

Modified cleft surgery for humanitarian missions and local surgeon training program in developing countries: A 85 patients case study in Myanmar

(Abstract ID: 90)

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Background:

Orofacial clefts are one of the most common human malformations. A cleft can occur uni- or bilateral as well as incompletely or completely. A total of 85 - 95% of the affected children are in the developing world, where access to proper medical care is limited. Therapy should be started as early as possible and involve an interdisciplinary team. Untreated patients suffer from consequences that come along with their disease, including functional, aesthetic and social problems. Cleft surgery has been the most commonly humanitarian mission to overcome the misconception that surgery is too challenging and expensive in third world countries.

Materials and methods:

Since 2005 the corresponding author regularly takes part in humanitarian missions with ProInterplast in Myanmar to perform cleft surgeries on patients who could not afford medical support. Furthermore, dedicated local surgeons were encouraged and trained. A questionnaire for evaluating the patient's facial function and appearance as well as psychological and social problems before and after surgery, postoperative complications and follow-up care was analyzed.

Results:

From 07/2015 to 2019 a total of 85 patients (52 male, 33 female) underwent cleft surgery. Their ages ranged from 0,25 years to 49 years (mean value 8,13). Patients underwent 1 to 3 surgeries. Malformations were divided in uni- (n=68) and bilateral (n=4) cleft lips as well as uni- (n=38) and bilateral cleft palates (n=8). Only 22.4% of patients were very satisfied with their aesthetic facial appearance before the operation; after surgery 51.8% reported a very satisfactory result. Preoperatively 10.6% of patients considered their face as aesthetically unsatisfactory, postoperatively only 1.2%. With regard to function (including eating, drinking, chewing, speaking, hearing and breathing) 22.4% of patients were very satisfied before surgery, postoperatively 38.8% of patients. 5.9% rated their functionality as unsatisfactory preoperatively and no more patients after surgery. Postoperative complications included open stiches (2,4%), infection (3,5%), bleeding (5,9%) or pain (16,5%).

Conclusion:

Cleft surgery can be performed successfully even in developing countries either by humanitarian missions or more sustainably by trained local surgeons.



3D quantification of facial asymmetry in children with positional cranial deformity

(Abstract ID: 140)

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Background:

The extent of facial involvement and facial asymmetry in positional plagiocephaly is only little investigated so far. Investigation methods which take into account the challenging anatomic conditions as well as growth of infants' faces are desirable. Within this study we established a new 3-dimensional photogrammetry quantification method evaluating pre- and post-therapeutic facial asymmetry in positional plagiocephaly. Furthermore, a Facial Asymmetry Index (FAI) was established and evaluated.

Materials and methods:

3D-photographs of 100 children undergoing treatment with head orthoses (helmet) were analysed by constructing a standardized interindividual coordinate system. Defining landmarks, section planes and point coordinates with a CAD software (Rhinoceros 5®), the left and right side of the faces were compared. Facial asymmetry was quantified by measuring differences between left and right side as well as pre- and post-therapeutic changes in each patient. The FAI was calculated by putting the absolute differences in relation with the coordinates of the non-affected side.

Results:

Present results indicate that positional plagiocephaly results in a distinct facial asymmetry (range - 3.8mm - 9.6mm) in all spatial directions and nearly all facial regions. Helmet therapy led to a significant reduction ($p < 0.05$) of intraindividual facial asymmetry Δ FAI (median [%]) range -1.9 - 3.1). However, only a weak to no correlation of the Cranial Vault Asymmetry Index (CVAI) and facial asymmetry (Spearman's rank correlation coefficient $\rho = -0.09$ to $+0.47$) has been seen. According to these results severe occipital deformation does not necessarily provoke distinct facial asymmetry.

Conclusion:

Present 3-dimensional photogrammetry method allows the longitudinal quantification of facial involvement in positional plagiocephaly. Asymmetry has been determined in all facial regions. The facial asymmetry decreased through helmet therapy but was not eliminated completely. An increasing facial asymmetry with increasing severity of plagiocephaly as postulated by Argenta in his classification could not be confirmed.

Precision of simultaneous PSI based orthognathic surgery and CAD/CAM based bone reconstruction in craniofacial malformations

(Abstract ID: 88)

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Syndromal craniofacial skull deformities like craniosynostoses and branchial arch deformities encompass malformations of the cranial and visceral bones. Such patients suffer from multiple operations during lifetime. To improve the functional and esthetic outcome, orthognathic surgery measures for the viscerocranium and bone augmentation for the neurocranium are necessary. Computer aided surgery enables nowadays a precise planning and execution of even complex surgeries.

Materials and methods:

In our study of 18 patients (11 syndromal craniosynostoses, 7 branchial arch diseases) we performed in 8 patients PSI based orthognathic surgery (mandibular, Le-Fort Osteotomies and midfacial distraction) with CAD/CAM based cranial reconstruction procedures in one operation (10 craniofacial patients operated in a two stage approach served as a control). All single stage patients underwent first a CT based planning procedure for the orthognathic part and the fabrication of the patient specific cutting guides and osteosynthesis plates. Based on the virtually planned orthognathic outcome, cranial reconstruction was planned in a subsequent planning step and CAD/CAM based PEEK implants were fabricated. The whole skull reconstruction was performed in one surgery. The accuracy of the skull reconstruction was determined by a splint control of the occlusion and matching of the planning data set with the postoperative bony and soft tissue CT data set. Additionally, we compared the two groups (one and two stage surgery) according to the operative accuracy.

Results:

All operations were performed without intraoperative problems in respect to the execution of the orthognathic part as well as to the cranial bone reconstruction. The planned class I occlusion was reached in all patients. Matching of the planning data with postoperative data yielded a high precision in all anatomical skull locations with a maximum difference of 2 mm and showed no statistical difference to control patients, who underwent a two stage approach (first operation: orthognathic surgery; second operation: CAD/CAM skull reconstruction).

Conclusion:

The combined performance of PSI based orthognathic surgery and CAD/CAM based skull reconstruction enables nowadays a high precision of facial reconstruction in a single operation even in severe malformed patients.

Evaluation of clinical and cephalometric diagnostic in craniosynostosis

(Abstract ID: 628)

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Background:

Diagnostic findings and control examinations in craniofacial surgery include skull measurement to quantify the morphometric conditions and their parameterization. This is done directly on the patient and ex post in the computer-supported analysis of the patient - 3D data. In addition to the measurement of the maximum head circumference for the assessment of skull growth and brain size development, the skull surface is evaluated on surface scans using landmark points. The validity of the data collected on the patient in the first year of life with additive ear-to-ear measurement as well as the evaluation of surface scans for morphometric analysis of the forehead area are the subject of the study.

Materials and methods:

3D surface scans (3D-Shape®, Erlangen, Germany) to assess cranial volume were performed in this comparative method study on 44 healthy Caucasian children (29 men, 15 women) aged 4 and 12 months, and a cephalometric examination in children with craniosynostosis using cephalometric analysis (Onyx Ceph®, Image Instruments, Chemnitz, Germany) of the forehead area after Frontoorbital Advancement (FOA).

Results:

The cranial volume increased by an average of 1174 ± 106 to 1579 ± 79 ml as a result of measurements at the age of 4 months to 12 months. The maximum skull circumference increased from 43.4 ± 9 cm to 46.9 ± 7 cm and ear-to-ear measurements from 26.3 ± 21 cm to 31.6 ± 18 cm at the same time. There was a monotonous association between maximum head circumference (HC) and volume increase, but a backward calculation from maximum circumference to volume had a predictive value of only 78% (adjusted R²). Including the additional measurement of ear-to-ear distance strengthened the model's ability to predict the achieved true value of 90%. The addition of the parameter skull length seemed to be negligible. The cephalometric examination in children with non-syndromic craniosynostosis postoperatively showed stable and constant long-term results in most cases without growth inhibition and with normalization or improvement of subsequent skull development. After correction of the forehead the mean frontal angle was 145° and the frontoparietal angle 137°-140°. Head circumference and head height increased significantly ($p = 0.001$, $p=0.002$). These changes were confirmed in all postoperative measurements.

Conclusion:

The results showed that for a significant improvement in the evaluation of a physiological cranial volume development, the additional measurement of the ear-to-ear distance with a tape measure is useful and should be performed especially in the case of pathological cranial changes, such as craniosynostosis.

The additional cephalometric analysis of the surface profile in children with craniosynostosis revealed during the 12-month follow-up period that the specific FOA angle parameters proved to be stable and

that no significant impairment of harmonic skull growth after FOA could be observed. The anterior orbital angle is a useful parameter to assess long-term outcome. The frontoparietal angle is important for the stability of the frontoparietal region where some growth inhibition can be observed postoperatively.

The role of PET/CT and 3D-navigation system based needle biopsy for tumorsize distribution in patients with head and neck cancer

(Abstract ID: 32)

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The goal of magnetic resonance imaging (MRI) and computed tomography scans (CT) is to determine cancer extension. Effective imaging should therefore lead to the identification of cancer distribution, followed by fewer recurrent tumors over time. The risk of local recurrence of malignant tumors remains high given the high proportion of positive resection margins. Identifying tumor margins is all the more acute in the context of tumor control. Effective delineation of tumor boundaries will require the alignment of positron emission tomography and computed tomography followed by histological examination. We tested the hypothesis that PET/CT use had the appeal of quantitative precision for assessment of tumor extension.

Materials and methods:

We assessed tumor extension with image-guided biopsy among patients who had surgical treatment of advanced (stage III-IV) primary squamous cell carcinoma of the head and neck (SCCHN) between 2016 and 2017. To approximate tumor extension (invasive tumors measuring ≥ 4 cm), histopathological findings were correlated with PET/CT scan images, performed on a 3D navigation-system based workstation. We classified the recorded cancer size in four color coded zones within each tumor volume to attempt precise estimation of tumor distribution. Image-guided needle biopsies were obtained from these zones. Size-specific incidence was not calculated.

Results:

We recruited 12 participants (eight male, four female). The mean age of the participants was 61 ± 15.0 years. There was a statistically significant difference in the proportion of positive tumor specimens and corresponding PET/CT detected metabolic zones (Friedman-test; $p=0.03$). The highest incidence of positive biopsies (91.7%) was detected in the zone adjacent to the outermost area. Specimens taken from the outer metabolic zone were positive in 66.7% of participants. However, 81.3% of biopsies from the central area were positive.

Conclusion:

PET/CT image-fusion shows the potential for identifying tumor extension, with respect to only large tumors. The results of our study indicate that PET/CT may overestimate tumor size. This suggests a need for trials of tumor-size distribution especially in patients with small head and neck cancer.

Functional microsurgical reconstruction in head and neck surgery: Interdisciplinary cooperation of reconstructive plastic surgery

(Abstract ID: 170)

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Background:

In patients with advanced tumor disease, extended tissue dissections are performed by various surgical disciplines. Small defects of the body surface are often covered by the resecting surgeons themselves using simple, local procedures. Extended skin or tissue defects or organ reconstruction, however, may necessitate a free tissue transfer and, therefore, require microsurgical expertise of a reconstructive surgeon.

Materials and methods:

In 102 patients with advanced tumor disease, skin and tissue defects, especially in the face and neck were reconstructed free microsurgically in cooperation with the otorhinolaryngological and neurosurgical department of our university hospital. 62 patients received free fasciocutaneous or myocutaneous flaps for soft tissue coverage. In 40 additional patients, free jejunal grafts were used to reconstruct the pharynx and, after segmentation, also the soft tissue defect.

Results:

In three patients, primary graft loss occurred. Consecutively, one latissimus and two jejunal retransplants were necessary. One of the jejunal retransplants was vascularized via an arteriovenous loop from the cephalic vein. A scapular flap was rescued by venous thrombectomy and venous interposition.

Strictures on the anastomoses are often feared as possible late complications. According to current literature, the rate is about 8% for jejunal grafts (Disa et al., 2006) and comparable in free radial flaps.

Conclusion:

The free microvascular reconstruction using fasciocutaneous flaps or jejunum grafts is remunerated with flat rates per case (disease related groups, DRG) with rates up to 24000 €. Therefore, the therapeutic procedures and in particular the defect coverage are often influenced by the case flat rate system. Even a lack of internal accounting with the participating disciplines may influence the interdisciplinary surgical cooperation. A necessary requirement for successful local and, in particular, free, microvascular defect coverage is the careful preservation of the arterial and venous vessels in the recipient area during resection in accordance with oncological principles. Plastic-microsurgical expertise is of major importance to ensure sufficient and permanent perfusion of the grafts, especially in microvascular vessel anastomoses and to avoid postoperative complications. The current German remuneration system and the internal settlement may influence the interdisciplinary collaborations.

Surgical Approach in Cervicothoracic Tumors in Children

(Abstract ID: 367)

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Background:

The surgical approach to cervicothoracic tumors represents a challenge for surgeons. Several techniques have been described for safe and complete tumor resection in adult surgery. The aim of this study was to analyse different surgical techniques for resection of solid cervicothoracic tumors in children.

Materials and methods:

We retrospectively evaluated 8 children with solid cervicothoracic tumors who were treated at our institution between 2011 and 2019. Three of them had a Ganglioneuroma, two had a Neuroblastoma, one had a Ewing sarcoma, one had a Neurofibroma and one had a pseudosarcomatous fibroma. All children were treated according to current multicentric treatment protocols and received multiple slice MRI scans with contrast medium for diagnostic work up. Diagnostic work up was complemented by plexus sonography in one child and cervical angiography in another child. The surgical approach was determined based on the location of the tumor.

Results:

The mean age of patients (6 girls and 2 boys) at surgery was 54 months (range 11 - 134 months). The aspired surgical goal was achieved in all children: Microscopically complete tumor resection (R0) was achieved in two patients with an open cervical approach and in one patient with a trap door approach (including partial sternotomy). Macroscopically complete tumor resection (R1) was achieved in two patients with an open cervical approach, in two patients with a trap door approach, in one patient with an anterior cervical incision and partial sternotomy and in one patient with a combined open cervical and thoracoscopic approach. In three children surgery was performed together with neurosurgeons. Mean operating time was 203 minutes (range 90 - 295). No immediate postoperative complications were observed. Four patients developed transient Horner's syndrome, one patient had a temporary diaphragm paralysis, and one patient had dysphagia. All children are without evidence of disease after a mean follow-up of 21 months (range 0 - 88).

Conclusion:

Using an adequate approach and exposure surgical removal of cervicothoracic tumors in children can be achieved successfully with excellent surgical and oncological outcome. Preoperative diagnostic work up is crucial to determine the surgical approach and extent of the incision. Interdisciplinary procedures may be necessary in distinct conditions.

New method for alloplastic reconstruction of the mandible after subtotal mandibulectomy due to MRONJ

(Abstract ID: 233)

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Background:

Medication-related osteonecrosis of jaws (MRONJ) may require subtotal mandibulectomy leading to severe mandible defects.

Reconstruction of the mandible using osseous free flaps causes donor site morbidity and is often complicated, due to multimorbidity and high patient age. Alloplastic reconstruction using mandibular reconstruction plates may be followed by plate fracture or plate exposure. Not to reconstruct the defect causes poor functional outcome and facial disfigurement.

We present a new method for alloplastic reconstruction of the mandible after subtotal mandibulectomy due to MRONJ, combining patient specific CAD-CAM reconstruction plates (Gebrüder Martin GmbH & Co. KG, KLS Martin Group, Tuttlingen) and PALACOS® LV+G Bone Cement (Heraeus Medical GmbH, Wehrheim).

Materials and methods:

The basic idea of the reconstruction technique is based on the principle of composite materials. Originally, two hand-bent Pape-Gerlach-Rekon-plates (2.0 mm, KLS-Martin GmbH) in combination with Palacos® Bone Cement were used for mandibular reconstruction. In the further development, we replaced the hand-bent osteosynthesis plates by CAD-CAM reconstruction plates (3.0 mm, KLS-Martin GmbH).

Great attention is given to the careful refixation of the floor of the mouth to the implant. Intraoral mucosal defects are closed thoroughly by local mucosa plasty, rarely also by microvascular flaps.

Results:

In our pilot study, we treated seven patients using two Pape-Gerlach-Rekon-plates and Palacos® for reconstruction. Due to plate fractures in clinical follow up examinations, we replaced the hand-bent plates by a patient-specific CAD-CAM reconstruction plate in our method. Six patients were reconstructed using a CAD-CAM plate and Palacos® bone cement. Mean follow-up is 22.5 months (12 to 33). Oral food intake is possible for all patients. One implant had to be removed, due to severe wound healing disorders.

Conclusion:

No donor site morbidity occurs using this method. Due to volume identical reconstruction of the defect, shrinking of soft tissue is minimized and no facial disfigurement occurs.

Image-based orbital surgery beyond orbital traumatology

(Abstract ID: 263)

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Background:

By now image-based surgery has gained much importance in orbital traumatology. However, there are more areas of application of image-guidance in orbital surgery which will be addressed.

Materials and methods:

Between 2011- 2018 95 patients were treated by image-guided planning and intraoperative navigation due to orbital disease beyond orbital traumatology. The largest group was bony decompression surgery in endocrine orbitopathy (77 patients, uni- or bilateral 1-3 wall decompressen), followed by benign intraorbital vascular malformations (9 patients). 4 patients suffered from orbital-midfacial osteopathy with constriction of the orbital contents. In 3 cases sinus carcinoma treatment was planned by way of image guidance to preserve the orbital function. The smallest group were 2 patients suffering from orbital foreign bodies.

In all cases CT-based planning was performed using iPlan and FAT software. Main planning procedures included mirroring, boolean operations, atlas-based and manual segmentation, and trajectory planning. Depending on the individual situation, planning time lay between 30 min and 2hrs. Subsequently the plan was used for intraoperative navigation.

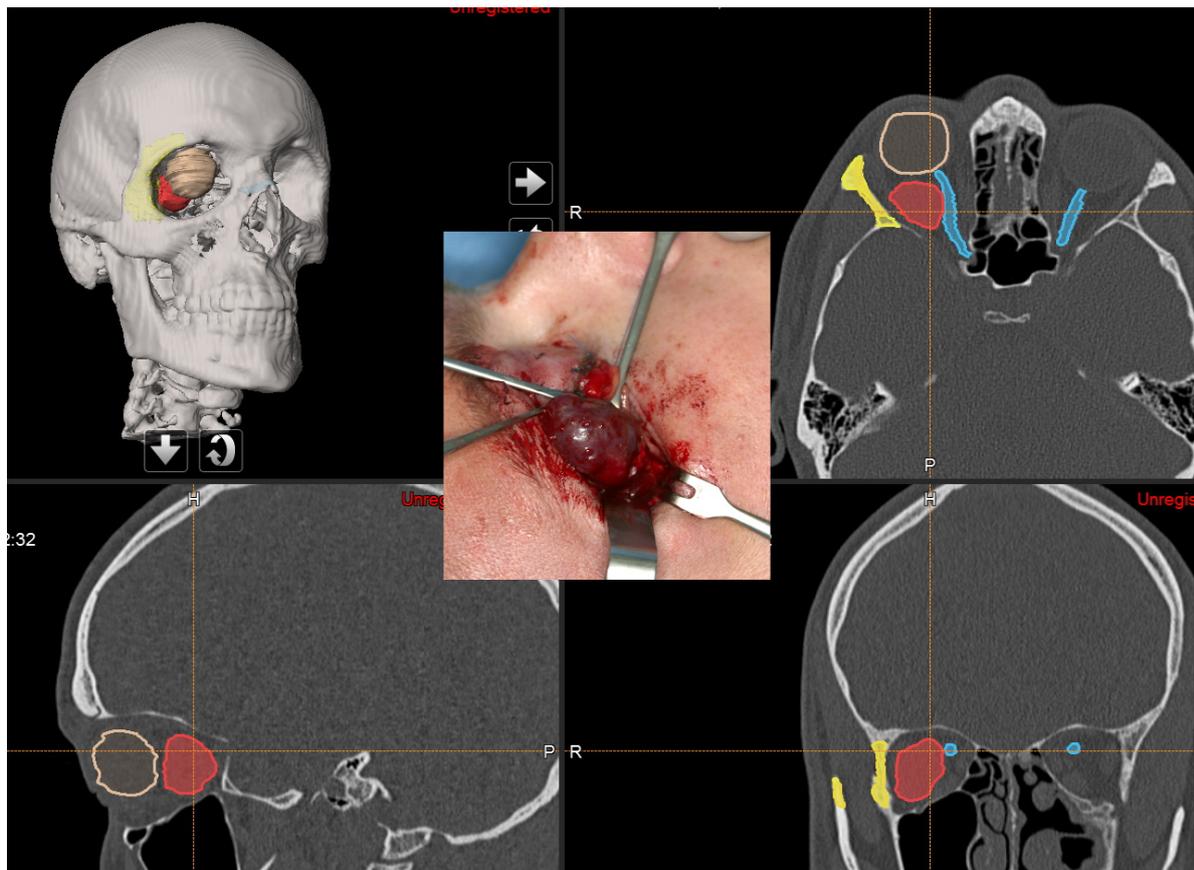
Results:

All surgeries were performed as planned. In all but one case, post-surgical vision was unimpaired. In this single case bilateral blindness was seen following unilateral surgery, which was presumably caused by intraoperative hypotensive general anesthesia. Regarding diplopia, no new onset in presurgically unaffected patients was seen. Minimally invasive transconjunctival or upper lid crease access was utilized using preoperative planning and navigation in all cases with the exception of the 7 patients suffering from sinus malignancy or osteopathy, where additional extraorbital tissue removal was performed.

Conclusion:

Image-based planning and intraoperative navigation can be used successfully in orbital surgery beyond orbital traumatology. Regarding complex surgical planning, improved software tools could cut down planning time and effort further more to expand the routine use of image-guided planning.

Picture:



Vascular orbital malformation presentation optic nerve shift. Inset shows removal.

Comparative outcome analysis of nasal tip reconstruction using the frontonasal flap and other local and regional flaps

(Abstract ID: 39)

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Background:

The frontonasal flap is a time-tested technique for coverage of nasal tip defects. However, potential draw-backs of this flap are limited movement, contour deformities, retraction of the nasal tip and alae, and extensive scars that do not follow the nasal subunits. This study investigates the outcome of nasal tip reconstruction using frontonasal flaps compared to other flaps.

Materials and methods:

A series of consecutive nasal tip reconstructions with different flaps performed by a single surgeon during a 6-year period (2009-2015) were reviewed using a prospectively collected data set on defect position and size, flap type, risk factors and comorbidities and a chart review on complications, revisions and secondary surgery. Patients were followed-up clinically for at least 6 months. Digital photographic images were obtained in standard projections before surgery and at the time of follow-up and evaluated for aesthetic outcomes by three independent observers considering nasal contour, symmetry, scar formation and skin color match rated on a 4-point Likert scale.

Results:

Fifty-seven reconstructions of the nasal tip were performed in 24 male and 33 female patients with a mean (\pm SD) age of 72.1 (\pm 9.9) years at surgery. Reconstructions were divided in two main groups, with 29 frontonasal flaps (group I) and 28 local and regional flaps (group II) including three subgroups of 11 paramedian forehead flaps, 11 Rintala flaps, and 6 bilobed flaps. Average patient age was similar between groups and subgroups. Defect size and diameter were equal in reconstructions with frontonasal and Rintala flaps, smaller in bilobed flaps and larger in forehead flaps. Wound healing complications were comparable between groups I and II. Comorbidities were evenly distributed between groups except for diabetes mellitus and arterial hypertension, the former occurring six times more frequent in group II and the latter twice as often in group I. Secondary surgical procedures were performed in 54 percent of cases in group II and 17 percent of cases in group I. When corrected for the planned secondary surgery in two-stage forehead flaps, the percentage of secondary corrective surgery was the same in both groups. Aesthetic outcomes were rated slightly better in group I than group II.

Conclusion:

The frontonasal flap performs favorable in reconstructions of the nasal tip when compared to other local and regional flaps. It avoids a planned secondary surgery as in the paramedian forehead flap, allows coverage of similar size defects as the Rintala flap and yields superior aesthetic results compared to the Rintala and bilobed flap.

Augmented reality of indocyanine green fluorescence in simplified lymphovenous anastomosis in lymphatic surgery

(Abstract ID: 560)

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Background:

A physiological and minimal invasive form of surgery with minimal risk to treat lymphedemas is the so-called supermicrosurgical lymphovenous anastomosis (LVA) where a lymph vessel is connected with a venole.

Materials and methods:

Augmented reality intraoperative indocyanin green (ICG) lymphography-navigated modified "simplified lymphovenous anastomosis" were performed on 32 patients (between 2018 and 2019) with secondary upper extremity lymphedema refractory to conservative therapy (manual lymph drainage and compression therapy). For the assessment of lymphatic supermicrosurgery, an operating microscope in which a near-infrared illumination system is integrated (Leica M530 OHX with glow technology ULT530, Leica Microsystems) was used.

Results:

63 LVAs were performed with modified "simplified lymphovenous anastomosis" lymphography-guidance on 27 upper extremities and 5 lower extremities. Patency after lymphovenous anastomosis was confirmed by augmented ICG intraoperative microscopy - all patients showed good patency.

Conclusion:

Supermicrosurgery in the case of LVA is minimally invasive, highly effective and shows very low complication rate. The practice of LVA is restricted by the surgeon/equipment-related factors, and its effectiveness limited by technical constraints.