

DISTRACTIONS

The Newsletter of
The Limb Lengthening and Reconstruction Society: ASAMI North America

Volume 10, Number 1 January/February 2004

Specialty Day 2004 March 13, 2004

Agenda

8:00–8:05 a.m.	Welcome Disclosure, and Goals <i>S. Robert Rozbruch, MD, Program Chair</i>	12:00–1:00 p.m.	Lunch on own
8:05–8:15 a.m.	History of the Ilizarov Method: The Beginning and the Future – <i>Svetlana Ilizarov, MD</i>	<i>Best Papers from LLRS Annual Meeting, Boston 2003</i> Moderator: John Birch, MD	
8:15–8:30 a.m.	Choosing Your Tool: Type of Frame, Nail, or Plate? – <i>Mark T. Dahl, MD</i>	1:00–1:10 p.m.	Insufficient Sarcomereogenesis May Contribute to the Development of Muscle Contractures During Limb Lengthening <i>Marina Makarov, MD</i>
<i>Trauma Symposium</i>	Moderator: James Hutson, MD	1:10–1:20 p.m.	External Fixation During Postoperative Chemotherapy <i>Hiroyuki Tsuchiya, MD, PhD</i>
8:30–8:45 a.m.	Application of the Ilizarov Method to Acute Trauma: When to Take Out the Rings <i>Paul T. Freudigman, Jr., MD</i>	1:20–1:30 p.m.	Biomechanical Study of the Tension of the Fibular Nerve and the Importance of its Decompression in Lower Limb Deformity Correction – <i>Monica Nogueria, MD</i>
8:45–9:00 a.m.	Tibial Plateau Fractures (Schatzker 5, 6): ORIF – <i>Dean Lorch, MD</i>	1:30–1:40 p.m.	Discussion
9:00–9:15 a.m.	Tibial Plateau Fractures (Schatzker 5, 6): Circular Fixation – <i>John K. Sontich, MD</i>	<i>Pediatric Symposium</i>	Moderators: David Feldman, MD and William G. Mackenzie, MD
9:15–9:30 a.m.	Pilon Fractures: ORIF – <i>David Levine, MD</i>	1:40–1:55 p.m.	New Approaches to Congenital Shortening <i>Michael Weber, MD</i>
9:30–9:45 a.m.	Pilon Fractures: Circular Fixation <i>J. Tracy Watson, MD</i>	1:55–2:10 p.m.	Approaching Post-traumatic Growth Arrest <i>Charles T. Price, MD</i>
9:45–10:00 a.m.	Discussion	2:10–2:25 p.m.	Monolateral Approach to Pediatric Deformity – <i>Richard S. Davidson, MD</i>
10:00–10:15 a.m.	Tibial Nonunions – <i>James C. Binski, MD</i>	2:25–2:35 p.m.	Break
10:15–10:30 a.m.	Segmental Bone Defects – <i>Stuart Gold, MD</i>	<i>Tumor Symposium</i>	Moderator: Joseph Lane, MD
10:30–10:45 a.m.	Discussion	2:35–2:55 p.m.	Bone Tumor Reconstruction Strategies <i>John Healey, MD</i>
10:45–11:00 a.m.	Break	2:55–3:15 p.m.	Applications of the Ilizarov Method to Tumor Reconstruction <i>Hiroyuki Tsuchiya, MD, PhD</i>
<i>Foot and Ankle Symposium</i>	Moderator: Doreen DiPasquale, MD	3:15–3:35 p.m.	Discussion
11:00–11:15 a.m.	An Approach to Charcot Deformities <i>Paul S. Cooper, MD</i>		
11:15–11:30 a.m.	Post-traumatic Reconstruction <i>S. Robert Rozbruch, MD</i>		
11:30–11:45 a.m.	Foot and Ankle Deformity Correction: When to Perform Osteotomy, Arthrodesis or Neither – <i>Dror Paley, MD</i>		
11:45 a.m.–12:00 p.m.	Discussion		continued on page 2

Register onsite for the AAOS Annual Meeting and LLRS' Specialty Day!
Please visit www.aaos.org for more information.

Specialty Day 2004

Agenda
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Special Interest Topics **Moderators: Janet Conway, MD and Stuart Green, MD**

- 3:35–3:45 p.m. Enhancements of Bone Healing
Joseph Lane, MD
- 3:45–3:55 p.m. Muscle Lengthening, Basic Science and Clinical Applications
John G. Birch, MD
- 3:55–4:05 p.m. An Approach to Elbow Contracture: When to Use the Hinge
Robert Hotchkiss, MD
- 4:05–4:15 p.m. Internal Lengthening Nail: Clinical Update
Janet Conway, MD
- 4:15–4:25 p.m. Treatment Approach for Osteomyelitis
George Cierny, III, MD
- 4:25–4:35 p.m. New Spatial Frame Updates
J. Charles Taylor, MD
- 4:35–4:50 p.m. Discussion
- 4:50–5:00 p.m. Closing Remarks
S. Robert Rozbruch, MD
John G. Birch, MD
- 5:00 p.m. Complete Evaluation, Adjourn

LLRS Now Accepts Credit Card Payments

Membership dues are past due. If you have not received a receipt via e-mail, please contact Karen Syzdek to make sure payment was received.

Statements were sent in September and December by regular mail and e-mail. You may now pay online at www.asaminorthamerica.org.

Abstracts in A Minute

The purpose of Abstracts in A Minute is to facilitate members' self-study. Because of the brevity, these abstracts are not intended to be an authoritative or critical review.

Trauma – Upper Extremity

Cassidy C, Jupiter JB, Cohen M, et al. **Norion SRS cement compared with conventional fixation in distal radial fractures.** A randomized study. *J Bone Joint Surg [Am]* 2003; 85–A:2127–2137. This prospective randomized multicenter study of distal radius fractures treated with closed reduction and immobilization (cast or external fixation) compared 161 fractures treated with percutaneous or limited open insertion of Norion SRS (calcium phosphate bone cement) to 162 controls treated without Norion SRS. No Norion SRS patient wore an external fixator. Patients were followed clinically and radiographically and with SF-36 questionnaire. At six and eight weeks, the Norion group had better wrist strength, wrist ROM, digit motion, use of the hand, less swelling, and better social and emotional function than the controls. By three months, the differences were normalized, except for digit motion. At one year, no clinical differences were detected. The Norion group had greater change in ulnar variance. No differences were seen in complication rate, including loss of fixation. Rate of infection was higher in the control group. In the control group, those treated with an external fixator (versus a cast) had less loss of radial length and less change in orientation of distal radius. Use of Norion may allow accelerated rehabilitation. A limited open approach and supplemental K-wire fixation are recommended.

Komurcu M, Yanmis I, Atesalp AS, Gur E. **Treatment results for open comminuted distal humerus intra-articular fractures with Ilizarov circular external fixator.** *Mil Med* 2003; 168:694–697. Nineteen gunshot wounds of the distal humerus were treated with external fixation. Union was achieved in 4.6 (3 – 7) months. Results were better in those treated early (6–8 hours after injury) compared to those treated late. Circular external fixation can be preferred as a treatment alternative in selected cases of distal humerus intra-articular open comminuted fractures because it protects the soft tissue connections and blood circulation of the bone, permits early elbow movement and permits patients to return to daily life very early.

continued on page 3

Nonunion

Brinker MR, O'Connor DP. **Iizarov compression over a nail for aseptic femoral nonunions that have failed exchange nailing: a report of five cases.** *J Orthop Trauma* 2003; 17:668–676. Five patients (age 31–67) with femoral nonunions who had failed exchange nailing (average 2, range 1–3). None had infection or bone loss. All had oligotrophic nonunions. Slow compression (0.25–0.5 mm/day) was performed over a new smaller diameter (2–3mm less) nail, dynamically locked initially, then statically locked with external fixator removal when CT scan showed healing of 25% of the cross-section area of the fracture. Ciprofloxacin was prescribed prophylactically. All nonunions healed without further nonunion. Surgery in an average of 133 (range 86–238) days. No deep infection occurred. No clinically significant leg length discrepancy occurred. Slow compression over an intramedullary nail differs from exchange nailing, both from a biologic and mechanical perspective. This procedure gives direct bone-to-bone contact, minimizes shear and bending while allowing axial micromotion, is minimally invasive, and allows immediate full weight-bearing.

Infection

Yeargan IS, Nakasone CK, Shaieb MD, Montgomery WP, Reinker KA. **Treatment of chronic osteomyelitis in children resistant to previous therapy.** *J Pediatr Orthop* 2004; 24:109–122. Thirty children with chronic osteomyelitis of the tibia, resistant to previous therapy, treated between 1978 and 1998 were reviewed. Mean age at diagnosis was 8.5 (range 1.5–16) years. Mean age at admission was 9.6 (range 3.5–18) years. Follow-up averaged 2.5 (range 0–9) years. Patients underwent 97 procedures, averaging 3.2 procedures per patient. Cultures were positive in 77%; 78% of positive cultures identified as *S. aureus*. Hospital stay averaged 4.7 months (range 2 weeks – 18 months). Eighty percent had a good outcome. Patients with large tibial defects obtained good results with both tibiofibular synostosis and Iizarov distraction osteogenesis for bony tibial defects due to osteomyelitis. Four patients underwent creation of a tibiofibular synostosis; five underwent Iizarov bone transport. With the small numbers available, no significant difference could be detected between the Iizarov group and the tibiofibular synostosis group with regard to length of hospital stay, number of complications, or outcomes.

Trauma – Lower Extremity

Kesemenli CC, Subasi M, Arslan H, et al. **Is external fixation in pediatric femoral fractures a risk factor for re-fracture?** *J Pediatr Orthop* 2004; 24:17–20. 192 pediatric femoral fractures were treated with three different techniques: hip spica casting after traction (100), closed reduction and external fixation (57), open reduction and internal fixation (35). Patients undergoing open reduction and external fixation had greater length of time to union, length of hospital stay, and higher refracture rate. External fixation was not a risk factor for refracture in pediatric closed femoral shaft fractures. It may be used with ease in clinics with a shortage of personnel or space.

Krieg JC. Proximal tibial fractures: current treatment, results, and problems. *Injury* 2003; 34:A2–10. Author evaluates treatment protocols for proximal tibial fractures: closed treatment, external fixation, intramedullary nailing, and plating. Results of and problems associated with each technique are reviewed.

Pollak AN, McCarthy ML, Bess RS, Agel J, Swiontkowski MF. **Outcomes after treatment of high-energy tibial plafond fractures.** *J Bone Joint Surg [Am]* 2003; 85-A:1893–1900. Eighty tibial plafond fracture patients were evaluated 2–5 (mean 3.2) years after high-energy tibial plafond fractures. Outcomes measured were general health, walking ability, limitation of ROM, pain, and stair-climbing ability. SF-36 scores were significantly lower than age- and sex-matched norms. Forty-three percent were not working; of those, 68% said the fracture prevented them from working. Thirty-five percent reported stiffness. Thirty-three percent reported pain. Poorer results were associated with being married, a personal annual income less than \$25,000, failure to obtain a high school diploma, and having treatment with an external fixator, with or without limited internal fixation. All external fixation in this study was bridging external fixation; no hybrid systems were used.

Lengthening

Gurlek A, Bilen BT, Ynan M, et al. **Lengthening of the amputation stumps in hand by distraction osteogenesis.** *J Hand Surg [Am]* 2003; 28:45.

Orhun H, Saka G, Bilgic E, Kavakh B. **Lengthening of short stumps for functional use of prostheses.** *Prosthet Orthot Int* 2003; 27:153–157. Two patients underwent forearm lengthening for facilitation of prosthetic limb stump fitting. Sixty and 40% lengthenings were achieved. There were no major complications.

Please make note of Karen Syzdek's
e-mail address change.
The new address is
ksyzdek@assocconvspec.com.

Lengthening continued

Rodl R, Gosheger G, Leidinger B, et al. **Correction of leg-length discrepancy after hip transposition.** *Clin Orthop* 2003; 416:271–277. Four patients underwent limb lengthening following hip transposition after pelvic resection for Ewing's sarcoma (3) or osteosarcoma (1), pushing the femoral head to the lateral side of the sacrum or underside of the resected ilium after excision of bone sarcomas including the ilium. Femoral lengthening was started 4.4–6.8 (mean 5.7) years after tumor surgery. Age at initiation of lengthening was 10.3–20.8 (mean 17.3) years. Average leg-length discrepancy was 10.3 (range 6–12) cm. Average of achieved lengthening was 6.4 (range 6–7.5) cm. Average healing index was 32 (range 27–40) days/cm. Because 5-year survival after resection of a pelvic sarcoma is only 20–30%, leg lengthening after hip transposition should be offered only to long-term survivors with at least five years event-free survival.

Starr KA, Fillman R, Raney EM. **Reliability of radiographic assessment of distraction osteogenesis site.** *J Pediatr Orthop* 2004; 24:26–29. Forty-two lower extremity radiographs of distraction osteogenesis gaps were reviewed by nine examiners on two occasions to determine the number of healed cortices and whether fixation removal was indicated. Variation in assessment of number of cortices was slightly better than chance, indicating an inadequate measure of healing. The decision to remove an external fixator device based on radiographic assessment alone resulted in intra- and inter-observer variability moderately above chance. Examiners reported they routinely used other factors in determining timing for removal, including uniformity of callus, site of lengthening, patient weight, expected compliance, and activity restriction.

Troulis MJ, Coppe C, O'Neill MJ, Kaban LB. **Ultrasound: assessment of the distraction osteogenesis wound in patients undergoing mandibular lengthening.** *J Oral Maxillofac Surg* 2003; 61:1144–1149. Ten patients underwent mandibular lengthening. Healing was evaluated by plain radiographs and ultrasound immediately after external fixator removal as well as external appearance, as assessed by the surgeon, and graded on a semiquantitative scale. Authors concluded that plain radiographs underestimated bone formation compared to ultrasound and operative findings. Authors conclude ultrasound is an accurate noninvasive technique that may prove to be useful in assessing bone regeneration in mandibular distraction osteogenesis.

Deformity

Accadbled F, Laville JM, Harper L. **One-step treatment for evolved Blount's disease: four cases and review of the literature.** *J Pediatr Orthop* 2003; 23:747–752. In infantile tibia vara, the presence of a superomedial physal bridge and sloped tibial plateau requires four problems to be addressed: (1) correction of varus and internal tibial torsion, (2) prevention of recurrences, (3) restoration of normal joint congruity, and (4) prevention and treatment of leg length discrepancy. Four patients with Blount disease and a sloped tibial plateau were treated with percutaneous epiphyseodesis of the superolateral tibia and proximal fibula, elevation osteotomy of the medial tibial plateau, osteotomy of the fibula, dome-shaped tibial osteotomy followed by progressive leg lengthening. Angular correction was performed acutely or gradually; desired amount of correction was not specified. Mean age was 8 years, 2 months (range 6+9 to 10 years). Results were evaluated based on leg length, knee mobility, metaphyseo-diaphyseal angle (MDA) and angle of depression of the medial tibial plateau at 3–12 year follow-up (mean 6.9 years).

Degreef I, Moens P, Fabry G. **Temporary epiphysiodesis with Blount stapling for treatment of idiopathic genu valgum in children.** *Acta Orthop Belg* 2003; 69:426–432. This retrospective study reviews 44 patients who underwent temporary medial tibial and femoral hemiepiphysiodesis with Blount staples. Mean age at surgery was 12 years, 6 months for girls, 13 years, 8 months for boys. Results were assessed by the intermalleolar distance and the radiological hip-knee-ankle angle. 90% were satisfied and showed good alignment; two others had a good result after revision surgery. There was a rebound phenomenon after hardware removal, averaging 4° recurrence of valgus.

Jolly GP, Zgonis T, Polyzois V. **External fixation in the management of Charcot neuroarthropathy.** *Clin Podiatr Med Surg* 2003; 20:741–756. Review article on Charcot arthropathy. No results are given.

Launay F, Jouve J-L, Vichweger E, et al. **Progressive forearm lengthening with an intramedullary guidewire in children.** *J Pediatr Orthop* 2004; 24:21–25. Authors report 10 forearm lengthenings in 7 patients. Procedure was an open transverse osteotomy, application of a four-pin Orthofix fixator after correction of angular deformity, and insertion of Kirschner wires. A single intramedullary wire was inserted in all patients; a second wire to retain wrist alignment was inserted in two patients. All cases involved lengthening of only one forearm bone. Mean age at operation was 10.9 (range 6.8–14.8) years. Mean duration of distraction was 35.6 (range 17–56) days. Mean healing index was 59 (range 34–89) days/cm. Mean elongation was 30.8 (range 12–52) mm, corresponding to a mean percent of 26.8 (range 11.5–48) percent. Bone grafting was performed in 4 cases. Authors advocate initial shortening osteotomy for angular correction because it is easier to control angulation and provides less tension on soft tissue. Intramedullary wires were not removed.

Deformity continued

Meldrum KK, Baird AD, Gearhart JP. **Pelvic and extremity immobilization after bladder exstrophy closure: complications and impact on success.** *Urology* 2003; 62:1109–1113. 194 patients with bladder exstrophy who underwent initial bladder closure and pelvic immobilization were reviewed. Success rates were highest when patients were immobilized with an external fixator and 6–8 weeks of modified Buck's traction with osteotomy or 4–6 weeks of modified Bryant's traction without osteotomy. Spica casting and "mummy wrapping" were less successful.

Probe RA. **Lower extremity angular malunion: evaluation and surgical correction.** *J Am Acad Orthop Surg* 2003; 11:302–311. Author reviews quantitation, long-term effect, and surgical correction of lower extremity angular deformity. Results of several surgical techniques are reported from recent published clinical series.

Schroder H, Houshian S, Weeth R. **Madelung's deformity treated with Ilizarov-technique, follow-up of 8 cases.** *J Hand Surg [Am]* 2003; 28:34.

Tsuchiya H, Sakurakichi K, Uehara K, Yamashiro T, Tomita K. **Gradual closed correction of equinus contracture using the Ilizarov apparatus.** *J Orthop Sci* 2003; 8:802–806. Sixteen patients with equinus contractures were treated with the Ilizarov method without open soft tissue release. Seven patients were treated with an unconstrained construct, using the ankle joint as the hinge. Nine were treated with a medial and lateral hinge centered at the center of the talar dome (constrained construct). There was little difference in the results. The unconstrained construct is recommended because it is simpler and less invasive. Anterior subluxation of the talus and joint space narrowing, if occurring, must be corrected immediately.

Educational Material Needed

J. Mike Holloway, MD, requests CD or electronic sources of limb lengthening and reconstruction material and techniques to use in his teaching in Kampala. Basic level information is needed. If you have educational resources, external fixators and/or components you're willing to donate, please contact Mike at holloway@zianet.com (new address).

Research

Ali AM, Saleh M, Bolongaro S, Yang L. **The strength of different fixation techniques for bicondylar tibial plateau fractures—a biomechanical study.** *Clin Biomech (Bristol, Avon)* 2003; 18:864–870. Sawbone models of bicondylar tibial plateau fractures were fixed with one of five methods: dual plating, two-ring hybrid fixator with interfragmentary screws, a ring-bar hybrid fixator with interfragmentary screws, lateral plate and medial monolateral external fixator, lateral plate and medial interfragmentary screws. In all cases, failure was associated with collapse of the medial plateau. There was no significant difference in failure load between dual plating and two-ring hybrid fixator. Failure was seen at significantly lower loads with other external fixation systems. Weight-bearing mobilization may be undertaken earlier with more confidence by using the double-plating or two-ring hybrid fixation than with weaker techniques.

Augat P, Burger J, Schorlemmer S, et al. **Shear movement at the fracture site delays healing in a diaphyseal fracture model.** *J Orthop Res* 2003; 21:1011–1017. Authors test the hypothesis that interfragmentary axial movement of transverse diaphyseal osteotomies would result in improved fracture healing compared to interfragmentary shear movement. Ten sheep underwent a middiaphyseal tibial osteotomy treated with an external fixator with an interfragmentary gap of 3mm. The custom-made external fixators allowed either pure axial (n=5) or pure shear movement (n=5) of 1.5mm amplitude during locomotion. Shear movement considerably delayed healing. Bridging occurred in 5/5 in the axial group; 3/5 in the shear group. Peripheral callus and gap bone tissue was greater in the axial group. The axial group had three times larger mechanical rigidity at 8 weeks.

Hara Y, Tsujino A, Abe I, et al. **Pre-degenerated nerve shows enhanced regeneration after incremental elongation in rats.** *J Orthop Res* 2004; 22:189–193. Authors investigated the effect of linear elongation on subsequent nerve regeneration on 92 rats. Nerve was ligated at mid-thigh, then elongated 15mm at the rate of 3 or 5 mm/day by leg lengthening with an external fixator. Seven days after initiation of nerve elongation, the external fixator was removed and the initial bone length restored and stabilized with internal fixation. Then a 10mm segment at the ligature site was excised and repaired. Pre-degenerated nerve showed better regeneration after suturing than intact nerve. Elongation holds promise as an alternative to nerve grafting in the treatment of nerve injury.



Limb Lengthening and Reconstruction Society:
ASAMI-North America

AAOS Specialty Day
Saturday, March 13, 2004
Moscone Convention Center
San Francisco, CA

14th Annual Scientific Meeting
Friday-Sunday, July 23-25, 2004
Delta Chelsea Hotel
Toronto, Ontario, CANADA

Abstracts due March 1, 2004

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Research continued

Hee HT, Singh S, Chong SM, Myers L. **Protective effects of growth hormone on physal distraction: an experimental study on rabbits.** *J Pediatr Orthop [Br]* 2003; 12:332–337. Immature rabbits underwent physal distraction at proximal tibia. Controls were injected with saline subcutaneously at physis; experimental group underwent injection of growth hormone (GH) at physis. Experimental group showed increased bone formation in specimens harvested at day 42 and thickening at physis without physal fracture. GH may be useful in physal distraction by facilitating lengthening without fracture and may also reduce osteoporosis of the regenerate bone during physal distraction. Risk of premature physal closure may be reduced. Effect of GH may be local, systemic, or both.

Kim SG, Park JC, Kang DW, et al. **Correlation of immunohistochemical characteristics of the craniomandibular joint with the degree of mandibular lengthening in rabbits.** *J Oral Maxillofac Surg* 2003; 61:1189–1197. Rabbits underwent mandibular lengthenings of 2, 3, and 5mm using unilateral distraction osteogenesis. Changes in cartilage, osteoblast activity, and osteoclast activity were evaluated. No degenerative changes were seen in 2–3mm lengthening group, but 5mm group showed bone resorption in the TMJ. Osteoblast activity was highest in 3mm group, followed by 2mm group. Osteoclast activity was highest following 5mm lengthening.

Kokoroghiannis C, Papaioannou N, Lyritis G, Katsiri M, Kalogera P. **Calcitonin administration in a rabbit distraction osteogenesis model.** *Clin Orthop* 2003; 415:286–292. The effect of salmon calcitonin on the maturation of rabbit lengthening regenerate was investigated. Twenty-six mature rabbits underwent mid-diaphyseal lengthening of 0.375mm q12hours x 10 days. Fourteen rabbits underwent daily subcutaneous administration of 10 IU salmon calcitonin; twelve controls underwent injection of a placebo. Bone mineral density was measured at 20, 35, 45, 55 days, using DEXA. There was no significant difference between the experimental and the control group, as measured by DEXA. Limitations of DEXA are discussed: Calcitonin may have an effect on characteristics of new bone other than bone density, related to geometry and distribution in space, which DEXA is unable to detect.

Kollig E, Esenwein SA, Muhr G, Kutscha-Lissberg F. **Fusion of the septic ankle: experience with 15 cases using hybrid external fixation.** *J Trauma* 2003; 55:685–691. Authors report 15 tibiotalar arthrodeses performed with hybrid external fixators for combination of bone and soft tissue infections. Fourteen had post-traumatic OA; one had rheumatoid arthritis. Fixator used Schanz screws in the tibial shaft and midfoot, plus five wires in the tarsals and distal tibia and screws or wires in the metatarsals. Solid tibiotalar fusion was achieved in 14/15 (93%) of patients. Three patients had persistent fistula, but two out of the three had successful fusion. Authors concluded that the hybrid external fixator offers a successful alternative for ankle arthrodesis where bone/joint infections or poor soft tissue conditions may occur.

Marotta JS, Coupe KJ, Milner R, Heseltine KE. **Long-term bactericidal properties of a gentamycin-coated antimicrobial external fixation pin sleeve.** *J Bone Joint Surg [Am]* 2003; 85–A Suppl 4:129–131. This study investigates the bactericidal properties of 1.8mm and 6.0mm cannulated polyurethane tubing with gentamycin coating on inner and outer surfaces. Sleeves are designed to slide over external fixator wires or pins until they contact bone, where they remain. Gentamycin was selected because of the high susceptibility to form common pin tract pathogens: *E. coli*, *P. aeruginosa*, *S. aureus*, and *S. epidermidis*. The mean estimated gentamycin concentration at the pin site was estimated with the use of theoretical pin tract volumes. Gentamycin concentrations remained above 4 ug/ml for at least 20 weeks of simulated usage, where sleeves were agitated in a saline solution at 37°. The concentration exceeded the susceptibility threshold of pathogens commonly associated with pin tract infections.

Miller BS, Harper WP, Gillies RM, Sonnabend DH, Walsh WR. **Biomechanical analysis of five fixation techniques used in glenohumeral arthrodesis.** *ANZ J Surg* 2003; 73:1015–1017. Five methods of fixation for glenohumeral arthrodesis were evaluated in cadaver shoulders based on binding and torsional stiffness. Techniques included screw fixation, single plate fixation, double plate fixation, external fixation, and external fixation supplemented with screw fixations. Bending and torsional stiffness results in descending order were: double plate, single plate, external fixation with screws, external fixation alone, and screws alone.

Pacicca DM, Patel N, Lee C, et al. **Expression of angiogenic factors during distraction osteogenesis.** *Bone* 2003; 33:889–898. Two different angiogenic factors (VEGF and bFGF) were shown to localize at the leading edge of the distraction gap. Microassay analysis detected maximal mRNA expression for a wide variety of angiogenic factors. Expression of these factors was maximal during the phase of active distraction. A comparison between the patterns of gene expression in fracture healing and distraction osteogenesis showed similarities and differences. Bone formation during distraction osteogenesis is accompanied by the robust induction of factors associated with angiogenesis.

Tang J, Hu J, Wang ZG, Gao ZW, Li JH. **Expression of vascular endothelial growth factor during mandibular distraction osteogenesis in rabbits.** *Shanghai Kou Qiang Yi Xue* 2003; 12:191–193. Mandibular osteodistraction was performed in rabbits. Histologic and immuno-chemical analysis for VEGF was performed at 0, 7, 14, 28 days after completion of distraction. Intense angiogenesis was observed in the regenerate. Positive staining for VEGF was seen in the vascular endothelial cells and the active osteoblasts. Authors concluded that VEGF may play a critical role in angiogenesis and subsequent osteogenesis during mandibular lengthening.

Research continued

Topp R, Hayda R, Benedetti G, Twitero T, Carmack DB. **The incidence of neurovascular injury during external fixator placement without radiographic assistance for lower extremity diaphyseal fractures: a cadaveric study.** *J Trauma* 2003; 55:955–958; discussion 958. Twenty cadaveric femora and tibiae underwent fixation of fractures with 194 half pins by orthopedic surgeons of varying levels of experience. To mimic battleground conditions, no radiographic control was utilized. After pin placement, radiographs and dissections were used to evaluate pin placement. Forty-nine percent showed excessive penetration (more than two threads out of the second cortex). Mean over-penetration was +5.2 threads (13mm). There were three (1.5%) neurovascular injuries (popliteal trifurcation). At less than 2%, this may be an acceptable rate in battlefield/mass casualty situations. Increased experience with external fixation correlates with safer pin placement. In austere conditions, experienced surgeons can safely place external fixators without radiographic guidance.

Ugnow MG, Peat RA, Hile MS, et al. **Low-intensity ultrasound stimulation in distraction osteogenesis in rabbits.** *Clin Orthop* 2003; 417:303–312. Thirty-four rabbits underwent distraction osteogenesis. Seventeen were controls; 17 had low-intensity pulsed ultrasound therapy. Four and 6 weeks postoperatively, tibiae underwent quantitative CT and four-point mechanical testing. Histologic analysis was done at 4 weeks. There were no significant differences in bone mineral content, cross-sectional area, strength, or reduction in osteopenia between the two groups. The treated group had fewer osteoclasts. Authors conclude that ultrasound is effective in accelerated endochondral ossification through its action on chondrocytes, yet distraction osteogenesis is largely intramembranous; therefore, this study does not support the role of ultrasound as an adjunct in the treatment of patients undergoing osteogenesis.

Watson MA, Matthias KJ, Maffulli N, Hukins DW. **Yielding of the clamped-wire system in the Ilizarov external fixator.** *Proc Inst Mech Eng [H]* 2003; 217:367–374. This study demonstrates the clamped-wire system, used to suspend bones within an Ilizarov external fixator, yields when the perpendicular load exceeds 50N per wire. Wires underwent cyclic loading after four initial tension settings. Material yield, accompanied by some wire slippage through the clamps, is responsible for system yield. Although the initial wire tension has an appreciable load on the wire stiffness, it did not affect the elastic load range of the clamped-wire system. To prevent yield of the clamped-wire system in practice, the fixator should be assembled with sufficient wires to ensure the load transmitted to each wire by the patient does not exceed 50N.

Other

Ali AM, Villafuerte J, Hashmi M, Saleh M. **Judet's quadricepsplasty, surgical technique, and results in limb reconstruction.** *Clin Orthop* 2003; 415:214–220. Authors report the use of Judet's quadricepsplasty in 10 patients with loss of knee flexion (mean flexion = 33°) following external fixation. Mean flexion in OR was 105°; mean flexion at follow-up (average 24 months) was 88°. One patient had extension lag of 10°. The four conditions that cause a block to knee flexion are fibrosis and shortening of the medial and lateral parapatellar retinaculum, adhesions from the deep surface of the patella to the femoral condyles, fibrosis of the vastus intermedius with adherence to the rectus femoris and to the front of the femur, and actual shortening of the rectus femoris. Other causes include pin site tethering on the lateral side of the femur, fracture callus, and adherence of the skin to the underlying muscle. Authors recommend considering quadricepsplasty in patients with severe knee ankylosis following femoral fractures or following a prolonged period of external fixation.

Domingo LJ, Caballero MJ, Cuenca J, et al. **Knee arthrodesis with the Wichita fusion nail.** *Int Orthop* 2003; 10:10. Thirty-two patients underwent knee fusion following failed TKR. Techniques were Wichita knee fusion nail (11), external fixation with one or two fixators (15), plating (3), intramedullary nailing (3). Mean age was 68.6 years. The Wichita nail achieved fusion in 10/11 cases after a mean period of 4.5 (range 3–7) months. In the remaining 21, fusion was achieved in only 11 cases after a mean of 6.5 (4.5–10) months. Authors report this nail is unique, as it allows intraoperative compression at the level of the knee, maintaining at the same time a postoperative dynamic compression, which favors early weight-bearing. Removal, if necessary, can be difficult.

Gateno J, Teichgraber JF, Xia JJ. **Three-dimensional surgical planning for maxillary and midface distraction osteogenesis.** *J Craniofac Surg* 2003; 14:833–389. Authors have developed a planning system for distraction osteogenesis in craniofacial and maxillofacial surgery using three-dimensional CT scans and computer simulation in a virtual reality environment. Virtual osteotomies are performed, and movements of bone segments are simulated. The program generates a recipe for linear and angular correction necessary to achieve desired outcome.

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Other continued

McKee MD, DiPasquale DJ, Wild LM, et al. **The effect of smoking on clinical outcome and complication rates following Ilizarov reconstruction.** *J Orthop Trauma* 2003; 17:663–667. Thirty–nine limbs of nonsmokers were compared to 47 limbs in active smokers. Patients underwent Ilizarov limb reconstruction. Outcomes were based on ASAMI criteria. There were significantly more poor results, more persistent infections, higher rate of nonunions, and more complications in the smoking patients. Smoking is a significant, potentially remediable risk factor for failure following Ilizarov reconstruction. Cessation strategies are of paramount importance prior to initiating treatment.

San–Julian M, Dölz R, Garcia–Barrecheguren E, et al. **Limb salvage in bone sarcomas in patients younger than age 10.** A 20–year experience. *J Pediatr Orthop* 2003; 23:753–762. This is a retrospective review of a consecutive series of 40 patients treated over a 20–year period for osteosarcoma (19) and Ewing sarcoma (21). Ages ranged from 2–10 years. Intercalary allografts and Canandell’s technique for bone lengthening were used whenever possible. Epiphyseolysis was performed before excision in selected cases of metaphyseal sarcomas when tumor did not invade the epiphysis in order to preserve the joint and the physis. Prosthesis or osteoarticular allografts were used when the joint surface was involved. Survival rate was 75%. At follow–up (mean 11.2, range 5–19 years postop), 90% had preserved their limbs. Eighty percent had excellent or good results (MTS scale). Patient age was not a contraindication. Lengthening was performed for anticipated lower extremity discrepancy greater than 4cm and at least three years free of disease.

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