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SUMMARY
The authors of this clinical trial evaluated outcomes of the single versus double-incision techniques for acute distal biceps tendon repair. Patients who had an acute distal biceps rupture were randomly assigned to one of two groups: single-incision repair with two suture anchors (forty-seven) or double-incision repair with transosseous drill holes (forty-four). Follow-up evaluations were performed at three, six, twelve, and twenty-four months after the operation. The primary outcome was the American Shoulder and Elbow Surgeons (ASES) elbow score, whereas secondary outcomes were muscle strength; complication rates; and Disabilities of the Arm, Shoulder and Hand (DASH) and Patient-Rated Elbow Evaluation (PREE) scores. The groups did not differ significantly with regard to mean age, percentages of dominant arms affected, or Workers’ Compensation cases.

The two groups did not differ with respect to their final outcomes at two years—i.e., ASES pain score (p = 0.4), ASES function score (p = 0.10), DASH score (p = 0.3), or PREE score (p = 0.4) (Table I and Fig. 1)—or with regard to isometric extension, pronation, or supination strength at more than one year. The patients in the double-incision group had only a 10% advantage in final isometric flexion strength (104% versus 94% in the single-incision group; p = 0.01). The rate of strength recovery did not differ between the groups. The patients treated with the single-incision technique had more early transient neurapraxias of the lateral antebrachial cutaneous nerve (nineteen of forty-seven versus three of forty-three in the double-incision group; p < 0.001). The authors reported four reruptures; all were related to patient noncompliance or reinjury during the early postoperative period and did not appear to be related to the fixation technique (p = 0.3).

DISCUSSION
This is an important study for several reasons. First, it is the first prospective randomized clinical trial that compared the outcomes of single and double-incision techniques for the repair of distal biceps tendon ruptures. It was carefully planned and well-performed.
Second, since both groups achieved favorable outcomes and reported minimal pain and disability, surgeons can select the operative approach that is most suited to their personal experience.

The third interesting piece of information is the observation of a very low rate of heterotopic ossification, which was very mild, in each group of only 2%. This is unlike other series, in which the prevalence of heterotopic ossification has been reported to be between 5% and 10% (J Shoulder Elbow Surg. 2008 Jan-Feb;17[1 Suppl]:67S-71S, J Hand Surg Am. 2003 May;28[3]:496-502, and J Bone Joint Surg Am. 2000 Nov;82-A[11]:1575-81).

But for me, the most important message is that the use of more material and expensive implants does not necessarily mean that the outcome will be better. In this context, a comparative analysis of the operation time and total costs would have been interesting and valuable additional information.

Sugar Isn’t Always So Sweet

William T. Obremskey, MD, MPH
Vanderbilt University Medical Center

SUMMARY

The investigators studied the effect of perioperative hyperglycemia and the risk of surgical site infection (SSI) less than thirty days postoperatively in trauma patients without diabetes. Seven hundred and ninety patients were identified. The hyperglycemic index was used as a marker for patients at risk. Overall, twenty-one thirty-day SSIs (2.7%) were noted. Of the patients, 37% had at least one glucose value of ≥200 mg/dL. Patients who had a hyperglycemic episode had an SSI risk of 4.4% versus a risk of 1.6% for patients who did not have more than one hyperglycemic value of ≥200 mg/dL. Multivariable logistic regression indicated that having two or more blood glucose levels of ≥200 mg/dL was a risk factor for thirty-day SSI with an odds ratio of 2.7. Patients with an open fracture had an increased risk of SSI as well, with an odds ratio of 3.3. After controlling for open fractures and in a multivariable regression model, the authors noted that having a hyperglycemic index of ≥1.76 was a significant risk factor for SSI (odds ratio: 4.9).

DISCUSSION

General surgeons, cardiac surgeons, and intensivists routinely monitor blood glucose levels for inpatients as the literature identifies hyperglycemia as a risk factor for infection and mortality (Ann Surg. 2007 Oct;246[4]:605-10; discussion 610-2, Crit Care Clin. 2001 Jan;17[1]:107-24, Am Surg. 2005 Feb;71[2]:171-4, and J Trauma. 2005 Jul;59[1]:80-3). Orthopaedic surgery is a specialty with populations at high risk for deep infection. Our patients frequently have implants, traumatized tissue, and long procedures associated with medical comorbidities. This study demonstrated increased SSI risk in adult trauma patients with perioperative hyperglycemia. Additional work should determine if the link is due to causation or if it is associated in patients who respond poorly to the stress of surgery or trauma, which increases the level of hyperglycemia. We also need to determine if improved glycemic control leads to decreased infection risk.

A Lateral Pinning Pattern Is Preferred for Supracondylar Distal Humeral Fractures in Children

T.A. DeCoster, MD, and U. Modhia, MD
University of New Mexico

SUMMARY

This article is a meta-analysis of the world literature on the controversial topic of lateral pinning versus cross pinning for displaced supracondylar humeral fractures in children. Only eighteen of more than 1800 studies met the authors’ inclusion standards. They compared outcomes and complications among more than 1600 patients from the literature. The results showed that,
with cross pinning, two extra cases of loss of fixation were prevented but five additional ulnar nerve injuries were caused per 100 patients treated. The authors, therefore, favored lateral pinning.

**DISCUSSION**

Supracondylar distal humeral fractures in children are common worldwide. They are classified as 13M according to the AO/OTA pediatric fracture classification. The optimal pin pattern has been controversial, with medial and lateral pins (cross pinning) and lateral pins only, being the two leading patterns. Cross pinning is thought to be mechanically superior, but it places the ulnar nerve at risk for injury. The authors confirmed these findings and quantified the comparative benefits (less loss of reduction) and complications (ulnar nerve injury). The risk of late deformity and poor function was the same for both groups. The authors also emphasized that the risk of loss of fixation with lateral pinning can be minimized with the insertion of divergent pins or three pins. When cross pinning is used, it is mechanically superior if the pins cross proximal to the fracture line and not at the fracture. Other practical factors that affect outcome, including quality of reduction, exact location of the pins within the distal and proximal fragments, and number of attempts necessary to achieve final pin position, could not be compared.

**Should We Treat Acute Osteoporotic Fractures with Bisphosphonates?**

Kyle J. Jeray, MD
Greenville Hospital System University Medical Center

**SUMMARY**

Bisphosphonates prevent bone resorption with a resulting increase in bone mineral density by inhibiting osteoclastic activity; however, the effect of bisphosphonates on fracture healing is still unclear. The authors performed a prospective multicenter study looking at the use of bisphosphonates (risedronate, 35 mg weekly) in patients who had intertrochanteric hip fractures and a diagnosis of osteoporosis, but who had not been on any bisphosphonates prior to the fracture. There were three groups of thirty patients: group A started on bisphosphonates one week after surgery; group B started on bisphosphonates one month after surgery; and group C started on bisphosphonates three months after surgery. The healing times (10.7, 12.9, and 12.3 weeks in groups A, B, and C, respectively) did not differ among the three groups. The incidence of fracture complications did not differ among the groups. The authors also considered the functional outcomes at one year, and found no difference among the groups. They concluded that risedronate did not affect healing of intertrochanteric hip fractures in patients with osteoporosis.

**DISCUSSION**

As the rate of fragility fractures continues to rise and the number of patients being treated with bisphosphonates rises as well, the question of whether or not we should treat acute osteoporotic fractures with bisphosphonates is of increasing importance. The obvious concern is that, by suppressing the ability of bone to remodel when treated with a bisphosphonate, healing may be adversely affected. However, several animal studies have conflicting evidence. Some studies involving bisphosphonates demonstrated delays in fracture healing²⁻³, while others showed no effect⁴⁻⁵, and others even suggested enhanced fracture healing⁶⁻⁷. Authors of some small clinical studies have reported no adverse effects of bisphosphonates on healing⁸⁻⁹. Kim et al. examined the use of bisphosphonate treatment on osteoporotic fractures in a small, well-defined population. Although their numbers were small, they did perform a power analysis prior to the start of the study based on their primary end point of radiographic healing time. Based on their reported data, it appears that the clinical use of risedronate may not make a difference in the time to fracture healing if risedronate is started within a week after the fracture, as compared with starting the drug after the fracture has healed. However, we need to be cautious, as this is only one small study, and it involved a single drug in the bisphosphonate class. The authors did not evaluate individuals who were already on the drug prior to fracture, which is often the case.

Ultimately, the goal of bisphosphonate treatment is to prevent secondary fractures and reduce mortality after the fragility fracture. The authors of this paper did not report if any additional fragility fractures occurred in the study patients, or whether there was a difference based on the time to starting the bisphosphonate. Assuming no additional fragility fractures or such time-based differences occurred, we then need to ask ourselves: what is the value of treating patients with bisphosphonates early on versus waiting three months if there is no difference in preventing additional fragility fractures?
To Remove or Not to Remove: That Is the Hardware Question

William T. Obremskey, MD, MPH
Vanderbilt University Medical Center

SUMMARY
Williams et al. reported on a prospective study of sixty-nine patients who underwent elective removal of symptomatic hardware from the foot and ankle. The Short-Form McGill Pain Questionnaire was used to assess pain preoperatively and six weeks postoperatively. The patients were also asked if they would undergo the procedure again and if they were satisfied with the results. Pain, as measured on the visual analog scale (VAS), decreased from 3.06 to 0.88. Sixty-five percent of patients had no pain at six weeks postoperatively. Ninety-one percent of patients stated that they would undergo the procedure again and were satisfied with the result.

DISCUSSION
As health care in the United States moves towards accountable care organizations and increased scrutiny, hardware removal may be a procedure that is difficult to justify without adequate data to support patient quality-of-life and functional improvement. Hardware removal may be one of those procedures that insurance companies say is not medically necessary and is not covered under a health-care plan. The indications and outcomes for hardware removal have not been well-documented. In general, orthopaedic surgeons are well-positioned to prove and demonstrate the effectiveness (clinical and functional outcomes) of procedures that we perform. Data from this article are more pieces of information that will help physicians (as opposed to administrators or politicians) continue to drive medical decision-making. The authors should be commended for providing good data on a common clinical issue, as hardware removal is one of the most common procedures reported by orthopaedic surgeons who sit for Part II of their American Board of Orthopaedic Surgery (ABOS) certification.

REFERENCES
DeNovo® NT Natural Tissue Graft

DeNovo NT Graft is the only available particulated juvenile cartilage allograft. It consists of pieces (approximately 1 mm³) of donated viable, immune-privileged articular (hyaline) cartilage.

It is intended as an early-intervention option for the repair of articular cartilage in a wide range of anatomic focal cartilage defects.

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Basic Science:

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- No donor site morbidity

Compare/Contrast with Contemporary Treatment Options

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<td>Single Stage</td>
<td>5-10 cm²</td>
<td>Donated tissue - not juvenile; Limited supply</td>
</tr>
</tbody>
</table>


Additional Publications

Bonner patellar case report published, J Knee Surg, Oct 2010. Case report on patient #1, with follow-up MRI at 21 months, demonstrating filled defect, resolution of subchondral edema, and patient’s return to full function.

Farr poster publication (study pts), Barcelona ICRS 2010. Dr. Farr’s subset of the ongoing 25-patient, multi-center prospective study, with the first 9 patients reaching up to 18 months post-op and demonstrating significant improvements in clinical outcomes over the pre-op baseline data. MRI data indicate good defect filling, and no revisions performed to date.

Hatic and Berlet review, Foot & Ankle Spec, Dec 2010. Discussion of DeNovo NT use and technique in osteochondral lesions of the talus.

Ng pediatric arthroscopy technique poster, ACFAS 2011. Case review of an osteochondral defect of the talus treated with DeNovo NT using an arthroscopically-assisted surgical technique. Patient returned to full unrestricted activity at 6 months post-op and was 16 months post-op at the time of the poster publication and remained very satisfied with the surgery.

Marliah pediatric case review poster, ACFAS 2011. Case review of an osteochondral defect of the talus treated with DeNovo NT using an open technique. 15-month MRI images suggested positive filling of the defect and no instability of the graft.

Farr Chondal Repair of the Knee, Cartilage, July 2011. Case review of 4 patients with chondral lesions on the femoral condyle and/or trochlea treated with DeNovo NT. Patients are a subset of ongoing 25-patient, multi-center prospective study. Evaluation at 24 months post-op showed improved clinical outcomes and MRI data suggests good and persistent defect filling.

Farr poster publication (study pts), Montreal ICRS 2012. 12-month MRI images for 24 of the 25 patients enrolled in prospective, single-arm study. The majority of repair tissue was shown to be well-integrated and percent fill with repair tissue was also good with 89% of lesions demonstrating >75% fill. MRI results confirm consistent with improved clinical outcomes as compared to baseline.

Adams Treatment of OC lesions in the talus, Tech Foot Ankle Surg, June 2011. Article provides a brief review of surgical treatment options for symptomatic lesions and the particulated juvenile cartilage allograft transplantation technique for OC lesions of the talus.

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to see how you compare to other subscribers on the treatment of articular cartilage lesions.
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Gritti-Stokes Amputation Increased Rate of Walking without Assistive Devices When Compared with Transfemoral Amputation in Trauma Patients

SUMMARY

The Gritti-Stokes procedure is a modification of the traditional transfemoral amputation; the bone is resected at a supracondylar femoral level and the patella is fixed to the distal part of the femur (Fig. 1). More than fourteen months after surgery, Taylor et al. evaluated fourteen patients who underwent Gritti-Stokes amputation and fifteen patients who underwent traditional transfemoral amputation. More than thirty-six months after surgery, the authors gave the Sickness Impact Profile (SIP) questionnaire to the two groups to assess functional outcomes. There were three important findings.

First, despite a lack of significant differences in demographics or preoperative variables between the two groups, the domain and SIP questionnaire scores were significantly better in the Gritti-Stokes group thirty-six months after surgery.

Second, the residual limb of patients in the Gritti-Stokes group was significantly longer than that of the patients in the traditional transfemoral amputation group (an average of 46.1 cm versus 34.6 cm).

Third, the percentage of patients of walking without assistive devices was significantly increased in the Gritti-Stokes group when compared with the percentage in the transfemoral amputation group (five of fourteen patients versus none of fifteen).

DISCUSSION

Transfemoral amputation includes substantial muscle transection; it is complicated with problems of stump wound healing, and low ambulatory rates of sometimes less than 50% (South Med J. 2001 Oct;94[10]:997-1001) have been described.

| TABLE I Data Comparing Traditional Transfemoral and Gritti-Stokes Amputations |
|---------------------------------|-----------------|-----------------|
|                                 | Transfemoral Amputation | Gritti-Stokes Amputation | P Value |
| Number of patients              | 15               | 14              |         |
| Operative time* (min)           | 108.8 (74-167)   | 140.5 (105-160) | 0.19    |
| Follow-up† (mo)                 | 14.8 ± 12.1      | 17.7 ± 14.5     | 0.60    |
| Residual limb length* (cm)      | 34.6 (27.7-43.8) | 46.1 (42.9-52.0) | <0.01  |
| Overall SIP questionnaire score†| 26.2 ± 8.0       | 16.9 ± 6.8      | 0.02    |
| Walking without assistive devices| 0               | 5               | 0.04    |
| Walker                          | 4               | 0               | 0.04    |

*Mean with range in parentheses. †Mean and standard deviation.
In knee disarticulation amputation, the patella is maintained and the patellar tendon is sutured to the cruciate ligaments. The remaining large bulbous femoral condyles allow excellent weight-bearing, but without surgical modification there can be issues with skin breakdown and prosthetic fitting (South Med J. 2001 Oct;94[10]:997-1001). Other studies have demonstrated major reamputation rates between 9% and 17% (Prosthet Orthot Int. 1979 Apr;3[1]:15-9, J Bone Joint Surg Am. 2000 Nov;82-A[11]:1571-4, Ann R Coll Surg Engl. 1987 Jan;69[1]:1-4, and J Bone Joint Surg Am. 1988 Jun;70[5]:746-50).

The Gritti-Stokes technique does not involve major muscle transection and does not have the problems related to large bulbous femoral condyles. Despite several limitations (a small sample size and retrospective analysis), this is an important study; for the first time it showed that Gritti-Stokes amputation in a trauma population was not only safe and beneficial, but also had several important functional advantages when compared with transfemoral amputation (Table I).

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**Lack of Support for the Importance of Debridement Within Six Hours of Open Fractures in Meta-Analysis**

Thomas A. DeCoster, MD
University of New Mexico

**SUMMARY**

The authors of this meta-analysis of the importance of time to operative debridement of open fractures with regard to infection rate identified sixteen high-quality studies, which included more than 3500 patients, and found that debridement within six hours was no better than debridement after six hours. The authors cautioned that timely operative debridement is warranted and future studies are necessary to determine what time lag may be associated with an increased infection rate. Dr. Jason Calhoun provided additional perspective in an invited commentary on this article in the online version of The Journal of Bone and Joint Surgery.

**DISCUSSION**

The “within six hours” rule for operative debridement of open fractures has been an orthopaedic principle for decades and has been incorporated into trauma system standards worldwide without much scientific data to support it (J Orthop Trauma. 2008 Nov-Dec;22[10 Suppl]:S133-4). Recently, researchers have questioned this principle, and data reported from the last ten years (including data from my own institution) (Orthopedics. 2008 Dec;31[12]) have not supported it. I agree with Dr. Calhoun’s recommendations. Surgeons and institution personnel who closely monitor their open-fracture infection rates should investigate and report important time parameters and consider the new Orthopaedic Trauma Association (OTA) open-fracture classification as a guide (J Orthop Trauma. 2010 Aug;24[8]:457-64). Others should probably continue their current practice and monitor future literature for evidence-based guidelines on optimal timing of debridement for open fractures.

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**The Tip Apex Distance “Myth”: Not Busted**

William T. Obremskey, MD, MPH
Vanderbilt University Medical Center

**SUMMARY**

De Bruijn et al. challenged one of the well-established “myths” of orthopaedic trauma. They attempted to assess the validity of the tip apex distance (TAD) as a predictor of intertrochanteric screw cutout in stable and unstable fractures. In 1997, Baumgaert-
In this retrospective review, Moed and colleagues polled ten busy centers regarding failures of locked symphyseal plates and received responses from three surgeons, who reported a total of six cases. The total number of operations performed could not be reliably calculated, so the frequency of failure could not be determined. The failures followed one of two pathways. Half of the implants failed due to bone resorption at the screw-bone interface or due to gradual loosening and minor (10 to 12-mm) asymptomatic gapping at the symphysis. These failures were thought to be similar to the loosening sometimes seen with nonlocking plate-and-screw constructs. The other half of the implants failed in an early, abrupt fashion, with complete unilateral screw pull-out from bone, or breakage of screws at the screw-plate interface. Investigation of the three abrupt cases showed that, in one of them, malalignment of the screws with the threaded holes during screw insertion may have led to the failure.

The authors concluded that failure mechanisms of the design-specific symphyseal locked plates included failure modes seen with nonlocked and locked plates in other settings, and noted that specific indications for the use of locked plates in the pelvis remain to be determined.

Is a Stiff Symphyseal Implant a Good Idea?


Adam J. Starr, MD
UT Southwestern Medical Center

**SUMMARY**
In this retrospective review, Moed and colleagues polled ten busy centers regarding failures of locked symphyseal plates and received responses from three surgeons, who reported a total of six cases. The total number of operations performed could not be reliably calculated, so the frequency of failure could not be determined. The failures followed one of two pathways. Half of the implants failed due to bone resorption at the screw-bone interface or due to gradual loosening and minor (10 to 12-mm) asymptomatic gapping at the symphysis. These failures were thought to be similar to the loosening sometimes seen with nonlocking plate-and-screw constructs. The other half of the implants failed in an early, abrupt fashion, with complete unilateral screw pull-out from bone, or breakage of screws at the screw-plate interface. Investigation of the three abrupt cases showed that, in one of them, malalignment of the screws with the threaded holes during screw insertion may have led to the failure.

The authors concluded that failure mechanisms of the design-specific symphyseal locked plates included failure modes seen with nonlocked and locked plates in other settings, and noted that specific indications for the use of locked plates in the pelvis remain to be determined.

**DISCUSSION**
This is an interesting, albeit small, study that demonstrated failures that were anticipated by many pelvic fracture surgeons as locked symphyseal implants were released for use. As the authors correctly noted, this small series can offer only a snapshot of potential failures. The rate of failure remains unknown. It may be that the problems with locked implants occur no more frequently than those encountered with traditional, nonlocked plates. Larger series are needed.

The authors should be commended for highlighting this important topic—namely, asking what is the preferred construct for stabilization of a joint, as opposed to a fracture? Locked plating systems were designed to stabilize fractures. It has long been...
recognized that nonlocked symphyseal plates become loose over time, due to the normal motion at the symphysis. Does a locked system, with its more rigid design, offer a theoretical benefit in joint stabilization? Should we be designing implants that employ or facilitate loosening instead of rigidity? Other parts of the body (the ankle syndesmosis comes to mind) where use of rigid implants is expected to lead to failure may offer insight. Pelvic surgeons look forward to additional data from the authors on the topic of failure after symphyseal repair.

Missed Injuries in Trauma Patients

P.V. Giannoudis, BSc, MD, FRCS
School of Medicine, University of Leeds

SUMMARY
Giannakopoulos et al. wished to determine the frequency, type, and implications of missed injuries in a large cohort of trauma patients. The authors also wanted to identify the factors that contributed to the injuries being missed and in which survey or period of treatment the missed injuries were diagnosed.

The study was conducted as part of a trial to assess the effects of a strategy involving early trauma resuscitating room computed tomography (CT) scanning compared with standard diagnostic imaging of adult trauma patients. Patients with missed injuries were defined as patients in whom a new injury was diagnosed after the primary and secondary surveys. To identify potentially missed injuries, a chart review was carried out of all radiological examination reports and operation records for at least three months after the trauma. To analyze factors associated with missed injuries, two patient categories were formed: patients with and those without missed injuries. All missed injuries were classified according to the Abbreviated Injury Scale (AIS) body regions with the use of AIS-90.

In the group of 1124 patients, 122 injuries were missed in ninety-two patients (8.2%). The missed-injury population, compared with the population without missed injuries, had significant differences with regard to Injury Severity Scores (higher), length of intensive care unit (ICU) stays (higher), traumatic brain injuries (lower Glasgow Coma Scores), and emergency interventions and receipt of blood transfusions within twenty-four hours after admission. Patients who were directly admitted to the ICU following trauma room evaluation had the highest chance for missed injuries (odds ratio 3.2; 95% confidence interval, 2.0 to 5.1; p < 0.001). The most common anatomic regions in which the missed injuries occurred were the extremities (74.6%), thorax (8.2%), and spine (6.6%). Seventy-two missed injuries (59%) remained undetected during the tertiary survey. In total, thirty-one operations were required for twenty-six missed injuries.

DISCUSSION
Reasons for missing injuries during the tertiary survey could have been the presence of distracting injuries, a lowered level of consciousness, and sedative or analgesic medication. The authors suggested that the creation of a tertiary survey checklist be introduced into each trauma patient’s chart to accurately register all examinations and findings.

Limitations acknowledged for this study were the retrospective review of the radiographs, the potential of having missed undiagnosed injuries as no autopsy reports were collected, and the fact that certain soft-tissue injuries not visible on radiographs could have been missed.

Moreover, patients younger than sixteen years of age were excluded. In addition, according to the protocol utilized, the authors used a selective CT algorithm after clinical evaluation and standard conventional radiography of the chest and pelvis. The implementation of a routine CT algorithm can have a substantial added value with regard to the miss rate of injuries.

The authors concluded that a high index of suspicion remains warranted, especially for polytrauma patients.