of our papers (Šmahel and Brejcha, 1983). On lateral films the subspinal point (Ss) is the deepest point of the subspinal concavity and thus its position is not influenced by retroinclination of the alveolar process in clefts. The midpoint between projections of all bilateral landmarks was used where appropriate. With a few exceptions (Sp, Pm, K) the designations are based on the terminology accepted at the International Craniometric Conference held in Monaco in 1906.

Reference lines used for the assessment of lateral films are described on figure 3. On anteroposterior films the mediosagittal line (MSL) was constructed with the method of a regression straight line (Fig. 2). MSL proceeds from its starting point forming the central point between the apex of the crista galli (point No. 1) and one half of the biorbital distance Lo-Lo (point No. 2), between further three points: at half of the bizygomatic width (No. 3) and biantegonial width (No. 4) and at a point constructed by perpendiculars to the upper margin of the orbits (from the crista galli) and to its lower margin (from the half of bizygomatic width), marked at a constant distance (No. 5). The horizontal line HL is then plotted perpendicular to MSL from the left Lo point.

The characteristics measured on lateral X-ray films are listed in table 1a, b, c, while those on A-P films are given in table 2 (dimensions required only for construction purposes which did not attain the level of statistic significance are not included). The perpendicular distance of a given point from the reference line is designated as Cd-NSL, an angle by the triple abbreviation N-S-Ba, or as a fraction of two reference lines forming the given angle i.e. ML/RL. The thickness of soft tissues of the profile was measured in the region of the upper lip from points Ss' and Pr parallel to the palate line (PL), and in the region of the lower lip from points Id and Sm' representing the smallest thickness, and on the chin from point Pg' perpendicular to the facial profile line N'-Pg' (mark Pg_t' etc.). On AP projection we measured in addition the projective minimum suborbital height of the

maxilla in the region of zygomaticomaxillary suture (zy-max, arrow on Fig. 2). The perpendicular distances of all landmarks from MSL and HL were measured as well and used for assessment of asymmetries (with the exception of Cr points measured as C-Cr dimensions). Deviations of medial facial structures (Intis, Id, Gn) were measured in degrees from MSL at point C. The interorbital index was calculated according to the formula $100 \times \text{Mo-Mo} : \text{Ek-Ek}$.

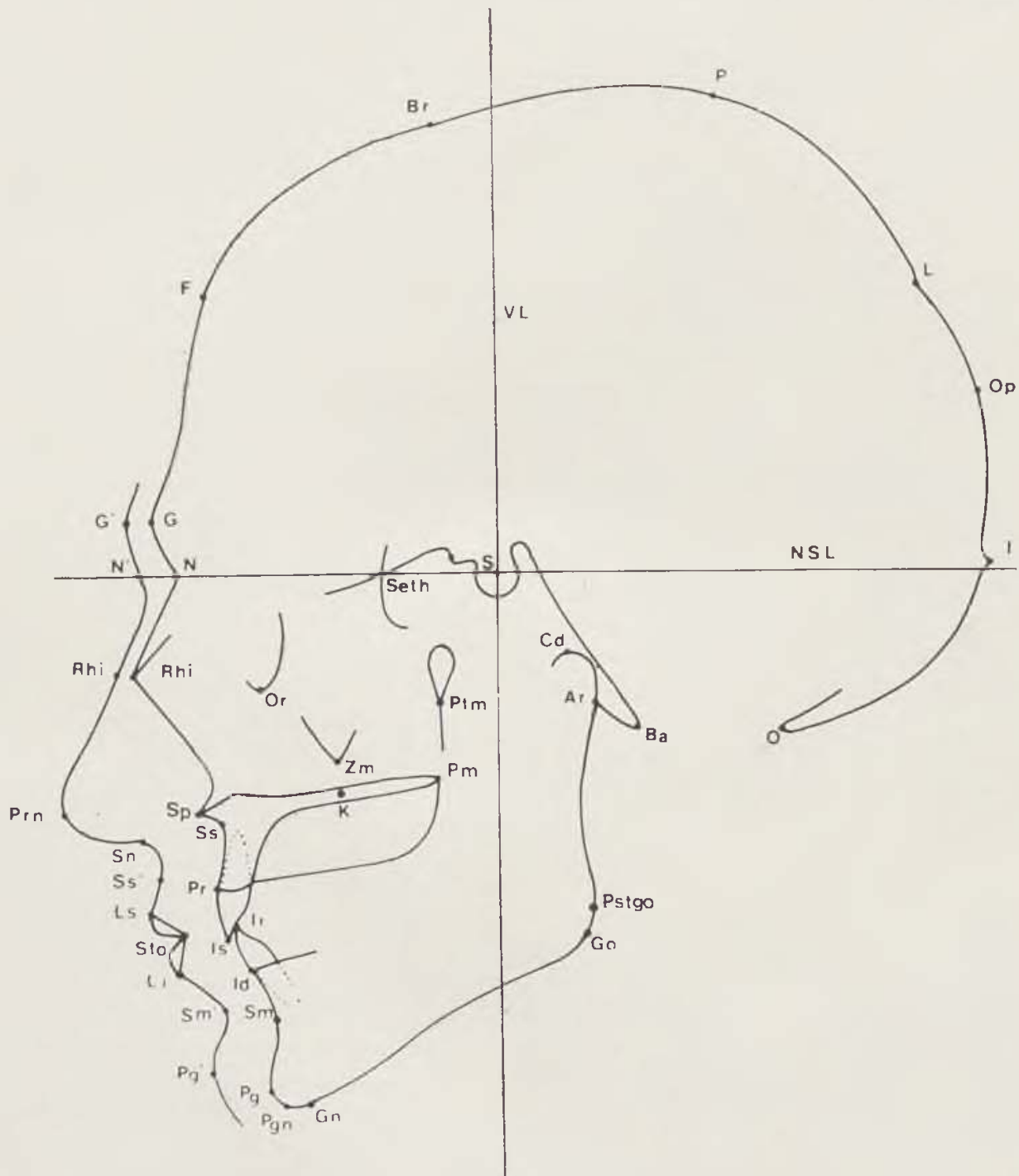


Figure 1. Cephalometric points used for the assessment of lateral X-ray films.

Numbers of cases were substantially reduced for the dimensions including the apex of upper incisors (Sp-Is, Is-PL, ISL/PL and point Intis), because of a prothesis in 26 of the patients ($n = 32$). Due to the retrusion of the maxilla, however, the apex of lower incisors was not visualized in eleven patients only, and the pertinent values were $n = 47$ (Ii-Gn, IIL/ML and IIL/NSL). The results were tested with the F-test (variability) and with the appropriate t-test.

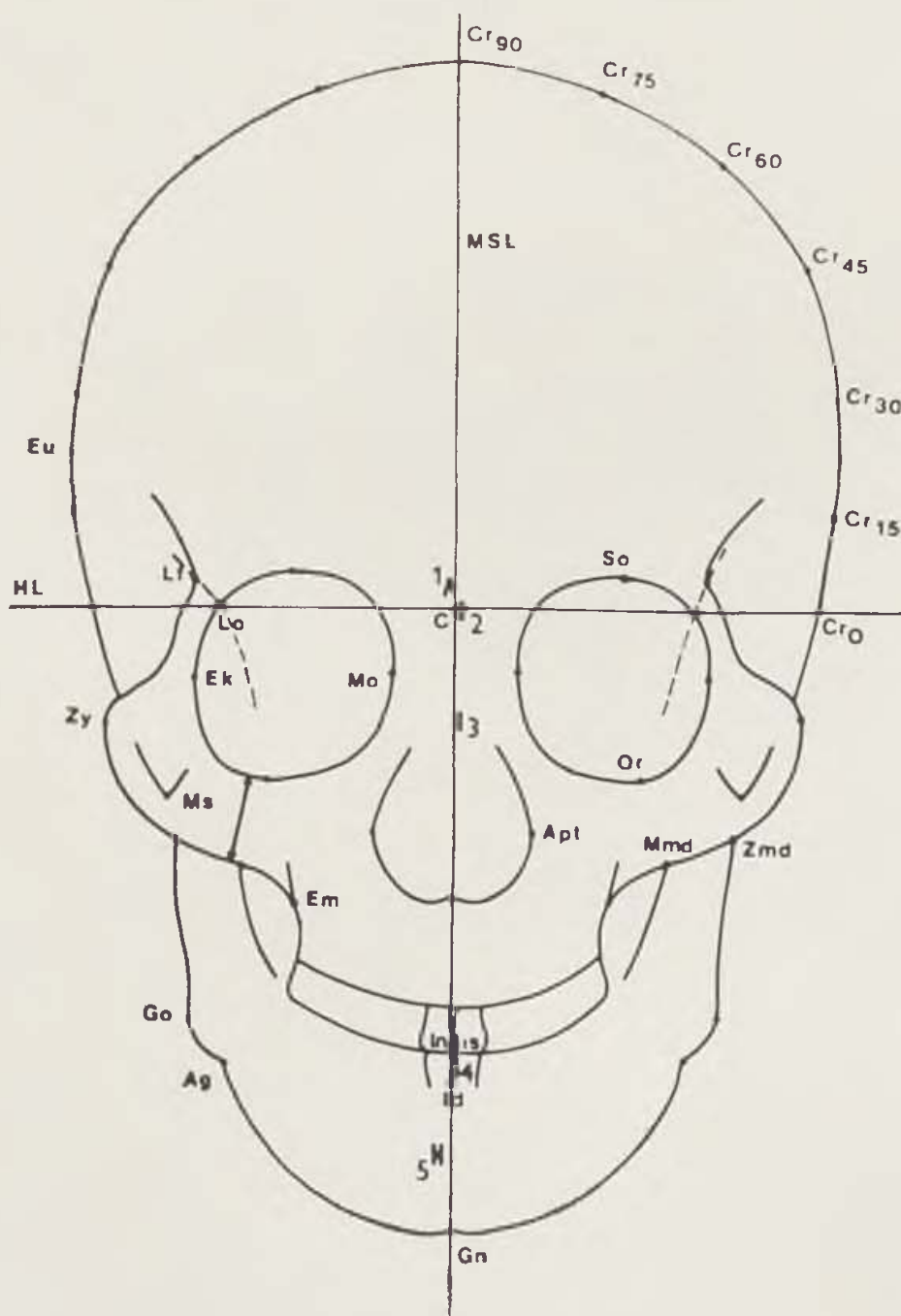


Figure 2. Cephalometric points on anteroposterior X-ray films and the method of construction of mediosagittal line (see text).

RESULTS

The results are presented in tables 1a, 1b, 1c, and 2, and illustrated schematically on figures 4 and 5.

Neurocranium. The differences of the length (N-Op, N-I) and width (Eu-Eu) was not significant, but at $p < 0.05$ direct cephalometry showed a smaller head circumference (Šmahel, 1982). The neurocranial height was also significantly smaller (Ba-Br, Ba-L). The length of the foramen magnum was shorter (Ba-O), its slope was unchanged (S-Ba-O). The cranial vault was slightly posteriorly rotated (N-S-Br, N-S-L, Op-NSL and I-NSL). The rotation and the smaller size of the neurocranium were reflected in the slower slope of the frontal bone (S-N-F). The lower height of the skull vault was evident in anteroposterior projection (C-Cr₉₀), which revealed also the increase of the minimum frontal width (Lf-Lf) associated with a lateral displacement of orbits.

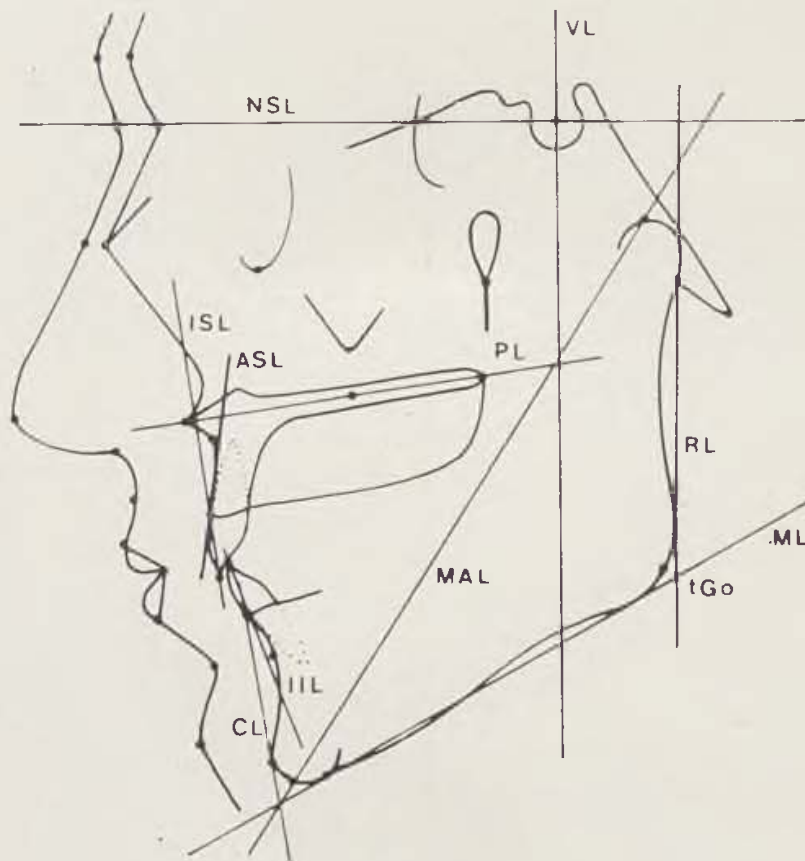


Figure 3. Reference lines plotted on lateral X-ray films (NSL = line through N and S, VL = perpendicular to NSL through S, PL = line through Sp and Pm, CL = line through Pg and Id, ML = tangent to the mandibular body through Gn, RL = tangent to the mandibular ramus through Ar, MAL = line through Pgn and Cd, ASL = tangent to the maxillary alveolar process through Pr, ISL = line through Is and Pr, IIL = line through Ii and Id, tGo = intersection of ML and RL).

Cranial base. The shortening of the anterior part (N-S) was reflected in its total length (N-Ba), while the postsellar part, i.e. the length of the clivus (S-Ba) was unchanged. The shortening of the presellar part of the base occurred within the medial cranial fossa (S-Seth). The curvature of the cranial base did not differ from controls, both within the median plane (N-S-Ba) and in lateral regions (N-S-Cd).

Nasopharyngeal bony framework. Highly significant was the reduction of height (S-Pm) and even more of the depth (Pm-Ba). This was

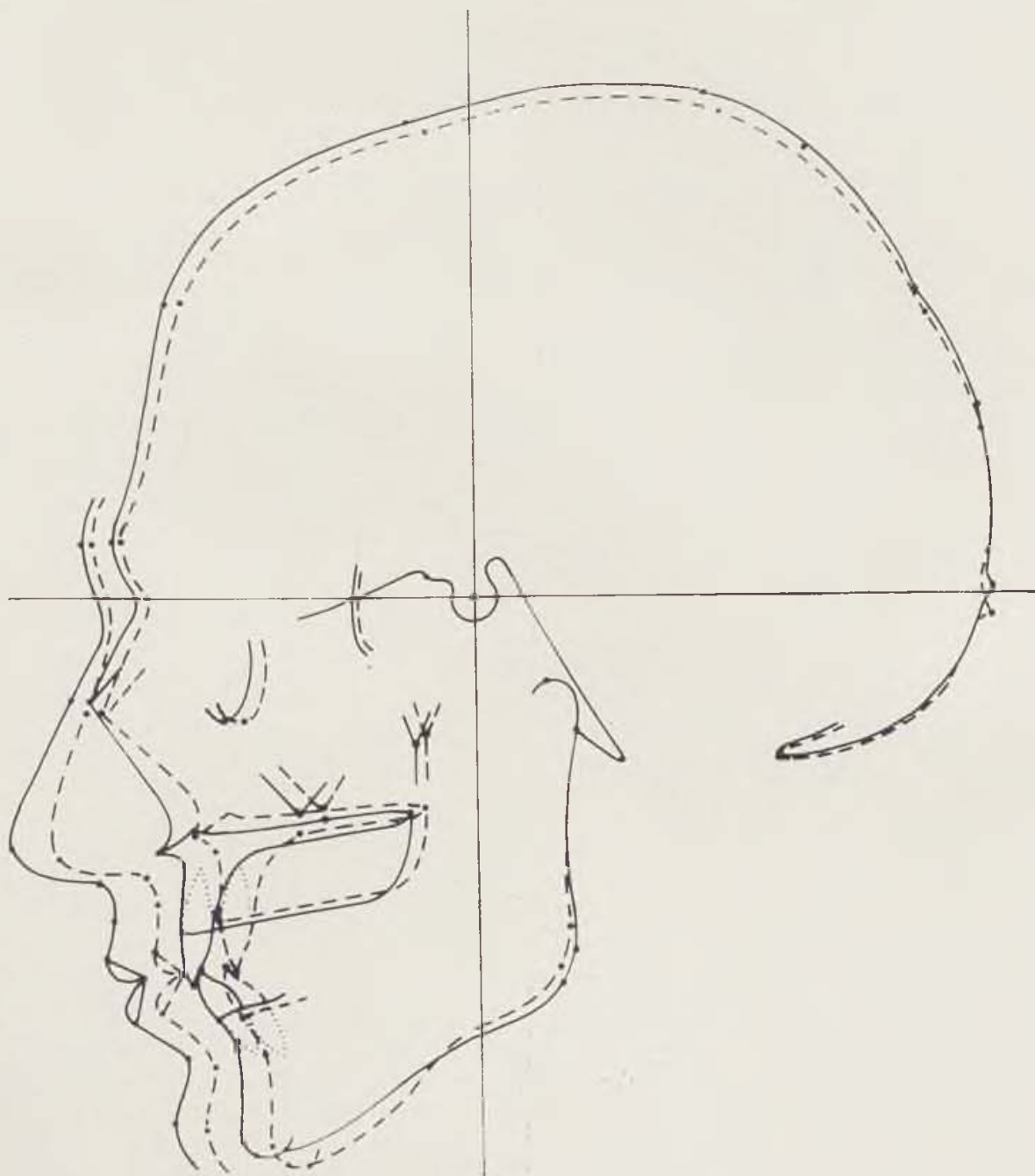


Figure 4. Lateral craniogram in adult males with unilateral cleft lip and palate (dashed line) as compared to the controls (solid line).

due to the reduced posterior height of the upper face, and in the second case by the displacement of the maxilla posteriorly. This finding might indicate a smaller capacity of the nasopharynx.

The upper face. The bizygomatic width of the face (Zy-Zy) remained unchanged, however, the interocular space was markedly widened (Mo-Mo). There was also an increase of the distance between the upper

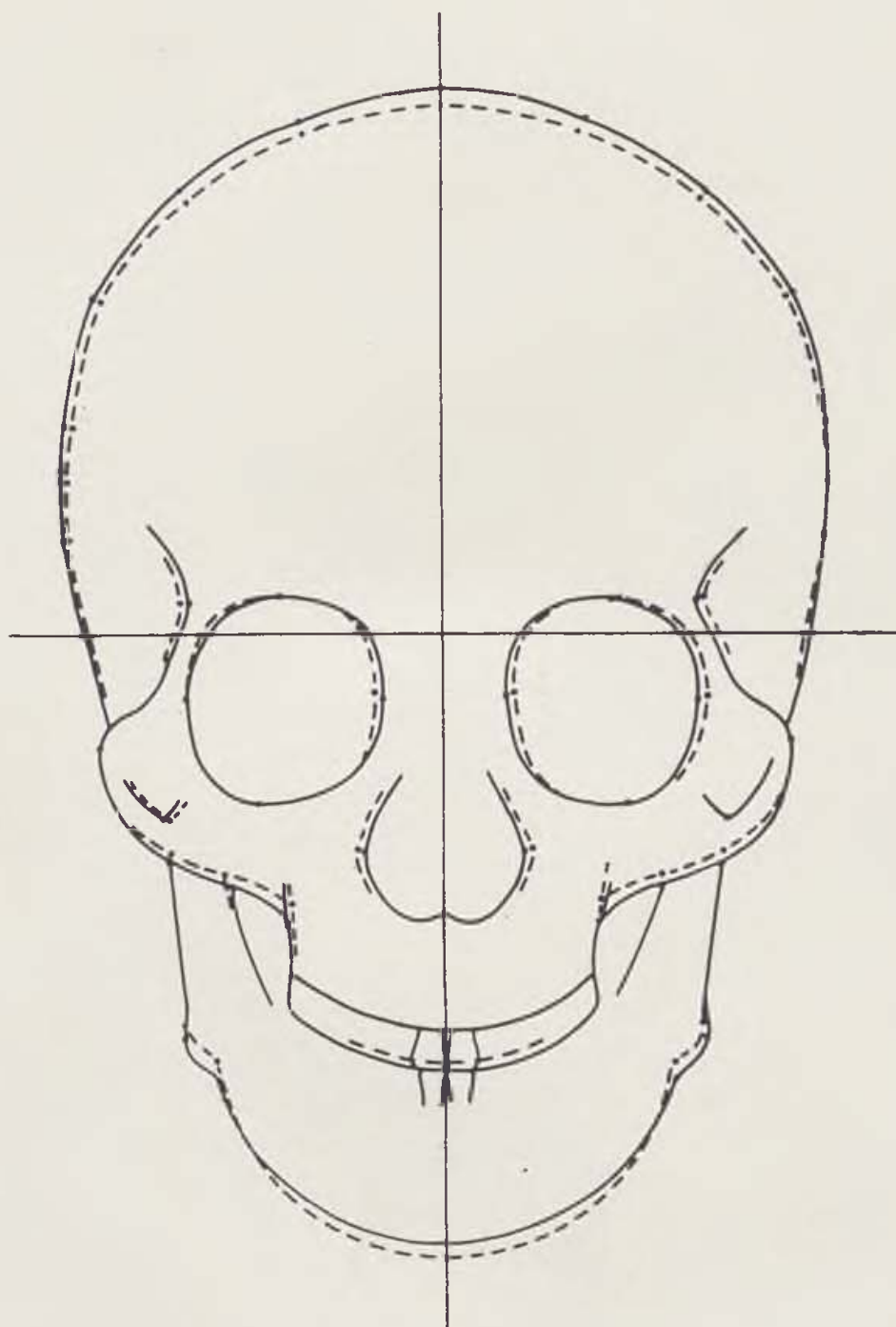


Figure 5. Anteroposterior craniogram in adult males with unilateral cleft lip and palate (dashed line) as compared to the controls (solid line).

outer orbital margins (Lo-Lo), but this increase was less marked horizontally (Ek-Ek) and thus resulted in a significant narrowing of the orbits (Mo-Ek). The proportional deviation was confirmed by the interorbital index value. The widening of the interorbital space was symmetric (Mo-MSL dx et sin). There was equally a distinct widening of the nasal cavity (Apt-Apt) which, on the average, was symmetric as well (Apt-MSL dx et sin), yet the affected side showed a large scatter of values (variability $p < 0.01$) confirming individual asymmetry. The suborbital height of the maxilla (zy-max) was reduced only insignificantly, the width of the alveolar arch at its base remained unchanged (Em-Em).

The anterior height of the upper face (N-Sp) was significantly shortened (by 3.5 %), while its posterior height was shortened only insignificantly (Pm-NSL). This shortening was not present in the orbital region (Or-NSL). The distance between the margin of the alveolar process and the spina nasalis anterior (Sp-Pr) was increased, yet only because of the retroinclination of this structure; measurements perpendicular to the palate line (Pr-PL) yielded insignificant differences. A vertical shortening recorded above the palate plane was no more present on the alveolar process and thus the dimensions N-Pr and N'-Sto were not significantly reduced. The length of the nose (N'-Prn) and its height (N'-Sn) did not differ from those in controls, but there was a lengthening of nasal bones (N-Rhi). Antero-posterior craniogram disclosed also the reduced height of the upper face decreasing in lateral regions (Em-HL $p < 0.001$ and Mmd-HL $p < 0.05$, Zmd-HL insign) which was confirmed in lateral projection (Zm-NSL $p < 0.1$). The depth of the maxilla (Sp-Pm and Ss-Pm) was markedly shortened on the average by as much as 8 per cent. The shortening was similar in its anterior and posterior part (Sp-K and Pm-K). The slope of the palatal plane remained unchanged (PL/NSL).

The upper jaw showed a high degree of retrusion (S-N-Sp, S-N-Ss and S-N'-Ss'). The slope of nasal bones was reduced similarly (S-N-Rhi). The retrusion in the position of orbits (S-N-Or) and of zygomatic bones (S-N-Zm) was smaller. The terminal part of the palate was displaced posteriorly (Pm-VL, N-S-Pm) and thus in relation to the cranial base the maxilla as a whole (Ptm-VL) was displaced backwards (see also the shortening of S-Seth). The alveolar process was retroinclined by as much as 10° (ASL/PL) but the incisors only by 8° (ISL/PL). The latter was not due to the smaller number of cases including only those without prosthetical repair.

Mandible. Both the body and the ramus were shortened by 4 per cent (Pgn-Go, Pgn-tGo, Cd-Go). On the contrary the anterior height of the mandible (Ii-Gn) and the height of the symphysis (Id-Gn) were both increased; the width of the jaw was unchanged (Go-Go, Ag-Ag). The length of the mandibular body, measured at pogonion level (Pg-Pstgo) was not significantly reduced, since this dimension was influenced by the larger gonial angle. Therefore this characteristic proved not useful for evaluations. For the same reason the total length of the mandible (Pgn-Cd), showed no changes. The gonial angle was increased (ML/RL) and the angle of the chin



was reduced (CL/ML). The incisors were retroinclined by 12° (IIL/ML), however their inclination to the cranial base was less deviated (by 4.5° IIL/NSL).

Retrognathia of the mandible was reflected by the reduction of the skeletal and soft profile angles (S-N-Id, S-N-Sm, S-N-Pg, S-N-Gn, S-N'-Sm' and S-N'-Pg'). The position of the condyle within the skull was unchanged (Cd-NSL, N-S-Cd), similarly as the slope of the mandibular ramus (RL/NSL). The shortening of the mandibular ramus resulted in a posterior obliquity of the body (ML/NSL). The position of the gonion within the skull was significantly higher (Ar-tGo), which was confirmed in A-P projection (Ag-HL and Zy-Go). The position in anteroposterior direction (Go-VL) was not changed. The distance S-Pgn characterizing the total antero-inferior growth of the lower jaw was within the range of norm, however, the direction of mandibular growth was deviated in favour of the vertical component (MAL/NSL).

Facial profile. A larger retrusion of the upper jaw, as compared to the lower jaw resulted in a flattening of the face. The angle of skeletal convexity (N-Ss-Pg) was increased by 6 degrees and was concave (184°). The soft profile differed even more (by 10.5° , N'-Sn-Pg') and a similar difference showed the angle N'-Prn-Pg' including the nose. For the same reason the relation of the upper and lower face in anteroposterior direction was disturbed (Ss-N-Pg, Ss'-N'-Sm', Ss'-N'-Pg'). The posterior obliquity of the face was by 2.3° larger than in controls (S-N'-Pg').

A more marked flattening of the soft profile, as compared to the skeletal profile, was caused by the smaller thickness of the upper lip (at the level of Ss' and Pr). The height of the upper lip was significantly reduced (Sn-Ls and Sn-Sto). The distance between the apex nasi and the anterior spina (Prn-Sp) was markedly reduced as well, obviously because of the deficiency of soft tissues and the flattening of the apex. However as a result of further repairs the deviation was only minimum in the depth of the nose (Prn-Sn).

Facial asymmetry. As compared to the unaffected side only one characteristic of antero-posterior projection was significantly smaller on the affected side, i.e. the half of the width of the alveolar arch (Em-MSL dx:sin $p < 0.05$). This finding could reflect the original relationship with a medial displacement of the lateral alveolar segment on the affected side (deviations were caused exclusively by complete clefts; Šmahel and Brejcha, 1983).

The face as a whole. The total anterior height of the face (N-Gn) was significantly increased. In this increase participated the elongation of the subpalatal part of the face (Sp-Pg), which exceeded the shortening of the upper face (N-Sp). This resulted in vertical disproportion: in clefts upper face height accounted for 41.3 % of total facial height as compared to 43.9 % in controls. In the elongation of the lower part of the face participated the increase of the anterior height of the mandible (Ii-Gn) by 2 mm, the maxillary dentoalveolar retroinclination by 1.5 mm (the increase of distance Sp-Pr) and an impaired overjet by 2.2 mm (the distance Pr-Id). The posterior height of the face (S-Go) was decreased and its ratio to the

Table 1a. X-ray cephalometric characteristics in lateral projection:
linear measurements (S. E. = standard error, diff. = difference from the control;
+ significant differences between clefts and controls in variability)

Variable	Mean	S. E.	diff.	Variable	Mean	S. E.	diff.
Cranium				Facial height			
N-Op	190.29	0.84	-1.35	N-Rhi	27.41	0.45	+2.47***
N-I	187.17	0.87	-1.71	N-Sp	55.22	0.53	-1.92*
Ba-Br	149.22	0.64	-3.30**	N-Ss	59.17	0.55	-1.23
Ba-L	123.14	0.61	-1.98*	N-Pr	74.93	0.67	-0.51
S-P	123.41	0.56	-1.67	N-Gn	133.62	0.87	+3.46*
Ba-O	36.38	0.38	-1.14*	Sp-Is	32.53	0.51	+1.45
Op-NSL	37.09	1.70	-5.63*	Sp-Pr	20.12	0.45	+1.52*
I-NSL	-4.24	1.53	-5.62*	Is-PL	31.56	0.49	+0.76
O-NSL	36.14	0.87	+1.50	Pr-PL	18.98	0.44	+0.64
Base				Pr-Id	23.48	0.33	+2.18***
N-Ba	111.95	0.57	-1.89*	Sp-Pg	73.14	0.81	+5.48***
N-S	73.29	0.42	-1.75**	S-Go	86.02	0.65	-2.08*
N-Seth	48.09	0.39	-0.01	S-Pgn	135.62	0.89	+0.06
S-Seth	25.62	0.33	-1.36*	S-Pm	49.17	0.47	-1.77**
S-Ba	49.41	0.38	+0.09	Pm-NSL	47.88	0.47	-1.06
Mandible				Or-NSL	28.24	0.33	+0.18
Pgn-Cd	125.03	0.93	-1.11	Zm-NSL	47.60	0.41	-0.98
Pgn-tGo	77.43	0.79	-3.29**	Ptm-NSL	31.38	0.43	-2.02**
Pgn-Go+	76.17	0.78	-2.79**	Facial depth			
Pg-Pstgo	83.91	0.78	-1.71	Ss-Pm+	48.14	0.61	-4.26***
Cd-Go	65.02	0.58	-2.40**	Sp-Pm	52.48	0.60	-4.22***
Ar-tGo	54.19	0.64	-3.65***	Sp-K	30.05	0.52	-1.91**
Ii-Gn	48.06	0.52	+2.12**	Pm-K++	22.36	0.53	-2.26**
Id-Gn	36.56	0.52	+2.06**	Pm-Ba	45.03	0.42	-3.47***
Cd-NSL	19.09	0.54	-0.05	Pm-VL	11.71	0.50	-2.57***
Go-VL	18.14	0.88	+0.44	Ptm-VL	11.66	0.41	-2.00***

*p<0.05

**p<0.01

***p<0.001

anterior height was 64.4 % in clefts, as compared to 67.7 % in controls and indicated the deficiency of the anterior growth rotation (counterclockwise) of the face during ontogenesis. The elongation of the face was visualized also on antero-posterior craniogram (C-Gn), yet it was not significant in this projection.

Sagittal maxillomandibular relation was distinctly impaired (Ss-N-Sm, i.e. ANB). This deviation, together with a retroinclination of the alveolar process and incisors of the upper jaw resulted in mandibular overjet since the dento-alveolar component of the mandible was not capable of an adaptation to this high degree of changes. The vertical maxillomandibular relationship was altered as well (PL/ML), while there were no deviations in transversal direction (dev. Id and Gn).

Variability. Only a few characteristics showed a significant increase of variance. Almost all of these were within the affected region (Tab. 1

Table 1b. X-ray cephalometric characteristics in lateral projection:
angles (explanatory notes see tab. 1a)

Variable	Mean	S. E.	diff.	Variable	Mean	S. E.	diff.
Cranium				Upper face			
S-N-F	82.45	0.46	-2.55***	PL/NSL	7.24	0.60	-0.78
N-S-Br	84.21	0.55	+2.03*	ASL/PL	97.10	1.08	-10.50***
N-S-L	147.29	0.72	+3.21**	ISL/PL	84.16	1.60	-8.10***
N-S-Ba	130.78	0.74	-1.38	N-S-Pm	76.26	0.59	+2.42**
S-Ba-O	128.62	0.73	-0.32	S-N-Or	52.69	0.50	-1.89*
				S-N-Zm	50.34	0.48	-3.10***
Profile				Mandible			
S-N-Rhi	109.03	0.80	-6.23***	ML/RL	128.78	0.87	+6.82***
S-N-Sp	79.43	0.68	-5.79***	CL/ML	64.66	0.66	-6.10***
S-N-Ss	75.40	0.63	-5.28***	RL/NSL	88.07	0.72	-0.09
S-N-Pr	77.24	0.61	-5.70***	MAL/NSL	61.28	0.65	+3.08**
S-N-Id	77.55	0.60	-2.53**	ML/NSL	36.81	0.82	+6.75***
S-N-Sm	75.95	0.58	-2.25**	PL/ML	29.57	0.93	+7.53***
S-N-Pg	77.74	0.59	-2.10*	IIL/ML	67.64	1.19	-11.92***
S-N-Gn	74.48	0.59	-2.06*	IIL/NSL	75.40	1.03	+4.62**
Ss-N-Sm ⁺	-0.55	0.43	-3.03***	N-S-Cd	130.83	1.26	-0.25
Ss-N-Pg ⁺	-2.38	0.47	-3.22***	N-S-Pgn	71.31	0.58	+2.83***
N-Ss-Pg ⁺	183.91	0.91	+5.79***				

Table 1c. X-ray cephalometric characteristics in lateral projection:
dimensions of the soft profile (explanatory notes see tab. 1a)

Variable	Mean	S. E.	diff.	Variable	Mean	S. E.	diff.
Height				Angle			
N-Prn	59.14	0.59	-0.20	Ss'-N'-Sm'++	3.00	0.41	-4.16***
N'-Sn	63.34	0.56	-0.70	Ss'-N'-Pg'++	0.71	0.46	-4.03***
N'-Sto	85.81	0.58	-0.97	N'-Sn-Pg'+	174.98	1.07	+10.34***
N'-Pg'	122.41	0.80	+2.03	N'-Prn-Pg'	143.29	0.90	+9.29***
Sn-Ls	15.31	0.33	-2.35***				
Sn-Sto ⁺	22.37	0.31	-1.97***	Thickness			
Depth				G-G'	6.24	0.14	+0.12
Prn-Sn	19.48	0.33	-0.52	N-N'	8.98	0.17	-0.36
Prn-Sp	29.53	0.38	-2.77***	Rhi-Rhi'	3.83	0.12	+0.23
Angle				Ss' _f	14.05	0.23	-0.75*
S-N'-Ss'	80.72	0.64	-6.36***	Pr _f	14.48	0.25	-0.78*
S-N'-Sm'	77.72	0.57	-2.20**	Id _f ⁺	11.38	0.17	-0.22
S-N'-Pg'	80.02	0.59	-2.32**	Sm' _f	12.02	0.18	-0.24
				Pg' _f	14.59	0.34	-0.09

Table 2. X-ray cephalometri_o characteristics in anteroposterior projection
(explanatory notes see tab. 1a)

Variable	Mean	S. E.	diff.	Variable	Mean	S. E.	diff.
Cranium				Orbits			
Eu-Eu	162.41	0.77	-0.98	Mo-Mo	29.78	0.33	+2.88***
Lf-Lf	111.68	0.59	+2.39**	Lo-Lo	103.67	0.53	+2.08**
Ms-Ms	119.02	0.68	-1.39	Ek-Ek	110.64	0.51	+0.99
C-Cr ₉₀	116.22	0.73	-2.51*	Mo-MSL dx	14.64	0.20	+1.11***
Upper face				Mo-MSL sin	15.05	0.19	+1.48***
Zy-Zy	147.74	0.76	+0.56	Mo-Ek dx	40.48	0.24	-1.03**
Apt-Apt	36.47	0.44	+1.80**	Mo-Ek sin	40.41	0.23	-0.90*
Em-Em	68.69	0.64	+0.34	i. interorb.	26.88	0.26	+2.27***
Apt-MSL dx ⁺⁺	18.29	0.30	+0.86*	Mandible			
Apt-MSL sin	18.12	0.25	+0.81*	Go-Go ⁺	111.61	0.72	-0.94
Em-MSL dx ¹	33.62	0.35	-0.54	Ag-Ag	99.72	0.63	+1.68
Em-MSL sin ¹	34.64	0.37	+0.50	Ag-HL dx	94.79	0.94	-2.99*
Em-HL dx	58.64	0.60	-3.93***	Ag-HL sin	94.19	0.85	-3.48**
Em-HL sin	58.24	0.55	-3.94***	Zy-Go dx	64.54	0.72	-2.91**
Mmd-HL dx	53.16	0.51	-1.53*	Zy-Go sin	64.25	0.71	-2.69*
Mmd-HL sin	53.07	0.42	-1.48*	C-Gn	135.86	0.83	+1.90
zy-max dx ⁺	17.59	0.56	-1.14	dev. Id (dx)	+0.20	0.16	0.30
zy-max sin	17.93	0.51	-0.62	dev. Gn (sin)	-0.12	0.12	0.06

i Significant differences between the right and left sides at $p < 0.05$

and 2). A decreased variability at $p < 0.05$ showed on the contrary the height of the upper lip {Sn-Sto} and the width of the mandible {Go-Go}. The former indicated that the height of the repaired lip was uniform while at the same time its mean value documented that it was short.

DISCUSSION AND COMPARISON

The above described deviations illustrate the extent, the character and complexity of changes in craniofacial regions in unilateral cleft lip and palate. Most facial structures are influenced in varying degrees by this malformation and the neurocranium shows some changes as well. The latter consist of slightly reduced dimensions of the neurocranium (by 1-2 %), corresponding to smaller body height (by 2 %) recorded in our series (Šmahel, 1982). However the deviations are related, to a certain degree, to the extent of the cleft (Šmahel and Brejcha, 1983) and thus probably are not due solely to the smaller stature of these patients showing no correlation with the extent of the anomaly (Šmahel, 1982). There were no deviations of the cranial base, with the exception of a slight shortening of its presellar part.

The widening of the interocular space associated with a lateral displacement of the whole orbits is related, according to Moss (1971), to the wider nasal cavity. This resulted from the lateral displacement of maxillary segments due to the interrupted continuity of the lip, jaw and palate at the site of the cleft. Since an increase of the interocular distance always occurred in a cleft lip (even when it was isolated), but not in an isolated cleft palate (Dahl, 1970, Aduss et al. 1971, Farkas and Lindsay 1972, Figalová et al. 1974) a primary association with cleft of the primary palate cannot be excluded.

The fundamental and largest deviation within the whole complex of final craniofacial changes in clefts of the lip and palate consisted of the reduction of maxillary depth leading to a marked retrusion of the middle portion of the face and to alterations of the sagittal maxillo-mandibular relations. It was due to growth deficiency in which secondary postoperative effects played an important part (evidence of the progressive character of maxillary retrusion in clefts was provided in numerous studies: Derichsweiler 1959, Graber 1964, Shibasaki and Ross 1969, Hayashi et al. 1970, Bishara and Tharp 1977 etc.). The primary damage of the growth efficiency was underlined by Burian (1952). The retrusion of the maxilla was subsequently followed by other profile deviations. However the retrusion was slighter in lateral facial regions (the posterior displacement in relation to the nasion amounted in point Zm to 3 mm, as compared to 5.5 mm in point Ss) and thus a flattening of the face in transversal direction, was present as well.

Simultaneously, in relation to the cranial base, the upper jaw as a whole was displaced backwards. This might result from primary growth insufficiency of the circummaxillary system of sutures. This deviation was present prior to palatoplasty and thus it did not seem probable that it was affected by the pushback (Šmahel and Müllerová, 1986). The retroinclination of the alveolar process and of the upper incisors was mainly due to the increased tension exerted by the repaired lip. The retroinclination of incisors was slightly smaller than that of the alveolar process which was obviously due to orthodontic therapy. The deficiency of vertical growth of the upper face was mostly interpreted as the sequelae of the altered interaction between the maxilla and the nasal septum which is believed to control vertical growth (Scott 1967, Latham 1969). However, the causality of this relation was questioned by Siegel et al. (1985). The height of the alveolar process was not reduced, possibly because its growth was produced by apposition only and regulated by the length of teeth. The prolongation of nasal bones (disclosed also by Sadowsky et al. 1973) was related to the retrusion of the maxillary complex, as confirmed by a significant correlation (between N-Rhi and S-N-Ss, $r = 0.259$, $p < 0.05$).

The smaller size of the lower jaw could to a high degree represent a primary growth deficiency (Šmahel and Brejcha 1983). The shortening of the ramus was followed necessarily by the flattening of the gonial angle and a more marked obliquity of the body with altered vertical jaw interrelations and with an adaptation of the sharper chin angle and increased

anterior mandibular height. It was confirmed by our studies into the cranial intrarelations (Šmahel and Škvařilová, 1988). This question was discussed in more detail in a previous study (Šmahel and Brejcha, 1983).

From the above described features the basic changes were as follows: shortening of the maxillary depth, widening of interorbital distance and nasal cavity, the reduced height of the upper face, the dentoalveolar retroinclination of the maxilla and the deficient growth of the mandible. Most of other facial skeletal deviations could be derived from these changes (they include facial flattening, impaired jaw relations, reduction of anterior growth rotation, impaired facial proportions etc.). The skeletal changes were subsequently followed by corresponding deviations of the soft profile, where the reduced thickness of the upper lip was due to primary deficiency of soft tissues and the reduction of the upper lip height mostly to surgical repair.

Comparable data relative to the neurocranium were virtually lacking. Domanská (1971) failed to disclose any difference between individual dimensions in a small group of children of pre-school age. Dahl (1970) detected in adults a reduction of the circumference, as well as of length and height. We did not succeed in confirming a significant shortening of the neurocranium which could be due to the fact that our population was markedly brachycephalic as compared to the Danish population. On the contrary, we found a less steep slope of frontal bones.

Most reports confirmed a slight shortening of the presellar part of the cranial base. A flattened cranial base was described by Blaine (1969), Dahl (1970) and Hayashi et al. (1976), but it was not demonstrated by Brader (1957), Ross (1965), Ross and Coupe (1965), Engman et al. (1965), Schweiger (1966), Havlová (1969), Aduss (1971) and Krogman et al. (1975). A shortening of the clivus was found by Dahl (1970). Though the findings were not uniform the described deviations were not marked.

Facial morphology was the subject of comprehensive studies and the basic characteristics were mostly in good agreement. Therefore we have compared our results only with the data reported by Dahl (1970) in adult males with unilateral cleft lip and palate. The findings were in agreement, the only differences consisted in the supraposition of the mandibular joint and of a steeper slope of the palate which were not found in our patients (the latter was not demonstrated also by Hayashi et al. 1976). The supraposition of the temporomandibular joint was equally mentioned by Derischweiler (1959) as well as by Ross and Coupe (1965), yet it was not demonstrated by Vaško (1975), or by Müllerová and Brejcha (unpublished data). On the whole there were, however, larger deviations from normal calculated by Dahl for his series, which was most probably due to the fact that he examined earlier born individuals (1928—1942), as compared to our patients (1938—1955), when the results of surgical repair were inferior. This author measured on antero-posterior films only the interocular space which was significantly increased and the biantegonial width and maxillar width (Em-Em) which both did not differ from controls.

An increase of the interocular distance was confirmed in addition by Psaume (1957), Graber (1964), Moss (1965), Havlová (1969), Aduss et al. (1971), Farkas and Lindsay (1972), Figalová et al. (1974), Ishiguro et al. (1976) and Müllerová and Brejcha (unpublished data). The four last studies were suggestive in addition of an increase of the biorbital distance. Havlová (1969) ascertained a widening of the apertura piriformis. No significant asymmetry was demonstrated on AP X-ray films outside the region of the cleft (Harvold 1954, Ishiguro et al. 1976). In lateral projection a smaller thickness of the upper lip was recorded by Sadowsky et al. (1973) and by Vaško (1975) who mentioned in addition a significant posterior obliquity of the facial profile. Besides Dahl (1970) a posterior displacement of the whole maxilla was reported also by Hausser (1965), Blaine (1969), Havlová (1969) and Hayashi et al. (1976), a smaller height and depth of the nasopharyngeal bony framework by Coccato et al. (1967). The inclination of the mandibular ramus remained unchanged (Hayashi et al. 1976). Comprehensive comparisons were made especially by Dahl (1970) and Hayashi et al. (1976).

The findings obtained were definitely related to the surgical technique of palatal pushback and lip suture according to Veau, used in 1940s and 1950s. These data could provide the possibility of a comparison with final results of other surgical procedures and could be equally helpful for the elucidation of some present discrepant findings (e.g. about cranial base curvature, superposition of the mandibular joint etc.).

SUMMARY

X-ray measurements were used for studies of craniofacial morphology in unilateral (right-sided) cleft lip and palate in 58 adult males operated upon with the same technique. The results obtained showed a slightly smaller neurocranium without marked changes of the cranial base. Basic facial skeletal deviations included a shortening of maxillary depth, reduction of the upper face height, widening of some maxillary dimensions (interorbital and of nasal cavity), retroinclination of upper incisors and alveolar process and mandibular changes resulting from growth deficiency (they consisted of shortening of the body and ramus, elongation of anterior mandibular height, obtuse gonial angle, acute chin angle, steeper slope of the body, retroinclination of incisors and retrognathia). Described changes caused an impairment of sagittal and vertical jaw relations, anterior cross-bite, flattening of the face and a limitation of its anterior growth rotation. There was also a displacement of the whole maxilla backwards and a reduction of the height and of the thickness of the upper lip (increasing retrocheilia). The elongation of the lower face and thus of the whole face was produced by the increase of the anterior height of the mandible, impaired overjet and by maxillary dentoalveolar retroinclination. A slight transversal flattening of the face (greater retrusion in the centre than in the zygomatic regions) was present as well.

R É S U M É

Changements craniofaciaux chez la fente labiale et palatine unilatérale

Šmahel, Z., Brejcha, M., Müllerová, Ž.

Se basant à l'évaluation métrique des clichés téléradiographiques, on a étudié la morphologie craniofaciale de la fente labiale et palatine (de droit) chez 58 hommes adultes opérés par la même méthode. Les résultats montrent une diminution crânienne, la base crânienne ne présentant pas de changements importants. Les anomalies essentielles du splanchnocranium sont: raccourcissement de la profondeur maxillaire, diminution de la hauteur du visage supérieur, élargissement de quelques segments maxillaires (écart intraoculaire et cavités nasales), rétroinclinaison de la saillie alvéolaire supérieure, des incisives et changements de la mandibule dus à sa croissance insuffisante (raccourcissement du corps et de la branche, augmentation de la hauteur antérieure de la mandibule, angle gonial plat, angle aigu du menton, inclinaison plus abrupte du corps, rétroinclinaison des incisives et rétrognathie). Les changements décrits causent des troubles dans les relations sagittales et verticales des maxillaires, l'occlusion inverse, l'applatissage facial et la limitation de l'antériorotation du visage. Simultanément, la maxillaire supérieure est en sa totalité poussée dans le sens postérieur. Nous avons aussi constaté le raccourcissement de la lèvre supérieure et son épaisseur moins exprimée ce qui accentue encore la rétrochélie. L'allongement de la face inférieure et par conséquent de la face entière représente le résultat de la plus grande hauteur de la mandibule, des troubles de l'occlusion et de la rétroinclinaison dentoalvéolaire du maxillaire supérieure. La face est aussi un peu aplatie dans le sens transversal.

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

Kraniofaziale Veränderungen bei einer einseitigen Spaltung der Lippe und des Gaumens im Erwachsenenalter

Šmahel, Z., Brejcha, M., Müllerová, Ž.

Auf Grund der metrischen Auswertung von Teleröntgen-Aufnahmen wurde die kraniofaziale Morphologie bei einer einseitigen (rechtsseitigen) Spaltung der Lippe und des Gaumens bei 58 erwachsenen Männern studiert, die mittels der gleichen Methode operiert worden waren. Die Ergebnisse zeigen eine Verkleinerung des Zerebrums, während die Kranial-Basis keine wesentlichen Veränderungen aufweist. Die grundlegenden Abweichungen des Splanchnocraniums sind die Verkürzung der Tiefe der Maxilla, die Verkleinerung der Höhe des oberen Gesichts, die Erweiterung mancher Formationen der Maxilla (Zwischenraum zwischen den Augen und der Nasenhöhle), die Retroinklination des oberen alveolären Fortsatzes und der Schneidezähne, sowie die Veränderungen an der Mandibule, wie sie sich aus deren unzureichendem Wachstum ergeben (Verkürzung des Körpers und des Zweiges, Vergrößerung der vorderen Höhe der Mandibula, flacher Gonialwinkel, scharfer Kinnwinkel, steilere Körperneigung, Retroinklination der Schneidezähne und Retrognathie). Diese beschriebenen Veränderungen bewirken eine Störung der sagittalen und vertikalen Beziehungen zwischen den Kiefern, eine umgekehrte Bissstellung, eine Verflachung des Gesichts und eine Beschränkung der Anteriorotation des Ge-

sichts. Die Maxilla ist gleichzeitig als ein Ganzes posterior verschoben. Wir fanden auch eine Verkürzung der Oberlippe und deren geringere Dicke, was die Retrocheilitis noch mehr ausprägt. Die Verlängerung des unteren und damit des ganzen Gesichts ist das Ergebnis einer vergrößerten vorderen Höhe der Mandibula, der Störungen der Bissstellung und der dentoalveolaren Retroinklination der Maxilla. Das Gesicht ist dann etwas verflacht, auch in der Querrichtung.

RESUMEN

Transformaciones craniofaciales en los casos de fisura labial y palatal en los adultos

Šmahel, Z., Brejcha, M., Müllerová, Ž.

En base a la evaluación métrica de teleradiografía se estudió la morfología craniofacial en los casos de fisura labial y palatal (de lado derecho) en 58 hombres adultos operados con el mismo método. Los resultados muestran una reducción de la cavidad cerebral y la base del cráneo no acusa cambios sustanciales. Las anomalías básicas del del esplanchnocranium son: disminución de la profundidad maxilar, reducción de la altitud facial superior, ampliación de ciertos segmentos maxilares (distancia interocular y cavidades nasales, retroinclinación alveolar superior y de los incisivos y transformaciones de la mandíbula resultantes de su insuficiente crecimiento (disminución del cuerpo y de la rama, aumento de la altura de la mandíbula anterior, ángulo gonial plano, ángulo agudo de mentón, inclinación mas aguda del cuerpo, retroinclinación de los dientes incisivos y retrognacia. Los cambios descritos causan alteraciones en las relaciones sagitales y y verticales de los maxilares, oclusión inversa, aplastamiento facial y limitación de la anteriorrotación de la cara. El maxilar superior, en su totalidad, está corrido en sentido posterior. Comprobamos, además, un acortamiento del labio superior y una disminución de su espesor, lo cual acentúa la retrochelía. La prolongación de la parte inferior de la cara, y por ende de toda la cara, es el resultado de una mayor altura de la mandíbula, de los defectos de la oclusión y de la retroinclinación dentoalveolar del maxilar. La cara es un tanto aplastada también en sentido transversal.

REFERENCES

1. Aduss, H.: Craniofacial growth in complete cleft lip and palate: Angle Orthodont., 41: 202, 1971.
2. Dahl, E.: Craniofacial morphology in congenital clefts of the lip and palate. Acta Odont. Scand., 28, Suppl. 57, 1970.
3. Hayashi, I., Sakuda, M., Takimoto, K., Miyazaki, T.: Craniofacial growth in complete unilateral cleft lip and palate: A roentgenocephalometric study. Cleft Palate J., 13: 215, 1976.
4. Sadowsky, C., Aduss, H., Pruzansky, S.: The soft tissue profile in unilateral clefts. Angle Orthodont., 43: 233, 1973.
5. Šmahel, Z.: Cephalometric and morphologic changes associated with unilateral cleft lip and palate in adults. Acta Chir. Plast., 24: 1, 1982.
6. Šmahel, Z.: Variations in craniofacial morphology with severity of isolated cleft palate. Cleft Palate J., 21: 140, 1984a.
7. Šmahel, Z.: Craniofacial morphology in adults with bilateral complete cleft
8. Šmahel, Z.: Craniofacial changes in

unilateral cleft lip in adults. Acta Chir. Plast., 26 : 129, 1984c.

9. Šmahel, Z., Brejcha, M.: Differences in craniofacial morphology between complete and incomplete unilateral cleft lip and palate in adults. Cleft Palate J., 20 : 113, 1983.

10. Šmahel, Z., Müllerová, Z.: Craniofacial morphology in unilateral cleft lip and palate prior to palatoplasty. Cleft Palate J., 23 : 225, 1986.

11. Šmahel, Z., Škvařilová, B.: Roentgencephalometric study of cranial interrelations. J. Craniofac. Genet. Dev. Biol., 8 : 303, 1988.

The other references are available from the authors.

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THE INFLUENCE OF EXTERNAL FACTORS ON THE DEVELOPMENT OF PRIMARY PALATAL CLEFT

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Since the northern tip of Moravia is a region heavily polluted by a variety of contaminants as a result of local industrial activities, we decided to study the incidence of primary palatal cleft in this region in relation to fall-out levels of heavy metals.

The study was designed for a five-year period between 1985—1990. Its aim was to identify, at least roughly, the fallout components most probably involved in the exogenous effect on palatal cleft development. The fact that the investigation was started under the totalitarian regime when all signs of an unhealthy environment were kept strictly confidential made findings from the local public health service unavailable to us.

To get around this problem, we contacted the State Forest enterprise furnishing us not only the confidential data but, also, standards applicable to heavy metal fallouts which provided the basis for our analysis.

Registration of children with primary palatal cleft, born in the study period, was done at the Department of Medical Genetics in Ostrava for the whole of Northern Moravia and Silesia (which was officially the North Moravian region at that time).

METHODS OF RESEARCH

1. Registry: annual registries covered the period from 1 October to 20 September of the next year. It was critical to retain this shift in view of the interval between the child conception and periods of fallout monitoring.

Each newborn had his/her own medical record file (Tab. 1) with the parameters and chemical fallout levels monitored within the area in the period of his/her conception. Code to the medical record is shown in Tab. 2.

Children with primary palatal clefts were enrolled into our study. The registry included children operated on at the Department of Plastic Surgery

at Třinec after basic genetic examination (minus those with primary palatal clefts due to a genetic risk).

The following numbers were entered:

year	total of newborns with primary palatal cleft	genetic risk	No. in study
1986	18	2	16
1987	28	5	23
1988	31	7	24
1989	34	6	28
1990	27	7	20
total	138	28	110

Table 1. A sample medical record

S. M.	F 11 959
2. 6. 2. 1986	
3. Štramberk	
4. NJ	
5. incomplete right	
6. 5 mm	
7. 1. 7. 1986, mod. RT	
8. no	
9. mother-shop assistant (food shop)	
10. yes	
11. a) Mn: 950, Zn: 29,5, Cu: 7,50, Pb: 85, Cr: 0,75, Cd: 0,35, Co: 7, 50 mg/kg	
b) Mn: 886, Fe: 135, Zn: 68, Pb: 3,9, Cu: 3,6, Cr: 3,9, Co, Cd, Ni too low to measure	
c) industrial fallout: 30,5, Cd: 90,6, Co: pms, Cr: 2,29, Cu: 1 : 35, Mn: 21,6, Ni: 1,00, Pb: 4,94, Zn: 26,6	
12. no	

Table 2. Code to the medical record

List of monitored parameters in children with primary palatal cleft
1. Name, sex, No. of medical record
2. Date of birth
3. Home address
4. District
5. Type of cleft
6. Extent of cleft
7. Date of surgery, type of surgery
8. Genetic risk
9. Effect of mother's workplace
10. Keeping domestic animals
11. External factors:
a) soil
b) needles
c) ground surface
12. Closeness of industrial agglomeration

Table 3. Findings of increased incidence of palatal cleft correlating with increased levels of heavy metals

District	1986	1987	1988	1989	1990
Opava	3‰ Cd 0.7/0.99	11‰ Co 0/19	0‰ Cd 0.4	17‰ Cd 4.7	9‰
Ostrava	Cd 0.15 4‰	Cd 0.42 9‰	Cd 0.38 / / 0.69 13‰	Cd 0.17 12‰	Cd 0.38 10‰
Frýdek	Cd 0.15 9‰	Cd 0.35/Co 1.0 9‰	Cd 0.57/ Co 0.58 12‰	Cd 0.17 9‰	Cd 0.38 10‰
Karviná	unassessable	Cd 0.35 12‰	Cd 0.57/Co 0.5 14‰	Cd 0.17 12‰	Cd 0.9/0.14 11‰
Bruntál	0 0‰	Cd 0.73/ /0.32 Co 19	Cd 0.4/4.0 12‰	Cd 0.4 0‰	Cd 0.4/1.0 Co 1.5 19‰
Šumperk	Cd 0.92/0.95 Co 0/3.0 Pb 49 4‰	Cd 3.5/2.3 Pb 14 9‰	Cd 0.33/2.4 Co/2.5 9‰	Cd 0.1 Č‰	Cd 0.12 0‰
Olomouc	Cd 0.7/0.9 Co 0/1.8 6‰	Cd 0.3/0.3 0‰	Cd 0.4/2.4 3‰	Cd 0.1 2‰	Cd 0.12 3‰
Vsetín	Cd 0.25/Co 0.8 5‰	Cd 0.5/Co 0.9 9‰	Cd 0.2/Co 0.49 20‰	Cd 0.48 10‰	Cd 0.22 0‰
Prerov	Cd 0.35 5‰	Cd 0.3/2.4 0‰	Cd 0.38/0.11 Co 0/0.7 10‰	Cd 1.27/0.5 Pb 104 Co 0/0.6 64‰	Cd 0.3 31‰
Nový Jičín	unassessable	Cd 0.25/0.55 Co 0/1.4 4‰	Cd 0.4/ Co 0.69 22‰	Cd 0.43/1.27 23‰	Cd 0.28 0‰

Cd — cadmium *Co — cobalt *Pb — lead

Number of clefts to the number of newborns in the study period (in %)

1022 ACTA 4 metér Boštica RKP 9 Kolom

Thus, a total of 110 children with palatal cleft born without a genetic risk were followed up in our study.

2. to avoid distortion of the numbers of primary palatal cleft in each area due to cumulation of the population, the per mill of children born with cleft with an excluded genetic risk was calculated (Tabs. 3 and 5).

3. The exceeded permissible levels of heavy fallout were established using the medical records of each child (Tab. 4).

Table 4. Permissible levels of heavy metal fallout (table by State Forest enterprise)

Element	Forest soil mg/kg		Needles mg/kg ashes
	mean	range	
Zn	50	10-300	3-16
Cu	20	2-110	2-15
Ni	40	10-1,000	25
Mn	850	100-4,000	15-150
Cd	0,06	0,01-0,07	0,2-0,8
Co	8	1-40	0,05-0,5
Pb	10	2-200	0,1-10
Cr		10-100	

4. Special attention was given to fallout levels of cadmium and cobalt, elements which appear to be associated with palatal cleft development. Manganese, while virtually omnipresent in our region and occurring here at increased levels, cannot be ruled out as a possible another cause of the defect.

Based on our data, a table was developed (Tab. 5) indicating areas of increased fallout levels of the above metals as well as their dynamics related to the development of palatal cleft. A clear-cut correlation between the rise in the incidence of primary palatal cleft and increased fallout levels was demonstrated (and, conversely, a reduction in the numbers in periods of lower fallouts) was demonstrated in 68 % of cases. Multiples of exceeded permissible fallout levels were used for this table.

5. Distribution of children with primary palatal cleft into boys and girls altogether and in individual localities:

year	m	f
1986	11	4
1987	14	9
1988	16	8
1989	16	12
1990	12	41
total	89	= 100

Table 5. Multiples of excess of permissible Cd and Co fallout levels over the 1985-1990 period and the effect on the incidence of primary palatal cleft (per mill of the total of newborns)

District	1986					1987					1988					1989					1990				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Opava	10×1	0	0	0	3	0	1×	0	30×	11	↓6×	0	0	0	0	6×	0	0	0	17	0	0	0	0	9
Ostrava OV	2×	0	0	0	4	↑6	0	0	0	9	↑7×	0	0	1×	13	3×	0	0	0	12	5×	0	0	0	10
FM	2×	0	0	0	0	5×	0	0	2×	9	↑7×	0	0	1×	12	↓3×	0	0	0	9	5×	0	0	0	10
Karviná	unassessable					5×	0	0	0	12	↑7×	0	0	1×	14	↓3×	0	0	0	12	10×	2×	0	0	11
Bruntál	unassessable					10×	4×	0	2×	12	6×	5×	0	0	12	↓6×	0	0	0	0	↑6×	2×	0	3×	19
Šumperk	12×10	0	6×	4		↑50×	0	0	3×	9	5×	3×	0	5×	9	↓1×	0	0	0	0	1×	0	0	0	0
Olomouc	10×10	0	3×	6		↓5×	0	0	0	0	5×	3×	0	0	0	2×	0	0	0	2	2×	0	0	0	3
Vsetín	4×	0	0	2×	5	↑8×	0	0	2×	9	5×	0	0	1×	20	7×	0	0	0	10	↓3×	0	0	0	0
Přerov	5×	0	0	0	5	5×	3×	0	0	0	↑5×	1×	0	0	10	25×	1×	0	2×	64	↓5×	0	0	0	31
N. Jičín	unassessable					5×	1×	0	3×	4	6×	0	0	1×	22	7×	7×	0	0	23	3×	0	0	0	0

1 = Cd in soil

2 = Cd in needles

3 = Co in soil

4 = Co in needles

5 = palatal clefts of total newborns (per mi)

An analysis by the type of primary palatal cleft, locality and sex in the region is in Tab. 6 (map).

Table 6.



The map again clearly shows a high number of cases of primary palatal cleft in the more polluted areas, along with a rise in the severity of the type of cleft (see high incidence in neighbouring districts of Karviná and Frýdek, or Vsetín and Přerov in 1989).

6. Tab. 7 provides a detailed list of places in the region with reported cases of cleft (with an excluded genetic risk plus the current per mill in districts).

4. In addition to the type of the cleft, the extent of the fissure was determined perioperatively (Tab. 8). The extent of Cd and Co pollution also seem to correlate. When assessing the effect of increased fallout levels, we were surprised to find more serious cases of cleft lip in localities exposed to the simultaneous effect of Cd and Co.

Table 7. Communities with palate cleft incidence over the years 1986—1990

Year		1985	1987	1988	1989	1990	Total
District	Community						
NJ	Klokočůvek	—	—	—	1	—	1
	Studénka	—	—	1	—	—	1
	Fulnek	—	—	1	—	—	1
	Kateřinice	—	—	1	—	—	1
	Nový Jičín	—	—	1	—	—	1
	Suchdol	—	1	—	—	—	1
	Kopřivnice	1	1	1	—	—	3
	Štramberk	1	—	—	—	—	1
	Příbor	—	—	—	1	—	1
	Frenštát	—	—	—	1	—	1
	total	2	2 4 %	5 22 %	3 23 %	—	12
Brť	Bruntál	—	3	—	—	1	4
	Rázová	—	—	1	—	—	1
	Krnov	—	—	—	—	1	1
	Dobročov	—	—	—	—	1	1
	total	—	3 12 %	1 12 %	—	3 19 %	7
Pr	Radslavice	—	—	—	—	1	1
	Bělotín	—	—	1	—	—	1
	Přerov	—	—	1	—	1	2
	Hranice	1	—	—	1	—	2
	Lobodice	—	—	—	1	—	1
	Dravka	—	—	—	1	—	1
	total	1 5 %	—	2 10 %	3 64 %	2 31 %	8
OC	Pnovice	—	—	1	—	—	1
	Olomouc	1	—	—	—	—	1
	Praskaře	1	—	—	—	—	1
	Lutín	—	—	—	1	—	1
	Červenka	—	—	—	—	1	1
	total	2 6 %	—	1 3 %	1 2 %	1 3 %	5
Vs	Rožnov	—	1	1	—	—	2
	Valmez	—	—	1	—	—	1
	Vsetín	1	1	1	1	—	4
	Lidečko	—	—	—	1	—	1
	total	1 3 %	2 9 %	3 20 %	2 10 %	—	8

% = per mill of incidence out of total of newborns in calendar

The study included only cases of primary palatal cleft as the defect most sensitive to external factors.

Year		1986	1987	1988	1989	1990	Total
District SU	Hoštejn	—	1	—	—	—	1
	Vlčice	—	—	1	—	—	1
	Písečná	—	1	—	—	—	1
	Šumperk	1	—	1	—	—	2
	total	1 4 %	2 9 %	2 9 %	—	—	6
PM	Frýdek	—	2	—	1	1	4
	Třinec	1	2	2	1	—	6
	Raškovice	—	—	1	—	—	1
	Mosty u J.	1	—	—	1	—	2
	H. Tošanovice	1	—	—	—	—	1
	Brušperk	—	—	—	—	1	1
	total	3 9 %	4 9 %	3 13 %	3 12 %	2 10 %	15
OV	Bohumín	—	—	—	1	—	1
	O. Zábřeh	2	4	1	—	1	8
	O. Hrabůvka	—	—	3	—	—	3
	O. Dubina	—	—	—	1	—	1
	O. město	—	—	—	5	5	10
	total	2 4 %	4 9 %	4 13 %	7 12 %	6 10 %	23
KI	D. Marklovice	—	1	—	—	—	1
	Český Těšín	—	—	3	1	1	5
	Orlová	1	—	—	1	1	3
	Rychvald	—	—	1	1	—	2
	Karviná	—	1	—	—	1	2
	Haviřov	1	1	—	1	—	3
	Petrovice	—	—	—	—	1	1
	total	2	3 12 %	4 14 %	4 12 %	4 11 %	17
OP	Šilhárovice	—	1	—	—	—	1
	Hlavnice	—	1	—	2	1	4
	Štěpánkovice	—	1	—	—	—	1
	M. Lazce	1	—	—	—	—	1
	Rohov	—	—	—	2	1	3
Total		1 3 %	3 11 %	—	4 17 %	2 9 %	10

Every effort was made to avoid using distorted information based on fallout levels obtained either from ashes of tree needles from various localities (calculated by analysis in mg/kg of ashes). Data were also obtained from forest soil (mg/kg of forest soil from the same localities).

Table 8. Extent, localization and type of cleft in children born in the 1986-1990 period

Year	CLL -		CLL +		CLR -		CLR +		CLB -		CLB +		CLPL -		CLPL +		CLPR -		CLPR +		CLPB -		CLPB +		Total
	m	f	m	f	m	f	m	f	m	f	m	f	m	f	m	f	m	f	m	f	m	f	m	f	
1986	4	0	1	0	3	0	0	0	1	0	0	0	1	1	1	1	0	0	0	0	1	1	0	0	15
1987	2	2	1	1	0	1	2	0	1	0	0	0	1	0	3	2	1	0	2	0	1	0	1	2	23
1988	2	1	1	1	1	0	0	0	0	1	0	0	1	0	4	1	0	0	1	0	2	0	3	5	24
1989	1	3	1	0	3	1	0	0	1	1	1	1	2	0	4	4	0	0	2	1	0	0	1	1	28
1990	2	3	3	3	1	3	0	0	1	0	0	0	1	0	4	1	0	0	2	1	0	1	1	0	20
Colkm	11	9	4	2	8	5	2	0	4	2	1	1	6	1	16	9	1	0	4	4	5	1	6	8	110

Extent: - = less than 1 cm
+ = more than 1 cm

Abbreviations: CLL - left lip cleft
CRL - right lip cleft
CLPL - complete left cleft
CLPR - complete right cleft
CLB - bilateral lip cleft
CLPB - bilateral complete cleft

As a rule, measurements were performed at the nearest possible site from the place of birth of the child with cleft.

SUMMARY

The study was designed to assess the effect of heavy metal fallouts in industrial areas on the development of primary palatal cleft in Northern Moravia and Silesia over a period of five years (1985—1990).

The study involved a total of 110 children; fallout levels in their places of residence were determined.

Heavy metal fallout levels were measured in the ashes of needles and forest soil in the nearest possible locality to the place of birth of the child.

The data obtained show a striking correlation between increases in cadmium and cobalt levels and the development of primary palatal cleft.

RÉSUMÉ

Influence des facteurs extérieurs à la genèse des fentes

Česaný, P., Ševčíková, M., Raška, L.

On a suivi l'influence des déchets de métaux lourds des agglomérations industrielles à la genèse des fentes du palais primaire, dans la région de la Moravie du Nord et de la Silésie, dans la période de 5 ans, 1985—1990. Au total, on a examiné 110 enfants et les déchets dans leurs environs.

Les déchets métalliques étaient suivis dans les cendres des aiguilles de conifères et dans la terre forestière aux sites les plus proches à la naissance de l'enfant.

Les résultats montrent une coïncidence frappante entre l'augmentation du cadmium et du cobalt et la genèse de la fente.

ZUSAMMENFASSUNG

Der Einfluss äußerer Faktoren auf die Entstehung eines Spaltungsdefektes

Česaný, P., Ševčíková, M., Raška, L.

Beobachtet wurde der Einfluss von Niederschlägen schwerer Metalle in industriellen Agglomerationen auf die Entstehung eines Spaltungsdefektes des primären Gaumens in Nordmähren und Schlesien in einem Zeitraum von 5 Jahren — 1985 bis 1990.

Im Ganzen wurden 110 Kinder mit Niederschlägen in ihrer Umgebung untersucht. Die Niederschläge der Metalle wurden in der Asche von Nadelhölzern und im Waldboden in der nächsten Umgebung der Geburt des Kindes beobachtet.

Die Schlussfolgerungen zeigen einen auffallenden Zusammenhang der Steigerung von Kadmium und Kobalt mit der Entstehung der Spaltungsdefekte.



RESUMEN

Influencia de factores exteriores el surgimiento de fisuras

Česaný, P., Ševčíková, M., Raška, L.

El estudio hace el seguimiento de la influencia de la diseminación de metales pasados en aglomeraciones industriales en el surgimiento de fisuras de paladar primario en las regiones de Moravia septentrional y Silesia durante el período de 1985 a 1990.

En total fueron examinados 110 niños y simultáneamente la diseminación de metales pesados en el entorno residencial.

La investigación se realizó en las cenizas de la pinocha de las coníferas y en la tierra de los bosques de las cercanías de la localidad de residencia de los niños.

Los resultados logrados confirmaron una evidente correlación entre el aumento del contenido de cadmio y cobalto y el incremento de los casos de fisuras de paladar.

REFERENCES

1. Barr, M.: The teratogenicity of lead in two stocks of W. rats. *Teratology*, 7: 237, 1973.
2. Brendel, K., Duhamel, R., Shepherd, T.: Embryonic drugs. *Biol. Research in Pregnancy and Perinatology*, 6:1, 1985.
3. Dostál, M.: Species specificity of teratology. In: Klika. *Proceedings of the 2nd Conf. of European Teratology Society*. *Acta Univ. Carol. Med.*, p. 57, Prague 1973.
4. Fára, M., Jelínek, R., Peterka, M., Dostál, M., Hrivnávková, J.: Orofacial clefts and theoretical basis for their prevention and treatment. *Acta Univ. Carol. Med.*, Prague 1988.
5. Johnston, M., Morris, G., Kushner, D., Bingle, G.: Abnormal organogenesis of facial structures. *Handbook of Teratology*, Plenum Press N. Y., London, 2:241, 1977.
6. Wilson, J., Fraser, F.: *Handbook of Teratology*. Plenum Press N. Y., London, 1977.

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CONTENTS

Candiani, P., Campiglio, G. L., Quattrone, P., Lovaria, A.: Computerized angiographic study of the vascular supply of the pectoralis major muscle . . .	185
Bingsen, Liu, Liangui, Li, Jiaru, Zhou.: Successful healing of a burn injury covering 100 % of TBSA and 96 % IIIrd degree with inhalation injury . .	194
Basse, P., Lohman, M., Hovgaard, C., Alsbjørn, B.: Multiple symmetric lipomatosis	204
Fára, M., Hrivnáková, J., Tvrdek, M.: Extensive corium grafts	210
Dražan, L., Mrázek, T., Dungelová, E.: Bilateral breast reconstruction after mastectomy	217
Šmahel, Z., Brejcha, M., Müllerová, Ž.: Craniofacial morphology in unilateral cleft lip and palate in adults	224
Česaný, P., Ševčíková, M., Raška, L.: The influence of external factors on the development of palatal cleft	242
Veselý, J., Samohýl, J.: Courses in the dissection of musculocutaneous flaps on cadavers, Brno	216
