Paper Reference	Last Name	First Name	Speakers Paper Title	Speakers Theme Description	Session Description
SP001	Jorgsholm	Peter	PROGNOSTIC RADIOLOGICAL FACTORS/ CLASSIFICATION - DISTAL RADIAL FRACTURES	Surgery - Fractures Of The Radius	S1 - Distal Radial Fractures
SP002	Hintringer	Wolfgang	THE ROLE OF EXTERNAL FIXATORS	Surgery - Fractures Of The Radius	S1 - Distal Radial Fractures
SP003	Jupiter	Jesse	PLATE FIXATION - FRONT, BACK, BOTH OR NONE	Surgery - Fractures Of The Radius	S1 - Distal Radial Fractures
SP004	Beppu	Moroe	The Distal Radius Fracture with Calcium Phosphate Bone Cement	Surgery - Fractures Of The Radius	S1 - Distal Radial Fractures
SP005	Leslie	Ian	OPPOSING VIEWS - PLASTER OR ORIF IN THE ELDERLY	Surgery - Fractures Of The Radius	S1 - Distal Radial Fractures
SP006	Orbay	Jorge	OPPOSING VIEWS - PLASTER OR ORIF IN THE ELDERLY	Surgery - Fractures Of The Radius	S1 - Distal Radial Fractures
SP007	Habenicht	Rolf	APERT HAND	Surgery - Congenital	S2 - Congenital Anomalies
SP008	VanHeest	Ann	ARTHROGRYPOTIC LIMB	Surgery - Congenital	S2 - Congenital Anomalies
SP009	Teoh	Lam-Chuan	Direct Closure Of Syndactyly Release Using Dorsal Pentagonal Flap	Surgery - Congenital	S2 - Congenital Anomalies
SP011	Nachemson	Ann, Kerstin	CEREBRAL PALSY: AETIOLOGY	Surgery - Congenital	S2 - Congenital Anomalies
SP012	Graham	Kerr	THE ROLE OF BOTULINUM TOXIN	Surgery - Congenital	S2 - Congenital Anomalies
SP013	Koman	L. Andrew	SURGICAL MANAGEMENT OF THE UPPER EXTREMITY IN CEREBRAL PALSY	Surgery - Congenital	S2 - Congenital Anomalies
SP014	Amadio	Peter	SURGERY - PROMOTION OF TENDON HEALING	Surgery - Tendon Injury / Repair	S3 - Flexor Tendon Injury
SP015	Savage	Rob	SURGERY - RELEVANCE OF PULLEY SYSTEM	Surgery - Tendon Injury / Repair	S3 - Flexor Tendon Injury
SP016	Tang	Jin Bo	SURGERY - OPTIMAL SUTURE (MATERIAL AND METHOD)	Surgery - Tendon Injury / Repair	S3 - Flexor Tendon Injury
SP017	Riccio	Michele	More on tendon adhesions	Surgery - Tendon Injury / Repair	S3 - Flexor Tendon Injury
SP018	Coleman	Stephen	SECONDARY RECONSTRUCTION AFTER FLEXOR TENDON INJURY - DIFFICULT CASE PRESENTATIONS FOR PANEL DISCUSSION	Surgery - Tendon Injury / Repair	S3 - Flexor Tendon Injury
SP019	Tark	Kwan Chul	SECONDARY RECONSTRUCTION AFTER FLEXOR TENDON INJURY	Surgery - Tendon Injury / Repair	S3 - Flexor Tendon Injury
SP020	Soucacos	Panayotis	SECONDARY RECONSTRUCTION AFTER FLEXOR TENDON INJURY	Surgery - Tendon Injury / Repair	S3 - Flexor Tendon Injury
SP021	Strickland	Jim	SECONDARY RECONSTRUCTION AFTER FLEXOR TENDON INJURY	Surgery - Tendon Injury / Repair	S3 - Flexor Tendon Injury
SP022	Sandow	Michael	SECONDARY RECONSTRUCTION AFTER FLEXOR TENDON INJURY	Surgery - Tendon Injury / Repair	S3 - Flexor Tendon Injury
SP023	Solomons	Michael	SECONDARY RECONSTRUCTION AFTER FLEXOR TENDON INJURY - DIFFICULT CASE PRESENTATIONS FOR PANEL DISCUSSION	Surgery - Tendon Injury / Repair	S3 - Flexor Tendon Injury
SP024	Bain	Gregory Ian	FRACTURE - IDEAL IMAGING TO DIAGNOSE ACUTE FRACTURE, DELAYED UNION, NON-UNION, IMPAIRED VASCULARITY	Surgery - Scaphoid & Other Carpal Fractures	S4 - Scaphoid
SP025	Campbell	Doug	ACUTE PROXIMAL POLE FRACTURES OF THE SCAPHOID	Surgery - Scaphoid & Other Carpal Fractures	S4 - Scaphoid
SP026	Lussiez	Bruno	PERCUTANEOUS FIXATION OF SCAPHOID FRACTURES	Surgery - Scaphoid & Other Carpal Fractures	S4 - Scaphoid
SP027	Mathoulin	Christophe	FRACTURE - VASCULARISED BONE GRAFTING	Surgery - Scaphoid & Other Carpal Fractures	S4 - Scaphoid

SP028	Dias	Joseph	OPPOSING VIEWS: THE UNDISPLACED WAIST FRACTURE, POP & ORIF	Surgery - Scaphoid & Other Carpal Fractures	S4 - Scaphoid
SP029	Krimmer	Hermann	OPPOSING VIEWS: THE UNDISPLACED WAIST FRACTURE, POP vs ORIF	Surgery - Scaphoid & Other Carpal Fractures	S4 - Scaphoid
SP030	De Smet	Luc	PREISER DISEASE OR AVASCULAR NECROSIS OF THE SCAPHOID	Surgery - Scaphoid & Other Carpal Fractures	S4 - Scaphoid
SP031	Garcia-Elias	Marc	ANATOMICAL AND MECHANICAL CONSIDERATIONS OF SCAPHOLUNATE INSTABILITY	Surgery - Other Wrist Conditions	S5 - Wrist Instability
SP032	Osterman	Lee	THE ROLE OF ARTHROSCOPY IN THE TREATMENT OF SCAPHOLUNATE LIGAMENT INJURY	Surgery - Other Wrist Conditions	S5 - Wrist Instability
SP033	Ritt	Marco	SLI - THE LUNO-TRIQUETRAL LIGAMENT	Surgery - Other Wrist Conditions	S5 - Wrist Instability
SP034	Moojen	Thybout	ACUTE REPAIR OF THE SCAPHOLUNATE LIGAMENT	Surgery - Other Wrist Conditions	S5 - Wrist Instability
SP035	Gunal	Izge	REPAIR OF RADIOSCAPHOCAPITATE LIGAMENT FOR SCAPHOLUNATE	Surgery - Other Wrist Conditions	S5 - Wrist Instability
SP036	Saffar	Philippe	SCAPHOLUNATE INSTABILITY - METHODS AND RESULTS OF SECONDARY LIGAMENT RECONSTRUCTION	Surgery - Other Wrist Conditions	S5 - Wrist Instability
SP037	Lichtman	David	MIDCARPAL INSTABILITY - LECTURE	Surgery - Other Wrist Conditions	S5 - Wrist Instability
SP038	Millesi	Hanno	A MODERN CONCEPT OF BRACHIAL PLEXUS INJURY MANAGEMENT	Surgery - Brachial Plexus Injuries And OBPP	S6 - Adult Brachial Plexus Injury
SP039	Songcharoen	Panupan	Brachial Plexus Injuries in the Adult. Nerve Transfer for Shoulder and Elbow Reconstruction	Surgery - Brachial Plexus Injuries And OBPP	S6 - Adult Brachial Plexus Injury
SP040	Oberlin	Christophe	NERVE TRANSFERS TO RESTORE THE FLEXION OF THE ELBOW. COMPARISON OF A SINGLE ULNAR TO BICEPS TRANSFER WITH A DOUBLE TRANSFER ASSOCIATING A TRANSFER FROM THE MEDIAN NERVE TO THE BRACHIALIS MUSCLE	Surgery - Brachial Plexus Injuries And OBPP	S6 - Adult Brachial Plexus Injury
SP041	Doi	Kazuteru	RECENT VERSION OF THE DOUBLE FREE MUSCLE TRANSFER TECHNIQUE FOR RECONSTRUCTION OF UNIVERSAL PREHENSILE FUNCTION FOLLOWING COMPLETE PARALYSIS OF THE BRACHIAL PLEXUS	Surgery - Brachial Plexus Injuries And OBPP	S6 - Adult Brachial Plexus Injury
SP042	Clarke	Howard	EXTENDING THE INDICATIONS FOR PRIMARY NERVE SURGERY IN OBSTETRICAL BRACHIAL PLEXUS PALSY	Surgery - Brachial Plexus Injuries And OBPP	S6 - Adult Brachial Plexus Injury
SP043	Raimondi	Piero Luigi	THE PLACE OF DISTAL NEUROTISATIONS IN THE TREATMENT OF UPPER PALSY	Surgery - Brachial Plexus Injuries And OBPP	S6 - Adult Brachial Plexus Injury
SP044	Gilbert	Alain	IS REOPERATION POSSIBLE AFTER FAILURE OF PRIMARY REPAIR OF THE PLEXUS?	Surgery - Brachial Plexus Injuries And OBPP	S6 - Adult Brachial Plexus Injury
SP045	Bahm	Jörg	OBSTETRIC BRACHIAL PLEXUS PALSY: FROM INJURY TO THE SUPRASCAPULAR NERVE TO GLENOHUMERAL DYSPLASIA	Surgery - Brachial Plexus Injuries And OBPP	S6 - Adult Brachial Plexus Injury
SP046	Kawabata	Hidehiko	HAND FUNCTION IN OBSTETRICAL BRACHIAL PLEXUS PALSY	Surgery - Brachial Plexus Injuries And OBPP	S6 - Adult Brachial Plexus Injury
SP047	McGrouther	Gus	ANATOMY AND BIOMECHANICS	Surgery - Hand Fractures (Phalangeal & Metacarpal)	S7 - Combined IFSSH/IFSHT Symposium
SP048	Ball	Jennifer	THE PIP JOINT IN RA - PRINCIPLES OF MANAGEMENT AND HAND THERAPY INTERVENTION	Surgery - Dupuytren's	S7 - Combined IFSSH/IFSHT Symposium
SP049	Lluch	Alberto	THE PIP JOINT IN RHEUMATOID ARTHRITIS	Surgery - Dupuytren's	S7 - Combined IFSSH/IFSHT Symposium
SP050	Thurston	Alan	THE PIPJ IN DUPUYTREN'S DISEASE - ASSESSMENT OF CAUSES OF PIPJ CONTRACTURE	Surgery - Dupuytren's	S7 - Combined IFSSH/IFSHT Symposium
SP051	Smith	Paul	THE PIPJ IN DUPUYTREN'S DISEASE - PIP JOINT RELEASE	Surgery - Dupuytren's	S7 - Combined IFSSH/IFSHT Symposium

SP052	Mee	Sarah	THE PIPJ IN DUPUYTREN'S DISEASE - POST OPERATIVE MANAGEMENT	Surgery - Dupuytren's	S7 - Combined IFSSH/IFSHT Symposium
SP053	Tonkin	Michael	THE PIJ IN DUPUYTREN'S DISEASE - PROBLEM PRESENTATIONS	Surgery - Dupuytren's	S7 - Combined IFSSH/IFSHT Symposium
SP054	Mee	Sarah	THE PIPJ IN DUPUYTREN'S DISEASE - PROBLEM PRESENTATION	Surgery - Dupuytren's	S7 - Combined IFSSH/IFSHT Symposium
SP055	Laxamana	Joan	THE PIPJ IN DUPUYTREN'S DISEASE - PROPLEM PRESENTATION	Surgery - Dupuytren's	S7 - Combined IFSSH/IFSHT Symposium
SP056	McGrouther	Gus	THE PIPJ IN DUPUYTREN'S DISEASE - PROBLEM PRSENTATIONS	Surgery - Dupuytren's	S7 - Combined IFSSH/IFSHT Symposium
SP057	Thurston	Alan	THE PIPJ IN DUPUYTREN'S DISEASE - PROBLEM PRESENTATIONS	Surgery - Dupuytren's	S7 - Combined IFSSH/IFSHT Symposium
SP058	Smith	Paul	THE PIPJ IN DUPUYTREN'S DISEASE - PROBLEM PRESENTATIONS	Surgery - Dupuytren's	S7 - Combined IFSSH/IFSHT Symposium
SP059	Dellon	Arnold Lee	INNOVATIONS IN NERVE SURGERY: NERVE CONDUIT RECONSTRUCTION and SENSORY NERVE TRANSFERS	Surgery - Nerve Injuries / Repair	S8 - Nerve Injury and Repair
SP060	Fontaine	Christian	THE DEEP BRANCH OF ULNAR NERVE. MACROSCOPIC AND MICROSCOPIC ANATOMY AND APPLICATIONS TO SPASTIC AND PARALYTIC HAND SURGEY	Surgery - Nerve Injuries / Repair	S8 - Nerve Injury and Repair
SP061	Jaquet	Jean-Bart	RESULTS OF MEDIAN AND ULNAR NERVE REPAIR, ELBOW TO WRIST	Surgery - Nerve Injuries / Repair	S8 - Nerve Injury and Repair
SP062	Naam	Nash	SURGICAL TREATMENT OF CUBITAL TUNNEL SYNDROME	Surgery - Nerve Injuries / Repair	S8 - Nerve Injury and Repair
SP063	Sridahr	Krishnamurthy	TENDON TRANSFERS OPTIONS IN LOW ULNAR NERVE LESIONS OPPOSITION TRANSFERS IN LOW MEDIAN NERVE LESIONS	Surgery - Nerve Injuries / Repair	S8 - Nerve Injury and Repair
SP064	Nanchahal	Jagdeep	MECHANISMS OF RHEUMATOID JOINT AND TENDON DESTRUCTION	Surgery - Rheumatoid Hand	S9 - Rheumatoid Arthritis
SP065	March	Lyn	LATEST ADVANCES IN MEDICAL MANAGEMENT OF RHEUMATOID ARTHRITIS (RA)	Surgery - Rheumatoid Hand	S9 - Rheumatoid Arthritis
SP066	Mizuseki	Takaya	TENOSYNOVECTOMY AND RECONSTRUCTION OF TENDON RUPTURES IN RHEUMATOID ARTHRITIS	Surgery - Rheumatoid Hand	S9 - Rheumatoid Arthritis
SP067	Giddins	Grey Edward Bence	MP JOINT SURGERY	Surgery - Rheumatoid Hand	S9 - Rheumatoid Arthritis
SP068	Cooney	William	THE THUMB	Surgery - Rheumatoid Hand	S9 - Rheumatoid Arthritis
SP069	Stanley	John	OPPOSING VIEWS: DARRACH VS SAUVE-KAPANDJI	Surgery - Rheumatoid Hand	S9 - Rheumatoid Arthritis
SP070	Kapandji	Adalbert	OPPOSING VIEWS: DARRACH VS SAUVE-KAPANDJI	Surgery - Rheumatoid Hand	S9 - Rheumatoid Arthritis
SP071	Xu	Jianguang	CONTRALATERAL C7 NERVE ROOT TRANSFER	Surgery - Brachial Plexus Injuries And OBPP	S10 - Adult Brachial Plexus Injury 2
SP073	Brunelli	Giorgio	MY APPROACH TO RECONSTRUCTION OF HAND FUNCTION IN THE FLAIL LIMB	Surgery - Brachial Plexus Injuries And OBPP	S10 - Adult Brachial Plexus Injury 2
SP074	Manske	Paul	PUBLISHING PAPERS IN HAND SURGERY - NOW AND THE FUTURE	Journal Publications	S11 - Journal Publications
SP075	Hooper	Geoffrey	Proper writing style	Journal Publications	S11 - Journal Publications
SP076	Beppu	Moroe	The Asia-Pacific journal of hand surgery	Journal Publications	S11 - Journal Publications
SP077	Sauerbier	Michael	RECONSTRUCTION OF COMPLEX DEFECTS OF THE FOREARM AND HAND WITH OSTEOCUTANEOUS FREE FLAPS	Surgery - Soft Tissue Cover	S12 - Microsurgery - Flaps and Replantation
SP078	Sabapathy	Raja	SECONDARY MANAGEMENT OF MUTILATING UPPER LIMB INJURIES - SOFT TISSUES	Surgery - Soft Tissue Cover	S12 - Microsurgery - Flaps and Replantation

SP079	Georgescu	Alexandru	PERFORATOR FLAPS IN UPPER LIMB	Surgery - Soft Tissue Cover	S12 - Microsurgery - Flaps and Replantation
SP080	Levin	L. Scott	ADVANCES IN SOFT TISSUE RECONSTRUCTION - ENDOSCOPIC HARVEST	Surgery - Soft Tissue Cover	S12 - Microsurgery - Flaps and Replantation
SP081	Kim	Woo-Kyung	PHARMACOLOGIC THERAPHY OF MICROSURGERY	Surgery - Soft Tissue Cover	S12 - Microsurgery - Flaps and Replantation
SP082	Morrison	Wayne Allan	TISSUE ENGINEERING OF 3D SOFT TISSUES	Surgery - Soft Tissue Cover	S12 - Microsurgery - Flaps and Replantation
SP083	Breidenbach	Warren	OPPOSING VIEWS - TRANSPLANTATION - FOR HAND TRANSPLANTATION - WHERE ARE WE NOW?	Surgery - Soft Tissue Cover	S12 - Microsurgery - Flaps and Replantation
SP084	Lee	Andrew WP	OPPOSING VIEWS - TRANSPLANTATION - AGAINST	Surgery - Soft Tissue Cover	S12 - Microsurgery - Flaps and Replantation
SP085	Gupta	Amit	WRIST ARTHRODESIS AND ARTHROPLASTY	Surgery - Degenerative Joint Disease	S13 - Degenerative Joint Disease
SP086	Fernandez	Diego	INFERIOR RADIO-ULNAR JOINT RECONSTRUCTION	Surgery - Degenerative Joint Disease	S13 - Degenerative Joint Disease
SP087	Beckenbaugh	Robert	MP AND PIP JOINT REPLACEMENT ARTHROPLASTYIS	Surgery - Degenerative Joint Disease	S13 - Degenerative Joint Disease
SP088	Van Der Westhuizen	Johan	OSTEO-ARTHRITIS OF THE SCAPHO-TRAPEZIO-TRAPEZIODAL (STT) JOINT	Surgery - Degenerative Joint Disease	S13 - Degenerative Joint Disease
SP089	Trail	Ian Alexander	OPPOSING VIEWS - TRAPEZIECTOMY ALONE VS TRAPEZIECTOMY PLUS TENDON RECONSTRUCTION	Surgery - Degenerative Joint Disease	S13 - Degenerative Joint Disease
SP090	Scheker	Luis R.	OPPOSING VIEWS - TRAPEZIECTOMY ALONE VS TRAPEZIECTOMY PLUS TENDON RECONSTRUCTION	Surgery - Degenerative Joint Disease	S13 - Degenerative Joint Disease
SP091	Braga Silva	Jefferson	ANATOMICAL BASIS OF DORSAL FINGER SKIN COVER	Surgery - Soft Tissue Cover	S14 - Microsurgery - Flaps For The Hand
SP092	Balakrishnan	Govindasamy	MY FAVORITE FLAP IN HAND SURGERY - REVERSE DORSAL METACARPAL ARTERY FLAP	Surgery - Soft Tissue Cover	S14 - Microsurgery - Flaps For The Hand
SP093	Adani	Roberto	THE RADIAL FOREARM FLAP	Surgery - Soft Tissue Cover	S14 - Microsurgery - Flaps For The Hand
SP094	Szabo	Zsolt	POSTERIOR INTEROSSEOUS AND ANTERIOR INTEROSSEOUS PEDICLED FLAPS FOR TISSUE SUBSTITUTION IN THE HAND	Surgery - Soft Tissue Cover	S14 - Microsurgery - Flaps For The Hand
SP095	Giele	Henk	THE GROIN FLAP IN HAND SURGERY	Surgery - Soft Tissue Cover	S14 - Microsurgery - Flaps For The Hand
SP096	Garcia-Elias	Marc	INTRODUCTION - NEURAL INFLUENCE OF HUMAN WRIST MECHANICS	Surgery - Other Wrist Conditions	S15 - Neural Influence Of Human Wrist Mechanics
SP097	Berger	Evelyn	MORPHOLOGY AND CLASSIFICATION OF MECHANORECEPTORS	Surgery - Other Wrist Conditions	S15 - Neural Influence Of Human Wrist Mechanics
SP098	Hagert	Elisabet	DISTRIBUTION OF MECHANORECEPTORS IN THE WRIST LIGAMENTS	Surgery - Other Wrist Conditions	S15 - Neural Influence Of Human Wrist Mechanics

SP099	Berger	Richard	CHANGES OF PERFORMANCE IN PROPRIOCEPTION IMPAIRED PATIENTS	Surgery - Other Wrist Conditions	S15 - Neural Influence Of Human Wrist Mechanics
SP100	Garcia-Elias	Marc	PROPRIOCEPTION IN CARPAL INSTABILITY	Surgery - Other Wrist Conditions	S15 - Neural Influence Of Human Wrist Mechanics

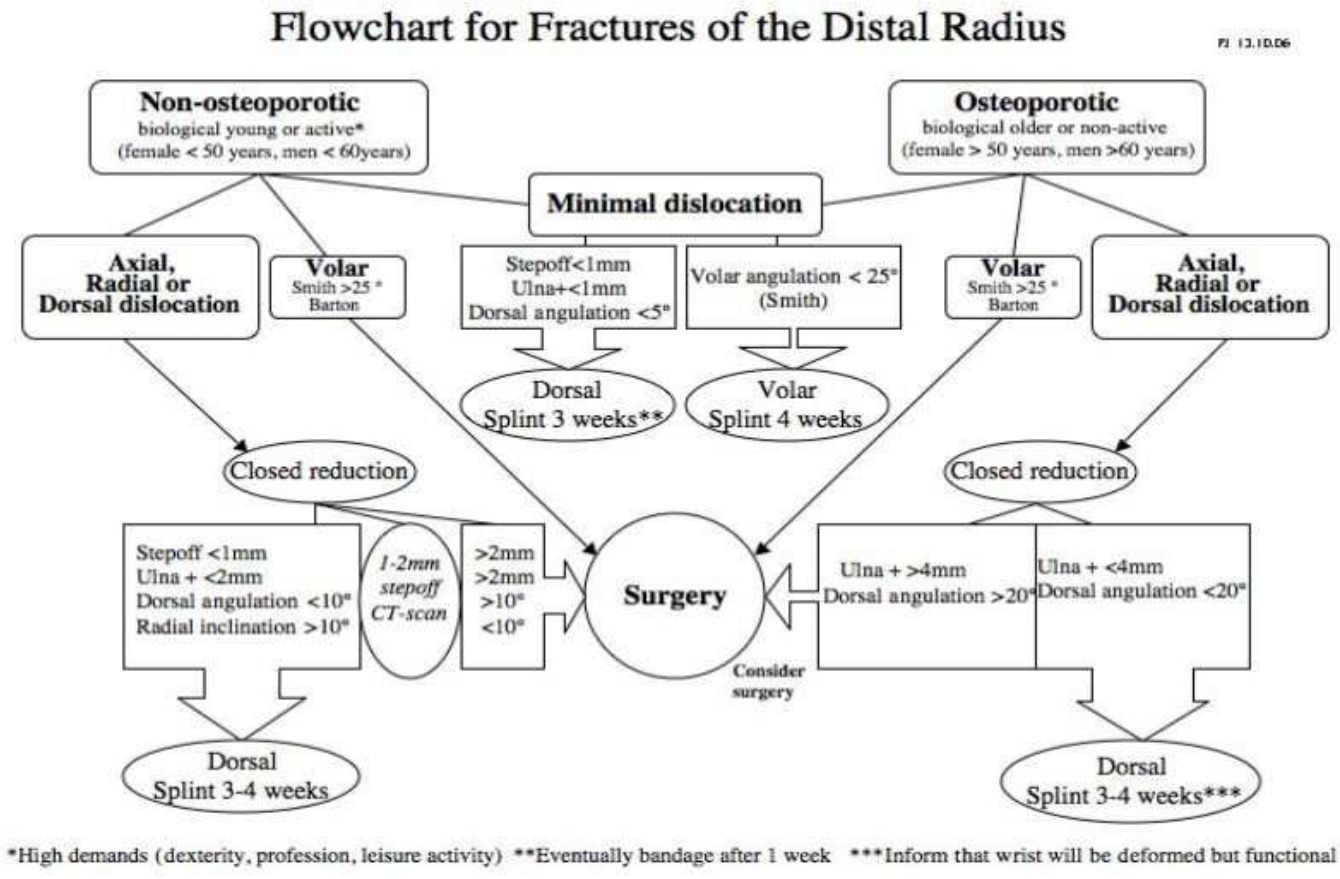
SP001

Prognostic radiological factors/ classification – Distal radial fractures

Peter B Jørgsholm

Department of Hand Surgery, Malmö University Hospital, University of Lund, Sweden

Prognostic radiological factors and classifications will be presented and an evidence based flowchart developed by the South Sweden Distal Radius Fracture Study Group will be proposed to be used as a routine procedure in the emergency room.



SP002

Distal radius fractures, the role of external fixators

Hintringer Wolfgang 1 ,Leixnering Martin 2, Pezzei Christoph 2

1 *Humanis Klinikum Niederösterreich/ Korneuburg, Austria*
2 *Lorenz Böhler Krankenhaus Wien, Austria*

Introduction: Joint bridging external fixation of distal radius fractures was the method of choice in the treatment of distal radius fractures for the last years in our hospitals, especially in comminuted and instable fractures.

Methods: Different external fixators were used in a radio radial configuration in the treatment of mostly unstable distal radius fractures (Types A-3.2, C-1.2 and C-2.1 according to the AO classification). Accessory K-wires for stabilizing the fracture were done in all cases. Also bone grafting was performed in cases with extensive dorsal comminution. Traction was released intraoperatively after reduction and fixation of the fragments with k wires.

Conclusion : External fixators were the method of choice for the last 10 years in our hospitals. In most cases the anatomic radial and volar angle could be restored, but not the length of the radius. A longitudinal sintering up to 6mm occurred.

So we changed our method to palmar locking plate systems. Other problems occurred.

So maybe the external fixator becomes a revival in special cases were the palmar plating fails.

SP003

Plate fixation of the distal radius-dorsal, volar, or both

Jesse B. Jupiter

Massachusetts General Hospital, Boston, Massachusetts, USA

This discussion will clarify the indications for plate application of distal radius fractures. The indications for volar plating include dorsally displaced Colles' fractures, Smith and reverse Barton's fractures, and corrective osteotomy. The rationale for palmar plating of Colles' fractures includes more anatomic restoration of radial length, early function with less dystrophy, less need for radiographic and clinical follow-up, and more predictable outcome. The indications for dorsal double plating include a displaced dorso-ulnar fragment, associated intercarpal fracture or ligament injury, or corrective osteotomy. Lastly, the indications for combined palmar and dorsal plating include loss of the palmar or dorsal buttress with central impacted fragments or rotated palmar fragments and associated intercarpal ligament injury or fracture.

SP004

The distal radius fracture with calcium phosphate bone cement

Moroe Beppu 1 , Masahiro Tobe 2, Noriaki Hidaka 3, Takeshi Arai 1

1 St.Marianna University School of Medicine Universit y , Kawasaki, Japan
2 Toho University , Tokyo, Japan
3 Osaka City General Hospital ,Osaka, Japan

Fractures of the distal end of the radius are the most common bone fractures of the upper extremity. The clinical symptom, treatment, and outcome have been described in much literature in past decades. In many cases, the distal radius fracture occurs in the elderly from minor injuries due to osteoporosis. However, it is also seen in young adults from high-energy injuries. In patients with osteoporosis, distal radius fractures become unstable due to the loss of density and weakness of the cancellous and cortical bone. Therefore, we consider that bone filling is often necessary. A metaphysial bone defect after reduction requires bone filling for better structural support. Bone grafting has traditionally been performed using autogenous bone, which is usually harvested from the iliac crest. It provides mechanical support and accelerates fracture healing, and shortening the external fixation period. Calcium phosphate bone cement (CPC) has been recognized as a bone graft substitute, due to its biomechanical properties and osteoconductivity that are similar to those of the human cancellous bone. The CPC becomes a hydroxyapatite by hydration in vivo, and the dynamic strength is about 80 Mp within 72 hours. The strength is maintained at least for three months. Although, its injectability is a great advantage, it is impossible to tightly fix the fracture with CPC alone. Therefore, it is also necessary to use rigid fixation. We would like to show our clinical experience of the distal radius fracture with calcium phosphate bone cement .

SP007

Apert hand

Rolf Habenicht

Catholic Children's Hospital Wilhelmstift, Hamburg, Germany

Multiple operative procedures are required to improve form and function of the hands in Apert syndrome due to manifold anatomical variations of the digits.

Taking into account the necessary craniofacial treatment, the number of hand operations should be limited by doing several corrections in one hand or in both hands at the same time. Thus treatment periods as well as psychological and social stress for patients and their families can be reduced.

Soft cross-tissue distraction, a new operative treatment, allows a reconstruction of all fingers even in hands with severe anatomical pathological variations. This is of great importance for the self-image of the patients.

Additional treatments, such as the correction of the clinodactyly of the thumbs, help to increase grip function.

At the end of growth, a final correction of bones, joints and soft-tissues can help to improve the shape of the hands.

SP008

The arthrogrypotic limb

Ann Van Heest 1

1 *University of Minnesota, Minneapolis MN USA, Shriner's Hospital for Children- Twin Cities Unit, Gillette Childrens Specialtycare Hospital, St. Paul, MN USA*

Arthrogryposis is characterized by congenital contractures of two or more joints. Amyoplasia is the most common form of arthrogryposis treated by orthopedic surgeons and is characterized by multiple congenital contractures, typical and symmetric positioning of the limbs, decreased muscle mass and strength, and sporadic occurrence with no known hereditary pattern. Most commonly both upper and lower extremities are involved, although upper or lower extremity involvement alone has been reported 4. Most children with amyoplasia have above average intelligence. Life expectancy is normal.

In the upper extremity, the most common deformity pattern is internal rotation of the shoulders with weak or absent shoulder girdle muscles; extension contractures of the elbow with weak or absent biceps and brachialis muscles; pronated, flexed, and ulnar deviated wrists with weak or absent wrist extension; and rigid digits with thumb-in-palm deformity. The degree of stiffness and weakness varies from mild to severe, and is not progressive. Elbow dysfunction poses a significant functional limitation for these children. With the elbow stiff in extension, the hand cannot reach the mouth for feeding or facial hygiene.

The goal of treatment for children with arthrogryposis is to improve quality of life by facilitating functional independence. Treatment begins at birth and includes non-operative measures such as range of motion exercises, muscle stretching, and splinting. Because the major underlying problem in arthrogryposis is stiff joints, the first goal of treatment is always improvement of passive mobility. Passive motion of a joint is needed before augmentation of active motion can be considered. In the upper limb, comprehensive planning with simultaneous assessment of shoulder, elbow, wrist, and hand function is essential.

SP009

Direct closure of syndactyly release using dorsal pentagonal flap

L. C. TEOH , J. Y. L. Lee

Department of Hand Surgery, Singapore General Hospital, Singapore

Many techniques of syndactyly release have been described. However these techniques always results in skin deficiency, making direct closure without skin grating difficult.

We use the dorsal pentagonal flap technique to reconstruct the web and direct closure of the release. We report 12 patients with a total of 22 syndactyly webs using this technique.

The dorsal pentagonal flap is designed with a proximal V and the distal transverse edge just distal to the MP joint. Zigzag incision reaching the midline of the digit extends from the distal edge of the pentagonal flap. The palmar zigzag incision begins just distal to the distal palmar crease and extends distally. The pentagonal flap is raised and the digits separated, the excess fat and soft tissues are excised preserving the neurovascular bundles to the digits. The pentagonal flap is advanced distally and palmarly to reconstruct the web. The distal zigzag incision is closed directly with slight tension. 12 webs were complete syndactylies and 10 incomplete. Seven webs were complex syndactylies or in Apert's syndrome.

All 22 web releases were successfully reconstructed. There were no intra-operative complications. In all cases, the pentagonal flaps were adequately perfused and sufficiently mobile to be advanced for reconstruction of the commissure. There were no flap losses. Direct suture of all the incisions was accomplished in all cases. With a follow up of mean 33.7 months. All 22 web commissures were aesthetically favourable, having normal heights and a good dorsal to volar slope. All the patients had full functional recovery.

Direct closure of syndactyly release is possible with the use of dorsal pentagonal island flap. This technique can be used in the treatment of syndactyly of varying complexity.

SP011

Cerebral palsy: Aetiology

Ann Nachemson

Sahlgrenska University Hospital, Gothenburg, Sweden

Cerebral palsy has been defined as a non-progressive disorder of movement and posture caused by a lesion of the developing brain. Little described already 1862 that complications at birth causing asphyxia could lead to cerebral palsy. This view was current for more than 100 years. However, recent evidence suggests that the brain-lesion may be of prenatal, perinatal as well as postnatal origin and of different aetiology.

The incidence of cerebral palsy has been reported from several countries (e.g. Australia and Sweden) to be 2-2,5 children/1 000 births. The incidence is correlated to prematurity and birth weight, with 50 times higher incidence for early preterm children than for full term children. Prevalence of cerebral palsy increased in the 1970s and 1980s at the same time as the survival rates of premature babies increased.

Seizures and thyroid disease in the mother as well as pre-eclampsia, bleeding (placenta previa) increase the risk for cerebral palsy. Intrauterine infection is a factor correlating with pre-term birth and cerebral palsy. Other significant infections, including urinary tract infections, in the mother during pregnancy have been associated with cerebral palsy. Treating infections during pregnancy has recently been suggested as a potential area for prevention. Genetic factors are attributed to particularly ataxic form of cerebral palsy Although the fetus has protection mechanisms for asphyxia during delivery some conditions such as placental or cord complications can exceed these protection mechanisms and increase the risk for hypoxic ischemia. This may be avoidable although improved perinatal monitoring has not significantly decreased the rate.

Postnatal factors for cerebral palsy are encephalitis, head injuries, near drowning and vascular disturbances. We have now sophisticated neuro-imaging techniques, MRI, to show the damaged brain area. They do not however state the aetiology of the damage.

SP012

The role of botulinum toxin

H. Kerr Graham

The Royal Children's Hospital, Melbourne, University of Melbourne, Murdoch Childrens Research Institute, Melbourne, Australia

This paper will review the clinical and laboratory evidence supporting the use of Botulinum neurotoxin A (BoNT-A) in the management of the upper limb in children with cerebral palsy and discuss the need for more clinical trials. Botulinum neurotoxin A (BoNT-A) has been used in the management of focal spasticity in children with cerebral palsy for the past 15 years. Corry, Cosgrove and Graham reported the first clinical trial in the hemiplegic upper limb in 1994. Many additional articles and 3 randomised clinical trials have been published since then. Despite the explosion of interest in BoNT-A, many questions remain unanswered. Injection of BoNT-A results in a reversible chemodenervation of the target muscle. In the upper limb, spastic imbalance can be improved by identifying and injecting spastic agonists. This may improve function by correcting agonist-antagonist imbalance. Niche applications for BoNT-A in the upper limb include the management of focal dystonias, simulation of upper limb muscle-tendon surgery, postoperative chemoprotection of tendon transfers and peri-operative analgesia. It is in the routine management of spastic hypertonia in the upper limb, where the many questions remain unanswered. There is robust evidence that intramuscular injection of BoNT-A will decrease spasticity, decrease muscle stiffness (resonant frequency) and improve distal joint range of motion. There is some evidence for decrease in spastic posturing and improved function. Uncertainty remains in respect of dose, dilution, frequency, and the most appropriate method of muscle targeting (electromyography, electrical stimulation or ultrasound). However, the main area for investigation is the use of adjunctive therapies including serial casting, splints, upper limb training and constraint therapy. Newer assessment tools including the Manual Ability Classification System (MACS) the Melbourne assessment of unilateral upper limb function, the QUEST and 3D kinematics may all contribute.

SP013

Surgical management of the upper extremity in cerebral palsy

L. Andrew Koman

Wake Forest University School of Medicine, Winston-Salem, North Carolina, USA

This study reviews the current indications, techniques, rehabilitation and result of upper extremity surgery in CP. The conclusions are based upon the peer-reviewed literature and personal experience. An estimated 2.6 to 2.8 patients per 1000 live births are affected cerebral palsy; eighty percent of these patients with quadriplegia or hemiparesis have significant upper extremity impairment. Management options for upper extremity deformity include therapy, orthotics, oral and parenteral pharmacologic medications, and surgery. This presentation provides an overview of appropriate physical examination, preoperative planning, surgical selection, specific surgical techniques and postoperative care. It is based upon the peer-reviewed literature and the Wake Forest University experience.

Surgical goals include improving function; elimination or diminution of pain, normalization of appearance and self esteem; and enhancement of caregiver capability. The most common deformities include internal rotation of the shoulder, elbow flexion, forearm pronation, wrist flexion, finger flexion, and thumb-in-palm. In addition, thumb metacarpophalangeal joint instability and swan-neck deformity of the fingers are common.

It is estimated that only 10 to 20% of patients are good candidates for surgery because of significant impairment of sensibility, cortical control, or movement disorders. The use of botulinum toxin has increased potential surgical candidates. The most common operative procedures include: elbow release, procedures to improve supination of the forearm, interventions to increase wrist extension and finger extension, and operations to diminish thumb-in-palm. The discussion will emphasize indications, surgical pearls, and postoperative care including bioprotection with botulinum toxin.

SP014

Promotion of flexor tendon healing

Peter C. Amadio

Mayo Clinic, Rochester, MN, USA

Until recently, tendon healing simply occurred; the surgeon's concern was focused on the tendon repair and rehabilitation methods. More recently, we have begun to learn about the factors which regulate tendon healing. This presentation will summarize knowledge in this area.

Promotion of tendon healing has several dimensions. Prevention or reduction of tendon adhesions can promote tendon gliding and reduce the forces which the tendon will experience postoperatively, thus reducing the risk of repair failure. Acceleration of tendon healing may involve protection from ischemic injury, promotion of neovascularization within the tendon, acceleration of collagen crosslinking, or other similar processes.

To date, the difficulty has been that the cellular processes which form adhesions, and those which heal the tendon, are very similar, if not identical. Moreover, these processes occur adjacent to each other. While it is possible that highly targeted delivery of the proper agents, in the correct sequence, may inhibit the one while promoting the other, to date there is little evidence that this can actually be accomplished clinically. An alternative strategy, tissue engineering of the injured tendon for improved strength and lower friction, may be more rewarding, at least in the near term. Preliminary data to this end will be presented.

SP015

Surgery – Relevance of the pulley system

Robert Savage

Royal Gwent Hospital, Newport, Gwent, South Wales, UK.

In the flexor sheath and pulley system, structure, function and biology are affected by tendon injury and surgical repair.

The synovial layer of tendon sheath provides a smooth, slippery surface for tendon gliding, and produces fluid that nourishes the tendon. The fibrous layer provides resistance to palmar tendon displacement, promoting efficient finger movement and power. The tough annular pulleys give strength and the soft cruciate pulleys allow finger flexion. Injury to the sheath and pulley system is a cause of adhesion.

In primary flexor tendon repair, we aim to reduce adhesions and to minimise functional disturbance by restricted opening of the sheath and pulleys. This is an important general concept but it must not overrule another important principle: that the tendon repair site must move freely within the pulley system. Snagging of the repair site on an unyielding annular pulley edge, that is unresolved at the end of surgery, will commit the finger to certain stiffness and possible repair rupture.

Laboratory and clinical work shows that contiguous short sections of sheath can be opened even if this includes part of A2, or part of A4 and occasionally all of A4, but only if most of the pulley system is intact. The technique 'venting' of an annular pulley opening, ensures free tendon movement at the completion of surgical repair.

In secondary tendon reconstruction, where little or no flexor sheath remains, the optimum position for pulleys over the proximal and middle phalanx will be discussed.

SP016

Optimal suture (Methods and materials)

Jin Bo Tang

Department of Hand Surgery, Hand Surgery Research Center, Affiliated Hospital of Nantong University, Nantong, China

Surgical repairs of the lacerated flexor tendons are an essential part of clinical flexor tendon repairs in the hand. Traditionally, 2-strand repairs including Bunnell and Kessler type repairs are used. Tsuge's looped tendon repair has also gained popularity since its introduction in 1970's. In recent two decades, we saw great enthusiasm of developing multi-strand repair techniques among hand surgeons. These techniques include 4-strand repairs such as cruciate, locking cruciate, 4-strand Savage, and double Kessler methods, 6-strand repairs such as Savage, Lee, and those using three groups of looped sutures (Tang and M-Tang), and 8-strand repairs such as Winters-Gelberman. The multi-strand techniques may increase baseline surgical repair strength of the tendon, and apparently are more complicated than 2-strand repairs. These repairs represent novel attempts to decrease the risk of repair rupture and increase the safety margin of the postoperative motion exercise. Optimal sutures should have sufficient gap resistance and ultimate failure strength, do not strangulate the tendon, elicit minimal tissue reactions, and cause little friction to tendon gliding. There seems to be a trend moving towards multi-strand repairs, but conventional 2-strand repairs are still used extensively. Future clinical studies are needed to validate effectiveness of these repairs on reducing repair ruptures.

There are several peripheral suture techniques: simple running, running locking, Halsted, and Silfverskiold, and deep running. The materials used to make repairs include nylon, braided polyester, and polypropylene, 4-0 or 3-0 (for core stitches), and 6-0 or 5-0 (for peripheral stitches). Absorbable suture PDS was also used for tendon repairs. Repair by Teno-fix is a recent development, but bulkiness of the tendon after implanting Teno-fix, long-term tissue reactions of this implant, and the effectiveness in reducing postoperative ruptures are concerns of surgeons and require further investigations.

SP017

Hyaloglide (Hyaluronan derivative) can reduce the scar adhesions of tendons of the hand. Definitive results of the Italian Society of Hand Surgery (SICM) clinical study on flexor tendon adhesions in zone II.

Michele Riccio 1, Antonio Landi 2, Bruno Battiston 3, Umberto Passaretti 4, Maurizio Altissimi 5, Massimo Ceruso 6, Giorgio Pajardi 7, Andrea Atzei 8, Maurizio Corradi 9, Massimo Del Bene 10, Luca Vaienti 11, Lorenzo Rocchi 12, Riccardo Luchetti 1

Study Group on Post-Traumatic Adhesions Pathology of Tendons and Peripheral Nerves of the Upper Limb
Italian Society of hand Surgery (SICM) - Italy

1 Ancona, 2Modena, 3Torino, 4Napoli, 5Perugia, 6Firenze, 7Milano Sesto S. Giovanni, 8Verona, 9Parma, 10Legnano, 11Milano S. Donato, 12Roma

Postoperative adhesions that restrict tendon gliding are major cause of failure after tendon repair and grafting on Zone II, so restoration of gliding function after injury is a major issue in hand surgery.

The aim of this clinical study was to demonstrate that the exogenous administration of a new Hyaluronan derivative, Hyaloglide®, may reduce peritendineous adhesions in patients undergone to tenolysis in zone II. It is an Auto Cross-linked Polymer (ACP®) of Hyaluronic Acid with the same methabolic pathway of native HA and prolonged residence time in situ up to 12 days. The Authors present a multicenter controlled and randomized study.

Definitive results of this clinical study showed a reduction of peri-tendineous fibro-adhesive scar using Hyaloglide with good or complete recovery of the motion after clinical evaluation using the Total Active of Motion (TAM) and cost-benefit analysis. The Hyaloglide® has the same viscoelastic properties of the native Hyaluronan (HA), so for 12 days after injury or surgery works against the adhesions. The Hyaluronan (HA) is a natural, water-retaining and lubricating linear polysaccharide composed of repeating disaccharide units of N-acetyl-glucosamine and glucuronic acid. It is distributed in the extra-cellular matrix (EMC) of several mammalian tissues. In the tendon sheath High Molecular Weight Hyaluronan has a specific role in maintaining gliding and promote the healing processes after tendon injuries, reducing peri-tendineous adhesions which represent a severe clinical consequences after hand surgery. This clinical study has demonstrate the ability of the Hyaloglide to prevent the post-traumatic and post-operative tendineous adhesions and to restore the gliding function of the flexor tendons after tenolysis. This definitive clinical work suggests that the post-operative use of Hyaloglide® may prevent the tendineous adhesions.

SP024

Scaphoid fracture – Ideal imaging to diagnose acute fracture, delayed union, non-union and assess vascularity

Gregory Bain

The Royal Adelaide Hospital, South Australia, Australia

Imaging of the scaphoid has always been controversial.

In the acute setting plain radiographs with the scaphoid series are required. These four views will usually identify 97% of scaphoid fractures.

If the initial radiographs are negative then it is recommended to repeat radiographs at 10-14 days. However even repeat radiographs can miss a small percentage of fractures.

Further imaging of CT scan, MRI and bone scan will identify occult fractures. These investigations increase the cost of management but allow the patient to have a definitive diagnosis without the need for prophylactic immobilisation.

MRI scan has the advantage of identifying other associated carpal injuries including scaphoid oedema and scapholunate ligament injury. Assessment of Vascularity and avascular necrosis can also be identified.

Pre-operative CT scanning is useful to identify the personality of the fracture including the exact anatomical location of the fracture, the associated sclerosis and comminution. CT scanning in the longitudinal plane proves a superior orientation of the scaphoid and assess the humpback deformity. It also allows templating of the fracture, bone graft and internal fixation.

A CT scan has a significantly higher intra-observer variability for the assessment of scaphoid fracture union and humpback deformity than plain radiographs.

Assessment of sclerosis associated with degenerative arthritis is well visualised on CT scan. Changes in the bone marrow for avascular necrosis are well seen with MRI scan.

SP025

Acute proximal pole fractures of the scaphoid

Doug Campbell

Leeds Teaching Hospitals NHS Trust, Leeds, UK

Estimates of the frequency of fracture of the proximal pole of the scaphoid suggest that this is an unusual injury, occurring at this site in approximately 5% of all fractures.

It is critical to understand the details of the vascular supply of the scaphoid in order to appreciate the importance of this injury *(Buchler & Nagy 1995)*. Fractures proximal to the vascular entry point(s) are likely to result in reduced vascularity of the proximal fragment(s). However, loss of vascularity is not simply a result of the *site* of fracture. Factors such as energy transfer, fragment displacement, instability (in the form of associated ligament injuries), competence of any associated extrinsic vascular supply and other medical factors will all have an effect on subsequent blood flow (and therefore, healing).

The symptoms from such an injury are often less pronounced than symptoms after fractures in the waist or distal aspect of the scaphoid. It is rare for there to be any displacement of this intra articular injury, and radiographs are often apparently 'normal'. If symptoms persist beyond 2 weeks, it is essential to image the bone using a more sophisticated modality such as CT scan or, even better, MRI scan. This latter investigation provides information on intra osseous blood flow – so helping to guide prognosis *(Sakuma et al 1995)*.

Assuming the injury has been diagnosed successfully, management of the fracture is no different from undisplaced waist fractures in most cases, although an extended period of immobilisation is usually recommended (often around 12 weeks) for fractures of the proximal pole. The improvement in imaging and implant technology has driven many surgeons to treat this acute injury by percutaneous screw fixation.

SP026

Percutaneous fixation of scaphoid fractures

Bruno Lussiez , Nicolas Dreant, Jean-Pierre Pequignot

Institut Niçois de Chirurgie de la Main, Nice, France

Most acute scaphoid fractures occur in young people with manual and/or athletic activities.

Conservative treatment may lead to several complications (displacement, non-union), and morbidity (joint stiffness, amyotrophy). The consequences are a delay return to sport and professional activities with their economic impact.

Surgical fixation of the scaphoid allows a rapid healing with a better consolidation rate. For non displaced or minimally displaced acute fractures, the percutaneous techniques are an attractive procedure, preventing the anatomical pitfalls of open exposure (vascularization, ligaments and cartilage lesions).

The percutaneous fixation of scaphoid are technically demanding to assure the best central placement of a headless screw, and necessitate the utilization of fluoroscopic control, and eventually arthroscopic assistance to assess the reduction and compression of fracture, and lesions of intercarpal ligaments.

The approach may be volar or dorsal, and the different techniques are exposed with their difficulties, their limits, and their failures.

SP027

Vascularized bone graft based on the volar carpal artery for treatment of scaphoid non-union

Christophe Mathoulin

Institut de la main, Paris, France

Introduction: We report the results of the surgical treatment of scaphoid non-unions with a vascularized bone graft vascularized by the volar carpal artery from the volar aspect of the distal radius in 94 patients.

Material and method: Patients were operated on under local-regional anaesthesia in outpatient basis. With the same volar approach, the scaphoid was first fixed with a screw, and then the vascularized bone graft harvested from the palmar aspect of the distal radius is put into the scaphoid. There were 20 female and 74 male patients.

Mean age was 31.4 years (range 18 – 63).Average time from scaphoid fracture to vascularized bone graft was 23 months. (range 4 – 120). 31 patients had already undergone surgery (11 Russe's graft, 16 screws)42 patients had a stage 2A pseudarthrosis, 47 patients a stage 2B pseudarthrosis and 5 patients a stage 3A pseudarthrosis (ALNOT's classification).

Results: Our average follow-up is 42 months (range 10 to 117) Union was obtained in 88 patients (93 %) Union was achieved after an average of 8.6 weeks (range 6 – 24). Patients noted a significant decrease in pain postoperatively. Mean flexion increased from 45° to 56° and mean extension increased from 54° to 65°. Grip strength increased from 52% of the opposite side to 90% of the opposite side. The functional result was graded as excellent in 54 cases, good in 27 cases, fair in 9 cases and poor in 4 cases.There were 8 significant complications: 3 Sudeck's dystrophies, 2 cases of evolutive radiostyloid arthritis, 3 cases of severe postoperative stiffness necessitating an arthrolysis.

Discussion: The use of a vascularized bone graft harvested from the palmar aspect of the radius often results in union of scaphoid non-union. It can be recommended in the primary treatment pseudarthroses with limited bone loss.

SP030

Preiser's disease or avascular necrosis of the scaphoid

Luc De Smet

1 Catholic University Leuven, Pellenberg university hospital, Belgium

Despite the high incidence of avascular necrosis of the proximal pole of the scaphoid, and the awareness of the vascularity at risk, "idiopathic" or non-traumatic avascular necrosis of the scaphoid is rare. During the last decades we retrieved 31 cases.

The main points in the diagnosis were absence of trauma, presence of bone necrosis in the distal third of the scaphoid. This could be seen on plain RX, MRI and/or histological examination.

In one third a metabolic origin could be documented. Ulnar variance did not seem to have any etiological value in this pathology.

Based on the disappointing results of reconstructive procedures, primary resection of the proximal row of the carpus was performed in the majority of the cases with satisfactory outcome.

Recently revascularization procedures were published. The largest series from the Mayo clinic did not show an overwhelming success rate (Morgan et al 2006).

Conclusion: AVN of the scaphoid is probably more frequent that previously thought. Awareness of the possibility is the major step in the diagnosis. Proximal row carpectomy gives in our hands satisfactory results

SP031

Anatomical and mechanical considerations of scapholunate instability

Marc Garcia-Elias

Institut Kaplan, Barcelona, Spain

The scaphoid is the least restricted bone of the proximal carpal row in terms of rotation under load. Its mobility (magnitude and direction) is directly determined by: 1) the geometry of the periscaphoid joints (the deeper the scaphoid fossa, the more stable), 2) the periscaphoid ligaments [proximal scapholunate, dorsal scaphotriquetral (STT), palmar scaphocapitate (SC) and lateral scaphotrapezial ligaments), and 3) the indirect action of specific muscle forces (mostly FCR, APB and ECRL) (1). When axially loaded, the three proximal bones are not equally constrained by the palmar crossing midcarpal ligaments. In fact, because of the peculiar arrangement of the STT and SC ligaments, the scaphoid is allowed larger rotation into flexion and pronation than the lunate, being the triquetrum the one more tightly constrained by the ulnar portion of the arquate ligament. If both the palmar and dorsal scapholunate and lunotriquetral ligaments are intact, such differences in angular rotation are likely to generate increasing torques at both intercarpal levels resulting in an increasing coaptation of these joints. Such an increased coaptation further contributes to the proximal carpal row stability. Based on this, if the SL ligaments are completely torn, the scaphoid no longer appears constrained by the rest of the proximal row, and tends to collapse into an abnormally flexed and pronated posture (the so called "rotatory subluxation of the scaphoid"), while the lunate and triquetrum, under the influence of the ulnar part of the arquate ligament, become abnormally extended, a pattern of carpal malalignment known as a "dorsal intercalated segment instability"(DISI).

SP032

The role of arthroscopy in the treatment of scapholunate ligament injury

A. Lee Osterman

The Philadelphia Hand Center, Thomas Jefferson University, Philadelphia , Pa, USA

This presentation will address the role of wrist arthroscopy in the diagnosis and treatment of scapholunate instability.

Arthroscopic assessment includes a staging of the SL lesion. The surgeon should answer three questions**.** I. What is SL status in RC joint? II. What is SL congruency in MC joint? III. What is reactive change in Triscaphe area?

Once staged, an arthroscopic treatment algorithm is presented. This proceeds from simple debridement, through ARIF, and thermal capsular shrinkage. Therapeutically, Debride Stable, Partial Tears; ARIF in REDUCIBLE Unstable Partial Tears or Acute Tears w/Wrist Fractures; and Capsular Shrinkage may play a role in Dynamic & Partial Tears. Results in SL pathology with complete diastasis older than six weeks are unpredictable and not as good as in open reconstruction. When tears can be treated arthroscopically, the morbidity is less than in open repair

SP033

The luno-triquetral ligament

Marco Ritt

VU Medical Center, Amsterdam, the Netherlands

The luno-triquetral ligament is only one of the many ligaments constraining the luno-triquetral joint. In addition to this, the triquetrum is not only involved in luno-triquetral articulation, but it is the keystone in the coördination of ulnar carpal motions occurring at four articulations. Therefore, pathomechanics of luno-triquetral dissociation and treatment options for this cannot be discussed by addressing only the luno-triquetral ligament. First, a few important characteristics of the anatomy and kinematics of this region will be stressed.

There are two intrinsic, palmar and dorsal, interosseous ligaments, with the palmar region being the strongest in material property testing. Next, there are several extrinsic radioulnocarpal ligaments oriented obliquely relative to the longitudinal axis of the forearm, constraining passive supination/pronation of the proximal row relative to the forearm. Finally, there are midcarpal ligaments. Kinematics of the luno-triquetral joint will be discussed as well as stabilizing mechanisms.

It will become apparent that injuries of the luno-triquetral ligament may seem to be isolated, but are often part of a spectrum. Clinical examination with supportive imaging studies are of importance for an accurate diagnosis, however arthroscopy provides the most accurate means of diagnosis of luno-triquetral pathology.

Isolated injury of the luno-triquetral ligament(s) is rare and although treatment is controversial, most authors prefer ligament repair or reconstruction. Obviously, in case of an ulnar impaction syndrome, some form of decompression of the ulnocarpal articulation is indicated. Appropriate indications for a luno-triquetral arthrodesis include symptomatic LT coalitions, chronic luno-triquetral tears, failed ligament repair, etc. However, due to the allotted time, the several pathologies and their treatment options will not be discussed.

SP034

Acute repair of the scapholunate ligament

Thybout Moojen

Diakonessenhuis and The Hand and Wrist Center of the Netherlands, Zeist, The Netherlands

There is a spectrum of injuries to the Scapholunate (SL) ligament. The kinematic consequences of the loss of the SL ligament are investigated by many authors. Complete sectioning of the SL ligament in cadaver specimen results in substantial alterations of the kinematics of the carpal bones.

The main problem is that scapholunate ligament lesions are frequently missed at presentation. If the injury is not treated properly and early, the abnormal position of the scaphoid and lunate results in degenerative changes of the wrist, referred to as scapholunate advanced collapse (SLAC). But even if diagnosed early, the ligament remnants are short, making it difficult to repair.

Recent literature suggests that by reconstruction in patients with complete rupture of the SL ligament with the use of bone anchors, with or without dorsal capsulodesis, performed within 4-6 weeks, good results can be achieved, which can be maintained over time. 1,2

Alternatives mentioned in literature are, among others, the use of temporary percutaneous Kirschner wire fixation of the SL joint in patients with an acute predynamic SL dissociation. 3 Partial ruptures of the SL ligamentous complex might be best treated arthroscopically, eventually combined with electrothermal shrinkage of the distended proximal membrane.

SP035

Repair of radioscaphocapitate ligament for Scapholunate instability

Izge Gunal

Dokuz Eylul University Hospital, Izmir, Turkey

We had previously had demonstrated that sectioning of the scapholunate (SL) ligament solely did not result in SL instability, but if radioscaphocapitate (RSC) ligament was also sectioned, radiographic SL instability occurred. So our treatment of choice is to repair RSC in cases with SL instability.

The wrist is exposed through a palmar incision. The SL joint is reduced by manipulation, usually with radial deviation of the wrist and secured with a Kirschner wire through radius, scaphoid and capitate. Then RSC ligament is repaired and the wire and the cast are removed six weeks later.

All patients treated by this technique returned their previous occupations without pain or instability. Radiographic measurements were also in normal limits.

SP036

Scapholunate instability: Methods and results of secondary ligament reconstruction

Philippe Saffar

Institut Français de Chirurgie de la Main Paris, France

Soft tissue repairs are used to restore and maintain a normal orientation to the scaphoid and to recover a normal congruency of the scaphoid proximal pole with the scaphoid facet of the distal radius after a scapholunate (SL) tear.

Three different anatomical stages may be described:

1) scapholunate tear without scapholunate desaxation

2) scapholunate tear with scapholunate desaxation

3) scapholunate tear with scapholunate dissociation

Methods of diagnosis: ArthroCTscan is our favorite investigation. 1 mm cuts provide precise informations on the site and length of a ligament tear, existence of a ligament stump suitable for suture or reinsertion and cartilage status. Arthroscopy may be used for same purposes.

The major factor of severity is the **horizontal scaphoid**

Treatment: Includes reduction of the malrotated scaphoid and

- Ligament suture or reattachment using transosseous repair or anchors and pin fixation.
- A ligamentoplasty stabilizing the distal scaphoid was reported by Brunelli and variants of this technique published.
- Capsulodesis may be used alone but is often associated with ligamentous repair.
- Bone-ligament-bone reconstruction

Results: The ligament repaired is not as competent as a normal ligament but carpal dynamics is usually restored. A scapholunate gap may reappear at follow-up. Evolution to osteoarthritis is avoided.For our first 40 cases: residual pain was absent or climatic, range of motion was 110° in flexion-extension, and 48° in radial and ulnar deviation. Strength was increased to 78% of the opposite side. The scapholunate angle is within normal values but the scapholunate joint space demonstrates a 4 mm gap on average. Since then, 50 other cases.

Indications: Secondary repair by ligament reconstruction is only indicated in stages 1 and 2 when the scaphoid is reducible.

SP037

Understanding midcarpal instability

David M. Lichtman

University of North Texas Health Science Center, Fort Worth, Texas

Midcarpal instability (MCI) is a poorly understood wrist condition; however, it is being diagnosed with increasing frequency. This paper presents a historical overview of the aetiology, pathomechanics and diagnosis and treatment options for this disorder. A functional classification system differentiating several basic forms of MCI is proposed, along with a contemporary treatment algorithm for each type. A video case report of a patient's pre-operative assessment and surgical pathology highlights the discussion. Recommendations for further collaboration to standardize the terminology, better define the pathology and identify more effective treatment methods are suggested.

SP038

A modern concept of brachial plexus injury management

Hanno Millesi , Robert Schmidhammer

Millesi Center for Surgery of Peripheral Nerves and Plexus brachialis, Vienna, Austria

In closed injuries without emergency we have to differentiate between cases with chances of spontaneous recovery and more sever lesions without such chances. This differentiation is based on clinical examination and experience of the examiner. The clinical decision might be supported by MRI, CT-myelography and electrophysiologic studies. The cases with chances of spontaneous recovery get physiotherapy. Surgery is advised if regeneration stops.

Cases without chances of spontaneous recovery are scheduled for surgery. We are interested to know the degree of damage (root avulsion, rupture of spinal nerves, loss of continuity at trunk or cord level, lesion in continuity), however the indication for surgery is not influenced by the result of these investigations. The surgical approach is designed to minimize the surgical trauma and preserve important structures as much as possible (no osteotomy of the clavicle, no transection of structures crossing the surgical field, exploitation of our knowledge about the subfascial spaces).

The surgical repair is aggressive attempting to reconstruct as many structures as possible. It is our concept to inform the patient or their relatives that the overall treatment will continue for approximately 5 years. After the surgery on the plexus in elected cases a contralateral C7 transfer might be indicated. After 1.5 years an evaluation of the amount of functional recovery is performed and an individual plan for further surgery is established in order to restore as many functions as possible.

A priority list is given what has to be repaired at the plexus (elbow flexion, shoulder joint abduction, external rotation of the shoulder, serratus anterior muscle function). Contralateral C7 transfer should be used to reinnervate forearm flexors for gripping reconstruction. We report on a consecutive series of 65 cases with complete brachial plexus lesion based on a new grading system reflecting the present day higher demand.

SP039

Brachial plexus injuries in the adult. Nerve transfers for shoulder and elbow reconstruction

Panupan Songcharoen

Professor and Chief of Hand & Microsurgery, Department of Orthopaedic Surgery, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok

The incidence of severe brachial plexus injuries presenting with root avulsions has increased in many centers in the past few decades. The higher incidence of this kind of injury is due to the growing number of motorcycle accidents. At present the most acceptable method of treatment for this kind of injury is nerve transfer or neurotization. Theoretically, there are several kinds of neurotization but neuro-neural neurotization has been the most frequently used method.

In restoration of elbow flexion and shoulder abduction of root avulsion injury patients, the donor nerves that have been used include extraplexal and intraplexal sources. The extraplexal donors being used are spinal accessory nerve, phrenic nerve, intercostal nerve, cervical plexus, seventh cervical spinal nerve from the contralateral side, and hypoglossal nerve. The intraplexal donor nerves being used are fascicles from ulnar or median or radial nerve, long thoracic nerve, median pectoral nerve, triceps branch nerve, ipsilateral seventh cervical spinal nerve.

Results of the commonly performed nerve transfers for shoulder abduction and elbow flexion can be classified in to three group according to the percentage of MRC III or better motor recovery. Good – Nerve transfers that give more than 80% MRC III or better motor recovery include transfer of fascicles of median or ulnar nerve to restore elbow flexion. Average – Nerve transfers that give 60% to 80% MRC III or better motor recovery include transfers of spinal accessory nerve, phrenic nerve, intercostal nerve, and the seventh cervical nerve root from the contra lateral side to restore shoulder abduction or elbow flexion. Poor – Nerve transfers that give less than 60% of MRC III or better motor recovery include transfers of hypoglossal nerve, motor branch of cervical plexus to restore elbow flexion. The use the other donor nerves to restore elbow flexion and shoulder abduction are still in their emerging phase and need more time to verify the result.

SP040

Nerve transfers to restore the flexion of the elbow. Comparison of a single ulnar to biceps transfer with a double transfer associating a transfer from the median nerve to the brachialis muscle

Christophe Oberlin , Zoubir Belkheyar, Sébastien Durand

Hand Surgery Unit, Orthopaedic Department, Hôpital Bichat, Paris, France

In C5C6 and C5C6C7 post-traumatic adult brachial plexus palsies, the first goal consists in restoring the flexion of the elbow.

We reported recently (Teboul and al. 2004) 32 single nerve transfers from a fascicule of the ulnar nerve to the nerve to the biceps. The average time required for reinnervation of the biceps was 5 months. No motor and sensory deficit was recorded. 24 patients recovered grade 3 or more elbow flexion from the nerve transfer. Ten patients needed a secondary Steindler flexorplasty. Overall 30 of the 32 patients achieved a grade 3 or 4 strength. This first series is compared to a series of double nerve transfer, ulnar to biceps + median to brachialis muscle. 33 patients have been operated according to the second procedure between march 2003 and march 2006. The minimum follow up is six months.18 patients had a C5C6 palsy. 16 recovered from the nerve transfer a grade 4 elbow flexion, 1 a grade 3 flexion, 1 a grade 2 flexion. 15 patients had a C5C6C7 palsy. 11 recovered a grade 4 flexion, 1 a grade 3, 2 a grade 2, and only one had a complete failure after 12 months. One patient, with an infraclavicular palsy, recovered a grade 4 flexion.

In the whole series, only one patient was secondarily operated by means of a Steindler flexorplasty. But we have to deplore 2 cases of deficit on the anterior interrosseous nerve. The double nerve transfer, reinnervating both elbow flexor muscles, provides significantly better results than the single ulnar to biceps transfer. But care must be taken to harvest a small sized fascicle from the median nerve, to prevent a post operative motor deficit at the hand level.

SP041

Recent version of the double free muscle transfer technique for reconstruction of universal prehensile function following complete paralysis of the brachial plexus

Kazuteru Doi, Yasunori Hattori

Ogori Daiichi General Hospital, Ogori, Yamaguchi, Japan

We have already reported the long-term results of the double free muscle transfer technique for reconstruction of prehensile function following complete paralysis of the brachial plexus and its indications. Our recent version of this technique to improve shoulder function and control the intrinsic-minus finger deformity, and its recent outcome will be presented. Our original technique of the double free gracilis muscle transfer technique consisted of five established but modified reconstructive procedures: (1) exploration of the brachial plexus and repair of the ruptured motor nerves if possible; (2) the first free muscle transfer, neurotized by the spinal accessory nerve, for elbow flexion and finger extension; (3) the second free muscle transfer, neurotized by the fifth and sixth intercostal nerves for finger flexion; (4) a nerve-crossing procedure using the third and fourth intercostal nerves to neurotize the motor branch of the triceps brachii muscle for elbow extension, done simultaneously with the second muscle transfer; and (5) the intercostal sensory rami coapted to the medial cord of the brachial plexus to restore sensibility of the hand. In cases, where C5 or C6 nerve root is available as donor at the procedure 1, neurotization of suprascapular nerve (SSN) is performed using nerve graft for reconstruction for shoulder stability and movement. If C5 or C6 nerve root is not available, the contralateral C7 nerve root is opted as the donor motor nerve and transferred to the SSN using vascularized ulnar nerve graft.

After successful recovery of double transferred muscles, intrinsic-minus finger deformity had developed, although some of patients could control the deformity by the postoperative serious splint to make joint stiffness of wrist, PIP and DIP joints. We performed two options of operative correction of the intrinsic-minus finger deformity, including PIP and DIP fusion and Zancollis' MPJ capsulodesis with or without wrist fusion.

SP042

Extending the indications for primary nerve surgery in obstetrical brachial plexus palsy

Jenny C. Lin 1, Christine G. Curtis 2, **Howard M. Clarke 1**

1 *Division of Plastic Surgery, Hospital for Sick Children; Department of Surgery, University of Toronto, Toronto, Canada*
2 *Department of Rehabilitation Services, Hospital for Sick Children, Toronto, Canada*

Many patients with obstetrical brachial plexus palsy recover well spontaneously, while others require surgical intervention to achieve the best outcome. Several criteria have been published to identify surgical candidates, including Horner's sign or poor biceps recovery at three months. Using the Active Movement Scale, we have shown that failure to obtain a Test Score of 3.5 out of 10 at three months is a criterion for surgery, as is the failure to obtain adequate elbow flexion to pass the cookie test at nine months. However, some patients do not meet any published criteria for nerve surgery, but have deficient shoulder external rotation, an important functional limitation. We report the operative management of four such patients. All patients seen at three months had elbow flexion (2-5/7) and passed the Test Score. All passed the cookie test but lacked external rotation despite good passive range of motion. Active pre-operative external rotation was absent (0/7). The surgery occurred at a mean age of 10.3 months. In three patients, an isolated spinal accessory to suprascapular nerve transfer was performed. Post-operative follow-up of six months to one year shows these patients have already achieved active external rotation (2-3/7). A fourth patient underwent anatomical upper trunk reconstruction with sural nerve grafts. By six months post-operatively, she had regained her pre-operative scores for elbow flexion and hand function, and had achieved active external rotation (2/7). In conclusion, we believe that a small subset of patients with obstetrical brachial plexus palsy recover sufficient elbow and hand function, but have persistent poor shoulder function. All criteria that are currently used to designate patients for surgical intervention would exclude these children. An additional sign, lack of active external rotation with good passive range of motion, can be used to identify these patients, who can obtain improved shoulder movement following surgery.

SP043

The place of distal neurotisations in the treatment of upper palsy

Piero Raimondi, Giorgio Pivato, Chiara Novelli

Hand Surgery Dept, Policlinico Multimedica,Milano (Sesto San Giovanni), Italy

Neurotisation (cross nerve, nerve transfer) is a well known surgical technique used in brachial plexus palsy either in adult and in obstetrical injuries. The aim of neurotisation is to allow functional reinnervation of muscles whose corresponding roots have been avulsed.

In avulsion of C5C6 and C5C6C7 multiple neurotisation must be performed. Spinal accessory (distal branch) to suprascapular nerve (Narakas 1987) and a fascicle of ulnar (or median) nerve to the branches of musculocutaneous devoted to biceps (Oberlin 1991) have been used by us with good result. Only in the last years new neurotisation have been described to reinnervate deltoid muscle in order to improve shoulder abduction. A branch devoted to subscapular muscle can be used to neurotise axillary nerve (Borrero 1999) or a branch for triceps (usually to the long head) can be used to neurotise specifically the branches of axillary nerve devoted to deltoid (Bertelli 2003)

These associated neurotisation can lead to useful external rotation and abduction of the shoulder and elbow flexion in the majority of cases of avulsion of upper roots. Therefore the prognosis of these lesions which was considered in the past very severe, is now rendered more benign thanks to these neurotisations.

As a logic consequence we extended the utilization of distal neurotisations in delayed repairs (either in previously operated cases or in cases in which spontaneous recovery had been poor or limited to only some functions).

We underline that these apparently simple techniques can induce someone to avoid surgical exploration and repair of upper roots (even in presence of good root stumps) and to reconstruct the plexus only with distal neurotizations. This can be a dangerous strategy which can loose the possibility of a more complete, anatomical and physiological repair of the brachial plexus.

SP044

Is reoperation possible after failure of primary repair of the plexus?

Alain Gilbert

Institut de la Main, Paris , France

There are instances where, after a primary repair of the plexus, the initial result is so poor that reoperation should be encompassed.

This lack of result may be due to technical reasons or poor planning. This secondary procedure is difficult in the scary bed and often late. However there should be attempts to improve the situation.

In the past 30 years, more than 3600 Obstetrical Plexuses have been followed and 936 had a primary repair.

In the same time, 53 patients have been seen with a primary repair done in unknown conditions and a very poor result. Many of them were too old for a secondary surgery. Some of them (7) seemed to have had a correct exploration but most (47) had a very small incision not compatible with a correct exploration and repair.

Only 10 families accepted the reoperation which was difficult in all cases. Neurotizations are probably a good solution.

Only few of these patients have now a long follow-up but all of them have been improved although only partially.

In conclusion, the quality of the first procedure on the Brachial Plexus should be stressed as the secondary procedure is long, tedious, and give only limited improvement.

SP045

Obstetric brachial plexus palsy: from injury to the suprascapular nerve to glenohumeral dysplasia

Jörg Bahm ,Claudia Ocampo-Pavez

Euregio Reconstructive Microsurgery Unit, Franziskushospital, Aachen, Germany

Limitation of rotational movements and growth disturbance of the gleno-humeral joint are among the most frequent sequelae in children suffering from obstetric brachial plexus palsy (OBPP). Initial injury to the suprascapular (SSC) nerve and subluxating forces to the gleno-humeral joint might be responsible for imbalance and an unfavorable evolution towards severe gleno-humeral dysplasia.

Methods: Over 800 children were examined in the last 10 years; clinical assessment of active range of motion (ROM) at all joint levels was completed in cases of shoulder impairment after upper OBPP by MRI. Over 200 surgical procedures (joint release, humeral osteotomy, muscle transfers) were performed for shoulder rotational problems.

Results: When severe injury to the SSC nerve could be assessed early (i.e. within the first year of life) and successfully corrected by elective neurotisation, using the distal branch of the spinal accessory nerve, either by an anterior or posterior approach, muscular imbalance between medial and lateral rotators at the shoulder could be diminished and risk of dysplasia decreased.

Older children seen with already progressive joint deformity including dorsal (sub)luxation or dislocation needed joint release procedures and tendon transfer to interfere with the ongoing dysplasia.

Several children with severe joint contracture and an hypothesis of connatal dorsal subluxation of the gleno-humeral joint could be identified and treated early by closed reposition and immobilisation.

Conclusion: Most of the pathogenetic steps from nerve injury to joint dysplasia might be identified- and treated successfully if presented early.

SP046

Hand function in obstetrical brachial plexus palsy

Hidehiko Kawabata ,Daisuke Tamura, Mayuko Wada, Ruiko Takagi, Yuri Inagaki

Osaka Medical Center and Research Institute for Maternal and Child Health, Osaka, Japan

Evaluation of the hand function in OBPP is usually descriptive because young children will not cooperate well with an examiner and long follow-up is necessary for concluding final results. The purpose of this study is to get objective data of motor and sensory function of the patients with OBPP.

Hand function is an integrated function and any single parameter by itself cannot represent it sufficiently. The quantitative parameters that we could accumulate was limited to grip strength and side pinch strength. Hence, motor function in this study was mainly represented by these two parameters, which were evaluated with relative value to the contralateral side, and thumb abduction/opposition and finger extension was supplementarily evaluated with semi-quantitative fashion. Sensory function was evaluated with Semes-Weinstein monofilament test and 2-point discrimination test. Age at the time of evaluation varies from 5 years to 25 years with an average of 9.4 years. Fifty three cases had had nerve repair and 38 cases were followed conservatively.

There was a definite dissociation between the results for motor and sensory functions. In majority of the cases except for true neurapraxia cases, motor function was not reached normal level even after apparent excellent recovery in infantile period. Neurosurgical reconstruction in poor prognosis cases never raised hand function strictly to the normal level. In contrast, sensory function was nearly normal in 85% of the cases.

In conclusion, even a transient deprivation of the neural continuity in very early stage of life is crucial for the late development of the hand motor function. Clinically excellent result in OBPP dose not necessarily mean recovery of normal function at least in the hand.

SP048

The PIP joint in RA – Principles of management and hand therapy intervention

Jennifer Ball

1 Hand and Upper Limb Physiotherapy, Hobart, Tasmania, Australia
2 Physiotherapy Department, Royal Hobart Hospital, Hobart, Tasmania, Australia

The destructive effects of chronic inflammation of the synovium present ongoing and ever-changing challenges to all involved in the care of the Rheumatoid patient.

The effect on the PIP joint is discussed with respect to prophylaxis and early interventions to address zig-zag forces, intrinsic tightness, and flexor tendon and joint synovitis as well as post-operative care.

Hand Therapy options for assisting stability and regaining equilibrium in the classic deformities of swan neck and boutonnière will also be presented and assessed for their effect on pain, function and prevention of progression.

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SP049

The PIP joint in rheumatoid arthritis

Alberto Lluch

Institut Kaplan, Barcelona, Spain

Hypertrophic synovitis of the PIP joint may cause joint cartilage destruction and joint deformity from ligament attenuation or tendon force imbalance.

The most frequently observed deformity is the boutonnière or button-hole deformity, as the condyles of the proximal phalanx protrude dorsally through both lateral bands, like a button through a button hole. A finger with a boutonnière deformity is characterized by flexion of the PIP joint and hyperextension of the DIP joint. Hyperextension of the MP joint is not a consequence of tendon imbalance, but just a position that the patient adopts in order to place the tip of the finger aligned with the plane of the palm of the hand.

Joint synovitis will cause attenuation of the thin connective tissue holding the central slip and lateral bands together, allowing the lateral bands to progressively displace volar to the axis of rotation of the joint. Under these circumstances, tendon forces acting through the joint will be unbalanced. The lateral bands will become flexors of the joint, adding to the forces of the extrinsic flexor tendons, and as a consequence the central slip of the extensor apparatus will become ineffective to actively extend the joint. With time, the central slip will also become attenuated, causing proximal migration of the extensor apparatus, responsible for a hyperextension deformity of the distal interphalangeal joint.

Under normal circumstances the extensor apparatus is responsible for maintaining a balance of proximal and distal interphalangeal joint positioning, in such a way that when the PIP joint is extended the DIP joint should extend, and when the PIP joint flexes the DIP joint should proportionally flex.

When a boutonnière deformity develops quickly, the PIP joint flexes and has very little mobility, causing the synovitis to diminish or ever resolve completely. Under this circumstance, both the joint cartilage and ligaments will be spared from destruction. On the contrary, in the presence of a low grade synovitis, joint mobility and function will be maintained for longer periods of time allowing for cartilage and ligament destruction. Ligament destruction will cause lateral joint instability and slight volar subluxation of the middle phalanx.

Before attempting to surgically correct a boutonnière deformity, passive extension of the PIP joint should be possible. A flexion contracture can be corrected with splinting, and this should be done by applying minimal force over a long period of time, as otherwise there is the risk of accelerating joint destruction from increased cartilage pressure, or lack of compliance from the patient because of pain.

Surgical correction of a boutonnière deformity is most difficult, as repair of an attenuated extensor apparatus requires very accurate anatomical reconstruction of the central slip and the connective tissue holding the central slip and lateral bands. Short periods of postoperative immobilization will lead to disruption of the repaired structures from the powerful force transmitted by the flexor tendons. On the other hand, long periods of immobilization may cause joint stiffness in extension, and the patient will be unhappy with the result, as he prefers to loose the last degrees of extension rather than the last degrees of flexion, which would impaire grasping of medium and small size objects.

After a period of postoperative immobilization of about 5 weeks, recovery of flexion should be closely supervised, as the patient will be eager to regain finger flexion as soon as possible. If the patient recovers joint flexion but looses active joint extension, this will be the consequence of disruption of the extensor apparatus repair.

If the PIP joint is destroyed by the disease, a PIP joint implant arthroplasty could be done, but this is not recommended in severe boutonnière deformities, as joint stiffness is most likely to occur. The best alternative is a joint fusion, mainly when all fingers are involved, a situation frequently observed in rheumatoid patients.

SP050

The PIPJ in Dupuytren's disease - Assessment of causes of PIPJ contracture

Alan Thurston

Wellington School of Medicine & Health Sciences, University of Otago, Wellington, New Zealand

The primary deformity of the PIP joint is caused by involvement of the palmar fascial structures. It is not unusual to see a patient with a severe PIP joint contracture due to lateral or spiral cord involvement without evidence of disease elsewhere in the hand. Secondary changes in the joint structures may prevent correction of the deformity despite excision of the contracted fascia. Secondary changes can also be seen in the extensor tendons. The surgical approach must address not only the primary mechanisms but also the secondary changes in the joint structures, tendons and digital theca.

SP051

The PIPJ in Dupuytren's disease - Pip joint release

Paul Smith

Great Ormond Street Hospital, London, UK

The Management of the contracted PIPJ in Dupuyten's. Digital cords of Dupuytren's tissue may lead to flexion deformities of the PIPJ. In a series of 201 patients who underwent a fasciectomy using Skoogs technique, it was found that 188 PIPJ (95%) were contracted. Following digital fasciectomy, 75 PIP joints (45%)required some form of further proximal interphalangeal joint procedure. These procedures ranged from gentle passive manipulation to stretch out any peri-articular adhesions, through to volar plate release.

Once PIP joint contractures have reached 60 degrees, 80% of patients will suffer from some degree of central slip attenuation, thus making a different post operative rehabilitation regime essential. Failure to detect central slip attenuation will lead to failure in correction of the flexion deformity simply due to the fact that there is no extensor pull on the PIP joint.

Gentle passive manipulation of the PIP joint will not always resolve the flexion deformity. If it does not, attention should be directed to the volar plate. The volar plate itself is not usually contracted, but its lateral attachments to the side of the proximal phalanx known as the check-reign ligaments may be thickened. Release of the volar plate maybe effective therefore in correcting any residual contracture. Often, following release of the contracture, full extension is possible but the finger tends to snap into flexion. Attention to the accessory collateral ligaments is then required. The achievement of full extension maybe compromised by the fact that there is peri vascular fibrosis and the digital vessels may not tolerate full extension. Post operative rehabilitation may therefore again be compromised because vascularity maybe present in flexion. The treatment of the PIPJ is complex and requires a logical and structured approach.

SP052

Post-operative management of the PIPJ in Dupuytren's disease

Sarah Mee

Chelsea and Westminster NHS Trust, London, United Kingdom

There has been little agreed evidence to support specific types of therapy post Dupuytren's release. Modalities such as splinting have produced strong contradictory evidence for effectiveness and for duration (Jain 1988, Robins 1993, Sennwald 1990). Much of the benefit of splinting and other therapy modalities, such as ultrasound and movement, seems to relate to the progress of the disease, the degree of contracture pre-operatively, the joints affected and the surgery required to release them (McGrouther 1990, Glassey 2001). Authors agree that therapy should relate more to the individual case than an agreed protocol following specific surgery (Glassey 2001, McGrouther 1990). Surgery for digital disease, and particularly release of the PIPJ from long-term flexion contracture, requires careful and regular therapy to maximize therapy gains. Initial rest during the inflammatory phase reduces the risk of increasing scar tissue and recurrence (Burgess 1990, Fess et al 1998). Splinting is advocated following long-term PIPJ contractures, where dissection is prolonged or difficult, or where wound healing is more problematic. An increase in digital oedema or inflammation, following any of these situations, is likely to increase the contractile potential of the scar tissue (McGrouther 1990, McFarlane and McDermid 2002).

This session will discuss in detail the relative benefits and limitations of splinting following fasciectomy and dermofasciectomy at the PIPJ. Methods for early and long-term maintenance of extension and gaining flexion will be considered, as well as scar management methods such as silicon oil and gel, compression and massage. Return to function, strengthening, and management of complications such as CRPS Type 1 and sensory neuropraxia will be debated.

SP059

Innovations in nerve surgery: Nerve conduit reconstruction and sensory nerve transfers

A. Lee Dellon

Dellon Institutes, Baltimore, USA

Since approval of the bioabsorbable polyglycolic acid nerve conduit, the Neurotube™, by the FDA in the USA, this is the only device reported in humans for improvement in sensibility compared to nerve repair or grafting. Its use for digital nerves, median and ulnar nerve reconstruction in the wrist and brachium, both sensory and motor will be demonstrated with clinical examples.

Loss of sensation due to irreparable or proximal nerve injuries presents unique protective and functional goals for the reconstructive surgeon. Example of restoration of sensibility to the lateral key pinch area by transfer of radial sensory to median nerve, and ulnar to median nerve sensory transfers will be demonstrated. Also, example of forearm and median sensory transfers to provide hypothenar and ulnar protective sensibility will be demonstrated.

SP060

The deep branch of the ulnar nerve. Macroscopic and microscopic anatomy and applications to spastic and paralytic hand surgery

C. Fontaine 1, 2 , G. Wavreille 1, 2, H.-J. Kim 3, L. Pasquesoone, A.-S. Coussemacq

1 Department of Anatomy, Faculty of Medicine, University of Lille2, 59045 Lille cedex, France
2 Department of Orthopedic Surgery, Unit B, Roger Salengro Hospital, 59037 Lille cedex, France
3 Division in Anatomy and Developmental Biology, Department of Oral Biology, Oral Science Research Center, Human Identification Research Center, Brain Korea 21 Project, Yonsei University, College of Dentistry , Seoul, South Korea

One could think that everything is known about the ulnar nerve (UN). Nevertheless, insufficient results after partial neurotomy performed for upper limb spasticity or after abductor digiti minimi (ADM) transfer (according to Huber) as an opponensplasty could find an anatomical explanation .

We used forty formaline-preserved upper limbs. The ulnar nerve trunk (UNT) at wrist and its terminal branches, the superficial (SBUN) and the deep branch (DBUN) were disected under optic magnification. The distances between the origin of all the branches in relation to the bistyloid line were measured and the branching patterns were recorded. Then all branches were dissected intraneurally as far as possible .

The branches to the hypothenar muscles arose short after the bifurcation of the ulnar nerve; those to the interosseous muscles arose from the convexity (disto-medial aspect) of the deep branch, those to the deep thenar muscles from the terminal part of the nerve. Inside the nerve, the branches to the interosseous muscles ran in the medial fascicle, those to the deep thenar muscles in the lateral fascicle that could be found in the deep branch of the ulnar nerve after microdissection.

The ADM can be supplied by one, two or three branches. These branches can arise from the DBUN, as classically described, but also from the UNT, its furcating point and/or the SBUN. These branches can arise directly from the nerve

We propose that: 1) the neurosurgeon dissect intraneurally the proximal part of the ulnar nerve and proportionate the hyponeurotization of the medial and lateral fascicles to the effects expected on the interosseous and deep thenar muscles, respectively; and 2) the ulnar nerve be dissected in each case of ADM transfer, in order to assess the branching pattern of the UN and to prevent any injury of its nerve supply.

SP061

Results of median and ulnar nerve repair, elbow to wrist

Jean Bart Jaquet , TAR Schreuders, S Kalmijn, PDL Kuypers, ACJ Ruys, SER Hovius

Department of Plastic Surgery, Erasmus Medical Center Rotterdam, Netherlands

Introduction : This study investigated the overall long-term outcome of median and ulnar nerve injuries. Furthermore the end-point for functional recovery has been determined and predictors for the different outcome markers have been quantified.

Materials & methods : A longitudinal cohort study (n=136), with a mean follow-up of 5.5 years, and a meta-analysis (n=623) were performed. Parameters of outcome were sensory recovery (Semmes-Weinstein monofilaments and MRC scale), motor recovery (Grip, Tip-pinch strength and MRC scale), restoration of activities of daily living (Functional Symptom Score), psychological morbidity (Impact of Event Scale) and the ability to return to work. **Results**: Our meta-analysis showed that 44% of the median nerves reached 'good' (S3+ or better) sensory recovery and 61% 'good' motor recovery (M4 or better). For ulnar nerve injuries 41% reached 'good' sensory recovery and 45% 'good' motor recovery. Combined median-ulnar nerve injuries and 'spaghetti wrist' injuries had worse prospects. 59% of the study population was able to return to work within 1 year and the mean time off work was 31 weeks. On average 5.5 years following surgery the FSS was 19. 36% of the subjects reported sufficient early post-traumatic psychological stress, at one month post-operatively, to be in need of psychological treatment (Impact of Event Scale >30). A significant improvement of sensory recovery was found up to 4 years following surgery. Motor recovery stabilised three years post-operatively. Age, delay, level of injury, cognitive capacity, type of injury, compliance to hand therapy and early psychological stress seemed to be significant predictors for final outcome. **Discussion**: Despite all the efforts to improve functional outcome following nerve injuries the clinical outcome is still far from ideal. The central nervous system is one of the leading predictors for clinical outcome. Early collaboration with a psychologist is essential to identify those patients who are likely to develop a post-traumatic stress disorder. Quantification of predicting variables will help us to create a prognostic model to predict final functional outcome.

SP062

Surgical treatment of cubital tunnel syndrome

Nash Naam

Southern Illinois University and Southern Illinois Hand Center, Effingham, Illinois,USA

Cubital Tunnel Syndrome is the second most common entrapment neuropathy of the upper extremity. It was described by Buzzard in 1922.

The multiple surgical options that have been recommended in the literature reflect the controversy surrounding surgical treatment of Cubital Tunnel Syndrome.

Simple decompression in Situ: proponent of this technique describe it as simple, safe and effective.

Medial Epicondylectomy. Described by King in 1950. It decompresses the cubital tunnel. Potential complication: medial elbow instability.

Subcutaneous anterior transposition. Described by Curtis in 1898. The nerve is placed subcutaneously. Soft tissue of the anterior skin flap is sutured to the fascia over the medial epicondyle to keep the nerve in its anterior position.

Intramuscular anterior transposition. Described by Adson in 1918. A groove is dissected in the muscle in line with the ulnar nerve in the transposed position.

Submuscular anterior transposition. Described by Learmonth in 1942. Flexor pronator muscle is divided in a Z-shaped fashion and reflected distally and radially until the Median nerve is identified. The nerve is then placed under the muscle adjacent and parallel to the median nerve. The flexor pronator muscle is reattached in the lengthened position.

Transmucular anterior transposition. Described by MacKinnon. A fascial flap is constructed from the flexor pronator origin. The nerve is placed underneath that flap.

Failed decompression: No clear cut recommendation. Allow enough time for axonal regrowth. Repeat EMG using inching technique in order to identify the site of entrapment. Some suggested microsurgical neurolysis. Others suggested saphenous vein wrapping.

In a review of 29 articles, Mowlavi suggested the following for management of Cubital Tunnel Syndrome:

Minimal: 65% improve with conservative treatment.

Moderate: Submuscular transposition. Success 80%

Severe: All options have poor prognosis.

Recurrent: Extensive exploration, microsurgical neurolysis and possible saphenous vein wrapping.

SP063

Tendon transfer options in low ulnar nerve lesions; opposition transfers in low median nerve lesions

Krishnamurthy Sridhar

Apollo Hospitals, Chennai, India

The most ideal options for these palsies in the Indian Scenario were analysed. The transfers were performed by a single surgeon. 360 patients who were operated between 1991 and 2005 were taken for analysis. Follow up varied between 1 to15 years. Injuries and Hansan's disease formed the bulk of these cases. The overall results were analysed including patient satisfaction and return to work. In the Indian context three important aspects dictated the Choice of procedure.

1. Ability to Eat semi solid food with bare hands.

2. Hypermobile and soft fingers especially in young.

3. Non availability of adequate supervised physical training.

The hypermobile fingers precluded the usage of FDS without tenodesis at PIP, But it is easy to train without supervision. Insertion into pulleys are preferable to Lateral slips. EIP and EDM which were used in the young during earlier period have produced good result in ulnar claw without any reversal of metacarpal arch. Ability to eat with bare hands requires good adduction of fingers and cupping of hand. These requirements are better fulfilled by PALANDE's procedure wherein Five tails of one FDS are used. Three tails are looped around the adjoining interossei in the region of distal palmar crease and one each are attached to 1st dorsal interosseus and Abd. Dig. Minimi.

In Opponen's transfer ECU was used only when others were not available as the wrist developed a tendency to radial deviation even when FCU was acting. PL with palmar aponeurosis as extension was used again in limited cases. The main stay was FDS and EIP. The Guyan's canal and lower end of ulna were the common pulleys. APB and EPL two slip inserts yielded good results. In combined median, ulnar palsy if Palande's procedure was done for claw, Adductor and 1st dorsal interosseus activation for pinch can be avoided.

SP064

Mechanisms of rheumatoid joint and tendon destruction

Jagdeep Nanchahal

Kenendy Institute of Rheumatology and Department of Plastic and Reconstructive Surgery, Charing Cross Hospital, Imperial College, London, UK

Synovial proliferation in rheumatoid arthritis leads to destruction of tendons and joints.

Synovial invasion into tendons predisposes to rupture. Invasive tenosynovium produces increased amounts of matrix metalloproteinases (MMPs) known to degrade structures rich in type I collagen, the major constituent of tendon. Tenosynovium is more vascular than joint synovium and produces high levels of pro-agniogenic factors. Inhibition of the cytokines tumour necrosis factor a (TN F a) and interleukin 1 (IL-1) reduced the production of vascular endothelial growth factor by tenosynovium. Cytokine blockade also reduces the production of the MMPs in both tendon and joint synovium but combined blockade is more effective in tenosynovium.

Rheumatoid joint disease has been extensively studied in relation to cartilage destruction and bone erosion. The latter remains an unsolved problem, and occurs early in the disease process. Osteoclasts, derived from the monocyte/macrophage lineage are key in this process, driven by receptor activator of nuclear factor kappa B ligand (RANKL) and TNF a and IL-1.

Unlike large joints, the function and stability of the small joints in the hand is very dependent on the pericapsular soft tissues. This is an area that has been relatively neglected by basic scientists working in the field of rheumatoid arthritis.

SP065

Latest Advances in medical management of rheumatoid arthritis (RA)

Lyn March

University of Sydney Institute of Bone and Joint Research, Royal North Shore Hospital, St Leonards, Australia

RA is known to have a major impact on health related quality of life and now is also recognised to contribute to premature mortality and reduced length of life. Epidemiological studies confirm that early aggressive treatment before significant bony erosions have developed offers the best chance for maintaining function and improving mortality outcomes.

This has lead to a shift in treatment paradigms to recommend early diagnosis and referral for commencement of DMARDs (Disease Modifying Anti-Rheumatic Drugs) within 6 to 8 weeks of the onset of polyarthritis.

The anti-CCP antibody is emerging as a more sensitive and specific test than rheumatoid factor and a better predictor of the development of chronic erosive RA.

Methotrexate is still considered the most effective initial mono-therapy however combination therapy with two and three DMARDs concurrently is now utilised in more active disease to bring the inflammatory markers CRP and swollen joint counts under control. Non-pharmacological therapies, exercise and omega-3 oils are useful adjuncts. Cardiovascular co-morbidities are recognised as a major contributor to the premature mortality and aggressive monitoring and treatment of risk factors is recommended.

The new biologic DMARDs offer dramatic potential for disease control by blocking some of the major inflammatory cytokines and activated immune cells. Treatments that provide variable blockade of TNF- a, IL-1 and CD20+ B cells are now available. These therapies are expensive and have strict regulations for initial and ongoing access in Australia. They are generally well tolerated but carry potential for increased risk of serious infection at any dose and a potential increased risk, albeit small, of malignancy at higher doses. A national register to monitor long-term and uncommon adverse effects has been established by the Australian Rheumatology Association.

SP066

Tenosynovectomy and reconstruction of tendon ruptures in rheumatoid arthritis

Takaya Mizuseki, Akira Kodama, Kenya Tsuge

Hiroshima Prefectural Rehabilitation Center, Hiroshima, Japan

Tendon problems in rheumatoid hands are not uncommon. Surgery is indicated when the medicine fails to control tenosynovitis, bothering motion of the digit or causing pain.

Finger flexor tenosynovectomy is indicated when flexion is disturbed or painful, or triggering is persistent. Unfavourable results are anticipated when intratendinous nodules are seen within the pulley. Wrist flexor tenosynovectomy is indicated when carpal tunnel syndrome and/or trigger wrist is present due to tenosynovitis. When properly done, it yields satisfactory results.

On the other hand, extensor tenosynovectomy alone is rarely indicated. It is usually combined with wrist joint synovectomy. Extensor ruptures usually occur at around the ulnar head. Differential diagnosis includes PIN palsy due to the cyst around the elbow, and extensor tendon dislocation at the MP joints. Ruptures of the EDC(V) and the EDM are most common, followed by EDC(IV and V) ruptures. Procedures for their reconstruction vary with the number of the involved digits. Drooping of the little finger along can be reconstructed with end-to-side suture of EDC(V) and EDM to EDC(IV). Drooping of the ring and little finger can be best treated by tendon transfer of EIP to EDC(IV and V). However when drooping occurs in more than three fingers, reconstruction becomes very difficult. Free tendon grafting yields limited results due to the myostatic contracture and weakness of the donor muscles. Tendon transfer from EIP to EDC(III, IV, and V) yields unsatisfactory results due to the inadequate power of the donor EIP. A combination of tendon graft to EDC(IV and V) and transfer from EIP to EDC(III) is a treatment of choice today. Postoperative rehabilitation alters final outcome of the ROM. Tension reduced early active mobilization exercise introduced by Ishiguro is recommended to obtain easy and faster recovery.

SP067

MP joint surgery

Grey Giddins

Royal United Hospital and Royal National Hospital for Rheumatic Diseases, Bath, UK

Introduction - MP joints problems are common in RA giving local symptoms of pain, swelling and instability and distal problems primarily swan-neck deformities in the PIP joints.

Diagnosis is straightforward

Non-operative treatment – Medication (DMARDs) and steroid injections are improving patient care.

Surgical treatment – There are soft tissue and bone procedures:

Soft tissue only – Synovectomy and rebalancing was common decades ago for intractable synovitis. Now most patients present with significant cartilage wear and some subluxation. In such patients soft tissue procedures alone are unreliable.

Bone procedures – Silastic implants have given good long service with reasonably predictable but not excellent results. Variations in implant design have not changed outcomes significantly. New anatomic designs may have a role although most patients present with too much damage. The importance of ligament reconstruction in MP joint silastic replacement is unclear although increasing ulnar drift is closely associated with implant failure both clinically and biomechanically. The role of crossed intrinsic transfers is also unclear. The post-operative regimes for mobilization appear important although again the best approach is unknown.

Outcomes – Most patients achieve an arc of 40 0 with good pain relief, function and cosmesis although with deterioration with time.

The future – Fewer patients may present as medical treatment improves. Those that present may present earlier allowing more opportunity to use anatomical implants. Modifications of silastic implants will continue probably more closely linked to improved techniques for ligament reconstruction.

SP068

Rheumatoid thumb deformities

William P Cooney, MD

Department of Orthopedic Surgery, Emeritus, Mayo Clinic, Rochester, Minnesota, USA

Classification and treatment:

Type I:

- Boutonniere deformity: Flexion of MPJ / Extension of IPJ

Rx: Thumb MCP fusion/arthroplasty vs soft tissue rebalancing. Fusion IP joint.

Type II:

- Gamekeepers thumb: Abduction of MPJ / Adduction metacarpal

Rx: Capsulodesis of ulnar collateral ligament or fusion MPJ. Release adduction contracture.

Type III:

- Swan neck deformity: Extension of MPJ / Flexion of IPJ

Rx: Fusion MPJ only - arthroplasty contraindicated. Rebalance IPJ.

Type IV:

- CMCJ subluxation: Abduction of MPJ and CMCJ subluxation

Rx: Arthroplasty of CMCJ, release 1 st web and metacarpal adduction. MPJ fusion.

SP071

Contralateral C7 nerve root transfer

Jianguang Xu

Huashan Hospital, Fudan University, Shanghai, PR Cia

The talk features the evolution of contralateral C7 transfer, covering both experimental studies and clinical experience. Various studies have been conducted to answer questions concerning contralateral C7 transfer. What is the functional muscle innervation of each brachial plexus nerve root? What is the nerve fiber composition and distribution in C7 nerve root? Why is C7 nerve root dispensable and compensable, even in ipsilateral C7 transfer? What are the major considerations in selective/hemi-contralateral C7 root transfer and ipsilateral C7 transfer? Should contralateral C7 transfer be performed in a staged fashion? Can contralateral C7 nerve root not be used to neurotize multiple recipient nerves? What is the optimal way and combination of doing so? New techniques such as prespinal routing in contralateral C7 transfer will be mentioned. Major challenges in C7 transfer, especially the difficulty in achieving independent movement, are discussed. Preliminary results of studies on brain plasticity following contralateral C7 transfer will be reported. Other indications of C7 transfer, e.g. repair of Bell's palsy, accessory nerve injury, and paraplegia, will also be disused.

SP073

My approach to reconstruction of hand function in the flail limb

Giorgio Brunelli

Brescia University Medical School, Italy

Brachial plexus palsies are treated by sophisticated techniques.

In forearm and hand the functions to be restored are: extension of wrist and digits – flexion of wrist and digits – opposition and thumb abduction– adduction– the interossei function. Palsies of singular nerves are repaired by classical operation. Lack of wrist and digits extension and of thumb extension and abduction may be restored by transferring the F.C.R., the F.C.U., the B.R. and the P.T.Lack of function of F.D.S., F.D.P. of index and long finger, F.P.L. and thumb opposition are restored by E.C.R.L., E.C.R.B., F.D.P. of ring and little finger, E.I.P., E.D.M., and A.D.M.

Lack of function of F.C.U., F.D.P. of ring and little finger, ADD.P. and interossei, are restored with: E.I.P., E.D.M., E.C.U., F.D.S.

M.P.J. flexion is obtained also with a simpler operation: the opening of A1 pulleys.

In combined palsies of radial and median nerve functions to be restored are: fingers ext., thumb ext., thumb abduct, thumb flex. and opposition.

The available muscles are hypothenar for opposition, F.C.U. for E.D.C. & E.P.L. F.D.P. (little) for F.P.L. F.D.P. (ring) for F.D.P. (index & long), with D.R.U.J. fusion in pronation, and I.P. fusion thumbs.

In palsies of radial and ulnar nerve functions to be restored are: fingers ext., thumb ext., wrist ext., thumb opp., M.P.J: flex, thumb abd.

The available motors are: F.C.R. for M.P.J. and thumb ext., P.T. for wrist ext., F.D.S. (index) for M.P.J. flex. (4 slips), F.D.S. (long) for thumb add.

In palsies of ulnar and median, functions to be restored are: flexion of thumb and fingers, opposition, adduction, M.P.J. flexion, I.P. extension: available motors are E.C.R.L. to F.D.P., B.R. + E.D.M. for opposition, E.I.P. for adduction.

SP077

Reconstruction of complex defects of the forearm and hand with osteocutaneous free flaps

Michael Sauerbier

Department for Hand, Plastic and Reconstructive Surgery -Burn Center-
BG -Trauma Center Ludwigshafen; Plastic & Hand Surgery of the University of Heidelberg, Germany

Complex defects of the forearm and hand often require microvascular reconstruction with osteocutaneous free flaps for limb salvage. The aetiology of these complex defects can result from major trauma about the forearm and hand, from severe infections including bony structures or from radical resection of malignant tumors. The purpose of this presentation is to demonstrate a therapeutic approach for plastic reconstruction of complex defects about the forearm and hand for different situation such as trauma, infection, tumor etc. Various cases are demonstrated and discussed and finally an algorithm for sufficient treatment options including the timing for flap coverage is presented.

Also the presented results with experiences from operations at our institution will clearly demonstrate that salvage of the forearm and hand with osteocutaneous free flaps is the treatment of choice instead of ablative surgery.

SP078

Secondary management of mutilating upper limb injuries – Soft tissues

S Raja Sabapathy

Director, Plastic, Hand and Microsurgery, Ganga Hospital, Coimbatore, INDIA

Provision of Skin cover during secondary reconstruction of Mutilating Upper Limb Injuries is practiced in three situations. 1. When reconstruction of bone, tendon or nerve is planned and the available skin cover would not safely provide access or cover, 2. The soft tissue cover provided would also help provide a missing function, such as a functioning muscle transfer and 3. When functional reconstruction is complete and soft tissue reconstruction is needed for contour correction for cosmetic reasons. When done to provide access, skin flaps are better than fascial flaps with grafts. There is no difference in outcome whether the flap chosen is pedicle flap or free flap, and the results seem to depend upon the debridement prior to flap cover even during secondary reconstruction. All fibrous tissue in the base need to be excised prior to flap cover and primary healing is a must to reduce fibrosis at the interface of the flap and the bed. Timing of surgery is important. Subsiding of induration at the flap – skin junction is an appropriate time to do the next stage of surgery. For better results, the tendon and nerve repair junctions could be placed in normal tissue and the grafts tunnelled through the flap. During secondary reconstruction with tendon and nerve grafts it is safer to do them together. Staged reconstruction has the risk of damaging the previous reconstruction. Composite defect reconstruction with a composite flap though appealing, is used less often because the geometry of the defect of the various components may make the planning difficult. There is no difference in outcome when defects in various tissues like tendons, bone and nerve are individually addressed and skin cover is provided. For secondary contour correction, free or pedicle skin flaps can be used and in selected instances Tissue expanders can be useful.

SP079

Perforator flaps in upper limb

Alexandru Georgescu

Department of Plastic Surgery and Reconstructive Microsurgery, University of medicine "Iuliu Hatieganu" Cluj-Napoca, Romania

Relatively new method in flap's surgery, perforator flaps tend to monopolize nowadays the surgeon's interest. These flaps can be used both as free and pedicled flaps. The free perforator flaps are very useful but, the question is: could these flaps be successfully used as local or regional flaps? Fu-Chan Wei developed the concept of free-style perforator flaps, referring to the flaps harvested after a Doppler detection of the perforators. But, the local perforator flaps could also be harvested without such investigations, through a very attentive flap design and microsurgical dissection. Because these flaps need a microsurgical dissection, but do not need microvascular sutures, they could be defined as **"microsurgical non-microvascular flaps".** The study refers to both free and pedicled perforator flaps, but insisting to the second category. In the absence of a preoperative Doppler examination, the flaps were designed intraoperatively in a free-style manner. In each case we thought to 2-3 possible flaps able to cover the defect and, for the beginning, we drew only an incision possible to be one of the future flap edges. Then, we proceed to undermine one of the wound edges, trying to find a perforator pedicle able to provide the blood supply of the flap. Generally, it is impossible to not find a patent perforator. The length of the flap must have 2 cm more than the distance from the perforator to the most distally edge of the defect.

In conclusion, the perforator flaps could be used in the upper limb both as free and pedicled local/regional flaps but, because their advantages we take into consideration whenever possible the local or regional resources. These flaps could be designed and harvested even in the absence of a preoperative Doppler examination, by an attentive dissection and design function of the defect needs.

SP080

Endoscopic microsurgery and limb reconstruction

Scott Levin

The trend towards minimally invasive surgery has revolutionized surgical techniques in all disciplines of surgery. The benefits of minimally invasive surgery are that they are more minimized operative morbidity. They can shorten hospital time and costs and they can be aesthetically more pleasing to the patients because of limited approaches and limited incisions. Upper Extremity reconstructive microsurgery has evolved to a point where techniques in minimally invasive surgery can be applied to such a discipline. Minimally invasive microsurgical techniques are complimentary to minimally invasive techniques in limb salvage and reconstruction that are also being developed in parallel to microsurgical procedures. The ability to rapidly dissect tissues that include muscle, muscle flaps, vessels, nerves, as well as the ability to prefabricate expanded tissue transplantation using endoscopic techniques have improved on previous surgeries. All endoscopic surgery requires an optical cavity for adequate visualization and space to perform surgical dissections. These natural cavities exist in the thorax and abdomen and certain pelvic organs. They do not exist in the extremities and thorax and extra thoracic regions. The use of balloon dissectors has enabled us to create optical cavities that then can be accessed with endoscopes and instruments to perform surgery such as flap harvest, vessel harvest, and placement of tissue expanders for free tissue transfer prefabrication of flaps. We have had extensive experience in endoscopic harvest of latissimus dorsi muscle, experience in harvest of sural nerve grafts, the harvest of veins for vein graft, the prefabrication of free tissue transfers using tissue expanders and recently have developed techniques for minimally invasive surgery in the extremities as they relate to long bone reconstruction and surgery to the pelvis and acetabulum. Optical cavities can be created in the extremities that may obviate the need for open incisions and decrease the morbidity of extremity operations that lead to the need for free tissue transfer.

This trend toward minimally invasive surgery as it relates to extremity trauma and reconstruction may change requirements and profile of reconstructive microsurgery in the extremities as these techniques develop. The benefits and risk and complications as well as practicality of minimally invasive microsurgical techniques will be discussed in detail. Specific examples of endoscopic microsurgery will be presented as well as the history of the development of this by me and my team and the anticipation for future work, particularly in the Upper Extremity.

SP081

Pharmacologic therapy of microsurgery

Woo-Kyung Kim

Department of Plastic and Reconstructive Surgery, Korea University College of Medicine, Seoul, Korea

The purpose of this presentation is to review the literature on this topic and study a practical clinical management for pharmacologic therapy in microsurgery. In microsurgery the failure rates vary from 5 to 10 percent of free flaps and 15 to 30 percent of replants. The single most important factor in the vessel anastomosis is surgical technique.

To improve on anastomotic success, however, various pharmacologic therapies have been proposed. Aspirin, heparin and dextran remain the mainstays of treatment and more than 21 pharmacological agents have been used. Aspirin decreases the products of arachidonic acid metabolism, including thromboxane. The effective dose of enteric-coated aspirin is 50 to 100 mg. The heparin is effective at preventing thrombosis and intraoperative bolus and topical irrigating agent have less complication than the routine clinical use. A single preoperative bolus of dextran or dextran (500cc/24 hours) treatment ha ve shown improved patency in the postoperative period . Thrombolytic agents (tissue-type plasminogen activator, urokinase and streptokinase) have been used as well, with good results in local thrombolytic therapy. New pharmacological agents (Bivalirudin, Clopidogrel, SR121566A) are good tools in peripheral vascular interventions and microsurgery.

Despite the lack of unified science, pharmacologic therapy is often practiced on the basis of clinical experience and has a good result in preventing anastomosis failure with often marked differences in agents, dosing, and timing .

SP082

Tissue engineering of 3D soft tissues

Wayne Morrison

Professor of Surgery and Head of Plastic, Hand and Microsurgery, St Vincent's Hospital, Melbourne, Department of Surgery, University of Melbourne and Bernard O'Brien Institute of Microsurgery

The classical model of three-dimensional tissue engineering involves seeding cells into structural biodegradable scaffolds and implanting these in vivo. Their limitation has been the inability to sustain cell viability until vascular ingrowth occurs. The plastic and hand surgeon through his experience through flap vascularisation, and particularly in flap pre-fabrication by vascular implantation, can combine micro-vascular techniques with traditional tissue engineering to overcome the key issues of blood supply.

If a vascular pedicle is placed inside a semi-sealed empty chamber space, it promotes intense angiogenesis. In this environment, cells can be seeded and rapidly connect to a blood supply. Furthermore, the chamber environment which mimics a wound healing model, signals systemic influx of inflammatory, epithelial and mesenchymal precursors to produce autologous tissue. The tissue type that forms can be directed by the addition of specific cell types, biological matrices, growth factors or differentiation factors. There are parallels to this, which we observe in nature.

Using this approach, we have been able to grow fat, muscle and bone. Organ tissue has also been manufactured in this way, including heart, liver, pancreas and thymus. Apart from the obvious clinical potential of this technology the chamber model when implanted into genetically modified and immune privileged mice, enables us to study the behaviour of human cells, including stem cells, in the in vivo environment and their response to various genetic manipulations, drugs or matrix materials.

SP085

Wrist arthrodesis and arthroplasty

Amit Gupta

Department of Orthopedic Surgery, University of Louisville, Louisville, KY, USA

Louisville Arm & Hand, Louisville, KY, USA

When the wrist joint is affected by severe rheumatoid or osteoarthritis, the option of management traditionally has been limited to wrist arthrodesis. Although, wrist arthrodesis results in a stable and painless joint, it does compromise wrist motion. Moreover, not all wrist arthrodesis are painless.

An alternative to wrist arthrodesis is wrist arthroplasty which restores motion to the wrist

Joint and relieves the patient's pain. Wrist arthroplasty is not generally recommended due to the bad experience with previous wrist arthroplasty designs which all had high rates of complications and failure.

The design criteria and clinical experience with a new wrist arthroplasty design will be discussed. The design rationale involves minimal bone resection thus preserving the rim of the distal radius and all the ligaments attached to the radius. Preserving the ligaments helps in protecting the proprioceptive function of these ligaments. Moreover, minimal bone resection should make any salvage easier. The design also avoids the use of bone cement for both the radial as well as the carpal part. The carpal fixation involves use of a peg fixing to the capitate and two screws facilitating intercarpal fusion converting the carpus into one bony mass. The entire distal fixation is limited to the carpus minimizing the chances of loosening. Additionally, there is a rotating carpal polyethylene insert which decreases the torque transmitted to the carpal plate/bone interface. Early clinical results of this implant are encouraging.

SP086

Inferior radio-ulnar joint reconstruction

Diego L. Fernandez

Department of Orthopaedic Surgery, Lindenhof Hospital, Bern, Switzerland

The purpose of this presentation is to highlight our current indications and surgical techniques applied for distal radio-ulnar joint (DRUJ) reconstruction using a non-constrained titanium-ceramic ulnar head prosthesis (Herbert UHP Ò Martin, Tuttlingen) (van Schoonhoven J., Fernandez D.L. et al. JHS [A] 2000) as well as the medium and long term results obtained by the author in a consecutive series of 40 patients treated in a period of ten years (1996 – 2006).

In this cohort 36 patients had post-traumatic sequelae of the DRUJ after distal radius fractures and the other four were two dysplastic wrists, one Madelung and one recurrent giant cell tumor of the distal ulna. The vast majority of the patients (35 out of 40) has had one or more failed previous procedures at the DRUJ level.

A conventional UHP was used in 27 patients, and one custom made prosthesis in one other patient. A spherical head prosthesis was implanted in 12 patients with symptomatic radio-ulnar convergence and stump instability following Sauvé-Kapandji procedures (Fernandez D.L., Joneschild E.S. et al. CORR 2006).

At late follow-up the vast majority of the patients reviewed were pain free, had improved forearm rotation, grip strength and working ability. Radio-ulnar convergence disappeared in all patients with pre-operative unstable ulnar stumps. There were no stem loosenings or infections in these series. Complications included a fractured stem in a thin custom made prosthesis in the conventional UHP group. It was successfully revised with a standard stem and has an uneventful nine year follow-up. In the spherical head group one intra-operative and one traumatic fracture of the fused area occurred and were treated with screw fixation with a satisfactory outcome. There was one case with periprosthetic heterotopic bone formation that required resection. The patient healed without recurrence.

SP087

MP and PIP joint replacement arthroplasty

Robert Beckenbaugh

Mayo Clinic, Rochester MN USA

Total joint arthroplasty of the MP and PIP joints is now possible and associated with an acceptable success and reoperation rate. This presentation outlines the indications, surgical techniques, results, and complications of joint replacements in the hand with pyrocarbon implants.

Pyrocarbon has been shown to be an effective implant material with non-cement fixation for wear properties and biologic compatibility (1). At the MCP joints the simple ball and socket design is inserted in a press-fit manner with precise instruments preserving collateral ligaments and bone stock. The implants are indicated in all osteoarthritis and post-traumatic conditions with normal soft tissues and in earlier non-deforming rheumatoid arthritis. A highly structured postoperative therapy regime is required.

In the PIP joint the design is more complex being shaped like a total knee with refinement concepts to adapt to the function of the PIP joint. The device is also inserted with precise instrumentation through a dorsal extensor splitting approach. The implant can be inserted in any digit in osteoarthritis, post-traumatic arthritis, and inflammatory arthritis (RA and psoriasis). The postoperative therapy is highly individualized to achieve full extension without an extension lag or hyperextension.

The physical characteristics of pyrocarbon results in the appearance of a radiolucent zone by one year postoperatively. This is a normal phenomena that does not represent implant loosening.

New materials and design concepts available to hand surgeons in 2007 make reconstructive total joint replacement surgery possible in the MCP and PIP. This has dramatically increased the indications for arthroplasty at these levels compared to the limited salvage previously available with silicone spacers.

1. Cook et al, 1999.

SP088

Osteo-arthritis of the scapho-trapezio-trapeziodal (STT) joint

Johan van der Westhuizen , Ulrich Mennen

Jakaranda Hospital, Pretoria, South Africa

STT arthritis is still an unsolved problem: what is the biomechanical reason that this joint develops isolated OA or OA in conjunction with other joints e.g. first CMC? Isolated STT osteo-arthritis is reported to affect between 4 – 10% of the population.

Symptoms are classical: wrist pain, mainly with rotatory movements of the wrist. Examination reveals tenderness situated just distal to the distal pole of the scaphoid, with balloting of the scaphoid and pain with radial deviation of the wrist. It can be challenging to differentiate between CMC and STT arthritis. It is estimated that concomitant STT and CMC arthritis occurs in approximately 60% of patients. X-rays are usually sufficient for a diagnosis, but other special investigations may be necessary, to exclude associated conditions.

Conservative treatment is aimed at symptomatic relief. Surgical treatment may be divided into procedures that restrict movement and preserve movement. Fusion of the STT joint will provide excellent pain relief, but several reports have questioned the long-term outcome of arthrodesis. Several procedures have been proposed to preserve movement of the mid-carpal joint: debridement by arthroscopy, removal of the distal pole of the scaphoid, removal of the proximal part of the trapezium and trapezoid, with or without an interposition. However, these procedures are also associated with complications. Due to the high incidence of associated CMC arthritis, there is probably a case to be made to treat these patients as pan trapezium arthritis.

When treating STT arthritis however, the most important factor is the high incidence of associated conditions. Therefore, we need to consider these factors when orchestrating a treatment plan.

SP091

Anatomical basis of dorsal finger skin cover

Jefferson Braga-Silva

Pontific Catholic University of Rio Grande do Sul. Division of Hand Surgery and Microsurgery. Porto Alegre, Rio Grande do Sul, Brazil

Objectives: this study describes the anatomy of the dorsal cutaneous vascular system of 180 digits (36 thumbs, index, middle, ring, and little fingers) from 18 pairs of fresh human cadaver hands. The aim of this paper is to incorporate the anatomical data to the current way of designing the homodigital adipofascial turn-over flap for cutaneous coverage of the dorsum of the finger.

Methods : we have carried out an anatomical study in preserved cadaver hands to define the distance between the joint and the origin of the dorsal cutaneous branches of the proper palmar digital artery in the proximal and middle phalanx of the long fingers. For the thumb to metacarpal and interphalangeal joint. All branches of the proper digital artery which ran to the dorsal skin were then identified, and their diameters and the distances of their origins from the proximal interphalangeal joint were measured .

Results: we showed that two constant branches in the proximal and middle phalanx from each proper digital artery have consistent sites of origin at predictable distances from the proximal interphalangeal joint for the long fingers and metacarpal and interphalangeal joint for the thumb. The flap survival was excellent and no donor site complications were observed.

Conclusions: we showed that these branches have consistent sites of origin at predictable distances from the proximal interphalangeal joint. The adipofascial turnover arterial flap has appeared as an excellent alternative to achieve early coverage of cutaneous wounds at the dorsal aspect of the fingers.

SP092

My favourite flap in hand surgery - Reverse dorsal metacarpal artery flap

Govindasamy Balakrishnan

RIGHT Hospitals, Chennai, India

The coverage of the dorsal finger defects and defects over web spaces remains a challenge to the hand surgeons. It often needs a flap from adjacent finger or a distal flap, which becomes a staged procedure. The reverse dorsal metacarpal artery flap is a boon to the hand surgeons to cover such a defect in a single stage. It is a perforator based axial flow skin flap based upon the communication between the palmar and dorsal vessels at the level of the neck of the metacarpal. The constant communication at this level makes it a versatile flap. The dorsal skin is always lax and a secondary defect up to 3cms width can be closed primarily. These flaps can be raised as fasciocutaneous flaps or adipo fascial flaps. These flaps can also be used as composite flaps by raising the extensor tendon and part of the dorsal cortex of metacarpal bone. The classical dorsal metacarpal artery flap can be used to cover defects up to the PIP joint or base of the middle phalanx. The extended reverse dorsal metacarpal artery flap based upon the communication between the dorsal metacarpal artery and dorsal digital branches can be used to cover defects up to the DIP joint. I would like to present my experience of 30 cases of reverse dorsal metacarpal artery flaps.

SP093

The radial forearm flap

R.Adani

Department of Orthopaedic Surgery, University of Modena and Reggio-Emilia, Modena, Italy

The radial forearm flap based on the radial vessels was first developed as a free microvascular flap by Yang Guofan in 1978 and initially this free flap was used to reconstruct controlateral hand injuries. In 1984 Foucher reported the application of this flap as a pedicle flap raised on a distal pedicle of the radial vessels on the same side for the reconstruction of skin defects of the hand.

The advantages of using this flap for hand reconstruction are numerous, however two major disadvantages of the donor site are present: sacrifice of the radial artery and a displeasing donor site.

The aim of this work is to describe the use of this flap for hand reconstruction.

In the period 1988-2006 the radial forearm flap was used in different way for cover hand defects:

- Free and reverse forearm flap to reconstruct large tissue defects;

- Reverse forearm flap containing the palmaris longus tendon and a strip of brachioradialis and FCR for reconstruction of the extensor tendons of the hand;

- Reverse fascial flap for reconstruction of the gliding floor of tendons;

- Distally based radial cutaneous or fascio-subcutaneous flap based on the distal perforators of the radial artery.

The radial forearm flap is indicated for hand reconstruction such as a skin defects at the dorsal and palmar hand/wrist, release adduction contracture of the first web space and for reconstruction of soft tissue defects with dorsal tendon injuries.

The distally based radial forearm cutaneous or fascio subcutaneous flap with preservation of the radial artery is a reliable alternative to “the standard radial forearm flap” and reduces the donor site complications preserving the radial artery and also provides a more acceptable donor site.

In conclusion we believe that the radial forearm flap, employed in appropriate way, still plays an important role in reconstructive surgery of the hand.

SP094

Posterior interosseous and anterior interosseous pedicled flaps for tissue substitution in the hand

Zsolt Szabo

BAZ University Teaching Hospital, Miskolc, Hungary

The era of reversed fow arterial pedicled flaps have started since 1981 with the introduction by Yang Guofan of the radial forearm flap. This flap has a lots of advantages but also the great disadvantage to sacrifice the radial artery. To avoid this inconvinience a new generation flap, a reversed pedicled flap of the interosseous posterior artery was introduced by Masquelet and Zancolli in 1986. This is a technically demanding but safe and constant flap which in the everyday practice has took the place of the radial and ulnar flaps. In 2-3% of the cases anatomical variations result in the absence of the distal anastomosis of the interosseous artery. In these cases a new flap the interosseous anterior flap can substitute it. This relatively new flap, introduced by Hu and Baudet in 1994 is based on two perforators of the interosseous anterior artery which penetrates the interosseous membrane and provide vascularisation to the skin of the distal dorsal forearm. I would like to present the anatomic background, the technical tips and tricks and some of our results with these two flaps.

SP095

The groin flap in hand surgery

Henk Giele

University of Oxford, United Kingdom

The groin flap the first axial pattern flap, popularized by McGregor and Jackson in 1972 was the principle flap for hand coverage as a pedicle flap but lost popularity with advancement in other free fasciocutaneous flaps due to it's variable short and small pedicle. However it remains my favourite flap in hand surgery due to the groin flaps large possible size (10x25cm), of flexible durable usually hairless skin, overlying fat that can provide a good tendon gliding surface, all of which allows immediate mobilization. The flap size can be extended in dimension by utilizing the inferior epigastric artery territory. The groin flap has advantages in a hidden directly closeable donor site,with low donor site morbidity. Though it can be bulky in the obese especially at the medial corner it is easily debulked.

SP097

Morphology and classification of mechanoreceptors

E. J. Berger , R. A. Berger, K. Tomita, Y. T. Lin

Mayo Clinic Orthopedic Research Laboratories, Rochester, Minnesota, U.S.A.

Classification: Mechanoreceptors are specialized nerve endings that initiate afferent nerve trans-missions when stimulated mechanically. The Freeman & Wyke classification is the most widely used system today. Type I (Ruffini) receptors are globular or ovoid in shape and are believed to provide information about static position and dynamic joint movement. Type II (Pacinian) receptors are thick, laminated or onionskin-like capsules with a single nerve terminal in cylindrical or conical shape and are thought to provide information about initial and final movement. Type III (Golgi) receptors are more elongated and larger in dimension than other receptors, possess dense nerve terminal and appear to provide information about extremes of joint movement. Type IV receptors include non-corpuscular nerve endings and are thought to convey pain.

Methods: Fresh cadavers with no history of neurological disorders were used. Radiographs were taken to exclude any arthritic condition. The tissues were fixed in paraformaldehyde, cryoprotected, cryostat- sectioned at 50µm, serially collected on glass slides and processed for fluorescent immunohistochemistry using PGP 9.5 as the primary antibody conjugated to a fluorescent secondary antibody. Each section was completely scanned with a confocal laser scanning microscope system, focused on the fluorescence frequency of the secondary antibody. Because of the extremely high level of resolution and three-dimensional scanning capacity of the laser microscopy system, with its integrated software, structures such as nerve endings can be imaged three-dimensionally, rotated and objectively measured for parameters such as overall size of the mechanoreceptors and the diameters of the afferent and terminal nerve fiber.

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SP098

Distribution of mechanoreceptors in the wrist ligaments

Elisabet Hagert

Karolinska Institutet, Department of Hand Surgery, Stockholm Söder Hospital, Stockholm, Sweden.

Joint stability is dependent on a proper skeletal congruity, the passive restraint from ligaments, and the muscular compressive forces acting on the joint. From other joint systems in humans and animals, it is well established that sensory signals from nerve endings in ligaments contribute information regarding joint velocity, angle and distortion. The degree of innervation, however, varies greatly between joint systems. Based on this, the human wrist ligaments have recently been analyzed extensively with regard to the distribution of nerves and mechanoreceptors, in an aim to further elucidate the possible proprioceptive role of wrist ligaments in maintaining joint stability.

The distribution of the nerve endings in human wrist ligaments is found to vary greatly. The differences in degree of innervation is, furthermore, reflected in structural differences between the ligaments. Hence, while certain wrist ligaments are found to have innate sensory qualities, with a rich presence of mechanoreceptors and nerve endings, other ligaments have a structural composition indicating primarily a mechanical, not sensory, function. It is proposed that the differences in innervation and structural composition indicate that wrist ligaments are not equal with regard to proprioceptive and biomechanical functions.

SP099

Changes of performance in proprioception impaired patients

R.A. Berger 1 , E. R. Laskowski 2

1 *Orthopedic Research Laboratories*
2 *Sports Medicine Clinic, Department of Physical Medicine and Rehabilitation*
Mayo Clinic, Rochester, Minnesota, U.S.A

Understanding proprioception is important to understand normal neural networking,

Developing applications to reconstruction, understanding pathophysiology and

designing rehabilitation algorithms. Very little information regarding proprioceptive sense in the human wrist has been published in peer review literature. We know that there are 7 major peripheral nerves that cross the wrist, and potentially provide afferent connections to the joint structures. We know that the nerves that represent an afferent connection with the wrist terminate in specific nerve endings that are believed to be mechanoreceptors. It has recently been demonstrated that the anterior and posterior interosseous nerves do not contribute to the conscious awareness of position sense in the human wrist. Motion threshold is being evaluated currently. It has been hypothesized that the displacement parameters for the wrist would fall somewhere between the distal interphalangeal joint (20 deg/sec with 0.8 ° displacement) and the elbow joint (2 deg/sec with 0.1 ° displacement). It is entirely possible that conscious awareness of proprioception may be minimal, and that afferent/efferent reflexes are happening at a lower level, such as direct arcs with muscle spindles or through the spinal cord. From other joints, we have learned that injury can create a diminution of function of afferent/efferent pathways and disrupt static restraints and that retraining dynamic stability is essential in successful adaptation to injury. Traction injuries to ligaments or capsule results in rupture of nerve fibers, or partial joint "de-afferentation". This in turn results in a cycle of re-injury, well documented in studies of recurrent ankle sprains. Numerous studies have demonstrated clinical improvements in patients who have undergone proprioceptive re-education of injured joints.

SP100

Proprioception in carpal instability

Marc Garcia-Elias

Institut Kaplan, Passeig de la Bonanova, 9, 2on 2a, 08022 Barcelona, Spain

Proprioception, understood as the conscious and unconscious appreciation of joint position, is an important step in the process of generating adequate efferent (motor) responses helping in the stabilization of joints. Proprioception is directly dependent on the existence of local mechanoreceptors distributed in specific soft-tissue structures around the joint (skin, periosteum, capsule, ligaments, etc). Wrist ligaments are not an exception. When the wrist is loaded, the mechanoreceptors contained in its ligaments detect changes in tension and generate warning messages to the spinal chord which are followed by almost automatic orders to specific motor tendons which reactive contraction may control joint displacement within physiologic limits. Indeed, muscle activation comes not immediately after a sudden load. There is always some delay (latency time) in the response of the protective muscles. If the muscle response is slow, owing to absence of capsular receptors, capsular strain could easily progress beyond limits causing injury. The key issue, therefore, is to make this feedback loop as short as possible: the shortest the latency, the less the damage. In this round table, updated information will be provided on what sort of receptors exist in the wrist ligaments. We will also discuss how densely distributed sensory corpuscles are in some carpal ligaments, and what possible clinical implications this information may have for our future management of wrist instability.