·论著·

可吸收螺钉治疗儿童肱骨外髁骨折 40 例

张 路 覃佳强 李 明 张德文 刘传康 曹豫江 刘 星 罗 聪 王忠良

【摘要】 **目的** 探讨可吸收螺钉治疗儿童肱骨外髁骨折的方法及临床疗效。**方法** 2001 年至 2006 年，本院收治 40 例 Milch Ⅰ和 Milch Ⅱ型儿童肱骨髁上骨折的患儿，均采取切开复位、可吸收螺钉内固定术，并与 55 例采用传统金属钉(针)固定进行治疗的患儿进行疗效比较。**结果** 40 例均获随访，随访时间 6～24 个月。根据肘关节外观及功能进行疗效评价，其中优 32 例，良 7 例，差 1 例，优良率为 97.5%，2 例出现功能障碍。55 例采用传统金属钉(针)固定的患儿优良率为 96.8%，临床愈合时间延长，出现术后针道感染、愈合延迟、畸形愈合、断针或钢针滑脱等 11 例。**结论** 可吸收螺钉用于儿童肱骨外髁骨折内固定方法简单，固定可靠，骨折断端紧密结合，骨折临床愈合时间缩短，疗效确切，是一种较好的内固定方法。

【关键词】 骨螺丝; 可吸收性植入物; 肱骨骨折/外科学

Absorbable screw/wand fixation for lateral condylar fracture in children. *ZHANG Lu, QIN Jia-qiang, LI Ming, et al. Children's Hospital of Chong Qing, Chong Qing, 400014, China.*

【**Abstract**】 **Objective** To investigate the treatment and effect of humeral lateral fractures in children by absorbing screw. **Methods** There were 40 cases of children with humeral lateral fractures treated by absorbing screw in our hospital from 2001 to 2006. In the same period, 55 cases of children with humeral lateral fractures be treated by Kirschner wire, therapeutic effect was compared,and the characteristic of operation and the bionomics was discussed. **Results** All the children were followed 6-24 months, According to the shape and action of elbow joint, the result was excellent in 32,good in7,worse in 1.The excellent-good rate was 97.5%. **Conclusions** Using absorbing screw to fix children's humeral lateral fractures was a easy method .In operation the bone flaps be fixed reliable, then the coalesced time be shorted , the curative effect was certain ,so it was a better method ,and be worthy to spread in clinical working.

【**Key Words**】 Bone screws; Absorbable implants; Humeral fractures/SU

儿童肘部骨折约占肱骨外髁骨折的 16.9%。只有少数骨折块移位小于或等于2 mm 者可行保守治疗石膏固定术[1]，多数病例骨折块被周围肌肉或韧带牵拉、移位，常需手术切开复位、内固定术治疗。如处理不当，可并发肘外翻畸形[2]、骨不愈合、迟发性尺神经炎等。本院自 2001 年 11 月至 2006 年 8 月对 40 例肱骨外髁骨折患儿在切开复位后使用可吸收螺钉(棒)进行内固定，疗效较为满意，现报告如下。

材料与方法

一、临床资料

本组 40 例，男 31 例，女 9 例，平均年龄 6 岁 8 个月(2 岁 5 个月至 14 岁 5 个月)。其中伴肘关节脱位 1 例，桡骨头脱位 1 例。按照 Milch[3]分类法分型，Milch Ⅰ型 6 例，Milch Ⅱ型 34 例。受伤至入院时间 2 h 至 8 个月不等，其中 8 例(占 20%)于院外行手法复位外固定后转入本院，X 线片提示骨折未完全复位，骨折断面畸形愈合，并伴有不同程度肘关节功能障碍[4]，临床表现为屈伸及旋转功能受限，无神经血管损伤。

二、治疗方法

1. 术前准备：除常规准备外，术前拍患侧肘关节正侧位 X 线片，并与健侧进行对比，对复杂骨折如骨折伴脱位、肱骨外髁粉碎性骨折等行三维 CT 成像检查[4]。准备直径为 2 mm 或 3 mm，长度 30～70 mm 不等的可吸收螺钉以及直径为 1.5 mm，长度为 40～70 mm 不等的可吸收棒。

作者单位：重庆医科大学附属儿童医院矫形外科(400012)，E-mail：jichigege@126.com

2.手术方法：采用基础麻醉 + 臂丛神经阻滞麻醉。选择肘外侧弧形或直切口手术入路，显露骨折断端，对陈旧性骨折病例，先判断骨折断面所在位置及骨折片畸形愈合的位置[5]，对复杂骨折在术中使用 C 臂 X 光机进行动态观察。判断清楚后再行剥离术，剔除多余骨痂，行骨折复位，如因肌肉挛缩造成复位困难，则行 Z 形延长前臂伸指总肌腱。骨折复位后先用克氏针或巾钳临时固定，再行钻孔，根据骨折片的大小和骨折固定所需要的长度选择可吸收螺钉(棒)，并置入固定。可使用 2 枚克氏针临时固定，在 C 臂 X 光机透视下，退出 1 枚位置较好的克氏针，置入可吸收螺钉(棒)，妥善固定后，再退出另 1 枚临时固定克氏针。如病情允许，手术可在气囊止血带压迫下进行。

对于骨块较大的 Milch Ⅰ型骨折，可使用同种可吸收棒辅助固定，用 2 枚可吸收螺钉或可吸收螺钉 + 可吸收棒从不同方向固定，以防止骨折块在肌腱牵拉下发生旋转。固定位置尽量选择在通过干骺端的骨质，以防止骺板损伤，图 1～2 一例典型病例为手术前后 X 线片。

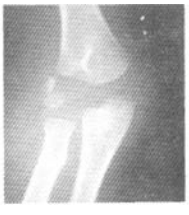

图 1 手术前肱骨外髁骨折，骨片向下翻转

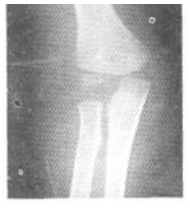

图 2 手术后骨片复位，见可吸收螺钉钉道影

3. 术后处理：术后肘关节伸肘位石膏外固定 3 周，每周复查 X 线片，根据骨折愈合情况改功能位石膏固定 1～3 周，再确定拆除石膏的时间及功能锻炼计划。一般情况下，在石膏固定期间行等长肌肉收缩，拆除石膏后行无痛关节活动，少数自行功能锻炼欠佳者，则在医生指导下行 CMP 机辅助功能锻炼。

结 果

本组 40 例均获随访，平均随访时间 19 个月(6 个月至 4 年)。切口均Ⅰ期愈合，骨折均获解剖复位，达到骨性愈合，无一例螺钉穿越骺板造成骨骺损伤而形成骨桥的病例。新鲜骨折均在术后 12 周内达到骨性愈合，8 例陈旧性骨折愈合时间在 10～15 周。根据肘关节外观及功能进行疗效评价，以肘外观和功能正常，无后遗症为优；肘关节屈伸在 110° 以上，肘外翻在 11°～15°以内，无疼痛及其它后遗症为良；肘关节屈伸在 110°以下，肘外翻在 15°以上，或有骨不连、骨折块缺血坏死等后遗症者为差。本组疗效优 32 例，良 5 例，差 1 例，优良率为 97.5%，均得到骨性愈合。2 例出现功能障碍。

在本院同期采取传统金属钉(针)固定的 55 例患儿中，9 例使用骨片钉，46 例使用克氏针。临床愈合时间延长，11 例出现了不同程度的针道感染[6]、断针、钢针滑脱、畸形愈合等[7]，骨折愈合优良率为 96.8%，与采用可吸收螺钉组相比，优良率差异无统计学意义($P > 0.05$)，但并发症比较，差异有统计学意义($P < 0.05$)，见表 1。

表 1 两组临床疗效比较

分组	临床愈合时间	并发症						随访优良率
		术后感染	延迟愈合	畸形愈合	骨不连	功能障碍	断针或滑脱	
金属固定物组	≥4 周	3	23	1	0	3	2	97.5%
可吸收螺钉固定组	3~4 周	0	0	0	0	2	0	96.8%

讨 论

可吸收螺钉(棒)系高分子生物材料，为 L-PLA 和 D-PLA 共聚的聚合物(PDLLA)，无色透明，初始强度较高，在体内可保持强度时间为 10 周至半年，与骨折愈合时间同步。PDLLA 具有良好的组织相容性，骨折愈合后 1～2 年内 PDLLA 水解成二氧化碳和水，参与体内正常的新陈代谢。抗弯强度为 220～400 MPG，剪切强度为 180～250 MPG，弹性模量 10～15 GPA，与松质骨相似[8]，具有和松质骨接近的弹性膜量及一定的韧性，固定后可允许骨折断端局部产生微小活动，促进骨折断端成骨细胞代谢，利于骨折愈合，从而缩短术后骨折愈合时间。无金属表面

的电解作用,固定作用可靠,植入人体骨组织 2 h 后螺钉韧性增强,同时发生微小的经向膨胀、纵向收缩现象,可使固定更加牢固。且安全可靠,对组织无刺激,无抗原性和致癌性,12～18 个月内可完全降解吸收,通过新陈代谢排出体外。随着固定物的降解,应力将逐渐转移到愈合的骨折面上,可促进骨折愈合。可吸收钉(棒)使用时针尾无外露,可被周围组织吸收,避免了术后换药或再次取出内固定物的痛苦,能减轻了治疗费用,降低术后感染的发生率。

可吸收螺钉螺纹粗大,具有较好的韧性,固定加压效果确切,可以对断端施加压力,使骨折端端吻合紧密,术后骨折块血供迅速恢复,能减少临床愈合时间。手术后见可吸收钉隧道,其逐步消失的过程可作为一项判断骨折愈合的指标,与骨痂生长一起作为判断骨折愈合的标准,以决定功能锻练时间。

可吸收螺钉的不足是其强度不如金属螺钉,抗扭切力不够,适合于应力较小的关节骨折,尤其适合于儿童上肢干骺端骨折。其价格较贵,硬度不及金属内固定物,术中易发生螺钉损伤,因此,术中操作应注意在骨折解剖复位后,钻孔方向应符合生物力学原理,与骨折线方向垂直,钻头、丝攻、螺钉应相互配套,确保置入内固定物一次成功。另外,还应选择长度、直径合适的螺钉,避免尾端过长,留于软组织内不易吸收,造成周围组织应力损伤。

可吸收螺钉治疗儿童肱骨外髁骨折,方法简单,固定可靠,骨折断端紧密结合,临床愈合时间缩短,疗效确切,是一种较好的内固定治疗方法,可作临床推广。

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·消息·

《儿童骨与关节损伤》出版

《儿童骨与关节损伤》由赫荣国、梅海波主编,中南大学出版社出版,全书约 140 万字,定价 98 元。本书是国内第一部系统论述儿童骨骼与关节损伤的专著,全书两部分二十章组成:第一～八章主要介绍儿童骨骼、肌肉系统的发生学、生物学、生物力学、骨与关节损伤后的全身反应、骨折愈合机制和儿童骨科常用的诊疗技术与操作方法;第九～二十章则依照应用解剖对儿童四肢、脊柱每一部位的骨折与关节脱位从损伤机制、临床表现、X 线影像、临床诊断、治疗、并发症的防治等方面进行深入的阐述。全书在结合作者经验的基础上,参考了国内外最新版本的专业书籍和参考文献,重点介绍了新的治疗方法,学术内容全面、系统、新颖。特别是本书选用了大量珍贵的儿童骨与关节损伤的影像资料,图文并茂,体现了儿童骨科诊疗技术的新发展,是广大骨科医师、尤其是儿童骨科医师不可缺少的参考工具书。联系地址:湖南省长沙市左家垅,中南大学出版社;邮政编码:410083;联系人:易建国、谢贵良;电话:(0731)8876770、8836721;邮购:(0731)8830330、8876188;E-mail:zndxcbs@163.com。

可吸收螺钉治疗儿童肱骨外髁骨折40例

作者： 张路， 覃佳强， 李明， 张德文， 刘传康， 曹豫江， 刘星， 罗聪， 王忠良
作者单位： 重庆医科大学附属儿童医院矫形外科,400012
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8. 陈永志 肱骨外髁骨折骨不连并肘内翻畸形的手术治疗[期刊论文]-中华创伤骨科杂志 2004(08)

相似文献(10条)

1. 期刊论文 王锡榜.唐新桥.梁培雄.刘忠 可吸收螺钉治疗踝关节骨折 -中国医师杂志2009,11(8)

目的 探讨可吸收螺钉在踝关节骨折中的应用.方法 回顾性分析63例踝关节部位骨折患者切开复位可吸收螺钉内固定的临床治疗效果.结果 63例患者平均随访13个月,骨折全部愈合,功能恢复满意.结论 可吸收螺钉可做为踝关节部位骨折切开复位内固定的理想材料.

2. 期刊论文 邵景范.罗永湘.MR Sarkar.LE Claes.L Kinzl 可吸收陶瓷改善椎弓根螺钉稳定性的体外生物力学试验 -中华骨科杂志2001,21(10)

目的探讨在椎弓根螺钉置入时添加可吸收陶瓷Biobon对椎弓根螺钉稳定性的影响.方法采用28个L3～L5椎体标本,将椎弓根螺钉按标准操作分别置入两侧椎弓根,随机在其中一侧加Biobon.对其中16个椎体测试螺钉最大轴向拔出力(F-max)和螺钉拔出过程中达到最大轴向拔出力时的能量吸收值(E-F-max)及螺钉拔出一个螺距(2.0mm)时的能量吸收值(E-2mm).另外12个椎体作梯增负荷的周期抗屈试验.结果同未加Biobon组比较,加入Biobon组的F-max增加了79.7%.E-F-max和E-2mm也分别增加了83.1%和68.2%,两组差异有非常显著性意义(Wilcoxon检验,P<0.01).周期抗屈试验中,添加Biobon可使螺钉耐受更强的负荷或在同等负荷下仅产生较小的位移.结论在椎弓根螺钉置入时添加Biobon可显著提高其初始稳定性.

3. 外文期刊 Fealy.S.Drakos.MC.Allen.AA.Warren.RF Arthroscopic bankart repair: experience with an absorbable, transfixing implant.

The use of arthroscopic means to address shoulder instability has provided a technically advantageous way to approach Bankart lesions while posing complex questions regarding the specific indications for such an intervention. A successful outcome with arthroscopic Bankart repair is a function of proper surgical indication and patient selection. Several authors have evaluated the causes of failure and reasons for success with the Suretac device. The development of a bioabsorbable repair device at the authors' institution was precipitated by a desire to address and repair Bankart lesions arthroscopically while avoiding the frequent complications associated with the metal staple and the transglenoid suture technique. The Suretac represents the first generation of bioabsorbable transfixing devices. The initial objectives of the Suretac device were to adequately and dynamically tension soft tissue to bone, while providing a bioabsorption profile that mirrored the native healing response. The Suretac device is an appropriate surgical tool for arthroscopically repairing Bankart lesions in a carefully selected patient population.

4. 外文期刊 Thordarson.DB.Samuelson.M.Shepherd.LE.Merkle.PF.Lee.J Bioabsorbable versus stainless steel screw fixation of the syndesmosis in pronation-lateral rotation ankle fractures: a prospective randomized trial.

Thirty-two patients who had pronation-lateral rotation (PLR) fractures occurring four centimeters or more proximal to the ankle

joint or lower if the talus was displaced greater than one centimeter laterally were enrolled in this study. Seventeen patients were randomized to fibular plate fixation with a 4.5 ml polylactic acid (PLA) bioabsorbable syndesmotic screw, and fifteen patients randomized to fibular plate fixation with a 4.5 mm stainless steel syndesmotic screw. All thirty-two patients had uncomplicated healing of their fibular fracture without loss of reduction. There was neither evidence of osteolysis nor sterile effusion in the patients who were treated with the PLA screw. There were no wound complications in either group. No difference in range of motion or subjective complaints was noted in either group. Use of the PLA syndesmotic screw at short-term follow-up was well tolerated and avoided the need for subsequent screw removal.

5.外文期刊 Buijs GJ.van der Houwen EB.Stegenga B.Verkerke GJ.Bos RR Mechanical strength and stiffness of the biodegradable SonicWeld Rx osteofixation system.

PURPOSE: To determine the mechanical strength and stiffness of the new 2.1 mm biodegradable ultrasound-activated SonicWeld Rx (Gebruder Martin GmbH & Co, Tuttlingen, Germany) osteofixation system in comparison with the conventional 2.1 mm biodegradable Resorb X (Gebruder Martin GmbH & Co) osteofixation system. MATERIALS AND METHODS: Plates and screws were fixed to 2 polymethylmethacrylate blocks to simulate bone segments and were subjected to tensile, side bending, and torsion tests. During testing, force and displacement were recorded and graphically presented in force-displacement diagrams. For the tensile tests, the strength of the osteofixation system was measured. The stiffness was calculated for the tensile, side bending, and torsion tests. RESULTS: The tensile strength and stiffness as well as the side bending stiffness of the SonicWeld Rx system presented up to 11.5 times higher mean values than the conventional Resorb X system. The torsion stiffness of both systems presents similar mean values and standard deviations. CONCLUSIONS: The SonicWeld Rx system is an improvement in the search for a mechanically strong and stiff as well as a biodegradable osteofixation system. Future research should be done to find out whether the promising in vitro results can be transferred to the in situ clinical situation.

6.外文期刊 Vaananen P.Nurmi JT.Lappalainen R.Jank S Fixation properties of a biodegradable "free-form" osteosynthesis plate with screws with cut-off screw heads: biomechanical evaluation over 26 weeks.

OBJECTIVE: The aim of this study was to compare the postoperative fixation properties of a biodegradable osteosynthesis "free-form" plate achieved with countersunk screws with those provided by screws with cut-off screw heads. STUDY DESIGN: Acrylic pipes were fixed together to simulate fracture fixation for tensile testing. Additional plates were fixed to a polyurethane block with a single screw for plate-screw pullout testing. Specimens were incubated in phosphate buffer solution at 37 degrees C, and testing was conducted at various time points during hydrolytic degradation of 26 weeks. In both tests the specimens were loaded at a speed of 5 mm/min until failure. The yield load, maximum load, and stiffness were recorded, and failure mode was visually determined. RESULTS: Both countersunk screws and screws with cut-off screw heads provided similar plate fixation properties over degradation time. CONCLUSION: According to these results, fixation of the biodegradable osteosynthesis free-form plate with screws with cut-off screw heads seems to be feasible.

7.外文期刊 Bach FD.Carlier RY.Elis JB.Mompoint DM.Feydy A.Judet O.Beaufils P.Vallee C Anterior cruciate ligament reconstruction with bioabsorbable polyglycolic acid interference screws: MR imaging follow-up.

PURPOSE: To examine at magnetic resonance (MR) imaging the degradation of an interference screw made of polyglycolic acid (67.5%) and trimethylene carbonate (32.5%) and compare the MR findings with the clinical evaluation results. MATERIALS AND METHODS: Clinical and MR imaging studies were performed concomitantly 6 months (in 20 patients), 1 year (in 10 patients), and 2 years (in eight patients) after surgery. Screw resorption rate, tibial tunnel appearance and contents, epiphyseal reaction, reconstructed ligament appearance, bone plug healing, joint effusion, and synovitis were evaluated. RESULTS: The screw was observed to be partially resorbed (by approximately one-third) at 6 months and totally resorbed at 1 year. Enhancement of the tunnel content, which can be linked to bone healing and screw replacement, was seen without a surrounding inflammatory reaction. Bone tunnel enlargement was observed and remained stable over time; this phenomenon has often been reported with metallic or polylactic acid interference screws and could be due to the position of the screw within the tunnel. The tissue that was seen at MR imaging to be replacing the screw was either fibrous or fatty and fibrous but never bone. CONCLUSION: Resorption of the screw does not appear to be related to clinical results.

8.外文期刊 Steenlage E.Brand JC Jr.Johnson DL.Caborn DN Correlation of bone tunnel diameter with quadrupled hamstring graft fixation strength using a biodegradable interference screw.

PURPOSE: The purpose of this study was to determine whether the ultimate load at failure of a quadrupled hamstring tendon graft (QHT) fixed with a biodegradable interference screw is improved with a more precise match of the bone tunnel diameter to the diameter of the QHT. TYPE OF STUDY: Biomechanical testing. METHODS: In group A, 8 cadaver knees with a mean age of 69.4 years (range, 60 to 76) were used. QHT graft diameters were measured using sleeves in standard 1.0-mm increments, with matching bone tunnels drilled in 1.0-mm increments. In group B, 9 cadaver knees, with a mean age of 66.5 (53 to 81) were used. Grafts were measured using sleeves in 0.5-mm increments and matching bone tunnels in 0.5-mm increments were drilled. In both groups, the QHT grafts were fixed with a biodegradable interference screw (BioScrew, Linvatec, Largo, FL) in both the tibia and the femur. Tendon interference fixation was tested to failure using a material testing device that tensioned the grafts directly in line with the bone tunnels. Bone mineral density was measured using dual photon absorptimetry for the metaphyseal area of the tibias and femora in the area of interference screw fixation. RESULTS: Femoral maximum load at failure significantly improved from 341 N in the 1.0-mm group to 530 N (P <.05) in the 0.5-mm group; the tibial maximum load at failure improved from 221 N to 308 N (P =.35). CONCLUSIONS: Fixation strength results of this study suggest that commercially available instrumentation could be improved with sleeves and reamers available in 0.5-mm increments.

9.外文期刊 Shino K.Mae T.Maeda A.Miyama T.Shinjo H.Kawakami H Graft fixation with predetermined tension using a new device, the double spike plate.

PURPOSE: To biomechanically evaluate a new fixation device, DSP (Double Spike Plate; Meira Corp, Nagoya, Aichi, Japan), for pullout graft fixation. TYPE OF STUDY: Biomechanical study. METHODS: A porcine tibia in which 8-mm diameter drill holes had been made from the medial tibial metaphysis to the anterior cruciate ligament attachment was rigidly fixed to a tension analyzer. A quadrupled graft consisting of 2 double-looped bovine tendons was prepared with No. 3 polyester sutures placed distally. The graft was passed through the drill hole, and its proximal loop ends were rigidly fixed to a load cell for monitoring graft tension. The graft's distal

ends were connected to the DSP by tying the sutures to the top hole in the DSP. The graft tension was predetermined at 49 N (n = 5) or 98 N (n = 5). This tension was maintained for 5 minutes with a suture passed through the bottom hole of the DSP. The plate was fixed to the tibia by hammering its spikes into the bone under the index tension. Finally, the fixation was completed by inserting a screw. RESULTS: Although the graft tension immediately increased to 69 +/- 11 N or 133 +/- 14 N during hammering, it gradually reduced to 49 +/- 10 N or 100 +/- 7 N 5 minutes later. CONCLUSIONS: This study shows that graft fixation under a predetermined tension can be achieved with the DSP.

10.外文期刊 Boileau P.Krishnan SG.Coste JS.Walch G Arthroscopic biceps tenodesis: a new technique using bioabsorbable interference screw fixation.

PURPOSE: To report a new technique of arthroscopic biceps tenodesis using bioabsorbable interference screw fixation and the early results. TYPE OF STUDY: Prospective, nonrandomized study. METHODS: Technique: The principle of arthroscopic biceps tenodesis is simple: after biceps tenotomy, the tendon is exteriorized and doubled on a suture; the biceps tendon is then pulled into a humeral socket (7 or 8 mm x 25 mm) drilled at the top of the bicipital groove, and fixed using a bioabsorbable interference screw (8 or 9 mm x 25 mm) under arthroscopic control. Patients: 43 patients treated with this technique between 1997 and 1999 were followed-up for at least 1 year. The technique was indicated in 3 clinical situations: (1) with arthroscopic cuff repair (3 cases), (2) in case of isolated pathology of the biceps tendon with an intact cuff (6 cases), and (3) as an alternative to biceps tenotomy in patients with massive, degenerative and irreparable cuff tears (34 cases). The biceps pathology was tenosynovitis (4 cases), prerupture (15 cases), subluxation (11 cases), and luxation (13 cases). RESULTS: The absolute Constant score improved from 43 points preoperatively to 79 points at review (P <.005). There was no loss of elbow movement and biceps strength was 90% of the strength of the other side. Two patients, operated on early in the series, presented with a rupture of the tenodesis. In both cases the bicipital tendon was very friable and the diameter of the screw proved to be insufficient (7 mm). No neurologic or vascular complications occurred. CONCLUSIONS: Arthroscopic biceps tenodesis using bioabsorbable screw fixation is technically possible and gives good clinical results. This technique can be used in cases of isolated pathologic biceps tendon or a cuff tear. A very thin, fragile, almost ruptured biceps tendon is the technical limit of this arthroscopic technique.